Wetland Science Conference

2018 Wisconsin Wetlands ASSOCIATION

Abstracts & Presenter Biographies

Wetland Resilience

23rd Annual Wetland Science Conference

February 20-22, 2018

Lake Geneva, WI

WEDNESDAY, February 21, 9:00 am - 9:30 pm

9:00 - 10:10	**Plenary Session (Grand Ballroom)**	*Sponsored by We Energies*		
9:00	**Welcome & Opening comments**			
9:20	**Conference Keynote:** Resiliency for Wetlands and Communities: Notes from the Field Gillian Davies, Senior Ecological Scientist, BSC Group, Inc. and Past President, Society of Wetland Scientists			
10:10 - 10:40	**Break (Grand Ballroom and Foyer)**	*Sponsored by Midwest Groundcovers*		
10:40 - 12:00	**Concurrent Sessions**			
	Location: Loramoor C **SYMPOSIUM: Preparing Wisconsin's wetlands for a changing world | Moderator: Amy Staffen**	**Location: Loramoor B** **Wetland Wildlife | Moderator: Bill Mueller**	**Location: Loramoor A** **Long-term Restoration & Management** **Moderator: Jacob Straub**	
10:40	Climate change and adaptation in Wisconsin | **Vimont**	Recovering impaired fish and wildlife in the Milwaukee Estuary Area of Concern | **Casper**	Influence of hydrologic restoration techniques on plant communities in the Glacial Habitat Restoration Area | **Schultz**	
11:00	Changing climate, changing hydrology | **Montgomery**	Status of Blanchard's cricket frog in Wisconsin | **Badje**	Restoration of boreal forest wetlands in Superior, Wisconsin: 10-years post construction monitoring | **Staskowski**	
11:20	Scratching below the surface: The uncertain future of groundwater recharge in a changing climate | **Murdock**	Colonization of a restored island chain by piping plover and other rare species in Lower Green Bay, Wisconsin | **Prestby**	Contaminated urban wetlands and streams: Five years of channel/wetland restoration at the Cobalt Project | **Lennie**	
11:40	Lessons from the field: Changes in water resources | **Thompson**	Pollinator opportunities within rights of way: Using geospatial and decision modeling to target conservation | **Salas**	25 years of change: Nitrogen and phosphorus removal in a freshwater coastal wetland in the past and present | **Richardson***	
12:00 - 1:30	**Lunch (provided - Grand Ballroom)**	*Sponsored by GEI Consultants, Inc.*		
1:00 - 1:50	**Legislative/Policy Updates (Grand Ballroom)**			
1:30 - 2:50	**Concurrent Sessions**			
	Location: Loramoor C **SYMPOSIUM: Preparing Wisconsin's wetlands for a changing world | Moderator: Jason Fleener**	**Location: Loramoor B** **Watershed Approaches | Moderator: Kyle Magyera**	**Location: Loramoor A** **Wetlands & People | Moderator: Travis Olson**	
1:30	Moving from general to site-level vulnerability of Wisconsin's wetland plant communities | **O'Connor**	Understanding wetlands as solutions to flood risks | **Magyera**	Impacts of stormwater runoff and road salt intrusion on the soil quality of an urban wetland in Chicago | **Hernandez***	
1:50	A vulnerability assessment of wetland plants: Combining scientific and traditional ecological knowledge | **Panci**	Lake County's Wetland Restoration and Preservation Plan, part 1: Approach | **Crane**	Community and conservation: Studying urban biodiversity in Milwaukee County, Wisconsin | **Robson**	
2:10	If this is another 100-year storm, I must be 400 years old: The likely impacts of climate change on wild rice | **David**	Lake County's Wetland Restoration and Preservation Plan, part 2: GIS & decision-support tool | **Prusila**	Wisconsin's Healthy Lakes Initiative: Working with lakefront property owners to apply BMP's | **Goggin**	
2:30	Through drought and high water: Vegetation dynamics in Lake Superior coastal and inland wetlands | **Johnson**	Wetlands by Design: Finding conservation opportunities for ecosystem services and watershed resilience | **Miller**	Using poetry to express our human connection to wetlands | **Thompson**	
2:50 - 3:20	**Break (Grand Ballroom and Foyer)**	*Sponsored by Merjent*		
3:20 - 5:00	**Concurrent Sessions**			
	Location: Loramoor C **SYMPOSIUM: Preparing Wisconsin's wetlands for a changing world | Moderator: Sarah Johnson**	**Location: Loramoor B** **Wetland Flora & Plant Communities** **Moderator: Ron Londré**	**SPECIAL SESSIONS** **Location: Loramoor A**	**Location: Galewood C**
3:20	The short and long of wetland carbon emissions, uptake, and lateral transfer | **Desai**	Floristic quality assessment benchmarks for wetlands of Wisconsin's north central hardwood forests ecoregion | **Marti**	**Career Development & Continuing Education in Wetland Science** **Moderated by Susan Schumacher**	
3:40	Lessons from the field: Wetland restoration as a tool to maintain watershed health and ecosystem services under a changing climate | **Miller**	Samuel Myers Park: Incorporating coastal resilience into an urban wetland restoration | **Koski**		
4:00	Wisconsin's changing climate and wetland invasive species | **Granberg**	Restoring native upland buffers: An integral component of wetland resiliency | **Kraszewski**	**Tribal Wetland Programs Working Group** **Moderated by Randy Poelma** (by invitation only) *Sponsored by Forest County Potawatomi Foundation*	**Wisconsin Wetland Inventory Redesign Listening Session** **Moderated by Chris Noll, Amanda Minks, and Calvin Lawrence**
4:20	Potential for an invasive hybrid involving southern cattail: A case study from Wisconsin | **Geddes**	Investigating seasonal variation in prescribed burn impacts to lowland brush ecosystems | **Knosalla ***		
4:40	Understanding the vulnerability of wetland-dependent wildlife to climate change | **Zuckerberg**	Comparing the plant communities in wetland mitigation banks to those in natural wetlands | **Tillman ***		
5:00 - 6:30	**Poster Session & Cash Bar (Grand Ballroom and Foyer)**	*Sponsored by Stockbridge-Munsee Community*		
6:30 - 9:30	**Banquet & Presentation (Ticketed event—Grand Ballroom and Foyer)**	*Sponsored by Wisconsin Coastal Management Program*		
7:30	Banquet Presentation: It's Kind of Fun to do the Impossible! | **Ken Leinbach**, Urban Ecology Center in Milwaukee			

THURSDAY, February 22, 8:30 am - 4:30 pm

8:30-9:20 **Plenary Session (Grand Ballroom)** *Sponsored by Cardno*
8:30 **Welcome**

8:40 **Plenary Address:** Climate Change and Waters of Wisconsin: An Update
John Magnuson, Emeritus Professor and Emeritus Director, Center for Limnology, UW – Madison

9:30-10:30 **Concurrent Sessions**

	Location: Loramoor C SYMPOSIUM: Preparing Wisconsin's wetlands for a changing world | Moderator: Ryan O'Connor	Location: Loramoor B Invasive Species I Moderator: Aaron Feggestad	Location: Loramoor A Hydrology & Geomorphology Moderator: Dreux Watermolen
9:30	Climate change risk management: Introduction to adaptation in planning and decision-making | **Shannon**	Large-scale evaluation of reed canarygrass suppression treatments across four floodplain sites in SE Minnesota| **Kiser***	2018 status of lidar elevation products in Wisconsin | **Giglierano**
9:50	Overview of adaption tools and approaches for wetland managers | **Ontl**	Tree sapling responses to reed canarygrass treatments across four floodplain sites in SE Minnesota | **DeLaundreau ***	Modeling the frequency and extent of overbank flow of a wetland stream | **Potter**
10:10	Lessons from the field: Pre-adapting restorations to ongoing climate change: Assessing tools, lessons learned, and future challenges | **Sullivan**	An adaptive management approach to treatment of *Phragmites* in northeast Wisconsin wetlands | **Webster**	Spring systems in Wisconsin | **Graham**

10:30 -11:00 **Break (Grand Ballroom and Foyer)** *Sponsored by Applied Ecological Services*
11:00 -12:00 **Concurrent Sessions**

	Location: Loramoor C SYMPOSIUM: Preparing Wisconsin's wetlands for a changing world | Moderator: Amy Staffen	Location: Loramoor B Invasive Species II Moderator: Kelly Kearns	Location: Loramoor A Identifying and Implementing In-Lieu Fee Mitigation Projects Moderator: Nick Miller
11:00	Is your adaptation approach working? The importance of monitoring | **Ontl**	Phragmites Adaptive Management Framework: Citizen science and decision support tool for the Great Lakes basin | **Ferrier**	In-lieu fee mitigation in Wisconsin: Lessons learned and adaptations | **Gallagher-Jarosz**
11:20	Preparing Wisconsin's wetlands for a changing world: Pioneers in adaption share their stories | **Staffen**	Is native cattail on the decline? A case study in Volo Bog State Natural Area, IL | **Murphy ***	Using the Wetlands Explorer to find and evaluate wetland conservation sites for compensatory mitigation | **Bernthal**
11:40		Monitoring the effectiveness of invasives control at Pheasant Branch Conservancy using timed meander surveys | **Trochlell**	Partnering to successfully secure an in-lieu fee project | **White**

12:00 - 1:30 **Lunch (provided — Grand Ballroom)** *Sponsored by J. F. Brennan Company, Inc.*

1:30 - 4:30 **Working Groups, Workshops, and Field Trips**

WORKING GROUP & WORKSHOP

Practitioners Working Group
Location: Loramoor C
Moderator: Dan Salas

This session offers an opportunity for wetland practitioners—including consultants, federal, state, and local regulators, land managers, and others—to discuss current issues relevant to their daily work. The agenda will be set with the input of those who participated in similar sessions at previous WWA conferences. The last hour is reserved for a closed-door session for consultants and WWA policy staff to discuss strategies to bring more consultant input into the wetland policy development process.

Aquatic Plant Identification Workshop
Location: Loramoor A
Instructor: Paul Skawinski

Wisconsin is blessed with about 150 species of plants that live completely submerged or floating in our lakes, streams, and wetlands. Even a small sedge meadow pool may have a dozen aquatic species in it, ranging from carnivorous bladderworts to pondweeds to macro-algae like *Chara*. Paul will introduce the diversity of aquatic plants in Wisconsin and highlight the major groups that occur here. Specimens will be available during the workshop for participants to study. Participation by advanced registration only. No walk-ins.

FIELD TRIPS

Sign up for field trips at the registration desk.

Hackmatack National Wildlife Refuge

This field trip will depart by bus from the Grand Geneva Conference Center Entrance.

Field Trip Leaders: Vince Mosca, Steve Byers, Ed Collins

Thank you to Hey & Associates, Inc. for their generous sponsorship of this trip.

Mukwonago River Wetland Restoration: An In-Lieu Fee Mitigation

This trip will meet in Loramoor B. This is a self-drive field trip; directions provided.

Field Trip Leaders: Cheryl White, Meghan Wersel, Peter Ziegler, Sally Gallagher-Jarosz

Thank you to Midwest Natural Resources for their generous sponsorship of this trip.

Wetlands in Winter: Scuppernong River Habitat Area

This field trip will depart from the Grand Geneva Main Entrance and will be self-driven.

Field Trip Leaders: Pat Trochlell and Don Reed

Thank you to TRC Environmental Corporation for their generous sponsorship of this trip.

Wetland Science Conference
2018 Wisconsin Wetlands Association

WE WANT YOUR FEEDBACK! *Please complete the conference evaluation coming to your email inbox. Thank you!*

* Asterisks indicate the presenter is a participant in the student presentation competition.

Badje, Andrew, WDNR
Rori Paloski, WDNR
Tara Bergeson, WDNR

Status of Blanchard's cricket frog in Wisconsin

Once thought of as the most abundant small frog in southern Wisconsin, the Blanchard's cricket frog (*Acris blanchardi*) underwent an enigmatic and precipitous decline from the 1960s through the 1980s in Wisconsin and other nearby states. Subsequently, Wisconsin listed the species as Endangered in 1982. WDNR biologists have since performed a series of field and calling surveys to document existing populations and to determine the species' current distribution in the state. WDNR additionally established 35 long-term monitoring sites in southwest Wisconsin to document population trends since 1990. I will provide an overview of WDNR directed surveys from the 1980s to the present and will provide an update on the distribution and status of Blanchard's cricket frog in Wisconsin. Additionally, I will describe a few mitigation tactics to aid land managers in developing effective solutions to increase cricket frog distribution and abundance by promoting connectivity and healthy wetlands.

Wetland Wildlife, Wednesday, February 21, Loramoor B, 11:00-11:20 am

Bernthal, Tom, WDNR
Nick Miller, The Nature Conservancy
Joanne Kline, Conservation Strategies Group
Matthew Silveira, The Nature Conservancy
John Wagner, The Nature Conservancy
Chris Smith Jr, WDNR
Matthew Axler, former WDNR

Using the Wetlands Explorer to find and evaluate wetland conservation sites for compensatory mitigation

The "Wetlands by Design" project, a joint venture between WDNR and The Nature Conservancy, has produced a unique on-line decision support system, called the Wetlands and Watersheds Explorer. Using real world examples, we will describe using the Explorer's "Find a Site" feature and its "Evaluate a Site" feature to search for the conservation opportunities and sites best situated to meet watershed needs. The user can view a comparison of the relative need for a chosen ecosystem service among the sub-watersheds nested within a larger watershed, then "zoom-in" to choose which sub-watershed to evaluate further. Within the chosen subwatershed, the user can view all of the potential restoration sites and the services each site could be expected to provide if restored. This process can be repeated as many times as needed to identify sites that are of greatest interest. The "Evaluate a Site" feature repeats the same process, but starts with a chosen site and "zooms-out" to successively larger watersheds so one can gauge the benefits of restoring a chosen site relative to watershed needs.

Identifying and Implementing In-Lieu Fee Mitigation Projects, Thursday, February 22, Loramoor A, 11:00-11:20 am

Casper, Gary, UW-Milwaukee Field Station
Julia Robson, Milwaukee County Dept. of Parks, Recreation & Culture

Recovering impaired fish and wildlife in the Milwaukee Estuary Area of Concern

We assessed the status and conservation of fish and wildlife communities in the Milwaukee Estuary Area of Concern in a four year study. We determined species' local conservation status rankings and made conservation recommendations. Results reveal differing levels of concern across taxonomic groups and link species' status to habitat conditions. Mussels, small bodied frogs, salamanders, and habitat specialists were the most severely impaired groups, while bats, large bodied frogs, some carnivores, and turtles were more resilient than expected. We examined differences among conservation ranking systems for regional conservation implications and identified knowledge gaps and emerging research needs. Our data driven process identified impaired species and developed metrics for assessing recovery. This approach to local fish and wildlife assessment and conservation is applicable to other study areas and has the potential to improve conservation planning for long term resilience of biodiversity.

Wetland Wildlife, Wednesday, February 21, Loramoor B, 10:40-11:00 am

Comstock, Sara, UWSP
Jacob Straub, UWSP
Rachel Schultz, UWSP

Detection probabilities of waterfowl pairs using wetlands in the Glacial Habitat Restoration Area of Wisconsin

We conducted independent double-observer waterfowl pair surveys in the Glacial Habitat Restoration Area (GHRA) of southeastern Wisconsin to determine detection probabilities of mated pairs. Monitoring and evaluating waterfowl use of these habitats is important for understanding functionality and resilience of restored wetlands that are put on the landscape. Additionally, detection of waterfowl pairs can be used to detect trends in local breeding populations. We observed and counted all waterfowl pairs on 94 basins within 33 properties (28 randomly selected restored sites; 5 Waterfowl Production Areas) from April - May of 2017. Wetlands ranged in size from 26.75 to 0.14 acres. We used a closed capture model within Program Mark with the goal of estimating detection rates of waterfowl pairs. Specifically, we evaluated if detection rates varied by observer, species of waterfowl, or guild (ducks vs. geese) of waterfowl, or if rates were consistent among these effects. Overall, we found Canada geese were most abundant (48 pairs), followed by blue-winged teal (22 pairs), mallards (14 pairs), and wood ducks (5 pairs). Our results indicated breeding pair detection probability was reliable and precise between observers and among species, and averaged 92.9% (SE = 2.3%). We believe our detection rates are high relative to other studies because our wetlands were relatively small (mean = 2.08 acres), we encountered easily identifiable species, we could easily walk up to wetlands, and we surveyed waterfowl pairs before dense wetland vegetation grew in. Regardless, our results are important for the future of our project because we can assume detection rates are high and reliable regardless of observers or the species encountered.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Crane, Juli, Lake Co. Stormwater Mgmt. Cmsn.
Glenn Westman, Lake Co. Stormwater Mgmt. Cmsn.
Mike Prusila, Lake Co. Stormwater Mgmt. Cmsn.

Lake County's Wetland Restoration and Preservation Plan, part 1: Approach

This is the first half of a two-part presentation and covers the Stormwater Management Commission's (SMC) approach to developing the Lake County (Illinois) Wetland Restoration and Preservation Plan (WRAPP). The goal of the WRAPP is to provide a wide audience of end-users with decision-making support to help prioritize wetland restoration and preservation efforts. A major component of doing this is predicting wetland and water body functionality. SMC took processes that have been carried out largely at regional or state geographies and tailored them to a county-wide scale using high-density data and input from a 13-member technical advisory group. Through a multi-step process, we enhanced Geographic Information System datasets and assessed wetlands and water bodies within Lake County for 13 functions, including several that are unique to the WRAPP (e.g., woodland amphibian habitat, wildlife movement corridors, nutrient transformation-phosphorus focus, native fish habitat). SMC conducted field studies of 48 wetlands and water bodies to calibrate and refine the preliminary functional criteria and significance ratings. Through the WRAPP, we estimated the extent of historic wetlands and locations of potentially restorable wetlands, learning that restoration opportunities at the watershed level are not equally distributed between watersheds, or even within a watershed, and that functional restoration opportunities are likewise unevenly distributed.

Watershed Approaches, Wednesday, February 21, Loramoor B, 1:50-2:10 pm

Cronce, Shelby, UW-Whitewater
Mackenzie Manicki, UW-Whitewater
Brett Bortz, UW-Whitewater
Kevin Doyle, WDNR
Nicholas Tippery, UW-Whitewater

Water level fluctuations and an endangered plant: Fassett's locoweed in central Wisconsin

Wetland plants depend on water levels to provide them with suitable habitat and, in many cases, to eliminate competition. In central Wisconsin, the endangered species Fassett's locoweed (*Oxytropis campestris* var. *chartacea*) grows on the sandy shorelines of groundwater-fed lakes with historically fluctuating water levels. We conducted a study to investigate the annual effects of groundwater and lake water levels on life history traits of Fassett's locoweed, such as survival, growth, and seedling establishment. Using available data from groundwater wells and satellite imagery, we constructed a topological and bathymetric map of the study lake and plotted the locations of plants over six years of study. We hypothesized that Fassett's locoweed plants would exhibit resilience to uncertain water levels by germinating seedlings along portions of shoreline with optimal water abundance and by producing enough seeds to replace individuals lost to submergence. We found that plants in three life history categories (seedling, mature-sterile, and mature-reproductive) were distributed at different elevations along the shoreline each year and that the mean abundance of each life history category was correlated with the water level of the lake.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

David, Peter, GLIFWC

If this is another 100-year storm, I must be 400 years old: The likely impacts of climate change on wild rice

The southern edge of the range of "northern" wild rice (*Zizania paulustris*), and the northern edge of "southern" wild rice (*Zizania aquatic*) overlap in Wisconsin. Both species are annuals with limited habitat niches and seed dispersal abilities. In addition, most predictions of climate change include conditions that are contrary to the necessary growing requirements of the plants. Thus it is likely that wild rice is highly susceptible to climate change impacts, especially the northern species, which produces the large seed that is an important food source for people as well as many species of wildlife. While the potential impacts of climate change on *manoomin* (as it is known to the Ojibwe) are yet to be well-documented by western science, monitoring of manoomin beds in northern Wisconsin and parts of Minnesota and Michigan over the last 25 years suggest that observable effects are already occurring, and that others can likely be expected. I will review the habitat requirements and life cycle of manoomin and use aerial imagery of regional rice beds gathered in annual monitoring efforts to depict apparent climate-related impacts on wild rice itself and on human harvest levels. I will also review other possible, but less apparent, impacts.

Symposium Part 2, Wednesday, February 21, Loramoor C, 2:10-2:30 pm

DeLaundreau, Maria, University of Minnesota
Rebecca Montgomery, University of Minnesota
Meredith Thomsen, UW-La Crosse
William Kaiser, UW-La Crosse
Tim Schlagenhaft, Audubon MN

Tree sapling responses to reed canarygrass treatments across four floodplain sites in SE Minnesota

Many forested wetlands in the Upper Mississippi River floodplain have been converted into monocultures of invasive reed canarygrass (*Phalaris arundinacea*; RCG), and forests cannot regenerate once these monocultures form because tree seedlings are unable to compete. Floodplain forest communities are a restoration priority because they provide habitat for many species, and they provide valuable ecosystem services. We need to establish best management practices for RCG control and tree restoration treatments. Here, I present results on first year growth and survival of two stock types of four tree species planted into two RCG treatments. We selected four sites dominated by RCG in active floodplains and treated half of the RCG plots with Rodeo (glyphosate), and half with Oust XP (sulfometuron methyl). We treated RCG in fall 2016, and in spring 2017, we planted small bare root and large containerized cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), swamp white oak (*Quercus bicolor*), and hackberry (*Celtis occidentalis*). Preliminary results suggest greater growth and survivorship of trees when RCG has been treated with Rodeo, but the difference is not great giving land managers flexibility in their herbicide choices. Bare root stock plantings showed greater growth especially cottonwood and silver maple, so land managers aiming to achieve fast growth in order to shade out RCG may want to densely plant cottonwood and silver maple bare roots.

Invasive Species I, Thursday, February 22, Loramoor B, 9:50-10:10 am

Desai, Ankur, UW-Madison

The short and long of wetland carbon emissions, uptake, and lateral transfer

Temperate and boreal wetland ecosystems contain a diverse array of species that photosynthesize, respire, and/or decompose carbon. These rates tend to vary with expected factors, like temperature, water table position, and nutrient availability. However, when considering the contribution of wetlands to the global carbon cycle and climate and their potential for mitigation or adaptation, time scale matters. Small differences in net balance of photosynthesis and respiration drive long-term carbon accumulation. Oxygen availability drives methane production or consumption, but the contribution of methane to climate is a function of chemistry in the atmosphere and the timescale being considered. Connectivity of wetland hydrology and fluctuations influence rates of lateral transfer and emissions downstream. Finally, vegetation dynamics at wetland-upland edges lead to successional trends. Wetland carbon credit policies rarely take all of these factors into account and often oversimplfy the problem by using metrics like CO_2-equivalents, which are not entirely appropriate to wetlands and can actually lead to short-sighted restoration decisions. Adaptation efforts need to consider multiple timescales. I will discuss some of the latest research both in my lab and elsewhere on wetland carbon and methane cycling and will present approaches to better account for these processes in restoration and carbon credit policies.

Symposium Part 3, Wednesday, February 21, Loramoor C, 3:20-3:40 pm

Ferrier, Elaine, Great Lakes Commission
Kurt Kowalski, USGS Great Lakes Science Center
Clint Moore, University of Georgia
Heather Braun, Great Lakes Commission
Karen Alexander, Great Lakes Commission

Phragmites Adaptive Management Framework: Citizen science and decision support tool for the Great Lakes basin

The Phragmites Adaptive Management Framework (PAMF) is using a systematic adaptive management approach to unite management with science and learn how to manage non-native *Phragmites* most effectively. Using a standardized monitoring protocol, a predictive model, and an interactive online database, PAMF enhances the impact of individual efforts in a way that accelerates our collective learning about site-specific best management practices. PAMF collects the details of a management effort (e.g., herbicide concentration, application method) and analyzes the outcomes to find out how those details influence treatment effectiveness. PAMF uses the results of the annual data analysis to provide treatment guidance that can help land managers achieve their objectives. Learn how to participate in PAMF and get insight into what to expect as a PAMF partner during this presentation.

Invasive Species II, Thursday, February 22, Loramoor B, 11:00-11:20 am

Fuller, Sarah, UW-Madison
Anita Thompson, UW-Madison

Suspended sediment and phosphorus changes within a marsh following a decade of carp exclusion

Silver Creek Estuary is the primary input to Green Lake, Wisconsin's deepest natural inland lake. In the 1990's, the marsh had high carp (*Cyprinus Carpio*) densities and was algae dominated. Following the installation of a barrier in the early 2000s to reduce carp entrance from the lake, macrophytes became established by 2006. Currently, the marsh has extensive submersed moncrophyte communities comprising mostly coontail (*Ceratophyllum demersum*), hybrid water milfoil (*Myriophyllum sibiricum* X *spicatum*), and common waterweed (*Elodea canadensis*). Limited analysis exists concerning changes to water quality within the marsh following this management action and biological shift. The goal of this study is to combine existing USGS and WDNR monitoring data with additional water quality measurements to characterize sediment and phosphorus (P) within Silver Creek Estuary before and after carp exclusion. Monthly water samples analyzed for Total Suspended Solids, Total Phosphorus, and Total Dissolved Phosphorus were collected July – October 2016 and April – October 2017 at 5 sites in Silver Creek Estuary. USGS and WDNR data include discharge and P concentrations at the marsh's largest tributary and at the outlet of the marsh as well as P concentrations at three locations within the marsh. At the outlet, data date back 30 years. Data over this time period are currently being analyzed to identify water quality changes coinciding with Silver Creek Estuary's shift from an algal to macrophyte-dominant community. I will present results from this analysis and how they will help inform future management for reducing P loading to Green Lake.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Gallagher-Jarosz, Sally, WDNR
Josh Brown, WDNR

In-lieu fee mitigation in Wisconsin: Lessons learned and adaptations

The Wisconsin Wetland Conservation Trust (WWCT), a WDNR-sponsored wetland in-lieu fee mitigation program, has made great strides in the past year and has experienced some setbacks as well. I will address the accomplishments the program has made, current project details, and what efforts have been taken to streamline future projects and partnerships. To date, the WWCT has reviewed applications from 3 requests for proposals and is currently in various stages of review for 9 projects. The program is on track to start fieldwork on at least 6 projects in 2018; details about the projects will be shared. Proposed and approved WWCT projects are planning to restore and enhance sedge meadow, wet prairie, floodplain forest, hardwood swamp, and shrub-carr communities, among other wetland types. Program staff remain engaged with regulators and partners to meet our required milestones and to restore quality wetlands.

Identifying and Implementing In-Lieu Fee Mitigation Projects, Thursday, February 22, Loramoor A, 11:00-11:20 am

Geddes, Pamela, Northeastern Illinois University

Potential for an invasive hybrid involving southern cattail: A case study from Wisconsin

Typha domingensis (southern cattail) is native to tropical wetland regions of Florida and the Caribbean. It appears to be moving north from its native habitat to the Midwestern US, presumably via human transport and aided by global warming that allows southern species to shift their range northward. *T. domingensis* can be a threat to all native wetland plants, but particularly so to the native cattail, T. latifolia. Because *T. domingensis* can hybridize with the native or the other Midwestern species (exotic *T. angustifolia*), hybridization could provide a mechanism for its establishment. It's difficult to accurately identify cattails morphologically as similar phenotypes caused by hybridization; therefore, the use of molecular tools can be a preferred technique to positively identify them. In order to determine whether *T. domingensis* has migrated to the Midwest, we used microsatellites to address whether this technique may be successful distinguishing *T. domingensis* from the other Midwest Typha species. We tested 6 microsatellite primers that we used previously to distinguish among the Midwest Typha species on 11 T. domingensis samples from Florida. Additionally, we tested the diagnostic markers against ~180 cattail samples that we had previously collected from the Midwest, and we are currently testing samples from Wisconsin specimens that morphologically align with descriptions for *T. domingensis*. If positive identification for *T. domingensis* results, this would be the first record of its establishment in the Midwest and further immediate action should be taken to prevent its spread and/or further invasion.

Symposium Part 3, Wednesday, February 21, Loramoor C, 4:20-5:00 pm

Gibson, Melissa, WDNR

New plant lists for native Wisconsin sedge meadows from WDNR's FQA benchmark surveys

In 2017 WDNR's Bureau of Water Quality completed a 5-year effort to survey the vegetation of more than 1,000 remnant wetlands across the state for the purposes of establishing benchmarks for floristic quality. Complete vascular plant species lists and estimated cover data were collected for each wetland community using the timed meander method. In addition, sites were rated for overall disturbance on a scale of 1-5 based on a disturbance factor checklist where evidence of disturbances such as ditches, roads, agricultural practices, and invasive species were tallied. Using the subset of 158 wetlands classified as "sedge meadows" according to WDNRs natural community classification, we created separate recommended planting lists for northern sedge meadows and southern sedge meadows tailored for each of the 4 major Omernik ecoregions in Wisconsin. For each region and community we will: 1) summarize the species composition and abundance of plants in reference-quality sedge meadows, highlighting the species that tend to dominate these communities as well as species that are found at low abundance; and 2) highlight potentially "resilient" species: i.e. species that are present in high quality, undisturbed wetlands but are also present at a minimum frequency or average cover across sites that ranked high in overall disturbance. These species may be important to include in restoration plantings due to their potential ability to withstand disturbance caused by invasions and hydrological alteration. The resulting plant lists will be made available on WDNR's website.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Giglierano, Jim, WDOA

2018 status of lidar elevation products in Wisconsin

Lidar-derived elevation and land cover data are increasingly being used to help delineate and map wetlands. High resolution lidar digital elevation models are also used to create GIS data for stream networks, water bodies, watershed boundaries, contours and other products useful in the management of wetlands and adjacent areas. These products are critical for modeling surface and groundwater, soil erosion and nutrient management, storm water runoff, and wetland functions. With the introduction of federal elevation grants in 2014 and additional local funding for lidar through Wisconsin Land Information Program strategic initiative grants, coverage of the state will finally be completed next year. In addition, older data sets are in the process of being refreshed. In this talk, I will provide an overview of the status of lidar acquisition in the state and discuss efforts to increase the distribution of data products and provide more basic lidar training to users. I will show how various groups are collaborating to map wetlands using lidar data.

Hydrology & Geomorphology, Thursday, February 22, Loramoor A, 9:30-9:50 am

Goggin, Patrick, Wisconsin Lakes Partnership/
UWEX Lakes/UWSP
Pamela Toshner, WDNR

Wisconsin's Healthy Lakes Initiative: Working with lakefront property owners to apply BMPs

The Wisconsin Lakes Partnership recently implemented a statewide initiative providing technical assistance and funding for simple and relatively inexpensive shoreland habitat and runoff and erosion control best practices. "Healthy Lakes" is the outcome of a lean government project to streamline grant funding while simultaneously simplifying technical information for lakeshore property owners, wetland enthusiasts, lake groups, municipalities, and other partner organizations. Launched in late 2014, Healthy Lakes has received positive feedback and widespread geographic interest. Public participation and lessons learned from social marketing studies shaped Healthy Lakes and continue to be key to its success. Next steps include web site enhancement, program and best practice evaluation, and integrating the initiative into long-term administrative code. I will provide an overview of Healthy Lakes and information on tapping into funding for wetland fringe plantings along lakeshores, rain garden installations, and other promoted water conservation best practices. I will also share example wetland-related projects completed in the first years of the initiative.

Wetlands & People, Wednesday, February 21, Loramoor A, 2:10-2:30 pm

Graham, Grace, WGNS
Susan Swanson, Beloit College
Kenneth Bradbury, WGNS
David Hart, WGNS

Spring systems in Wisconsin

Like all waters of the state, springs and spring-fed environments can be susceptible to groundwater drawdown or changes in recharge. With this in mind, Wis. Statutes 281.34 mandates that impacts to springs flowing at least 1 cubic foot per second (cfs) at least 80% of the time be considered during the application review for new high-capacity wells. A need for more information on spring hydrology for assessing the impacts of wells prompted the WDNR to support the WGNHS in completing a statewide inventory of springs. Field surveys conducted between 2014 and 2017 resulted in a comprehensive database that includes descriptions for 415 large springs, many of which are located within and supply water to wetlands. Spatial patterns in geologic origin, topographic position, and water chemistry reveal six distinctive categories of spring systems in Wisconsin. The inventory shows that most springs form as a result of preferential groundwater flow through fractures in exposed or shallowly buried Paleozoic bedrock. Other springs form at breaks in slope along moraines in glaciated regions. Wetlands are supported by each identified category of spring. Each category also includes springs with measured flow rates of 1 cfs or more. To characterize the vulnerability of different springs (and the environments they support) to impacts such as groundwater drawdown, the WGNHS will continue to monitor eight reference springs that are representative of the different spring systems identified during this inventory. This work has implications for wetland scientists, as it gives insight into the sources of groundwater to spring-fed wetlands throughout Wisconsin.

Hydrology & Geomorphology, Thursday, February 22, Loramoor A, 10:10-10:30 am

Granberg, Jason, WDNR

Wisconsin's changing climate and wetland invasive species

As Wisconsin's climate changes, native wetland communities will be subjected to stress from increased climactic variability and invasive species will increase their potential ranges and competitive advantage over native species. It is possible to predict how wetland invasive plants and animals may perform under future emission scenarios using a combination of climate models provided by the WICCI and the USFWS Risk Assessment and Mapping Program (RAMP). Using invasive species records from neighboring states and regional plant watch lists, we determined how well 330 invasive aquatic and wetland plant and animal species fit Wisconsin's current climate and potential future climates at years under a median emissions scenario. The results of this modelling indicate potential invasive species that may extend their range into Wisconsin and species that may be pre-adapted to Wisconsin's future climate. The modelling also indicates how well existing invasives will perform in the coming years.

Symposium Part 3, Wednesday, February 21, Loramoor C, 4:00-4:20 pm

Hefko, Aletha, Northland College
Michele Wheeler, WDNR
Matthew Cooper, Northland College

Biofilm nutrient limitation in Lake Superior coastal wetlands

Coastal wetlands are among the most productive habitats in the Great Lakes and provide many important services, including fish spawning areas and migratory bird habitats. The influence of nutrient loading to these systems from watershed land use is generally understudied. Because anthropogenic nutrient loading can alter the macronutrients that limit primary productivity in wetlands, understanding nutrient limitation patterns can provide insight into potential nutrient-related impacts. Lake Superior has a lower level of anthropogenic development and colder waters than the other great lakes, and both of these factors impact productivity and nutrient availability within these coastal wetlands. We used algal biofilm chlorophyll-a accumulation on nutrient diffusing substrates (NDS) to determine nutrient limitation within eight coastal wetlands on the Bayfield peninsula and nine wetlands in the Apostle Islands. An NDS consisted of agar treated with a nutrient amendment and a glass frit upon which the algae grows. In an additional mainland coastal wetland, we placed nutrient diffusing substrata at 15 locations to investigate intra-site variability. We predicted that nutrient limitation would be associated with land-use patterns, with a tendency for nitrogen limitation to be common but to decline with increased human land use. We also predicted that nitrogen limitation would vary within a wetland based on the dominant water source for a given location: lake or tributary. Preliminary results suggest that biofilm communities in southwestern Lake Superior coastal wetlands are nitrogen limited in general and that variation occurs within wetlands based on water source.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Hernandez, Liliana M., Northwestern University
Vivien A. Rivera, Northwestern University
Colin Phillips, Northwestern University
William M. Miller, Northwestern University
Aaron I. Packman, Northwestern University

Impacts of stormwater runoff and road salt intrusion on the soil quality of an urban wetland in Chicago

One of the expected effects of climate change is an increase in the intensity and frequency of rainfall events. This will aggravate stormwater runoff and adversely affect the quality of our wetlands in urban environments. In this work, we assessed the soil quality of Gensburg-Markham Prairie (GMP), a high-quality tallgrass prairie in Markham, IL. GMP is surrounded by high-traffic highways and residential communities. Stormwater runoff and heavy metals inputs into GMP are a concern because of observed ecosystem degradation around its periphery. To understand the biogeochemical status of GMP and potential degradation, we collected 14 soil cores to 1 meter depth and 16 surficial soil samples during summers 2016 and 2017. We analyzed spatial patterns for soil type, pH, and organic matter and determined concentrations of Pb, Cu, Zn, Mg, Fe, K, Ca and P using ICP-OES. To quantify soil pollution, we calculated the Enrichment Factor (EF) and the Single Element Pollution Index. The mean EF values for Pb, Cu, Zn and P revealed a significant enrichment of these elements in our core samples. In order to determine the effect of surface runoff in the surficial samples, we used an ArcGIS software package to derive the flow accumulation path and the stream network of GMP. The results showed that higher concentrations are primarily located in surface flow pathways (lower swale and ephemeral wetland). Elevated concentrations of Mg and Ca were found near roads, indicating road salt intrusion to the site during winter months. The detailed soil chemistry data constitute a dynamic spatial contamination map that can be used to assess long-term impacts on the ecosystem and can inform site management and biodiversity conservation efforts at GMP.

Wetlands & People, Wednesday, February 21, Loramoor A, 1:30-1:50 pm

Jensen, Heather, Northland College
Sarah Johnson, Northland College
Erik Olson, Wisconsin Lakes Program/
UWEX Lakes/UWSP

Native aquatic plant community response to water-level fluctuations with a focus on the *Potamogeton* genus

Strategically applied management of water levels in impounded reservoir systems can positively influence aquatic and wetland communities. The Chippewa Flowage has had a long history of winter drawdowns that expose the extensive area of littoral zone. Winter drawdowns were subtle during a prolonged period after 1997 but significant drawdowns were implemented again in the winter of 2014, 2015, and 2016. One objective for these recent drawdowns was to reduce the spread of Eurasian watermilfoil (*Myriophyllum spicatum*). An annual point-intercept survey has occurred since 2005-06 to monitor the impact of these fluctuating water levels on aquatic species. At each sample point, water depth, substrate, rake total fullness, and species abundance for each aquatic plant species were recorded. We present preliminary results on the changes between 2005-06 and 2017 in the relative abundance and spatial distribution of all *Potamogeton* species found in relation to water-level management to determine the influence of the winter drawdowns on this group of native species. *Potamogetons* are diverse and abundant throughout the flowage, and they differ in their sensitivity to drawdowns, water quality, and biotic competition. Lag effects may obscure or make it difficult to detect relationships between changes in the plant community and fluctuating water-levels. Hence, long-term data such as these that have broad spatial and temporal coverage are critical for assessing the ecological impacts of water level management. Monitoring can continue to inform adaptive management of these wetlands and is essential for promoting resilient wetland ecosystems.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Johnson, Sarah, Northland College
Matthew J. Cooper, Northland College

Through drought and high water: Vegetation dynamics in Lake Superior coastal and inland wetlands

Detecting directional or cyclic changes and their causes in naturally dynamic ecosystems is a challenge. To meet this challenge, we monitor. In 2017, we resurveyed 11 coastal and 3 inland wetlands within the Apostle Islands National Lakeshore previously sampled by J. Meeker in 1998-2002 and 2010. These data allowed us to determine the influence of both a falling and rising water level in Lake Superior over a 21-year period. During a sustained low water period, Meeker concluded in 2010 that coastal plots were experiencing increases in shrubs and declines in obligate wetland plant species. The plant community in the sphagnum -dominated inland plots changed little. Using the same methods in 2017 during a year of higher than average water levels, we frequently recorded >0.5m of standing water in coastal wetlands where Meeker had recorded only saturated soils. Preliminary results indicate declines in shrub species (e.g., *Alnus incana*) and shifts from panne and sedge meadow species to obligate emergent species at coastal sites. Myrica gale-dominated coastal wetlands have persisted. Similarly, vegetation on floating sphagnum mats in coastal sites appears more resilient to these water level changes. As Meeker found, inland bogs have not changed much. Our results support the hypothesis that these coastal wetlands are maintained by 'pulse-stability' hydrologic processes that promote cyclical changes in the plant communities. Pervasive, directional changes due to species invasions are occurring in coastal wetlands elsewhere in the Great Lakes region, so the Apostle Islands wetlands, which have fewer exotic species, could serve as reference wetlands for informing restoration of more degraded coastal wetland complexes.

Symposium Part 2, Wednesday, February 21, Loramoor C, 2:30-2:50 pm

Jones, Michael, Stockbridge-Munsee Cmty
Angela Waupochick, Stockbridge-Munsee Cmty
Christel Kern, USFS
Anne Timm, USFS

Long-term monitoring of forested wetland stands in anticipation of emerald ash borer invasion

The invasive Emerald Ash Borer (*Agrilus planipennis*; EAB) poses a major threat to forested wetlands on the Stockbridge-Munsee Reservation in Northeast Wisconsin. Black ash (*Fraxinus nigra*) is an ecologically and culturally important tree species to the Stockbridge-Munsee Community (SMC). The species is often found in headwater and riparian wetlands on the reservation and plays a key role in the hydrology of those systems. When EAB invasion occurs, the loss of transpiration from black ash likely will lead to a rise in water levels which may cause vegetation community shifts. Additionally, an increase in water temperature associated with the loss of canopy cover could become detrimental to downstream trout habitat. To determine current conditions and guide future management actions, SMC's Environmental Department is beginning long-term monitoring of wetland sites containing black ash. Twelve sites will be selected for monitoring using a combination of timber cruise data, GIS analyses, and field visits. The monitoring strategy involves periodic tree, shrub, and herbaceous layer sampling, floristic quality assessments, and continuous logging of water levels and water temperatures. This sampling will be coupled with site-level EAB surveys to determine pre- and post-invasion conditions. Early monitoring will establish baseline conditions that SMC will use to help maintain wetland function in the wake of EAB. Long-term data will be used to evaluate the effectiveness of mitigation actions and can be used to guide planning for other tribes, agencies, or professionals facing the threat of EAB.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Kakatsch, Alissa, UWSP
Jacob Straub, UWSP
Paul Samerdyke, WDNR

Effectiveness of herbicide spray treatments on cattail growth in Horicon Marsh

The 33,000 acre Horicon Marsh is mostly wetland and home to flourishing wildlife. Since the latest marsh restoration project, a mixed variety of broad, narrow leaved, and hybrid cattail vegetation dominates most of the wetland area, crowding out other important vegetation. Although cattails can have an important role within the marsh, current multi-species management is designed to promote more plant and animal diversity. An abundance of prior research has demonstrated that the ideal ratio of cattail to open water should be 50:50, as this ratio promotes other useful vegetation growth and attracts the greatest wildlife diversity. Over the past decade, WDNR staff at Horicon has been using several management methods to reduce cattail vegetation 'overgrowth' on the marsh, specifically different ratios of glyphosate n-glycine, and isopropylamine salt. In the summer of 2017, we began compiling data from previous treatment areas and observing the effect of these treatments on the cattails. We observed and measured cattail abundance in the treated areas, along with other wetland plants, wildlife usage, and water levels. So far, we have observed more than twenty different plant species growing within the previously treated cattail blocks. Some of the more common species include jewelweed (*Impatiens capensis*), smartweed (*Polygonum*) and duckweed (Lemnoideae). Long-term goals of the project are to allow WDNR to have better insight into what and where management treatments have been most effective or if they need to explore different techniques.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Kiser, William, UW-La Crosse/USFWS
Meredith Thomsen, UW-La Crosse
Rebecca Montgomery, University of Minnesota
Maria DeLaundreau, University of Minnesota
Tim Schlangenhaft, Minnesota Audubon
Andy Beebe, Minnesota Audubon

Large-scale evaluation of reed canarygrass suppression treatments across four floodplain sites in SE Minnesota

Experiments can provide insights as to whether invasive plant dominance is caused by superior competitive ability or by negative environmental changes that facilitate plant invasion. Reed canarygrass (*Phalaris arundinacea*, RCG) displaces native plants and forms near-monocultures in North American wetlands. In the Upper Mississippi River (UMR) system, floodplain forests are negatively impacted by RCG invasion. Converting RCG monocultures back to forested wetlands is a high priority among UMR stakeholders. We are testing two RCG control techniques and three methods of tree propagation (bare-root stock, container stock, and direct-seeding). We are monitoring herbaceous plant responses, litter depth, and tree performance over two growing seasons. Treatments consist of (1) fall applications of Rodeo (glyphosate) and (2) mulching followed by late-fall application of Oust (sulfometuron methyl) herbicide. Treatments were applied in fall 2016 and trees were planted in spring 2017. Initial results indicate that both treatment methods significantly reduce RCG performance relative to controls. Although RCG cover and height increased over time, differences remained significant among treatments. Additionally, herbaceous plants increased in species richness and cover relative to controls, although volunteer plant diversity varied among sites. Preliminary results indicate that lack of native tree propagules may be a factor in RCG invasions. Herbicides will be re-applied in early spring 2018; data collection in 2018 will verify if early observations continue to hold true. By studying the causes and consequences of RCG invasion, we can assess community dynamics while evaluating the effectiveness of restoration methods.

Invasive Species I, Thursday, February 22, Loramoor B, 9:30-9:50 am

Knosalla, Lori, University of Minnesota
Rebecca Montgomery, University of Minnesota
Lee Frelich, University of Minnesota
Charlotte Roy, Minnesota DNR
Lindsey Shartell, Minnesota DNR
Annie Hawikson, University of Minnesota

Investigating seasonal variation in prescribed burn impacts to lowland brush ecosystems

Prescribed burning is a tool often employed to manage fire dependent plant communities such as lowland brush ecosystems. These plant communities are dominated by willows, alder, dogwoods, bog birch, Labrador tea, leatherleaf, and a broad diversity of grasses, sedges, and other herbaceous wetland plants. To maintain a patchwork of brush and open grassland/sedge habitat for wildlife within these ecosystems, natural resource managers use prescribed fire to reduce the encroachment of woody shrubs and trees. While prescribed burns are frequently conducted in the spring, historically, fires occurred throughout the spring, summer, and fall seasons. Studies in other plant communities show that the season in which a fire takes place impacts the variability in fire severity and how plant communities respond. In partnership with the Minnesota DNR (MN DNR), we are investigating how lowland brush ecosystems in northern Minnesota respond to burns in different seasons. The findings of this research will be applied to management practice to inform management objectives for lowland brush ecosystems. Five study sites were selected by the MN DNR, each containing four replicate burn units of spring, summer, fall, and control (no burn). To date we have conducted 2 spring burns (5/10/17 and 5/12/17), 2 summer burns (8/11/17 and 9/12/17), and 2 fall burns (11/16/16 and 10/19/17). We will discuss some of our preliminary findings on burn severity by seasons, which has begun to show that lower severity burns have occurred in the summer and high severity burns in the spring and fall. We will also introduce our new innovative approach to monitoring fire severity using standard wooden dowels in 1-hr and 10-hr fuel size classes, and we will discuss what's coming in 2018.

Wetland Flora & Plant Communities, Wednesday, February 21, Loramoor B, 4:20-4:40 pm

Koski, Adrian, City of Racine
Julie Kinzelman, City of Racine

Samuel Myers Park: Incorporating coastal resilience into an urban wetland restoration

Samuel Myers Park is located on the shore of Lake Michigan in Racine, WI. Successive periods of natural accretion resulted in accumulation of sediments at the shoreline, resulting in wetland formation. However, function was impaired, these wetlands were primarily comprised of non-native species, and surface water quality was unsupportive of recreational use. In 2009, a 4-year intensive monitoring program to identify pollution sources, delineate the wetland, develop engineering plans, and secure permits began. Recent frequent/intense storms required incorporation of design elements with the ability to absorb the force and accommodate the volume of water associated with these events as well as with fluctuating lake levels. As part of the restoration process, 5 acres of invasive species were removed and replaced with more than 30,000 native plants, forbs, and trees. Wetland restoration (2014 – 2017) has resulted in reduced nutrient loading, improved surface water quality, the return of fish/amphibians, and increased migratory bird diversity. Improved wetland function has been aided by the development of successive coastal ecosystems (upland, dry prairie, inter-dunal/constructed wetlands and dunes), preventing direct stormwater runoff from reaching the shoreline. Hydrologic connectivity between the wetland features has helped protect the park through successive storm events. Samuel Myers Park is now the second most popular birding hotspot in Racine, with 38 new species seen since 2014. Nearshore water quality has improved by 50%, resulting in the removal of a decades-long swim ban. Unique in the Milwaukee-Chicago corridor, this restored wetland serves as both an outdoor education venue and a recreation destination within the Pike River Watershed.

Wetland Flora & Plant Communities, Wednesday, February 21, Loramoor B, 3:40-4:00 pm

Kraszewski, Sarah, Stantec Consulting Services, Inc.

Restoring native upland buffers: An integral component of wetland resiliency

It has become widely accepted that restoring diverse native upland buffers enhances the functional values of restored wetlands, though more quantitative studies of the value of upland buffers are needed. Although adjacent upland areas often face development pressure and restoring these areas may appear to be economically unfeasible, I argue that these buffer areas are important to wetland restoration success. Preliminary results from a completed wetland restoration project in NE Illinois support the role of buffers in water quality protection, floristic quality, wildlife habitat, and human use values within the wetland restoration and demonstrate a quantifiable economic value provided by upland buffers. I assessed pre- and post-restoration data sets for stormwater modeling, floristic quality, avian diversity, and recreational values. The avian diversity results are somewhat complicated by intensive management efforts (prescribed burning, management mowing), and additional monitoring may be required to elucidate long-term trends. Preliminary results indicate that restoring native upland buffers may enhance wetland resiliency in the context of our changing climate and may improve long-term wetland restoration success.

Wetland Flora & Plant Communities, Wednesday, February 21, Loramoor B, 4:00-4:20 pm

Lennie, Brian, Stantec Consulting Services, Inc.

Contaminated urban wetlands and streams: Five years of channel/wetland restoration at the Cobalt Project

Wetland and stream restoration projects present a wide variety of challenges to a project team. I will provide a five-year snap shot of a project within a contaminated brownfield redevelopment site in Menomonee Falls, WI. The project included a 1.2-acre wetland fill impact mitigation and a navigable stream reconstruction for contaminant remediation as well as a 0.3-acre wetland restoration and 700-foot stream restoration. The project goals included meeting WDNR remediation cleanup standards for future development of a 54-acre mixed-use brownfield TIF District. Working in a contaminated urban setting presents new sets of challenges for design, construction, and monitoring phases of the project. I will focus on lessons learned, including the science of wetland and waterway identification, permitting, restoration design, monitoring, management, and the intricacies of working under a WDNR-mandated remediation of lead, arsenic, PAHs (poly-aromatic hydrocarbons), and solvent contamination. Urban wetlands provide a wide variety of functions and values and are resilient systems that can rebound from environmental contamination, provide much needed open space and habitat in urban areas, and serve as aesthetically pleasing buffers in urban settings. Urban restoration can be successful when matched with achievable project goals, regulatory flexibility, and purpose.

Long-term Restoration & Management, Wednesday, February 21, Loramoor A, 11:20-11:40 am

Loken, Zack, UWSP
Rachel Schultz, UWSP
Jacob Straub, UWSP

Mapping spatial heterogeneity and floristic quality of wetlands in the Glacial Habitat Restoration Area

The Glacial Habitat Restoration Area is a 558,879-acre restoration zone that spans across 24 townships in east-central Wisconsin. From 1990 to 2013, open water, emergent marsh, and shrub wetlands increased by 17,774 acres in the GHRA. In summer of 2017, we used WDNR's timed-meander sampling protocol for wetland floristic quality assessment to sample wetland plant community condition on 38 randomly selected wetlands within the GHRA. We categorized wetlands into 3 groups based on hydrologic modification: scrape (category A), category A wetlands with ditch plugs, ditch-fills, and/or tile breaks (category B), and category B wetlands with berms and/or berms with a water control structure (category C). The study included two reference groups: Waterfowl Production Areas and unmodified sites without basins. Wetland plant communities were categorized following the Natural Heritage Inventory database, mapped using aerial imagery from Columbia, Dodge, Fond du Lac, and Winnebago counties, and field checked for accuracy. Field sampling data are stored in a file geodatabase using ESRI's ArcMap 10.5 software, including relative cover of introduced species and other floristic quality metrics for each property. Habitat heterogeneity was assessed within each property using an interspersion-juxtaposition index (IJI) because wetlands with diverse habitat types may be more attractive to waterfowl than wetlands with little diversity. Greater values of IJI indicate that community types are more evenly dispersed throughout the wetland than areas with large blocks of similar vegetation. An analysis of variance showed no statistically significant difference in IJI values between wetlands of different hydrologic modification type. The outcomes of this research provide insight into the integrity of restored wetlands and how techniques of restoration may lead to wetlands that are more resilient to disturbance, including invasive species.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Magyera, Kyle, Wisconsin Wetlands Association

Understanding wetlands as solutions to flood risks

Protecting and restoring wetlands can provide cost-effective and innovative solutions for communities dealing with flood risks, water quality impairments, and vulnerable infrastructure. Planners, policy makers, and land use decision makers, however, do not always have the information, tools, and resources they need to understand how upstream wetland loss can contribute to downstream water problems. To help communities in northern Wisconsin overcome these barriers, the Wisconsin Wetlands Association is conducting a geospatial analysis and field investigation of the watershed characteristics that may have influenced the location and severity of the road and culvert damages that occurred after a large July 2016 storm event in Bayfield, Ashland, and Iron Counties. I will present preliminary findings, including examples of how to identify simple, cost-effective wetland conservation strategies to "slow the flow" of stormwater runoff and how to engage participants in a discussion about the goals, methods, and potential applications of this WCMP funded project.

Watershed Approaches, Wednesday, February 21, Loramoor B, 1:30-1:50 pm

Marti, Aaron, WDNR
Tom Bernthal, WDNR

Floristic quality assessment benchmarks for wetlands of Wisconsin's north central hardwood forests ecoregion

Although the Wisconsin Floristic Quality Assessment (WFQA) method was established more than a decade ago as a tool for monitoring and assessment of plant communities, benchmarks of plant community condition are needed in order to fully utilize WFQA for assessment of the relative condition of a given plant community to others of the same type at multiple scales (e.g., regional, statewide), particularly for wetlands. Development of these benchmarks is 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, 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 assessments of potential site-level wetland disturbance factors were completed at more than 1,000 assessment areas statewide from 2011 to fall 2017 in order to assess WFQA metric response to anthropogenic stressors. Preliminary benchmarks for the Northern Lakes and Forests Ecoregion were proposed in 2015, but establishment of benchmarks for the North Central Hardwood Forests, Driftless Area, and Southeastern Wisconsin Till Plains Ecoregions is ongoing. This presentation will highlight the overall ongoing data analysis strategy for establishing these floristic benchmarks and will include preliminary proposed condition benchmarks for many of the major wetland community types encountered in the North Central Hardwood Forests ecoregion.

Wetland Flora & Plant Communities, Wednesday, February 21, Loramoor B, 3:20-3:40 pm

Miller, Nick, The Nature Conservancy
Joanne Kline, Conservation Strategies Group
Tom Bernthal, WDNR

Lessons from the field: Wetland restoration as a tool to maintain watershed health and ecosystem services under a changing climate

Wetlands have always played important roles in keeping our watersheds healthy and our communities safe and productive—abating floods, improving water quality, maintaining streamflow, providing habitat for fish and wildlife, protecting shorelines, and storing carbon. These wetland roles will become increasingly important as climate change leads to different weather patterns, shifting land-uses, and associated increased stresses to natural and built infrastructure. Carefully targeted wetland restoration can increase the resilience of watersheds and may be considered an important climate change adaptation tool. We will discuss factors that influence the ecosystem service potential of current wetlands and restoration opportunities, such as watershed position, hydrologic connectivity, and land-use context. We will provide specific examples of wetland restoration projects from Indiana, Illinois, and Wisconsin aimed at increasing watershed-scale health and resilience. A new tool from The Nature Conservancy and WDNR—the Wetlands and Watersheds Explorer—will illustrate how restoration sites may be selected to promote watershed health under a changing climate.

Symposium Part 3, Wednesday, February 21, Loramoor C, 3:40-4:00 pm

Miller, Nick, The Nature Conservancy
Joanne Kline, Conservation Strategies Group
Matthew Silveira, John Wagner, Michele Kille, The Nature Conservancy
Tom Bernthal, Chris Smith Jr., Matt Matrise, Sally Jarosz, Josh Brown, WDNR
Matthew Axler, former WDNR

Patricia Moran, Lac du Flambeau

Wetlands by Design: Finding conservation opportunities for ecosystem services and watershed resilience

Wetlands provide habitat for fish and wildlife as well as ecosystem services for people and communities. WDNR and The Nature Conservancy collaborated to create an online mapping decision support system—the Wetlands and Watersheds Explorer—that ranks wetland preservation and restoration opportunities for all of Wisconsin's watersheds based on potential to abate floods, improve water quality, protect shorelines, supply surface water, store carbon, and provide habitat. In addition to ranking individual sites based on service potential, the Explorer ranks watersheds at the 8-, 10-, and 12-digit HUC scales based on the relative amount of ecosystem service loss resulting from historical wetland conversion and degradation. Users of the Explorer may: 1) start with a site, evaluating it based on the ranks of the watersheds within which it occurs and the rankings of other sites in the same watershed; or 2) start with a watershed, progressively zooming in through prioritized subwatersheds to identify sites with the greatest potential to meet watershed priorities. The Explorer was developed to support decisions of a broad range of users with different goals, including municipalities and industries aiming to restore water quality, regulatory programs targeting wetland mitigation funds, outdoor enthusiasts interested in fish and wildlife, and municipalities working to abate floods. The Explorer is a product of GIS analysis and was field validated in the Milwaukee River Basin. In combination with field assessments, the Explorer identifies top-tier opportunities for watershed health and resilience.

Watershed Approaches, Wednesday, February 21, Loramoor B, 2:30-2:50 pm

Montgomery, Rob, Montgomery Associates: Resource Solutions

Changing climate, changing hydrology

Expected changes in climate, such as temperature, duration of frost-free growing season, and precipitation amount and pattern, will drive changes in hydrologic response and landscape processes. Some of these responses are expected with some confidence, such as flooding, increased sediment and nutrient runoff, overwhelmed storm water and waste systems, and resuspension of industrial contaminants. In response, wetland communities may shift to those that favor greater degrees of inundation and that tolerate sediment and nutrient runoff. Flooding may also transport non-native invasive species to areas previously free of them. Other hydrologic responses to climate change, such as changes in lake and pond water levels, are much less certain due to the complexity of hydrologic interaction between variables such as precipitation, evaporation, and transpiration. Evaluating hydrologic response important to wetlands could benefit from a vulnerability approach, which considers in turn the confidence in prediction of climate variable changes, resulting hydrologic response, and the vulnerability of various wetland types to those responses. Additionally, reviewing the hydrology of other areas to our south that now have climate similar to that projected for Wisconsin in the future can be valuable. Understanding the type and confidence in hydrologic response will be important to develop an informed adaptive management plan for wetlands areas.

Symposium Part 1, Wednesday, February 21, Loramoor C, 11:00-11:20 am

Murdock, Evan, Montgomery Associates: Resource Solutions

Scratching below the surface: The uncertain future of groundwater recharge in a changing climate

While a great deal of effort has gone into understanding the impacts of a shifting climate on surface waters, the impacts on subsurface hydrologic regimes has received comparatively little attention. Climate change will alter many key hydrologic variables, including precipitation timing and intensity, soil frost formation, and soil moisture conditions, which will in turn affect water partitioning at the soil surface. What research has been carried out on impacts to groundwater recharge suggests a significant degree of spatial variability, owing to variation in temperature and precipitation regimes. Research carried out at UW-Madison found an increase in groundwater recharge in Wisconsin by midcentury, driven by changes in soil frost formation and winter precipitation patterns. Increased recharge could well result in increases in baseflow and groundwater levels, potentially mitigating some impacts on wetland areas that depend on these features.

Symposium Part 1, Wednesday, February 21, Loramoor C, 11:20-11:40 am

Murphy, Lynnette, Northeastern Illinois University
Pamela Geddes, Northeastern Illinois University

Is native cattail on the decline? A case study in Volo Bog State Natural Area, IL

Volo Bog State Natural Area was designated an Illinois Nature Preserve in 1970 and a National Natural Landmark in 1973. Host to ~25 state-threatened and endangered plant species, Volo Bog remains the southernmost open-water quaking bog in North America. *Typha*, a wetland plant genus commonly known as cattail, is ubiquitous in North American wetlands. In the Midwest, there are three common cattail species: native *Typha latifolia*, exotic *Typha angustifolia*, and a hybrid between native and exotic cattail called *Typha* x *glauca.* Both exotic and hybrid cattails are invasive and aggressively overtake native flora. Through surveys and morphological identification of cattails at Volo Bog, we found that native *Typha latifolia* seems distributed closer to the bog center, while the exotic and/or hybrid occur around the periphery of the bog. Therefore, we hypothesized that lower levels of hybridization may have occurred in native *Typha latifolia* individuals located toward the bog center. We are testing our hypothesis in ten cattail populations using molecular tools (microsatellites), which can detect instances of hybridization that morphological identification can miss. Contrary to expectations, preliminary results show some hybridization among individuals close to the bog's center. Our previous research demonstrated that the native cattail, *Typha latifolia*, may be at risk of extinction via hybridization. If a lower rate of hybridization is located at the bog center, initiatives to preserve *Typha latifolia* seed may be in order if this species is experiencing a decline. Our results highlight two major concerns for managers: 1) morphological identification may lead to errors in cattail species identification and therefore they should be aware of the fact that hybridization seems to be more common than previously thought, and 2) due to high hybridization rates, managment to preserve native *T. latifolia* may be warranted, mostly in wetlands where preservation of floral diversity is a high priority.

Invasive Species II, Thursday, February 22, Loramoor B, 11:20-11:40 am

O'Connor, Ryan, WDNR
Amy Staffen, WDNR

Moving from general to site-level vulnerability of Wisconsin's wetland plant communities

Wisconsin's 30 wetland plant communities are vulnerable to changing environmental conditions, e.g., increased flooding and associated nutrient runoff and sedimentation, changing water budgets, and amplified threat of non-native invasives. While general vulnerability assessments are available for wetland natural communities, functional vulnerability is best evaluated at the site level, where local characteristics may increase or decrease exposure to environmental stressors. Characteristics that influence local vulnerability include position within the local watershed, proportion of natural cover and intact wetlands in the watershed, hydrologic water sources (e.g., deep vs. shallow groundwater aquifers), level of abundance of existing invasive species, and natural buffering capacity for short-term temperature swings as well as extreme precipitation events and short-term droughts. Evaluating and understanding site-level vulnerability is an important step in the process of adaptive management.

Symposium Part 2, Wednesday, February 21, Loramoor C, 1:30-1:50 pm

Ontl, Todd, NIACS/USDA Northern Forests Climate Hub
Danielle Shannon, NIACS/USDA Northern Forests Climate Hub
Chris Swanston, NIACS/USDA Northern Forests Climate Hub

Is your adaptation approach working? The importance of monitoring

Natural resource managers are increasingly recognizing the need to consider climate change impacts in the management of wetland ecosystems. Uncertainty in the variability and magnitude of change of key wetland ecosystem drivers such as ground water and runoff highlight the particular importance of monitoring in managing wetlands. Integrating information on how a changing climate may impact wetlands necessitates information on potential impacts and management responses that intend to reduce climate risks. Effective adaptation does not end there, however. In order to continue to meet management objectives into the future, wetland managers need to determine if these adaptation actions are effective by identifying clear and concise monitoring metrics. I will highlight the importance of monitoring in an effective adaptation plan, provide a description of different types of monitoring, and provide case studies of adaptation projects where monitoring has been used to demonstrate success in meeting management objectives.

Symposium Part 5, Thursday, February 22, Loramoor C, 11:00-11:20 am

Ontl, Todd, NIACS/ USDA Northern Forests Climate Hub
Danielle Shannon, NIACS/ USDA Northern Forests Climate Hub
Chris Swanston, NIACS/ USDA Northern Forests Climate Hub

Overview of adaptation tools and approaches for wetland managers

I will provide an overview of the tools and resources that have been developed for climate change adaptation in wetlands, including the Adaptation Workbook, and will describe climate adaptation efforts in wetland ecosystems that are currently underway. The Northern Institute of Applied Climate Science developed the Adaptation Workbook to assist managers in creating plans that enhance ecosystem adaptability while addressing site-specific management goals. Originally developed for forested systems, the Workbook is increasingly being used by land managers working in non-forested sites, such as wetlands, as new ecosystem-specific resources are being developed. I will highlight wetland-specific climate change adaptation resources, including recently published climate change vulnerability assessments and the newly developed menu of adaptation strategies and approaches for non-forested wetlands.

Symposium Part 4, Thursday, February 22, Loramoor C, 9:50-10:10 am

Panci, Hannah, GLIFWC
Melonee Montano, GLIFWC
Travis Bartnick, GLIFWC
Aaron Shultz, GLIFWC

A vulnerability assessment of wetland plants: Combining scientific and traditional ecological knowledge

The Ojibwe member tribes of the GLIFWC depend on natural resources to meet spiritual, cultural, medicinal, subsistence, and economic needs. Climate change is likely to affect many species' distributions and abundances and, therefore, the ability of tribal members to harvest these resources. We used NatureServe's Climate Change Vulnerability Index tool to assess how climate change may affect species of tribal interest, including many wetland plants. We also conducted interviews to solicit Traditional Ecological Knowledge (TEK) to identify species of concern and record environmental and phenological changes experienced within the cultural memory. Wild rice with a vulnerability score of 20.8 was the most vulnerable of the more than 60 species in the assessment. The average wetland plant vulnerability score was 11.0 (±6.8); the average score of other plant species was 5.1 (±3.8). All of the assessed wetland plant species were above the 50th percentile of vulnerability compared to other plant and animal species in the assessment. Knowledge from TEK interviews confirmed many of our findings. For example, a Mole Lake harvester mentioned that *mashkiigobag* (Labrador tea) is not as abundant as when he was young, and a Lac du Flambeau harvester mentioned that *wii'ike* (sweet flag) is harder to find recently. We found that the combination of Scientific Ecological Knowledge (SEK) and TEK broadened our understanding of climate change impacts on these species and provided very place-based information. Climate change will continue to affect the ability of tribal members to exercise their treaty rights and thus adaptation planning must consider tribal perspectives.

Symposium Part 2, Wednesday, February 21, Loramoor C, 1:50-2:10 pm

Parsons, Matt, Eco-Resource Consulting, Inc.
Stephen Hjort, Eco-Resource Consulting, Inc.
Clayton Frazer, Eco-Resource Consulting, Inc.

Restoring remnant sedge meadow along Sucker Creek at the B. Bruce Krier Conservancy, Ozaukee County, WI

Eco-Resource Consulting, Inc. (ERC) in collaboration with the USFWS, Pheasants Forever, Wisconsin Waterfowl Association, WDNR, and NRCS, is the lead ecological firm charged with planning, permitting, and implementing a 30-acre floodplain wetland restoration project along Sucker Creek at the B. Bruce Krier Conservancy in Ozaukee County, WI. Prior to restoration, the floodplain was degraded from decades of adjacent agricultural activity and resulting mineral sediment accumulation and reed canary grass invasion. ERC facilitated the drafting of a grading plan and oversaw the contract for the excavation of mineral soils from the wetland in the winter of 2012/2013. Several ponds were graded and with native wetland seed and more than 8,000 native wetland plugs were installed along the pond edges. ERC also installed 30 acres of mesic and wet-mesic native seed mixes into adjacent uplands to provide a buffer for the restored wetland. Restoration activities have significantly improved the quality of the Conservancy's wetlands. Native species richness increased substantially from 23 in 2011 to 102 in 2017. The Floristic Quality Index increased from 15.6 (low floristic quality) in 2011 to 36.9 (intermediate floristic quality) in 2017. Relative cover of native species increased from 73.8% in 2014 to 75.3% in 2017. ERC will continue monitoring and maintaining the restoration site using an adaptive management approach. The long-term goals for the Conservancy are to utilize the restored land for wetland science and restoration education and as a source of native seed for use on other restoration projects.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Potter, Kenneth, UW-Madison (retired)

Modeling the frequency and extent of overbank flow of a wetland stream

It has been observed that baseflow dominated streams flowing through wetlands are commonly at or near bankfull, and overflow their banks much more frequently than other streams. However, there is very little published quantitative support for this observation. This study focuses on a reach of Black Earth Creek, a baseflow-dominated stream in Wisconsin. We used one-dimensional hydraulic modeling to estimate bankfull discharge at 50 evenly spaced stream cross sections, 37 of which were in the wetland. We used two-dimensional modeling to quantify the inundation extent as a function of discharge. In both cases, we modeled with and without the sediment deposits that were observed on the streambed. We then used historical streamflow data from two USGS gaging stations to quantify the frequency of wetland inundation. For the case where the sediment was assumed to be present, the frequency of overbank conditions at the 37 cross sections ranged from 3 to 85 days per year, and averaged 43 days per year. For the same case, 10% of the wetland was inundated for an average of 35 days per year. For the case without sediment, the frequency of overbank conditions ranged from 2.6 to 48 days per year and averaged 14 days per year. For this case, 10% of the wetland was inundated for an average of 25 days per year. These unusually high rates of floodplain inundation are likely due to very low sediment concentrations in overbank flows and the absence of lateral stream migration.

Hydrology & Geomorphology, Thursday, February 22, Loramoor A, 9:50-10:10 am

Prestby, Tom, GEI Consultants, Inc.
Sumner Matteson, WDNR
Robert Howe, UW-Green Bay
Amy Wolf, UW-Green Bay

Colonization of a restored island chain by piping plover and other rare species in Lower Green Bay, Wisconsin

The Cat Island Wave Barrier is an ambitious coastal wetland restoration project in lower Green Bay that is using dredge disposals to re-create an island chain. We examine the response of shorebirds and terns to construction of this site as an example of the restoration's resiliency. On standardized point counts in 2013 through 2015, 33 shorebird and 5 tern species were documented using the wetland, including federally endangered Piping Plover (*Charadrius melodus*), federally threatened "rufa" Red Knot (*Calidris canutus rufa*), as well as 11 other conservation concern shorebird species. Piping Plovers breed at the site, representing the first breeding record for the species on Green Bay in 75+ years. Three species of state-endangered terns have successfully bred at the site as well. We detail relationships between these species and the newly available coastal wetland created by placement of dredged material, including responses to adaptive management. This project has many management implications for wildlife and the entire lower Green Bay system. Ongoing management, including adaptive management, will need to balance the needs of many species including shorebirds, terns, colonial breeding waterbirds, and migrant songbirds and waterfowl. These species will benefit from a mosaic of coastal wetland habitat, maintained by strategically planning where vegetation is desirable and undesirable. Managers must adhere to the lessons of other dredge island projects, some of which have proven to be long -term successes and some of which have lost functionality due to invasive vegetation such as *Phragmites*, to maintain and increase the early ecological successes of this project.

Wetland Wildlife, Wednesday, February 21, Loramoor B, 11:20-11:40 am

Prusila, Mike, Lake Co. Stormwater Mgmt. Cmsn.
Glenn Westman, Lake Co. Stormwater Mgmt. Cmsn.
Juli Crane, Lake Co. Stormwater Mgmt. Cmsn.

Lake County's Wetland Restoration and Preservation Plan, part 2: GIS & decision-support tool

This is the second half of a presentation on the Lake County (Illinois) Wetland Restoration and Preservation Plan (WRAPP). I will focus on how the Lake County Stormwater Management Commission (SMC) developed, enhanced, and field-calibrated wetland Geographic Information System datasets to support assessment of 13 functions for mapped wetlands and water bodies countywide at a qualitative level (high, moderate, low, n/a significance ratings). Our approach could be adapted to other locations, particularly where similarly robust data are available. The goal of the WRAPP is to provide a wide audience of end-users (e.g., government, development sector, and the public) with decision-making support to help identify opportunities and prioritize wetland restoration and preservation efforts. The online decision-support tool (DST) is modeled on existing web applications from similar studies. The DST reflects the end-product of the WRAPP wetland mapping and functional assessment efforts and helps achieve the County's goal. The DST has a level of detail that will allow the user to consider even parcel -based restoration and is currently being used for SMC's watershed-based planning efforts. In this presentation, we provide an example of how to use the interactive web-based DST to identify and prioritize wetland restoration and preservation efforts.

Watershed Approaches, Wednesday, February 21, Loramoor B, 2:10-2:30 pm

Richardson, Bree, Kent State University
Lauren Kinsman-Costello, Kent State University
Laura Johnson, Heidelberg University
Kristi Arend, Ohio DNR

25 years of change: Nitrogen and phosphorus removal in a freshwater coastal wetland in the past and present

Excess nitrogen (N) and phosphorus (P) in the Great Lakes stimulates toxic algal blooms that are harmful to the environment, wildlife, and human health. Research has shown that Great Lakes coastal wetlands are able to store N and P to help mitigate eutrophication. However, little is known about how effective natural wetlands are at storing these elements over time. Our objective was to determine the percent N and P retained in Old Woman Creek (OWC), an unaltered wetland along the coast of Lake Erie. OWC surface waters are normally separated from Lake Erie by a sand barrier. However, storm events and other high-energy hydrologic events reconnect the wetland to the lake, causing the water level inside the wetland to decrease. Daily water samples were taken at the inlet and outlet of OWC from October 1988–September 1990 and October 2015–September 2017. We calculated N and P loading into OWC and Lake Erie. We estimated that between October 1988–September 1990, OWC retained 7% and 47% of the nitrate and soluble reactive P, respectively, while releasing 1% of the total P into Lake Erie. Between October 2015–September 2017 OWC retained 19%, 52%, and 42% of the nitrate, soluble reactive P, and total P, respectively. Nitrate loading into OWC decreased 25% between 1988-1990 and 2015-2017 (175,771 kg N and 130,524 kg N, respectively). Soluble reactive P increased by 200% between 1988-1990 and 2015-2017 (580 kg P and 1320 kg P, respectively). Total P also increased by 200% between 1988-1990 and 2015-2017 (7250kg P and 15,550 kg P, respectively). The wetland was disconnected from Lake Erie for an extra 91 days during 2015-2017 compared to 1988-1990. This disconnect increased residences, allowing more time for nutrients to be removed in the wetland.

Long-term Restoration & Management, Wednesday, February 21, Loramoor A, 11:40-12:00 pm

Robson, Julia, Milwaukee County Parks
Ryan Glasford, Milwaukee County Parks
Maxwell Kotelnicki, Milwaukee County Parks

Community and conservation: Studying urban biodiversity in Milwaukee County, Wisconsin

From 2008-2011, the Milwaukee County Department of Parks, Recreation and Culture's (DPRC) Natural Areas Program worked to verify the presence of more than 430 ephemeral wetlands within the Park System's 10,000 acres of natural areas. These temporary wetlands serve as crucial breeding habitat for various species of unique, and often rare, wetland wildlife, including salamanders, frogs, and primary burrowing crayfish. With limited staff time and resources, the DPRC looked to employing the use of citizen science in order to gain a better understanding of what wildlife species were utilizing these ephemeral wetlands throughout Milwaukee County's very urban park system. In 2014, the DPRC created a citizen-based wetland monitoring program, which resulted in the discovery of several rare amphibian populations and of the rarest crayfish in the state of Wisconsin. We will discuss how Milwaukee County Park's award-winning Natural Areas Program utilized citizen science to monitor wetland wildlife and we will protect our unique findings.

Wetlands & People, Wednesday, February 21, Loramoor A, 1:50-2:00 pm

Salas, Dan, Cardno
Johanna Sievewright, American Transmission Co.

Pollinator opportunities within rights of way: Using geospatial and decision modeling to target conservation

As pollinator declines become acknowledged as a conservation concern, public and private entities are equally considering their role in pollinator conservation. American Transmission Company (ATC) has initiated its own pollinator protection program to address these concerns along the approximately 10,000 miles of rights-of-way ATC operates. As part of this program, ATC worked with Cardno to define priorities for landscape conservation across ATC's transmission footprint, which is adding to the science of pollinator conservation by developing a better understanding of how landscape structure influences pollinators. To help ATC achieve its goals, Cardno developed the Pollinator Opportunities Within Rights-of-Way (POWR) model to help identify priority areas for pollinator conservation and provide a tool to inform future conservation decisions related to pollinators. This model identified more than 3,000 miles of high value pollinator habitat. Of this total, 21% occur within emergent wetlands and additional amounts in other wetland types. The findings of this landscape conservation analysis yielded spatial priorities for restoration opportunities and helped define the roles of various transmission work activities in supporting pollinator habitat restoration. We will describe the model and its application, with focus on the contribution of wetlands within these corridors.

Wetland Wildlife, Wednesday, February 21, Loramoor B, 11:40-12:00 pm

Schachameyer, Shea, Northland College
Matt J. Cooper, Northland College
Sarah E. Johnson, Northland College

Resilience & vulnerability of Apostle Islands coastal wetlands to changing hydrology

Coastal wetland vegetation and hydrology are closely linked, and as a result, fluctuating Lake Superior water levels impact vegetation within Apostle Islands National Lakeshore coastal wetlands. Using hydrological data available from NOAA and color infrared aerial photos from 2004, 2010, and 2015, this study compares mean annual lake levels for Lake Superior with vegetation cover type change observed in Stockton, Outer, and Michigan Island coastal wetlands. We compared the percent cover for each vegetation cover class with the mean annual water levels to determine the direction, magnitude, and type of change observed. Overall, results show vegetation resiliency to natural water level fluctuation with some vegetation cover classes remaining stable and others expanding and contracting. For instance, the wiregrass sedge cover class increased in abundance during low water (2004-2010) and decreased in abundance during high water (2010-2015) while the *Sphagnum* and conifer cover classes show less than one percent change across the time series. Individual wetlands do deviate from these overall trends, possibly indicating directional change and a transition from poor coastal fen to a different wetland type. For example, our results showed wiregrass sedge increased in high water (2010-2015) in Michigan island's wetland, but from ground-truthing we concluded an invasion of non-native *Typha* may instead be occurring here. As such, while Apostle Island coastal wetlands show resiliency to normal fluctuations in mean annual water level at a broad scale, results also show vulnerability to invasive species at a local scale.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Scherer, Jeanne, UWEX, WDNR
Tim Campbell, UWEX, WDNR, WI Sea Grant
Jenny Seifert, UWEX, WDNR, WI Sea Grant

Adapting existing methods to reach waterfowl hunters with the Stop Aquatic Hitchhikers! message

Recreational boaters on Wisconsin lakes and rivers are the primary vector of secondary spread for aquatic invasive species (AIS). Outreach programs (e.g., Stop Aquatic Hitchhikers!, Clean Boats, Clean Waters) are designed to educate boaters about their role in preventing the spread of AIS. These programs have effectively raised awareness and inspired boaters to take action. Evaluation efforts indicate that boaters have a high awareness of AIS issues and high compliance with invasive species laws. However, one segment of boaters, waterfowl hunters, uses their watercraft outside of the Memorial Day to Labor Day boating season to access lakes, rivers and wetlands. Hunters that only use their watercraft during hunting seasons may not have been exposed to the Stop Aquatic Hitchhikers! message. By adapting existing outreach methods, the Wisconsin Aquatic Invasive Species partnership has reached thousands of hunters through media and in-person contacts. The Clean Boats, Clean Waters survey, used by boat inspectors during the summer to evaluate boater behavior, was repurposed for the 2017 Waterfowl Hunter AIS Campaign with questions designed to evaluate hunters' understanding of the AIS Law and how it applies to their sport. Over 800 in-person hunter contacts were made by boat inspectors during the September duck hunting openers. Initial results suggest that waterfowl hunters welcomed contacts at their access points and the hunter-related focus on how they can help prevent AIS from spreading in our lakes, rivers, and wetlands. Ongoing training and planning will occur in 2018 to help inspectors be more successful in their outreach efforts, since the needs of waterfowl hunters are different than those of the standard recreational boater.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Schultz, Rachel, UWSP
Jacob Straub, UWSP

Influence of hydrologic restoration techniques on plant communities in the Glacial Habitat Restoration Area

To reverse wetland loss and regain essential habitat for wetland specialists such as waterfowl and marsh birds, numerous partners have joined to implement landscape-level restoration projects such as the 558,879-acre Glacial Habitat Restoration Area (GHRA) in southeastern Wisconsin. We sought to assess restored plant communities and evaluate associated wetland characteristics at various spatial scales using multivariate analysis. We randomly selected restored wetlands based on hydrologic modification type (e.g., scrape, ditch plug, water control structure/berm) and included two separate reference groups: Waterfowl Production Areas (WPAs) and sites not modified with basins. In summer 2017, we surveyed plant communities on 28 wetlands restored between 1988 and 2011 and on 10 reference wetland properties within the GHRA using the timed meander protocol developed by the WDNR. We recorded approximately 270 native plant species and 80 introduced species in 191 surveys of 6 community types classified using the Wisconsin Natural Heritage Inventory of Natural Communities. On average, the invasive plant species reed canarygrass, narrow-leaf cattail, and hybrid cattail constituted approximately 62% of the southern sedge meadow communities and 70% of the emergent marsh communities we surveyed. We found greater floristic quality of emergent marsh communities on sites not modified with scrapes and those restored using ditch modification in addition to scrapes than on sites modified with scrapes combined with water controls structures and/or berms and the WPAs. Our preliminary results indicate that wetland characteristics associated with different methods of restoring hydrology could influence resilience to invasive species and habitat for wetland-dependent species.

Long-term Restoration & Management, Wednesday, February 21, Loramoor A, 10:40-11:00 am

Shannon, Danielle, NIACS

Climate change risk management: Introduction to adaptation in planning and decision-making

Confronting the challenge of a changing climate presents opportunities for managers and other decision-makers to plan ahead, manage for resilient landscapes, and ensure that the benefits wetlands provide are sustained into the future. Over the next several decades, projected climate change will challenge the long-term stability of our water resources. Given these challenges, it is important for land managers and conservation organizations to be forward-looking, flexible, and responsive to ongoing changes and to consider site-specific risks, opportunities, and ways to adapt. I will introduce key climate change adaptation concepts necessary for planning: addressing uncertainty, thresholds of change, and risk-management options.

Symposium Part 4, Thursday, February 22, Loramoor C, 9:30-9:50 am

Smith, Christopher, WDNR
Amanda Minks, WDNR

Potential wetland indicators mapping: A new approach

As a customer service measure, WDNR presented a map layer displaying "wetland indicators" on their Surface Water Data Viewer to be viewed in conjunction with the "wetlands" layer showing existing wetlands mapped by the Wisconsin Wetland Inventory (WWI). The idea was to help landowners and other users identify wetlands in an area of interest to determine whether a wetland permit may be needed for land development projects. Because some wetlands are missed on the WWI, the "wetland indicators" layer was added to flag areas where the soils indicate a wetland may be present and a delineation may be warranted. The original technique for identifying "wetland indicator" soils was to use NRCS soil data to map complete soil map units with a drainage class of "very poorly drained," "poorly drained" and "somewhat poorly drained." This has proven to be problematic, particularly with regard to mapping all of "somewhat poorly drained" soil map units as wetland indicator soils. Several approaches were investigated to address these errors of commission. The chosen technique presented here was to use additional NRCS soil data fields, such as "potential wetland soil landscapes" and "% hydric" to reduce the number of soil map units that are considered. The "compound topographic index," a measure of likely flow accumulation and ponding, was applied to these areas. The final result is a set of soil polygons that are more likely to support wetlands. This technique is currently under review by an expert team.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Staffen, Amy, WDNR

Preparing Wisconsin's wetlands for a changing world: Pioneers in adaptation share their stories

A common barrier to climate change adaptation for wetland managers is the translation of available literature and research into practical on-the-ground actions. We hope to begin breaking down this barrier by learning about adaptation practices applied within the context of real-life examples. Three panelists will present overviews of their work in incorporating adaptation considerations into management of wetlands. The audience will then be given the opportunity to engage these early adapters during a facilitated question-and-answer period. Our panelists: Nicholas Koltz has worked for WDNR for 17 years and is currently a forester based in Janesville. Nick will talk about how he is addressing the increasing threat of Emerald Ash Borer to forested wetlands in southern Wisconsin by underplanting species that are projected to fare best in southern Wisconsin. Gary Sullivan is Senior Restoration Ecologist for The Wetland Initiative, a conservation non-profit in Illinois that plans and implements wetland restorations in partnership with both public and private organizations. Gary will discuss how periodic monitoring of wetland restoration projects helps assess efficacy of adaptation approaches. He will also answer questions on his earlier symposium presentation on wetland restoration projects. Abigail Derby Lewis is the Chicago Region Senior Program Manager for the Chicago Field Museum. Abigail will share examples of how she and her colleagues partner with natural resource managers at the local, state, and regional levels to develop specific adaptation strategies as well as identify priorities for management. Facilitator Amy Staffen is an ecologist with WDNR.

Symposium Part 5, Thursday, February 22, Loramoor C, 11:20-11:40 am

Staskowski, Nicole, Cardno
Nayo Parrett, American Transmission Company

Restoration of boreal forest wetlands in Superior, Wisconsin: 10-years post construction monitoring

American Transmission Company is completing a 120-acre restoration project in compensation for forested wetland conversion impacts along a new transmission line in northwestern Wisconsin. The restoration project activities are three-fold: removal of aggressive woody species, planting of boreal forest tree species, and monitoring to assess the success of conversion. The first two activities, the removal of aggressive woody species and planting of appropriate boreal forest species, took place over the first four years of the restoration. Woody vegetation targeted for control as part of this phase includes trembling aspen (Populus tremuloides), speckled alder (Alnus incana), and various willow (Salix) species. Woody removal activities included cut stump treatment, forestry mowing, and targeted herbicide treatment. Native boreal forest species were targeted for planting across the site. In the wetland areas, these include black spruce (Picea mariana), tamarack (Larix laricina), and northern white cedar (Thuja occidentalis); in the upland islands these include white spruce (Picea glauca), white pine (Pinus strobus), balsam fir (Abies balsamea), and northern white cedar. Restoration work and monitoring began in 2008 and continued through 2017. The goal of the project is to set the successional trajectory of the site to support an assemblage of boreal forest tree species within 10 years. This is largely measured by the survival of trees and reduction of invasive species across the site. In addition to the boreal forest conversion monitoring, the project also improved habitat for populations of the State Threatened arrowhead sweet colt's foot (*Petasites sagittatus*) and tea-leaved willow (*Salix planifolia*) on the site.

Long-term Restoration & Management, Wednesday, February 21, Loramoor A, 11:00-11:20 am

Sullivan, Gary, The Wetlands Initiative
Izabella Redlinski, The Field Museum
Anna Braum, The Wetlands Initiative

Lessons from the field: Pre-adapting restorations to ongoing climate change: assessing tools, lessons learned, and future challenges

At the Wetlands Initiative since 2011, we have been altering our wetland restoration strategies to address ongoing and future changes in climate. Our goal has been to develop projects that resist ecosystem change, are resilient and stable in the face of ongoing change, and that evolve to survive the unavoidable changes to come. Here I outline the approach we took on a 166-acre wetland restoration project that took climate change into account and present information on how the project evolved over a period of five years. I will discuss how we chose the site, altered the topography to restore a stable and functional wetland hydrology, developed resilient plant communities to support a broad range of species and functional groups, enhanced genetic diversity and adaptability, and incorporated an adaptive approach to managing ecosystem development. Based on plot data between 2011 and 2016, native cover increased 213%, native diversity increased 117%, wetland plots increased 356%, and FQI increased 161%. Based on satellite imagery, wetland area increased 551% (from 20.6 to 113.5 acres). Ground water monitoring wells also indicate long-term improvements in hydrology. Although this restoration is still developing and it will be many years before we can completely judge the efficacy of these efforts, we are incorporating these techniques into ongoing restoration work in the region. However, despite initially positive results, it becomes increasingly clear that additional factors need to be considered on multiple levels, from landscape position and habitat complexity to the sourcing of genetic material from areas whose climate more closely resembles that predicted for the future.

Symposium Part 4, Thursday, February 22, Loramoor C, 10:10-10:30 am

Sulman, Joshua, Stantec Consulting Services Inc.

Taxonomic changes to Wisconsin *Sparganium*: A new regional treatment of cattail and bur-reed

Sparganium (bur-reeds), with 8 species in Wisconsin (10 in North America), is one of the more diverse, and confusing, aquatic plant genera in our flora. In a new taxonomic treatment of *Typhaceae* in the New Manual of Vascular Plants of Northeastern United States and Adjacent Canada, we present a new key and descriptions of the species based on recent phylogenetic advancements. Molecular studies have given us renewed insights into species relationships, biogeography, and morphological variability in Sparganium. These insights have direct consequences for the Wisconsin wetland flora. *Sparganium emersum* (widespread from Eurasia to western North America) is excluded and *S. acaule* (an eastern North American endemic originally described over 100 years ago) is resurrected in its place. Molecular results indicate that *S. acaule* is sister to *S. glomeratum* (WI-Threatened), and only distantly related to *S. emersum*. A calibrated molecular clock analysis showed that the *S. acaule* and *S. emersum* lineages likely diverged over 5 million years ago.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Tharpgeorge, Samuel, Northland College
Jena Miles, Nortland College
Hannah Hoff, Nortland College
Matthew Cooper, Nortland College
Sarah Johnson, Northland College

Long Island wetland response to changing Lake Superior water levels

Lake Superior's Apostle Islands National Lakeshore contains floristically diverse and unique coastal wetlands. Long Island, one of the more dynamic islands, has coastal wetlands at different successional states, providing a natural experiment for tracking change among different wetland types. To monitor plant community composition and structure in response to changing water levels, J. Meeker established eight long-term monitoring transects (15-100m) on Long Island in 1996-97 and resurveyed these in 2002 and 2010. Lake Superior sustained below average water levels from 1997 to 2013, followed by four years of above average water levels. We resurveyed the Long Island transects in 2017 to discern the direction and magnitude of vegetation changes in relation to fluctuating water levels. Our preliminary analysis indicates that *Sphagnum*-rich peatland sites had lower rates of change in population and community metrics than other wetland community types on Long Island. Sites classified as sedge meadow and wet sand panne declined in species richness (up to 53%) as they shifted to wet-meadow communities during the drought period. Water levels at those sites are now up to 66 cm and emergent sedge and aquatic species dominate, and species richness has not yet returned to pre-drought levels. Wetlands where alder (*Alnus incana*) flourished during low lake levels have transitioned toward an open marsh habitat with standing dead alder. These data demonstrate the dynamic nature of these coastal wetlands and suggest that some wetland types are more resilient than others to environmental change such as water level fluctuations.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Thompson, Alice, Thompson & Associates Wetland Svcs.
Tim Ehlinger, UW-Milwaukee

Lessons from the field: Changes in water resources

Beginning in the 1880s, the Pike River in southeastern Wisconsin was dredged and straightened to improve agricultural drainage. The channel was disconnected from its floodplain, wetlands were drained and filled, prairies were plowed, and fish passage was blocked. Towns and villages grew up alongside an altered, low functioning river with flashy flows, poor water quality, and degraded fisheries. Accelerating urban development in Mt. Pleasant since the 1970s resulted in increased flood frequencies and magnitudes, impacting the village, downstream communities, and ultimately Lake Michigan. Climate change amplifies the impact of these existing threats to the river in several important ways: 1) More frequent and intense storm events increases the threat of flooding, which is further exacerbated by the degradation of riparian wetland buffers and stream channelization; 2) These same storm events magnify sediment and nutrient transport into the stream; 3) Winter precipitation in the form of rain may fall on frozen ground, further contributing to nutrient runoff. The Mount Pleasant Pike River Restoration Plan (1998) was implemented in nine phases from 2002-2016 and resulted in 5.6 miles of restored meandering river and floodplain. The project has created a wetland and prairie corridor along the river by creating native vegetation and by reconnecting wildlife and fisheries to the river and urban green space. While flooding drove the impetus for the project, the resulting ecological landscape has become a community resource. This project demonstrates how wetland and riparian restoration can alleviate the collective threats of urbanization and climate change.

Symposium Part 1, Wednesday, February 21, Loramoor C, 11:40-12:00 pm

Thompson, Alice, Thompson & Associates Wetland Svcs.
Tod Highsmith, WWA Board
Mike Mossman, WDNR (retired)

Using poetry to express our human connection to wetlands

"*Like the heron, who can only croak, who wishes he could sing, I wish I could sing*." Mary Oliver. Wetland poetry reflects our connection with wetlands and water in ways that science cannot adequately define. Poetry can express our heart leap as the great blue heron lifts off the water, the spring sound of a thousand frog calls, or the secret worlds hidden under a water lily leaf. We will present poetry by various authors, including original material. Authors may include Mary Oliver, Lorine Niedecker, Wendell Barry, Mary Linton, Basho, Liu Zongyan and others.

Alice Thompson, Tod Highsmith, and **Mike Mossman** put aside their scientific credentials and read wetland poetry. This is becoming an annual event that was initiated by Mary Linton, retired WWA board president, wetland biologist, and poet.

Wetlands & People, Wednesday, February 21, Loramoor A, 2:30-2:50 pm

Tillman, Stephen, U of Illinois at Urbana- Champaign
Greg Spyreas, U of Illinois at Urbana-Champaign
Jeffrey Matthews, U of Illinois at Urbana-Champaign

Comparing the plant communities in wetland mitigation banks to those in natural wetlands

Wetland mitigation banks are the USACEs' preferred method of compensation for wetland impacts, and the banking industry has become well-established in the last three decades. To acheive the goal of no-net-loss of wetlands, banks must produce plant communities that are similar to those in natural wetlands. In 2017 we collected plant species cover data from emergent and wet meadow habitats in 20 wetland mitigation banks (from 9 to 24 years old) in the Chicago region. We compared these to 115 randomly-selected natural wetlands that reflect ambient levels of degradation in Illinois, which we ranked by floristic quality metrics into groups of high, medium, and low quality. We also compared banks to 16 high-quality reference wetlands with minimal degradation. In banks, the average native mean coefficient of conservatism was 3.8 in emergent sites and 3.5 in wet meadows, and was most similar to medium quality natural wetlands. In wet meadow sites, the average relative importance value (the average of relative frequency and relative cover) of native species in banks was 71.3%, and was most similar to medium quality natural wetlands. In emergent wetlands in banks, this value was lower (52.1%), due partly to 30.5% relative cover of *Typha angustifolia*. Banks consistently scored lower than high-quality reference sites for several measures of floristic quality. Our results provide an important assessment of the ecological condition of banks that have passed their required 5-year monitoring period. Our results indicate that banks have produced plant communities that are most like natural wetlands of medium quality and that generally outperform low quality natural wetlands, but fall short of high quality reference sites.

Wetland Flora & Plant Communities, Wednesday, February 21, Loramoor B, 4:40-5:00 pm

Trochlell, Patricia, WDNR (retired)
Thomas Bernthal, WDNR

Monitoring the effectiveness of invasives control at Pheasant Branch Conservancy using timed meander surveys

We outline wetland invasive control efforts in the Dane County portion of the Pheasant Branch Conservancy from 2010 to the present. We will also evaluate monitoring data gathered through timed-meander surveys to assess the effectiveness of control measures and the response of the native plant assemblages. Control efforts initially were focused on three main control zones with particular goals: removal of reed canary grass (*Phalaris arundinacea*, RCG) at the Fredericks Springs; removal of invasive shrubs to restore sedge meadow in the ditch fill and adjacent areas; and removal of invasive shrubs to restore sedge meadow on the west side of the Acker stream. Timed-meander surveys were conducted to establish baseline condition before treatment. Control methods included winter cutting and treating shrubs with triclopyr; spot treatment of RCG at flowering; and summer cutting and treating of cattail, small clusters of Phragmites, and widely scattered purple loosestrife (*Lythrum salicaria*). Spring prescribed burning has been conducted the last two years in two sedge meadow zones. As control efforts took place, surveys were conducted in the subsequent field season. Results at the Fredericks' Springs showed dramatic improvement in both weighted Mean C and weighted Floristic Quality Index, while trends in the other zones were positive but appear to be reaching a plateau.

Invasive Species II, Thursday, February 22, Loramoor B, 11:40-12:00 pm

Vimont, Daniel, UW-Madison
David Lorenz, UW-Madison
Michael Notaro, UW-Madison

Climate change and adaptation in Wisconsin

Climate is changing in Wisconsin. This presentation will outline some of the historical climatic changes that Wisconsin has experienced over the last several decades and will introduce expected changes in the coming century. These changes are assessed in a probabilistic downscaled data set that enables realistic representation of extremes, which are often more consequential for impacts than expected changes in mean variables. I will discuss few potential changes, with a focus on variables that are important for wetlands and water resource management.

Symposium Part 1, Wednesday, February 21, Loramoor C, 10:40-11:00 am

Vujanovic, Michael, Northeastern Illinois University
Jennifer Slate, Northeastern Illinois University
Zak Zillen, Northeastern Illinois University
Ryan Pierce, Analytics Lounge
Peter Zieba, Analytics Lounge

Diatoms epiphytic on *Sphagnum* moss in midwestern quaking bogs: Use as paleolimnological indicators

Volo Bog is surrounded by a rural area that is progressively becoming suburbanized, and it is important to look at how the changes to the areas around Volo Bog are affecting the bog over time. Volo Bog is a unique habitat due to its floating mat of *Sphagnum* moss, on which microscopic organisms such as diatoms live. These epiphytic diatoms can also be recovered from *Sphagnum* samples preserved in museums, providing a record of environmental conditions at the time of collection. To determine their potential as indicators for Volo Bog conditions in the past, we compared epiphytic diatoms from herbarium *Sphagnum* samples to diatoms growing on *Sphagnum* in quaking bogs today. We also compared the epiphytic assemblages to diatoms in nearby bog sediments. From a 100-km radius spanning parts of Wisconsin, Illinois, and Indiana, we collected live *Sphagnum* samples from Beulah Bog, Volo Bog, and Pinhook Bog. The herbarium samples, collected from the same region over the past one hundred years, were obtained from the Field Museum of Natural History. Diatoms were plentiful on both the live and herbarium *Sphagnum* samples, and were dominated by *Eunotia nymanniana*, *Eunotia paludosa*, and *Pinnularia hilseana*. These diatoms could be used to infer the quality of the water in which they are found. Because herbarium samples are labeled with the date of collection, our results also show the potential of using epiphytic diatoms to infer recent anthropogenic impact that humans have made over the years.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Webster, Bobbie, UW-Green Bay
Lisa Grubisha, UW-Green Bay

An adaptive management approach to treatment of Phragmites in northeast Wisconsin wetlands

Non-indigenous populations of the common reed, *Phragmites australis*, have invaded shorelines and wetlands across the Great Lakes, reaching locally epidemic levels in northeast Wisconsin. Dense stands of *Phragmites* negatively affect the biodiversity and ecological functions of invaded habitats, impair the recreational use of wetlands and shorelines, decrease property values, and increase fire risk. Effectively managing invasive species such as *Phragmites* is a high priority for habitat and wetland restoration. Over the past ten years, and most intensely during the last five, millions of dollars have been spent to treat thousands of acres of *Phragmites* in northeast Wisconsin. Nevertheless, we still lack clear recommendations for both initial and follow up treatments, mechanisms for evaluating success or failure of treatment efforts on a regional scale, and a standardized assessment protocol. UW-Green Bay researchers are working to increase scientific understanding of *Phragmites* population control and, in collaboration with the *Phragmites* Adaptive Management Framework, to promote an adaptive management approach to the restoration of *Phragmites*-invaded wetland communities in the Great Lakes region. These efforts, funded by WDNR, will include an on-line information clearinghouse, experimental *Phragmites* treatments, and field assessments and analyses of previous treatments, including the effects of *Phragmites* invasion on native plant and microbial communities. The focus of our presentation will be preliminary results of these field assessments of previously treated wetlands conducted during the 2017 field season. These results will encompass a broad summary of existing *Phragmites* treatments in northeast Wisconsin.

Invasive Species I, Thursday, February 22, Loramoor B, 10:10-10:30 am

White, Cheryl, Waukesha County Land Conservancy
Michele Kille, The Nature Conservancy

Partnering to successfully secure an in-lieu fee project

We will share the experiences of the Waukesha County Land Conservancy (WCLC) and The Nature Conservancy in successfully partnering to secure in-lieu fee project funding. WCLC was awarded an $886,000 contract from WDNR to restore its 52-acre Davis Property west of the Village of Mukwonago to a highly functioning wetland. WCLC secured the contract, one of the first of several awarded by the Wisconsin Wetland Conservation Trust Program, with assistance from The Nature Conservancy. We will briefly highlight key success factors and lessons learned related to identifying the project, assembling the project team, and applying for the funding. We will provide the perspective of a smaller land trust as we identified project risks, gained support and approval from our board of directors, and assembled a team to approach a large-scale project such as this.

Identifying and Implementing In-Lieu Fee Mitigation Projects, Thursday, February 22, Loramoor A, 11:40-12:00 pm

Woods, Brock, UWEX/WDNR
Jason Granberg, WDNR

Help protect our wetlands from tall manna grass

Tall manna grass (*Glyceria maxima*) is a large, aggressive, exotic grass that can have disastrous effects on our wetlands by eliminating all its native competition. Tall manna grass is most prevalent in southeastern Wisconsin where it was first reported in 1975, however several outlying populations have also been found in northern and northeastern counties. WDNR has received federal grants to work primarily in its Great Lakes watersheds—where most stands are found—to find, map, and begin to eliminate or reduce populations. Extensive mapping of stands in SE counties took place in 2017 and we will show all known sites. We have begun to treat in experimental and satellite infestations. Goals are to determine the best chemical control method, reduce tall manna grass' presence where possible, and use outreach to ensure that future local efforts can maintain cleared areas and stop further dispersal. You can help by learning to identify this species (since it is often mistaken for a similar native), understanding where it currently exists, reporting any new sites you see, and educating others about avoiding stands with small seeds that are easily transported on footwear.

Poster Session, Wednesday, February 21, Grand Ballroom, 5:00-6:30 pm

Zuckerberg, Benjamin, UW-Madison

Understanding the vulnerability of wetland-dependent wildlife to climate change

The mission of the WICCI is to generate and share information that can limit vulnerability to climate change in Wisconsin and the Upper Midwest. As part of WICCI, the Wildlife Working Group has the responsibility of assessing the impact of climate change on the abundance, distribution, and diversity of the state's wildlife populations. For the past several years, the Wildlife Working Group organized a series of workshops with managers across the Midwest to identify species that are of high conservation concern and conducted research to identify how these species are sensitive to past and future climate change. One such species is the wetland-dependent Eastern massasauga rattlesnake (*Sistrurus catenatus*), a federally threatened species that lives in wet prairies, marshes, and low areas along rivers and lakes. Using a series of population models, we found that winter drought and extreme rainfall during summer negatively impact the survival of these rattlesnakes and that their range is likely to contract in the future due to climate change. Climate change vulnerability provides a framework for linking demographic and distributional dynamics to environmental change and can provide unique information for conservation planning. The next step of the WICCI Wildlife Working Group is to develop a comprehensive menu of management actions to help managers incorporate climate change adaptation into their plans.

Symposium Part 3, Wednesday, February 21, Loramoor C, 4:40-5:00 pm

PRESENTER BIOGRAPHIES

Andrew Badje (andrew.badje@wisconsin.gov) is a conservation biologist with the WDNR's Bureau of Natural Heritage Conservation. Andrew received a bachelor's in Biological Aspects of Conservation and a Geographic Information Systems Certificate from UW-Madison. His current work involves the inventory, monitoring, and management of Wisconsin's amphibians and reptiles.

Tom Bernthal (thomas.bernthal@wisconsin.gov) is the wetland assessment and monitoring coordinator for WDNR. Tom has developed and applied wetland assessment and monitoring tools across a full range of scales, from the coarse landscape level (using available GIS and remote sensing information) to the intensive site assessments of wetland plant communities and functions.

Gary Casper (gc@greatlakeseco.com) is an associate scientist at the UW-Milwaukee Field Station, an adjunct of the graduate faculty at UW-Green Bay, and an associate editor for the Natural Areas Journal and Herpetological Conservation and Biology. He researches wildlife conservation, inventory, and monitoring throughout the Great Lakes Region.

Sara Comstock (Sara.A.Comstock@uwsp.edu) has a bachelor's in wildlife ecology and management with a minor in biology from UWSP. Sara has a strong interest in waterfowl and wetland research and management of habitat. Having graduated in December, she hopes to start her professional career in waterfowl and wetland management this spring.

Juli Crane (jcrane@lakecountyil.gov) works for Lake County Stormwater Management Commission as a principal wetland specialist. Juli's background is in vegetation with a degree in fisheries and wildlife. She is a professional wetland scientist.

Shelby Cronce (secnorc@gmail.com) graduated with a bachelor's in biology from UW-Whitewater in 2017. In addition to the Fassett's locoweed study, she has worked on species distribution mapping, performed data validation and statistical analyses, and conducted field botanical surveys.

Peter David (pdavid@glifwc.org) is a wildlife biologist with GLIFWC, where he assists GLIFWC's member tribes in the implementation of their off-reservation, treaty-reserved rights. He received his education (bachelor's and master's in wildlife ecology) from UW-Madison, and from the tribal elders and members for whom he has worked for the last 30+ years.

Maria DeLaundreau (dela0271@umn.edu) is earning a master's in natural resources at the University of Minnesota and has been tromping and boating through riparian wetlands for most of her career to improve habitat and conduct forest restoration experiments. She has a bachelor's in biology from Lawrence University and is excited to be helping land managers by researching management techniques.

Ankur Desai (desai@aos.wisc.edu) is associate chair and professor of the Atmospheric and Oceanic Sciences Department at UW-Madison, holds the Ned P. Smith Professorship of Climatology, and faculty affiliates of the Nelson Institute Center for Climatic Research, Nelson Sustainability and Global Environment center, and the UW Freshwater and Marine Sciences program.

Elaine Ferrier (eferrier@glc.org) is a senior program specialist with the Great Lakes Commission where she assists with the coordination of the Great Lakes Phragmites Collaborative. She holds a master's in environmental studies degree from the University of Waterloo and a bachelor's in environmental studies with a specialization in policy and law from Trent University.

Sarah Fuller (sfuller3@wisc.edu) is a master's student at UW-Madison in the department of biological systems engineering. She is pursuing a master's in both natural resources engineering and water resources management. Her graduate work has focused on addressing phosphorus water quality issues in Wisconsin, and she has thoroughly enjoyed her field work kayaking to collect water samples in the wetlands of Green Lake.

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

Pamela Geddes (p-geddes@neiu.edu) is an associate professor in the Dept. of Biology and the Environmental Science Program at Northeastern Illinois University, where she teaches 10 courses and does research on wetland plant invaders. Pam completed her bachelor's and master's at Florida International University and her Ph.D. at University of Chicago. She did her post-doc at Loyola University Chicago.

Melissa Gibson (Melissa.Gibson@wisconsin.gov) received her bachelor's in biology from Grinnell College in Iowa and her master's in botany from the UW-Madison in 2001. Her work in the WDNR's Water Quality Bureau is focused on wetland floristics.

PRESENTER BIOGRAPHIES

Jim Giglierano (jim.giglierano@wisconsin.gov) is the geographic information officer for the WDOA, Wisconsin Land Information Program, which provides funding and assistance to county land information programs that maintain most of the high quality GIS data in the state. Prior to moving to Wisconsin in 2015, Jim was a geologist working for the Iowa Geological and Water Survey.

Patrick Goggin (pgoggin@uwsp.edu) works with the Wisconsin Lakes Partnership team, collaborating on trainings and materials for lake lovers. He helps lake groups, shares management resources, and aids in the understanding and appreciation of the native flora found on lakeshores. He is with the UWSP College of Natural Resources and the UWEX Lakes team out of the WDNR office in Rhinelander.

Grace Graham (grace.graham@wgnhs.uwex.edu) is a geologist at the WGNHS. She received a bachelor's in environmental geology from Beloit College.

Jason Granberg (Jason.Granberg@Wisconsin.Gov) is a water resources management specialist at WDNR. Funded by the Great Lakes Restoration Initiative since 2014, he has been working on wetland invasive species monitoring and control efforts. He is also an ecological modeler working on invasive species record systems and developing tools for invasive species issues.

Aletha Hefko (hefkoa821@myemail.northland.edu) is an undergraduate student at Northland College in Ashland WI, working towards a bachelor's in natural resources with a focus on ecological restoration and a bachelor's in water science with a focus on water resources. She has been an intern at the Mary Griggs Burke Center for Freshwater Innovation for the past two summers, studying nutrient limitation patterns in Lake Superior coastal wetlands.

Liliana M. Hernandez (lhernandez@u.northwestern.edu) is a third-year PhD student in environmental engineering at Northwestern University working with Dr. Aaron Packman. She is from Puerto Rico, where she graduated with a bachelor's in civil engineering. In 2016, Liliana received the NSF-GRFP award to conduct research monitoring green spaces around Chicago to determine their ecosystem services, especially for stormwater retention.

Heather Jensen (jenseh506@myemail.northland.edu) is a senior studying at Northland College in Ashland, WI. She is majoring in both natural resources and biology with an emphasis on ecological restoration. This past summer she was employed through the Mary Griggs Burke Center for Freshwater Innovation as a research technician, where she worked on collected data for the Chippewa Flowage Aquatic Plant Management Plan.

Sarah Johnson (sjohnson@northland.edu) is an associate professor of natural resources at Northland College. She received a Ph.D in Botany from UW-Madison. She researches the signatures and causes of ecological change of plant communities in the upper Midwest and Great Lakes region and serves on the WICCI Plants and Natural Communities Working Group. She enjoys getting her undergraduate students out into the field often.

Michael Jones (michael.jones@mohican-nsn.gov) is the wetland specialist for the Stockbridge-Munsee Community. He previously worked as an environmental scientist for Tetra Tech. He received his bachelor's in biology and wildlife ecology from UWSP and his master's in wildlife and fisheries resources from West Virginia University.

Alissa Kakatsch (akaka633@uwsp.edu) is an undergraduate at UWSP, majoring in general resource management. She has a strong interest in wetlands and habitat management. Along with doing research at Horicon Marsh throughout the summer of 2017, Alissa has dedicated many volunteer hours at the WDNR education center located in Horicon, Wisconsin.

William Kiser (kiser.william@uwlax.edu) is a biologist for the USFWS where he works with landowners to restore habitat of private lands as a part of the Partners for Fish and Wildlife Program. William received his bachelor's from Ohio University in 2004 and is completing his master's at UW-La Crosse.

Lori Knosalla (knosa003@umn.edu) is a graduate student at the Univeristy of Minnestoa working towards a master's in natural resource management and conservation with a minor in ecological restoration. Lori's graduate research is conducted in partnership with the Minnesota DNR, where they are investigating how seasonality of prescribed burning impacts lowland brush ecosystems in northern Minnesota.

Adrian Koski (adrian.koski@cityofracine.org) is a grant coordinator/research assistant at the City of Racine Health Department. He has a bachelor's in geoscience from UW-Parkside and a master's in freshwater sciences from UW-Milwaukee. His interests include recreational water quality, community outreach, habitat restoration, and data analysis.

PRESENTER BIOGRAPHIES

Sarah Kraszewski (sarah.kraszewski@stantec.com) is a professional wetland scientist and an environmental scientist at Stantec. She researched dry prairies for her bachelor's and master's thesis projects. Sarah has spent the last 12 years focusing on prairie, savanna, and wetland restoration, and much of her current workload is dedicated to wetland mitigation implementation and assessment.

Brian Lennie (brian.lennie@stantec.com) is an associate/senior scientist and has been with Stantec since 1994. He earned his bachelor's from UW-Madison in 1992. Brian assists clients with early identification of environmental issues (developing alternatives to minimize impacts), coordination with regulatory agencies, and preparation of permit applications. Brian has completed the US ACOE and the WDNR/SEWRPC wetland delineation training programs.

Zack Loken (Zachary.J.Loken@uwsp.edu) is an undergraduate at UWSP with a wildlife ecology and management major and a GIS and spatial analysis minor. Zack has a strong interest in the practice of ecosystem restoration on privately owned lands and is a waterfowl enthusiast and advocate of species management.

Kyle Magyera (kyle.magyera@wisconsinwetlands.org) is a local government outreach specialist for the Wisconsin Wetlands Association, where he primarily develops tools and trainings to help Wisconsin communities improve consideration of wetlands in land use policy, planning, and implementation. He holds two master's: urban and regional planning and water resources, both from UW-Madison.

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 UWSP and his master's in biology from Ball State University.

Nick Miller (nmiller@tnc.org) is the science director for The Nature Conservancy in Wisconsin and integrates 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 and developing associated online decision support tools.

Rob Montgomery (rob@ma-rs.org) is the principal of Montgomery Associates: Resource Solutions and became interested in water and the environment when he was growing up in suburban Chicago looking at the sad condition of the Des Plaines River and volunteering at a nature center. Education at the University of Illinois and Colorado State gave him the tools to pursue 40 years of work in the field of water resource engineering, and he still likes the subject.

Evan Murdock (evan@ma-rs.org) is with Montgomery Associates: Resource Solutions. His lifelong interest in aquatic systems was born in the tide pools of Southern California and blossomed in Minnesota's Boundary Waters Canoe Area Wilderness. He received his doctorate from the Nelson Institute for Environmental Studies at UW–Madison, where he studied the impacts of climate change on water resources in the Midwest.

Lynnette Murphy (lmurphy1@neiu.edu) is a student at Northeastern Illinois University in Chicago, IL, pursing a bachelor's in environmental science. Selected to participate in a competitive summer research experience at NEIU under the mentorship of Dr. Geddes during the summer of 2016, Lynnette has continued to work on research pertaining to an invasive wetland plant genus, *Typha*, alongside her undergraduate studies.

Ryan O'Connor (ryan.oconnor@wisconsin.gov) is an ecologist and coordinates and conducts biotic inventories of natural communities for the WDNR's Natural Heritage Conservation program. 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.

Todd Ontl (tontl@fs.fed.us) is a USDA Climate Hub fellow whose work focuses on helping natural resource managers integrate climate change into their management decision-making for forested and wetland ecosystems. His background is in restoration ecology and plant-soil interactions. Prior to his current position, he was a postdoc studying climate change impacts to northern peatland ecosystems.

Hannah Panci (hpanci@glifwc.org) is a scientist in the Climate Change Program at GLIFWC. She spent a lot of time outdoors in avian field biology jobs before getting a master's from the University of Minnesota-Duluth and starting work at GLIFWC. Her primary projects at GLIFWC include a seed bank pilot project, a phenology study, and a vulnerability assessment.

Matt Parsons (mparsons@eco-resource.net) is a senior ecologist at Eco-Resource Consulting specializing in wetland delineation and ecological restoration. Matt received his master's in ecology from Utah State University in 2008 and his bachelor's in forestry from UWSP in 2005. Matt is a certified wetland delineator, an ESA certified ecologist, and a SER certified ecological restoration practitioner.

PRESENTER BIOGRAPHIES

Kenneth Potter (kwpotter@wisc.edu) is an emeritus professor of civil & environmental engineering at UW-Wisconsin. His interests include estimation of hydrological risk; stormwater modeling, management, and design; adaptation to climate change; assessment and mitigation of human impacts on aquatic systems; restoration of aquatic systems; and sediment and phosphorus control.

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

Mike Prusila (mprusila@lakecountyil.gov) is the planning supervisor at the Lake County Stormwater Management Commission and oversees watershed plan development and project implementation. Mike's academic training includes bachelor's and master's degrees in geography. He has worked for the Lake County Stormwater Management Commission for more than a decade.

Bree Richardson (bricha34@kent.edu) received her bachelor's in water resources with a minor in soil science, and a certificate in wetland science) at UWSP. She is currently working on her master's at Kent State University. Her thesis is about spatial and temporal nutrient removal mechanisms in a freshwater estuary.

Julia Robson (julia.robson@milwaukeecountywi.gov) is the assistant natural areas coordinator for the Milwaukee County Parks Department. She assists with the management of 10,000 acres of natural areas within Wisconsin's most urban park system. She manages the parks department's wildlife research and management initiatives as well as its award-winning citizen-based wetland monitoring program.

Dan Salas (dan.salas@cardno.com) is a senior consultant for Cardno, an environmental consulting firm supporting clients throughout North America. Dan is also a senior ecologist certified by the Ecological Society of America. He has published several peer-reviewed papers on the topics of conservation planning, stream restoration, ecological restoration, and decision analysis for conservation.

Shea Schachameyer (SSchachameyer@gmail.com) has worked as a research associate with Northland College's Burke Center for Freshwater Innovation, as a research technician on the UW-Milwaukee School of Freshwater Science R/V Neeskay, and as a deckhand on environmental advocacy cruises around the world. She graduated from Northland College in December, 2017, with a bachelor's in natural resource management ecological restoration.

Jeanne Scherer (jeanne.scherer@ces.uwex.edu) is an aquatic invasive species (AIS) outreach specialist with UWEX's Environmental Resources Center and an AIS monitoring specialist with WDNR. She received a bachelor's in liberal arts from Carthage College, teacher certification though Barat College, and a bachelor's in physical environmental geography from UW-Whitewater.

Rachel Schultz (raschult@uwsp.edu) received her Ph.D. at The Ohio State University and is currently a wetland scientist and lecturer at UWSP. Her research interests include biodiversity and ecosystem functioning in wetlands, invasive species, and restoration ecology.

Danielle Shannon (dshannon@mtu.edu) is staff at NIACS where she helps land managers cope with and adapt to the challenges of climate change. With a master's from the University of Minnesota in forest hydrology and watershed management, Danielle is responsible for expanding the suite of adaptation resources at NIACS into the field of forest hydrology and the management of forested watersheds.

Christopher Smith (christopherj.smith@wisconsin.gov) received his bachelor's in geography from UW-Platteville and his master's in GeoEnvironmental Studies from Shippensburg University. He is an accomplished GIS professional who has been working with the Wetland Monitoring Section for the the past 8 years. His contributions include the Wisconsin Potentially Restorable Wetlands Layer and the Tiner attribution to the PRW and WWI.

Amy Staffen (amy.staffen@wisconsin.gov) is a conservation biologist in the WDNR's Natural Heritage Conservation Program . She is also co-chair of the WICCI Plants and Natural Communities Group, where her main focus is promoting adaptation of natural area management approaches to changing environmental conditions.

PRESENTER BIOGRAPHIES

Nicole Staskowski (nicole.staskowski@cardno.com) is a senior consultant for Cardno in Wisconsin, providing technical and project management oversight to Cardno's ecological and regulatory projects. She has more than 20 years of wetlands and natural resource experience throughout the Midwest. She manages complex natural resource mitigation and restoration design and implementation projects.

Gary Sullivan (gsullivan@wetlands-initiative.org) is an ecologist with The Wetlands Initiative, a Chicago non-profit organization restoring wetlands in the Midwest. He earned a doctorate in plant ecology from Binghamton University, NY. He has worked on coastal wetlands in California and Mexico, estuaries and streams in Oregon, and landscape-scale restoration incorporating mosaics of species, habitats, and hydrology in the Midwest.

Joshua Sulman (joshua.sulman@stantec.com) is a botanist and environmental scientist with Stantec, where he's worked since 2013. He completed his bachelor's and master's in botany at UW-Madison. He's tracked *Sparganium* across the state by canoe; sampled transects through the Wisconsin River floodplain; sampled Curtis' original sites across Wisconsin, including on the Apostle Islands; and done floristic inventories across the state forest system.

Samuel Tharpgeorge (tharps514@myemail.northland.edu) is a senior at Northland College majoring in natural resources. In the summer of 2017, he and fellow researchers participated on a collaborative research project between the Mary Griggs Burke Center for Freshwater Innovation and Northland College Plant Ecology Lab to monitor plant community composition and distribution in coastal wetlands of the Apostle Islands National Lakeshore.

Alice Thompson (thompsonandassoc@sbcglobal.net) is a wetland ecologist with a master's from UW-Milwaukee. Thompson consults for the Village of Mount Pleasant on native vegetation and wetland issues for the award-winning Pike River Restoration Project, one of the largest stream restoration projects in the Midwest, completed in 2016.

Stephen Tillman (stillma2@illinois.edu) is a graduate research assistant at the University of Illinois at Urbana-Champaign. He is performing his master's research in wetland ecology and restoration, with a focus on wetland mitigation banking. He has previously performed vegetation monitoring work for the Bureau of Land Management in California and the McHenry County Conservation District in Illinois.

Patricia Trochlell (ptrochlell@gmail.com) is a wetland ecologist who recently retired from WDNR. In her former position, she worked in the areas of wetland policy and regulations, ecology, assessment, monitoring, research, delineation and training. She is a licensed professional hydrologist and soil scientist. She is on the board of the Invasive Plant Association of Wisconsin, is actively involved with The Prairie Enthusiasts, and is a Wisconsin Master Naturalist instructor.

Daniel Vimont (dvimont@wisc.edu) is a professor in the Atmospheric and Oceanic Sciences Department at UW-Madison and serves as the director of the Nelson Institute's Center for Climatic Research and co-director of WICCI. His research focuses on climate variability and change as well as regional impacts of climate change.

Michael Vujanovic (m-vujanovic@neiu.edu) is an undergraduate at Northeastern Illinois University and has conducted research in Volo Bog as part of his undergraduate research project. Mike has a strong interest in aquatic ecology and in studying sediment contamination, and upon graduation he plans to pursue a job as a biological technician.

Bobbie Webster (websterb@uwgb.edu) is the natural areas ecologist for UW-Green Bay where she works with students, faculty, and partners on research and regional collaborations. Previously she has worked with The Door County Land Trust, Applied Ecological Services, The Nature Conservancy, and WDNR. She received her master's in natural resources and her bachelor's in public administration and resource management from UWSP.

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INDEX OF AUTHORS

Find an abstract page number by looking for the first author in the listing below.

Key to Common Agency Abbreviations Used in Abstracts and Bios

GLIFWC	Great Lakes Fish and Wildlife Commission	UW	University of Wisconsin
NIACS	Northern Institute of Applied Climate Science	WCMP	Wisconsin Coastal Management Program
NRCS	Natural Resources Conservation Service	WDOA	Wisconsin Department of Administration
USACE	U.S. Army Corps of Engineers	WDNR	Wisconsin Department of Natural Resources
UWEX	University of Wisconsin - Extension	WGNS	WI Geological and Natural History Survey
UWSP	University of Wisconsin-Stevens Point	WICCI	Wisconsin Initiative on Climate Change Impacts
USFWS	U.S. Fish and Wildlife Service	TNC	The Nature Conservancy