



# Wetland Science Conference

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2019

Wisconsin Wetlands  
ASSOCIATION

## Abstracts & Presenter Biographies

*Wetlands: Yesterday, Today, and Tomorrow*  
24<sup>th</sup> Annual Wetland Science Conference  
February 19-21, 2019  
Madison, WI

# WEDNESDAY, February 20, 9:00 am - 9:30 pm

9:00 - 10:10		Plenary Session (Michigan)		Sponsored by Stantec	
9:00		Welcome & Opening comments			
9:20		Conference Keynote: Yesterday, Today, and Tomorrow in U.S. Wetland Policy: How Did We Get Here, Where are We Headed, and Is It Enough? Jeanne Christie, Christie Consulting Services, LLC			
10:10 - 10:40		Break (Superior)		Sponsored by Merjent	
10:40 - 12:00		Concurrent Sessions			
		Location: Wisconsin Watershed Approaches Moderator: Kyle Magyera	Location: Mendota Invasive Species: The Big Picture Moderator: Nicole Staskowski	Special Sessions	
10:40		Wetland restoration and protection decision support: Lower Fox/Green Bay wetlands & water quality   Grimm	Wetland first aid toolbox: Strategies to combat invasive species in challenging wetlands   Angerhofer	Location: Geneva Career Development & Continuing Education in Wetland Science Moderator: Susan Schumacher	Location: Geneva Tribal Wetland Programs Working Group Facilitator: Randy Poelma (by invitation only)
11:00		Wetlands for tomorrow: Maintaining resilient, connected, and functional landscapes as climate changes   Miller	Lessons learned in the field: Short-term observations on managing invasive grasses in wetlands using herbicides   Loftus		
11:20		The Floodplain Explorer: A decision tool to prioritize floodplain restoration in the Mississippi River Basin   Lent	Evaluating the success of restoration and management techniques for prairie fen sites in Michigan   McGowan-Stinski		Sponsored by Forest County Potawatomi Foundation
11:40		The role of wetlands in a watershed approach to restoring the Little Plover River in Wisconsin   Gaffield	Invasive species early detection surveys and management recommendations in coastal wetlands of Lake Superior   Bates	Legislative/Policy Update Location: Geneva Facilitated by WWA	
12:00 - 1:30		Lunch (provided – Michigan)		Sponsored by GEI Consultants, Inc.	
1:30 - 3:10		Concurrent Sessions			
		Location: Wisconsin Wetland Flora and Plant Communities: ID and Assessment Moderator: Pat Trochlell	Location: Mendota Invasive Species: Species-Specific Control Moderator: Kelly Kearns	Workshop Location: Geneva Don't Talk Like A Scientist	
1:30		Development of a key to wetland plant communities   O'Connor	A cryptic invasion: Lessons learned attempting to control southern cattail ( <i>Typha domingensis</i> ) in a Midwest wetland system   Thompson	**Pre-registration required**  Instructor: Cindy Crosby	
1:50		Wetland floristic quality assessment benchmarks for WI Driftless Area & Southeastern WI Till Plains Ecoregions   Marti	Mapping the invasive plant reed sweet mannagrass ( <i>Glyceria maxima</i> ) using aerial imagery, machine learning, and field reconnaissance   Granberg		
2:10		Assessing the effectiveness of vegetative restoration techniques using wetland floristic quality   Strojny	Retrofitting three wastewater treatment facilities to eradicate non-native <i>Phragmites</i> in the Chequamegon Bay region   Abel		
2:30		Applying FOA methodology to assess restored wetlands: Results from 32 restoration projects   Gibson	Results of landscape-scale exotic <i>Phragmites</i> treatments in Wisconsin   Kron		
2:50		The new wetland mapping initiative   Smith	<i>Phragmites</i> Adaptive Management Framework: Managing <i>Phragmites</i> with science on your side   Stanton		
3:10 - 3:40		Break (Superior)		Sponsored by NES Ecological Services	
3:40 - 5:00		Concurrent Sessions			
		Location: Wisconsin Wetland Flora and Plant Communities: Sites and Species Moderator: Dan Collins	Location: Mendota Wetlands and People Moderator: Alison Peña	Workshop Location: Geneva Conservation Dogs: What's the Sniff All About?	
3:40		Wild rice restoration on the Green Bay west shore   Glenzinski	A story is worth a thousand facts: Communicating wetlands issues to future conservationists   Vosen*	**Pre-registration required**	
4:00		Sod in motion: Moving wet prairie sod to preserve one-half acre of high-quality prairie remnant   Poole	Wetland connections between science and poetry   Highsmith	Instructors: Cory Gritzmacher and Laura Holder	
4:20		<i>Cypripedium candidum</i> in the southeast glacial plains of Wisconsin: Distribution, ecology, and threats   Weissgerber*	New tools to promote wetland literacy across audiences   Beilfuss, K.		
4:40		Fire in forested peatlands of the Upper Great Lakes: Reconstructing the past to protect the future   Sutheimer*			
5:00 - 6:30		Poster Session & Cash Bar (Superior)		Sponsored by ENCAP	
6:30 - 9:30		Banquet & Presentation (Ticketed event—Michigan)		Sponsored by We Energies	
7:30		Banquet Presentation: The Dismal Swamp Revealed: A Pathway to Freedom Dr. Cassandra Newby-Alexander, Professor of History, Dean of the College of Liberal Arts, and Director of the Joseph Jenkins Roberts Center for African Diaspora Studies, Norfolk State University			

WETLANDS: YESTERDAY, TODAY, AND TOMORROW

Green Shading = Pre-registration required

# THURSDAY, February 21, 8:30 am - 4:30 pm

8:30-9:20		Plenary Session (Michigan)		Sponsored by Cardno	
8:30	Welcome				
8:40	Plenary Address: The Power of Community: Advancing Wetland Conservation in Wisconsin Katie Beilfuss, Outreach Programs Director, Wisconsin Wetlands Association				
9:30-10:30		Concurrent Sessions			
	Location: Wisconsin Wetlands: Yesterday, Today, and Tomorrow: The Big Picture Moderator: Gail Epping Overholt	Location: Mendota Wetland Restoration Moderator: Susan Schumacher	Workshop Location: Geneva Biology and Identification of Aquatic Macrophytes  **Pre-registration required**  Instructor: Paul Skawinski		
9:30	A watershed approach to Waubesa Wetlands: Today and tomorrow   Herbst*	In-lieu fee wetland mitigation in Wisconsin: Finding competitive restoration opportunities   Jarosz			
9:50	WWA's wetland leadership extends to the Carolinas: The emergence of the Carolina Wetlands Association   England	Riparian wetland restoration site investigation, then and now: Evolving site investigation methods and consideration of climate change   Hjort			
10:10	A risky climate for cranes, wetlands, and our world   Beilfuss, R.	Habitat heterogeneity and wetland-dependent bird use in Wisconsin's Glacial Habitat Restoration Area   Loken*			
10:30 -11:00		Break (Superior)			
11:00 -12:00		Concurrent Sessions		(Biology and Identification of Aquatic Macrophytes, continued)	
	Location: Wisconsin Wetlands: Yesterday, Today, and Tomorrow: Sites Over Time Moderator: Travis Olson	Location: Mendota Wetlands and Water Quality Moderator: Nick Miller			
11:00	50 years of wetland restoration and protection at Goose Pond Sanctuary   Martin	Recovery of an AOC: Using vegetation and wildlife communities to evaluate the present and look to the future   Prestby			
11:20	Dunn's Marsh: A brief history of stormwater / wetland modifications from 1836 to present and what's next   Eilertson	Wetlands and agriculture: Working together to improve water quality   Houghton			
11:40	Middleton's Pheasant Branch and trail system: Past, present, and future   Steber	Identifying limits to denitrification in constructed wetlands   Izadmehr*			
12:00 - 1:30		Lunch (provided – Michigan)		Sponsored by J.F. Brennan Company	
1:30 - 4:30		Working Groups, Workshop, and Field Trips			
WORKING GROUP & WORKSHOP					
Practitioners' Working Group  Location: Wisconsin Facilitator: Eric Parker		Fire and Management in Wetland Ecosystems: Identifying Priorities for Information Sharing and Research  Location: Mendota Facilitators: Craig Maier and Jack McGowan-Stinski	Wetlands and Water Quality in Wisconsin: Where Have We Been, and Where Do We Go from Here?  Location: Middleton Facilitator: Aaron Marti	Wetland Soils: An Introduction or Refresher Short Course  Location: Geneva Instructors: Pat Trochlell and Neil Molstad  **Pre-registration required**	
FIELD TRIPS Pre-registration is required. Meet at the Conference Center Entrance at 1:20 to depart by bus.					
The Devastating Flood of Pheasant Branch: A Tale of Two Ecosystems Field Trip Leaders: Tom Bernthal and Herb Garn  Sponsored by Midwest Natural Resources.		A Bird Haven in Winter: Goose Pond Sanctuary Field Trip Leaders: Mark Martin, Sue Foote-Martin, and Graham Steinhauer  Sponsored by Wisconsin Coastal Management Program.		Explore Natural History Collections at UW-Madison Field Trip Leaders: Laura Monahan, Mary Ann Feist, and Ken Cameron  Sponsored by Midwest Groundcovers.	

Green Shading = Pre-registration required

## WE WANT YOUR FEEDBACK!

Please complete the conference evaluation coming to your email inbox. Thank you!



WETLANDS: YESTERDAY, TODAY, AND TOMORROW

### **Retrofitting three wastewater treatment facilities to eradicate non-native *Phragmites* in the Chequamegon Bay region**

A collaborative project led by the Red Cliff Band of Lake Superior Chippewa was conducted in the Chequamegon Bay region to eradicate one of the only known sources of non-native *Phragmites* (*Phragmites australis subsp. australis*) in the Lake Superior basin. Project funding was provided by EPA and BIA through the Great Lakes Restoration Initiative, and Red Cliff's primary partners included the cities of Bayfield and Washburn, WI. A 2016 genetic study determined that recently established local populations of non-native *Phragmites* were related to those used to dewater sludge in three community wastewater treatment facility reed beds. If non-native *Phragmites* were to continue spreading, this invasive plant would pose a significant threat to 14,000 acres of Lake Superior coastal wetlands in Wisconsin. After conducting an alternatives analysis into other wastewater treatment technologies, project partners undertook the extensive task of completely retrofitting all three facilities with native *Phragmites* (*P. australis subsp. americanus*) throughout the summer of 2018. This presentation will outline all aspects of the project and lessons learned, with specific emphasis on how removal and replacement activities were executed and how post-project monitoring will be used to evaluate project success.

### **Wetland first aid toolbox: Strategies to combat invasive species in challenging wetlands**

Aggressive aquatic invasive species (AIS) are a primary threat to the long-term success of restored wetlands. Sites undergoing restoration are prone to rapid invasion by reed canarygrass (*Phalaris arundinacea*), exotic cattails (*Typha spp.*), invasive common reed (*Phragmites australis subsp. australis*), and other AIS that thrive on construction-related disturbances. During this "triage" phase, timely development and administration of site-specific prescriptions, based on examination of factors leading to invasion and site conditions, may result in the difference between healing a site from invasion and further degradation. There is not one tool or technique to cover all situations: hydrology and soils, site access constraints, impacts on desirable native plants and wildlife, degree of invasion, and other factors often complicate control efforts. Years of lessons learned, enhanced understanding of wetland ecology, and advances in technology have diversified the tools and techniques now available to combat AIS. Case studies will highlight the use of integrated tools that utilize the growth characteristics of AIS against them through strategically-timed herbicide treatments, mowing, prescribed burning, seeding, planting, and use of specialized equipment and tools. This expanded toolbox can help minimize impacts to the wetland landscape resulting from management, build resiliency in developing plant communities, and make recovery both feasible and economical.

*Invasive Species: Species-Specific Control, Wednesday, February 20, Mendota Ballroom, 2:10-2:30 pm*

*Invasive Species: The Big Picture, Wednesday, February 20, Mendota Ballroom, 10:40-11:00 am*

**Arneson, Jade**, UW-Green Bay  
Mathew Dornbush, UW-Green Bay  
Kevin Fermanich, UW-Green Bay  
Amy Carrozzino-Lyon, UW-Green Bay

**Bates, Jeremy**, WDNR  
Amy Eliot, Lake Superior Research Institute

### **Restoration of wild rice (*Zizania palustris* L.) at coastal wetlands in the Bay of Green Bay, Lake Michigan**

The Bay of Green Bay is the world's largest freshwater estuary and one of the most productive systems in the Great Lakes. However, the Bay and its watersheds have a long history of intensive use and modification, including loss of wetland habitat. Due to significant impairment of beneficial uses, including those affecting fish and wildlife habitats, the Lower Menominee River and the Lower Green Bay and Fox River were designated as Great Lakes Areas of Concern in the 1980s. Today, Ducks Unlimited, UW-Green Bay, and conservation partners are working to improve coastal wetland habitat within this system. This poster describes an ongoing project to re-introduce northern wild rice (*Zizania palustris* L.) to these historically impaired and dynamic coastal wetland systems. Several other near-shore habitat restoration studies are also ongoing, including land-based migratory waterfowl surveys, which compliment wild rice re-introduction efforts. This poster will focus on the 2018 monitoring efforts conducted within wild rice restoration areas, which occur along the shoreline of the Bay, from Marinette, WI, south to the Lower Bay and east to Point au Sable. Preliminary results suggest that differences exist in wetland habitat quality and wild rice establishment across restoration sites, with initial analyses suggesting a series of contributing factors, including exposure, carp, water quality, and aquatic vegetation. Results are consistent with other restoration projects in the region. This project demonstrates that Great Lakes coastal wetland restoration efforts benefit from strong conservation partnerships among multiple agencies and organizations, as well as from science-based adaptive management.

### **Invasive species early detection surveys and management recommendations in coastal wetlands of Lake Superior**

The WDNR and Lake Superior Research institute collaborated to perform invasive species surveys in fifteen Lake Superior Coastal Wetlands during 2017 and 2018. The locations and species targeted for the surveys were identified by past wetland assessment work, stakeholders, and partners. These surveys employed early detection methods for pioneering and priority invasive species, focusing on plants and some invertebrates. The surveys also determined extent and percent cover for species only currently known by presence/absence data. Each survey included meander paths identified through heat maps based on management priority and anthropogenic influence. Wetlands with priority species were further assessed through floristic quality assessments to capture the quality and diversity of the wetland prior to management activities and to evaluate effectiveness of future management activities. Management recommendations have been drafted for all 15 wetlands, and initial management and control/restoration has been performed in some wetlands. The Lake Superior Coastal Wetland Invasive Species Early Detection and Rapid Response project was funded through an EPA GLRI coastal wetland grant and addresses the concerns of AIS in Lake Superior nearshore areas.

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm

Invasive Species: The Big Picture, Wednesday, February 20, Mendota Ballroom, 11:40 am-12:00 pm



**Beilfuss, Katie**, Wisconsin Wetlands Association  
Tracy Hames, Wisconsin Wetlands Association  
Erin O'Brien, Wisconsin Wetlands Association

**Beilfuss, Richard**, International Crane Foundation

### **New tools to promote wetland literacy across audiences**

Get a special sneak peek at a suite of short videos produced by Wisconsin Wetlands Association (WWA) about wetlands. These videos address the changing nature of communications: nearly twice as many adults today get news online compared to print, one-third of online activity is spent watching videos, and videos shared on social media generate 1,200% more shares than text and images combined. To address these trends, WWA is repackaging messages from our many programs and print materials into short videos. These videos bring basic wetland information to a fresh, more accessible format that will allow us to be more effective at reaching larger audiences with our messages. We plan to market and promote these videos this spring in order to connect audiences with our existing publications, resources, and technical support. While we will use Facebook, web ads, and other outreach electronic marketing, we also seek to make these videos available to our partners for their use in programming. Come preview these new resources and contribute suggestions for ways to help them reach a wide audience in Wisconsin.

### **A risky climate for cranes, wetlands, and our world**

Cranes are among the most endangered bird families and are sentinels for understanding the risks of climate change to wetlands worldwide—especially where wetland loss and watershed degradation already impact biodiversity. In Texas, rising sea levels and reduced freshwater inflows threaten the coastal marshes used by endangered Whooping Cranes. Melting polar regions inundate the arctic marshes where critically endangered Siberian Cranes breed. Retreating glaciers in Asia no longer feed the high-altitude wetlands that support Blacknecked Cranes. Reduced runoff and higher temperatures on Southern Africa floodplains increase water stress, fire, and invasive species that threaten Wattled Cranes, elephants, and other renowned wildlife. Even our abundant Sandhill Cranes are vulnerable to more frequent and prolonged droughts, especially in the western US. To manage and secure wetlands facing climate change, we draw on lessons from decades of crane conservation—that the needs of cranes, many other species, and people are linked strongly to healthy wetlands and watersheds. In Africa, we challenge developers to incorporate climate change into dam operation and to release environmental flows to maintain floodplain health. In China, we negotiate with municipalities to maintain wetlands that are critical staging sites for migratory cranes and waterbirds. In Texas, we model how sea-level rise and freshwater inflows affect future wetland availability for Whooping Cranes, using this knowledge to guide land purchase and easements sufficient for the population to recover fully. Here at home in Wisconsin, we seek wetland protections that provide for a wide range of water conditions for cranes and other wildlife to weather years of extreme drought and flood.

*Wetlands and People, Wednesday, February 20, Mendota Ballroom, 4:20-5:00 pm*

*Wetlands: Yesterday, Today, and Tomorrow: The Big Picture, Thursday, February 21, Wisconsin Ballroom, 10:10-10:30 am*

**Belleville, Lexi**, Loyola University Chicago  
Andrew Monks, Loyola University Chicago  
Shane Lishawa, Loyola University Chicago

**Bergen, Erin**, Northland College  
Ella Shively, Northland College  
Matthew Cooper, Northland College

### ***Typha* × *glauca* and waterfowl food availability in Great Lakes coastal wetlands**

Great Lakes coastal wetlands are crucial for waterfowl due to the abundance of moist-soil seed producing plants they offer. These annually-produced seeds can resist deterioration for years and serve as a primary food source for wintering and migrating waterfowl. However, many wetland plant communities have been altered by the invasion of hybrid cattail (*Typha* × *glauca*). *Typha* × *glauca* is a highly invasive emergent macrophyte that forms dense, monotypic stands and suppresses native vegetation. We designed and conducted a study in Shiawassee National Wildlife Refuge in Saginaw, Michigan, in August of 2018 to examine effects on the abundance and biomass of moist-soil seeds of both the presence of *Typha* × *glauca* and the influence of management regimes. Areas of the refuge invaded by *Typha* × *glauca* are currently being treated using different harvesting techniques to determine how *Typha* × *glauca* can be managed in the future. We took soil cores from different treatment areas (harvested, control, and channels within each) and extracted the moist-soil seeds they contained. The seeds from each core were identified, counted, dried, and weighed to find their biomass during fall 2018. To examine the impact of management techniques of *Typha* × *glauca* on moist-soil seed production, abundance, and biomass, data for each treatment area were tested for statistical differences. We will present these data. This study gives researchers insight on the impact of *Typha* × *glauca* invasion on waterfowl food resources. Ultimately, this research helps inform land managers and scientists on the connections among *Typha* × *glauca* invasion, seed production, and waterfowl food resources within the context of wetland management.

### **Drivers of non-native fish species richness and distribution in the Laurentian Great Lakes**

Coastal wetlands provide vital ecosystem services in the Laurentian Great Lakes region, including the support of basin-wide fish communities. Unfortunately, less than 50% of Great Lakes coastal wetlands (GLCWs) remain today, and many are degraded. Wetland fish communities have suffered from invasion by non-native species, which can disrupt food webs and alter ecosystem function. Using data from the Great Lakes Coastal Wetland Monitoring Program, we explored drivers of non-native fish occurrence and species richness in GLCWs. The data set included observations from 388 coastal wetlands located throughout the interconnected Great Lakes sampled from 2011 through 2015. Across the Great Lakes basin, mean non-native richness (NNR) of fishes tended to be higher in submersed aquatic vegetation than in other habitat types. However, to account for disparities in the distribution of habitat types among individual lakes, we further categorized NNR by both habitat type and lake. These results showed much more variability in habitat utilization, suggesting that habitat-related drivers of NNR varied by lake. Additionally, we identified hotspots of NNR in the Duluth-Superior Harbor, Green Bay, Keweenaw Bay, Sault St. Marie, Western Lake Erie, and several points around Lake Ontario. All of these locations were in relatively close proximity to major ports, suggesting a relationship between high NNR in coastal wetlands and commercial shipping. Clearly, there are many factors at play in the distribution of non-native fishes in GLCWs. Identifying these factors could aid in management decisions regarding coastal wetland rehabilitation and the prediction of invasion susceptibility.

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm





**Clark, Olivia**, UW-La Crosse  
Meredith Thomsen, UW-La Crosse  
William Kiser, USFWS

**Eilertson, Rick**, AECOM

**Battle of the Titans: Can aggressive natives hold their own against reed canarygrass (*Phalaris arundinacea*)?**

Reed canarygrass (*Phalaris arundinacea*) is an intruder to the Upper Mississippi River floodplain that dominates native vegetation under wet and disturbed conditions. Plant diversity and ecosystem quality decrease when reed canarygrass (RCG) is present due, in part, to its competitive advantage from early spring emergence. We compared fall mowing to fall mowing plus spring herbicide application of water-safe glyphosate in terms of the effects of these treatments on the performance of resident RCG and native plants. Furthermore, we evaluated the survival and growth of aggressive native species planted as plugs in treated plots in the first growing season: prairie cordgrass (*Spartina pectinata*), fox sedge (*Carex vulpinoidea*), and sawtooth sunflower (*Helianthus grosseserratus*). Compared to mowing alone, mowing plus herbicide application significantly reduced RCG and preexisting graminoid cover, but increased resident angiosperm abundance. Community richness was significantly increased in mowed plus herbicide plots compared to mowed plots (10 vs. 5.4 species detected per plot respectively). The mowing plus herbicide treatment also increased sunflower plug survival as well as average height for all plug species. Comprehensively, prairie cordgrass and fox sedge had higher average survival rates of 75% and 84% as compared to sawtooth sunflower at 33%. Our results suggest that managers can lessen RCG dominance in areas with co-existing native species with the use of mowing plus spring glyphosate treatments, although the cover of native graminoids may also be reduced by this approach. We predict a higher rate of additional native species establishment in areas dominated by aggressive native flora as compared with RCG.

**Dunn's Marsh: A brief history of stormwater / wetland modifications from 1836 to present and what's next**

Dunn's Marsh was historically a closed depression (aka internally drained watershed) that has seen a significant addition of stormwater runoff from previous closed depressions to the north and south. This increase in stormwater runoff now contributes significant flow into the Greene Prairie of the UW Arboretum and then to Nine Springs Creek. In this presentation, I will provide a brief history of development within the watersheds from 1836 to present. I will also describe early environmental activism by Jim and Libby Zimmerman and the Dunn's Marsh Neighborhood Association during the 1960s and 1970s that led to the purchase of Dunn's Marsh by the City of Madison. I will provide background on the stormwater facilities designed and constructed from 1986 to present that were intended to offset some of the negative stormwater impacts to Dunn's Marsh and Nine Springs Creek. Finally, I will help lead a discussion of future improvements that could be implemented to work towards restoration of Dunn's Marsh.

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm

Wetlands: Yesterday, Today, and Tomorrow: Sites Over Time, Thursday, February 21, Wisconsin Ballroom, 11:20-11:40 am



**England, Laura**, Appalachian State University  
Rick Savage, Carolina Wetlands Association  
Amin Davis, Carolina Wetlands Association & NC  
Department of Environmental Quality

**Gaffield, Stephen**, Montgomery Associates: Resource  
Solutions, LLC  
Nick Hayden, Montgomery Associates: Resource  
Solutions, LLC  
Tracy Hames, Wisconsin Wetlands Association  
Daniel Mahoney, Village of Plover

### **WWA's wetland leadership extends to the Carolinas: The emergence of the Carolina Wetlands Association**

For five decades now, Wisconsin Wetlands Association (WWA) has provided wetlands leadership and a national model of what a statewide wetland organization can do to promote the protection, restoration, and enjoyment of wetlands. WWA's science-based approach has inspired many people over the years and has created an untold number of ripples, the impact of which is mostly hard to see. However, some of these ripples have grown to visible, tangible waves of wetlands work. The emergence of the Carolina Wetlands Association (CarWA) is a perfect example of WWA's growing influence beyond the borders of Wisconsin. I will chronicle the emergence of CarWA (founded in 2015) and discuss the current work of this organization on behalf of wetlands in both North and South Carolina. CarWA's leadership quickly grew to include a large number of wetland scientists, professionals, and enthusiasts, and the organization committed to the same kind of science-based approach taken by WWA. CarWA's work includes: outreach, advocacy, and science. We launched our flagship outreach program, Wetland Treasures of the Carolinas, in May 2016 during American Wetlands Month, a program modeled after WWA's Wetland Gems®. I will proudly share the details of this program and other ways in which CarWA has been inspired by and influenced by the WWA model.

### **The role of wetlands in a watershed approach to restoring the Little Plover River in Wisconsin**

The Little Plover River watershed has experienced significant streamflow depletion and wetland loss due to widespread groundwater pumping and drainage. The Little Plover River Watershed Enhancement Project is a watershed approach to restoring flow and habitat in this Central Sands trout stream. The Village of Plover is leading this collaboration with the Wisconsin Wetlands Association, the Wisconsin Wildlife Federation, the Wisconsin Potato and Vegetable Growers Association, Portage County, WDNR, and Montgomery Associates to implement voluntary protection and restoration actions. The project is currently engaging stakeholders, implementing initial projects, and planning additional restoration actions. We are using a groundwater flow model to help develop a watershed strategy to quantify and prioritize different flow restoration alternatives, including reducing municipal, agricultural and industrial well pumping. Restoration of wetlands in different parts of the watershed is also an important part of the strategy due to the benefits of wetlands to watershed hydrology and geomorphology. An in-progress headwater wetland mitigation project will decommission one irrigation well and fill ditches, diverting groundwater to a natural headwater stream reach, increasing flood storage, reducing erosive high flows downstream, and potentially increasing groundwater recharge. Restoration underway in floodplain wetlands along the main stem of the river aims to restore a narrower, deeper river channel to improve river-floodplain connection, reduce stream temperature, and increase cover for fish. I will provide an update on the hydrologic analysis and actions that have already been implemented, are in progress, and are planned.

*Wetlands: Yesterday, Today, and Tomorrow: The Big Picture, Thursday, February 21, Wisconsin Ballroom, 9:50-10:10 am*

*Watershed Approaches, Wednesday, February 20, Wisconsin Ballroom, 11:40 am-12:00 pm*



**Gibson, Melissa, WDNR**

Thomas Bernthal, WDNR (retired)

Pat Trochlell, WDNR (retired)

Allison Willman, WDNR

**Glenzinski, Brian, Ducks Unlimited**

Amy Carrozzino-Lyon, UW-Green Bay

Patrick Robinson, UWEX

Mathew Dornbush, UW-Green Bay

Kevin Fermanich, UW-Green Bay

**Applying FQA methodology to assess restored wetlands:  
Results from 32 restoration projects**

WDNR has recently developed its own Floristic Quality Assessment (FQA) methodology for evaluating the biological integrity of native plant communities. Here we apply the FQA method to 32 wetland restoration projects: 73 wetlands within these projects were surveyed in 2016 and 2017. All wetlands surveyed were greater than 5 years old. Their restoration involved restoring hydrology by disabling drainage structures, removing accumulated sediment, or creating scrapes. Sites were classified as either undergoing regular maintenance or not. We asked the question, are there significant differences in floristic quality between restoration techniques? Also, how does floristic quality in restored wetlands compare to natural wetlands assessed using the same methods? The majority of wetlands in our study (82%) fell within either the “Poor” or “Fair” condition category based on benchmarks for average weighted mean Coefficient of Conservatism (wC), with “Very Poor,” “Good,” and “Excellent” conditions poorly represented or missing. Tests of differences in wC were unable to detect significant differences between partial and complete restoration techniques but significant differences were found between maintained and un-maintained sites. We will also present results of ordination analysis to compare the plant composition of restored and natural wetlands.

**Wild rice restoration on the Green Bay west shore**

Northern wild rice (*Zizania palustris*) is an ecologically and culturally important native emergent plant found in Upper Midwest aquatic systems. Wild rice, an annual requiring seed production for longevity, is believed to be lost from Lower Green Bay by the mid-20th century after a long history of intensive land use and environmental degradation. Ducks Unlimited and partners are working to restore wild rice and enhance fish and wildlife habitat in 5 key wetlands on the Green Bay west shore. Restoration sites were selected based on expert knowledge and an assessment of environmental conditions identified in the literature as appropriate for wild rice. Sites varied in water depth, water quality, flow, and substrate providing a gradient to test limits of establishment. All sites were hand-seeded in late fall to allow seed to overwinter in the sediment and to stimulate germination in the spring. After 1-3 years of seeding, response of wild rice has been variable across sites. Mid-bay sites responded immediately after the first seeding, while lower bay sites have experienced challenges with establishment after 3 years of seeding. Preliminary observations suggest that exposure to high energy wave action, carp disturbance, and persistent water clarity and turbidity issues are likely factors influencing establishment. Monitoring efforts help to understand these factors and influence adaptive management. For example, we can adjust exposed locations at higher water levels to provide adequate wave protection or use exclosures to protect early season plants from disturbance. A combination of flexibility in response to environmental conditions, collective management experience, and continued monitoring are all critical to the success of this effort.

*Wetland Flora & Plant Communities: ID & Assessment,*  
Wednesday, February 20, Wisconsin Ballroom,  
2:30-2:50 pm

*Wetland Flora & Plant Communities: Sites & Species,*  
Wednesday, February 20, Wisconsin Ballroom,  
3:40-4:00 pm

**Granberg, Jason**, WDNR

Fugui Wang, Applied Ecological Services, Inc.

Todd Polacek, Applied Ecological Services, Inc.

**Grimm, Mike**, The Nature Conservancy

Nicole Van Helden, The Nature Conservancy

John Wagner, The Nature Conservancy

### **Mapping the invasive plant reed sweet mannagrass (*Glyceria maxima*) using aerial imagery, machine learning,**

#### **and field reconnaissance**

Reed sweet mannagrass is an aggressive, obligate, wetland invasive plant known to cause harm to wetland and aquatic ecosystems. It can intensify flooding and deoxygenation, leading to local fish kills. After it reaches peak biomass, it collapses, smothering adjacent wetland plants. It has also been documented to cause cyanide poisoning in cattle who eat the grass. Following reconnaissance in 2016, we found that *G. maxima* has a more widespread distribution than was previously understood and we need precise maps to develop treatment plans. To assess this species, WDNR hired Applied Ecological Services, Inc. to provide detailed maps of *G. maxima* in Jefferson and Calumet Counties. The methodology to map *G. maxima* is an iterative process and includes (1) collection and processing aerial imagery and other data for software compatibility; (2) image segmentation and object delineation; (3) classification with Random Forest algorithm; and (4) post-processing of apparent identification and accuracy assessment. Spatial distribution maps of *G. maxima* were created to help develop a management strategy and are available to the public. The quality of the analysis indicated that *G. maxima* can be mapped successfully with a high degree of accuracy by using remote sensing techniques at the landscape level. It is hoped this remote sensing approach can be utilized as a landscape-scale tool to understand additional areas at risk beyond the study areas and as a potential tool for under-surveilled species. This study shows additional details of this species' distribution and finds areas at future risk, information useful for land managers, ecologists, and landowners.

### **Wetland restoration and protection decision support: Lower Fox/Green Bay wetlands & water quality**

The Decision Support Tool of the Lower Fox Basin assessed current wetlands and potentially restorable wetlands (former wetlands that have been drained and converted to upland) for their water quality improvement potential. The statewide Wetlands by Design ([www.WetlandsByDesign.org](http://www.WetlandsByDesign.org)) tool was used as a starting point and refined in both geography and functionality in the Lower Fox River Watershed to identify opportunities to achieve water quality and wildlife goals in this EPA-designated Area of Concern (AOC). Wetlands by Design is a statewide online tool for identifying wetland protection and restoration opportunities that can provide an array of ecosystem services, including water quality improvement. This GIS approach combined information from Wetlands by Design with local field-level soil phosphorus data and remotely-sensed drain tile data created by the Outagamie County Land Conservation Department to rank preservation and restoration opportunities. The results of the assessment are shared in our decision support tool "Wildlife Recovery: Lower Green Bay & Fox River AOC" on The Nature Conservancy's (TNC) "Freshwater Network" platform, a web-based data interface for freshwater data and tools developed by TNC partnerships across the country. The tool is intended to be followed up by on-site evaluations to verify physical properties and to determine restoration feasibility. To that end, TNC used the tool to identify sites in the Lower Fox with the greatest water quality improvement potential and screened them further using additional GIS layers, landowner willingness assessments provided by the County conservation office, and desktop and in-field feasibility assessments by an experienced restoration professional.

*Invasive Species: Species-Specific Control, Wednesday, February 20, Mendota Ballroom, 1:50-2:10 pm*

*Watershed Approaches, Wednesday, February 20, Wisconsin Ballroom, 10:40-11:00 am*



**Hall, Anna**, University of Minnesota Duluth  
Hannah Ramage, Lake Superior National Estuarine  
Research Reserve/UWEX

**Herbst, Stephanie**, UW-Madison  
Lianna Johnson, UW-Madison

### **Vegetation changes within the St. Louis River Estuary**

The role of sustained high water levels on plant communities and percent cover was studied in the St. Louis River estuary, a biologically diverse coastal wetland of Lake Superior. Lake Superior has had higher than average water levels from 2014 to 2018, causing high wetland water levels within the St. Louis River estuary. Emergent and submersed plant species and percent cover were surveyed at permanent plots from 2014-2017 in five separate embayments of the Pokegama River (where it meets the St. Louis River estuary). The goal was to examine changes in species composition and percent cover relative to water depth. We found dramatic and rapid changes to species composition in the majority of our plots. We also documented shifts from emergent to submersed communities and a net loss of percent cover in the study area. This study has implications for aquatic plant restoration and seeding efforts in the St. Louis River estuary, as well as for predicting coastal wetland changes to future climate conditions across the Great Lakes. Future water level regime fluctuations combined with the predicted increased number and severity of flood events may cause stress on Great Lakes coastal wetlands. The continuation of this study will enable us to track plant community shifts in response to these potential stressors and therefore assess wetland resiliency.

### **Promoting long-term stewardship of the Waubesa Wetlands watershed**

The 370-acre Waubesa Wetlands, located on the Southwest toe of Lake Waubesa in Dane County, have captured the attention of people for many years. Waubesa Wetlands are well recognized for their unique ecological and cultural significance. Named a Wetland Gem® by Wisconsin Wetlands Association, this natural treasure provides people with valuable services as well as recreational and educational opportunities. To promote long-term stewardship of Waubesa Wetlands and the many services it provides, Water Resources Management graduate students engaged with people that most directly affect the future functionality of the wetlands. We increased awareness of Waubesa Wetlands through 11 outreach events and partnered with several local organizations. Through these outreach events, we augmented Friends of Waubesa Wetlands, a citizen-led group working to sustain and celebrate the terrestrial and aquatic natural resources of Waubesa Wetlands and the surrounding watershed. These efforts are part of a larger project that assesses water quality, ecosystem services, and future land use change, the results of which will be available on a website hosted by Capital Area Regional Planning Commission. We will share our success stories and lessons learned for capacity building of citizen-led groups.

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*

*Wetlands: Yesterday, Today, and Tomorrow: The Big Picture, Thursday, February 21, Wisconsin Ballroom, 9:30-9:50 am*

**Highsmith, Tod**, Wisconsin Wetlands Association  
Alice Thompson, Thompson and Associates  
Wetland Services  
Mike Mossman, WDNR (retired)

**Himmler, Kurtis**, Loyola University Chicago

### **Wetland connections between science and poetry**

What started off as a one-time reading of wetland poetry, initiated by wetland scientist and poet Mary Linton, has become an annual tradition at this conference. We recognize the unique connections we make to wetlands and their watery environment that are captured by poetry. Take a moment during this conference to listen to how poets speak to the ecosystem that we more commonly seek to understand through science.

### **The effects of hybrid cattail invasion on wetland bird community composition and moist-soil seed production**

The invasive hybrid cattail (*Typha × glauca*) degrades wetland habitat quality throughout the Midwest by replacing diverse native plant assemblages with a persistent monoculture. Waterfowl rely on native wetlands as food-rich stopover sites during their fall and spring migrations. Hybrid cattail invasion likely makes wetlands less viable as stopover sites by reducing the abundance of the seed-bearing plants that account for most of the diet of migrating waterfowl. Thus, my research aims to 1) quantify the impact of hybrid cattail invasion on wetland seed production and 2) identify the method of cattail removal that most effectively increases wetland seed production the following year. To address these objectives, I established survey plots in native plant-dominated, cattail-dominated, harvested, herbicided, and burned areas of the Dixon Waterfowl Refuge in central Illinois. During the summer of 2018, I conducted multiple rounds of vegetation surveys to assess the abundance and seed yield of each plant species present in each plot. I also collected soil cores at each plot in November of 2018 and extracted, identified, and weighed the seeds from each core. I converted seed yield to duck-use days and then conducted ANOVAs to compare the plant community composition and seed yield of the 5 plot types. By quantifying the cost of hybrid cattail invasion in terms of duck-use days, this project informs wetland restoration efforts aiming to increase wetland seed production through hybrid cattail control. Results from the Dixon Waterfowl Refuge will likely be typical of restored riverine wetlands throughout the Mississippi Flyway, the most heavily used waterfowl migration route in North America.

*Wetlands and People, Wednesday, February 20, Mendota Ballroom, 4:00-4:20 pm*

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*



**Riparian wetland restoration site investigation, then and now: Evolving site investigation methods and consideration of climate change**

A case study of a 2009 site investigation for a proposed 30-acre wetland restoration in Ozaukee County indicated that recently-available modeling tools allow for more concise and cost-effective landscape level planning. One of these newer modeling and GIS-based tools is named “Wetlands by Design”. This collaborative effort between USEPA, WDNR, and The Nature Conservancy provides a GIS-based software platform named the “Wetlands and Watersheds Explorer” (Explorer) that considers a larger scope of watershed inputs, not just the immediate sub-watershed. The need for site-specific data collection is still the logical next step in the process and Explorer can help focus these efforts. In addition, the installation of numerous and strategically-placed monitoring wells and data loggers, using up-to-date H&H modeling software, as well as extensive soils lithology data collection, have made the “ground-truthing” process more efficient and cost-effective. While no reliable predictors of surface- and groundwater impacts that may occur due to climate change are available, the investigator can use modified precipitation data to better plan for these changes in multiple modeling runs leading to designs that consider the potential for wider variances in water levels.

**Wetlands and agriculture: Working together to improve water quality**

NEW Water, the brand of the Green Bay Metropolitan Sewerage District, has been piloting a watershed project, working in the community with landowners to improve land use in an effort to address high levels of phosphorus and sediment runoff. By working in the watershed NEW Water is evaluating if it is more cost effective to invest in wastewater treatment plant improvements or to work with agriculture to reduce the amount of phosphorus and sediment reaching Green Bay. One of the many practices utilized in retaining and slowing down rural runoff is wetland restoration. The Silver Creek subwatershed is roughly 4,800 acres, of which agricultural land use accounts for 48%. NEW Water worked with agricultural landowners in this subwatershed to remove 150 acres of poor quality agricultural land from production and restore these acres to create seven different wetland complexes. Often these areas had had poor crop yield, had hydric soils, and in some cases had wetland indicator vegetation. Collectively, these seven basins drain 650 acres of the subwatershed, allowing for sediment and phosphorus capture from these acres as the runoff filters through. Wetlands now account for 7% of the 48% of acreage in this subwatershed that had been in agricultural land use. These wetlands vary in size and were custom-designed to fit the needs of each location. Each wetland includes native grasses, pollinator habitat, and extended buffers around each basin. The project goal is not to take agricultural land out of production, but instead to find a balance of healthy productive ecosystems from both a water quality perspective and an agricultural perspective.

*Wetland Restoration, Thursday, February 21, Mendota Ballroom, 9:50-10:10 am*

*Wetlands and Water Quality, Thursday, February 21, Mendota Ballroom, 11:20-11:40 am*

**Izadmehr, Mahsa**, University of Illinois at Chicago  
Karl Rockne, University of Illinois at Chicago  
Jill Kostel, The Wetland Initiative

**Jaros, Sally**, WDNR  
Josh Brown, WDNR  
Tom Pearce, WDNR

### **Identifying limits to denitrification in constructed wetlands**

In-field practices to reduce agricultural runoff are one way to meet the goals of the Illinois Nutrient Loss Reduction Strategy. We are studying nutrient removal efficiency in small, precisely-sited constructed wetlands as part of this strategy. These wetlands remove nitrate (NO<sub>3</sub>) naturally by microbial denitrification using organic matter (OM) in the sediment, producing environmentally-benign nitrogen gas (N<sub>2</sub>). Two wetlands (W1 & W2) were built by The Wetlands Initiative for this study. The wetlands receive tile drainage from cropland in corn/soy rotation. We studied the three primary components of the denitrification process: NO<sub>3</sub>-N, OM, and the microbial community that catalyzes the reaction. We analysed NO<sub>3</sub>-N at the inlet, outlet, and within the wetland as well as changes in sediment OM biodegradability during wetland development and changes in the sediment microbiome using genetic data. Lower concentrations of NO<sub>3</sub>-N were observed in 2017 in W1, primarily due to the switch from corn to soy for much of the drainage area. Overall, 1000 kg of N was removed in 2016 but with relatively low efficiency. We attribute these results to the lack of OM and denitrifying bacteria in Year1. In Year2, W1 NO<sub>3</sub>-N removal efficiency increased significantly, and >1700 kg N were removed. There was a concurrent increase in known denitrifying bacterial species during this time. This was accompanied by input of fresh OM from wetland vegetation into the sediment after a complete year of operation. We conclude that wetland plant growth is required to provide sufficient fresh OM to build up denitrifying bacteria for efficient NO<sub>3</sub>-N removal. Thus, establishment of wetland plants prior to full operation will likely result in improved performance.

### **In-lieu fee wetland mitigation in Wisconsin: Finding competitive restoration opportunities**

Since 2014, the Wisconsin Wetland Conservation Trust (WWCT) in-lieu fee wetland mitigation program (operated by WDNR) has been collecting mitigation fees and funding large-scale wetland restoration projects throughout the state. The WWCT is constantly in search of new and high-quality wetland restoration opportunities across the state. In this presentation, we will outline where in the state we have the greatest need for restoration projects. Through experience reviewing and managing projects since the program's inception, we have identified site characteristics that lead to a stronger WWCT wetland restoration project, and we will share those lessons with attendees. We will discuss the conditions that are more likely to result in project success, the tools available to help you identify a great wetland restoration site, and "red flags" that may indicate that a site is not appropriate. If you are interested in applying for a wetland restoration grant, join us to learn more about how to prepare an application for greater chances of success.

*Wetlands and Water Quality, Thursday, February 21,  
Mendota Ballroom, 11:40 am-12:00 pm*

*Wetland Restoration, Thursday, February 21, Mendota  
Ballroom, 9:30-9:50 am*





**Johnson, Rachel**, UW-Madison

Mitch Buthod, UW-Madison

Némesis Ortiz-Declet, UW-Madison

Courtney Bothelo, UW-Madison

Stephanie Herbst, UW-Madison

Lianna Johnson, UW-Madison

Kyle Pepp, UW-Madison

### **A watershed approach to Waubesa Wetlands: Today and tomorrow**

Watershed scale approaches to wetland management can achieve broad environmental and social goals and provide context for understanding current wetland conditions and future impacts. Waubesa Wetlands, a 370-acre lakeshore wetland complex in Dane County are recognized as a state Wetland Gem® and a national Wetland of Distinction. The watershed of Waubesa Wetlands includes multiple upstream wetlands and two tributaries that drain agricultural and urban land. Water Resources Management (WRM) students used a watershed scale, science-based analysis to assess current community involvement, ecosystem services, surface water quality and quantity, and land use of the Waubesa Wetlands watershed. WRM students engaged with watershed residents and stakeholders through creation of a website and community outreach events. We used the WDNR's Wetland Rapid Assessment Methodology to gather a current snapshot of ecosystem services provided by watershed wetlands. Our surface water monitoring augmented previous work and quantified nutrient loading. Future conversion of upstream farmland to urban development and a changing climate could influence tributary conditions and ecosystem services provided by the watershed, in turn affecting Waubesa Wetlands. To better understand future impacts, we modeled scenarios of potential watershed land use and precipitation change using HydroCAD and STEPL modeling programs, and we synthesized results with data on surface water quality and quantity and ecosystem services. We will share management recommendations for the future of the watershed of Waubesa Wetlands.

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*

**Kretlow, Amy**, WDNR

### **Graceful cattail (*Typha laxmannii*) discovered in Southeast Wisconsin**

Graceful cattail is a perennial cattail native to wetlands in Europe and Asia that only grow three to five feet tall. Until recently, there have been no documented wild populations in Wisconsin or even in the United States. Under Wisconsin's Invasive Species Law (NR 40), the graceful cattail is a prohibited species. Species with this designation are not yet in Wisconsin or are found in very small numbers and/or isolated populations where eradication is feasible. In the late summer of 2017, a WDNR restoration regulator reported an unusually short cattail found on a recently restored WDOT property. Once the report was made, vouchers were collected and identified by WDNR Natural Heritage Conservation botanists and the Wisconsin State Herbarium at UW-Madison. The morphology of the cattail vouchers suggested that they are a cultivar of the graceful cattail. Samples were also sent to a cattail genetic expert at Northeastern Illinois University for DNA testing. Because this is a species new to Wisconsin, we have no previous genetic markers to use for comparison. The WDNR has been sending fresh samples to Northeastern Illinois to help build a genetic profile for this species. Because this stand has been identified as graceful cattail, control work has been moving forward to prevent its spread in Oak Creek. In the of spring of 2019, control work will also be starting at two additional sites. The WDNR followed the State's Invasive Species Response Framework that clearly outlines the verification, communication, and control process, enabling a smooth process.

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*

Kron, Zachary, WDNR  
Brock Woods, UWEX

Lent, Jennie, The Nature Conservancy  
Eugene Yacobson, The Nature Conservancy  
Nicholas Miller, The Nature Conservancy  
Kris Johnson, The Nature Conservancy

### Results of landscape-scale exotic *Phragmites* treatments in Wisconsin

Non-native *Phragmites* (*Phragmites australis* subs. *australis*) has been invading across Wisconsin since at least 1980 from Lake Michigan shorelines. Known introductions also took place near Superior, at waste water treatment facilities, and elsewhere. An invasion front was identified by analyzing occurrence, density, and frequency data collected from multiple data sources and roadside surveys. The east-west invasion front from Lake Michigan had reached the center of the state by 2012, with many large, old stands occurring in eastern counties, but mainly small and very sparse stands occurring in the west. In 2014, WDNR began GLRI grant-funded herbicide work to eliminate all stands along the advancing front to stop further dispersal west. WDNR work has also been proceeding further east as funding and local cooperation have allowed. Comprehensive monitoring to determine the current status of treated stands took place in summer 2018. Monitoring results indicate that herbicide treatments were effective in reducing population size, but relatively few sites were eliminated. We will discuss the influence of initial site size, number of years of treatment, and continuity of treatments on control. While eradication of large sites was not achieved within the timeframe of this effort, many small sites were eliminated along the advancing invasion front. This is an ongoing, large-scale reduction effort, and results should inform both local governments and NGOs about the status of their *Phragmites* problem so they can develop follow-up plans once WDNR's work concludes in 2019.

### The Floodplain Explorer: A decision tool to prioritize floodplain restoration in the Mississippi River Basin

For many decades, floodplains in the Mississippi River Basin (MRB) have seen extensive degradation, conversion, and hydrologic disconnection, leading to severe disruption of natural processes and contributing to the vast hypoxic "dead zone" in the Gulf of Mexico. Large-scale floodplain restoration is a critical strategy for restoring the health of the MRB, with potential to yield benefits for water quality, wildlife, and human communities that are increasingly vulnerable to extreme flood events. With limited resources available to accomplish this strategy, we must identify high-impact areas to target for investment in floodplain projects. In this presentation, we will share a spatial analysis and web-based decision tool designed to identify priority opportunities for floodplain restoration and conservation. This project leverages a state-of-the-art, large-scale floodplain model and integrates a variety of basin-wide spatial datasets including nutrient export, denitrification potential, likelihood of future floodplain development, critical habitat benefits, and human exposure to flood damage. The interactive online tool provides regional, state, and local stakeholders with portfolios of priority sites, integrating selected aspects of these data inputs at their discretion. Potential sites are identified at multiple, nested watershed scales and for distinct potential management actions including protection, restoration, and hydrologic reconnection. Overall, this project fills an urgent need to increase the pace of floodplain restoration and to direct resources towards floodplain projects likely to have the greatest impact on restoration of the MRB and the most benefits for communities in the region.

*Invasive Species: Species-Specific Control, Wednesday, February 20, Mendota Ballroom, 2:30-2:50 pm*

*Watershed Approaches, Wednesday, February 20, Wisconsin Ballroom, 11:20-11:40 am*



### **The Wisconsin Citizen-based Monitoring Network: 15 years of partnership**

2019 is the 15th anniversary of the Wisconsin Citizen-based Monitoring (WCBM) Network, a statewide stakeholder collaboration designed to improve Wisconsin's natural resource citizen science efforts by providing communications, resources, and recognition. Since 2004, the WCBM Network has offered volunteers, practitioners, educators, and others involved in citizen science opportunities for networking and resource sharing. It hosts conferences, offers funding and equipment-lending opportunities, and promotes and encourages cross-promotion of projects and partner organizations. Members of the citizen-based monitoring community use those resources to study, manage, and protect Wisconsin's wetlands and other ecosystems. For example, volunteers with the Wisconsin Frog and Toad Survey have contributed new county records for several species, and Milwaukee County's Citizen-based Wetland Monitoring Program has been highly successful in using volunteer data for management of wetlands and wetland species. Learn about the history and accomplishments of the WCBM Network, what resources it offers, ongoing work, and how to get involved.

### **Lessons learned in the field: Short-term observations on managing invasive grasses in wetlands using herbicides**

Since 2004, Cardno has completed hundreds of wetland habitat enhancement projects throughout the Midwest and in Wisconsin. In most cases, a large component of those projects is the management of invasive species. In this presentation, we will focus on some of these herbicide control efforts over the past two to three growing seasons, specifically when targeting invasive species. We will share a few of the different herbicide solutions we have used along with some of the short-term results we observed. We will discuss some of our successes along with our thoughts on why a few treatments may have been less successful.

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*

*Invasive Species: The Big Picture, Wednesday, February 20, Mendota Ballroom, 11:00-11:20 am*

**Loken, Zack**, UW-Stevens Point  
Jacob Straub, UW-Stevens Point  
Rachel Schultz, State University of New York-  
Brockport

### **Habitat heterogeneity and wetland-dependent bird use in Wisconsin's Glacial Habitat Restoration Area**

The Glacial Habitat Restoration Area (GHRA) is a 558,879-acre restoration zone in east-central Wisconsin. The GHRA was designed to enhance wildlife habitat, especially for waterbirds, through wetland restoration actions. We observed and counted all waterbird on wetland basins ( $n = 103$ ) from April – June of 2017 and 2018 using fixed-location focal scans. Study wetlands were categorized into 3 groups based on hydrologic modification: scrape; scrape plus ditch plug, ditch-fill, and/or tile break; and scrape plus berm and/or berm with a water control structure. Two reference groups were included: Waterfowl Production Areas (WPAs) and unmodified wetland sites without basins. Wetland plant communities were categorized following the Natural Heritage Inventory database, mapped using aerial imagery, and field checked for accuracy. Habitat heterogeneity was then assessed within each wetland property using an interspersed-juxtaposition index (IJI). Greater values of IJI indicated that contrasting cover type patches were more evenly interspersed throughout a landscape than areas with low IJI. Wetlands with greater habitat heterogeneity may attract more waterbird species than wetlands with a homogenous composition (i.e. low IJI). A boosted regression tree analysis was used to assess the influence of landscape-scale variables on use of restored wetlands by wetland-dependent bird species, including: hydrologic modification category, IJI, average water depth and pH, relative cover of introduced species, weighted mean C, hectares open water, distance to nearest wetland 3,000 acres or larger, and the ratio of nesting-to-foraging habitat at three different scales.

**Manning, Nicholas**, UW-Stevens Point  
Alexis Hollander, UW-Stevens Point  
Brianna Dunbar, UW-Stevens Point  
Sarah Orlofske, UW-Stevens Point

### **The effects of road salt on the growth and survival of freshwater snails (*Helisoma* sp.)**

With the use of road salt in many areas of Wisconsin, we must consider the effect of this practice on our wetlands. Almost 1 million tons of salt are used on roads to melt snow each decade in America. This large amount of an osmotically-active substance in the environment likely affects freshwater wetlands and their inhabitants. The goal of our study is to determine the effect of road salt on the life history of marsh rams-horn snails (*Helisoma trivolvis*). Snails are ecologically important organisms in wetlands because of their roles as detritivores and hosts to parasites because they are an important food source. We conducted a five-week laboratory experiment in which mature snails were exposed to ecologically-relevant NaCl concentrations (the primary component of road salt) as determined by published literature documenting measurements in natural systems. The mass, size, and reproductive output of the snails was recorded twice weekly. There was a statistically significant increase in the mass of snails exposed to salt compared to control snails ( $p < 0.0066$ ). The effect was non-linear with respect to salt concentration. One week following the experiment, when all snails were returned to control conditions, the difference in snail mass was no longer statistically significant, suggesting that salt is a temporary stressor on snail physiological systems. These results may suggest short-term effects on growth or behavioral effects that may make snails more vulnerable to predation or parasitism. Our research suggests subtle yet significant temporary effects on snails due to salt contamination in freshwater environments. Future research will look at the role of salt exposure on interactions between snails and other natural stressors.

Wetland Restoration, Thursday, February 21, Mendota Ballroom, 10:10-10:30 am

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm



**Marti, Aaron**, WDNR  
Thomas Bernthal, WDNR (retired)

### **Wetland floristic quality assessment benchmarks for WI Driftless Area & Southeastern WI Till Plains Ecoregions**

The Wisconsin Floristic Quality Assessment Method (WFQA) was established over a decade ago as a tool for monitoring and assessment of plant communities. However, benchmarks of plant community condition (numeric ranges of WFQA scores distinguishing “Excellent” to “Very Poor” condition) are needed in order to fully utilize WFQA for assessing the condition of a given plant community relative to others of the same type at multiple scales (regional, statewide, etc.), particularly for wetlands. These benchmarks are also a necessary first step before estimates of overall wetland community condition can be completed at these same scales to provide a baseline for future wetland conservation, management, and protection efforts. To address these needs, the WDNR and numerous partners embarked on a project to establish WFQA benchmarks for wetland plant community condition assessment in each of the four major EPA Omernik Level III Ecoregions of Wisconsin. Timed-meander vegetation surveys and field assessment of potential site-level wetland disturbance factors were completed at nearly 1,100 assessment areas statewide from 2011 to fall 2018 to assess WFQA metric response to anthropogenic stressors. Preliminary benchmarks for the Northern Lakes and Forests Ecoregion were proposed in 2015 and for the North Central Hardwood Forests in 2018. We will highlight the methods and data analysis used for establishing floristic benchmarks for the final two ecoregions (Driftless Area & Southeastern Wisconsin Till Plains) and will include preliminary proposed condition benchmarks for many of the major wetland community types encountered in these ecoregions. We will also discuss potential applications of these benchmarks.

*Wetland Flora & Plant Communities: ID & Assessment, Wednesday, February 20, Wisconsin Ballroom, 1:50-2:10 pm*

**Martin, Mark**, Madison Audubon Society-Goose Pond Sanctuary  
Sue Foote-Martin, Madison Audubon Society-Goose Pond Sanctuary  
Graham Steinhauer, Madison Audubon Society-Goose Pond Sanctuary

### **50 years of wetland restoration and protection at Goose Pond Sanctuary**

As the name implies, Madison Audubon focuses on birds. However, this organization uses a holistic conservation approach and considers plants, insects, amphibians, mammals, and reptiles. Goose Pond is a prairie pothole that historically provided a migration stopover and breeding area for waterfowl. A 60-acre parcel, including only a portion of the pond itself, was purchased 50 years ago with the simple goal of providing a waterfowl refuge. Goose Pond Sanctuary has grown to 660 acres of wetlands and uplands that is managed for wildlife habitat. This case study is relevant to wetland managers across Wisconsin and informs them on wildlife survey techniques, invasive species removal approaches and the process of building a wetland complex. Wetland enhancement and restoration has been an ongoing goal at Goose Pond Sanctuary. Water control structures, wetland scrapes, and strategic acquisition have been used to promote the diversity of wetland wildlife. We have learned that, by providing a more robust wetland complex consisting of semi-permanent and ephemeral water bodies, the abundance of many species increase, notably tiger salamanders (*Ambystoma tigrinum*), sandhill cranes (*Antigone canadensis*), and northern harriers (*Circus hudsonius*). Rare species such as the eared grebe (*Podiceps nigricollis*) have been sighted at Goose Pond, and 109 wetland bird species have been observed since the original purchase. Our wetland management strategies change with successes and failures. We recommend an approach focused on adaptive management, sound science and partnerships. Endless wetland project options are available to us, and we will describe specific goals and initiatives that we plan on undertaking to benefit wetland wildlife to the greatest extent possible.

*Wetlands: Yesterday, Today, and Tomorrow: Sites Over Time, Thursday, February 21, Wisconsin Ballroom, 11:00-11:20 am*

### Evaluating the success of restoration and management techniques for prairie fen sites in Michigan

In 1994 The Nature Conservancy in Michigan began intensive restoration of eight severely-degraded prairie fens. Site Conservation Plans and an ecological model were developed to guide restoration. Over the next ~18+ years, prairie fen sites were moved from restoration to maintenance phase through a combination of: 1) removal techniques for woody and herbaceous invasive species, including: herbicide application and spot-burning protocols for glossy buckthorn (*Rhamnus frangula*), tree-of-heaven (*Ailanthus altissima*), purple loosestrife (*Lythrum salicaria*), reed canarygrass (*Phalaris arundinacea*), and *Phragmites* (*Phragmites australis*); 2) re-introduction of prescribed fire in both dormant and growing seasons; 3) hydrological restoration in ditched and tiled areas; 4) native seeding; and 5) intensive monitoring and research. Monitoring initially included: floristic quality assessments, groundwater monitoring wells, species inventories, and photo-monitoring. Coarse-level metrics were later developed to provide a quick means to track progress of restoration/maintenance and determine next management steps needed. Three graduate research projects assessed the Eastern massasauga (*Sistrurus catenatus*), namely: 1) adult and neonate prey preference; 2) home range and habitat requirements; and 3) pre-and-post-fire home ranges and behavioral response during prescribed burns. Specific monitoring and research of massasauga led to development of prescribed fire guidelines for the Candidate Conservation Agreement with Assurances for Eastern Massasauga in Michigan. Restoration success was only achieved by constantly evaluating and adapting the management strategies listed above.

### Wetlands for tomorrow: Maintaining resilient, connected, and functional landscapes as climate changes

Land protection and restoration are high-impact, long-term, yet expensive conservation strategies for maintaining biodiversity. Under climate change, however, species need to move to access necessary microclimates and resources and to rearrange communities. How can we ensure today's work to conserve landscapes is relevant tomorrow? The Nature Conservancy strove to answer this question with a broad array of partners via landscape-scale analyses that considered geophysical settings, landform diversity (availability of microclimates and resources), local connectivity (potential for species to access microclimates), and regional connectivity (facilitating migration in response to climate change). Data and maps resulting from this nationwide effort, called Conserving Nature's Stage, have been tailored to our Great Lakes Region and can be found at <http://maps.tnc.org/resilientland>. Wetlands played key roles in this analysis, as they provide diverse microclimates and hydrologic gradients and can maintain connectivity. It is no surprise, therefore, that today's wetland restoration and protection efforts will be pivotal to helping wildlife respond to climate change. These same efforts will help people adapt because wetlands provide ecosystem services like flood reduction and keeping streams clean and flowing. I will provide Wisconsin-specific examples of how two online mapping tools—Conserving Nature's Stage and Wetlands by Design: A Watershed Approach for Wisconsin ([www.WetlandsByDesign.org](http://www.WetlandsByDesign.org))—can be used in combination to target wetland conservation opportunities most likely to support biodiversity and people under a changing climate.

*Invasive Species: The Big Picture, Wednesday, February 20, Mendota Ballroom, 11:20-11:40 am*

*Watershed Approaches, Wednesday, February 20, Wisconsin Ballroom, 11:00-11:20 am*





**Mosca, Vince**, Friends of Hackmatack National Wildlife  
Refuge

**Nichols, Al**, Beloit College  
Brendan Reid, W. K. Kellogg Biological Station  
Sarah Fitzpatrick, W. K. Kellogg Biological Station

### **Regional significance of the Hackmatack National Wildlife Refuge: Wisconsin and Illinois**

The Hackmatack National Wildlife Refuge (HNWR) is a bi-state conservation area that straddles the Wisconsin-Illinois state line. At full implementation, HNWR would occupy 11,200 acres or more of natural habitats. Planning for the refuge started in the mid-2000's and was officially approved in August 2012 as the 561st NWR. The refuge brings ecotourism and recreational opportunities to the more than 12 million people who live within a 1.5-hour drive. Located along major transportation corridors and trail networks, this open space provides easy access for users and educational activities. This type of large conservation area will be critical in the future to supporting viable populations of native wildlife, insects, and vegetation communities. The significant size of HNWR also can assist in the moderation of extreme weather events and with mitigation planning while providing critical green infrastructure and nature-based adaptation support. The restoration priorities for HNWR include the conversion of largely agricultural land to grassland bird habitats, supported by a mosaic of woodland, savanna, upland prairie, and wetland communities located along the riparian corridors of Nippersink Creek. The relatively large size of the refuge and variety of habitats confers some inherent resilience to climate change. Currently about 1200 acres of land have been protected by various land partners in both states.

### **What's under the surface: Ecosystem characteristics predict growth and shell morphology in painted turtles (*Chrysemys picta*)**

Since the early 1960s, painted turtles from marsh and lake populations around the W. K. Kellogg Biological Station in Hickory Corners, Michigan, have been studied using mark-release-recapture methods. These past studies focused on a variety of population biology themes and helped to establish *C. picta* as a model species for the study of reptiles and aquatic organisms due to their abundance, hardiness, and ease of handling. This study aimed to update the work of the past by using modern techniques in addition to those outlined by past researchers. We used geometric morphometrics—a statistical technique that involves plotting landmarks on photographs of specimens to compare their shapes—and standard metrics of shell size to analyze the phenotypic variation within and between different populations in the context of ecosystem structure. Our findings indicate a strong correlation between shell morphology and ecosystem characteristics, such as prey and predator species, population density, nutrient availability, and shelter. Growth and body size are significantly correlated with habitat in painted turtles, meaning that populations in close proximity can be visually distinct due to their unique habitat conditions. Since amphibian populations have been decimated by climate change, it would follow that aquatic turtles, living in similar habitats and with some similar physiology, would suffer as well. However, the adaptability represented in our data indicates that these turtles may display more resilience than once believed. Future research may show whether this resilience comes from plasticity of developmental pathways or evolutionary adaptation. Regardless, painted turtles are tougher than was once believed.

Poster Session, Wednesday, February 20, Superior  
Ballroom, 5:00-6:30 pm

Poster Session, Wednesday, February 20, Superior  
Ballroom, 5:00-6:30 pm



**Niosi, Olivia**, Loyola University Chicago  
Andrew Monks, Loyola University Chicago  
Shane Lishawa, Loyola University Chicago

**O'Brien, Maggie**, Loyola University Chicago

### **Spatial analysis of nutrients affecting *Typha*-invaded wetland**

Dominance of the hybrid cattail (*Typha x glauca* [*T. latifolia* x *T. angustifolia*]; hereafter *Typha*) has altered the resilience of Great Lakes coastal wetlands. *Typha* establishes large, monotypic stands that suppress native vegetation and establish feedback loops that further favor its dominance by blocking sunlight, creating dense litter, and altering nutrient availability. Native plants growing in Great Lake coastal wetlands are historically adapted to oligotrophic (i.e. low nutrient) conditions. Anthropogenic run-off from sewage effluent and agricultural fertilizers—containing high-levels of nitrogen and phosphorus that passes through the area—can facilitate the growth of invasive plants. In my research, I combined plant root simulator (PRS) probe nutrient data and vegetation surveys from a *Typha*-invaded marsh into statistical principal components and spatial analyses in order to investigate the dynamics between *Typha* growth, water levels, and nutrient availability. The goal of this study was to explore influences of nutrients beyond the well-studied nitrogen and phosphorus and to examine ways PRS probe data can be utilized in wetland research. By looking at the major contributors of the significant principle components, I identified the strongest relationships amongst *Typha* growth and nutrient variables over each year sampled. Restoration goals of the marsh may be updated to reflect contributing factors to the establishment of *Typha* dominance. This study is constrained by the sample size of one marsh. It is meant to be an exploratory method that may be applied to other sites and the results should not be extrapolated without further study.

### **How does the time since invasion by hybrid cattail affect the diversity of a wetland seed bank?**

Great Lakes coastal wetlands are key habitats that support many species of fish, invertebrates, and amphibians. Native plant species play an important role in these communities. Increasing impacts of invasive plant species over the past three decades have altered these wetlands' structural and trophic foundations. Invasive species like hybrid cattail (*Typha x glauca*) outcompete native plant species, which fade from the visible plant community. However, the seeds they produced remain in the sediment for a number of years as a seed bank. Regardless of the methods of removal of an invasive species, the re-growth of native plants depends on the composition of the seed bank. My research project tests the hypothesis that the diversity of species persisting in the seed bank will decrease as time progresses following *Typha* invasion. I addressed seeds that would already be present in the community, disregarding plant growth from other methods of seed dispersal. I collected seed cores from Sand Island Marsh in northern Michigan and conducted a seedling emergence study to evaluate the viable seed bank in areas with differing ages of *Typha* invasion. I compared these results to a reference uninvaded wetland and analyzed the results to determine the species richness and diversity of the seed bank. This work will provide critical information that can be used to evaluate which wetlands will exhibit the most resilience to invasive plant removal. It will also inform the study of ecological thresholds by documenting the point at which invaded wetlands lose the ability to return to their previous state. This change represents the crossing of a threshold and a shift into a more permanent invaded state.

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm



### Development of a key to wetland plant communities

The WDNR Natural Heritage Inventory natural community classification is based upon John Curtis's Vegetation of Wisconsin (1959). However, wetlands were poorly covered by Curtis, and many communities now recognized were historically lumped into broad categories with poor plot data. While subsequent efforts have refined the classification, including the recent publication of Natural Communities, Aquatic Features, and Selected Habitat in the Ecological Landscapes of Wisconsin (Epstein 2017), the relative lack of quantitative vegetation data has hampered efforts to objectively differentiate similar communities from one another to date, inhibiting accurate determination of communities for restoration and mitigation. Recently, Floristic Quality Assessment surveys of nearly 1,100 assessment areas (AAs) across all major wetland communities of Wisconsin were completed, including more than 400 AAs that qualified as high-quality reference sites. Distinctness among community types was independently verified using Non-Metric Multi-Dimensional Scaling (NMDS). Data from reference sites were then pooled for each community type and analyzed to determine the species composition and characteristics that best differentiated similar communities from one another. This information was combined with natural community physiographic characteristics and distribution patterns to produce two new data products: 1) a key to wetland natural communities of Wisconsin and 2) a new feature for each wetland community WDNR webpage: Defining Characteristics and Similar Communities. These resources will help practitioners determine wetland communities with greater accuracy and confidence and will facilitate appropriate management, restoration, and mitigation.

*Wetland Flora & Plant Communities: ID & Assessment,  
Wednesday, February 20, Wisconsin Ballroom,  
1:30-1:50 pm*

### Wisconsin Wetland Conservation Trust: 2019 updates for WDNR's in-lieu fee mitigation program

The Wisconsin Wetland Conservation Trust (WWCT) is WDNR's statewide program to offset unavoidable permitted impacts to wetland resources. At 4 years old, the WWCT is constantly evolving to meet the state's need for wetland mitigation projects. This poster will highlight aspects of recent updates to the WWCT Program Guidance, changes to the project development process, and the new State Lands Grant Subprogram. The poster (and discussion with the author) is intended to help interested project proponents (non-profit land organizations, environmental consultants, individual landowners) learn the ins and outs of the program.

*Poster Session, Wednesday, February 20, Superior  
Ballroom, 5:00-6:30 pm*

**Poole, Bill**, Stantec  
Elias Wilson, WDNR

**Prestby, Tom**, GEI Consultants, Inc.  
Kyle Bretl, GEI Consultants, Inc.  
Stacy Hron, WDNR

### **Sod in motion: Moving wet prairie sod to preserve one-half acre of high-quality prairie remnant**

Prairie remnants in Wisconsin are now <1% of their historic extent. Wet-mesic prairies historically occurred in large wetland complexes, especially in southeast Wisconsin. Remaining remnants are the last habitats for a host of rare and protected species. Remnants that have avoided the plow and the bulldozer can be found within transportation corridors but are vulnerable to road expansion projects. Successful relocation of prairie sod in the path of road expansion is often costly and logistically challenging. New innovative techniques are needed to make these relocations cost-effective and practicable when avoiding impacts is not feasible. A highway interchange project in Racine County involved inevitable impacts to a wet-mesic prairie remnant. We used a custom implement that was fabricated specifically for this project to relocate 24,000 square feet of prairie to a new location in the Bong State Recreation Area. The implement cut and extracted “tiles” of sod that were then loaded onto pallets and trucked to the relocation site. Sod was cut to an average depth of 8 -10 inches to preserve as much of the root network as feasible. The relocation site was prepared by excavating 8-10 inches of soil to remove existing non-native vegetation and the new sod was installed by WDNR staff. Monitoring by WDNR documented prairie sod tiles established well on the new site by the end of the first growing season, with a high diversity of native prairie species observed. Considering the relatively shallow depth of excavated soil, the sod transplant method was effective in conserving a diverse native wet-mesic prairie and was completed under budget.

### **Recovery of an AOC: Using vegetation and wildlife communities to evaluate the present and look to the future**

The once productive and dynamic wetlands of the Sheboygan River area have experienced tumultuous times as Sheboygan developed, but restoration actions have begun the path to a healthier future. The lower 14 miles of the Sheboygan River were designated an Area of Concern (AOC) in 1987 primarily due to high levels of contaminants, eutrophication, and loss of fish and wildlife habitat. In 2008, goals for restoration addressing these impairments were established with the ultimate goal of delisting the AOC. Locations along the Sheboygan River with public ownership and maximum opportunity for improvement were selected for restoration. During 2018, GEI Consultants Inc., (GEI) evaluated the restoration efforts that took place beginning in 2012. Restoration efforts included invasive species control, native plantings, shoreline restoration, in-stream habitat creation, and projects addressing restoration of wildlife habitat, particularly for birds, bats, herptiles, fish, and mussels. Wetland types including marsh, meadow, and forested wetlands were restored. Assessments by GEI focused on two evaluations: a vegetation community assessment and a herptile inventory. The vegetation community assessment included a floristic quality assessment and a WI Wetland Rapid Assessment. The comparison of a 2018 herptile inventory with a pre-restoration inventory in 2011 provided the opportunity to correlate the restoration efforts with the immediate response of a portion of the wildlife community. We will present the context of the current situation and future implications for the long-term recovery of the Sheboygan River AOC as well as lessons for restoration of other Area of Concerns.

*Wetland Flora & Plant Communities: Sites & Species,  
Wednesday, February 20, Wisconsin Ballroom,  
4:00-4:20 pm*

*Wetlands and Water Quality, Thursday, February 21,  
Mendota Ballroom, 11:00-11:20 am*



**Ray, Shelly**, Northland College  
Sarah Johnson, Northland College  
Matthew Cooper, Northland College

**Smith, Christopher**, WDNR  
Calvin Lawrence, WDNR  
Christopher Noll, WDNR  
Amanda Minks, WDNR

### **Bathymetric mapping of lagoonal wetlands in the Apostle Islands National Lakeshore**

Lagoonal wetlands of the Apostle Islands in Lake Superior form within a dynamic coastal setting. Surface connections between the wetlands and Lake Superior vary from open river mouths to transient sand barriers that open and close periodically, to more stable sand barriers that remain closed for long periods of time. Accordingly, wetland hydrology is influenced to varying degrees by Lake Superior water levels depending largely on the nature of wetland-to-lake connections. To understand how Lake Superior water levels influence wetland water levels and inundation patterns in Apostle Island lagoonal systems, we conducted bathymetric surveys and collected high temporal resolution water level data at seven wetlands throughout the summer and fall of 2017. Bathymetric data were interpolated to produce bathymetric maps over which wetland water level data were modelled to visualize how fluctuating Lake Superior water levels influence wetland inundation patterns. Preliminary results suggest multiple water level regimes and inundation patterns driven primarily by the stability of lake-lagoon sand barriers as well as flow through the barriers themselves. Understanding how wetland water levels and bathymetry influence inundation patterns has the potential to improve our understanding of biotic communities and their dynamics in these rare coastal wetlands.

### **The new wetland mapping initiative**

At the 2018 wetlands conference, we presented a rough outline of WDNR's efforts to develop an accurate, all-digital wetland mapping process and resume in-house map production using 1-1.5m Light Detecting and Ranging (LiDAR) derived Digital Elevation Models (DEMs) and 6-12 inch uncompressed leaf-off imagery as primary base data. Notable changes include concurrent mapping of all surface waters with wetlands, replacing point symbols with delineated polygons, and retiring the WWI classification system in favor of the National Wetland Inventory standard (Cowardin et al 1979). In this presentation, we will present lessons learned as well as a summary of progress, including refined methods, Python Add-Ins, and draft maps produced for a handful of 12-digit hydrologic unit watersheds (HUC's) in Oneida, Adams, Vernon, and Monroe Counties. Map creation is taking place using a minimum 1:2000 viewing with the goal of representing all detectable hydrologic features (surface waters and wetlands) as polygons and creating geometry for an updated flow network for connected surface waters.

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*

*Wetland Flora & Plant Communities: ID & Assessment, Wednesday, February 20, Wisconsin Ballroom, 2:50-3:10 pm*



**Stanton, Samantha**, Great Lakes Commission  
Daniel Engel, USGS  
Elaine Ferrier, Great Lakes Commission  
Christine Dumoulin, University of Georgia  
Kurt P. Kowalski, USGS  
Erika Jensen, Great Lakes Commission

**Steber, Aaron**, Cardno

***Phragmites* adaptive management framework: Managing *Phragmites* with science on your side**

Non-native *Phragmites australis* is a highly invasive wetland grass in North America, and managers across the Great Lakes basin are working to control it. However, practitioners have reported difficulty in collaborating across the *Phragmites* community. Thus, the Great Lakes *Phragmites* Collaborative (GLPC) was formed to support managers in achieving their diverse management goals. Since its formation, the GLPC has provided dozens of *Phragmites* resources (including information on wetland restoration best management practices); hosted research and management webinars; formed dynamic mapping tool; and created the *Phragmites* Adaptive Management Framework (PAMF). PAMF is a program designed to reduce uncertainty in *Phragmites* management through a collective learning process. Using an adaptive management strategy and a data-driven predictive model, PAMF partners with *Phragmites* managers across the basin to refine best management practices and provide site-specific management guidance. PAMF provided participant guidance for the first time in August 2018 to more than 300 acres of land impacted by *Phragmites*, including many wetlands, and is on track to grow in 2019. This presentation will cover observations from year one, how site-specific management guidance was generated, and lessons learned in implementing an adaptive management strategy. We will have time at the end of the talk for a more in-depth discussion of PAMF and the adaptive management process.

**Middleton's Pheasant Branch and trail system: Past, present, and future**

On August 20, 2018, 11+ inches of rain fell in less than 24 hours in the Middleton and Cross Plains area. The resulting flooding was 3 to 4 times higher than anything recorded in this area (making it a 500 year event) and caused widespread damage throughout Pheasant Branch and the public trails system located within the City of Middleton. In order to better understand the impacts of this flood event, this presentation examines 1) historical wetland extent and land use changes within the watershed over time; 2) present flood damage and assessments; and 3) future efforts to create backwater wetland areas and re-connect floodplains to help dissipate energy from flood flows and enhance habitat quality and diversity throughout Pheasant Branch. The presentation will provide helpful background for anyone attending Thursday afternoon field trip to Pheasant Branch.

*Invasive Species: Species-Specific Control, Wednesday, February 20, Mendota Ballroom, 2:50-3:10 pm*

*Wetlands: Yesterday, Today, and Tomorrow: Sites Over Time, Thursday, February 21, Wisconsin Ballroom, 11:40 am-12:00 pm*



**Stern, Jessica**, University of Illinois - Urbana-Champaign  
Jeffrey Matthews, University of Illinois, Urbana-Champaign  
Brook Herman, USACE

**Strojny, Carol**, MN Board of Water & Soil Resources  
Tim Smith, MN Board of Water & Soil Resources

### **Comparing vegetation metric robustness using a standardized protocol across four regions of the United States**

Vegetation metrics, such as species richness, the Shannon-Weiner index, and metrics of floristic quality, are used to monitor the ecological condition of plant communities. In order to meaningfully compare such metrics among sites, it is imperative that metrics are robust to among-site differences in monitoring protocols, such as differences in area sampled or sampling effort. We analyzed the robustness of vegetation-based metrics to changes in sampled area and effort and determined whether the sensitivity of metrics to those changes was regionally dependent. During the summers of 2017 and 2018, we sampled three to four restored wetlands and grasslands in each of four U.S. regions (coastal New England, the Kissimmee River floodplain in Florida, the middle Rio Grande River in New Mexico, and the Chicago region) using a standardized protocol. Using transects and 1-m<sup>2</sup> or 0.25-m<sup>2</sup> quadrats, we collected species presence/absence and cover data and recorded the amount of time taken to sample each quadrat. We also conducted timed meander surveys for all sites to create comprehensive species lists. Our preliminary findings suggest that multiple metrics, including species richness and floristic quality metrics, are sensitive to changes in sample area, with mean C displaying greater robustness to changes in sample area and sampling effort than species richness. These differences in robustness are seen between regions. Our results suggest that less robust metrics are more area dependent, and we discourage using those metrics when comparing sites with different sampling methodologies. Metrics that are robust to methodological changes allow for comparisons among sites that have been sampled differently.

### **Assessing the effectiveness of vegetative restoration techniques using wetland floristic quality**

The MN Board of Water and Soil Resources oversees wetland restoration projects for conservation and regulatory programs. Guidance and requirements for restoration techniques have evolved in order to achieve better outcomes. For example, use of wetland seed mixes was not typically required for mitigation wetlands until the early 2000s. This study aims to quantify the longer term outcomes of these changes to restoration techniques in terms of floristic quality. We selected 7-15 year old wetland sites that were intensively restored (wetland seed mix installed, vegetative performance criteria required, hydrology restored), and passively restored (natural regeneration of wetland plants, hydrology restored), and we are comparing them to each other as well as to naturally occurring wetlands. We targeted depressional wetlands in the temperate prairie and mixed wood plains regions of Minnesota. Our field methods included delineating wetland communities and conducting a timed meander search to assess the floristic quality in each wetland community. We also documented adjacent and landscape disturbance factors by categorizing 1) human impairment within a 500 m and 50 m buffer (minimal-severe); 2) physical alterations within a wetland; 3) hydrologic alterations; and 4) non-native invasive species presence. After the second of three field seasons, we have sampled a total of 109 sites. Preliminary results indicate that the proportion of wetlands categorized as fair or good is higher for intensively restored and naturally occurring wetlands than for passively restored wetlands. These results will also be presented in the context of native cover, invasive cover, and native species richness among communities within those wetland types.

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*

*Wetland Flora & Plant Communities: ID & Assessment, Wednesday, February 20, Wisconsin Ballroom, 2:10-2:30 pm*

**Sutheimer, Colleen**, UW-Madison  
Jed Meunier, WDNR  
Volker Radeloff, UW-Madison

**Thompson, Alice**, Thompson & Associates Wetlands  
Services  
Aaron Menke, Thompson & Associates Wetland  
Services

### **Fire in forested peatlands of the Upper Great Lakes: Reconstructing the past to protect the future**

Forested wetlands, including peatlands, account for most of the freshwater wetlands in the United States, but recently they have declined by more than 250,000 ha. Changes in disturbance regimes are likely a key driver for this loss, yet there has been little research explicitly targeting fire as an important disturbance mechanism in these ecosystems. We are addressing this by reconstructing historic fire regimes within multiple forested bog and fen sites throughout the upper peninsula of Michigan and northeastern Wisconsin. We are reconstructing fire regimes using remnant red pine (*Pinus resinosa*) stumps from the 1800s logging cutover. We use dendrochronological techniques to determine exact calendar dates for all fire scars and subsequent mean fire return intervals. We are also working with Michigan Tech University to collect peatland soil cores to establish fire history based on char record providing a novel multi-proxy comparative analysis. In 2018, we extensively sampled a forested peatland bog in the east zone of the Hiawatha National Forest. We collected a substantial number of fire-scarred tree samples both around the periphery of the peatland (n=42) and on pine islands within it (n=43). A preliminary chronology of samples from the periphery date to 1518. Through continued research, we will reconstruct fire histories at more localized sites and ultimately create a fire history of forested peatlands across the entire upper peninsula of Michigan and into northeastern Wisconsin.

### **A cryptic invasion: Lessons learned attempting to control southern cattail (*Typha domingensis*) in a Midwest wetland system**

Southern cattail (*Typha domingensis*) has been identified since 2011 in multiple locations associated with stormwater swales in Middleton, Wisconsin. The closest recorded stand of Southern cattail is 150 miles south. As Southern cattail was found in constructed stormwater swales and outlets, we speculate that the plant hitchhiked on construction equipment. The Southern cattail stands were originally identified by the late Dr. S. Galen Smith, Professor Emeritus at UW-Whitewater. To an untrained eye the major difference between Southern cattail, and the three other types of *Typha* found in Wisconsin (hybrid cattail (*Typha X glauca*), narrow-leaved cattail (*Typha angustifolia*) and broad-leaved cattail (*Typha latifolia*)) is the orange- or cinnamon-colored flower spike and a slightly paler green leaf, which are subtle morphological differences. Advice from prominent UW–Madison botanists was that a 3-way hybrid was an ecological concern. Despite six years of chemical control with 2.5 % glyphosate, the Southern cattail stands persist, although a few stands were eradicated in the initial treatment. According to preliminary results of molecular analysis of Middleton cattail samples by Dr. Pamela Geddes, Northeastern Illinois University, hybridization of Southern cattail with other cattail species may already be occurring. We will examine these data and discuss issues regarding identification and control. We have found barriers to effective control include the lag time in detection, the seed bank, and difficulties in identification leading to a cryptic invasion as well as possible hybridization with local cattails. Learning from our experience, an immediate broader control zone of all cattails surrounding a similar cryptic invader capable of hybridizing could be warranted.

*Wetland Flora & Plant Communities: Sites & Species*,  
Wednesday, February 20, Wisconsin Ballroom,  
4:40-5:00 pm

*Invasive Species: Species-Specific Control*, Wednesday,  
February 20, Mendota Ballroom, 1:30-1:50 pm





**Toczydlowski, Rachel**, UW-Madison  
Donald Waller, UW-Madison

### **Drift happens: The genetic structure of jewelweed reflects fragmentation of lowland forests and marshes**

Lowland forests and marshes are estimated to provide more than a quarter of terrestrial ecosystem services but have declined greatly in area, become fragmented, and appear vulnerable to climate change in southern Wisconsin. Small, isolated populations often experience inbreeding and genetic drift, limiting their ability to adapt to environmental changes. We tested whether river networks and remaining suitable habitat promote gene flow among 12 populations of jewelweed (*Impatiens capensis*) embedded in an agricultural/urban matrix. Populations occurred along 4 river systems split between 2 major watersheds in S. Wisconsin. We generated a panel of 12,856 single nucleotide polymorphisms and assessed genetic diversity, differentiation, gene flow, and inbreeding. We did not find suitable habitat to genetically connect populations, but limited gene flow may occur along rivers. Overall, populations were strongly genetically differentiated from one another ( $F_{ST} = 0.32$ ). Population differentiation increased in populations with fewer private alleles ( $R^2 = 0.51$ ) and higher local inbreeding ( $R^2 = 0.22$ ). Local inbreeding levels varied greatly among populations ( $F_{IS} = 0.2$  to  $0.9$ ) and increase in smaller, more isolated populations. Genetic isolation and drift thus appear to play a strong role in structuring these jewelweed populations. Perennial, self-incompatible, and/or rare lowland plants are likely experiencing similar or more extreme genetic losses than we detected in jewelweed, a common selfing annual. Preserving large, connected lowland habitat patches may maintain genetic diversity, allowing species to better adapt to rapid environmental changes.

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm

**Turner, Jessica**, UW-Madison  
Ankur Desai, UW-Madison  
Jonathan Thom, UW-Madison  
Kim Wickland, USGS  
Brent Olson, USGS

### **Contrasting responses in ecosystem carbon cycling for two Northern Wisconsin fens**

The United States once had approximately 221 million acres of wetlands, but more than half of the original wetlands have been drained or destroyed. Understanding the benefits of wetlands and their ability to mitigate climate change has spurred restoration and protection action; however, scientific understanding of land-atmosphere interactions is limited by our limited continuous observations of environmental fluxes. Coterminous USGS and Ameriflux eddy covariance flux tower observations in Allequash Creek and Lost Creek shrub fen in the northern highlands of Wisconsin provide a unique opportunity to study wetlands in a changing climate. Net ecosystem exchange of  $CO_2$  (NEE) was compared from 2015-2017 between the two sites. While both sites produce daily average fluxes between  $-6$  and  $5 \mu mol/m^2/s$  throughout the growing season, fluxes at Allequash tend to be smaller and less sensitive to temperature. Lost Creek tends to have more sensitivity to temperature during both daytime and nighttime. Similar diel cycles can be observed in the atmospheric fluxes at each site as well. While previous studies have shown high resilience of wetland NEE to water table variation, our work suggests wetland setting and species have a stronger than expected effect on NEE. Ongoing work will address the GPP and Reco responses during periods after intense rain at each site and will incorporate stream  $pCO_2$  data from USGS.

Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm

### **A story is worth a thousand facts: Communicating wetlands issues to future conservationists**

This presentation will review existing communication research that reveals why simply “educating the public” is not enough. To increase public support for wetland conservation, ecologists and land managers must be intimately familiar with their audience(s). They are responsible for tying their work to the values of the audience: not just what they do or why it works ecologically, but why people should care. Sharing stories about successful conservation projects is one way to achieve this, as shown by theories of communication, neuroscience, and natural history interpretation. This presentation will recommend new approaches to conservation communication and outreach, especially when dealing with youth and Millennials.

### ***Cypripedium candidum* in the southeast glacial plains of Wisconsin: Distribution, ecology, and threats**

The purpose of this study was to explore how select biotic and abiotic factors influence white lady’s-slipper orchid (*Cypripedium candidum*) populations in the southeast glacial plains of Wisconsin. *C. candidum* was once a prevalent species in Wisconsin calcareous fens and wet prairies. However, populations have experienced rapid decline and the orchid is now a state threatened species. With a coefficient of conservatism of ten, the orchid has requirements that are closely linked to system functioning. This orchid is believed threatened due to habitat loss caused by land use change, alteration of hydrologic regimes, and encroachment of woody and invasive species. The current distribution of *C. candidum* is anecdotal: the last known comprehensive surveys in Wisconsin occurred over thirty years ago and its population response to community and ecosystem level changes is unknown. We surveyed thirty sites where *C. candidum* had been previously documented in order to determine changes in population distribution. Orchids were found at only half of these sites. The spatial distribution of *C. candidum* was analyzed for three of the survey sites where orchids were found. Orchid presence and absence within each site was studied for potential relationships with hydrology, water chemistry, light availability, and associated species. Results of this study indicate that orchid presence is positively correlated with minerotrophic hydrologic regimes. Shrub encroachment may have both direct and indirect effects on orchid populations. Including changes to *C. candidum* life history characteristics and surrounding groundwater functioning. In order to conserve *C. candidum* populations, land managers must manage against shrub encroachment and protect historic groundwater levels.

*Wetlands and People, Wednesday, February 20, Mendota Ballroom, 3:40-4:00 pm*

*Wetland Flora & Plant Communities: Sites & Species, Wednesday, February 20, Wisconsin Ballroom, 4:20-4:40 pm*



**Wilcox, Kayla**, UW-Stevens Point

Kiersten Czarnecki, UW-Stevens Point

Emma Schmidt, UW-Stevens Point

Teresa Wolf, UW-Stevens Point

Hannah Lukasik, UW-Stevens Point

**A baseline assessment to develop an appropriate restoration regime for the management and restoration of wetlands**

Wisconsin has lost nearly half of its original wetland environments, primarily due to development and agriculture. The recognition of the consequences of that loss has led to an interest in recent years to mitigate and restore wetlands. A wetland located west of Stevens Point was converted to an agricultural field nearly a century ago and has recently been restored to wetland. The Students for Wetland Awareness, Management and Protection (SWAMP) organization from UW-Stevens Point conducted a baseline assessment of this wetland to evaluate the quality of the site and provide recommended actions that could improve the area and conduct assessments annually to record changes. The parameters of the assessments include a soil survey, hydrologic analysis, vegetation assessment, macroinvertebrate collection, and water chemistry analysis. Groundwater monitoring wells are also being added to assess the flow of groundwater relative to surface water flow. From our base research, we have documented the presence of invasive species on the wetland. These invasive plants of high concern include reed canarygrass (*Phalaris arundinacea*) and cattails (*Typha latifolia*). The group determined that the best option to control these species is to implement a fire regime and insert water control structures. However, due to weather conditions and schedule conflicts, we are seeking other alternatives. Other alternative regimes may include herbicides or physical removal of species. We hope that a one of these new regimes may allow for the regrowth of rushes (*Juncus*), sedges (*Carex*), and sphagnum mosses (*Sphagnum*) that are in the seed bank on the property. Burning was determined to be the best alternative because it is the most natural form of eradication and causes less disturbance to soils and native plants. We hope to burn the property sometime in 2020.

*Poster Session, Wednesday, February 20, Superior Ballroom, 5:00-6:30 pm*

## PRESENTER BIOGRAPHIES

**Chad Abel** (chad.abel@redcliff-nsn.gov) has been the administrator of Red Cliff's Treaty Natural Resources Division for the last 8 years. He graduated with a bachelor's in conservation biology from UW-Madison in 2003 and worked principally in the Pacific Northwest for state, federal, non-profit, and tribal entities before returning to Wisconsin.

**Matt Angerhofer** (Matt.Angerhofer@stantec.com) has 17 years of experience in wetland mitigation and restoration planning, implementation, and reporting. His thousands of hours spent in the field working to control aquatic invasive species has led him to develop innovative equipment, tools, and techniques to restore degraded wetland plant communities.

**Jade Arneson** (arnejr01@uwgb.edu) is a graduate student in environmental science and policy at UW-Green Bay. Her master's research focuses on restoring wild rice to coastal wetlands within the Bay of Green Bay, understanding the various factors influencing wild rice success, and informing future wild rice restoration efforts.

**Jeremy Bates** (jeremy.bates@wisconsin.gov) has performed invasive species education, outreach, and management since 2009. He has worked for Lake Superior Research Institute, WI Sea Grant, Sawyer and Bayfield Counties, and WDNR. For the past 4 years, he has been the Lake Superior Basin AIS Detection and Response Specialist for WDNR. Jeremy has a bachelor's in biology from UW-Superior.

**Katie Beilfuss** (katie.beilfuss@wisconsinwetlands.org) is Outreach Programs Director at Wisconsin Wetlands Association. She has a master's degree in land resources from UW-Madison's Nelson Institute for Environmental Studies and has more than twenty years of nonprofit and environmental experience.

**Richard Beilfuss** (rich@savingcranes.org) serves as President & CEO of the International Crane Foundation, providing oversight for ICF programs across Asia, Africa, and North America. Beilfuss is a professional hydrologist with 30 years' experience in wetland conservation and management, specializing in environmental flows for wildlife. He is an avid unicycle rider, darts-thrower, and birder—but not all at the same time.

**Lexi Belleville** (rbelleville@luc.edu) is currently finishing her undergraduate degree in environmental science with a minor in dance at Loyola University Chicago.

**Erin Bergen** (berge851@myemail.northland.edu), a senior at Northland College and a research technician for the Mary Griggs Burke Center for Freshwater Innovation, has a passion for the interconnection of ecological systems and the cooperation of environmental disciplines. She pursues landscape-scale ecological questions such as non-native fish utilization of coastal wetlands across the Great Lakes region.

**Olivia Clark** (clark.olivia@uwla.edu) started Liv4prairie, a restoration company, in 2010, and is currently studying biology at UW-La Crosse. She was an intern for Madison Audubon in 2017. In 2018, she performed a study on reed canarygrass and native flora. Currently, she is cataloging plant species at her family's tamarack bog near the Dells. Olivia will graduate from UW-La Crosse in 2020 and plans to attend law school for environment law.

**Cindy Crosby** (phrelanzer@gmail.com) is an Interpretive Trainer for the National Association for Interpretation and certifies natural resources leaders in communicating clearly about the natural world. She has a passion for sharing the natural world through words, images, and experiences. She is also the author of several books including "Tallgrass Conversations: In Search of the Prairie Spirit."

**Rick Eilertson** (rick.eilertson@aec.com) grew up on a sand county farm in Wisconsin, practicing first-hand Aldo Leopold's land ethic of striving to live on a piece of land without spoiling it. He has worked in the municipal engineering field the past 28 years with a keen interest in stormwater improvements and education. He'll be presenting on his work to understand and protect Dunn's Marsh.

**Laura England** (englandl@appstate.edu) teaches in the Department of Sustainable Development at Appalachian State University. She has an academic background in freshwater ecology and watershed science and worked as Outreach Programs Director for Wisconsin Wetlands Association for five years. She was a founding board member for the Carolina Wetlands Association and led the group in developing and launching its flagship outreach program.

**Stephen Gaffield** (steve@ma-rs.org) has been a hydrologist at Montgomery Associates in Cottage Grove since 2004. He has 25 years of experience in hydrogeology and water resources engineering with interests in watershed management, groundwater-surface water interactions, urban planning, and lake and wetland restoration.



## PRESENTER BIOGRAPHIES

**Melissa Gibson** (melissa.gibson@wi.gov) received her master's degree in botany from UW-Madison, where she completed a phylogenetic study of a Wisconsin endemic, Fassett's locoweed. She worked in environmental consulting as a wetland delineator in Illinois and for the past 4 years has been spending her summers identifying plants in Wisconsin wetlands both natural and restored.

**Brian Glenzinski** (bglenzinski@ducks.org), a Ducks Unlimited Regional Biologist, has worked extensively on ecological restoration throughout Wisconsin. His previous work has focused primarily on wetland, grassland, and savanna restoration in Southern Wisconsin. Now Brian serves as DU's Regional Biologist, delivering conservation in Wisconsin while contributing to Great Lakes and Big Rivers Initiatives.

**Jason Granberg** (jason.granberg@Wisconsin.Gov) administers the various invasive species management projects and is an ecological modeler at WDNR.

**Mike Grimm** (mgrimm@tnc.org) works for The Nature Conservancy (TNC) as a conservation ecologist in the Northeast Wisconsin Office, Sturgeon Bay. His responsibilities include providing science and conservation planning, implementation, and monitoring support for TNC and partner conservation projects in northeast Wisconsin. Mike is a native of northeast Wisconsin and earned bachelor's and master's degrees from UW-Madison.

**Cory Gritzmacher** (coryg@mequonnaturepreserve.org) is the Director of Restoration and Operations at Mequon Nature Preserve. He oversees all the land restoration projects on 444 acres at the Preserve and is the canine handler for Mequon Nature Preserve's on-staff conservation dog Tilia.

**Anna Hall** (hallx778@d.umn.edu) is a junior attending the University of Minnesota Duluth studying biology, ecology, evolution, behavior, chemistry, and natural history. She spent one summer volunteering with the USEPA Mid-Continent Ecology Division. Currently she works at the Lake Superior National Estuarine Research Reserve. Her research interests include impacts of climate change and invasive species.

**Stephanie Herbst** (sherbst3@wisc.edu) recently graduated with her master's degree from the Nelson Institute for Environmental Studies' Water Resources Management program and focused on science communication and decision making. She has a bachelor's in environmental science, policy, and management from the University of Minnesota-Twin Cities.

**Tod Highsmith** (todhighsmith@me.com) is a retired writer/editor, environmental educator, and ornithological researcher. He collaborates with Mike Mossman, retired WDNR ecologist, and Alice Thompson, wetland consultant, to offer the "Wetland connections between science and poetry" session.

**Kurtis Himmler** (kurtis8himmler@gmail.com) is a master's student at Loyola University Chicago in Dr. Nancy Tuchman's wetland ecology lab. He graduated from Rutgers University in 2016 with a bachelor's in ecology. Kurtis is an avid birder and naturalist with interests in avian ecology, animal adaptation to anthropogenic stressors, citizen science, and ecotourism.

**Steve Hjort** (shjort@eco-resource.net) is a senior biologist at Eco-Resource Consulting, Inc. located in Stoughton. He has more than 26 years of professional experience in ecological and environmental sciences. His areas of specialty include ecological monitoring and wetland enhancement, restoration, and mitigation.

**Laura Holder** (laura@midwestconservationdogs.com) is the Executive Director and lead trainer/canine handler for Midwest Conservation Dogs, Inc., a Milwaukee-based non-profit specializing in the training and deployment of professional scent detection canines.

**Erin Houghton** (ehoughton@newwater.us) received her undergraduate degree in biology with concentration in environmental science from UW-La Crosse, followed by a master's degree from the University of Maine-Orono. Erin managed a lab at the UW-Milwaukee School of Freshwater Sciences for Dr. Harvey Bootsma before moving to Green Bay to become a Watershed Specialist at NEW Water.

**Mahsa Izadmehr** (mizadm2@uic.edu) received her master's degree in environmental engineering at Illinois Institute of Technology and worked as an entry level Environmental Engineer- EIT at Burns and McDonnell. She has since returned to school to pursue her PhD degree in civil and environmental engineering at University of Illinois at Chicago.

**Sally Jarosz** (sarah.jarosz@wisconsin.gov) is the WDNR in-lieu fee wetland mitigation program ecologist. She works with land trusts, private landowners, municipalities, government agencies, and other interested parties to identify potential wetland mitigation project sites, discuss restoration techniques, and assists project proponents through the mitigation planning, monitoring, and management processes.

## PRESENTER BIOGRAPHIES

**Rachel Johnson** (rejohnson9@wisc.edu) is a master's student at UW-Madison's Nelson Institute and a member of the 2017-18 Water Resources Management Cohort (WRM). The cohort conducted a two year, interdisciplinary, applied project on wetland watershed management. Rachel holds a bachelor's in Geology from Carleton College and is currently enrolled in a double master's program with Biological Systems Engineering.

**Amy Kretlow** (amy.kretlow@Wisconsin.gov) works with WDNR as an aquatic invasive species monitoring and response specialist. She has been looking for aquatic and wetland invasive species for the past four years in the southern portion of the Lake Michigan Basin. Amy has a bachelor's in conservation and environmental sciences from UW-Milwaukee.

**Zachary Kron** (zachary.kron@wisconsin.gov) is a wetland invasive plant manager with WDNR. He works on a variety of wetland invasive species control projects throughout Wisconsin.

**Jennie Lent** (jennie.lent@tnc.org) is the floodplain outreach coordinator for The Nature Conservancy's Floodplain Explorer prioritization tool. She has a master's in environmental conservation from UW-Madison and bachelor's degrees in journalism and communication studies from the University of Iowa.

**Eva Lewandowski** (eva.lewandowski@wisconsin.gov) is the Citizen-based Monitoring Coordinator at WDNR, where she coordinates a statewide citizen science network and co-coordinates the Wisconsin Bumble Bee Brigade. She is active in the national and international citizen science communities and earned a PhD in Conservation Biology from the University of Minnesota.

**Zach Loftus** (zachary.loftus@cardno.com) is in charge of restoration field operations at Cardno and also manages complex ecological restoration projects throughout Wisconsin and Minnesota. He specializes in projects involving native vegetation establishment and enhancement through integrated vegetation management techniques. He is also a lead on the project estimating and business development team.

**Zack Loken** (zachary.j.loken@uwsp.edu) is studying wildlife ecology and management with biology and GIS/spatial analysis minors from UW-Stevens Point. He has a strong interest in the practice of ecosystem restoration on privately owned lands to improve wildlife habitats. He is also a waterbird enthusiast and advocate of species management.

**Nicholas Manning** (nmann239@uwsp.edu) began working with Dr. Sarah Orlofske in spring of 2017 investigating the effects of road salt on freshwater snails and graduated from UW-Stevens Point in December 2018. He received a student research grant from UW-Stevens Point to continue research during the 2018/2019 school year.

**Aaron Marti** (aaron.marti@wisconsin.gov) is a wetland assessment research scientist with the WDNR Wetland Monitoring and Assessment Program. His research interests focus on bridging wetland and aquatic ecosystem ecology (specifically biogeochemistry) and soil science with wetland management and assessment. Aaron received his bachelor's in water resources from UW-Stevens Point and his master's in biology from Ball State University.

**Mark Martin** (gsteinhauer@madisonaudubon.org) attended UW-Stevens Point and is a past employee of WDNR. He has been a Resident Land Manager at Goose Pond Sanctuary since 1979 and has been instrumental in building the sanctuary to its current size and quality.

**Jack McGowan-Stinski** (mcgowan-stinski.1@osu.edu) is the program manager for the Lake States Fire Science Consortium, funded by the Joint Fire Science Program and administered through The Ohio State University. Jack received a bachelor's in wildlife biology from UW-Stevens Point and a master's from Central Michigan University. Jack has been a fire manager and land steward for The Nature Conservancy in Michigan.

**Nick Miller** (nmiller@tnc.org) is science director for The Nature Conservancy in Wisconsin, integrating science into conservation policy, strategies, and tools. His recent wetland-related work includes developing ecosystem service assessments to determine watershed needs and prioritize conservation opportunities, as well as developing online decision support tools.

**Neil Molstad** (nmolstad@hotmail.com) is a wetland identification specialist for WDNR, a position he has held since 2014. He worked in the private sector as an environmental consultant, for the USDA-NRCS as a soil scientist, and as a middle and high school science teacher prior to joining WDNR.

**Vince Mosca** (vmosca@heyassoc.com) has been involved with thousands of wetland and ecological assessment projects over the past 29 years in northeastern Illinois and Wisconsin. He also regularly leads regulatory permitting and restoration efforts for both public and private sector projects. Many of his recent projects relate to green infrastructure planning and design for stormwater quality and quantity management.





## PRESENTER BIOGRAPHIES

**Al Nichols** (nicholsaj@beloit.edu) is currently a senior at Beloit College. He spent the summer of 2018 as an REU intern at Michigan State's Kellogg Biological Station and the summer of 2016 as a DNA intern at the Field Museum of Natural History. After college, he intends to continue working with conservation of reptiles.

**Olivia Niosi** (oniosi@luc.edu) is a fourth year student at Loyola University Chicago studying environmental science with a focus in conservation biology and ecology. She works as a research assistant to the "team *Typha* lab" and hopes to continue a career in ecological field research. Olivia is interested in the biogeochemical and trophic interactions between aquatic and terrestrial ecosystems.

**Maggie O'Brien** (mobrien11@luc.edu) is a sophomore undergraduate student at Loyola University Chicago studying conservation and restoration ecology. She works as a research assistant for the "team *Typha* lab" in Michigan. Her research interests include the plant ecology and microbiology of invaded Great Lakes wetlands.

**Ryan O'Connor** (ryan.oconnor@wi.gov) is an ecologist and coordinates and conducts biotic inventories of natural communities for WDNR's Natural Heritage Inventory. His professional interests include providing land managers with high-quality data to make better decisions, developing adaptation resources, and hunting for rare and new invasive plants.

**Tom Pearce** (thomas.pearce@wisconsin.gov) is the in-lieu fee wetland mitigation project manager at WDNR. Tom works on credit sales, financial accounting, project development, database and web development, and other project needs.

**Bill Poole** (bill.poole@stantec.com) has more than 33 years of experience in the environmental field, including threatened and endangered species surveys and impact evaluations, resource agency consultation, and development of rare species habitat restoration and conservation plans. For more than 10 years, he has been involved with wetland mitigation bank planning, permitting, and implementation on behalf of Wisconsin Department of Transportation.

**Tom Prestby** (tprestby@geiconsultants.com) has been an avid enthusiast of the outdoors since he was a child. He received his bachelor's degree in forest and wildlife ecology at UW-Madison and his master's degree in environmental science and policy at UW-Green Bay researching shorebird and terns of lower Green Bay for his thesis project. Tom is now an environmental scientist at GEI Consultants, Inc.

**Shelly Ray** (rays445@myemail.northland.edu) is an undergraduate student majoring in water resources science and minoring in geographic information systems at Northland College. She is a research assistant for the Mary Griggs Burke Center for Freshwater Innovation and her research interests include stream monitoring and restoration, GIS analysis, and water resources engineering.

**Paul Skawinski** (pskawins@uwsp.edu) is the Statewide Citizen Lake Monitoring Network Educator for the UW-Extension Lakes Program and teaches Aquatic Botany at UW-Stevens Point. Paul is also the author and photographer of the widely used field guide "Aquatic Plants of the Upper Midwest" and has taught dozens of aquatic plant workshops.

**Christopher Smith** (christopherj.smith@wisconsin.gov) received his master's in geoenvironmental studies in 1999 and started work for WDNR soon after. He has since mapped watersheds, trout streams, potentially restorable wetlands, and wetlands and is currently involved in piloting the new wetland mapping program.

**Samantha Stanton** (sstanton@glc.org) is a program specialist at the Great Lakes Commission, where she coordinates the Phragmites Adaptive Management Framework. Samantha works binationally to engage land managers, agencies, and private citizens to support their efforts managing invasive *Phragmites*. She has master's and bachelor's degrees in fisheries and wildlife from Michigan State University.

**Aaron Steber** (aaron.steber@cardno.com) is a stream restoration specialist managing streambank and shoreline stabilization and habitat enhancement projects, including project planning, grant administration, permitting, design, and construction oversight. Since 1999, he has worked in streams throughout the Midwest and Northwestern United States, as well as Finland and Costa Rica.

**Jessica Stern** (jlstern2@illinois.edu) is a graduate research assistant at the University of Illinois at Urbana-Champaign. Her master's research is in wetland ecology with a focus in floristic quality analysis and vegetation metric performance. She has worked in restoration ecology and habitat monitoring with the National Park Service in Boston, the Bureau of Land Management in Oregon, and at the Joseph Jones Ecological Research Center in Georgia.



## PRESENTER BIOGRAPHIES

**Carol Strojny** (carol.strojny@state.mn.us) has worked for the MN Board of Water & Soil Resources for the past 12 years, monitoring wetlands restored through conservation programs and for regulatory purposes. Recently her work includes vegetative restoration planning of wetland mitigation sites. She received her bachelor's of science degree from UW-Stevens Point and a master's degree in wildlife ecology from the University of Maine.

**Colleen Sutheimer** (sutheimer@wisc.edu) graduated with a bachelor's in biology from UW-Madison in 2012. She has worked on both ecological research projects and in species and land management at the University of Minnesota, the USGS, the USFWS, WDNR, and the University of Montana. Colleen is currently pursuing a masters degree, studying the role of historic fire regimes in forested wetlands in the upper Great Lakes region.

**Alice Thompson** (thompsonandassoc@sbeglobal.net) has been principal scientist and owner of Thompson and Associates Wetland Services, LLC since 1998. She has a master's degree from the UW-Milwaukee, where she researched reed canarygrass. Thompson's expertise includes wetland delineation, natural areas and wetland restoration, wetland mitigation, monitoring, and invasive species control.

**Rachel Toczydlowski** (toczydlowski@wisc.edu) is currently a PhD student in the Department of Botany at UW-Madison. Her research interests center on how plant populations respond to changing environmental conditions. She is currently using classic field methods and next generation sequencing to study inbreeding, local adaptation, and population genetic differentiation of jewelweed in Wisconsin floodplain forests and marshes.

**Pat Trochlell** (ptrochlell@gmail.com) is a wetland ecologist who worked for WDNR for more than 37 years. She is also a licensed Professional Soil Scientist and Hydrologist. She continues to teach wetland plant identification as well as a Master Naturalist course, and she monitors both wetland and upland plant communities.

**Jessica Turner** (jturner9@buffalo.edu) is a first year master's student in land resources at UW-Madison in the Department of Atmospheric and Oceanic Sciences. Through her research, she hopes to address environmental issues with scientific as well as sociopolitical and cultural facets. Her interests include the history of wetlands and ecosystem responses to a changing climate.

**Grace Vosen** (gvosen@wisc.edu) is a graduate of Northland College, where she studied natural resources and biology. She has worked as a seed collector and volunteer leader for several conservation groups in southern Wisconsin. Vosen is pursuing a master's degree in Life Sciences Communication and hopes to work in nonprofit outreach. She lives in Sauk City.

**Andrea Weissgerber** (weissgerber@wisc.edu) is currently a graduate student pursuing a master's in restoration ecology. She also works as a teaching assistant in the Department of Integrative Biology. Andrea is interested in the restoration and management of Wisconsin native communities, namely wetlands and prairies. She anticipates graduating in spring 2019 and is actively seeking employment.

**Kayla Wilcox** (kwilc324@uwsp.edu) is one of many leaders of the SWAMP organization at UW-Stevens Point, a group focused on promoting awareness of wetland science and conservation that strives to provide education to students and community members about the importance of wetlands.

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## Key to Common Agency Abbreviations Used in Abstracts and Bios

USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
UWEX	University of Wisconsin - Extension
UW	University of Wisconsin
WDNR	Wisconsin Department of Natural Resources