"For the Love of Restoration: History and Adaptation"

14th SER MIDWEST-GREAT LAKES CHAPTER MEETING

Meeting Program





SER MIDWEST GREAT LAKES SOCIETY FOR ECOLOGICAL RESTORATION

THE ALDO LEOPOLD FOUNDATION

WELCOME

Welcome to central Wisconsin, the Wisconsin River Valley and the Fourteenth Annual Meeting of the Society for Ecological Restoration's Midwest-Great Lakes Chapter. This year we are celebrating the joy of restoration. We will reflect both upon its rich history as well as how it has evolved with our growing knowledge and experience. Our meeting co-host this year is the Aldo Leopold Foundation—located within minutes of our meeting venue. They will bring to our meeting a deep knowledge of both the history and practice of ecological restoration--much of it created right here in Wisconsin. Our secondary goal is to bring together all who are interested in ecological restoration and contribute to advancing the field. The agenda for our meeting features: 1) a keynote presentation by Curt Meine-a noted writer on the history of ecological restoration; 2) a tour by our co-host of the Aldo Leopold shack and the important restoration sites managed by the Foundation; 3) two workshops; 4) three symposia; 5) 30 oral presentations; 6) 24 poster presentations; and 7) four nearby offsite field trips. This is the seventh year we will offer meeting attendees continuing education credits. A highlight this year is the special plenary session our co-host has organized on the history of ecological restoration in this area and its continuing leadership role in the evolving practice in this field.

2023 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 Fourteenth Annual Chapter Meeting: Jessica Miller *(Chairperson),* Brad Gordon *(Chairperson),* Dave Coulter, Mary Damm, Martha Holzheuer, Mark Krivchenia, Chris Lenhart, Mia Piro, and Keith Summerville.

ACKNOWLEDGEMENTS

We are very grateful for the generous support provided by our meeting co-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 Aldo Leopold staff in both the planning and participation with us: Mitchell Groenhof and Amy Terbilcox. We thank Megan Taylor and Laura Capponi from SER Global for their help with setting up the online registration page and help with maintaining the registration database. We thank Martha Holzheuer for her work in enabling us to offer continuing education credits through SER. We thank Mark Krivchenia and Lucy Gregersen for setting up and maintaining our annual meeting webpage and setting up the meeting program and abstract book. We are thankful for the participation of the meeting presenters, moderators, tour leaders, field trip leaders, volunteers, and attendees at our Fourteenth Annual Meeting.

MEETING HOST

THE ALDO LEOPOLD FOUNDATION

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2023 MEETING SCHEDULE OVERVIEW

Friday April 14	
8:00 am – 4:30 pm	Registration (Vennebu Hill)
8:00am–10:20am	Continental Breakfast (Vennebu Hill)
8:20 am – 10:20 am	Workshops (Vennebu Hill)
10:20 am – 10:40 am	Break
10:40 am – 11:40 am	Concurrent Oral Presentation Sessions (Vennebu Hill)
11:40 am – 2:10 pm	Lunch and Opening Plenary Session (Vennebu Hill, Lower Level, Dining Area)
2:10 pm – 2:20 pm	Break
2:20 pm – 4:20 pm	Symposia (Vennebu Hill)
4:20 pm – 5:00 pm	Travel to The Leopold Center and Poster Presentation Setup
5:00 pm – 7:30 pm	Poster Session, Sponsorship Reception, and Leopold Center Dedication

Saturday April 15	
7:00 am – 11:00 am	Registration (Vennebu Hill)
7:30 am – 8:20 am	Continental breakfast (Vennebu Hill)
8:20 am – 10:00 am	Concurrent Oral Presentation Sessions (Vennebu Hill)
10:00 am – 10:20 am	Break
10:20 am – 12:00 pm	Concurrent Oral Presentation Sessions (Vennebu Hill)
12:00 pm – 1:00 pm	Lunch, Business Mtg, & Awards Ceremony (Vennebu Hill, Lower Level, Dining Area)
1:00 pm – 1:15 pm	Break
1:15 pm – 2:15 pm	Keynote Presentation (Vennebu Hill, Lower Level)
2:15 pm – 2:45 pm	Break & Travel to Leopold Center
2:45 pm – 6:05 pm	Meeting Host Field Tour
6:05 pm – 6:30 pm	Return to Vennebu Hill
6:30 pm – whenever	No Host Social

Sunday April 16	
9:00 am – 12:30 PM	Off Site field trips

All times are central daylight time

WORKSHOPS - FRIDAY APRIL 14, 2023

Workshop #1: Upper Level, Breakout Area 2

Designing ecological restoration goals and objectives to be climate-smart. Fevold, Brick[1]*, Tim Lewis[1], Craig Palmer[1], and Louis Blume[2]. [1]General Dynamics Information Technology. Falls Church, Virginia. [2]U.S. EPA-Great Lakes National Program Office, Chicago, Illinois. Emails: brick.fevold@gdit.com; timothy.lewis2@gdit.com; craig.j.palmer@gdit.com; blume.louis@epa.gov.

This workshop is for ecological restoration scientists and practitioners seeking guidance on how to develop goals and objectives that consider current and projected climate-change effects on Great Lakes ecosystems. Participants will develop and document goal and objective statements that articulate an informed understanding of the projected and evidentiary effects of climate change – vital to demonstrate that project plans are 'climate-smart' and that intended outcomes will be climate-change resilient. Practical team-oriented exercises will be used to facilitate discussion on identifying components of project design for the restoration of terrestrial, aquatic and wetland systems susceptible to extreme weather events. Discussion will focus on climate-change adaptation planning and its applicability as a tool to mitigate uncertainty associated with climate change impacts on the intended project outcomes. The principles and applications of quality assurance and quality control and how they can reduce uncertainty will be integrated throughout the workshop. The instructors of this course are co-authors of the publication, Application of Quality Assurance and Quality Control Principles to Ecological Restoration Project Monitoring, EPA-905-K-19-001 (https://www.glri.us/node/250) published by the USEPA Great Lakes National Program Office and the Interagency Ecological Restoration Quality Committee. This workshop is funded under EPA contract in support of the Great Lakes Restoration Initiative.

Workshop #2: Lower Level, Dining Area

Is the enemy of my enemy my friend? Identifying and reporting a newly arrived garlic mustard specialist aphid- *Lipaphis alliarae*. Troutman, Rebecah E.* and Melissa N. Dopirak*. Holden Forests and Gardens. Kirtland, Ohio. Emails: rtroutman@holdenfg.org and mdopirak@holdenfg.org

A newly discovered enemy of the invasive garlic mustard may help us in our fight against the pesky plant. This workshop will teach participants how to find and identify Liaphis alliariae, a garlic mustard specialist aphid native to Europe. In the 2021 field season during routine garlic mustard (Alliaria petiolata) management, at the Holden Arboretum in northeast Ohio, the Natural Areas Biologist noticed damaged garlic mustard plants infested with aphids. Affected plants produced twisted seed pods and puckered/wilted leaves. The aphid was identified as Liaphis alliariae, a garlic mustard specialist aphid native to Europe and previously unrecorded in the United States. Given the importance of controlling garlic mustard, the novel nature of the newly discovered aphid in the United States, we are trying to better understand the impact this species has on garlic mustard- could it be a desperately needed biocontrol agent? Our objective is to quantify the impact of this novel aphid on garlic mustard and map its current distribution- but we need your help! This workshop will teach you how you can contribute to this effort, learning how to identify the aphid in comparison to other aphids with preserved samples and live samples (if they can be found in the area). Participants will also learn how to join the citizen science effort to report the aphid's distribution via the EDDMapS website and phone application.

ORAL PRESENTATION SESSIONS - FRIDAY APRIL 14, 2023

Bolded names below signify the presenter of the presentation.

Session 1: Soils. 10:40 am – 11:40 am. Lower Level, Breakout Area 1		
10:40 - 11:00 am	**Badger Hanson, Ellen**	Exploring the effects of prairie restoration management on soil microbial communities and carbon.
11:00 - 11:20 am	**Bobo, Dean**	The microbial biome of recently restored Thompson Lake, Emiquon Preserve, Illinois
11:20 - 11:40 am	**Warneke, Christopher R.**	Fire modifies plant-soil feedbacks.

Session 2: Site Mgt and Restoration Outcomes. 10:40 – 11:40 am. Upper Level, Breakout Area 2		
10:40 – 11:00am	**Schiafo, Rory B.**	Light and soil and fire, oh my: Investigating the environmental gradients driving plant community diversity in oak woodland restoration
11:00 – 11:20am	**Parr, Mary & Todd Aschenbach**	Plant community response to fire season and order on prairie and savanna in the Great Lakes Basin
11:20 – 11:40am	**Gutiérrez, Grace R.**	Thorns, sweat, and tears of joy: successes and setbacks in a long-term collaborative student restoration project

Session 3: Butterflies and Bees. 10:40 am – 11:40 am. Upper Level, Breakout Area 3		
10:40 – 11:00am	**Zink, Madison**	Preference of plants as nectar sources by monarch butterflies (*Danaus plexippus*) in a tallgrass prairie reconstruction
11:00 – 11:20am	**Murphy, Tristan L.**	Observing expiring Conservation Reserve Program field enhancement methods for monarch habitat improvement
11:20 – 11:40am	**Kelly, Tara**	Partnerships for pollinators in Washington County, Minnesota

See abstracts on pages 28 to 32

OPENING PLENARY SESSION - FRIDAY APRIL 14, 2023
Lower Level, Dining Area

A Confluence of People, Passion, and Place: The Past, Present, and Future of Ecological Restoration in Southern Wisconsin

Presentations by Buddy Huffaker (The Aldo Leopold Foundation), Mike Mossman (Wisconsin Department of Natural Resources–Retired), and Karen Oberhauser (University of Wisconsin-Madison) will recount the role of Southern Wisconsin in the origins of ecological restoration, how the region continues to be a leader in the field, and what we need to be thinking about so that we collectively create healthy and resilient communities for all people and all places. Buddy Huffaker, Executive Director of the Aldo Leopold Foundation, will begin the session by situating where we are gathering and preview what we will see over the course of the conference. In addition to sharing relevant biographical background on Aldo Leopold, Buddy will also share the pioneering ecological work done by the Leopold family over 80 years ago at the Leopold Shack and Farm, now a National Historic Landmark. Buddy will also share an overview of how the Leopold Foundation continues that legacy across the 4,500 acre Leopold-Pines Conservation area, and how all of this represents the continued evolution of the Land Ethic so eloquently articulated in Leopold's classic, *A Sand County Almanac*. Mike Mossman is an ornithologist, ecologist, and community activist who has leant his outstanding ears for decades to help assess the impacts of management on avian and amphibian communities. Mike will share insights from interviews with landowners, professionals, staff and members of the Ho-Chunk Nation, and volunteers on how and why they have collaborated to restore upland, wetland, and aquatic ecosystems in Southern Wisconsin. Dr. Karen Oberhauser, Director of the University of Wisconsin-Madison Arboretum and one of the world's leading experts on monarch butterflies will take us from the founding of the Arboretum and the field of ecological restoration to contemporary challenges of ensuring restoration projects encompass as broadly as possible the full range of community members: flora, fauna, and of course people.

Time	Presenters	Title
12:10 – 12:30	**White Eagle, Kristin & Buddy Huffaker**	Welcoming comments
12:30 – 1:00 pm	**Huffaker, Buddy**	Restoration through the lens of Leopold
1:00 – 1:30 pm	**Mossman, Mike**	Stories from the land
1:30 – 2:00 pm	**Oberhauser, Karen**	Growing an ethic of care for all

SYMPOSIA – FRIDAY APRIL 14, 2023

SYMPOSIUM #1, Lower Level, Breakout Area 1: Monitoring and managing deer impacts as part of ecological restoration: varying challenges in urban, suburban, and rural natural areas

Organizers: [1]Courteau, Jacqueline B., [2] Allison Krueger, and [3]. Michael A. Hahn. [1] NatureWrite LLC, Ann Arbor, Michigan. [2] Washtenaw County Parks and Recreation Commission, Washtenaw County, Michigan. [3] City of Ann Arbor Natural Areas Preservation Program, Ann Arbor, Michigan. JC email: jbcourteau@gmail.com; AK email: kruegera@washtenaw.org; MH email: mhahn@A2gov.org.

Presenters: Courteau, Jacqueline B., NatureWrite LLC, Ann Arbor, Michigan. Tyler Mitchell, Huron-Clinton Metropolitan Authority, Brighton, Michigan. Michael A. Hahn, City of Ann Arbor Natural Area Preservation, Ann Arbor, Michigan. Allison Krueger, Washtenaw County Parks Natural Area Preservation Program, Ann Arbor, Michigan. Michael Kost, University of Michigan, Matthaei Botanical Gardens/Nichols Arboretum, Ann Arbor, Michigan. David Sheaffer, Southfield Wildlife Management Commission, Southfield, Michigan. Joseph Valentine, City of Farmington Hills and Oakland Community Deer Coalition, Farmington Hills, Michigan.

The Detroit metropolitan area has sprawled across five counties in southeast Michigan, with urban and suburban areas expanding into former rural areas. As development pressure increased, diverse conservation organizations have preserved land in a patchwork of public, non-profit, and private natural areas. While some areas are primarily recreational, many are the target of ecological restoration (including invasive species removal, prescribed burns, and sometimes planting) and active stewardship to promote biodiversity and public nature participation. At the same time, large and growing deer populations in the region pose big challenges for ecological restoration efforts and threaten the considerable investments communities have made. Similar to impacts observed in numerous studies throughout the eastern U.S. in recent decades, deer have browsed tree seedlings, inhibiting forest regeneration, and have reduced flowering of many wildflowers, reducing resources for other species including pollinators, birds, and small mammals. Concerned about ecological impacts (as well as about increased deer-vehicle collisions, Lyme disease, and damage to landscape plants), organizations including city and county governments and park systems have developed differing strategies for managing deer. Each community has its own administrative priorities, financial, and staffing resources, research needs, and community demographics that have informed development of differing deer management options. This symposium features land managers from city, county, and state governments, and from university and metropolitan parks. Each partner will describe their particular situation and the deer management and monitoring strategies they have implemented, with differing approaches for estimating deer population, assessing deer impacts, developing and implementing policies, and educating and engaging the public. Recent efforts to develop a coordinated regional approach will be outlined. We hope to engage presenters and audience alike in a lively exchange about how restoration ecologists working in varying settings can address the challenges of deer.

Time	Presenters	Title
2:30 – 2:45 pm	**Courteau, Jacqueline**	Deer impacts in various city, county, and metropolitan parks: monitoring methods and findings.
2:45– 2:55 pm	**Mitchell, Tyler**	Deer herd and ecosystem management at the Metroparks.
2:55 – 3:05 pm	**Hahn, Michael**	Deer management for the City of Ann Arbor.
3:05 – 3:15 pm	**Krueger, Allison**	Creative strategies for deer management.
3:15 – 3:25 pm	**Kost, Michael**	Partnering with local governments in managing deer at a public university.
3:25 – 3:35 pm	**Sheaffer, David**	Managing deer in an urban setting.
3:35 – 3:55 pm	**Valentine, Joseph**	Developing a coordinated deer management strategy for Southeast Michigan: The City of Farmington Hills and the Oakland Community Deer Coalition.
3:55 – 4:30 pm	**Courteau, Jacqueline**	Questions and panel discussion

SYMPOSIUM #2, Upper Level, Breakout Area 2: Spreading the Love: Doing Restoration and Stewardship Outside of Large, Public Natural Areas.

Organizer: Krivchenia, Mark. Broughton Nature Preserve, Marietta, Ohio. Email: mark.krivchenia@gmail.com

Presenters: Kleinwachter, Jim, The Conservation Foundation, Naperville, Illinois. David Apsley, Ohio State University Extension, Columbus Ohio. Jeff Weiss, Buffalo Grove, Illinois. David Bart, Stantec, Inc. Lemont, Illinois. Amy Toohey, American Electric Power, Inc, Columbus, Ohio.

The work of doing ecological restoration is mostly focused on the restoration of large, natural areas found in public lands (federal, state, county) or protected by large, private land trusts for the public good (e.g. the Nature Conservancy). In his recent book, "Nature's Best Hope" (2019), Doug Tallamy argues that we must expand our vision of where we do restoration if we are to restore the earth's ecosystems. It calls for the work of restoration to occur in our yards, in our communities, in our workplaces and on private landholdings. The SER's International Standards for the Practice of Ecological Restoration (2016) presents a vision of what this looks like with its "Restorative Continuum"—which recognize that not all restorative work leads to full recovery of a native ecosystem but moves in that direction. The purpose of this symposium is to explore restoration work outside of large, public natural areas. We will hear about the efforts of doing restoration on right of ways, in communities, on small private land holding and in our yards. Restoration professionals and practitioners will share their experience in doing restorative activities in these less common—but important settings. How do restoration strategies (planning, implementation, maintenance) differ in these different contexts. How can we engage citizens and stewards in this kind of work? What synergies and lessons can be taken from natural areas restoration to these different landscapes?

Time	Presenters	Title
2:20 – 2:40 pm	**Krivchenia, Mark**	Opening remarks: Doing restoration outside of large, natural areas.
2:40 – 3:00 pm	**Apsley, David**	Restoration on private, rural lands in southeastern Ohio
3:00 – 3:20 pm	**Weiss, Jeff**	Restoration in our communities: A successful partnership between a city, a park district and citizens to bring biological diversity, ecological services and natural beauty to a community"
3:20 – 3:40 pm	**Bart, David**	Restoration on Right of Ways #1: Natural Areas Stewardship on Right-of-Ways in Northern Illinois.
3:40 – 4:00 pm	**Toohey, Amy**	Restoration on Right of Ways #2: How post construction restoration on ROWs can go beyond standard vegetative requirements by using native seed mixes instead of turf grass.
4:00 – 4:30 pm		Question and answer session and discussion

Symposium #3, Upper Level, Breakout Area 3: Disturbance-renewal Ecology: Restoration of Processes for Long-term Ecological Integrity.

Organizer: Thomforde, Stephen L. Stantec, Duluth, Minnesota. Stephen.thomforde@stantec.com

Presenters: Larson, Evan, University Wisconsin Platteville, Wisconsin. Joseph Walton, Dakota County Parks, Dakota County Parks, Hastings, Minnesota.

Central to ecological restoration is re-storying relationships that make up the rich community of life that surrounds us. This symposium illuminates the importance of historic disturbance-renewal regimes (DRR) as critical to maintaining diverse, dynamic, resilient native ecosystems. Therefore, critical to restoration is the capacity to restore or mimic historic DRR processes and patterns. Our symposium involves three themes. The first explores the science of DRR ecology, e.g., Keystone Species and Adaptive Cycles, to show why DRR is critical to ecological integrity and provide participants a valid scientific framework for project design and management. The second theme weaves together prehistoric, historic, Oral Tradition, and current analog evidence to model pre-Columbian disturbances and feedbacks between herbivory, fire, foodwebs, and nutrient cycles that reinforced diverse, pulsing, resilient biological landscape patterns. Current observations of intact grazing ecosystems provide models of non-random, graze dependent vegetations, foodwebs, and nutrient cycles. Likewise, fire-scar tree ring analysis allows us to model historic human-ignition fire regimes that structured non-random patterns of fire-dependent vegetations, foodwebs, and nutrient cycles. We show how herbivore and fire suppression / exclusion facilitated trophic cascades, collapsed foodwebs, energy flows, and nutrient cycles causing catastrophic state transitions symptomized by eutrophication, toxic vegetation, and the erosion of natural capital. The final theme provides DRR applications for restoration. Case studies for restoring or mimicking native herbivory and Indigenous fire in the Midwest include ecological grazing on public and private lands, and Traditional fire to restore Pinus and Quercus dominated ecosystems of the Great Lakes Region. In summary, we blend science, prehistoric, historic and Indigenous Knowledge with case studies to provide ideas to increase restoration efficacy and enjoyment. Much like sweetgrass, the relationship between people, pines, prairie, and oaks is one of reciprocity, moderated through DRR processes of fire and herbivory with implications for restoration of diverse and resilient ecosystems in changing times. Thirty minutes is built into the symposium for Q & A and discussion.

Time	Presenters	Title
2:20 – 2:55 pm	**Thomforde, Stephen**	Disturbance -renewal ecology science, application, and the future
3:00 – 3:35 pm	**Larson, Evan**	Indigenous fire stewardship: the longer-term tradition in which the tradition of restoration ecology is situated
3:40 – 4:15 pm	**Joseph Walton**	Bridges and barriers: restoring herbivores (Bison bison) in suburban natural areas

POSTER SESSION – FRIDAY APRIL 14, 2023 (At The Leopold Center)

Poster Session: 5:00 pm – 7:30 pm (*Bolded names signify the presenter of the presentation.)*		
Poster #	**Presenters**	**Title**
1	**Adams, Trent M**	Will whitetail deer (*Odocoileus virginianus*) threaten Midwest lawn alternatives?
2	**Chen, Xiaoyong**	Species and distribution of exotic earthworms in forests in Huron Mountain Preserve, Michigan
3	**Ince, Evelyn**	15 years of Recovery of Arctiidae, Saturniidae, and Sphingidae based in Post-Harvest Forests
4	**Van Zee, Sophie**	15 years of recovery in post-harvest forest lepidopteran communities.
5	**Weld, Nicholas A.**	Evaluating the presence, distribution, and population characteristics of a previously extirpated species
6	**Arroyo, Paula**	Storage and distribution of organic carbon in various soil aggregate sizes in old growth northern hardwood forests
7	**Heffernan, Megan M.**	Plant diversity and grasses increase root biomass in a biodiversity-manipulation experiment
8	**Peterson, Chelsea M**.	Connecting vegetation with soil organic matter to explore tradeoffs in restored floodplain wetlands
9	**Lipstein, Alexis A.**	Peatland CO2 emission dynamics in a wetland mesocosm experiment
10	**Duda, Melissa A.**	Hybridization in rare species could signify an alarming step toward extinction
11	**Snyder, Erin F.**	Could post-industrial sites in Chicago, Illinois be a refuge for the imperiled *Tetraneuris herbacea*?
12	**Bryant, Reb L.**	Native arbuscular mycorrhizal fungi impact the survival and growth of several prairie forbs in a restoration involving volunteers
13	**Nelson, Audrey D.**	Differences in disease incidence across species richness and phylogenetic dispersion gradients
14	**McFarlane, Stephanie L.**	Do tallgrass prairie restoration efforts aimed at improving vegetation quality provide quality habitat for monarch butterflies?

Poster Session: 5:00 pm – 7:30 pm (*Bolded names signify the presenter of the presentation.)*		
Poster #	**Presenters**	**Title**
15	**Menzies, Rose**	Finding the middle ground: Designing low growing, native lawn-alternative plant communities for pollinator support.
16	**Shalit, Amanda G.**	Bumble bee colony life stage and pollen quality as factors affecting flower visitation frequency.
17	**Gunness, Ann Marie R.**	Tradeoffs for birdsfoot trefoil management in tallgrass prairies.
18	**Widell, Abigail F.**	Woody encroachment and management impacts on intraspecific trait variation in tallgrass prairie.
19	**Summers, Chloe J.**	Assessing the ecology of the Flint River in Flint, Michigan above and below a century-old dam.
20	**Palmer, Craig J.**	Fact sheets providing guidance for quality assurance in ecological restoration project monitoring.
21	**Fevold, Brick**	Adaptive management tools, references, and annotated bibliography for planners of ecological restoration and monitoring.
22	**Collins, Dan**	Learning ecological restoration: Getting to proficiency in eight weeks, incorporating classroom and field.
23	**Kirkpatrick, Bella A.**	UWSP Society for Ecological Restoration Student Chapter: Educating volunteers to promote restoration and stewardship.

See abstracts on pages 40 to 53

ORAL PRESENTATION SESSIONS - SATURDAY APRIL 15, 2023

Session 4: Urban Restoration and Outreach. 8:20 – 9:40 am. Lower Level, Breakout Area 1		
8:20 - 8:40 am	**Kozik, Liz A.**	Rethinking urban lawns through the elements and practices of prairie restoration
8:40 - 9:00 am	**Patterson, Mars**	Hopkins Hollow Preserve and EcoRest in the City
9:00 - 9:20 am	**Duke, Shawn T**	Developing ecological restoration management programs for municipally owned natural areas
9:20 - 9:40 am	**Tucker, Rebecca C.**	Building lasting stewardship of pollinator habitats on restoration projects through community engagement

Session 5: Technology and Planning. 8:20 – 10:00 am. Upper Level, Breakout Area 2		
8:20 - 8:40 am	**Pu, Ge**	Monitoring ecological restoration projects using affordable IOT sensors: examples in the Lake St. Clair and Lake Erie regions
8:40 - 9:00 am	**Kauten, Rebecca L.**	From toys to tools: Integrating 21st century technology with field surveying for flora, fauna and phenomena
9:00 - 9:20 am	**Pu, Ge,** & **Lindi Quackenbush**	Riparian vegetation delineation using free software and datasets
9:20 - 9:40 am	**Thomforde, Stephen L.**	Terrestrial eutrophication and afforestation: Catastrophic regime shift in Midwest Savanna ecosystems
9:40 - 10:00 am	**May, Christopher A.**	A summary of the ecological and social benefits of Great Lakes Restoration Initiative projects, 2010-2020

See abstracts on pages 54 to 69

Session 6: Restoration Case Studies. 8:20 – 10:00 am. Upper Level, Breakout Area 3		
8:20 - 8:40 am	**Edmonson, Trevor D.**	The Efroymson Restoration at Kankakee Sands – 25 years and beyond
8:40 - 9:00 am	**Grieser, Kevin A.**	Converting agriculture fields to wetlands in northwestern Ohio. Biohabitats, Cleveland, Ohio
9:00 - 9:20 am	**Majka, Brian R.**	Restoration and hydrologic reconnection of a former celery farm to the Muskegon River
9:20 - 9:40 am	**Overbeck, Will W.**	Why I love ecological restoration: lessons learned through adaptive management, a pictorial history of stewardship at Gladstone Fen in northeast Illinois
9:40 - 10:00 am	**Gordon, Brad**	Incentives for private land restorations: pollinator and vegetation surveys on prairie easements and grazed oak savannas

Session 7: Intersection of Restoration and Wildlife. 10:20 am– 12:00 pm. Lower Level, Breakout Area 1		
10:20 - 10:40 am	**Smiley Jr., Peter C.**	Spatial and temporal variation in fish community structure and instream habitat in a channelized agricultural headwater stream in central Ohio
10:40 - 11:00 am	**Demchik, Michael C.**	Incorporating elements of bird habitat within restoration reference conditions: The Burdette and Sarah Eagon Nature Education Preserve case study
11:00 - 11:20 am	**Thomas, Steve**	Native plant and animal responses to a solar array setting
11:20 - 11:40 am	**Fuka, Mark E.**	Seasonal variation in small mammal granivory of native tree species reveals the optimal window for seed additions in the absence of invasive woody shrubs
11:40 - 12:00 pm	**McCarthy, Ryan L.**	More friend than foe: Herbaceous cover protects tree seedlings from mammalian herbivory, facilitating restoration of riparian forest in a degraded urban site

See abstracts on pages 54 to 69

Session 8: Revegetation Strategies and Invasive Vegetation. 10:20 – 11:40 am. Upper Level, Breakout Area 2		
10:20 - 10:40 am	**Barak, Rebecca**	Seed sourcing for restoration in a changing climate - a review of current literature, and next steps
10:40 - 11:00 am	**Etterson, Julie**	Minnesota Million: Forest restoration for carbon sequestration
11:00 - 11:20 am	**Smiley Jr., Peter C.**	Evaluating the feasibility of establishing American water willow *(Justicia americana*) colonies in the Kokosing River, Ohio
11:20 - 11:40 am	**Troutman, Rebecah**	A potential new nemesis for garlic mustard? Exploring the range and impacts of a newly arrived specialist aphid

Session 9: Joy and Benefits of Restoration. 10:20 am – 12:00 pm. Upper Level, Breakout Area 3		
10:20 - 10:40 am	**Aten, Nancy**	The Land Restoration School — preparing the next wave of ecological restoration practitioners
10:40 - 11:00 am	**Ficenec, Craig**	Helping private landowners achieve the joy of restoration through regional partnerships in Wisconsin's Driftless area
11:00 - 11:20 am	**White, Mark C.**	Recipes for joy in restoration
11:20 - 11:40 am	**Weesies, Haley R.**	Restoring a creek by reconciling relationships: stories of joy from a west Michigan watershed
11:40 - 12:00 pm	**Lenhart, Christian F.**	SER-MWGL's strategic plan

See abstracts on pages 54 to 69

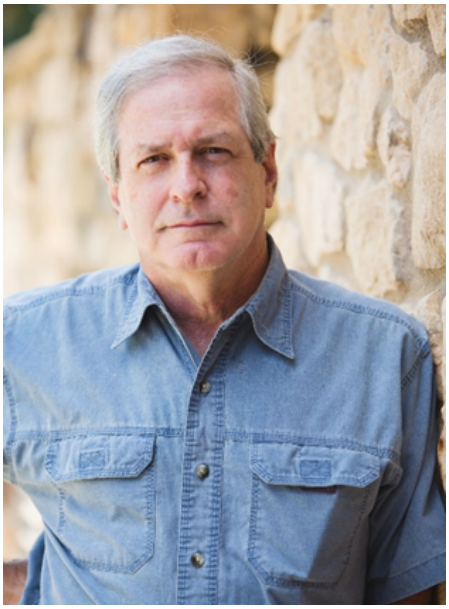
KEYNOTE PRESENTATION – SATURDAY APRIL 15, 2023

Lower Level: Dining Area

Curt Meine
The Aldo Leopold Foundation and Center For Humans and Nature

The Courage of Our Connections: Restoration in Times of Rapid Social and Environmental Change

Abstract: We live in a time of accelerating—we might say *disorienting*—social and environmental change. Under such circumstances, ecological restoration can be seen (depending on one's perspective) as essentially an exercise in futility, or as more necessary than ever. By revisiting restoration's history and evolution, we can find insight to meet the challenges we now face. In the 1930s Aldo Leopold noted that conservationists needed "guidance for meeting ecological situations so new or intricate" that society had not yet evolved an effective ethical or practical response. Since Leopold's generation, the "great acceleration" of global environmental change has altered the context of restoration. It has only revealed, however, the deep need to appreciate our socio-ecological connections—across landscapes, generations, communities, cultures, ways of valuing, and ways of knowing. With such appreciation of our relationships, we may carry the promise of restoration forward in our uncertain times.



Biography: Curt Meine (www.curtmeine.com) is a conservation biologist, environmental historian, and writer based in Sauk County, Wisconsin. He serves as Senior Fellow with the Aldo Leopold Foundation and Center for Humans and Nature; as Research Associate with the International Crane Foundation; and as Adjunct Associate Professor at the University of Wisconsin-Madison. Over the last three decades he has worked with a wide array of organizations at the intersection of biodiversity conservation, agriculture, water, climate change, environmental justice, and community resilience. Meine has authored and edited several books, including the award-winning biography *Aldo Leopold: His Life and Work* (1988/2010) and *The Driftless Reader* (2017). He served as on-screen guide in the Emmy Award-winning documentary film "Green Fire: Aldo Leopold and a Land Ethic for Our Time" (2011). In his home landscape, he is a founding member of the Sauk Prairie Conservation Alliance.

MEETING HOST FIELD TOUR - SATURDAY APRIL 15, 2023

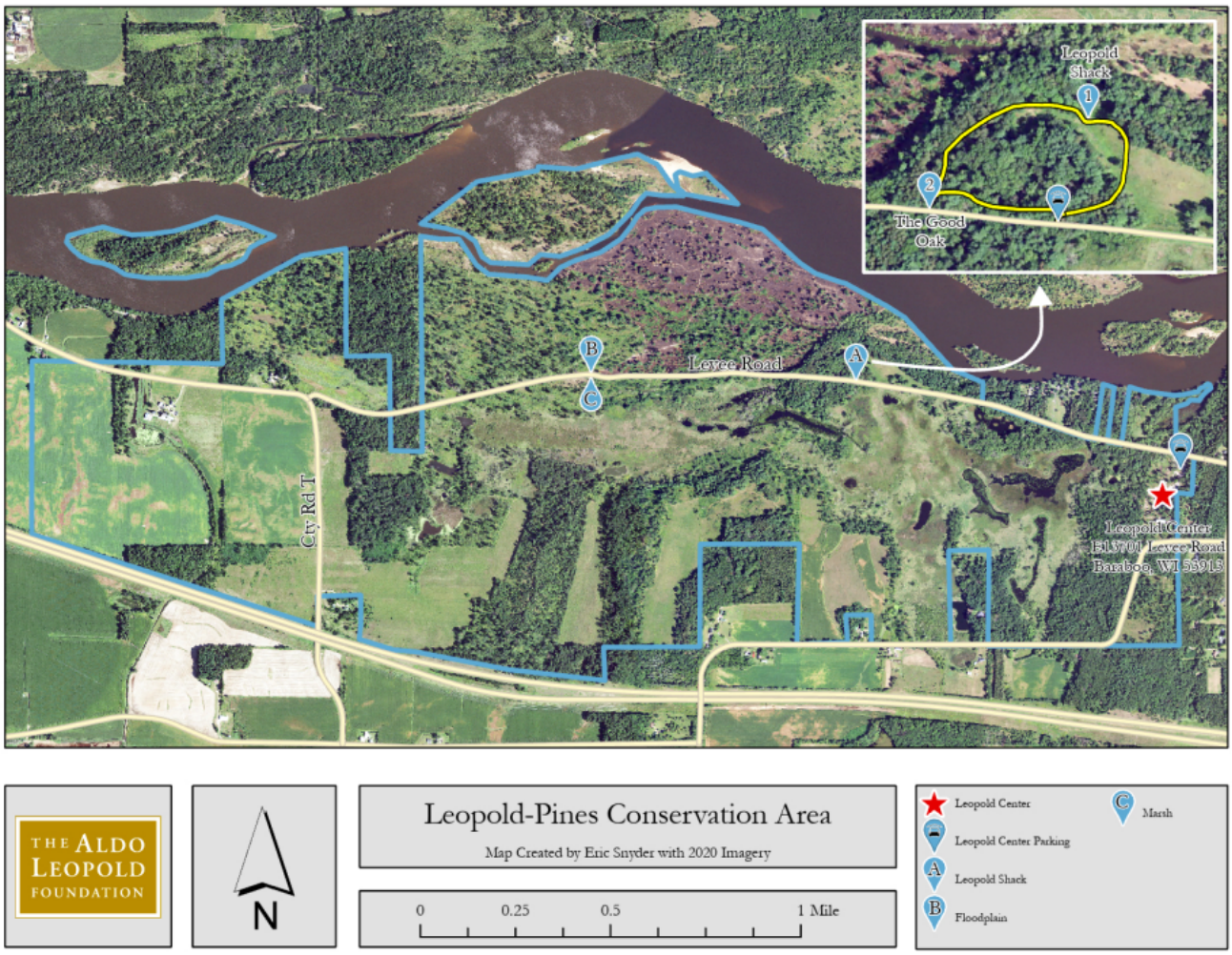
The Leopold Center

A Journey in Time with the Aldo Leopold Foundation

In 1935, Aldo and Estella Leopold purchased a worn-out farm that would become the setting of his literary masterpiece, A Sand County Almanac, and later recognized as a National Historic Landmark. During the tour, you will see where it all started around their hub of activity, the Leopold Shack. On the tour you'll appreciate Aldo and family's work to "rebuild what is being lost elsewhere," including the second oldest prairie restoration in the world. Radiating out, we will also tour our current conservation landscape and the 17.8 km^2 Leopold-Pines Conservation Area. The tour will cover our conservation vision, planning, tasks, methods and evaluation. Through intentional land management, our work seeks to meaningfully address declining populations of grassland birds, pollinators, and a changing climate.

Time	Bus #	Tour Stop Description
2:45 - 3:00 pm	**Buses**	Bathroom and water break - load buses and depart for Leopold-Pines Conservation Area and Leopold Shack
3:20 - 3:55 pm	**Bus Green**	Leopold Shack - Our restoration history and Leopold Shack
	Bus Yellow	Leopold-Pines Conservation Area - The conservation vision
	Bus Blue	Leopold-Pines Conservation Area - The means to get there
4:05 - 4:40 pm	**Bus Green**	Leopold-Pines Conservation Area - The means to get there
	Bus Yellow	Leopold Shack - Our restoration history and Leopold Shack
	Bus Blue	Leopold-Pines Conservation Area - The conservation vision
4:50 - 5:25 pm	**Bus Green**	Leopold-Pines Conservation Area - The conservation vision
	Bus Yellow	Leopold-Pines Conservation Area - The means to get there
	Bus Blue	Leopold Shack - Our restoration history and Leopold Shack
6:05 - 6:30 pm	**Buses 1, 2, & 3**	Return to Vennebu Hill

See Next Page for Map



** In the figure above A is the Leopold Shack–Our Restoration History and Leopold Shack stop; B is the Leopold-Pines Conservation Area – The Means to Get There Stop; and C is the Leopold-Pines Conservation Area – The Conservation Vision Stop*

OFFSITE FIELD TRIPS – SUNDAY APRIL 16, 2023

Pines Wetland Restoration: Legacy and Opportunity. This field trip will involve a guided tour of a restoration site that is a complex and unique wetland restoration situated in a landscape with a long history of heavily modified hydrology. This 1.3 km^2 site sits at the intersection of a drainage district, a side-hill seep, a historic levee system, and the Wisconsin River system. Restoration of the dynamic site started in the 1990s and we are actively planning the second major phase to finish the project. The field trip leaders will cover a variety of wetland restoration topics including landowner vision, restoring hydrology by filling ditches and various control structures, landscape-scale considerations, future management, and more.

Address: 12987 Co Rd O, Wisconsin Dells, WI 53965
Contact: Carl Cotter
Directions to site from Vennebu Hills

Image of Pines Wetland Restoration Area.

Forty years of Restoration by the International Crane Foundation. Starting time: 9AM, Sunday morning. April 16th. The International Crane Foundation has been involved with restoration at our headquarters facility near Baraboo, Wisconsin for over 40 years. During this guided field trip participants will visit the restoration areas, while learning about the site's history and the long process that we have embarked on to restore this once working farmstead to native prairie, wetland, and oak savanna vegetation. In addition, the field trip leaders will discuss future restoration projects at our headquarters site, highlight landscape conservation and restoration programs that International Crane Foundation is involved with in other places, and how these programs are working to secure crane populations globally. While crane exhibits will not be available for viewing during this field trip, we will also spend time talking specifically about International Crane Foundation's involvement with whooping crane and sandhill crane projects in North America. (Photo credit: Tom Lynn).

Address: E11376 Shady Lane Rd, Baraboo, WI, 53913.
Additional directions: Our headquarters is located between Baraboo and the Wisconsin Dells off of U.S. Hwy 12.

Image of a restoration site near headquarters, International Crane Foundation

Roll on Baraboo. Roll on Again. The 115 kilometers of the main stem of the Baraboo River's was freed from dams in 2001. Small streams in the upper reaches of the watershed, as well as the main river itself, were made accessible once again to native fishes including lake sturgeon and walleye. This internationally recognized restoration was accomplished through vigorous, concentrated work by a set of committed partners. Originating in the Driftless Area, the Baraboo River passes through the ancient rock formation of the Baraboo quartzite and cuts through moraines and glacial till deposits before it empties into the Wisconsin River a bit downstream of Portage, Wisconsin. Consequences from the foresight, deliberations, monitoring, scientific studies, careful and frugal plans, and actual removal of the dams were many. Efforts were markedly successful in healing damage of the dams, which had impacted the river's biotic integrity since the 1840s.

Across the four counties of its watershed, the Baraboo River mainstem restoration demonstrates that a tightly focused group of partners can achieve their shared goals in watershed-level restoration. These include reduce annual costs to citizens, improve public safety, diversify the native fishery, and remove the river from the list of impaired waters. More than 20 years after the last dam was removed, and beyond many people's expectations during the partnership's several years of work, the Baraboo River's health, recreational use, appropriate economic activities, and need for water quality improvements are now being ably advanced through businesses, municipalities and volunteer organizations. This site demonstrates the value and long-term improvement potential from a shared sense of urgency, willingness of each partner to contribute money or important services, and the embracing of a holistic, not segmented, commitment to improved land and water health. During this guided field trip, participants will walk approximately 2.4 km to see three of the four dam removal locations, hear about the rich history of the Baraboo River, and learn about the restoration activities that have resulted in restored ecological health

Address: Circus World Museum, 550 Water St, Baraboo, WI 53913.

Link to video: https://www.youtube.com/watch?v=GmllJ3K7U-c&t=5s&authuser=0

Mąą Wakącąkra Healing of People and Place. This guided field trip will encompass visiting the area known as Mąą Wakącąk, Sacred Earth, to learn about its history, natural resources and the projects underway to heal the land and people. Multiple trip leaders will discuss the history of the land from Ho-Chunk perspective to euromerican settlers to the world's largest ammunition plant that produced powder and propellant for World War II, Korea and Vietnam. The site is now managed by three major landowners including the Ho-Chunk Nation, Wisconsin Department of Natural Resources and USDA Dairy Forage Research Center. This trip will begin at the Badger Army Ammunition Plant Museum and then progress throughout the morning by caravan with multiple stops on the various landowner's parcels to discuss the history, geology, restoration and future plans. Be prepared to grab your binoculars to take in the abundant wildlife including grassland birds.

Image of Mąą Wakącąk, Sacred Earth

Address: *Badger Army Ammunition Plant Museum*, 7560 US-12, North Freedom, WI 53951

Contact: Randy H. Poelma

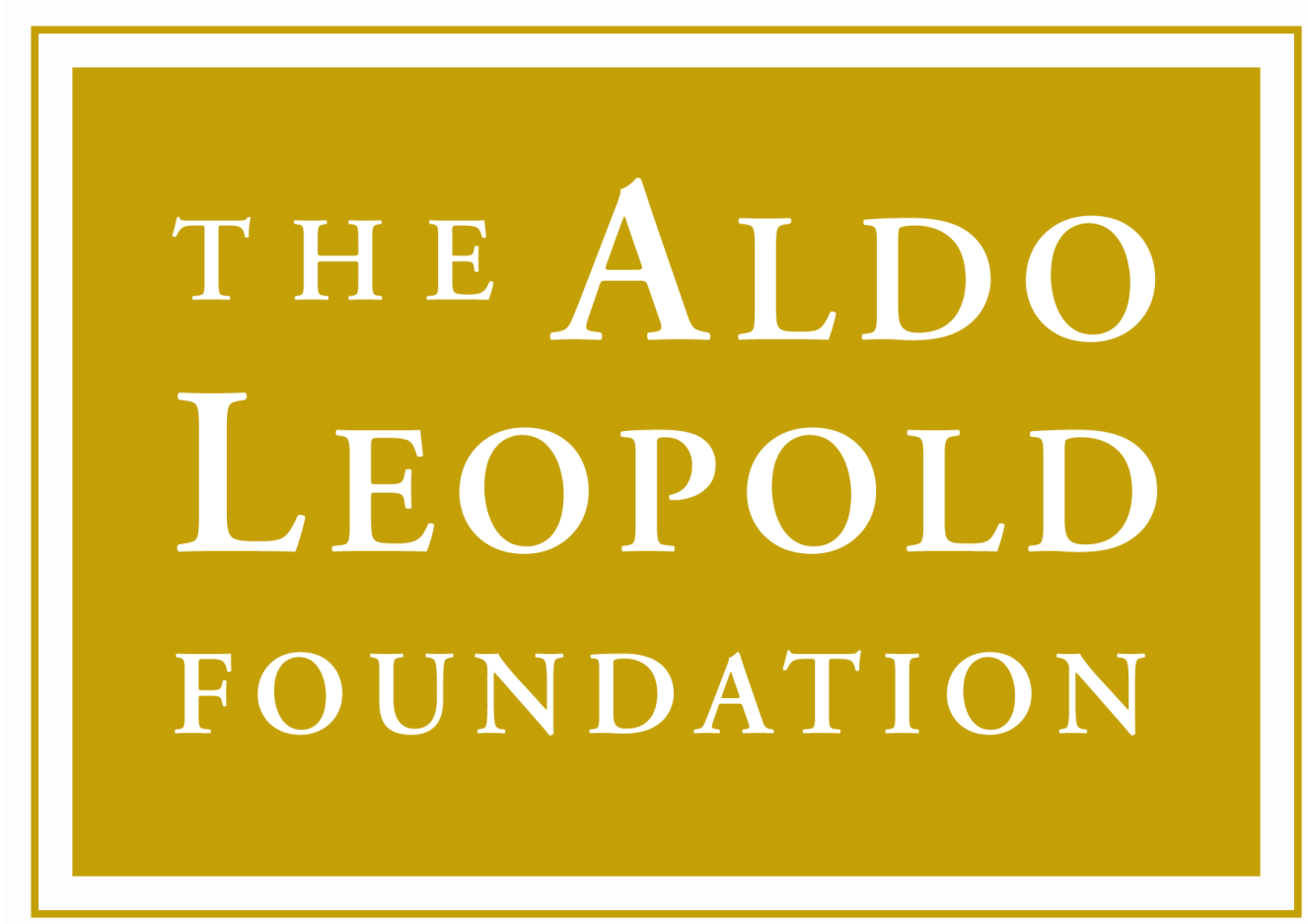
Important note on Continuing Education Credits (CEC's):

"For the Love of Restoration: History and Adaptation, 14th Annual Chapter Meeting, Society for Ecological Restoration – Midwest Great Lakes Chapter" was pre-approved for 10 continuing education credits under SER's Certified Ecological Restoration Practitioner (CERP) program. The event has been added to the calendar on the SER website (http://www.ser.org/events/).

We have also been pre-approved for CEC credits from the ISA (International Society of Arboriculture). For information on all potential CEC credits from organizations, please see the link to our "CEC Cheat Sheet" here: https://chapter.ser.org/midwestgreatlakes/files/2023/04/CEC-Cheat-Sheet_final_4.10.23.pdf

You will need to verify attendance/completion of the activity in order for attendees to receive CECs. For SER, the most common verification types are either a CERP/CERPIT sign-in sheet or a Certificate of Completion. All documentation must include the date and title of the event.

We have created a Passport to allow you to keep track of your attendance of events during the program. Check out the link here for the passport: https://chapter.ser.org/midwestgreatlakes/files/2023/04/Meeting-Passport_final_4.10.23.pdf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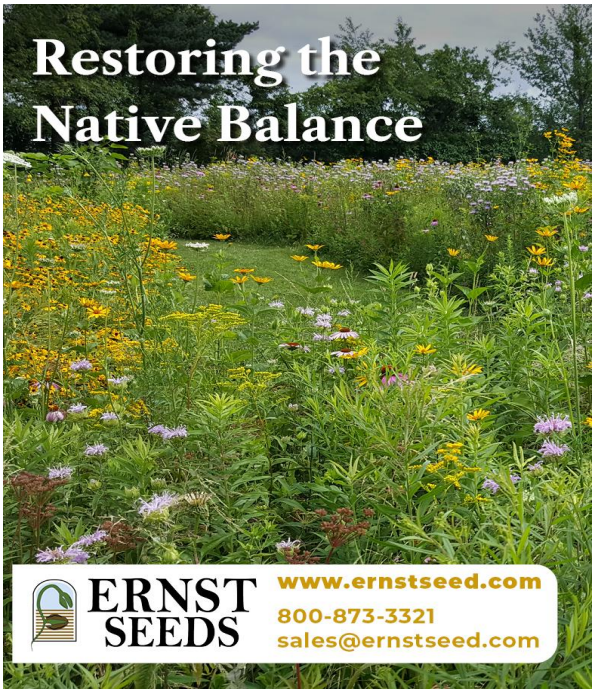
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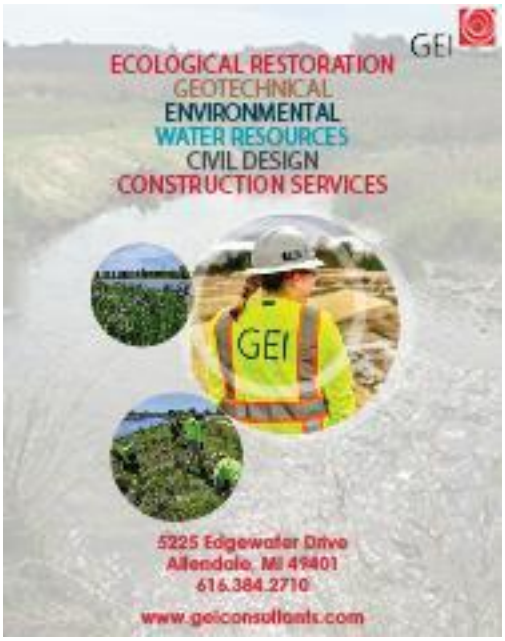
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tallgrassprairiecenter.org/case-studies

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ABOUT THE SER MIDWEST-GREAT LAKES CHAPTER

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

FRIDAY APRIL 14, 2023 ORAL PRESENTATION ABSTRACTS

Badger Hanson, Ellen* and Kathryn M. Docherty. **Exploring the effects of prairie restoration management on soil microbial communities and carbon.** Western Michigan University, Kalamazoo, Michigan. Email: ellen.m.badgerhanson@wmich.edu

Agricultural ecosystems are a major contributor to greenhouse gas emissions. One mitigation method involves integrating native prairie vegetation in marginal lands within agroecosystems. However, these restored prairies often do not regain the soil microbial community structure nor soil carbon storage found in old-growth prairies. Further study on the mechanisms behind these discrepancies is necessary to restore prairies more effectively for carbon storage. Soil microbes play a key role in determining the fate of organic material that enters the soil, and they are often overlooked in aboveground-focused restoration efforts due to logistical and financial challenges to their study. This work leverages a long-term, ongoing experiment at Kellogg Biological Station in southwest Michigan. We examined the effects of restoration size and plant seed mix richness on soil microbial communities and soil carbon. We hypothesized both would have an effect on microbial community composition. Initial 16S data indicate an interactive effect between size and plant richness in shaping microbial communities; in small and medium prairies (< 2 ha), distinct communities develop under the low-richness (12 species) and high-richness (70 species) plant seed mixes. In large prairies (> 2 ha), however, we do not find strong evidence of microbial communities differentiating by seed mix. We further hypothesized that restorations with high seed mix diversity would have more soil carbon than those with low, and that soil carbon would increase with restoration size. Microbial biomass carbon, soil organic matter, and total organic carbon data do not indicate strong effects of restoration size or seed mix richness, though there is weak evidence that microbial biomass carbon is greater in large prairies. This study aims to provide insight to inform better land management strategies for belowground restoration goals.

Bobo, Dean*[1,2], Mike Lemke[3] and Rob DeSalle[2]. **The microbial biome of recently restored Thompson Lake, Emiquon Preserve, Illinois.** [1]Columbia University, New York, New York. [2]American Museum of Natural History, New York, New York. [3]University of Illinois Springfield, Springfield, Illinois. E-mail: db3415@columbia.edu

Just as human microbiomes can serve as biotic indicators of health individuals, so too can bacteria community composition serve as an indicator of ecosystem health. Microbial communities provide critical functions by mobilizing and fixing nutrients and serving as the base of aquatic food webs. Microbial communities, which represent a third of Earth's biomass, can help to describe the biotic responses to the many and frequent changes that occur over the course of environmental restoration. For 10 years we monitored the microbial community responses to restoration in Thompson Lake, which was dried in 1919 and rewatered in 2007. In the current study we related water quality characteristics (e.g. depth, temperature, Secchi depth, select nutrients, pH, chlorophyll) to changes in the bacterial and other microbial communities from 2008-2016 to track the aquatic processes important to restoration. In 2008, Thompson Lake had remarkable water clarity and a spike in soluble reactive phosphate (SRP) that gave way to decreased clarity and little SRP by 2010. These events,

coupled with low dissolved nitrogen led to an extensive autotrophic response (i.e. cyanobacterial blooms) that were replaced by eukaryotic algae in 2010. We have characterized microbial communities in water and sediment via ARISA, 16S rRNA (for prokaryotes), 18S rRNA (for eukaryotes), ITS2 (for fungus), and shotgun sequencing to identify taxa responsible for the major pattern shifts in Thompson Lake. We describe the bacterial communities in water and sediment and relate them to environmental shifts and disturbances (e.g. nutrient fluxes, flooding events) as well as other changes to other communities that might be important for particular restoration goals - such as fish populations. This work provides important insights on how we can use microbial communities as indicators of ecosystem health and function in aquatic systems undergoing restoration.

Gutiérrez, Grace R.* and Ryan L. McCarthy. **Thorns, sweat, and tears of joy: successes and setbacks in a long-term collaborative student restoration project.** The Ohio State University, Columbus, Ohio. Email: gutierrez.272@osu.edu

Collaborative student restoration projects face unique challenges and opportunities. Here, we present a progress update on a restoration project initiated in 2019 by the SER student chapter at The Ohio State University. SER-OSU originated in 2018 and has since collaborated with local NGOs, university faculty and staff, and the public to manage a 1.5ha (3.8 acre) riparian forest restoration site along the Olentangy River in Columbus, OH. SER-OSU removed woody invasives (chiefly Lonicera maackii and Pyrus calleryana) and planted over 2,900 native tree and shrub seedlings and a mix of 20 herbaceous species, between 2019-2022 to begin restoring a riparian forest community in this heavily invaded site. Here, we discuss how this student chapter has navigated ecological and social challenges in this restoration project. The plant community has dramatically shifted in response to restoration efforts. For example, high mammalian herbivory pressure, rapid regeneration of thorn-producing P. calleryana after removal, rapid clonal expansion of Canada thistle (Cirsium arvense), and poor performance of tree cages have forced changes in management strategies. In contrast, an unexpectedly robust and diverse native herbaceous community has regenerated in areas cleared of invasives. This project has spanned multiple cohorts of students, which challenged SER-OSU to maintain institutional memory yet also benefitted members by participating in a project of a larger duration and scope than would be possible for individual independent projects. For instance, the 2019 cohort of woody plantings has been monitored yearly across five restoration project leaders and dozens of student participants. Student and staff members have learned ecological theory and applied it directly in a fieldwork setting, initiating careers and providing unparalleled mentorship opportunities.

Kelly, Tara[1]*, and Dan MacSwain[2]. **Partnerships for pollinators in Washington County, Minnesota.** [1]Washington Conservation District, Washington County, Minnesota. [2]Washington County Public Works, Washington County, Minnesota. Email: tkelly@mnwcd.org

Pollinator decline due to habitat loss, pesticide use, climate change, and other factors has the potential to cause significant declines in food production and threaten the health of our ecosystems. In 2016, the Washington County Board of Commissioners adopted a resolution in support of pollinators and resolved to plant 150 acres of prairie on County-owned property. Projects at two county parks will

be highlighted as part of this effort. At St. Croix Bluffs Regional Park, multiple agencies and non-profits organizations contributed funding and expertise to restore 18 acres of row crops to prairie. The project not only provides pollinator habitat, but protects water quality and explores alternatives in site preparation, seed mix design and timing of seeding. Lake Elmo Regional Park has over 110 acres of prairie that has been restored though numerous partnerships and funding mechanisms. One of these projects was a 32 acre prairie restoration to create new habitat for the Rusty Patched Bumble Bee. A unique partnership expanded the project to enhance wetland basins and provide volume control by also restoring natural hydrology.

Murphy, Tristan L.*, Laura L. Jackson, and Justin Meissen. **Observing expiring Conservation Reserve Program field enhancement methods for monarch habitat improvement.** University of Northern Iowa Tallgrass Prairie Center, Cedar Falls, Iowa. Email: murphtai@uni.edu

The monarch butterfly (*Danaus plexippus*) is a migratory species whose primary breeding range is the Upper Midwest United States. In 2022, the International Union for the Conservation of Nature listed the monarch as endangered due to milkweed and migratory habitat loss. One of the most promising opportunities for monarch recovery is to enhance habitat quality on private land currently enrolled in the USDA Conservation Reserve Program (CRP). In order to qualify for re-enrollment in the program and continuation of annual government payments, farmers must show adequate habitat quality or enhance their site by overseeding after burning, herbicide application, or tillage. We asked whether this process, as currently implemented, would succeed in improving monarch habitat. In summer of 2021, we assessed vegetation on seventeen farms in eastern Iowa using Daubenmire cover classes and counted milkweed stems stem density utilizing random transects. We repeated these measures on six sites that required enhancement in summer of 2022. We also measured the early establishment of five “sentinel” wildflower species in late summer 2022 that were provided to farmers to overseed on the enhanced sites. Six sites on four farms were required to enhance their vegetation in order to re-enroll. Surprisingly, end-of-contract habitat quality was not closely related to the requirement to enhance. All enhanced sites showed an increase in nectar-bearing forb cover, but milkweed density only increased on two sites and decreased at four. Warm-season grasses and *Bromus inermis* cover decreased at four sites. Most of the sentinel wildflower species established on all sites, varying from 0-30%, and some seedlings appeared at all sites, which demonstrates enhancement may afford an opportunity for seedlings to sprout. Increases in nectar resources and decreases in warm-season grasses may result in a more diverse vegetative community and incentivize usage by migrating monarchs, but milkweed loss may not.

Parr, Mary* and Todd Aschenbach*. **Plant community response to fire season and order on prairie and savanna in the Great Lakes Basin.** Grand Valley State University, Allendale, Michigan. Email: parrm@mail.gvsu.edu, aschenbt@gvsu.edu

In the southern transition zone of the Great Lakes Basin, prairie, savanna, and oak woodland communities evolved with fire and occurred as a shifting mosaic across the landscape. In the Midwest, prescribed fire is a critical management tool used to maintain biodiversity. However, fire

application is largely restricted to the dormant season, conflicting with historical fire regimes which took place year-round and in a randomized order. Land managers and researchers have questioned the influence of repetitive dormant season burns and propose diversifying fire season and order may promote greater biodiversity. Through this long-term, regional-scale study, we will evaluate plant composition and structure response to fire season and order of application in 5 locations throughout Michigan and Wisconsin. Results will evaluate fire treatments and resulting changes in 1) plant community response by study location, 2) functional plant guilds, and 3) plant species diversity. Our overarching goal is to provide greater insight into fire application and management of prairies and savannas in the Great Lakes Basin.

Schiafo, Rory B[1,2]* and Rebecca Barak[1,2]. **Light and soil and fire, oh my: Investigating the environmental gradients driving plant community diversity in oak woodland restoration.** [1]Northwestern University, Evanston, Illinois. [2]Chicago Botanic Garden, Glencoe, Illinois. Email: rschiafo@u.northwestern.edu

Once widespread, Quercus-dominated woodlands have been significantly degraded due to land use changes, fire suppression and invasive species. While we know that gradients of light, soil, and fire structured diversity in predegraded woodlands, we know less about the processes structuring diversity in those under restoration. Additionally, few studies have addressed how these gradients drive the assembly of species sown as seed. This study addresses how the environmental gradients of canopy openness, soil conditions, and prescribed fire frequency influence both the sown and non-sown diversity in restored woodlands. I investigated the relationships between environmental gradients and plant community diversity and composition in 210 m2 plots in seven woodland restorations in the Forest Preserves of Cook County, Illinois. In each plot, I surveyed plant community composition, canopy openness, soil properties, and determined the burn rate (total burns/years since first burn) and seeding history. When considering the entire community (sown and non-sown species), I found no effect of canopy openness, burn rate, or soils on species richness or Shannon-Weiner Index. However, I found that canopy openness ($r^2 = 0.05$, $p = 0.009$) and burn rate ($r^2 = 0.09$, $p = 0.001$) drive patterns of community composition. There were significant positive relationships between canopy openness and the abundance of native forbs ($r2 = 0.42$, $p < 0.0001$) and a significant negative relationship between burn rate and non-native abundances ($r^2 = 0.23$, $t1 = -2.04$, $p = 0.04$). Seeded status of a plot (i.e., whether that plot had received seed addition) and canopy openness interacted in their effect on species richness, such that there was a significant relationship between richness and canopy openness only when considering the unsown plots ($r2 = 0.53$, $p= 0.03$). Understanding the response of plant communities to environmental gradients will help guide restoration practices and enhance the predictability of future restorations.

Warneke, Christopher R[1,2]*, Stephanie G. Yelenik[3,4], and Lars A. Brudvig[1]. **Fire modifies plant-soil feedbacks.** [1]Michigan State University, East Lansing, Michigan. [2]University of Wisconsin-Madison, Madison, Wisconsin. [3]United States Geological Survey, Hawai‘i National Park, Hawai‘i. [4]United States Forest Service, Reno, Nevada. Email: warneke@wisc.edu

Feedbacks between plants and soils, often mediated by microbes (termed plant-soil feedbacks or PSFs) have been widely shown to influence plant diversity both locally and at landscape scales, yet these interactions are only rarely examined in the context of other environmental factors. Better understanding of how environmental factors affect PSFs is important because these factors can change the strength and/or the direction of PSFs for the plant species. A common environmental factor is that of fire, either natural or prescribed, which, despite its frequent occurrence, has not been examined in the context of PSFs. Fire may alter the composition of the soil microbial community, which can change what bacteria/fungi are available to colonize plant roots, and thus can affect how seedlings grow after the fire. We examined the effects of a recent fire on the early growth of two nitrogen-fixing plant species. Both of our focal species produced more biomass when grown in conspecific soils (in comparison with heterospecific soils), indicating a positive plant-soil feedback. This positive feedback was mediated by nodule formation, which is a critical stage of early growth for legume species. Additionally, these results show that there may be some host-specificity in the rhizobial bacteria that form the legume-rhizobial symbiosis with their parent plant. Fire led to a weakening of PSFs, which were significantly positive in non-burned soils but were nonsignificant in burned soils. Our results show that fire can modify PSFs and weaken the legume-rhizobial symbiosis, which may result in altered local competitive dynamics. Our findings illustrate the potential importance of the effect of fire in affecting feedbacks between plants, microbes, and soils.

Zink, Madison*, Kayla Lindquist, Annah Bender, and Russ Benedict. **Preference of plants as nectar sources by monarch butterflies (Danaus plexippus) in a tallgrass prairie reconstruction.** Central College, Pella, Iowa. Email: benedictr@central.edu

The monarch (*Danaus plexippus*) has declined in population in North America in the last decade. As a result, landowners are encouraged to plant prairie plants to benefit monarchs, but the preference of foraging adult monarchs is poorly known. Our goal was to determine which plants commonly seeded in prairie reconstructions in Iowa are most used by feeding adult monarchs. This project was conducted during summers of 2018-2020 in Marion County, Iowa. Monarchs were observed feeding, and measurements were taken of the plant used and the number of other flowers available within 5 m of the focal plant. Over three years, we observed 364 feeding events. Monarchs chose flowers from six plant families with Asteraceae having the highest number of feedings, followed by Asclepiadaceae. At the family level, use of plants by monarchs was correlated with abundance of those families. Within families, a total of 32 different plant species were used for nectaring, with compass plant (*Silphium laciniatum*), common milkweed (*Asclepias syriaca*), sawtooth sunflower (*Helianthus grosseserratus*), New England aster (*Symphyotrichum novae-angliae*), butterfly milkweed (*A. tuberosa*), and false sunflower (*Heliopsis helianthoides*) being the most frequently used. Within Asteraceae, the plant species chosen was correlated with abundance but not strongly; abundance and use were uncorrelated in other families. Given the breadth of plants used by monarchs, the specific species seeded in plantings may be only one of several factors to consider. In particular, given the increasing frequency of droughts and other forms of severe weather, planting prairies with high species richness likely will be beneficial by assuring access to nectar for monarchs (and other species) even if one plant species has a poor growing season. Furthermore, given changes in timing of migration of

monarchs, it likely also is important to include many early and late-blooming plants in reconstructions to provide nectar during migration.

SYMPOSIUM #1: Monitoring and Managing Deer Impacts as Part of Ecological Restoration

Individual Symposium Presentation Abstracts:

Courteau, Jacqueline B. **Monitoring deer impacts in various city, county, and metropolitan parks: summary of methods and findings.** NatureWrite LLC and University of Michigan, Ann Arbor, Michigan. Email: jbcourteau@gmail.com

From 1998 to 2021, we have assessed deer impacts in many natural areas in the southeast Michigan communities featured in this symposium, including the Huron-Clinton Metroparks, the Cities of Ann Arbor and Southfield, Washtenaw County Parks, and University of Michigan's Nickels Arboretum, sometimes tracking trends over time. Although years and methods have varied, findings have many similarities, and are also in keeping with those found many studies throughout the Northeast. In this talk, I will present an overview of methods used to assess deer impacts—including browse damage surveys, floristic quality assessments, exclosure studies, experimental plantings, and pollinator surveys, in various combinations; other monitoring methods were also tried but proved less useful. I will highlight key findings for forest ecosystems and grasslands in urban, suburban, and rural natural areas, and consider how deer impacts can pose a challenge for ecological restoration efforts.

Mitchell, Tyler. **Deer herd and ecosystem management at the Metroparks.** Huron-Clinton Metropolitan Authority, Brighton, Michigan. Tyler.Mitchell@metroparks.com

The Huron-Clinton Metroparks is a regional park system in Southeast Michigan covering 25,000 acres in a five-county region. The Metroparks began to investigate the need for deer management in 1998 following a widely observed loss in vegetation across the parks, and the visible malnutrition and decline in the park's deer herd. The Metroparks uses a combination of aerial deer population surveys, and vegetation study plots to assess the need to manage deer and track impacts on the parks' ecosystems. Annual aerial deer counts are utilized to estimate deer populations in each park, and deer are managed to a health density of 15–20 deer per square mile, based on recommendations from the Michigan Department of Natural Resources. In tandem with the aerial surveys, fenced plots or "deer exclosure" plots are monitored each spring to assess browse pressure and differences in vegetation present within the exclosures and outside in the surrounding park. Since the program began in 1998, deer populations have steadily decreased with our management program, in an effort to reach the 15-20 deer per square mile density in each park. The Metroparks recently reviewed and updated its Deer Herd and Ecosystem Management plan in 2021. This update ensured that our program was consistent with the latest scientific studies and best management practices. This review also updated our policies and procedures for internal and external communication. The Metroparks

deer management program is conducted annually in February under a nuisance permit issued by the Michigan DNR. The management activities of this program are largely conducted by staff, but also include public volunteers where able.

Hahn, Michael. **Deer management for the City of Ann Arbor.** City of Ann Arbor Natural Area Preservation, Ann Arbor,Michigan. Mhahn@a2gov.org

The City of Ann Arbor is home to over 120,000 people. What attracts them to the community are the universities, big city amenities yet small town feel, and easily accessible nature. In the city alone, there are 2,400 acres of rolling parkland and wooded natural areas. It is these same woodlands, open spaces and backyards that form an attractive habitat for a thriving herd of White-tailed deer. When you have an overabundance of deer an in urban area, as in Ann Arbor, the public will have both positive and negative interactions. In response to numerous resident reports of deer damaging landscaping, their impacts to ecological value of the City's public natural areas, as well as concerns regarding vehicle/deer collisions and deer-borne diseases, Ann Arbor City Council approved the establishment of Ann Arbor's deer management program in August 2015. Over the course of this presentation, I will cover the primary components of the city's deer management program: sterilization, culling, education, and the tools developed to help measure and communicate the program's success.

Krueger, Allison. **Creative strategies for deer management.** Washtenaw County Parks and Recreation Commission, Ann Arbor, Michigan. kruegera@washtenaw.org

Voters in Washtenaw County approved a millage for land preservation in 2000, and in 22 years, the county's Natural Areas Preservation Program (NAPP) has protected 6,000 acres through the purchase of land and conservation easements. Many of these properties are affected by the flourishing population of whitetail deer in the region. A 2014–15 study at one rural park, the Leonard Preserve, showed significant deer impacts on native plants and natural communities, and justified a need for management action. Although hunting can be a divisive topic for park agencies, NAPP staff developed a unique hunting partnership with Michigan Operation Freedom Outdoors (MiOFO). MiOFO is a nonprofit dedicated to connecting veterans and the disabled community to outdoor sports and adventures. This partnership has prioritized meaning community engagement alongside deer management. Seven years later, MiOFO veterans, families, and volunteers have removed 111 deer from Leonard Preserve. A follow-up study of deer impacts in 2020-21 showed improvements in grassland flowering species but continued damage to tree seedlings and forest wildflowers. Understanding the effects of this localized hunting strategy is informing other land management decisions. This unique strategy is being repeated with more hunting organizations to preserve grassland restoration sites. We are not sure who is more joyful, the land managers seeing improved plant communities or the veterans after a successful hunt.

Kost, Michael. **Partnering with local governments in managing deer at a public university.** University of Michigan, Matthaei Botanical Gardens/Nichols Arboretum, Ann Arbor, Michigan. michkost@umich.edu

The University of Michigan's Matthaei Botanical Gardens and Nichols Arboretum (MBGNA) receives over 500,000 visitors per year and has evolved its core mission to encompass biodiversity conservation on its four properties, which total over 800 acres. MBGNA staff and volunteers actively work to restore and steward natural areas through collecting and cleaning native plants seed, propagating and planting native plants, conducting prescribed fires, and removing invasive plants. However, maintaining native plant diversity and other botanical collections has become increasingly challenging with the rise in deer densities in and around the properties we steward over the past 30 years. Further, a field study in Nichols Arboretum in 2015-2018 (Courteau, 2019) concluded that browsing by deer is severely limiting oak regeneration, native plant reproduction, and food resources for pollinators. Conversely, where fencing has been installed to exclude deer, native plants and botanical collections have thrived. Unfortunately, installing and maintaining fencing to exclude deer from large areas is cost-prohibitive and not a practical solution to limiting the detrimental impacts of high deer densities on biodiversity. A deer cull led by the City of Ann Arbor that included Nichols Arboretum was conducting during 2017-2020, along with simultaneous culls at a small neighboring preserve, initially appeared to have reduced the overall numbers of deer observed in the Arb and allowed common trillium to flower en masse for the first time in over a decade. Reducing deer densities is a critically important tool in conserving biodiversity that requires a regional approach. In many instances, leadership for these efforts will need to come from state and local governments, with universities contributing to educational efforts, and where feasible, opening their lands as potential sites for culls.

Sheaffer, David. **Managing deer in an urban setting.** Wildlife Management Commission, Southfield, Michigan. dsheaffer@cityofsouthfield.com

Southfield, a suburb of the City of Detroit, has experienced an increase in resident perception of a growing whitetail deer population and potential human-animal conflict. The city began monitoring its deer population in 2017 using an annual aerial survey and commissioned a study of browsing impacts on local parks and green space. In 2020, the City Council created a public advisory commission staffed by residents to study the issue further and to propose a wildlife management program for the city. The commission has engaged in several different forms of public outreach to gather input from residents, has drafted and implemented a no feeding ordinance and increased wildlife signage throughout the city, has placed and advisory deer management question on the local ballot, and is drafting a report with numerous recommendations to the City Council concerning the future of wildlife management within the City, the role of the commission and city staff, and options for actively managing the local deer population. This talk will discuss the City of Southfield's ongoing human-wildlife conflict mitigation efforts, the commission's recommendations for future actions to the City Council, and political and financial concerns that can be an obstacle for local efforts. While the Commission is recognizes that concerns about deer were the impetus for its formation, it is urging the City Council not myopically focus on deer, and instead look at local wildlife and their impacts as a part of the broad ecosystem and to consider habitat restoration and public education along with population management as a long-term strategy.

Joseph A. Valentine. **Developing a coordinated deer management strategy for Southeast Michigan: The City of Farmington Hills and the Oakland Community Deer Coalition.** City of Farmington Hills, Farmington, Michigan. Email: JValentine@fhgov.com

Starting in 2014, the City of Farmington Hills began working with the Michigan Department of Natural Resources to develop and implement a deer management plan for the City. Following the recommendation of the Michigan Department of Natural Resources, the City began collecting deer data through annual aerial deer counts for Farmington Hills and Farmington (2016-2019; 2021-2022), logging resident concerns, conducting community deer surveys, tracking deer vehicle crashes and carcass removal, researching impact deer made in parks and neighborhoods as it relates to the ecosystem, and providing education and resources to residents. In 2018, the City of Farmington Hills began working with neighboring community, Southfield, Michigan to perform aerial deer counts and develop reports. The idea of creating a more formal regional deer plan was discussed with several neighboring communities of Farmington Hills, and in 2021 the Oakland County Urban Deer Management Coalition was formed. In 2022, the coalition partnered with SEMCOG (Southeast Michigan Council of Government) and its survey consultant, Cobalt Community Research, to conduct a seven-county deer survey where 12,275 individuals from 375 zip codes responded. The Coalition is now working on crafting a regional deer management strategy for Oakland County.

SYMPOSIUM #2: Spreading the Love: Doing Restoration and Stewardship Outside of Large, Public Natural Areas

Individual Symposium Presentation Abstracts

Apsley, David. **Restoration on private, rural lands in southeastern Ohio** Ohio State University Extension, Columbus, Ohio. Email:

The Ohio Interagency Forestry Team is working collectively to sustain and restore Oak Dominated forests--the dominant native ecosystem in a 17 county focus area in SE Ohio. This area contains about 43 percent of Ohio's forest resources. Presettlement, the entire region was composed of mixed hardwood forests. Much of the focus is to increase awareness of current trends in our oak dominated forests and to encourage practices that favor oak regeneration. David will discuss the successful programs OSU Extension has implemented in the region—including programs on restoring native woodlands and creating meadow and pollinator habitats restorations in old agricultural fields and pastures.

Weiss, Jeff. **Restoration in our communities: A successful partnership between a city, a park district and citizens to bring biological diversity, ecological services and natural beauty to a community** Buffalo Grove, Illinois. Email:

Jeff has been working with the community of Buffalo Grove (population >60,000) for more than twenty-five years to transform city and park lands into native, diverse habitat within a thriving suburban community. This work has includedd shoreline and creek restoration projects, green infrastructure, and native plantings in many park settings. I will share what I feel is the key to success in urban restoration, which is building a collaborative relationship with civic government (city and parks), civic organizations, and the local business community.

Bart, David. **Restoration on Right of Ways #1: Natural Areas Stewardship on Right-of-Ways in Northern Illinois**. Stantec, Inc., Lemont, Illinois. Email:

Dave will present results of natural areas stewardship on Commonwealth Edison's (Comed) powerline right of ways in northeastern Illinois. He will share the impetus for the program, how sites are selected, the work being conducted on the sites and their challenges and how success of these projects is being measured. Finally, Dave will share the lessons learned from this important work.

Toohey, Amy. **Restoration on Right of Ways #2: "How post construction restoration on Right-of-Ways can go beyond standard vegetative requirements by using native seed mixes instead of turf grass**. American Electrical Power, Inc., Columbus, Ohio. Email:

Ms. Toohey will share her company's experience doing post construction plantings on electric power right of ways in southeastern Ohio. Post construction plantings using native seeds in lieu of clover and cool season grasses have shown promising results. Information provided will include both the flexibility of native seed planting and compatibility with current post construction methods. Information presented will include: species data, top performing species in different mixes, and draw on some of the data from Dawes Arboretum (Ohio) research on pollinator and mammal response to native plantings on right of ways. These findings can hopefully dispel some of the myths among contractors/practitioners. They also show that cost and installation methods should not be a limiting factor in encouraging native plantings of electric power right of ways.

SYMPOSIUM #3: Disturbance-renewal Ecology

Individual Symposium Presentation Abstracts

Thomforde, Stephen*. **Disturbance (renewal) ecology science, application, and the future**. Stantec, Duluth, Minnesota. Email Stephen.thomforde@stantec.com

This presentation introduces primary ecological principles including Keystone Species & Processes, Disturbance Theory, Far From Equilibrium Dynamics, Connectivity, Holling Adaptive Cycles, Resilience, and State Transition models to illuminate the importance of disturbance ecology as the primary renewal mechanism in ecosystems. This presentation defines disturbance and identifies the top-level disturbances, herbivory and fire, associated with natural areas prior to settlement. Keystone herbivores, from mammoths to bison to native invertebrates are highlighted and modeled for structural impacts and nutrient cycling that benefited highly evolved, graze-fire obligate biological assemblages in ways that imposed shifting energy and nutrient flows for system renewal. The presentation then models the impacts and biotic / abiotic trajectories associated with the removal of keystone processes, e.g., disturbance, including Trophic Cascades, Eutrophication, Afforestation, Catastrophic Regime Shifts, and Social Myths that perpetuate the dysfunctional state. Presentation ends by modeling and providing case studies for how to restore herbivory and fire in ways that mimic historic patterns and processes, including grazing native and non-native herbivores, employing indigenous fire patterns, and haying as mimic for biomass harvest and nutrient cycling. This model provides a scientifically valid, technically feasible, and economically viable model for increasing ecological integrity on existing natural areas, and expanding restoration across the landscape, both public and private lands, to the benefit of social-ecological cohesion, including biodiversity, water quality, soils, while providing human communities alternative emerging markets for green foods, fibers, and careers.

Larson, Evan***. Indigenous fire stewardship: the longer-term tradition in which the tradition of restoration ecology is situated**. University Wisconsin Platteville, Wisconsin.

Restoration ecology has a long tradition of using fire to promote ecological diversity, resiliency, and function. The reason that this tradition exists, and that fire is such a central tool in the toolbox of restoration ecologists, is that among all of the environmental changes wrought by the arrival of Europeans to North American and the ensuing centuries of settler-colonial displacement and extraction, disrupting relationships among people, the land, and fire has been one of the most complete and widespread. Until recently, the dominant perspective of fire in U.S. culture reflected a mindset steeped in command-and-control ideology and the notion that people are distinct and separate from nature. Through the work of many, this perspective is changing. In this talk, I will share emerging research weaving tree-ring-based fire history information with Indigenous Knowledge to tell a more complete and accurate story about the role of people and fire in shaping the forested landscapes of the Upper Great Lakes. In the context of this story, notions of wilderness dissolve while ideas of reciprocity bring people squarely into the community of life as active participants and co-creators, rather than separate individualists. In particular, fire and forest demographic data illustrate that the fates of people and red pine are intertwined and moderated through flames, and that this relationship serves as a flagship for myriad other fire-dependent species. The stories of fire held in the rings of trees are a vital catalyst to this effort, enabling cross-cultural conversations and collaborations among stakeholder groups that are informing land and fire stewardship across the region. Restoration ecologists are key allies in the work of not just restoring ecosystems, but also in restoring the relationships that shaped them over millennia.

Walton, Joseph*. **Bridges and barriers: restoring herbivores (*Bison bison*) in suburban natural areas**.: Dakota County Parks, Hastings, Minnesota. Email: joseph.walton@co.dakota.mn.us.

This presentation describes the planning, coalition building, funding, and implementation of reintroducing bison, following a 175 year hiatus, to an Midwest Metro Regional Park System in Minnesota. The presentation covers the initial idea behind restoring keystone herbivores to county lands managed for nature. This includes an exhaustive literature review of ecological principles, based on disturbance (renewal) ecology to develop a framework to test ecological and social feasibility. This includes a costing for infrastructure for economic viability, an analysis of material and animal availability for technical feasibility, and outreach to gain public and peer acceptance. The presentation then shifts to implementation and describes how a particular park was chosen, the size of the bison patch, design of fencing and grazing systems, and baseline data and monitoring protocols. The presentation ends by describing assumed outcomes, including impacts on biological diversity and ecological integrity, and how this project / information might contribute to recoupling the second trophic level to the first in other natural areas and on private lands.

FRIDAY APRIL 14, 2023 – POSTER PRESENTATION ABSTRACTS

P1. Adams, Trent M*[1], Rebecca S. Barak[23], Liz Anna Kozik[4], Lauren Umek[5], and Rebecca K. Tonietto[1]. Will whitetail deer (*Odocoileus virginianus*) threaten Midwest lawn alternatives? [1]University of Michigan-Flint, Flint, Michigan. [2]Chicago Botanic Garden, Glencoe, Illinois. [3]Northwestern University, Evanston, Illinois. [4]University of Wisconsin-Madison, Madison, Wisconsin. [5]Chicago Park District, Chicago, Illinois. Email: Trentad@umich.edu

Turfgrass lawns are the most abundant irrigated crop in the United States. Turfgrass maintenance requires mowing, watering, and herbicide application which demands labor and can stress water resources. Native lawn alternatives made of short-growing grasses and forbs do not require mowing or watering once established and can provide resources to native insects. Lawn alternatives are beneficial when full prairie restoration is not feasible, especially in residential and commercial lawns. The establishment of native lawn alternatives could be threatened by deer browse, especially in the Midwest where deer populations are above historical levels. This experiment tested if three species of interest, Large-leaved aster (*Eurybia macrophylla*), Silky aster (*Symphyotrichum sericeum*), and Purple prairie clover (*Dalea purpurea*), would be browsed by Whitetail Deer (*Odocoileus virginianus*) or other common herbivores in southeastern Michigan. Plugs and seedlings of each plant species were placed in pots and set at each field site, with control plants being protected by a 3x3 foot mesh cage. Strawberry (*Fragaria × ananassa)* was used as a positive control because it is palatable by deer while Milkweed (*Asclepias* spp.) was used as a negative control because it is not palatable by deer. Experimental plants and trail cameras were placed at three sites in southeastern Michigan for one week each month from June-September 2022. We found that none of the Large-leaved and Silky Aster were browsed by wildlife. We observed raccoons, but no other wildlife, eating Purple Prairie Clover. However, a Chi-Squared Test of Association found no significant difference in herbivory damage between the protected and exposed plants (df = 1, p = 0.3).

P2. Chen, Xiaoyong[1]*, John Yunger[1], Timothy Gsell[1], Mary Carrington[1], Lynda Randa[2], Paula Arroyo[1], Madeleine Naliwko[1], Andren Yunger[3] and Yuanying Peng[4]. Species and distribution of exotic earthworms in forests in Huron Mountain Preserve, Michigan. [1]Governors State University, University Park, Illinois. [2]College of DuPage, Glen Ellyn, Illinois.[3]Lincoln-Way West High School, Lenox, Illinois. [4]Lewis University, Romeoville, Illinois. Email: xchen@govst.edu

Introduced exotic earthworms in northern Great Lakes forests can negatively affect ecosystem functioning and biodiversity. However, the extent and mechanisms of the influence of the exotic earthworms are poorly understood. To investigate species composition, abundance, distribution, and biomass of earthworms in northern coniferous-hardwood forests, three common forest types, hemlock-red pine forests (HPF), maple-poplar forests (MPF), and maple-birch forests (MBF), were selected in the Huron Mountains of Michigan, Upper Peninsula. Sampling quadrats (0.5m × 0.5m) were established in each forest type and earthworms were captured from these quadrates by using a mustard solution extraction. Each earthworm was identified to species, and its length and biomass measured. *Dendrobaena octaedra* was the dominant species, followed by *Aporrectodea longa* and *Lumbricus terrestris*; all these species are invasive exotic. The average earthworm density was about 14.2, 13.2 and 11.1 worm/m^2 in MPF, HPF and MBF, respectively. The earthworm biomass averaged 0.91. 0.22 and 0.25 g/m^2 in MPF, HPF and MBF sites. The average earthworm length was approximately 519.6, 328.0 and 328.3 mm/m^2 in MPF, HPF and MBF. There is a significant quadradic relationship between earthworm length and biomass. Large individuals represent a small portion of the population. These large individuals are often associate with lake shores. Our results provide reference for better understanding of the quantity and distribution of the exotic earthworms in northern hardwood forests.

P3. Ince, Evelyn* and Keith Summerville. 15 years of Recovery of Arctiidae, Saturniidae, and Sphingidae based in Post-Harvest Forests. Drake University, Des Moines, Iowa. Email: evelyn.ince@drake.edu

Lepidopterans are highly dependent on the type of forest community in which they live. Different types of harvest will shape both the dominant tree layer and the understory layer. Our study focuses on the response and recovery rate of lepidopteran families Arctiidae, Saturniidae, and Sphingidae (Tiger, Lichen, Sphynx, and Silkworm moths) to different harvest intensity levels imposed on restored oak hardwood forest. This ongoing, 100-year long study is based in the Morgan-Monroe State Forest in south central Indiana, with lepidopteran sampling first occurring in 2007. In 2008, private timber concessionaires were contracted to remove trees corresponding to the experimental design. The levels of harvest included no harvest, shelterwood cuts (20% harvest), patch cuts (60% harvest), and clearcuts (100% harvest). Moths were collected using universal black light traps and remained lit from 20:00 hours to 07:00 hours. Community structure was analyzed using data from 2007, 2013, and 2022. Utilizing repeated measures ANOVA, we found that harvest significantly impacts composition of these lepidopteran families. Community composition also differed among the stands. These results indicate that changes in Arctiid community structure are driven by both

the level of timber removed from a stand and the time since harvest. In general, intensive timber extraction methods disturb the moth community more than a less intensive method of extraction.

P4. Van Zee, Sophie*, and Keith Summerville. 15 years of recovery in post-harvest forest lepidopteran communities. Drake University, Des Moines, Iowa. Email: sophie.vanzee@drake.edu

Forest dynamics, are largely impacted by disturbances which can shape both the dominant tree layer and the understory layer. We explored the response and recovery rate of forest lepidopteran communities to different harvest intensity levels imposed to restore oak hardwood forests. This longitudinal experiment was conducted within Morgan-Monroe State Forest in south central Indiana, with lepidopteran sampling occurring since 2007. In 2008, private timber concessionaires were contracted to remove trees corresponding to the experimental design. The levels of harvest included no harvest, shelterwood cuts (amount of standing bole removed), patch cuts, and clearcuts. Moths were collected using Universal black light traps and remained lit from 20:00 hours to 07:00 hours. Community structure was analyzed using data from 2007, 2009, 2010, 2020, and 2021. Utilizing repeated measures ANOVA, we found that higher levels of timber harvest in patch cut stands were associated with greater loss of species compared to the species richness decline associated with shelterwood stands. Furthermore, we found that the level of timber harvest associated with forest stands directly impacts time-to-recovery for forest moth communities, with higher intensity logging associated with longer time-to-recovery. We also found that after logging reaches a critical threshold, communities recover to a new equilibrium rate that differs from pre-harvest community composition. These results indicate that shelterwood logging can be used to restore oak hardwood systems without lasting harm to the forest lepidopteran community.

P5. Weld, Nicholas A.*, Joseph Sucic, and Jill Witt. Evaluating the presence, distribution, and population characteristics of a previously extirpated species. University of Michigan-Flint, Flint, Michigan. Email: nweld@umich.edu

Anthropogenic pressures on many species globally, from habitat degradation to over exploitation, have led to extirpation from areas of their historic range. One example, the fisher, *Pekania pennanti,* was thought to be extirpated in the Lower Peninsula of Michigan. However, recent observations challenge this notion and suggest fishers are present in the Lower Peninsula. To detect the presence of fisher, we designed a map of possible sampling locations using ArcGIS. Parameters used to create this map include forest cover (60% or greater), home range size (6 km^2), and placement on public lands. These generated sites were then used to non-invasively collect genetic material from animals using hair snares. Snares were placed at each site for approximately 24 days before they were moved to a new location within the sample area. We checked these snares every 3-4 days for hair and collected samples for DNA extraction in the laboratory. We developed species specific primers and fluorescent probes for fisher to analyze these samples using quantitative polymerase chain reaction. Samples that contain fisher DNA will be confirmed using DNA sequencing. Confirmed samples will then be analyzed through microsatellite analysis. These results will indicate the number of individuals, their sex, and the genetic relatedness of the samples we collected. From the samples collected, we will determine if these fishers originate from the same population and areas of confirmed presence. If

enough samples were collected we will be able to determine other population characteristics such as population size, sex ratio, etc. Fishers are used as a management indicator species to track ecosystem health. This study will provide information about the fishers present in the Lower Peninsula and allow for more informed management decisions.

P6. Arroyo, Paula*, Xiaoyong Chen, and Mary Carrington. Storage and distribution of organic carbon in various soil aggregate sizes in old growth northern hardwood forests. Governors State University, University Park, Illinois. Email: parroyo2@student.govet.edu

Old-growth forests have been recognized as significant soil organic carbon (SOC) pools, but the storage potential and distribution of SOC at different soil aggregations in these forests are still not well understood. We examined the total amount and distribution of SOC across water-stable aggregate size fractions (<0.053 mm, 0.053-0.25 mm, 0.25-1 mm, and > 1 mm) in three old-growth forests (White birch - Hemlock - Red maple mixed forests (WHRF), Hemlock dominated forests (HDF), and Sugar maple forests (SMF)) in Huron Mountain, Michigan. Our specific objectives were: (1) quantify the amount, the proportion and stratification ratio of SOC at different soil depths, (2) assess the soil aggregate-size distribution and stability in the study site, and (3) compare the SOC sequestration in aggregates among the three forest types. Three 20m × 20m forest plots were set up in each forest type and soil samples were collected from these plots for SOC analysis. Soil aggregate fraction was determined by wet sieving method. SOC content was determined by the potassium dichromate ($K_2Cr_2O_7$) oxidation method. We found soil particles were mostly accumulated in the mediate-aggregate fraction (0.25-1 mm) in the studied forests. The proportion of soil microaggregates (<0.25 mm) was double higher in SMF (26.3%) than in other examined forest types (12.5-12.7%). We also found SOC stocks were significantly higher in SMF (89.9 t/ha) than in WHRF (52.3 t/ha) and HDF (40.3 t/ha). Mediate-aggregates were an important source of SOC in these forests and the proportion of mediate-aggregates associated SOC was 84.1, 93.4, and 86.8% of total SOC in WHRF, HDF, and SMF, respectively. These results demonstrated soil aggregate fraction and associated SOC stocks were greatly affected by different forest types, even in the old-growth forests.

P7. Heffernan, Megan M.*, James D. Bever, and Laura Y. Podzikowski. Plant diversity and grasses increase root biomass in a biodiversity-manipulation experiment. University of Kansas, Lawrence, Kansas. Email: megheff8@gmail.com

Biodiversity loss greatly exceeds levels sustainable for Earth. Though plant diversity is an important driver of aboveground productivity, whether these patterns are mirrored belowground remains poorly understood. This experiment explores how planted diversity, community composition, and precipitation alter belowground productivity, specifically root biomass. To address this, we established a biodiversity-manipulation experiment with twelve houses (20 plots) and six experimental designs manipulating plant richness (1, 2, 3, and 6 species) and community composition (all asters, legumes, grasses, or multiple families). Two houses mirror each other in design, one receiving 150% and the other receiving 50% ambient rainfall (drought). Three and five years after planting, two soil cores (2.54cm diameter, 20cm depth) were collected from each plot, composited, and homogenized in the field, before being transported on ice to a lab, stored at 4C, and picked for roots. Roots were washed

with RO water, oven dried at 70C for at least three days, and weighed. Five years after planting root biomass was significantly higher in comparison to year three ($t_{[1,462.7,0.05)}$=-9.3991, $p < 0.001$). In year five, root biomass is higher with greater planted diversity ($F_{[1,234,0.05]}$=16.5689, $p < 0.001$). Root biomass differs with plant family ($F_{[3,234,0.05]}$=9.2272, $p < 0.001$), and we see the highest and lowest biomass in grass and legume communities, respectively. We saw no difference between root biomass and precipitation, although root biomass was slightly elevated with drought. Overall, we see diversity effects on plant productivity are mirrored belowground, which suggests roots also generate productivity gains from plant diversity.

P8. Peterson, Chelsea M.[1]* and Jeffrey W. Matthews. Connecting vegetation with soil organic matter to explore tradeoffs in restored floodplain wetlands. [1]University of Illinois Urbana-Champaign, Urbana, Illinois. Email: cmptrsn2@illinois.edu

Restored wetlands have strong tradeoffs between plant species diversity and nutrient cycling because of restoration decisions and plant-soil feedbacks that favor invasive graminoids, such as *Phalaris arundinacea*. This study will evaluate how soil organic carbon (SOC) content and composition reinforce these tradeoffs at a 25-year floodplain restoration experiment along the Rock River with five afforestation treatments: balled-and-burlapped trees, bareroot trees, seedlings, acorns, and seedbank. In fall 2022, we established three transects per treatment, including the nearby reference forest, to survey herbaceous plant species and sample aboveground biomass and litter. In summer 2023, we will collect soil cores to measure soil inorganic nitrogen (N) concentrations and SOC in bulk soil and four aggregate size classes. We will also measure N mineralization, sediment deposition, and litter decomposition for three common litter types at the experimental site to evaluate how these processes structure soil properties. We will use ANOVAs to evaluate the effect of afforestation treatments on the SOC content and C:N ratio of each soil fraction and use linear mixed models to determine which variables best explain between-treatment differences in each measured process rate. The vegetation survey revealed that native species cover has increased in all treatments over 10 years, whereas *P. arundinacea* cover has decreased because of co-invasion by *Humulus japonicus*. We do not yet know how these shifts in vegetation impact soil properties, but treatments dominated by invasive species should have SOC contents similar to reference levels and greater than tree-dominated treatments. Though enhanced sedimentation and mineralization should contribute to SOC and N accumulation, litter production and decomposition should best explain between-treatment differences in soil nutrient levels. By relating vegetation composition to processes that alter soil structure and nutrient status, this research could help explain how restoration decisions that shape plant community development alter the long-term biogeochemical functions of floodplains.

P9. Lipstein, Alexis A.* and Chris F. Lenhart. Peatland CO2 emission dynamics in a wetland mesocosm experiment. University of Minnesota, St. Paul, Minnesota. Email: lipst005@umn.edu

Peat wetlands are diverse ecosystems that provide a significant amount of carbon storage and host large amounts of biodiversity in both plants and animals that inhabit them. Peatlands are carbon sinks in their natural state. However, they can also release a significant amount of greenhouse gasses, especially CO2 when they are disturbed by drainage. The use of wood chip mulch when restoring or

constructing a peat wetland has been theorized to reduce the CO2 emissions from the soil. It does this by releasing phenolic compounds that inhibit bacterial activity at the soil surface. To test this theory, nine mesocosm tanks were filled with peat moss, either naturally transplanted from a central Minnesota peatland or purchased as a harvested and dried gardening product. Wood chip mulch was applied to one half of several of the tanks. Wild peatland plants from the natural wetland at Cedar Creek were also transplanted into the mesocosms, and the "processed" peat moss tanks were planted with cultivated native peatland sedges. CO2 emissions were measured using a LICOR device at different times during the season, and soil samples were taken to measure several soil properties. We hypothesized that more CO2 would be released from the natural bog soils because of greater microbial activity and that the wood chips would reduce CO2 emissions. Some trends were observed in the initial data that supported the hypothesis, such as the bare processed moss soil in general released more CO2 than the half with wood chips. In the earlier sampled data, natural peat soil did have higher CO2 emissions on average (525.536 μmol mol^{-1}) but dropped below the levels released by the processed peat moss later in the sampling period (428.828 μmol mol^{-1} avg. for natural soil vs. 442.033 μmol mol^{-1} avg. for processed moss).

P10. Duda, Melissa A.*, Andrea Kramer, and Jeremie B. Fant. Hybridization in rare species could signify an alarming step toward extinction. Northwestern University, Evanston, Illinois. Chicago Botanic Garden, Glencoe, Illinois. Email: melissaduda2024@u.northwestern.edu

Natural hybridization involves successful mating between individuals from two species. For rare species, hybridization may accelerate extinction rates, through the loss of traits that make that species unique, but paradoxically, it can also allow a species to gain traits to adapt to changing conditions. I investigated the process of hybridization between two species of Gentian, *G. puberulenta*, a remnant dry prairie species considered rare in some of its range, and *G. andrewsii*, a common species found in mesic prairies. These two species co-occur at many sites in the Great Lakes region, but their hybrid (*Gentiana* x *billingtonii*) only occurs at a subset of sites. Minimal research exists for this hybrid complex, but some stewards are actively removing hybrid plants. For my study, I asked the questions; 1) What conditions promote hybridization between these taxa at some sites but not others? And 2) Are these hybrids viable, either through pollination or backcrossing to one or both of its parental species? To do this, I conducted pollinator observations, collected flowering phenological data, and assessed seed viability (based on embryo fill via x-ray). I found that masked bees (*Hylaeus* spp.) visit all taxa of gentian more often than any other pollinator, suggesting that this pollinator plays a role in promoting hybridization. I found an overlap of around ~2.5 weeks among all taxa, suggesting *Hylaeus* spp. moving pollen between taxa may result in hybridization and backcrossing. While seeds were largely viable for the two study species, seeds collected from the hybrid did not appear to contain embryos. The existence of hybridization events between sister species is predicted to increase with rarity, which is likely to occur with climate change. The results from this research can inform land managers seeking to understand the risk of extinction in rare species displaying hybridization.

P11. Snyder, Erin F.[1,2]*, Rebecca Barak[1,2], Andrea T. Kramer[1,2], and Angelica Ostiguin[3]. Could post-industrial sites in Chicago, Illinois be a refuge for the imperiled *Tetraneuris herbacea*?
[1]Chicago Botanic Garden, Glencoe, Illinois. [2]Northwestern University, Evanston, Illinois. [3]University of Illinois Chicago, Chicago, Illinois. Email: efsnyder@u.northwestern.edu

Urban, post-industrial sites are often underutilized in restoration efforts. Human land use can completely transform ecosystems, rendering traditional remediation methods impractical. In Chicago, historical slag fill (a steel manufacturing byproduct) created novel environments with shallow, gravelly, alkaline soil resembling dolomite prairie or alvar conditions. Slag could provide new habitat for rare plants that thrive in analogous conditions, such as the Great Lakes endemic *Tetraneuris herbacea* (federally threatened and endangered in Illinois, Michigan, and Ohio). Habitat analog models have been used successfully in Ohio to cultivate *T. herbacea* populations in former quarries, and similar methods could be applied to Chicago slag. We examined the impact of soil substrate on seedling emergence and performance to test the potential of slag to support *T. herbacea.* We grew *T. herbacea* from seed in slag and topsoil treatments in the Chicago Botanic Garden production greenhouse. At 12-weeks, we harvested 30 individuals per treatment. We used biomass and root traits to quantify fitness. We recorded belowground traits by scanning individual root systems and processing scans with RhizoVision software. We used linear models to assess the relationship between soil substrate and seedling fitness. Preliminary results indicate that slag could be a viable growing medium for *T. herbacea.* To better understand the slag environment, we used Plant Root Simulator (PRS®) probes to measure bioavailable nutrients in slag at Big Marsh Park in Chicago. We transplanted 21 *T. herbacea* individuals to Big Marsh Park slag in fall 2022 and will evaluate survival in spring 2023. The transplant experiment will further clarify the potential of slag to serve as habitat for *T. herbacea*. Our findings are directly applicable for Chicago Park District restoration practitioners who are determining how to manage slag sites long-term and will contribute to our understanding of how post-industrial, novel ecosystems can support rare plant conservation.

P12. Bryant, Reb L.[1,2]* and James D. Bever[1,2]. Native arbuscular mycorrhizal fungi impact the survival and growth of several prairie forbs in a restoration involving volunteers. [1]University of Kansas, Lawrence, Kansas. [2]Kansas Biological Survey and Center for Ecological Research, Lawrence, Kansas. Email: reb.bryant@ku.edu

Tallgrass prairie restoration methods have adapted as we learn more about the importance of the conditions and relationships that maintain high plant biodiversity and ecosystem functions in remnant prairies. One of these conditions is the relationship between prairie plants and co-evolved or native arbuscular mycorrhizal fungi (AMF). Past research has demonstrated how conservative prairie plant species, many of which are essential to ecosystem functioning and are consistently missing from restorations, particularly benefit from this symbiotic relationship. We also know that people have been and are a part of the tallgrass prairie ecology, and we have the opportunity in these experiments and restoration at large to include community members in developing and sharing our restoration methods. In this experiment, we planted 12 species of prairie plants into a post-agricultural field with and without AMF cultured from local remnant prairies. We involved over a dozen volunteers in the planting of the experiment, discussing about prairies, the plants we were using, and their relationship with AMF. In the first and second growing season after planting, we observed species-specific

responses to AMF. Many of the inoculated plants had greater survival and/or aboveground growth measures compared to plants grown with sterile soil. These results add to the substantial evidence that AMF promote both the survival and growth of many conservative prairie forbs in restorations as well as indicate the ability of community members to participate in further studies of inoculation and restoration in general.

P13. Nelson, Audrey D.*, and Haley Burrill. Differences in disease incidence across species richness and phylogenetic dispersion gradients. The University of Kansas, Lawrence, Kansas. Email: audreynelsonn@ku.edu

This project assesses the differences in disease incidence across plant species richness and phylogenetic dispersion gradients in an effort to aid the restoration of native plant communities. Diversity acts as a buffer, as disease is caused by bacteria and fungi which are typically family and species-specific. Pathogens are specialists, so we expect to see a dilution of pathogens when there is a higher variety of species due to plant diversity. This project poses the question, how does the level of disease incidence measured change depending on whether the plants are over-dispersed or under-dispersed? In order to answer this question, we manipulated species richness and plant phylogenetic diversity on 240 plots. These plots contained plants from three different native prairie families. The plots had different combinations of species as well as under and over-dispersion of families. We randomly selected individual plants of each species and recorded the disease seen using a 1-10 scale. We then conducted an analysis of variance to assess planting effects on disease incidence in response to the experimental design. The results show that the plant species richness factor is significant. We found that disease incidence decreased as plant species richness increased. Our findings provide evidence to support the dilution effect, as well as the concept of pathogen accumulation in low species richness. This supports the idea that host availability as well as pathogen specialization, is what influences the amount of disease incidence found in plants. This information provides insight into the role of resident microbial pathogens in native plant community diversity maintenance, which is accumulating consideration in novel restoration and conservation efforts.

P14. McFarlane, Stephanie L.*, Jade M. Kochanski, Claudio Gratton, and Ellen I. Damschen. Do tallgrass prairie restoration efforts aimed at improving vegetation quality provide quality habitat for monarch butterflies? University of Wisconsin-Madison, Madison, Wisconsin. Email: mcfarlane@wisc.edu

Monarch butterflies have been in decline since the 1950s, with populations decreasing by as much as 80% over the past 25 years. Research suggests that increased monarch mortality is the result decreased floral resource availability, milkweed decline, loss of wintering habitat, and extreme weather. Current monarch conservation efforts in North America focus on increasing milkweed abundance. Although high milkweed density may be the most effective way to help monarch recovery, floral resources are also necessary to provide nutrition for adult monarch butterflies. This study aims to gain a better understanding of which restoration efforts optimize monarch habitat. We ask the following questions: 1) Do restored tall grass prairies support healthy monarch populations? 2) Do restorations managed with fire result in larger monarch populations? 3) How does milkweed and

floral resource abundance interact to affect monarch population size? We visited 42 restored prairies throughout southern Wisconsin and measured milkweed density, floral resource availability, and monarch abundance at each life stage. All study sites had an agricultural land-use history and fell into three restoration categories: old field, seeded sites and sites that have been seeded and managed with fire. Our analyses show no significant difference in milkweed density or monarch abundance between these restoration categories. Milkweed density had a significant positive correlation with monarch abundance. Floral resources, on the other hand were only important when milkweed was also present. Our data suggests that milkweed density influences monarch abundance more than restoration effort, but that restoration activities indirectly enhances monarch habitat by providing floral resources.

P15. Menzies, Rose[1]*, Alexandrea Peake[1], Rebecca S. Barak[23], Liz Anna Kozik[4], Lauren Umek[5], Rebecca K. Tonietto[1]. Finding the middle ground: Designing low growing, native lawn-alternative plant communities for pollinator support. [1]University of Michigan-Flint, Flint, Michigan. [2]Chicago Botanic Garden, Glencoe, Illinois. [3]Northwestern University, Evanston, Illinois. [4]University of Wisconsin-Madison, Madison, Wisconsin, [5]Chicago Park District, Chicago, Illinois. Email: Romenzie@umich.edu

Non-native turfgrass lawns cover significant areas of the Midwest that could otherwise support native plant communities and provide ecosystem services. Not all current turfgrass lawns are feasible sites for full-scale habitat restoration. To this end, we are testing treatments of low growing, native lawn alternatives in the Midwest and their potential to provide ecosystem services while meeting aesthetic norms. Specifically, are low growing lawn-alternative plant communities more attractive to wild bees than a traditional lawn? Is floral abundance, diversity, or native status a predictor of wild bee visitation rates? We designed 10 turf treatments in 2 Chicago parks. Of these, we had one negative control (current park lawn), seeded turfgrass, sod, sedge mix, fescue mix, buffalo grass, two experimental native lawn alternative treatments (species richness = 8), a combination of both native lawn alternative treatments (species richness = 16), and lastly a positive control (prairie). We observed plots in August 2020 and tracked bee visitation and floral abundance. Floral abundance was significantly predicted by treatment ($p = 0.0001$) but not by planted vs “weed” status ($p = 0.87$). Treatments with planted forbs saw a high rate of bee visitation per flower compared to treatments without added forbs ($p = 0.004$). Of the four treatments with planted native forbs, bees preferentially visited the planted experimental floral species over blooming weedy species, even though more blooming weeds were available. Our results provide evidence that wild bees will choose to visit native forbs instead of low quality non-native blooming weeds in the lawn.

P16. Shalit, Amanda G.*, Michelle W. Chung, Stephanie L. McFarlane, Jade M. Kochanski, and Ellen I. Damschen. Bumble bee colony life stage and pollen quality as factors affecting flower visitation frequency. University of Wisconsin-Madison, Madison, Wisconsin. Email: shalit2@wisc.edu

Global pollinator declines have devastating economic and environmental repercussions, such as shortages in food supplies and decreased ecosystem biodiversity. Restoration projects can be used to stabilize pollinator declines by providing abundant floral resources across the growing season.

Bumble bees (*Bombus* spp.) are prolific generalist pollinators that provide important pollination services in both natural and agricultural systems. Previous research has shown that bumble bees prefer foraging on pollen that has a high protein-to-lipid ratio (P:L) in experimental situations. This research suggests that bumble bee abundance will be higher in areas with higher community pollen quality, which preliminary data confirms. However, we have yet to document whether bumble bee visitation is higher on plants that have high P:L than plants that have low P:L. Here we ask (1) if bumble bees in their natural habitat visit flowers with a higher P:L more frequently, and (2) if bumble bee foraging habits change over the course of the colony's life cycle. From May to August 2022, we conducted transect-based field surveys at restored prairies across southern Wisconsin to determine available floral resources and subsequent visitation rates, collecting data on how often bumble bees were seen pollinating different species. Pollen samples from the same sites were assayed to find P:L. Our preliminary analyses show a positive correlation between floral P:L and bumble bee visitation during the summer. We expect a reversal of this pattern in the spring; bumble bee queens likely seek out higher lipid concentrations as they emerge from overwintering and begin to forage to support themselves and their new nest. The knowledge gained from this research can be used to tailor restoration methods and seed mixes towards benefitting bumble bee populations by ensuring that restored sites provide nutrient-rich pollen across the lifespan of the colony.

P17. Gunness, Ann Marie R.*, and Marcella Windmuller Campione. Tradeoffs for birdsfoot trefoil management in tallgrass prairies. University of Minnesota-Twin Cities, St. Paul, Minnesota. Email: rogo0043@umn.edu

Management in a tallgrass prairie is largely a multifaceted approach, utilizing multiple management strategies to assist the recovery of a degraded ecosystem in order to tip the scales of resilience. Management strategies of both prescribed fire and herbicide treatment are common strategies used for reducing invasive species populations and promoting native vegetation. At the University of Minnesota Landscape Arboretum, the Natural Resource Management team utilizes a variety of techniques including herbicide and prescribed fire to both manage invading non-native species as well as encourage native plant species. One invading species in particular, birdsfoot trefoil (*Lotus corniculatus*), proves to be an aggressive invasive species and can form dense mats in prairies and stifle desirable native species if not actively treated. This species is considered among the most aggressive and invasive plants in the region alongside canada thistle (*Cirsium arvense*), sweet clover (*Melitotus spp.*), reed canary grass (*Phalaris arundinacea*), and hybrid cattail (*Typha x glauca*). To dive deeper on the effects of herbicide, prescribed fire, and its tradeoffs among management for birdsfoot trefoil, a split plot design was laid out in an affected area of a tallgrass prairie to look at how treatments influence birdsfoot trefoil and native prairie species diversity in a tallgrass prairie. Preliminary results show birdsfoot trefoil responds well to herbicide control, but fire can actually increase populations. Data from the experiment can assist natural resource management on the maintenance and restoration of tall grass ecosystems within the region.

P18. Widell, Abigail F.*, Katherine T. Charton, and Ellen I. Damschen. Woody encroachment and management impacts on intraspecific trait variation in tallgrass prairie. University of Wisconsin-Madison, Madison, Wisconsin. Email: afwidell@wisc.edu

North American tallgrass prairies are experiencing high rates of woody encroachment, or the spread of woody vegetation into historically herbaceous communities. Woody management is employed with the goal of maintaining herbaceous plant community diversity, however, outcomes of management are often unpredictable. Plant functional traits serve as predictive tools for understanding plant fitness and community assembly, but their predictive capacity is limited because we lack a thorough understanding of intraspecific variation, that is, trait variation within an individual species. We ask whether intraspecific variation of plant functional traits of herbaceous tallgrass prairie species is driven by (1) plasticity in response to rapid environmental changes via woody management within a growing season and (2) adaptation in response to an underlying moisture gradient across many generations. We established five experimental treatment plots at seven remnant tallgrass prairie sites along a moisture gradient. Two of the plots served as controls of intact tallgrass prairie vegetation and encroached vegetation, and the remaining three were treated with different woody management practices for two growing seasons: cut-stem, cut-stem-herbicide, and foliar herbicide. Late in the growing season following the second treatment application, we measured four traits related to growth and resource acquisition in 3 common grass and 3 common forb species. We found no indication of intraspecific variation both in response to (1) short-term environmental differences from woody management and (2) long-term environmental differences from the naturally occurring moisture gradient. These results suggest conservatism among these four traits and a lack of sensitivity to both rapid habitat changes and long-term environmental conditions. Furthermore, this may suggest herbaceous plants have reduced fitness following encroachment due to low intraspecific variation and adaptive capacity, highlighting the need to manage woody plants quickly and effectively in order to maintain the diversity of tallgrass prairies ecosystems.

P19. Summers, Chloe J.*, Arianna M. Elkins, Cason A. Konzer, and Heather A. Dawson. Assessing the ecology of the Flint River in Flint, Michigan above and below a century-old dam. University of Michigan-Flint, Flint, Michigan. Email: summersj@umich.edu

Habitat fragmentation is detrimental to biodiversity and productivity within an ecosystem. The Flint River Ecology Study aims to assess 200 meters of habitat above and below the Hamilton Dam in the Flint River, a tributary to Lake Huron. This study takes place in the City of Flint, Michigan prior to, during, and after dam removal and restoration efforts. As an urban river, the Flint River has a history of anthropogenic alterations. Through various assessments, we collect data on the biotic and abiotic components of this ecosystem to understand the human impact and ways to improve the environment. We report on fish distribution, diversity, and perceived fish habitat above upstream and downstream of the terminal dam collected prior to restoration efforts from May 2019- August 2019 and May 2021-November 2021. We used multiple gear types to collect macroinvertebrates and fish that were identified, measured, and weighed, and those 16 cm or larger were marked with numbered Floy tags. A subsample of fish was collected for contaminant testing. The Bathymetry of the study site was determined, and relevant abiotic data was collected. Simpson's diversity index for species richness above the dam was 0.762 and 0.671 below. We investigated fish feeding guilds above and below the dam and compared the guilds present with the habitat of the two areas. Mercury levels in non-piscivores were significantly higher in downstream fish, presumably because those fish were Great Lakes migrants. Sampling above versus below the dam enables comparisons within this

ecosystem that investigate how habitat fragmentation impacts the ecology of the Flint River. This data will be used to compare future assessments once restoration is complete and can serve as a reference for future river restorations. As dams age, consideration for removal is important when determining effective restoration methods.

P20. Palmer, Craig J.[1*], Brick Fevold[1], Tim Lewis[1], Molly Middlebrook[1], and Louis Blume[2]. Fact sheets providing guidance for quality assurance in ecological restoration project monitoring. [1]General Dynamics Information Technology. Falls Church, Virginia. [2]U.S. EPA-Great Lakes National Program Office, Chicago, Illinois. Email: craig.j.palmer@gdit.com

Ecological restoration requires the collection of reliable data for determining the appropriateness of restoration techniques, evaluating the effectiveness of project methods against restoration objectives, and building the necessary evidence to support management decisions. Often these data are collected as observations or estimates based on best professional judgment. Unlike accredited laboratory settings where rigorous quality assurance and quality control (QA/QC) procedures have been in place for decades, practitioners for ecological restoration projects do not have comprehensive guidance on how to ensure the reliability of data. To address this need, U.S. EPA's Great Lakes National Program Office (GLNPO) with the assistance of representatives from several federal agencies prepared a guidance document entitled *Application of Quality Assurance and Quality Control Principles to Ecological Restoration Project Monitoring* (EPA-905-K19-001, April 2019). A series of short fact sheets have been developed to cover each chapter of the document to acquaint restoration practitioners with the key concepts presented in greater detail in the guidance document. Topics addressed by this fact sheet series include a description of the benefits and principles of QA/QC (Chapters 1 & 2); defining the level of data quality in order to meet the intended use of the data (Chapter 3); preparing for field data collection (Chapter 4); defining and establishing QC field checks (Chapter 5); data review (Chapter 6); and data quality assessment (Chapter 7). These factsheets are a convenient resource for practitioners who are preparing quality assurance project plans (QAPPs) or are needing to disseminate information or provide training on a particular QA topic to collaborators and contractors. This effort is funded under an EPA contract in support of the Great Lakes Restoration Initiative.

P21. Fevold, Brick[1*], Tim Lewis[1], Craig J. Palmer[1], Molly Middlebrook[1], and Louis Blume[2]. Adaptive management tools, references, and annotated bibliography for planners of ecological restoration and monitoring. [1]General Dynamics Information Technology. Falls Church, Virginia. [2]U.S. EPA-Great Lakes National Program Office, Chicago, Illinois. Email: brick.fevold@gdit.com

Adaptive management (AM) is a learning and decision support framework used by program/project managers to plan for, document, and respond to unexpected outcomes when there is uncertainty in one or multiple system parameters. A diverse set of tools and other resources are available via the World Wide Web to support natural resource managers, scientists, and restoration project planners with the development and implementation of AM and the integration of quality oversight. These tools and resources are often represented by technical guidance and communicated through published

journal articles, government reports and policy, and other online content. This poster presents a synopsis of three digital resources prepared by the Inter-agency Ecological Restoration Quality Committee (IERQC). The first resource: "*Adaptive Management Tools and Resources*," is a document that provides a list of references and other resources accessible online, including interactive Web-based tools, beneficial to decision-makers and planners alike seeking to learn more about the general concept and application of adaptive management, including climate change adaptation. The AM tools and resources are organized according to the following topics: (1) key guidance publications, (2) standards, training, and templates, (3) searchable digital libraries, (4) case studies and examples, and (5) decision support tools. The second resource: "*Quality System Principles Applied to Adaptive Management of Ecological Restoration Projects: An Annotated Bibliography*," is a document that lists and summarizes a subset of recent peer-reviewed publications selected using keyword search terms relating to the applications, benefits, and costs regarding the integration of quality systems in AM. This annotated bibliography is supplemented by a web-based Zotero® Group "*IERQC's Adaptive Management Annotated Bibliography*" – an online reference manager database providing open access to a bibliography on AM and quality systems. This effort is funded under EPA contract (EP-C-17-024) in support of the Great Lakes Restoration Initiative.

P22. Collins, Dan[1]*, Nancy Aten[1] and Chris Young[2]. Learning ecological restoration: Getting to proficiency in eight weeks, incorporating classroom and field. [1]Landscapes of Place LLC and Land Restoration School, Mequon, Wisconsin. [2]University of Wisconsin-Milwaukee and Land Restoration School, Milwaukee, Wisconsin. Email: dancollins@landscapesofplace.com

The pathways toward a career in the practice of ecological restoration are varied. Some of us get there from an academic background in ecology or conservation coupled with a passion for field work; some of us use continuing education practicums to develop know-how; some may move in their career as on-the-job experience shifts us towards the field and the practice. Given the critical need for many more practitioners doing effective, transformational work, the Land Restoration School (LRS) was formed in 2021 and launched an inaugural school in summer 2022. We tested the hypothesis of getting people from a range of initial conditions of background and experience – to proficiency or beyond, in eight immersive weeks, five days each week. Proficiency means having critical knowledge to both practice ecological restoration and develop a plan for an actual site using the Society for Ecological Restoration framework, including assessment of ecological need, land use history, current conditions, reference models, trajectories, steps, methods and evaluation. This poster addresses the 'who' and 'how' of the LRS. We discuss the range of participants the LRS engaged and served and their transformation, and assess the eight-week program for developing the natural science knowledge, ecological restoration understanding, planning framework and field methods experience, the business essentials and case study insights, needed to effectively launch ecological restoration practitioner careers. That career might begin as an independent contractor, or as a project architect ready to help heal the earth. (See our complementary oral presentation for the 'what', 'why' and 'where' of the LRS.)

P23. Kirkpatrick, Bella A.*, Erin M. McCune, and Olivia J. Greymont. UWSP Society for Ecological Restoration Student Chapter: Educating volunteers to promote restoration and stewardship.

University of Wisconsin-Stevens Point Society for Ecological Restoration, Stevens Point, Wisconsin. Email: society.for.ecological.restoration.uwsp@uwsp.edu

The Stevens Point student chapter of the Society for Ecological Restoration (SER) teaches members about stewardship and safety protocols to follow during volunteer workdays through a newly developed stewardship training. In 2019 the officers of the club developed a weekend stewardship training class and a textbook based on the official Society for Ecological Restoration standards. This training allows them to safely lead workdays and put into practice many techniques used in the restoration field. This training is paired with a larger workday called the Restoration Celebration which focuses on a specific work site and allows new stewards to practice their leadership skills. SER has workday sites within Schmeeckle Reserve and around the Portage County area. These sites are in a variety of habitats, including wetlands. On these workdays, volunteers perform activities such as collecting native seeds, planting native plants, removing invasive species, assisting with prescribed burns, and more. This presentation will focus on the training of volunteer stewards and the work that follows at their chosen sites.

SATURDAY APRIL 15, 2023 – ORAL PRESENTATIONS ABSTRACTS (ALPHABETICAL)

Aten, Nancy[1]*, Dan Collins[1] and Chris Young[2]. The Land Restoration School — preparing the next wave of ecological restoration practitioners. [1]Landscapes of Place LLC and Land Restoration School, Mequon, Wisconsin. [2]University of Wisconsin-Milwaukee and Land Restoration School, Milwaukee, Wisconsin. Email: nancyaten@landscapesofplace.com

We face the challenge of needing many more ecological restorationists in a community of practitioners working to address ecosystem and wetland health. To help address this challenge, the Land Restoration School (LRS) formed in 2021 and launched an inaugural school in summer 2022 in northeastern Wisconsin. The LRS provides paid stipends and residency in support of a just and equitable program for up to twelve adult participants from diverse hometowns and experiences. We offered an immersive course on the principles, practice, and planning of ecological restoration for degraded lands and wetlands, with a badge upon completion. Eight weeks, every weekday together allowed us to persistently connect natural sciences and theory with field methods and observation – making links and demonstrating how to keep building knowledge and skills. The curriculum is designed to complement, or for some, replace a degree program. The LRS drew expertise from a diverse range of guest faculty from academic institutions and private practice, who share a commitment to the school's mission and are invested in its outcomes. We integrated topics in soils, hydrology, botany, community ecology, and human engagement, and culminated with participants developing ecological restoration plans for real sites. In this talk, we will review the structural framework – an investment in 'big seeds' –including paid stipend, residency, learning landscapes, facilities, funding methods, and affiliations in 2022, and changes that we plan for 2023. This talk is the 'what', 'why,' and 'where' of the LRS. (See our complementary poster for the 'who' and 'how' which assesses the transformation of participants in the eight-week process.)

Barak, Rebecca*[1,6], Anna Braum[2], Jessamine Finch[3], Stephanie Frischie[4], Izabella Redlinski[5,8], and Pati Vitt[6,7]. Seed sourcing for restoration in a changing climate - a review of current literature, and next steps. [1]Chicago Botanic Garden, Glencoe, Illinois. [2]The Wetlands Initiative, Chicago, Illinois. [3]The Native Plant Trust, Framingham, Massachusetts. [4]The Xerces Society, Portland, Oregon. [5]Cook County Forest Preserve District, Chicago, Illinois. [6]Northwestern University, Evanston, Illinois. [7]Lake County Forest Preserve District, Libertyville, Illinois. Email: rbarak@chicagobotanic.org

The Great Lakes region is predicted to experience increased air temperatures between 3 and 5°C by the end of the century. Along with changes in temperature are predicted increases in severity and frequency of heavy rain events and flooding. As a result, the challenges associated with managing and restoring natural habitats are becoming increasingly complex. Seed sourcing for restoration is a key management ecision for bolstering climate resiliency of native habitats. Organizations that use seed for restoration often work under a set of norms for seed collection or purchase. These norms can vary widely over organizations, and may or may not explicitly consider climate resilience. Many seed sourcing strategies focus on the “local is best” paradigm, which presumes that ecotypes are genetically adapted to their local environment. However, local adaptation and current distributions are potentially being outpaced by climate change. Furthermore, for many species used in seed-based restoration, there is a lack of empirical evidence to guide seed sourcing decisions, which are critical for the longevity and ecological function of restored natural communities. With the goal of characterizing, synthesizing, and applying experimental research to guide restoration practice, we conducted a systematic literature review about the role of provenance and climate in plant trait response. We found a strong bias in the literature in terms of the choice of study organism (predominantly trees in Pinaceae). This represents a gap in research that is relevant to seed-based restoration in the Midwest-Great Lakes, where most taxa are herbaceous species from many plant families. In this presentation, we will describe additional patterns and gaps our review identified, highlight specific topics which require further research, and provide practical suggestions of immediate and longer-term tools and actions that support restoration practice and building resilient natural communities under future climate scenarios for the Midwest-Great Lakes.

Brubaker, Grace[1*], Peter C. Smiley Jr.[2], and Jon P. Bossley[1]. Evaluating the feasibility of establishing American water willow (Justicia americana) colonies in the Kokosing River, Ohio. [1]Mount Vernon Nazarene University, Mount Vernon, Ohio. [2]USDA Agricultural Research Service, Columbus, Ohio. Email: rocky.smiley@ars.usda.gov

American water willow (Justicia americana) is a perennial emergent aquatic macrophyte found throughout the eastern United States and Canada. It is common throughout Ohio, but only found on gravel bars of rivers. American water willow’s ability to survive harsh conditions is one reason that it has been planted in reservoir littoral zones. However, information is lacking on the feasibility of planting American water willow in rivers despite its potential as a candidate species for restoration efforts. Our objectives were: (a) evaluate the feasibility of establishing American water willow colonies in a state scenic river in central Ohio where it was largely absent and (b) to determine what habitat

variables contributed to the success of planted colonies. Between March and August 2019 we planted between 10 and 50 whole plants at 15 sites in the Kokosing River. Post-planting surveys at all sites to evaluate survivorship occurred on October 2019, June 2020, and June 2021. Concurrently with the first planting we collected habitat data (i.e., location type, amount of sunlight, substrate type, slope, etc.). Percent occurrence of survivors was greater ($P<0.001$) in sites receiving three plantings than sites receiving one or two plantings. In 2019 and 2020 no difference ($P>0.05$) in percent survival occurred among planting treatments. In 2021 percent survival was the greatest ($P<0.05$) in sites receiving three plantings, the least ($P<0.05$) in sites receiving two plantings, and intermediate in sites receiving one planting. Additionally, substrate type differed ($P=0.004$) between five sites that exhibited good survival (>50%) and ten sites having poor survival (<3%). No other habitat variable differed between sites with good and poor survival. Our results suggest it is feasible to establish American water willow colonies in the Kokosing River and other similar Ohio rivers and planting efforts should target sites having mostly cobble substrate.

Demchik, Michael C.[1]*, Jesse Tucker[1], and Tom Quinn[1]. Incorporating elements of bird habitat within restoration reference conditions: The Burdette and Sarah Eagon Nature Education Preserve case study. 1University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: mdemchik@uwsp.edu

Establishment of effective forest restoration is dependent on development of goals, objectives and effective indicators/success criteria. These goals and objectives need to be informed by native reference conditions; however, in many cases, adequate reference conditions are not available due to land use history in a region presenting challenges for both restoration planning and monitoring. For this reason, I am going to present an approach that follows through these steps: 1) scope- focus of work in two adjacent townships, 2) vision which addresses plants, animals, water and cultural history, 3) restoration targets, 4) goals, objectives and indicators. The objective for this presentation is to discuss use of neotropical migratory bird habitat elements (for a subset of birds selected from guilds that use divergent habitat elements) as a component of reference site conditions and incorporation of those habitat elements into restoration targets. Additionally, monitoring of restoration success by use of bird point count data will be discussed. This will be a case study-based presentation focused on the Burdette and Sarah Eagon Nature Education Preserve (Eagon). Eagon is a small UWSP Foundation-owned property with a strong cultural history of active landuse. Preserving elements of that cultural history while conducting a restoration project presents unique challenges. The Eagon restoration project was part of a larger effort in New Hope and Alban township which involves a collection of UWSP Foundation-owned properties, NGO-owned lands and private parcels. The proximity of these restoration activities allows a larger landscape level impact. The Eagon restoration was planned and implemented using a collection of University of Wisconsin- Stevens Point courses in collaboration with a collection of funders, NGO's and agencies. The first year of bird point counts was conducted during 2022 and this initial data will be presented as a first step.

Duke, Shawn T. Developing ecological restoration management programs for municipally owned natural areas. Stantec Consulting Services Inc., Brighton, Michigan. Email: shawn.duke@stantec.com

Large scale ecological restoration projects are commonly implemented in targeted tracts of federally and state-managed lands or as short-term efforts to address specific environmental concerns on privately owned and municipal properties. Recently, more municipalities have instituted programs through various funding mechanisms that protect natural areas in perpetuity and also provide funding for active management. The value of these programs reaches beyond habitat quality improvements as they often protect properties that would otherwise be targeted for development, offer passive recreation opportunities and facilitate conversion to sustainable land use. Typically, a natural resources specialist or park system manager is tasked with managing the program. These individuals often have many responsibilities beyond the program management and limited staff capacity to support implementation. Specialized technical elements such as management planning, engineering/design and field tasks are often completed by utilizing contractors. Stantec has supported municipalities across the Midwest by providing all inclusive ecological restoration services. Case studies and a comparative analysis of best practices and lessons learned will be presented.

Edmonson, Trevor D. The Efroymson Restoration at Kankakee Sands – 25 years and beyond. The Nature Conservancy, Morocco, Indiana. Email: trevor.edmonson@tnc.org

In 1996 The Nature Conservancy of Indiana purchased about 6,000 acres of sandy farm fields with the idea to restore them to prairie and wetlands and create a resilient macrosite where biodiversity could thrive. Twenty-five years later we have finished planting the last of the large fields and the project area now totals 8,400 acres. This presentation will cover the natural history of the area, the timeline of the restoration, lessons learned and what the future holds for one of the largest most biodiverse restorations in the Midwest. The project could not have happened without the joy and talent of dozens of staff members, volunteers, and researchers.

Etterson, Julie[1]*, Abazs, David[2], Hammes, Mary[3], Meredith Cornett[3]. Minnesota Million: Forest restoration for carbon sequestration. [1]University of Minnesota Duluth, Duluth, Minnesota. [2]University of Minnesota Extension, Duluth, Minnesota, [3]The Nature Conservancy, Duluth, Minnesota. Email: jetterso@d.umn.edu

Minnesota Million is a burgeoning movement to engage the people in our state in natural climate solutions, or those that increase carbon storage or avoid greenhouse gas emissions in landscapes and wetlands. Reforestation is one example of a natural climate solution that increases carbon storage. Trees capture CO2 from the atmosphere and store carbon in their trunk and root systems. In Minnesota, there are three million acres that were historically forested but are not today. If we could reforest one third of that area, we could draw down 1.6 million tons of CO2 annually—the emissions equivalent to 348,000 average passenger vehicles. Reforestation also benefits water resources, habitat, and resilience to extreme events such as intense rainfall and heatwaves. So, why don't we do

it? A major obstacle is that we do not grow enough tree seedlings to meet reforestation demands, and especially of species and populations that will thrive with climate change. Consequently, even if we had the will to plant enough trees to reabsorb carbon emissions, we would not have the way. This project aims to remedy this problem by increasing the capacity of farmers, tree nurseries, students, and citizen groups to produce tree seedlings that will scale up forest restoration potential across the state while raising awareness of natural climate solutions. To meet our ambitious goal of reforesting one million acres by 2045, we need to grow seven times more tree seedlings per year than we do right now, a change from 6.1 million to ~42 million per year. Through this effort, our academic-extension-nonprofit collaboration is bringing the best science to bear on climate-smart tree sourcing, building broad expertise in nursery technique, planting trees that can serve the dual purpose of restoration and long-term research, while also fostering grassroots economic development.

Ficenec, Craig.[1]*, and Cindy Becker[2]*. Helping private landowners achieve the joy of restoration through regional partnerships in Wisconsin's Driftless area. [1]Sand County Foundation, Madison, Wisconsin. [2]Driftless Area Land Conservancy, Dodgeville, Wisconsin. Email: cficenec@sandcountyfoundation.org; cindy@driftlessconservancy.org

The Driftless Area, bypassed by the last continental glaciation, is an ancient landscape with steep hills and deep valleys. It contains some of the Midwest's highest quality remnants of oak savanna, bluff prairies, and grasslands, as is part of a vital migration corridor for more than half of North America's bird species. However, this resource is at risk as land ownership continues to fragment, fire no longer renews grasslands, and invasive species overtake remaining habitat. Of Wisconsin's 7.4 million acre share of the Driftless Area, 97% is privately owned. Restoration in this region requires voluntary action by thousands of landowners, many of whom desire to improve the ecological function of their land but lack knowledge, resources, and confidence to do so. Strong collaboration among conservation professionals in public, private, and non-profit sectors can inspire, educate, and equip these landowners to move in a similar direction to restore degraded habitat on their land. Through the Regional Conservation Partnership Program (RCPP), Sand County Foundation is working with the USDA-Natural Resources Conservation Service and experienced local partners to convert highly erodible croplands, overgrazed pasture, and low-quality prairie and savanna remnants into thriving habitat for grassland birds and pollinators while reducing water quality and flooding risks from agricultural lands. Early results of this project are beginning to demonstrate how regional partnerships can help bring the joy of restoration to private landowners who have the will but need support to achieve their goals.

Fuka, Mark E.[1], and John L. Orrock[1]. Seasonal variation in small mammal granivory of native tree species reveals the optimal window for seed additions in the absence of invasive woody shrubs. [1]University of Wisconsin-Madison, Madison, Wisconsin. Email: fuka@wisc.edu

Invasive shrubs dramatically reduce the biodiversity of native plants, making invaded areas important targets for restoration efforts. While a potentially promising means for restoration of native plant communities is to implement seed additions of native plants, the success of seeding efforts for

restoration in invaded habitats may be reduced because dense habitats created by invasive shrubs can alter the activity of native seed-eating rodents, fueling significant increases in seed consumption. The habitat structure provided by invasive shrubs is often seasonally variable, and this seasonal structure could be an important factor in predicting seasonal trends in small mammal granivory. Although invasive shrubs may generate strong seasonal changes in granivory, we lack experimental studies to evaluate whether seasonal changes in granivory caused by invasive plants amplify granivory at times of year when seeds are most vulnerable. By understanding seasonal variation in granivory, land managers can better implement seed additions to coincide with when rodent granivory is lowest. We manipulated the presence of the widespread invasive species common buckthorn (Rhamnus cathartica) in a deciduous oak-maple forest to track rodent granivory of three native tree species, basswood (Tilia americana), black cherry (Prunus serotina), and sugar maple (Acer saccharum) and the invasive shrub R. cathartica across early and late summer, autumn, winter, and spring. Our results reveal that the effect of invasive shrubs on rodent granivory changed across seasons with invaded habitat experiencing, on average, 25.6% higher seed removal, with the largest difference in winter. Our results suggest that sowing seeds in winter once invasive shrubs are removed may be the optimal window for seed additions to ensure seedling survival. In reviewing the critical role of timing in R. cathartica removal habitats, our results point to the value of understanding seasonal patterns in granivory for ecologists and seasonal patterns of seed additions for restoration managers.

Gordon, Brad[1], Austin Yantes[2], and Alan Ritchie[1]. Incentives for private land restorations: pollinator and vegetation surveys on prairie easements and grazed oak savannas. [1]Great River Greening, St. Paul, Minnesota. [2]University of Minnesota, St. Paul, Minnesota. Email: bgordon@greatrivergreening.org

Much of the low-hanging fruit for restoration in the Midwest is on public land. In Minnesota, multiple state funding sources are available to drive restoration activities forward, especially on permanently protected, public land. However, restoration organizations are oftentimes left looking at neighboring properties where invasive species are still thriving and will migrate back into the land they just restored. In other cases, restored habitats are isolated and cut off by annual row crops or developments. Incentivizing restoration activities on private lands continues to be a vital component of restoration efforts across the landscape. Great River Greening has been working on two projects focusing on incentivizing and surveying restoration activities on private land. This presentation will review results from pollinator and vegetation surveys across 16 prairie easements, vegetation surveys in cattle-grazed oak savannas, and impressions from educational events at restoration sites. Vegetation on the private land easements were surprisingly high quality populations on numerous sites, but flowering species could span more bloom periods. Grazing in oak savannas yielded promising results for profitable management strategies to improve natural systems. Public events yielded enthusiasm for restoration among private landowners and intrigue for learning more about restoration methods and operational productivity. In conjunction with these projects, Great River Greening is also piloting continuous living cover crops (i.e. cover crops, Kernza®, etc.) that could provide some habitat, economic, water quality, and other benefits. While Great River Greening

continues to use traditional and science-based methods for restoration, we will share how we are adapting to farmer and landowner needs while spreading the joy of restoration.

Grieser, Kevin A.* and Suzanne Hoehne. Converting agriculture fields to wetlands in northwestern Ohio. Biohabitats, Cleveland, Ohio. Email: kgrieser@biohabitats.com

With the draining of the Great Black Swamp in the late 19th century and the subsequent conversion of much of northwestern Ohio to agriculture; sediment loading, nutrient loading, and harmful algal blooms have become increasingly detrimental to our waterways in northwestern Ohio and ultimately Lake Erie. To address these issues, the Ohio Department of Natural Resources H2Ohio Program was launched in 2019 with one of the main targets of converting marginal agricultural lands along Lake Erie tributaries to wetlands. Since 2020, Biohabitats has worked to complete six H2Ohio design-build wetland restoration projects in northwestern Ohio. This session highlights the assessment, design, and construction phases of these projects; focusing on the importance of cultural resources investigations and how they can impact where and to what extent restoration can occur and how more dollars can be put into actual restoration. Secondly, the session discusses a suite of different earthworks techniques used to create different types of wetlands such as seepage berms, depressional features, hummock & hollow grading, as well as the different large woody debris habitat features that were installed like standing snags, downed logs, root wads, toe wood, brush wattles and white pine post clusters. Finally, this presentation will highlight the benefits of converting former agricultural lands along streams and rivers within the Lake Erie basin to wetlands – restoring floodplain connectivity, improving water quality through a reduction in suspended solids, phosphorus and nitrogen loading, and creating wetland habitat.

Kauten, Rebecca L.[1] and John Pearson[2]. From toys to tools: Integrating 21st century technology with field surveying for flora, fauna and phenomena. [1]Iowa Lakeside Laboratory Regents Resource Center, Milford, Iowa. [2]Iowa Department of Natural Resources, Des Moines, Iowa. Email: Rebecca-Kauten@uiowa.edu

Field science in the 21st Century retains many fundamental elements of basic scientific inquiry. However, the advent of digital devices and related technologies provide opportunities for budding field scientists to experiment with new methods of gathering traditional data. The summer 2022 prairie ecology field course at Iowa Lakeside Laboratory in northwest Iowa experimented with the use of digital tools as part of a systematic vegetative survey comparing grazed and ungrazed tracts within a native prairie. Through trial and error, teamwork and tenacity, this experiment yielded results to be compared with surveys from previous years. Use of ESRI Survey123 and experimentation with different plant identification mobile applications allowed students the opportunity to participate in a field study using both traditional and new technologies. Results of the survey indicate that light grazing favored or disfavored some individual species but overall diversity and abundance was not generally affected. Data collection came with a learning curve on tools as well as sampling protocols, with lessons learned for ongoing consideration. Future plans for this study site and others in northwest Iowa may serve as testing grounds for similar experiments in data collection, management and analysis.

Kozik, Liz A.*[1], Rebecca Barak[2], Rebecca Tonietto[3], Tony Troche[4], and Lauren Umek[5]. Rethinking urban lawns through the elements and practices of prairie restoration. [1]University of Wisconsin – Madison, Madison, Wisconsin. [2]Chicago Botanic Garden, Chicago, Illinois. [3]University of Michigan – Flint, Flint, Michigan. [4]Stantec, Chicago, Illinois. [5]Chicago Park District, Chicago, Illinois. Email: Liz@Kozik.net

With over fifty-million acres and a maintenance industry worth sixty-billion dollars a year, the American lawn is massive. While we would love to replace all lawns with restorations, that is not a realistic option at the present. Rather than challenge the culturally-entrenched aesthetics of lawns, we seek to curate native species mixes that could replace the traditional Eurasian grasses and forbs that occupy lawns. In this way, we seek to bring native biodiversity to spaces that will, for practical and cultural reasons, remain lawn. Coming from the perspective of restoration, our research focus is to find middle-ground between the aesthetics of the classic urban lawn and the biodiversity and ecosystem services of a full prairie restoration. In order to explore this topic, we have established research plots of species mixes across multiple Chicago Park District parks, the Chicago Botanic Garden, and University of Michigan-Flint. In each site, we have a variety of different treatments including graminoid-only, mixes of graminoids and flowering plants, as well as monocultures. Each treatment is then being analyzed for pollinator visitation, water infiltration, carbon sequestration, aesthetics, costs, implementation methods, and maintenance requirements. We seek to quantify the benefits of native lawn alternatives to better convince landowners big and small to consider the change. In this space between restoration and horticulture, we have encountered many differing perspectives on what the primary goals of lawn replacement should be. This is true even within our own team, as our expertises span restoration, pollinators, plants, cultural contexts, and the very practical logistics of land management for large public landowners. Rather than declare one option the best, we are working to make a menu of options for different stakeholders to choose from for their particular needs. Our research is ongoing and we are excited to share things we've learned so far.

Lenhart, Christian F.[1]*, Keith Summerville[2], Mark Krichevnia[3], and Trevor Edmonson[4]. SER-MWGL's strategic plan. [1]University of Minnesota, St. Paul, Minnesota. [2]Drake University, Des Moines, Iowa, [3]Broughton Nature Preserve, Marietta, Ohio. [4]The Nature Conservancy – Indiana Chapter, Morocco, Indiana. Email: lenh0010@umn.edu

The SER Midwest-Great Lakes (MWGL) chapter is updating its strategic plan, the second in its 14-year history. We are a regional chapter of SER International with a volunteer board and no employees except student interns. Its purpose is to promote the science and practice of ecological restoration in the region. Our chapter vision is to be a primary regional source for information on issues related to ecological restoration and provide a forum for interchange of ideas on restoration among scientists, practitioners, students, and members of the lay public. The strategic plan outlines the purpose of SER MWGL and strategies to achieve its major goals. The four goals revolve around outreach, professional development, and related services to members as well as students. Our vision remains largely unchanged since 2008, but the restoration field and the strategies needed to achieve

our chapters' goals have evolved. While the annual meeting is critical for building enthusiasm and making connections, the need for online webinars and communication tools continue to grow and was accelerated by Covid. SER MWGL is one of the only regional restoration non-profits focused on both applied and academic restoration focusing on issues across the region. The chapter has the unique opportunity to serve as a cross-state forum for restoration and promote good restoration practices as expressed in SER's Standards & Principles for Ecological Restoration. Early feedback on the strategic plan suggests we should focus on fewer things that we can do well as a volunteer board with no regular employees which includes meetings, webinars and website hosting. Refining and focusing the student grant program to align better with our goals and capacity was also suggested. The plan will be updated through June 2023 and is still open to comments, especially from members though feedback is welcome from all.

Majka, Brian R.* Restoration and hydrologic reconnection of a former celery farm to the Muskegon River. GEI Consultants, Inc. Allendale, Michigan. Email: bmajka@geiconsultants.com

The Muskegon Lake Area of Concern (AOC) is a lacustrine estuary located adjacent to Lake Michigan along Michigan's western coast. One of the projects that contributed to the delisting of the AOC is the restoration and hydrologic reconnection of a 60 acre former celery farm to the Muskegon River, which flows into Muskegon Lake and eventually into Lake Michigan. At the project site, which is hydrologically under the influence of both the Muskegon River and Lake Michigan, a dike had historically been constructed between the farm and the river to facilitate the draining of wetlands and farming. The historic land use led to excessively high nutrients in the site soils, as well as contamination and a loss of fish and wildlife habitat. The goal of the project was to remove nutrients and contaminants from the site that could impact aquatic biota, restore and or create a variety of coastal wetland habitats, and remove the dike to hydrologically reconnect the site to the Muskegon River. A broad partnership of local municipalities, planning organizations, landowners, academic, non-profit, state, federal, and private partners worked together to conduct wildlife assessments, sample soils and water, develop hydrologic and hydraulic models, develop designs, permit, and construct the wetland restoration and hydrological reconnection. The final connection to the Muskegon River was completed in Fall, 2021. This presentation will discuss how the physical, chemical, ecological, and anthropogenic factors at the site were combined into one design that accomplished multiple project goals.

May, Christopher A.*[1] and M. Jurjonas[2]. [1]GEI Consultants, Lansing, Michigan. [2]Lacy Consulting Services, Mexico City, Mexico. Email: cmay@geiconsultants.com

The Great Lakes Restoration Initiative (GLRI), a federal grant program, has awarded over $3.5 billion to over 5,300 projects across the midwestern United States. We used an online survey targeted at project managers of funded GLRI restoration projects to collect data on the program's perceived benefits and accomplishments. We asked survey respondents about links to existing plans and regulatory policies, community outreach and engagement, monitoring efforts, and both ecological and

social benefits. We received 437 responses (27.9% response rate). Most projects (n=345) implemented traditional land and water restoration and management actions focused on improving a habitat, species, or degraded Beneficial Use Impairment; however, many projects (n=112) had either a primary or secondary goal of providing a human wellbeing (i.e., social) benefit. Monitoring efforts included both ecological (e.g., invasive species, biodiversity, water quality) and human wellbeing (e.g., recreation, social cohesion, public health) measures. More than 70% of project managers who set a human wellbeing goal believed they reached it, while 90% of project managers believed they met their ecological goals. The United Nations' "Decade of Ecosystem Restoration" set a goal to promote more socio-ecological goals in ecosystem restoration. Our data suggests that project managers are setting and achieving social goals for ecological restoration. Restoration practitioners should develop systems to better measure and track such efforts to document the full extent of restoration outcomes.

McCarthy, Ryan L.,* and Grace R. Gutiérrez. More friend than foe: Herbaceous cover protects tree seedlings from mammalian herbivory, facilitating restoration of riparian forest in a degraded urban site. The Ohio State University, Columbus, Ohio. Email: r.lawrence.mccarthy@gmail.com

Restoration projects that remove invasive species and replant with natives face twin challenges of recolonizing invasives and low transplant survivorship of native plantings. In urban settings with high densities of mammalian herbivores such as deer, herbivore preference for planted natives can tip the balance in favor of less palatable exotic species, undermining restoration efforts. Herbaceous cover competes with woody seedlings for light and nutrients, but also provides shelter. While herbaceous cover can improve first-season survivorship of bareroot seedlings experiencing transplant shock, tall herbaceous vegetation can also shelter seedlings from browsing by deer, facilitating tree seedlings until they grow above the browse line. Here, we present four years of monitoring of a cohort of native tree seedlings planted by SER-OSU student volunteers in 2019 as part of an urban riparian forest restoration project along the Olentangy River in Columbus, Ohio. We mapped 648 seedlings of twelve native tree species planted in 2019 within a ~120x40m (0.5ha) region of Olentangy River floodplain. Each subsequent autumn we measured their end-of-growing-season height, within-season growth, and occurrence of herbivory, insect damage, and disease. We measured the percent cover of herbaceous vegetation at the height of the seedling, and the percent cover of regenerating Lonicera maackii and Pyrus calleryana in 1m2 surrounding each native tree seedling. Seedling growth was positively associated with increased herbaceous cover every year, with the effect size increasing between years: +0.20cm growth per percent herb cover in 2022 ($p<0.001$), compared to +0.11cm/%cover in 2019 ($p<0.001$). Seedlings with apparent herbivory damage had decreased annual growth only in later years: -19.8cm in 2022 ($p<0.001$), -7.1cm in 2021 ($p=0.003$) but not 2019 (-3.6 cm, $p=0.20$). Taken together, these results demonstrate the surprising sustained and increasing benefits of herbaceous cover for native tree plantings, through reduction in herbivory pressure.

Overbeck, Will W.* Why I love ecological restoration: lessons learned through adaptive management, a pictorial history of stewardship at Gladstone Fen in northeast Illinois. Hey and Associates, Inc., Volo, Illinois. Email: ecologylogic@gmail.com

Gladstone Fen Nature Preserve is a 10-acre conservation area that can serve as a model site for successful ecological restoration which has shown improvements in plant community composition over 20 years of stewardship. A landowner-facilitated management and monitoring process of adaptive management that is guided by learning and encourages progressively effective annual land management decisions allows for ecological insights from seasonal observations. Effective strategies such as mowing, prescribed fire, removal of invasive species, interseeding native species, and hydrological restoration have been combined to improve plant community composition and stability. By allowing natural ecology to aid in ecological restoration, plant community succession and increased stability can be achieved to create high-quality examples of regionally rare prairie, wetland, and savanna habitats.

Patterson, Mars*. Hopkins Hollow Preserve and EcoRest in the City. Art/Nature/EcoRest, Milwaukee, Wisconsin. Email: martinamarie88@gmail.com

Hopkins Hollow is a beautiful pocket paradise attempting to thrive within the industrial graveyard that is called the 30th Street Corridor in Milwaukee. It is an 18+-acre site with Lincoln Creek flowing through the center, bordered by streets and the railroad corridor. Lincoln Creek has been in the past lined with concrete, then between 2000 and 2005, the Milwaukee Metropolitan Sewerage District removed concrete banks to re-naturalize them. The current ecological dysfunction is readily apparent through the hydrology, and variability in the urban soils present. It can also be seen in the lack of variety of pollinators and bird species. The potential for fuller restoration of this site arises from the increasing awareness and collaborative efforts between neighbors, Nearby Nature MKE, and community partners such as Northwest Side Community Development Corp through educational hikes, stewardship volunteering, and neighborhood cleanups. The vision for this portion of the Lincoln Creek Greenway is a living classroom; preservation of an educational foundation that will foster Society for Ecological Restoration guidelines in an effort to reconnect communities and restore necessary ecosystems located in the inner city to their full thriving potential. This plan encourages opportunities to highlight and partner with fellow BIPOC ecologists, environmental educators, and Nature appreciators. Nurturing knowledge and skills to help grow in understanding, connecting, and envisioning a thriving ecosystem within a city space is pertinent to the success of restoration of the minds, land, waters and the intersectionality of these relationships.

Pu, Ge*. Monitoring ecological restoration projects using affordable IOT sensors: examples in the Lake St. Clair and Lake Erie regions. [1]Cleveland Water Alliance, Cleveland, Ohio. Email: jeff@clewa.org

Traditional water monitoring equipment has been expensive and thus limiting the monitoring spatial coverage. However, critical Lake Erie water phenomena such as shoreline flooding/erosion and upwelling have been proven to be spatially variable. With the rapid development of microcomputers and the Internet of Things (IoT), environmental monitoring costs are becoming increasingly affordable yet robust, which provides the perfect opportunity to increase water resources monitoring coverage with affordable means. This presentation will showcase very recent examples of real-time low-cost

water resource monitoring systems in the Lake St. Clair and Lake Erie regions for wetland and marshland restoration. Through these examples and hands on trainings, Jeff will present the cost-saving and reliability of the low-cost sensors against traditional monitoring systems. In addition, Jeff will present how using low-cost sensors can fill in spatial data gaps and enable large-scale analysis of ecological restoration projects through affordable means. This webinar is suitable for anyone interested in monitoring ecological restoration project outcomes through affordable means, i.e. managers, researchers, students, stakeholders, and concerned citizens.

Pu, Ge*[1], and Lindi Quackenbush[2]. Riparian vegetation delineation using free software and datasets. [1]Cleveland Water Alliance, Cleveland, Ohio. [2]State University of New York, Syracuse, New York. Email: jeff@clewa.org

Riparian buffers play a significant role in filtering contamination and maintaining water quality. Under stress from climate change, agricultural practices and urbanization, the extent of buffers in many areas within the Great Lakes Basin are decreasing and will remain under pressure. We developed a free tool for rapid riparian buffer vegetation delineation and monitoring based on imagery over a decade within, Google Earth Engine, a highly advanced yet freely available cloud-based platform for performing remote sensing and spatial analysis. Our new method uses publicly available 1 m aerial images and eliminates manual processing need by incorporating an semi-automatic image classification algorithm. As a pilot study, our tool was applied to quantify change in riparian buffer extent and vigor from 2006 to 2015 along the main stem of Genesee River, which flows through western Pennsylvania and New York into Lake Ontario. While this study focused on a small area and short time interval, we developed a framework that could be expanded beyond the scope of this study to address various temporal and spatial scales and explore the future potential of the approach for riparian buffer modeling. This presentation will also describe the riparian management and restoration implications of utilizing such tools.

Smiley Jr., Peter C.* and Tyler C. Wood. Spatial and temporal variation in fish community structure and instream habitat in a channelized agricultural headwater stream in central Ohio. 1USDA Agricultural Research Service, Columbus, Ohio. Email: rocky.smiley@ars.usda.gov

Developing restoration strategies for channelized agricultural headwater streams requires information on the impacts of restoration practices designed to improve fish community structure and instream habitat quality. Unfortunately, there is only a limited amount of information on the effects of restoration practices on fishes and instream habitat quality in channelized agricultural headwater streams. The City of Columbus is planning to implement a restoration project within a 0.2 km reach of a channelized agricultural headwater stream in central Ohio. This project will involve installation of instream habitat structures, alteration of stream geomorphology, creation of floodplain wetlands, and culvert removal. In 2022 we initiated a research project to evaluate the impacts of these planned restoration practices at the pool-riffle spatial scale on fish community structure and instream habitat within the project reach. We will present results from the analysis of data collected before the restoration efforts begin. Our research questions are: 1) does fish community structure and instream habitat differ between pools and riffles and seasonally within the project reach? and 2) does fish community structure and

instream habitat differ between upstream and downstream of the existing culvert within the project reach? We sampled fishes and measured instream habitat variables at six locations in the project reach in August and October 2022. We documented 11 fish species from 543 captures. Our preliminary analysis indicated fish species richness was greater ($P < 0.05$) in pools than riffles and was greater ($P < 0.05$) in the summer than the fall. Abundance did not differ ($P > 0.05$) between microhabitat types and seasons. Our final results documenting the pre-project spatial and temporal variation of fish community structure and instream habitat will serve as baseline conditions for the restoration project and will provide predictions about the potential impacts of the planned restoration practices at the pool-riffle scale.

Thomas, Steve*. Native plant and animal responses to a solar array setting. ECT Inc., Lansing, Michigan. Email: sthomas@ectinc.com

Witnessing plant and animal responses to atypical situations is often an opportunity to learn more about their capabilities, needs, and ecology. In fall of 2019 a two-acre solar field ("Project Starlight") in the metropolitan Detroit, Michigan region was seeded with 52 native prairie and savanna plant species. The goal of the planting was to provide low maintenance pollinator habitat next to and directly beneath the solar panels, while not interfering with energy production and infrastructure. For three growing seasons the vegetation has been subject to regular inspections and management efforts, including mowing and weed removal. Vegetation responses to this semi-artificial solar panel environment through 2022 has included numerous surprises that provide lessons in plant ecology, succession, and management. Animal responses to the project have also been informative and provide reasons for optimism in regard to some of our native species. In the next ten years, over a million acres of solar array habitats could be created in Midwestern states. Join as we discuss how the patterns observed on this relatively small solar project might show the way that some native plants and animals will survive on the Midwestern landscape in the decades ahead.

Thomforde, Stephen L.*. Terrestrial eutrophication and afforestation: Catastrophic regime shift in Midwest Savanna ecosystems. Stantec Environmental Services. Minneapolis, Minnesota, Email: Stephen.thomforde@Stantec.com

C. S. Holling, suggested two primary drivers are responsible for ecological collapse in natural areas. One is the Loss of Keystone Processes. The other is Social Myths. This presentation employs Holling's framework to describe catastrophic declines in Midwest savanna integrity as an outcome of losing keystone processes and how the catastrophic state is reinforced by social myths. I call this catastrophic transition "Terrestrial Eutrophication and Afforestation" (TEA). I model TEA as analogous to aquatic eutrophication, showing how the loss of keystone species facilitated the collapsed nutrient regulation that facilitated catastrophic transitions from the clear water to turbid water state. I suggest the primary keystone process that reinforced savanna integrity was biomass harvest by keystone herbivores and human-ignited fire. I show how the loss of biomass harvest caused foodwebs, energy flows, and nutrient cycles to collapse, which resulted in soil eutrophication by nitrogen. Subsequently, excess nitrogen facilitated positive feedbacks between faster-taller vegetation and shade that liberated more nitrogen. The outcome of TEA is exemplified by comparing functional traits associated

with dominate species between the savanna and afforested states to show how edible, foodweb promoting, nutrient regulating biotic assemblages are replaced by non-edible, foodweb demoting, nutrient liberating biotic assemblages. Next, I show how the catastrophic afforested state is reinforced by myths, including false premises that trees equal forest, and invasive species and too many deer are causative instead of symptomatic. In summary, I propose Holling's framework provides an argument for restoration to identify historic keystone processes that maintained highly evolved biotic assemblages and to also discern between causes and symptoms of collapse. Likewise, Holling's framework suggests restoration of catastrophic conditions requires shocking system dynamics beyond thresholds horizons. Finally, restoration should focus on restoring processes that promote ecological functions such as nutrient cycling through diverse foodwebs instead of battling chimeras and planting hyperrealities.

Troutman, Rebecah*, Katie Stuble, Emma Watson, Connor Marrie, and Rebecca Swab. A potential new nemesis for garlic mustard? Exploring the range and impacts of a newly arrived specialist aphid. Holden Forests and Gardens. Kirtland, Ohio. Email: rtroutman@holdenfg.org

In the 2021 field season during routine garlic mustard (Alliaria petiolata) management, the Holden Forests and Gardens Natural Areas Biologist noticed damaged garlic mustard plants that were infested with aphids. Affected plants produced twisted seed pods and puckered/wilted leaves. The finding was surprising; it previously had been extremely rare to find a garlic mustard plant with apparent herbivore damage. The aphid was identified as Liaphis alliariae, a garlic mustard specialist aphid native to Europe and previously unrecorded in the United States. Given the importance of controlling garlic mustard, the novel nature of the newly discovered aphid in the United States, and anecdotal evidence that this species may negatively impact garlic mustard, the 2022 pilot project included two components 1) to determine the local distribution of the aphid and 2) quantify how this aphid is affecting growth and productivity of garlic mustard within northeast Ohio. Our initial results suggest that 1) the aphid is distributed at least throughout the Great Lakes region and 2) garlic mustard plants with the aphid present on average are shorter, weigh less, have fewer seed pods, and have more twisted seed pods than plants without the aphid present. It is still unclear whether these differences will cause changes in garlic mustard populations.

Tucker, Rebecca C. *, Jessica Drummond, and Sara Nelson. Building lasting stewardship of pollinator habitats on restoration projects through community engagement. Great River Greening, St. Paul, Minnesota. Email: rtucker@greatrivergreening.org

Habitat restoration such as prairie enhancement, understory forb diversification, and turf conversion to native plantings occur on public land in rural and increasingly urban areas throughout the United States. These efforts are planned and implemented by the landowning entity and external facilitators often without the input of the adjacent community. However, that local engagement may be crucial for the neighboring community to accept, understand, and even contribute to habitat restoration efforts. Our non-profit environmental stewardship organization, Great River Greening, is coordinating over 20 projects in Minnesota focused on pollinator habitat restoration as well as pollinator population monitoring directly involving the public community around these projects. This engagement is

intended specifically to spread broad ecological knowledge, promote pollinator species education, and finally to document how these projects impact the pollinator populations on these sites over time. Through collaboration with the Xerces Society, the University of Minnesota Bee Lab, and multiple city and county landowners through Environment and Natural Resources Trust Fund grants, we have now had one full year of habitat restoration and community engagement utilizing three different types of pollinator monitoring protocols (staffed bumble bee catch and release ID events, guided “3-category” visual counts, and independent iNaturalist observations). We’ve learned a lot about what the community cared about before and after learning about pollinators through these hands-on interactions and are now preparing for another year of restoration work and public events on these sites. These experiences, and our adaptation to what we’ve seen in that first year, will be crucial for the act of sharing the love of restoration through local stewardship as well as conveying the power that community engagement has on broad restoration efforts.

Weesies, Haley R.* and David P. Warners. Restoring a creek by reconciling relationships: stories of joy from a west Michigan watershed. Calvin University, Grand Rapids, Michigan. Email: haley.weesies@calvin.edu

Plaster Creek Stewards (PCS) is a community-based watershed restoration initiative at Calvin University in Grand Rapids, Michigan. When we began PCS in 2009, our focus was to restore Plaster Creek, which is widely known as the most contaminated waterway in West Michigan. But we quickly realized that if we were somehow able to clean up the creek without addressing root causes of the degradation, our success would be short-lived at best. As we recognized that our work best fits a reconciliation ecology framework, we shifted our goals to address the damaged relationships between watershed residents and their creek. This talk will describe a variety of projects we have undertaken (tree planting, bioswales, curb-cut rain gardens, floodplain restoration, etc.), highlighting the ways we engage the community in our work. Particular approaches include providing opportunities for volunteers to assist in growing native plants in our greenhouses, forging upstream-downstream connections, working with local schools and houses of worship, running a summer high school green team, partnering with local businesses, and supporting Calvin students and faculty in watershed-focused place-based research. Although working together with people, particularly people from diverse cultural, religious, and socioeconomic backgrounds, continues to challenge us, we have found this work to be deeply meaningful. We will end our talk with several examples of how unexpected joy has emerged through this work.

White, Marc C.* Recipes for joy in restoration. GEI Consultants, Inc. Milwaukee, Wisconsin. Email: mwhite@geiconsultants.com

If practicing restoration ecology is the most important thing that people can do, then it follows that Restoration Ecologists are the most important type of people. Coming from a restoration ecologist, this tautology may seem self-serving. But even so, the logic of “if A is true, and A = B, then B is true” seems irrefutable. But as it turns out, this obvious truth is not in fact borne out by reality. In a world of 8 billion people, if there are 10 restoration ecologists, the importance value of restoration ecologists (IVRE) is approximately equal to 0. At the opposite extreme, in the same 8 billion-person world with 10

non-restoration ecologists, IVRE would also approximate 0. (Nobody would not want to be born into that world either.) It turns out - like pretty much everything else - IVRE is density dependent. It would be really cool to determine at what density IVRE is maximized – if for no other reason than it would be nice to know when restoration ecologists could expect to earn a living wage - but that would be a lot of work, so for now let's agree that IVRE has not reached its maximum, and that if we are ever to live in a world where restoration ecologist are the most important type of people, then the most important type of people are those that are currently helping others become restoration ecologists. The author will describe helpful practices to find joy in that pursuit and share some of his most popular recipes.