Fall Art & Science Poster Session

2025

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Hannah Agner

Emily Stanley

Temporal Dynamics of Nitrogen Forms in Streams of the Yahara Watershed

Nitrogen (N) inputs from agricultural landscapes can affect both water quality and greenhouse gas emissions in streams. Of particular concern is nitrite (NO_2^-), which can be a chronic toxin for sensitive aquatic organisms, and N_2O, a potent greenhouse gas. Since June 2024, we have been examining eight stream sites across the Yahara Watershed to understand patterns and drivers of temporal variability in NO_2^-,and N_2O. Four sites were sampled weekly and four were sampled monthly to capture fine- and broad-scale temporal patterns. At each site, concentrations of nitrate (NO_3^-), NO_2^-, ammonium (NH_4^+), total nitrogen (TN), and dissolved N_2O were measured alongside hydrological and chemical parameters. All streams exhibited substantial variability in all NO_2^- and N_2O within and among sites, yet the factors driving this variation remain unclear. Correlations with NO_3^-, the major N fraction, were positive at some sites and negative at others, suggesting very different mechanisms controlling their production among the eight sites. By characterizing the variability of reactive N forms in agriculturally influenced streams, this work highlights potential ecological risks and begins to identify factors contributing to greenhouse gas production. These insights can be applicable in guiding future research and management of nitrogen in freshwater systems impacted by agriculture.

Collaborative, Individual

Nutrients, Water Quality, Emissions

Adriana Agosta

Zhao Yang, Jenna T. Swenson, Kaitlyn J. Gruber, Alissia M. Milani, Adriana A. Agosta, Samantha G. Summerfield, Christina K. Remucal

Aquatic Chemistry at UW-Madison: Fate and transformation of organic contaminants

Organic contaminants, such as pesticides, pharmaceuticals, and industrial chemicals, enter the environment through processes like agricultural runoff and stormwater. Additionally, contaminants in our wastewater will enter the environment if they are not effectively removed or degraded in our wastewater treatment plants. These contaminants can have negative impacts on the environment and can be harmful to human health if found in drinking water sources. Once in the environment, these compounds may degrade via photochemical reactions (reaction with sunlight), microbial processes, or oxidation via naturally occurring minerals. Certain compounds like some PFAS (per- and polyfluoroalkyl substances) do not have any known natural degradation pathways and therefore pose a serious concern to human and environmental health. In engineered systems, processes are designed to remove certain organic contaminants. In the Remucal research group, we study how these organic contaminants behave in the environment and their potential treatment processes.

Collaborative, Inter/cross/trans disciplinary, Conducted in partnership with external groups

Contaminants & Water Treatment

Marian Azeem-Angel

Adam Bechle, Lydia Salus

The Coastal Processes Manual: Chapter 7 Coastal Flooding

The 3rd Edition of the Coastal Processes Manual provides local officials, decision makers, zoning

administrators, and other practitioners with a step-by-step guide to 21st century Great Lakes coastal concerns. It includes how to estimate vulnerability and risk to extreme lake levels, storms, and erosion, and methods to build community resilience. The Manual covers comprehensive technical information on coastal processes with technical solutions and worksheets for users to apply to various local conditions. This poster covers content from Manual chapter 7: coastal flooding basics, flood hazard zones, insurance, risk considerations, and community mitigation strategies that will be shared via the Wisconsin Coastal Management - Coastal Leadership Academy.

Conducted in partnership with external groups

Coastal & Great Lakes Resilience

Juyong Bak, AnnaBeth Thomas

Athena Nghiem

Investigating decadal-scale arsenic mobilization in dynamic aquifers of Vietnam

Our team, collaborating with eight research institutions in Switzerland and Vietnam through the DeltAs project (funded by the Swiss National Science Foundation, investigates both the natural mechanisms of arsenic (As) mobilization and its alteration by anthropogenic pressures across the major deltas in Vietnam. Geogenic contamination of groundwater by arsenic (As) exceeding global health advisory limits of 10 ug/L is widespread, especially in South/Southeast Asia. Over 20 years, we observed a drastic increase in groundwater As concentration (~200 ug/L) from across multiple sites in Hanoi, Vietnam where groundwater pumping has been widely hypothesized to mobilize As. Two potential mechanisms have been proposed: (i) the release of As through organic-matter-driven reduction in peat-rich clay layers, and (ii) riverine water intrusion introducing reactive organic carbon and sulfide into deeper aquifers. To investigate these processes, we drilled multiple cores (~50 m) across contrasting settings and analyzed sediments using synchrotron-based spectroscopy and microscopy. Bulk X-ray absorption spectroscopy (XAS) was used to characterize Fe redox profiles across the stratigraphy, while micro-X-ray fluorescence (uXRF) mapping combined with XANES (X-ray absorption near edge structure) analyses identified As-hosting phases and their associations with Fe and S. Our results will clarify the role of peat-rich clay layer and riverine recharge–particularly under pumping-induced perturbations–in As cycling and provide key insights for predicting future As contamination trends in similar geologic settings.

Collaborative, Conducted in partnership with external groups

Groundwater & Geochemistry

Anna Bierbrauer

Ryan Stowe, Peter Jaeger, Ian Brown, Phil Gaebler, Andrew Sell, Ann Tai

Tracing the Hydrosocial: Building a Transdisciplinary Landscape Science for John Nolen Drive

This presentation examines how transdisciplinary landscape science can offer new perspectives on urban water systems through the framework of the hydrosocial cycle. Focusing on Madison's John Nolen Drive corridor along Lake Madison, faculty and students from the Departments of Chemistry and Landscape Architecture are conducting baseline assessments of water quality, vegetation, and microclimate prior to the area's upcoming reconstruction. Chemistry students are

gathering samples and conducting visual field observations, while design students are documenting physical conditions, technical aspects, and user interactions. Collectively, these efforts aim to develop a comprehensive understanding of how ecological and infrastructural systems jointly shape the urban landscape. Rooted in the concept of the hydrosocial cycle, this work emphasizes that every movement of water is intertwined with policy, labor, and design considerations. The exhibit invites participants to share their expertise by suggesting new indicators, methods, and questions for long-term monitoring, contributing to the future development of Madison's urban watershed.

Collaborative, Inter/cross/trans disciplinary, Community-driven, Conducted in partnership with external groups

Policy, Planning, Economics & Communication

Lucille (Lucie) Carignan

Eric Kastelic, Steven Loheide

Relationship Between Elevation and White Pine Growth in Door County

Our study takes place at The Ridge Sanctuary in Baileys Harbor, Door County–home to one of the largest and most intact ridge and swale complexes in the region. These systems form from post-glacial sand deposition along a receding coastline, creating a series of relic shoreline ridges and alternating wetland swales oriented parallel to the shore. The Ridge Sanctuary is especially suited to this research due to its high groundwater variability, where the alternating topography closely corresponds with fluctuations in water table depth. The area is characterized by sandy soils and a diverse range of plant life that follows the ridge-swale pattern, making it particularly vulnerable to hydrologic change. To evaluate these ecohydrologic dynamics, we measured annual tree ring growth and collected relative elevation data for each sampled tree. We hypothesized that growth would vary with groundwater proximity, with intermediate elevations providing the most favorable conditions. Trees near swales may exhibit signs of oxygen stress due to persistently high water tables, while trees on ridge centers may be more prone to drought stress. These patterns suggest the existence of an optimal elevation range for pine growth where environmental stress is minimized. Ultimately, this study deepens our understanding of forest resilience in littoral ridge and swale systems and supports more informed conservation strategies in climate-sensitive Great Lakes regions.

Collaborative, Conducted in partnership with external groups

Hydrology, Flooding & Flow Processes

Luca Cecere

Eric Booth

Assessing the potential to enhance infiltration on Driftless Area hillslopes and reduce downstream flood peaks

Large flood events have increased in frequency in the Driftless Area of southwestern Wisconsin in recent years driven primarily by more frequent heavy rainfall events in a warming climate. Local communities and watershed organizations are keenly interested in exploring and implementing land management practices that are both effective and relatively likely to be adopted on a large scale. Decades of scattered research have provided evidence of the unique soil and geologic properties of the region's steep hillslopes – composed of coarse soils overlying fractured and/or

permeable bedrock – that likely result in high infiltration and recharge rates relative to other parts of the landscape. While most of these hillslopes were afforested in the mid-20th century - a process that fundamentally changed the hydrology of the region by enhancing infiltration and recharge and reducing flood peaks relative to the early 20th century baseline of overgrazed and gullied pasture – there are opportunities to enhance the infiltration mechanisms through forest management, detention structures, and gully / forest road repair. Using LiDAR data across the Kickapoo and Coon Creek watersheds, we investigate the current state of these practices and structures and then map out locations where interventions may be most effective. We are also re-starting a 60-year-old experiment that uses low-cost instrumentation to monitor runoff into and out of a series of hillslope infiltration basins to assess their efficacy during heavy rainfall events.

Collaborative, Community-driven, Conducted in partnership with external groups

Hydrology, Flooding & Flow Processes

Camden Chrudimsky

Rajpreet Kaur, Michael Holly

Aluminum Dross as a Sustainable Filter Media for Phosphorus Extraction

Extraction of dissolved orthophosphate (OP) from agricultural runoff is crucial for mitigating eutrophication and protecting aquatic ecosystems. Filter media can be implemented at the edge-of-field to remove lost phosphorus from runoff. Aluminum dross (AD) was chosen as the filter media for this specific study because it is a waste product containing various oxidized forms of aluminum with a low installation cost and promising sorption potential. This study aims to create an affordable, sustainable filter media that promotes a circular economy.

Collaborative, Individual, Conducted in partnership with external groups

Nutrients, Water Quality, Emissions

Sabine Dolan-Gaschignard

Katie Braun, Jacob May, Christian G. Andresen

Assessing Arctic Tundra Vegetation Shifts in Response to Permafrost Ice Wedge Degradation Using UAVs

Across the Arctic tundra, permafrost ice wedge degradation in polygonal landscapes is impacting vegetation communities. To investigate these ecological changes, we use high-resolution multispectral imagery collected by unmanned aerial vehicles (UAVs) to understand how these changes are influencing shifts in plant communities. Multispectral images were collected from the Arctic Coastal Plain of AK in summer 2024. We produced orthomosaics to classify in ArcGIS Pro and tested different classification methods, comparing accuracy using accuracy assessment. We identified and mapped 5 vegetation communities across an area of 323,000m2 at 7 cm spatial resolution. The classification results highlight how vegetation communities are changing in response to a warming Arctic and permafrost ice wedge thaw, foundational for assessing ecosystem trajectories and land-atmosphere carbon dynamics in the Arctic.

Collaborative, Inter/cross/trans disciplinary

Sensing, Remote Sensing & Modeling Methods

Savannah Finley

Athena Nghiem

Unraveling Molybdenum Contamination in Eastern Wisconsin: Method Development and Source Assessment in Bedrock

Molybdenum (Mo) is an essential nutrient; however, elevated concentrations in drinking water (>70 ppb) pose significant health risks. This study focuses on southeastern Wisconsin, where Mo concentrations are notably high, with ~30% of wells exceeding 70 ppb. While coal ash leaching from coal re-use sites was initially suspected as the primary contamination source, conflicting evidence suggests a geogenic origin. Initial research into the geogenic origins of Mo in this region has suggested that Mo was mobilized from the Maquoketa Shale. Despite this hypothesis, analyses of the solid phase geochemistry remain non-existent. Moreover, Mo concentrations appeared to be higher particularly in groundwater extracted from depths of 0-200 ft, corresponding to glacial till and/or Silurian dolomite . Our work investigates this geogenic hypothesis via analysis of Mo found in the solid phase from a core in the region; preliminary results from sequential selective chemical extractions suggest that carbonate dissolution may be a key process driving Mo release. To further elucidate Mo origins and mobilization mechanisms, this research also examines its co-occurrence with arsenic in the environment. By resolving the dominant geochemical processes, this work aims to inform strategies for mitigating Mo contamination in private wells across southeastern Wisconsin.

Collaborative, Inter/cross/trans disciplinary, Community-driven, Conducted in partnership with external groups

Groundwater & Geochemistry

Molly Fox-Kincaid

Shimaa Kteeba, Samantha Krueger, Rahmah Sajid, Laodong Guo

Influence of pH and Leaching Conditions on the Chemical Composition of Microplastic-Derived Dissolved Organic Matter

Large amounts of plastic waste enter freshwater environments, where they can break down through physical, chemical, and biological processes. Microplastics (<5mm) are of particular concern: as they degrade they may leach dissolved organic matter (DOM) into the water column. This DOM can alter biogeochemical cycling, threaten aquatic organisms and ecosystems, and compromise drinking water quality. This study investigates the influence of pH and leaching conditions on the composition of microplastic-derived DOM, providing insight into how environmental factors affect DOM quantity and quality. We find that leaching is highest and fastest under water soluble conditions and enhanced at a neutral pH.

Collaborative, Conducted in partnership with external groups

Contaminants & Water Treatment

Ken Genskow

Alayne Kulp

Celebrating 60 years of Water Resources Management MS graduates

This poster highlights the geographical reach and focus of Practicum workshop projects conducted by the student cohorts completing their MS in Water Resources Management (WRM) over the past 60 years. It will also include information about the WRM program and background

on the WRM Practicum process. In place of a master's thesis, WRM students complete a 2-year applied group research project for community clients.

Collaborative, Inter/cross/trans disciplinary, Conducted in partnership with external groups

Policy, Planning, Economics & Communication

Logan Goulette

Athena Nghiem, and Partners

Community-Based Research in Richland County Wisconsin

Groundwater is an essential water resource that about two-thirds of the population in Wisconsin rely on for their drinking water. Despite being a water-rich state, past and ongoing research has identified numerous groundwater quality issues such as anthropogenic problems related to nitrate and microbial contamination and naturally-occurring contamination of arsenic and other elements that can lead to adverse health effects. The sustainability of groundwater quantity and quality is of concern for highly agricultural and rural communities that rely on groundwater for both irrigation and drinking water. Private wells are especially vulnerable as there are no regulations for monitoring and falls under the individual responsibility of the well-owner. Notably, in Southwestern Wisconsin, not only is groundwater more geologically susceptible to contamination due to thin soil/sediment layers over fractured bedrock that leads to faster contamination from surficial sources (e.g., nitrate), but also 100% of residents get their drinking water from groundwater. There, community concern about groundwater is apparent and more urgent than ever, especially under trade-offs between agriculture, industry, water usage and a changing climate. Our project partnered with numerous organizations such as the Southwest Wisconsin Regional Planning Commission to provide free water sampling to any private Well owners in Richland County, empowering well owners to make educated decisions about their water quality. Further work will involve analyzing these data geospatially to identify any trends in groundwater contamination related to land usage and geology.

Collaborative, Inter/cross/trans disciplinary, Community-driven, Conducted in partnership with external groups

Community Science, Education & Engagement

G. Graham

Sue Swanson, Michael Cardiff, Pete Chase

Understanding and predicting groundwater-driven flooding at a watershed scale, Chequamegon-Nicolet National Forest

The Shunenberg Creek watershed is an 80 square mile area with seepage lakes and disappearing streams but no surface water inlets or outlets. Above average precipitation from 2013-2020 and extreme rain events in 2018 led to unprecedented flooding at Pigeon Lake and other seepage lakes within this watershed. The relatively gentle slopes and permeable surface materials imply that surface water hydrology is driven primarily by groundwater behavior rather than surface runoff processes, and groundwater modeling is thus necessary to understand and predict future lake flooding, despite limited available well records from the region. In this presentation, we demonstrate the use of isotopic data and aerial imagery to constrain groundwatershed behavior where other data are lacking. By combining aerial imagery with elevation data, we inform water level targets and also reveal spatially varied sensitivity to water

level fluctuations across the landscape. We traced the shorelines of 160 seepage lakes using images from 2010 and 2020. We also mapped the extent of drowned forested shoreline adjacent to each lake interpreted from the 2020 imagery. Results show that while some lakes experienced flooding comparable to Pigeon Lake (an 18 feet rise from 2010-2020), other lakes were virtually unaffected by high water. Local groundwater monitoring and stable isotope mass balance analysis at Pigeon Lake complement these remote observations by providing confidence in groundwater contributing areas.

Conducted in partnership with external groups

Hydrology, Flooding & Flow Processes

Peter Jaeger

High School Research Internship

The 11th grade High School Science Research Internship program is a partnership between MMSD and UW-Madison. Junior students from Madison Metropolitan School District are partnered with UW researchers during the summer to engage in authentic science research on campus and to experience how STEM research is conducted. Students enroll for the summer term and earn both college and high school credit through their work. The results of their work are communicated via a poster session held at the beginning of the fall term along with a celebration of their work. Over the past 5 cohorts, 75% of interns have enrolled at UW-Madison and 88% have continued to be engaged with research as undergraduates.

Collaborative, Inter/cross/trans disciplinary

Community Science, Education & Engagement

Alayne Kulp

Ken Genskow

Celebrating 60 years of Water Resources Management MS alumni

This poster highlights the geographical distribution of over 700 Water Resources Management (WRM) alumni from the past 60 years, now dispersed across 46 US states and 16 countries.

Collaborative, Inter/cross/trans disciplinary

Community Science, Education & Engagement

Emily Ledin

Bret Shaw, Anya Jeninga-Nehls

Emerging Contaminants Risk Communication: A Preliminary Needs Assessment of Health Officers

PFAS (per- and polyfluoroalkyl substances), often called ”forever chemicals,” are synthetic compounds widely used in products such as firefighting foams, non-stick cookware, food packaging, and personal care items. As detection methods improve, PFAS have emerged as a significant public health concern. This study examines how county-level public health communicators in rural areas–where residents often rely on private wells–address PFAS issues and what barriers they face. Preliminary findings reveal major challenges, including limited accessible information for non-scientific audiences, lack of local testing and data, uncertainty

about responsibility and remediation strategies, and high testing costs. These financial barriers often compound with resource constraints, especially in counties without dedicated environmental health departments. This research highlights the need for clearer communication tools and affordable testing options to support effective PFAS outreach in rural communities. Tools will be created by partners at UW Extension and WI Sea Grant to address some of these needs. This research was done in fulfillment of the requirements for Honors in the Major in Life Sciences Communication at the University of Wisconsin-Madison College of Agricultural and Life Sciences.

Collaborative, Conducted in partnership with external groups

Contaminants & Water Treatment

Eleanor Louise

Peter Sobol, Christopher Zahasky

Understanding the role of cryosuction on flow and transport in partially frozen porous media

Freeze-thaw cycles are ubiquitous in cold climates and can affect groundwater recharge and solute transport through the subsurface. These cycles create freezing and melting fronts that propagate centimeters to meters into the vadose zone. Within the vadose zone, these fronts cause spatial and temporal variations in pressure and temperature that impact flow and transport. In partially saturated soils experiencing freezing temperatures, ice content increases, which causes the capillary pressure in the soil to increase. This dynamic capillary pressure change causes fluid to migrate upwards, a phenomenon known as cryosuction. While freeze-thaw cycles are frequent in high latitude regions, a key knowledge gap exists in how cryosuction processes affect groundwater recharge and the mobility and distribution of contaminants within the vadose zone.

To quantify the influence of freeze-thaw cycles, we created a quasi-3-dimensional tank (Hele-Shaw cell) filled with glass beads as a soil analog. The tank was partially saturated with water and subsequently frozen using a circulating system to generate a top-down freezing front. To track the movement of fluid flow, we added a dye tracer to our water supply. Time lapse photography recorded the movement of the tracer throughout trials and was used to visualize the cryosuction-driven transport. Image processing was used to quantify liquid water content and tracer movement to interpret the role of cryosuction-driven transport. The results of this study provide valuable insights into cryosuction processes in the subsurface, as well as water quality and recharge of near-surface aquifers in areas that experience seasonal freezing.

Inter/cross/trans disciplinary

Groundwater & Geochemistry

Mae Moen

Fast Fashion Impacts on Water Quality and Usage

Environmental and social impacts of fashion production have been a growing concern since the beginning of industrialization. My poster will examine current research on the environmental impacts of production, specifically focusing on water, and will compare natural and synthetic fibers. I will discuss research and data gaps with the hope of pointing toward what the world needs for a more sustainable fashion industry.

Individual

Policy, Planning, Economics & Communication

Anne Moser

Rebecca Wojahn

Saving Our Sturgeon: The Next Generation

In the just released, Saving Our Sturgeon: Protecting Wisconsin's Ancient Fish, author Rebecca Hogue Wojahn tells the remarkable story of lake sturgeon in Wisconsin. It details the conservation efforts to save the species, and what is being done to keep the population healthy and thriving today. A great resource for readers ages ten and up, it contains maps, photos, and diagrams, plus a Who's Who list of individuals and groups and kid-friendly sources for further learning. It celebrates the success story about one remarkable species and shows young readers how they, too, can help protect these incredible creatures.

This interactive display will include a life-size cutout of the record sturgeon ever speared in Wisconsin and a special visit from Stella the sturgeon, a six-month specimen.

Collaborative, Inter/cross/trans disciplinary, Conducted in partnership with external groups

Ecosystems, Biodiversity & Restoration

Adam Ornelles

Christopher Zahasky, Christina Remucal

Laboratory Column Experiments for Contaminant Transport Through Fluctuating Water Tables

Per- and polyfluoroalkyl acids (PFAS) are a persistent environmental contaminant and adversely affect human health, in part, due to their highly polar nature. This polar characteristic of PFAS allows them to sorb to air-water interfaces in partially saturated soil, making PFAS transport from a contaminant source zone into the groundwater dependent on soil saturation.

Given their inherent properties, PFAS and similar contaminants which are dependent on soil saturation become difficult to model using data from steady state laboratory experiments. In reality, contaminant transport in the near subsurface is likely periodical, where rainfall infiltration and water table levels fluctuate regularly, and soil chemistry conditions remain outside of equilibrium. To replicate how these cyclical processes impact PFAS contaminant transport in a controlled environment, a novel laboratory soil column system was developed to precisely induce water table fluctuations and transient flow characteristics in local soils. Coupled with a bespoke auto-sampling system and pore water samplers, the experimental setup aims to provide a platform for studying contaminant flow behavior in non-steady-state conditions.

Various PFAS species, tracers, and SDBS (a proxy for PFAS), were injected into column experiments using this setup, with breakthrough and pore water sampling conducted to quantify retardation rates and plume behavior. Initial findings indicate that increased saturation levels likely leads to expedited breakthrough rates with SDBS. Future research aims to characterize contaminant breakthrough behavior under repeated water table fluctuations and more precisely quantify their impact.

Individual

Sarah Peterson
Alison Mikulyuk

Advancing Community-Engaged Water Research: A Participatory Incubator Model

Water researchers are looking for solutions to help communities adapt and thrive in the face of environmental challenges, but traditional science production models often fail to produce actionable solutions due to the intentional separation of science, policy, and people. Centering community voices and priorities before research proposals are written ensures the impact and validity of data, aligns real-world concerns with scientific outcomes, builds trust, and in some cases works to redress historic harm caused by past extractive research. Many researchers struggle with how to begin community-engaged work, and few grants provide support for the work required to understand and center community priorities. To address this gap, Water@UW-Madison and Wisconsin Sea Grant hosted a Water Partnership Workshop in September 2025 that functioned as an incubator for community-engaged water research. Our workshop brought together community groups and water researchers to co-develop project ideas in direct response to diverse issues raised by invited community guests. We employed a strengths-based approach to relationship-building, beginning with one-on-one conversations with community groups about their timely concerns. We then matched water researchers and community partners by aligning expertise, research interests, and capacity. Over the course of a full day workshop, groups built mutual understanding, identified knowledge gaps, and sketched out initial ideas for future collaborative projects.

Community-driven

Community Science, Education & Engagement

Catherine Pettinger
N. Venable, R. Johnson, E. Roden, C. Paradis, E. Majumder

Uranium and iron changes in microbially reduced environments during oxidative enhanced flushing experiments

Groundwater contamination at uranium mill sites continues to persist around the world. Typical remediation strategies are limited if reducing conditions are not maintained; most take advantage of microbial reduction reactions to immobilize uranium as U(IV) is generally less mobile than U(VI). Therefore, oxidative enhanced flushing via oxic injections is actively being tested to flush U from groundwater at a former uranium mill site near Riverton, WY. We hypothesized that during these flushing experiments, U(IV) oxidation occurs yet mobilization is limited due to U(VI) sorption to oxides formed. A batch experiment was designed to mimic field tested oxidative enhanced flushing at two sites, and additional experiments were performed to test the influence of tracers used on groundwater microbial communities. Initial phase I to stimulate reduction of metals by the microbial community. Phase II introduced an oxic surface water injection to the batch community to simulate the oxidative enhanced flushing event. Phase III allowed conditions to recover post injection. Typical field-used tracer concentrations did not fully inhibit microbial growth, but higher levels of specific tracers changed microbial growth. These batch experiments with multi-phase fluctuating reduction-oxidation events and tracer tests on microbial growth patterns will elucidate efficacy of remediation experiments.

Collaborative, Inter/cross/trans disciplinary

Cody Quiroz

Emily Stanley

Nutrient and Greenhouse Gas Dynamics Upstream and in a Low-Head Dam Impoundment

This study examined seasonal changes in nutrient and gas dynamics in upstream and downstream sites in the impoundment of a low-head dam on Pheasant Branch, a stream in southern Wisconsin, during summer 2025. Combined nitrate and nitrite ($NO_2 + NO_3$) concentrations were consistently lower downstream, with the upstream-downstream difference increasing throughout early-mid summer before stabilizing. Upstream and downstream differences in CO_2 and CH_4 also grew over time, while N_2O differences remained small. The persistent downstream nitrate depletion may reflect uptake and retention processes, potentially linked to rapid macrophyte expansion within the impoundment reach. The greenhouse gas patterns suggest increased in-stream biological processing during summer. Together, these results indicate that biological activity within small impoundments can drive spatial and temporal variation in both nutrient availability and gas production.

Individual

Nutrients, Water Quality, Emissions

Cecile Renfro

Hannah Nicklay, Kait Reinl, Kirsten Rhude

Hydrologic regime affects plant community dynamics in a Great Lakes Coastal Wetland

Water depth is a primary driver of wetland plant community structure, determining which species can establish, persist, or disappear over time. As hydrological regimes become increasingly erratic, understanding how wetland communities respond to changing water levels is essential for predicting and managing biodiversity. We monitored a wetland plant community in the Saint Louis River Estuary from 2014-2024, a period of pronounced deviation from mean water levels. We found a significant loss of species and individual abundances across the sampling period, suggesting extirpation as the dominant process of community composition change. We employed a Generalized Additive Mixed Model to quantify the relationship between the relative recruitment and extirpation across various axes of water depth. Our findings indicate that the relative amount of recruitment and extirpation was significantly predicted by water depth change between years.

Collaborative, Inter/cross/trans disciplinary, Conducted in partnership with external groups

Coastal & Great Lakes Resilience

Kirsten Rhude

Kathryn Hofmeister, Deanna Erickson

Adaptive restoration and understory plantings in black ash wetlands of the St. Louis River Estuary

Black ash (Fraxinus nigra) are abundant along the St. Louis River Estuary and the Lake Superior coast. These ash dominated wetlands are changing rapidly due to the invasion of Emerald ash borer (EAB) which reached the St. Louis River Estuary in 2013. Since 2023, The Lake Superior National Estuarine Research Reserve has been working with the Wisconsin Department of

Natural Resources and Wisconsin Conservation Corps to plant over 30,000 tree seedlings in an effort to maintain some of these sites as forested wetlands into the future. Replacement tree species were selected based on site conditions, projected future climate scenarios, and cultural uses and traditions these species support. Monitoring plots that include each replacement species were also planted to observe mortality and growth rate of these plantings over time. These findings should help identify promising species to incorporate into other restoration efforts in coastal ash dominated wetlands.

Collaborative, Inter/cross/trans disciplinary, Conducted in partnership with external groups

Ecosystems, Biodiversity & Restoration

Madison Teter

Robert Johnson

Effects of propeller scarring on organic matter decomposition rates in Thalassia testudinum seagrass meadows

Coastal seagrass meadows sequester large amounts of organic carbon (Corg). High burial rates of seagrass and other organic matter (OM), coupled with slow decomposition within anoxic sediments, create large carbon stocks within meadows. Despite their ecological importance, seagrass meadows are highly susceptible to anthropogenic disturbances that can accelerate decomposition and carbon loss, such as propeller scarring. Propeller scarring occurs when boat propellers damage the aboveground and belowground plant tissues. Propeller scars have been found to reduce macrofaunal abundance up to 5m from scars, and sediment %Corg in scars was lower compared to vegetated sediments. While propeller scarring is widespread in shallow meadows, the effects of these disturbances on seagrass ecosystem functioning are poorly understood. To investigate how propeller scarring affects ecosystem function in seagrass meadows, we conducted a decomposition experiment across three Thalassia testudinum meadows in the Florida Keys, an area with high levels of boat traffic and scarring. Litterbags filled with green or rooibos tea were buried in surface sediments within scars and along a gradient into adjacent vegetated meadow. Litterbags were collected after 2, 4 and 7 weeks to measure mass loss and determine how decomposition of labile (green) and recalcitrant (rooibos) materials differed. Additional data including seagrass characteristics, temperature, and sediment characteristics were collected to help us understand the variation in decomposition rates. Both seagrass and sediment characteristics affected the decay rates of green and rooibos tea, with effects generally more pronounced in the decay of rooibos tea. Our results indicate propeller scarring can alter decomposition rates, with important implications for Corg dynamics in shallow seagrass habitats.

Collaborative

Ecosystems, Biodiversity & Restoration

Talia Venner

Shiqing Cai, Haoran Wei

Quantitative Analysis of Noenicitinoids in Groundwater based on Its Concentration-dependent Surface-enhanced Raman Spectroscopy

Neonicotinoids are a class of insecticides commonly applied in agriculture to safeguard crops from pest infestations. However, neonicotinoids exhibit high toxicities towards insect pollinators

(e.g., bees) and uncertain chronic effects on human health. The frequent detection of neonicotinoids in groundwater, a critical source of drinking water, underscores the urgent need for efficient and continuous monitoring, especially in agricultural regions. Unfortunately, the traditional methods for neonicotinoid analysis are usually based on expensive and time-consuming solid-phase extraction and liquid chromatography-tandem mass spectrometry. Surface-enhanced Raman spectroscopy (SERS) is a promising alternative to the standard analytical methods because of its fast detection speed, high sensitivity, and potential for field deployment. To achieve rapid and inexpensive detection of neonicotinoids, such as clothianidin and thiamethoxam, a ”mixing-and-detecting” approach was employed using the benchmark citrate-coated gold nanoparticle (AuNP) colloid as the SERS substrate. We systematically investigated the reproducibility of the SERS spectra of these neonicotinoids as a function of its concentrations in water. We also examined the influence of groundwater matrices on the sensitivity and reproducibility of SERS for neonicotinoid analysis. Our results demonstrated a 100% reliability of SERS for the detection of neonicotinoids at 10 nM in Madison tap water. Furthermore, quantitative analysis was achieved using Partial Least Squares Regression (PLSR) modeling, which established strong linear correlations between predicted and actual concentrations (R2 > 0.9). The PLSR model effectively captured concentration-dependent variations in SERS spectral features, enabling accurate quantification of neonicotinoids across environmentally relevant ranges.

Individual

Contaminants & Water Treatment

Howard Veregin

Matt Noone, Melissa Michaud, Liz Levy, Mike Hasinoff, Cory Rich, Lance Green, Phil Gaebler, Collin Roland, Nicolas Buer, Anna Bierbrauer, Peter Jaeger, Sam Blackburn, Kyle Minks

A Community-Based Approach for Monitoring Chloride in Starkweather Creek, Madison

In fall of 2024, with funding from Water@UW, a team from the State Cartographer’s Office, the Capital Area Regional Planning Commission and Operation Fresh Start installed 8 continuous chloride monitors in Starkweather Creek, providing conductivity measurements every 10 minutes to a cloud database. Analysis of a year’s worth of data revealed seasonal patterns in chloride concentration, caused by runoff from winter road-salt application. This project has brought together water quality experts from UW-Madison, government agencies and local stewardship groups, creating a collaborative committed to monitoring, communicating and improving the health of Starkweather Creek. A public-facing website will enhance community engagement by providing monthly data updates and educational content on the harmful effects of chloride in waterways.

Collaborative, Inter/cross/trans disciplinary, Community-driven, Conducted in partnership with external groups

Community Science, Education & Engagement

Ian Vierck

David Buckley Borden, Adam DeSorbo, Asa DeWitt, Ashley Ferguson, Jenny Ginn, Blake Schouten, Nancy Silvers, Sabine Winkler

The Arboreal Anglers

The Arboreal Angler Collection is a creative combination of angling traditions, vernacular timber construction, and vintage logging camp equipment, aimed to capture the critical relationship between the local river ecosystem and the region's wood. The collection contains a diverse assemblage of oversized lures ranging from 12 to 32 inches. Each lure consists of three primary elements: the wood body, the hardware, and the dressing. When these elements are combined, they tell a rich story about the ecological role of large wood in aquatic ecosystems and their intertwined history with the timber industry. Each piece within the collection represents local organisms that rely on large wood for food, habitat, or the geomorphological processes it facilitates.

Collaborative, Inter/cross/trans disciplinary, Community-driven, Conducted in partnership with external groups

Community Science, Education & Engagement

Fangyao Wang

Jeffrey Hadachek, Wendong Zhang

The Spatial Capitalization of Producer-lead Watershed Conservation in Housing Markets

This paper estimates the causal effect of water protection policies on housing price using the implementation of the Producer-lead Watershed Protection Groups in Wisconsin. Leveraging comprehensive housing transaction data and a staggered Difference-in-Differences design, we find that the policy capitalize positively into property values. Our identification strategy exploits both the policy's staggered adoption and continuous variation in implementation intensity, while addressing threats to identification through two-way standard errors and Gardner's two step estimator. The results reveal significant spatial heterogeneity: each percentage point increase in policy intensity raises housing prices by 0.4% to 0.7%, but these economic benefits varies with distance from water bodies.

Collaborative, Inter/cross/trans disciplinary

Policy, Planning, Economics & Communication

Daniel Wright

Lei Yan, Yagmur Derin, G. Aaron Alexander, Mohammad Abbasian, Yichen Tao, Ashar Hussain, Kaidi Peng, Benjamin FitzGerald

Computational Weather, Climate and Infrastructure Research: The Hydroclimate Extremes Research Group, UW-Madison

The Hydroclimate Extremes Research Group at UW-Madison is a team of water, weather, and computational enthusiasts who do applications-oriented hydrometeorology and hydroclimatology research. Our work spans local-to-global scales, combines traditional observing systems, remote sensing, and community-based data, and supercomputer-based modeling and analysis frameworks. We focus on some of the most challenging questions around extreme rainfall and floods: when, where, why, and how things are changing with climate and land use changes.

Collaborative

Sensing, Remote Sensing & Modeling Methods

Cailin Young

Adam Bechle, Lydia Salus, Kate Angel

Wisconsin Coastal Leadership Academy: Building Local Capacity for Coastal Resilience

The Wisconsin Coastal Leadership Academy is a workshop being developed to help local governments build their capacity to address Great Lakes coastal hazards. Wisconsin's Great Lakes coastal communities face mounting risks from flooding, erosion, storms, and fluctuating lake levels. Despite the wealth of data and resources available, many local leaders report feeling overwhelmed and lacking the capacity to identify and implement effective resilience strategies. In response, the Wisconsin Coastal Management Program (WCMP) and the University of Wisconsin Sea Grant Institute (WISG) are partnering to pilot a Wisconsin Great Lakes Coastal Leadership Academy (CLA). Modeled after Michigan's successful CLA framework, this initiative will develop and deliver a targeted coastal hazards and adaptation strategies curriculum, tailored to the needs of Wisconsin communities. Through an in-person pilot workshop, local officials, planners, and decision-makers will gain a foundational understanding of coastal processes, risk assessment, and adaptation strategies, using local case studies and place-based examples. Workshops will also foster cross-community collaboration and communication while offering direct connections to funding opportunities and technical resources. This presentation will describe the CLA's development, curriculum content, workshop structure, highlight how the program addresses expressed local needs, supports long term resilience planning, and offer opportunities for feedback and input.

Collaborative, Inter/cross/trans disciplinary, Community-driven

Coastal & Great Lakes Resilience

Mari Zangano

Andrea hicks, Monica Rodriguez Morris

Public perception of embodied water and carbon footprint

Human activities affect the environment, however, most people struggle to understand the magnitude of these impacts. This paper reviews the existing literature on how people perceive the hidden environmental costs, specifically the water and carbon footprints, behind everyday actions or products consumed on a daily basis.These hidden environmental costs are known as embodied water and carbon.

Conducted in partnership with external groups

Policy, Planning, Economics & Communication