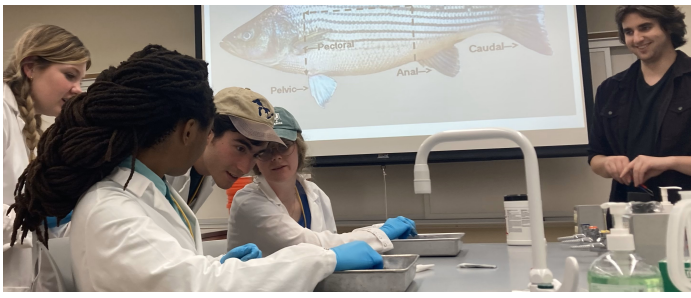
Freshwater@UW

Summer Research Opportunities Program

Freshwater@UW Project Catalog

2025–2026

The Freshwater@UW Summer Research Opportunities Program provides high-impact educational opportunities by facilitating immersive, hands-on mentored research experiences in freshwater science across the 13 UW Institutions. The program's central aim is to support the growth of our freshwater research enter-prise and freshwater workforce through collaborative, cross-system programming designed to train, recruit, and retain the next generation of freshwater scientists



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2025–2026

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Projects

GS01

How do Microplastics Impact Harmful Algal Blooms?

Institution: USGS - Madison, WI
Location: Madison, WI
Mentor(s): Sarah Janssen
Contact: sjanssen@usgs.gov
Keywords: microplastics, algae, algal toxins, water quality

Project Description

Harmful algal blooms (HABs) can pose a significant health risk to humans and wildlife due to the release of algal toxins, such as microcystin and anatoxin. There are many factors that influence the growth of HABs including nutrient concentrations, temperature, and trace metal availability but co-occurring stressors have been understudied. Within all freshwater environments microplastics are ubiquitous and have been shown to serve as an important transport vector for chemical contaminants. However, it is unclear how microplastics alter algal assemblages and the production of toxins within freshwater systems. As part of this work, we will be exploring how algae can colonize microplastics and how algal toxins can adsorb to environmentally weathered plastics. Students working in our group will aid in developing a staining method to identify microplastics from living cells using a multi-fluorescent dye approach and conduct sorption assays for algal toxins and microplastics. As part of this project, the student researcher will design laboratory-based experiments, participate in field collections of microplastics within local waterbodies, and learn microscopy techniques in the USGS Mercury, Metals, and Microplastics (M3) Research Laboratory. This project provides a unique opportunity to interface with academic and government researchers.

Project Tasks

Algal culturing, aiding in designing and conducting laboratory based experiments, participating in field collections, learning and performing microscopy based methods, working with imaging software such as image J

Required Skills

None

Preferred Skills

Has taken general chemistry and general biology

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

GB01

Fishing for Microplastics: Tracking Plastic Pollution Through Great Lakes Fish

Institution: University of Wisconsin - Green Bay
Location: Green Bay, WI
Mentor(s): Patrick Forsythe
Contact: forsythp@uwgb.edu
Keywords: microplastics; great lakes; fish ecology; freshwater pollution; environmental toxicology; aquatic field research; ecosystem health

Project Description

Microplastics—tiny plastic particles less than 5 mm in size—are an emerging pollutant of concern in freshwater ecosystems. The Great Lakes, which hold one-fifth of the world's surface freshwater, are particularly vulnerable because of their proximity to major population centers. Yet, we still know little about how these particles enter aquatic food webs or affect fish health.

This project will investigate the presence, types, and potential sources of microplastics in fish from Lake Michigan and Green Bay. Undergraduate researchers will collect and dissect fish, isolate microplastic particles from gastrointestinal tracts, and use microscopy and spectroscopy to identify their size, shape, and chemical composition. Students will learn about field sampling, laboratory analysis, data interpretation, and environmental toxicology while contributing to one of the first studies of its kind in the region.

Findings will help identify pollution "hotspots" and assess how different species interact with microplastics, providing valuable insights into ecosystem and human health risks. Students will gain hands-on research experience working alongside graduate students and faculty in the Aquatic Ecology and Fisheries Laboratory at UW–Green Bay, developing skills applicable to careers in environmental science, fisheries, and pollution management.

Project Tasks

Assist with fish collection and sample labeling during field surveys Dissect fish and extract gastrointestinal contents for analysis Filter, categorize, and measure microplastic particles using microscopy Record and organize data in spreadsheets and databases Participate in lab meetings, data interpretation, and presentations Contribute to outreach or poster sessions summarizing research findings

Required Skills

Basic coursework in biology, ecology, or environmental science Strong attention to detail and ability to follow lab safety protocols Willingness to work outdoors and handle live or preserved fish specimens Team-oriented attitude and reliable communication

Preferred Skills

Experience with microscopy or laboratory sample processing Familiarity with fish identification or aquatic field sampling techniques Interest in pollution ecology, fisheries biology, or environmental toxicology Basic data management or statistical analysis (Excel, R, or similar)

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

GB02

Evaluating Geochemical Controls on Phosphorus Mobility in Streambank Sediments

Institution: University of Wisconsin - Green Bay
Location: Green Bay, WI
Mentor(s): Erin Berns-Herrboldt
Contact: bernse@uwgb.edu
Keywords: water chemistry, phosphorus, geochemistry, groundwater-surface water interactions

Project Description

Phosphorus is a limiting nutrient in many surface water systems. Excess phosphorus (P) can drive eutrophication events, negatively impacting water quality, aquatic ecosystems, and water-based economies. Streambank sediments can store P through particulate entrapment or sorption; this stored P is often referred to as legacy P. Previous research has focused on how erosional events release legacy P to surface waters, but there is limited understanding of how changes in streambank groundwater chemistry associated with stream stage fluctuations impact the mobility of legacy P. Storage of P in sediments has been linked to biogeochemical processes that control mineral stability, but the magnitude of P release associated with these geochemical processes is not well constrained. This project aims to quantify P released from streambank sediments during high stream stage events and evaluate correlations with sediment carbon and mineral phases. Streambank porewater will be monitored at field sites on the Wisconsin River, and sediments sampled from the sites will be used to evaluate P mobility in batch experiments with varying water chemistry composition. Results from this study will allow for better quantification of P mobility associated with geochemical transitions during high stream stage events.

Project Tasks

1.) Sample streambank porewater at field sites 2.) Analyze sampled water for phosphorus and other analytes 3.) Set up a suite of batch experiments and regularly sample and analyze porewater

Required Skills

Ability to work in the field and canoe to field sites, curiosity and willingness to ask questions, general chemistry concepts

Preferred Skills

Hydrology concepts, experience with Excel, experience analyzing water samples

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

LC01

Tracing Jacques Cousteau and Calypso on the Mississippi Through Archival Research

Institution: University of Wisconsin - La Crosse
Location: La Crosse, WI
Mentor(s): Penelope K. Hardy
Contact: phardy@uwlax.edu
Keywords: history, literature, humanities, primary sources, archives, databases, inland waterways, mississippi river, maritime history, environmental history, jacques cousteau, calypso, documentaries

Project Description

In 1983, noted ocean personality Jacques Cousteau brought his famous ocean research vessel Calypso up the entire length of the Mississippi River. Cousteau, a household name thanks to his award-winning documentaries and popular television series, was filming a new documentary as part of a series on the great rivers of the world. Where did this voyage fit into Cousteau's broader legacy? How did Midwesterners understand Cousteau and his vision? And what traces did Calypso leave along the Mississippi? Partnering with a historian and an archivist/librarian, you will do the initial detective work necessary to research the history of this journey. If you want more experience thinking creatively about archives, digging through finding aids, and discovering and interpreting primary sources, this project wants your help.

Project Tasks

Assist in identifying potential archival collections across a variety of archives. Search databases. Use archival finding aids. Communicate professionally via email, phone, and in person with archivists, librarians, and other researchers. Learn and use applications such as Tropy, Zotero, and Google Sheets. Organize and contribute to shared online files. Identify, read, and use secondary sources to contextualize primary sources. Write citations. Write and annotate a bibliography.

Required Skills

Strong research and organizational skills. Ability to communicate ideas well in writing.

Preferred Skills

A humanities major or minor who has completed a research methods course in their field. Experience working with online archival and database collections, specifically finding and contextualizing primary sources. Familiarity with citations using the Chicago Manual of Style.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

LC02

Aquatic invertebrate productivity and biodiversity in threatened river floodplain habitats

Institution: University of Wisconsin - La Crosse
Location: La Crosse, WI
Mentor(s): Ross Vander Vorste
Contact: rvandervorste@uwlax.edu
Keywords: ecology, biodiversity, aquatic invertebrates, insects

Project Description

Aquatic invertebrates are an important component to floodplain ecosystems, providing food for aquatic and terrestrial organisms and are sentinels of global change. My research lab is exploring how aquatic invertebrate productivity and biodiversity is changing in the Upper Mississippi River. In the proposed project, I will work with a student researcher to continue the collection of a long-term aquatic invertebrate dataset aimed at detecting trends in invertebrate productivity and biodiversity. We will collect aquatic invertebrates from sites on the Upper Mississippi River near La Crosse by boat during a 4-week period. Then in the lab, invertebrates will be counted and identified to provide measures of productivity and biodiversity. Results will be analyzed using R software to provide unique insights into how invertebrates are responding to floodplain conditions and what environmental factors are responsible for these changes.

Project Tasks

Collect aquatic invertebrates from the Upper Mississippi River, Count and Identify invertebrates in the laboratory using a dissecting microscope, prepare and maintain sampling equipment. Data analysis related to aquatic invertebrates

Required Skills

Interest in collection and identification of aquatic invertebrates.

Preferred Skills

Experience in collection and identification of aquatic invertebrates. Experience using R programming language

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN01

Contributions of blue green algae (cyanobacteria) to freshwater quality

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Trina McMahon, Jacqueline Lemaire
Contact: trina.mcmahon@wisc.edu
Keywords: water quality, bacteria, algae, eutrophication

Project Description

The McMahon lab has been studying harmful blue-green algae (cyanobacteria) blooms in Lake Mendota for 16 years. A summer student would continue this work through a combination of field work and lab work. The student will be a member of our summer Lake Mendota Microbial Observatory field crew that collects samples twice weekly, weather permitting. The student will learn basic methods to measure water quality. Under the mentorship of a PhD students in Genetics, the summer student will collect water samples specifically for isolating cyanobacteria. The student will learn how to prepare selective culture media, to maintain cultures on both solid media (agar) and in liquid. They will also learn how to identify cyanobacteria using a microscope. This work will contribute to our broader understanding of how cyanobacterial communities change across the summer season, with implications for production of potent toxins and degrading water quality.

Project Tasks

Assisting with field sampling in a boat, microscopy to identify cyanobacteria in lake water, instrument calibration, data entry

Required Skills

None

Preferred Skills

Pipetting, simple chemistry, comfort with boats and field work

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN02

Developing a new proximal sensing platform for high-resolution soil moisture mapping for precision irrigation management

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Jingyi Huang
Contact: jhuang426@wisc.edu
Keywords: uav; soil moisture sensing; irrigation management; spatial analysis;

Project Description

Existing satellite soil moisture products have a coarse spatial and temporal resolution, which cannot be directly used for field-level irrigation management. We will develop a multi-sensor fusion platform to map soil moisture at super-high resolution (e.g., ~ 2 m by 2 m, daily) using a UAV system. The researcher will conduct field experiments in a multi-disciplinary team during the summer and obtain hands-on training in soil moisture measurements with handheld probes, UAV systems, as well as develop computer modeling skills for data processing and spatial analysis.

Project Tasks

Work with other team members for repeated field campaigns to collect soil moisture data and sensor measurements from the UAV system; use a computer program to process the data in batches and build basic models to map soil moisture in space and time.

Required Skills

Interest in field-based research experience; interest in soil moisture sensing technologies; problem-solving; interpersonal skills;

Preferred Skills

Programming in R, Python, or MATLAB platform; basic knowledge about soil science and hydrology; experience working with GIS software or geospatial data;

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN03

Feathers, Embryos, and Time: Decoding Four Decades of PFAS in Urban Birds

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Gavin Dehnert
Contact: dehnert2@wisc.edu
Keywords: pfas, birds, environmental health, historical contaminant reconstruction

Project Description

Per- and polyfluoroalkyl substances (PFAS) are persistent environmental contaminants that remain widespread despite the phase-out of several long-chain subtypes over a decade ago. Understanding how PFAS levels have changed through time is essential to evaluating the effectiveness of these phase-outs and ongoing remediation efforts. This project leverages museum collections from the Field Museum to reconstruct historical PFAS trends across Illinois from 1986 to the present. We will quantify PFAS concentrations in archived feathers and embryos collected from multiple urban sites (e.g., downtown Chicago, North Chicago, and Evanston) to assess spatiotemporal patterns across four decades. Using EPA Method 1633, we will identify dominant PFAS subtypes and evaluate changes in their abundance before, during, and after major phase-outs. In parallel, we will compare PFAS levels among feathers, embryos, and blood in birds to establish predictive relationships among these sample types. These relationships will help guide future museum sampling strategies and improve our ability to infer internal contaminant burdens from noninvasive samples. Collectively, this research will advance understanding of PFAS persistence, inform monitoring frameworks, and provide critical insights into the long-term success of pollution control measures in the Great Lakes region.

Project Tasks

Sample prep, tissue extractions, Eliza assays, data analysis.

Required Skills

Research, Time Management, and Professional Skills

Demonstrated ability to work independently. Strong time management and organizational skills.

Hardworking and detail-oriented, with a commitment to maintaining research quality and integrity.

Critical thinking, and communication skills. Proven ability to collaborate in interdisciplinary teams.

Preferred Skills

Analytical Chemistry and Contaminant Analysis: Knowledge of PFAS. Familiarity with sample extraction and cleanup techniques for biological matrices (feathers, blood, embryos).

Ability to handle, prepare, and analyze low-concentration contaminant samples with strict contamination control. Avian Ecology and Toxicology: Familiarity with avian life history, physiology, and ecology. Understanding of bioaccumulation and biomagnification processes for persistent pollutants.

Research and Communication Skills: Scientific writing and data interpretation abilities. Capacity to collaborate across disciplines (museum scientists, analytical chemists, ecotoxicologists).

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN04

Photodegradation of Aquatic Organic Contaminants

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Christy Remucal, Adriana Agosta
Contact: remucal@wisc.edu
Keywords: contaminants, pesticides, pharmaceuticals, photochemistry, water quality, chemistry

Project Description

Organic contaminants like pesticides, herbicides, industrial chemicals, and pharmaceuticals are frequently detected in surface waters and can pose a threat to human and environmental health. Reactions with sunlight can result in photodegradation of these chemicals; this process plays a key role in determining the environmental lifetime of many contaminants in aquatic systems. This project focuses on measuring the kinetic rates of photodegradation for numerous chemicals using multiple light sources to better understand how environmental factors (time of day, cloud cover, water depth) impact photodegradation.

While here, the undergraduate student will work with a UW-Madison graduate student and collaborate on sample preparation, kinetic monitoring, analysis using high performance liquid chromatography (HPLC), engaging with relevant scientific literature, and supporting other environmental chemistry research within the Remucal group. Student will conduct both indoor laboratory experiments and outdoor research to determine how light sources (between artificial light sources and the sun) affect the photostability of organic compounds. This project is a great opportunity to develop hands-on laboratory skills, get experience with analytical instrumentation, and gain a sense of ownership over their work as this project enables independence quickly.

Project Tasks

Student will work in the Water Science and Engineering Laboratory running photodegradation kinetic experiments, analyzing samples on the HPLC, and data analysis.

Required Skills

Interest in environmental chemistry, willingness to collaborate and work in a laboratory setting.

Preferred Skills

Pursuing a degree in/ have taken relevant courses in chemistry, environmental engineering, environmental science, or a related field. Previous lab experience preferred but not required.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN05

Exploring environmental contaminants using data analysis

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Christy Remucal, Ali Milani
Contact: remucal@wisc.edu
Keywords: contaminants, PFAS, precipitation, water quality, chemistry, data analysis

Project Description

Understanding the source and fate of environmental contaminants is a pressing problem threatening aquatic ecosystems. For example, per- and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals widely used in industrial and consumer products that are highly persistent in the environment. PFAS and have been associated with various health risks, including developmental toxicity, cancer, and bioaccumulation. The undergraduate student will assist our cutting-edge research on environmental contaminants in aquatic systems through a computational lens. This research aims to improve our understanding of the fate and transport of PFAS in the environment and to develop forensics methods for identifying PFAS sources. Although this is primarily a computational-based project, the undergraduate will also gain exposure to basic laboratory analysis of contaminants like PFAS.

Project Tasks

Student will work in the Water Science and Engineering Laboratory on a collaborative data analysis project and will perform statistical analyses using coding programs such as R

Required Skills

Interest in environmental chemistry and data analysis, willingness to collaborate and work in a laboratory setting.

Preferred Skills

Pursuing a degree in/ have taken relevant courses in chemistry, environmental engineering, environmental science, or a related field. Previous coding and/or laboratory experience preferred but not required.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN06

Ecohydrology of Ridge and Swale Systems in Door County, WI

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Steven Loheide, Eric Kastelic
Contact: loheide@wisc.edu
Keywords: ecohydrology, ridge and swales, groundwater, vegetation, tree rings, fieldwork, laboratory analysis

Project Description

Are you interested in the interactions between trees and groundwater? Measuring groundwater and studying trees in Door County, WI? Solving the puzzle of how landscape location and water levels impact tree growth? If so, come join the Hydroecology Lab at the UW-Madison for a summer of groundwater ecohydrology! This project will use tree core data collected in Door County to determine how groundwater within the root zone and landscape position affects tree growth. Individual hypotheses relating to these main project goals will be developed and explored as your grad student mentor Eric (ekastelic@wisc.edu) will tailor this experience to your current skill sets and interests! Potential project ideas for the summer may be included in your application (if desired) or developed once in Madison. Collaboration with Dr. Larson of UW-Platteville's TREES Laboratory will help you further develop skills in deciphering tree ring data. During this project you'll be involved in a mix of fieldwork, lab work, and office-based work. Approximately one week during the program will be spent completing field work in ridge and swale complexes around Door County, WI.

Project Tasks

Development (with mentor guidance) and execution of an independent research project. Collection of groundwater data. Collection of tree cores and analysis of tree rings. Collection of topographic data. Management and analysis of data.

Required Skills

Interest in spending time outdoors while deciphering natural processes. Interest in water and tree interactions (ecohydrology). Interest in tree growth response to environmental factors (dendrochronology). Ability to maintain a positive attitude during wetland focused summer fieldwork (potential hot and cold weather, summer rain, high humidity, and biting insects).

Preferred Skills

Basic hydrology coursework (Will be covered during the program regardless of background). Data processing skills (R, Python, Matlab, or Excel)

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN07

Revisiting molybdenum contamination in Wisconsin groundwater

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Athena Nghiem, Savannah Finley
Contact: anghiem@wisc.edu
Keywords: groundwater, field sampling, environmental chemistry, hydrogeochemistry, laboratory analysis

Project Description

This project focuses on understanding the sources of molybdenum to drinking water in southeastern WI, an area experiencing elevated concentrations. Molybdenum is an essential nutrient, but concentrations too high in drinking water can lead to adverse health effects. Initially, it was thought that the contamination stemmed from coal ash leaching from nearby landfills; however, recent findings suggest that it may be naturally occurring. Despite this evolving understanding, the exact origin of molybdenum in drinking water remains uncertain. This research aims to resolve molybdenum origins in drinking water wells to reduce its presence, with a specific emphasis on private wells. This research will also investigate molybdenum and arsenic co-occurrences in the environment, as this could provide more information on the source of molybdenum and its mobilization mechanisms. In this project, handling of both molybdenum and arsenic samples will be required. Field work will include collecting groundwater samples and solid phase samples. Field-employed instrumentation will be utilized to characterize groundwater samples in-situ and in-vitro analyses will further be employed on the collected groundwater and solid phase samples. Analytical instrumentation including but not limited to ICP-OES, ICP-MS, IC, XRD, SEM, and TGA will be utilized in this project.

Project Tasks

assist in field sampling of groundwater wells and sediment samples, operate and calibrate field instruments for in-situ water quality measurements, prepare and analyze samples using lab instrumentation, including ICP-MS, IC, and others, maintain organized field and lab records of sampling and analysis activities, contribute to data entry, preliminary analysis, and interpretation of findings under supervision

Required Skills

familiarity or willingness to learn laboratory and field safety protocols, strong organizational skills, ability to work independently and as part of a team, willingness to engage in outdoor work

Preferred Skills

Prior experience with fieldwork, knowledge of chemistry or geochemistry concepts, familiarity with analytical instruments, experience with GIS

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN08

Community-engaged PFAS monitoring in La Crosse, WI

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Michael Cardiff
Contact: cardiff@wisc.edu
Keywords: community engaged, pfas, mississippi river

Project Description

Our group has been working with the Village of Campbell, WI (located on French Island, WI) over the past 3 years to collect data about PFAS contamination, and to help this community engineer a new, sustainable source of high-quality drinking water. In this project, you will work with residents of French Island, learn to collect geophysical and hydrogeologic data, and contribute to an effort that will directly benefit a community in Wisconsin!

We expect that this project will involve several ~week-long trips to French Island for intensive data collection, including community work and potentially navigating the Mississippi river with a seasoned guide.

Project Tasks

Water Sampling Field data note-taking Communication with island residents Data organization and quality control (mentored) use of geophysical equipment

Required Skills

comfort in communicating with (friendly!) residents, ability to travel away from UW-Madison for ~5 days at a time.

Preferred Skills

Working knowledge of some hydrogeology concepts. Prior experience with water sampling or field data management is a plus, but you can learn on the job!

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN09

Detecting Invasive Carp Using Environmental DNA (eDNA) in the Wisconsin River

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Chris Bradfield
Contact: cabradfi@wisc.edu
Keywords: aquatic invasive species, environmental dna, biotechnology, conservation, field study, investigation, carp, wisconsin river, laboratory

Project Description

Upham Woods is a residential, youth-focused, outdoor learning center located on the Wisconsin River, just north of Wisconsin Dells. Upham Woods received a Wisconsin Sea Grant to create a novel program to monitor aquatic invasive species using environmental DNA (eDNA). The US Fish and Wildlife Service Great Lakes Region 3 uses eDNA to monitor Bighead Carp (Hypophthalmichthys nobilis) and Silver Carp (H. molitrix) in the Mississippi, Illinois, and Des Plaines rivers, as they have been steadily dispersing upstream and posing a threat to the Great Lakes ecosystem. The technique is appropriate for the Wisconsin River as the Department of Natural Resources discovered five adult bighead carp below the Prairie Du Sac Dam in 2017. This project will involve working with a mentor at the UW-Madison Biotechnology Center to refine existing laboratory protocols to amplify DNA from target species of positive experimental controls and experimental samples from the Wisconsin River, as well as troubleshoot negative control contamination issues. The goal of the project is to produce an improved laboratory protocol with more consistent and reliable results for use by high school aged youth to detect the presence or absence of both native (positive control) and invasive (experimental variable) species.

Project Tasks

While the majority of work will be performed at the UW-Madison Genetics and Biotechnology Center, this project will involve travel to and from the field research site at Upham Woods Outdoor Learning Center (~1 hour north of Madison in Wisconsin Dells). The mentee will:

Meet with Upham Woods staff to review field sample collection and current laboratory techniques and protocols. Work with Upham Woods staff at the field research site to collect water samples from the Wisconsin River at multiple locations Use a vacuum filtration pump, tubing, filters and 1L bottles to collect aquatic samples. Work with mentors to proficiently use basic biotechnology equipment including micropipettes, tubes, DNA extraction buffers/reagents, microcentrifuge, thermocycler, oligos, gel electrophoresis, and computer software to extract, purify, amplify and analyze DNA results, both at the field research site and at the UW-Madison Genetics and Biotechnology Center. Work with a UW-Madison Genetics and Biotechnology Center mentor to run multiple assays to test, troubleshoot, and evaluate the quality of the eDNA laboratory protocols, particularly related to contamination of negative controls and off target DNA amplification. Work with a UW-Madison Genetics and Biotechnology Center mentor to modify laboratory protocols and usable products to maximize successful eDNA amplification, visualization, and analysis through traditional and quantitative PCR.

Required Skills

Ability to work in a team setting with enthusiasm and creativity, as well as work independently. Ability to hike on uneven terrain in a wide variety of temperatures and environmental conditions. Knowledge of basic biotechnology principles and techniques, including use of P2-P1000 micropipettes, centrifuges, and gel electrophoresis equipment. Knowledge of basic laboratory techniques to reduce contamination. Ability to follow, troubleshoot, and modify laboratory protocols based on systematic tests. Ability to organize, analyze,

and present scientific data in commonly used programs such as Word, Excel, and Google products (slides, sheets, etc).

Preferred Skills

Experience performing standard column extractions to isolate and purify DNA from liquid samples Experience using a thermocycler to amplify segments of DNA using polymerase chain reaction (PCR) Experience using gel electrophoresis to visualize DNA and familiarity with a DNA ladders to estimate DNA segment length

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN10

Metal Metabolism of Microbial Communities in Contaminated Aquifer

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Erica Majumder, Catherine Pettinger (tentative)
Contact: emajumder@wisc.edu
Keywords: groundwater, contaminants

Project Description

In this project, we are studying how the metabolic activities of natural microbial communities are contributing to the mobility of metal contaminants in groundwater aquifers. Site managers are currently using an oxidative flushing strategy but it is not as effective as expected. We are testing our hypothesis that the microbes are acting on the metals in a way that is limiting the intervention. We have done some experiments to show that the microbial communities are capable of the hypothesized metabolisms. This summer, we will be testing if those metabolisms will occur under field conditions, simulated in the laboratory.

Project Tasks

Culturing microbial communities, measuring metal concentrations

Required Skills

Experience with either chemistry or microbiology or environmental science or geoscience.

Preferred Skills

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN11

Improving drought and flood resilience with regenerative agriculture

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Mallika Nocco
Contact: nocco@wisc.edu
Keywords: soil health, regenerative agriculture, infiltration, soil moisture, soil hydrology

Project Description

Soil health practices like cover cropping and reduced tillage have the potential to improve drought and flood resilience of soils across the Midwest United States. Stacking these practices together aligns with the key principles of regenerative agriculture. Over time, these practices can change the structure and function of soils to enhance desirable hydrological outcomes like infiltration and water holding capacity. However, investing in these practices can require some short term tradeoffs (e.g., increased cost and labor) before long term improvements can be demonstrated. This project seeks to quantify long-term benefits of different combinations of soil health practices on key indicators of soil physical health in Midwest agricultural systems. Students will learn how to measure key indicators for drought and flood resilience such as infiltration and soil moisture from two existing long-term (> 6 years) field experiments testing regenerative agricultural practices. We will work together to quantify how these long-term practices impact soil hydrology for Midwest cropping systems. We will also work with extension experts in science communication to translate these findings into outcomes that farmers care about for managing future floods and droughts in a changing climate.

Project Tasks

Experimental planning and literature review, field measurements and data collection, data processing, statistics, visualization

Required Skills

Enthusiasm for field work, Enthusiasm for soils and agriculture, Willingness to work evenings and some weekends (when weather is favorable), familiarity with MS Office, licensed to drive in Wisconsin

Preferred Skills

Coursework in soils or hydrology, data processing skills in R

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN12

Influence of deforestation and groundwater on lake ecology

Institution: University of Wisconsin - Madison
Location: Trout Lake Station (Boulder Junction, WI)
Mentor(s): Katie Hein, Robert Johnson
Contact: clhein@wisc.edu, robert.a.johnson@wisc.edu
Keywords: lakes, macrophytes, groundwater, ecology

Project Description

Are you interested in the connection between land and water? Lakes are intimately connected to their surrounding landscapes, and activities like logging can have powerful, unseen impacts. When a forest is cut, it can alter groundwater dynamics in the area. This project is focused on a key question: how do changes in groundwater hydrology due to deforestation influence benthic communities and ecological processes (such as CO2 exchange with the atmosphere) in lakes? This project is based at UW-Madison's scenic Trout Lake Station in Vilas County, WI, and offers a chance to explore this question while gaining hands-on experience in both field and laboratory research. Field tasks will involve working on Sparkling Lake—where a logging event is planned—and may include collecting lake water samples, groundwater sampling, conducting aquatic macrophyte (plant) surveys, and using instruments to collect high-frequency data. You will gain experience processing research samples and data in the laboratory, contributing to our understanding of how forests and groundwater hydrology influence ecological dynamics in lakes.

Project Tasks

Assist with groundwater sampling Collect lake water samples Conduct near-shore macrophyte surveys Deploy and retrieve in situ lake sensors

Required Skills

Interest in working outdoors Ability to work outdoors in potentially adverse conditions (e.g., rain, insects) Comfortable working in a small boat Ability/comfort swimming in water greater than six (6) feet deep

Preferred Skills

Ability to navigate potentially uneven terrain (groundwater sampling) Prior experience operating small boat trailers Snorkeling experience Prior coursework in limnology, ecology, hydrology, or similar

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN13

Understanding aquatic health in a changing world through collaborative field surveys and development of a citizen science initiative

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Jessica Hua, Mary Campbell
Contact: jhua23@wisc.edu
Keywords: amphibians, conservation, community science, field work, urban ponds.

Project Description

Aquatic ecosystems face diverse challenges including shifting climate patterns, pollutants, and infectious diseases emerging at unprecedented rates. The ability to detect and monitor these threats and their effects on wildlife across space and time are imperative to protecting aquatic ecosystems. However, the ability to sample broad enough spatial scales across multiple time points remains a significant challenge for scientists. To address this gap, community science initiatives where community members contribute to data collection across multiple sites and times, are often described as a win-win. This project aims to design accessible community science methods for detecting and evaluating threats to ponds and the wildlife within (amphibian conservation). Towards this goal, the project has three phases (1) Gain field experience and identify threat of interest by participating in collaborative lab survey ponds around Madison, WI. (2) Design and test protocols and community science data collection kits. (3) Generate community interest in community science via non-traditional science communication avenues (past efforts integrated art, social media, card games).

Project Tasks

Pond field surveys, DNA extractions for disease quantification, community science.

Required Skills

Willingness and committment to work well and closely with a team is a required skill.

Preferred Skills

Field work, DNA extractions, dissections, amphibian husbandry, disease ecology, ecotoxicology

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN14

Testing Outreach Strategies to Inform the Adoption of Ecologically Informed Aquatic Plant Management

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Bret Shaw
Contact: brshaw@wisc.edu
Keywords: outreach, lakes, environmental education, aquatic invasive species, aquatic plant management, social science, behavior change

Project Description

This project will use social science and digital marketing research to gain a better understanding of how to encourage lake association leaders and lakeshore property owners to consider and adopt ecologically informed aquatic plant management practices to control new invasive species in lakes. Currently, the most common response to the introduction of a new AIS is using herbicides which can unintentionally harm native flora and fauna. Working with researchers from the UW-Madison Division of Extension Lakes Partnership and Wisconsin Sea Grant, this student will learn how to interview stakeholders and use digital media analytics to provide actionable insights that inform how best to communicate about the multiple APM options available (e.g., monitoring, hand-pulling) to empower more informed decision making to protect Wisconsin's lakes.

Project Tasks

Interview lake association leaders and lakeshore property owners Based on these interviews, conceptualize and create outreach material informed by interviewing lake association leaders and lakeshore property owners Run digital A/B message tests to learn about efficacy of different approaches to APM Report analytics to inform future outreach

Required Skills

Basic graphic design and writing skills to create outreach material, ability to conduct interviews with lake association leaders and lakeshore property owners to learn more about their preferences related to outreach for ecologically informed aquatic plant management.

Preferred Skills

Understanding of Facebook and Instagram ad management platform (can teach on job)

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN15

Water quality and quantity monitoring at field sites in central WI

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Christopher Zahasky
Contact: czahasky@wisc.edu
Keywords: groundwater, surface water, sensors, data analysis

Project Description

This project is focused on understanding water recharge and water storage in confined bedrock aquifers. To accomplish this objective the summer scholar will assist in the expansion of an ongoing groundwater monitoring program in central Wisconsin. This will involve the installation of piezometers and sensors to monitor groundwater levels. There are several years of data already collected in this area that the scholar will have access to analyze in addition to data that they collect. There will also be a component of water quality monitoring that involves regular field water quality sampling.

Project Tasks

The scholar will be involved in water quality sampling, level logger install and monitoring, and data analysis.

Required Skills

Valid drivers license, ability to drive large SUV, ability to work independently

Preferred Skills

Microsoft Excel, paddling a canoe, python

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN16

Production of inorganic fertilizer and dischargeable water from separated dairy manure using a modular membrane electrochemical system

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Mohan Qin, Edward Heinen
Contact: mohan.qin@wisc.edu
Keywords: membranes, water treatment, electrochemistry, engineering

Project Description

Extracting ammonia and phosphate from livestock manure produces a renewable resource pool for fertilizer. As such, this project will address the growing need for sustainable and affordable livestock manure management to recover nutrients and generate clean water from local waste streams. The goal of this research is to develop a modular membrane electrochemical system for resource recovery from animal manure. Our proposed work is the first to take advantage of several key synergies in the proposed treatment train, driving the shift from a linear to a circular economy.

Project Tasks

Required Skills

Basic chemistry

Preferred Skills

None

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN17

Water- Landscape Interactions in Wisconsin's Driftless Area

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Ken Ferrier, Rachel Breunig
Contact: kferrier@wisc.edu
Keywords: groundwater, runoff partitioning, hydraulic conductivity, erosion, driftless area

Project Description

Wisconsin's renowned Driftless Area hosts bluffs, caves, and springs which stand as testament to the strong coupling of water and landscape evolution in the region. Hillslopes in the Driftless Area are composed of carbonate rocks, sandstones, and loess, that differ in their propensity to 1) partition water between overland flow and groundwater recharge and 2) erode. Surface/ subsurface flow partitioning and erodibility dictates the location and quality of the region's streams, springs, and groundwater resources used by plants, animals, and humans alike.
In our study catchment in Wyalusing State Park, stream channels only initiate on loess-laden hillslopes. This pattern suggests that loess-laden hillslopes may either erode by water more easily or produce more overland flow than loess-free hillslopes. A student researcher will collaborate to test these hypotheses by directly measuring and mapping hydraulic conductivity, shear strength, and stream discharge of a layered hillslope in the study catchment. Results will advance understanding of how sensitive groundwater and surface water resources in the Driftless Area are to threats of drought and contamination. The student researcher will gain hands-on experience in field-based hydrologic and geotechnical measurements, data analysis, and GIS mapping—skills that are highly valuable to a range of environmental careers.

Project Tasks

Work with mentor to take field measurements of hydraulic conductivity with permeameter and shear strength with a shear vane. Analyze quantitative data. Produce a map of results. Assist with stream discharge measurements.

Required Skills

Ability to hike modest distances (~2 miles/ day), ability to stand/ work on sloped ground, some experience with spreadsheet management (e.g. excel, google sheets), willingness to get dirty!

Preferred Skills

None

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN18

From Drained to Reclaimed: Hydrologic Responses to Peatland Restoration

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Steven Loheide, Jillian Lukez
Contact: loheide@wisc.edu
Keywords: hydrology, hydroecology, geology, groundwater, rivers, wetlands, fieldwork, laboratory analysis, ecosystem restoration

Project Description

Join the UW-Madison Hydroecology Lab to learn about the impacts of wetland restoration on peat hydrology! The wetlands in Necedah National Wildlife Refuge formed thousands of years ago as glaciers receded, providing wildlife habitat, flood control, carbon storage, and other invaluable ecosystem services. The area was ditched in the early 1900s to control the water and develop the rich, organic soil into farmland. This “drainage dream” era did not last long without wetlands to protect from fires and floods, but the disturbance fundamentally severed connections between aquifers, surface water, and floodplains. Recently, the U.S. Fish and Wildlife Service (USFWS) began plugging ditches to direct water back into natural channels. To support long-term management of restored peatlands, our group began research to document hydrologic properties of peatlands and monitor resulting hydrologic exchanges. The Freshwater@UW Student will complete an individualized research project focusing on peat stratigraphy analysis and/or sand and peat hydraulic conductivity measurements. This project will consist mainly of lab-based research and data analysis with regular fieldwork opportunities. We welcome students interested in soil science, surface water/groundwater connections, ecosystem restoration, and stakeholder engagement through collaboration with the USFWS. Please reach out to Jillian Lukez, the graduate student mentor, with any questions.

Project Tasks

Development (with mentor guidance) and execution of an independent research project

Collection of soil cores and subsequent lab analysis

Collection of groundwater and surface water data (as needed)

Management and analysis of data

Required Skills

Interest in lab-based soils analysis

Interest in surface, groundwater, and peatland interactions

Ability to maintain a positive attitude during wetland focused summer fieldwork (potential hot and cold weather, summer rain, high humidity, and biting insects)

Preferred Skills

Basic hydrology coursework (Will be covered during the program regardless of background).

Data processing skills (R, Python, MATLAB, or Excel)

Experience working in a lab setting

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN19

Exploring algal colonization in newly flooded littoral habitat

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Emily Stanley, Cassandra Ceballos
Contact: ehstanley@wisc.edu
Keywords: lake, primary production, algae, novel habitat

Project Description

Shifts in climate and land use often have strong effects on lakes by altering the timing or amount of water inputs (hydrology) to these ecosystems. We are studying an extreme case of shifting hydrology to understand how these changes can affect aquatic ecosystems. The water level of Fish Lake (southern WI) increased by >5m between ~1970 and 2015. Between 2017-2021, a 3m rise in water level expanded the lake outward and flooded the surrounding land creating novel littoral habitat consisting of forested areas, farmland, and lakeside houses. Our research goal is to determine how these newly flooded substrates are being used by algae, particularly diatoms. An SROP scholar would lead a project that investigates how these newly flooded surfaces vary in their ability to support colonization by attached algal communities. These communities participate in nutrient cycling, serve as a food resource for higher trophic levels, and have a high turnover rate making them essential components of the lake ecosystem. Understanding how algae might take advantage of newly formed habitat will provide valuable insight for productivity in other systems with extreme rises in lake level.

Project Tasks

· Collecting samples for chlorophyll-a analysis and to measure biomass · Assisting with routine limnological measurements and sample collection and habitat characterization · Preliminary sample processing in the lab · Data entry and preliminary data analysis · Other tasks may emerge depending on student interest and project development

Required Skills

Students must be comfortable/willing to do field work that involves working with others, being on a boat and/or wading in shallow water areas, and being able to follow directions and safety rules

Preferred Skills

Interest in environmental science; qualified to drive a State vehicle

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN20

Communicating Flood Resilience and Green Infrastructure to Strengthen Community Engagement

Institution: University of Wisconsin - Madison
Location: Green Bay, WI
Mentor(s): Julia Noordyk
Contact: jnoordyk@aqua.wisc.edu
Keywords: social science, environmental communication, community engagement, urban resilience, green infrastructure

Project Description

Communicating Flood Resilience and Green Infrastructure to Strengthen Community Engagement

Project Tasks

Tasks may include literature review, communication materials evaluation, developing visual and written content, conducting message testing or surveys, and assisting with community engagement events.

Required Skills

Interest in social science, environmental communication, and community engagement Willingness to learn about green infrastructure and flood resilience Curious and creative about how messages shape people's understanding and actions Reliable, organized, and able to work independently on tasks Some experience or interest in learning basic research skills (e.g., interviews, surveys, message testing)

Preferred Skills

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN21

Social Science to Support Local Tree Planting Efforts

Institution: University of Wisconsin - Madison
Location: Milwaukee, WI
Mentor(s): Deidre Peroff
Contact: dmperoff@aqua.wisc.edu
Keywords: trees, forestry, social science, community engagement

Project Description

With myriad environmental, socio-economic, and health benefits of trees (e.g. providing oxygen, increasing property values and curb appeal, providing shade to lower energy costs, habitat, stormwater management, carbon sequestration, etc.), many local governmental and non-governmental organizations have supported tree planting and giveaway programs to increase the urban tree canopy. However, many residents or property owners may consider trees more of a nuisance due to potential liability to their homes, financial and time commitments required to maintain the trees or even fear around how trees may harm their lives or property if there are extreme storms or they are not properly maintained. Without the buy-in of local residents and effective community engagement, giveaway programs alone have failed in increasing urban tree canopy. Through collaboration with several organizations on Wisconsin's Lake Michigan Coast, we will assess existing tree planting programs to better understand success stories among partners, barriers that prevent tree planting programs from being successful, and to strengthen regional collaboration and amplify the collective impact of tree planting efforts in the region. Social science tools such as project development, interviewing, coding and analysis to identify common themes will be used to help tree planting programs be more successful in meeting their goals.

Project Tasks

1) Become familiar with literature on tree planting campaigns/projects; 2) develop an interview protocol; 3) conduct interviews with local partners and/or residents. 4) analyze data for common themes and key takeaways

Required Skills

Enthusiasm about social science research

Preferred Skills

Driver's license, good communication skills, enthusiasm about community engagement and working with partners

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

Note: This project is mentored by Dr. Peroff, Wisconsin Sea Grant PI and UW-Madison affiliate. Dr. Peroff works out of the School for Freshwater Sciences in Milwaukee, WI. The project is located in Milwaukee.

MSN22

Identifying the main causes of tiny plastic buildup in the Great Lakes using a new, easy-to-use testing and imaging system

Institution: University of Wisconsin - Madison
Location: Madison, WI
Mentor(s): Haoran Wei
Contact: haoran.wei3@wisc.edu
Keywords: microplastics, Great Lakes, raman spectroscopy, data analytics, membrane technology

Project Description

We're trying to understand tiny plastic particles, smaller than a speck of dust, that are found in the Great Lakes but are hard to study because we don't have the right tools to see them well. Our main goal is to figure out how these tiny plastics build up in the lake's food chain by creating a new way to find and measure them easily. This new method will help us clean up, concentrate, and count these plastics in water and living organisms. We plan to use this method to see how widespread these plastics are in the Great Lakes and how they move up the food chain in different environmental conditions. We also want to start a program to involve local communities, especially indigenous people, in understanding this issue. By getting a better grasp on how these tiny plastics move through the Great Lakes and their food chains, we can come up with ways to minimize their effects on people and the environment.

Project Tasks

Sampling and analyzing low-micrometer microplastics in the Great Lakes. Optimizing pretreatment processes and analyzing spectroscopic data.

Required Skills

Basic experimental and data analysis skills.

Preferred Skills

Multivariate statistics, Raman spectroscopy

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MSN23

Wading into marshes and streams

Institution: University of Wisconsin - Madison
Location: Manitowoc, WI
Mentor(s): Titus Seilheimer
Contact: tseilheimer@aqua.wisc.edu
Keywords: stream ecology, fish ecology, restoration, fieldwork, coastal wetlands

Project Description

Dip your toes in the field of aquatic habitat restoration in Northeastern Wisconsin with this opportunity to contribute to several restoration and monitoring projects. We are collecting pre-restoration data in several streams that will be used to track improvements through time. There will also be opportunities to survey fish species in Green Bay's coastal wetlands. Work locations include bay of Green Bay, Two Rivers, Manitowoc, and Port Washington.

Project Tasks

Assist PI with planning and conducting monitoring in streams and coastal wetlands. Map stream habitat and physical conditions, measure stream flow, collect water for phosphate measurements, collect and identify invertebrates. Assist with wetland fish monitoring.

Required Skills

Ability to work in all conditions and weather, Ability to lift 40 pounds and walk on uneven ground, Interest in aquatic ecology and restoration, Basic science experience

Preferred Skills

Coursework in stream ecology and aquatic science, GIS experience, Comfortable in boats and water

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

Note: The project is based in Manitowoc but will include work in Green Bay wetlands and streams along the Lake Michigan coast. Project is on UW - Green Bay - Manitowoc Campus, furnished apartment housing provided in the city of Manitowoc.

MKE01

Virtual Water Trade

Institution: University of Wisconsin - Milwaukee
Location: Milwaukee, WI / Remote
Mentor(s): Avik Chakrabarti
Contact: chakra@uwm.edu
Keywords: water, trade, technology, comparative advantage, endowment

Project Description

Virtual water trade (VWT) is typically defined as international trade in water-intensive commodities. With the expansion of international trade in agricultural crops, VWT has gained significant mileage. How can we distinguish the contribution of technology from that of relative endowments to VWT? This challenging question has stimulated much debate among scientists, academics, and government policymakers ever since Merrett (1997) noted that the water content of imported grain is much less than the totality of water that was used to grow the grain. Early contributors, to this debate, had pinned the driving force behind VWT to technology (Ricardian Theory) while an alternative explanation is founded on factor proportions (Heckscher-Ohlin-Samuelson Theory). In this project, the student mentee is expected to gain hands-on experience in data modeling and analysis in the process of measuring the factor content of VWT to distinguish the contribution of technology from that of relative endowments.

Project Tasks

Data management, modeling, and analysis: deliverables include the completion of a short communications assignment and a poster presentation.

Required Skills

Reproducible data management, modeling, and analysis.

Preferred Skills

Familiarity with integrated statistical computing environment, data wrangling, R programming language, data graphics and visualization, and report generation using R Markdown. Experience using R to manipulate data; perform exploratory data analysis; write conditional expressions, loops, and functions; manipulating data matrices and arrays; extracting data from text; and making high level visualizations of data. Note to applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MKE02

Signal Strength and Relative Error of Natural Groundwater Tracers

Institution: University of Wisconsin - Milwaukee
Location: Milwaukee, WI
Mentor(s): Charles Paradis
Contact: paradisc@uwm.edu
Keywords: groundwater, transport, tracer

Project Description

Natural groundwater tracers (chloride, conductivity, and temperature) can perform as well as added tracers (bromide, iodide, and benzoates) during monitoring well testing if their signal strengths are sufficiently high. A recent field tracer study showed an inverse power law relationship between relative error and signal strength, that is, error decreased with increased strength. These interesting and important field results need to be studied under more controlled laboratory conditions to further test the apparent relationship between signal strength and relative error; this is the aim of research proposed herein.

Project Tasks

Construct one-dimensional flow-through gravel and sand columns and conduct transport tests with salt solutions.

Required Skills

Basic math (arithmetic, algebra, trigonometry) and tool use (wrench, plyers, drill).

Preferred Skills

Basic computation (python, R) and visualization (plotly, gnuplot).

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MKE03

What is Silicon Doing in Cyanobacteria?

Institution: University of Wisconsin - Milwaukee
Location: Milwaukee, WI
Mentor(s): Erica Young (with John Berges, Jeffrey Krause)
Contact: ebyoung@uwm.edu
Keywords: silicon, cyanobacteria, diatom, imaging, microscopy

Project Description

Silicon is a nutrient element in freshwater ecosystems, which supports growth of diatoms as critical food web primary producers. Diatoms and some other phytoplankton groups use Si to construct siliceous cell walls, forming frustules which may be important in anti-grazing cell defense. More recently, Si has been shown to be taken up by and required for growth by some marine and freshwater cyanobacteria, though the physiological role of Si in cells, or the sub-cellular localization is not known. This project will explore Si in selected cyanobacteria cultures and Lake Michigan phytoplankton by focusing on imaging of elemental Si within cells, using light microscopy and staining approaches. In collaboration with mentors, the scholar will design culture experiments to accumulate Si in cells, and test a range of staining techniques to visualize within cells. This project will contribute to an understanding of the possible roles of Si in cyanobacteria, which are ancient primary producers and important components of marine and freshwater ecosystems.

Project Tasks

Collection and processing of field samples, maintain and monitor cell growth in laboratory cultures, light microscopy and photography, analytical chemistry assay, possible electron microscopy and flow cytometry

Required Skills

Interest in cell imaging, cell biology, general chemistry concepts, willingness to do field sampling, some experience with light microscopy

Preferred Skills

Microscopy imaging, chemical analysis, electron microscopy

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MKE04

Evaluation of habitat and resource use by juvenile lake sturgeon in the Milwaukee River estuary

Institution: University of Wisconsin - Milwaukee
Location: Milwaukee, WI
Mentor(s): Brandon Gerig
Contact: gerig@uwm.edu
Keywords: fish ecology, acoustic telemetry, trophic ecology

Project Description

Across the Great Lakes, hatchery and stream-side rearing supplementation have been a key component to lake sturgeon (Acipenser fulvescens) rehabilitation efforts. Since 2009, ~1,000 age-0 sturgeon have been stocked annually into the Milwaukee River Estuary (MRE). While the life history of adult lake sturgeon is generally well known, there are significant uncertainties related to the movement, habitat use, trophic ecology, and survival of juvenile lake sturgeon, particularly in harbor habitats. The scholar will join a research project leveraging acoustic telemetry and stable isotopes to better understand the ecology of juvenile Lake Sturgeon in the MRE. The scholar will directly contribute hand-on field work including fish sampling, gear maintenance and deployment (e.g. telemetry receivers), and preparation of biological samples for stable isotope analysis, while working with the PI and graduate students to develop an independent research project within the scope of this project. Overall, the scholar will contribute to efforts that directly inform lake sturgeon rehabilitation efforts, guide Lake Michigan fish community objectives, and inform estuary remediation efforts in the Milwaukee Area of Concern (AOC).

Project Tasks

Conduct fisheries surveys using gill nets and set lines for juvenile lake sturgeon. Assist in the collection of biological data to inform sturgeon growth, habitat use, survival, and diet. Deployment and upkeep of river and harbor monitoring equipment including acoustic telemetry receivers. Assist in lab processing of stable isotope samples from Milwaukee harbor fish and invertebrates.

Required Skills

Ability to work in the field settings for long hours. Ability to closely collaborate with UWM graduate students, technicians, and the project PI. Ability to work safely from boats. Ability to follow protocols carefully and work independently following training. Willing to work on weekends and at night if necessary. Enthusiasm and desire to learn about Great Lakes fish ecology.

Preferred Skills

Experience handling fish and and driving boats is appreciated but also not required.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MKE05

Contaminant Fate in the Milwaukee Estuary Area of Concern

Institution: University of Wisconsin - Milwaukee
Location: Milwaukee, WI
Mentor(s): Benjamin Peterson
Contact: petersob@uwm.edu
Keywords: mercury, pcbs, contaminants, lake michigan, aoc, contamination, pollutants, heavy metals, remediation, dredging, invertebrates, rivers, harbors

Project Description

Due to a long history of industrial inputs, sediments in the Milwaukee Estuary are highly contaminated with organic and metal contaminants, such as polychlorinated biphenyls (PCBs) and mercury, leading to its designation as an Area of Concern (AOC). To address, a multi-agency team has planned sediment dredging in the AOC to remove these contaminants. This effort, the largest sediment dredging effort in the Great Lakes, is scheduled to start in 2027 or 2028. Our project will establish a critical pre-dredging baseline of mercury and PCB outcomes to evaluate this effort. There are two key objectives: 1) estimate the export of contaminants from the watershed to Lake Michigan, and 2) investigate the uptake of contaminants into the lower food web of the estuary (e.g. benthic invertebrates, prey fish). The student will join research teams to assist with fieldwork and sample processing, storage, and analysis. Finally, with supervision and guidance from the PI and graduate students, the student will conduct and independent research project that fits within the project scope. Overall, the student will contribute directly to a critical project that will monitor the success of a large-scale remediation effort and inform future remediation efforts in the Great Lakes and beyond.

Project Tasks

Collect and process biological and water samples from small boats and on foot (either from bridges or using waders). Deploy and maintain long-term monitoring equipment throughout the watershed. Support laboratory activities, including logging samples, acid washing glassware, filtering water, and preparing sediment and biological samples for trace mercury and PCB analysis. Assist with data entry and quality control.

Required Skills

Ability and enthusiasm to work in the field for long hours, including on a boat or wading in streams. Comfortable around water (requisite safety gear will be provided). Ability to follow safety and laboratory protocols, work well in a team, and stay organized within a big project. Willing and able to work flexible hours, as field work sometimes includes early mornings or late evenings. Enthusiasm about contaminant remediation and monitoring.

Preferred Skills

Experience with field work, laboratory work, or boat operations is preferred but not required.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

MKE06

Converting Fishery Byproducts into Value-Added Feed Ingredients to Support Local Seafood Production

Institution: University of Wisconsin - Milwaukee
Location: Milwaukee, WI
Mentor(s): Dong Fang Deng
Contact: dengd@uwm.edu
Keywords: fishery by product, feed nutrition, aquaculture

Project Description

This project focuses on reducing food waste by converting fishery byproducts into value-added feed ingredients for local aquaculture species such as yellow perch, lake sturgeon, and walleye. Fishery byproducts account for approximately 40–60% of total fish processing, representing an underutilized resource. Under the guidance of the principal investigator and graduate students, the student will learn how to process fishery byproducts into feed ingredients, formulate experimental diets, and conduct feeding trials. The project will also involve evaluating feed performance through measurements of fish growth, survival, feed efficiency, and overall health.

Project Tasks

Follow lab protocols to take care of fish including feeding, clean tanks, monitoring water quality. Assist feed preparation, sample collection, and prepare report for lab meeting

Required Skills

basic biology, data input into excels and use power point. willing to work on fish at wet laboratory. be comfortable working on live fish.

Preferred Skills

basic knowledge of fish or previously experience on fish handling or working in aquatic environment.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

OSH01

Investigation of Microplstic Abundance from Select Great Lakes Beaches

Institution: University of Wisconsin - Oshkosh
Location: Oshkosh, WI
Mentor(s): Greg Kleinheinz
Contact: kleinhei@uwosh.edu
Keywords: microplastics, great lakes, analytical laboratory, ftir

Project Description

This project will investigate the abundance of microplastics collected in nearshore water from a number of northern Lake Michigan beaches. The project will allow the researcher to learn sample processing techniques as well as analytical instrumentation for the detection and identification of microplastics such as FTIR. The researcher will be part of a larger team that explore a number of freshwater quality parameters and will be the lead in microplastics analysis. The researcher will have the opportunity to visit field research sites in Door County and Manitowoc, WI while engaged in their work. The researcher will get an exposure to field collection techniques as well as laboratory methodologies for a variety of analyses. Further, the Environmental Research and Innovation Center (ERIC) is a full-service, certified laboratory for a number of environmental analyses with a diverse student researcher population of 12-16 student researchers in the summer. In addition to being the FTIR lead, the researcher will also rotate through the laboratory so they can learn added instrumentation and methods such as discrete analyzers, AA, ICP, TOC, COD, and various microbiological analysis. The exact experience will be attached to the interest of the selected researcher to best optimize their experience.

Project Tasks

The project will allow the researcher to learn sample processing techniques as well as analytical instrumentation for the detection and identification of microplastics such as FTIR.

The researcher will get an exposure to field collection techniques as well as laboratory methodologies for a variety of analyses.

The researcher will also rotate through the laboratory so they can learn added instrumentation and laboratory methods such as discrete analyzers, AA, ICP, TOC, COD, and various microbiological analysis.

The exact experience will be attached to the interest of the selected researcher to best optimize their experience.

Required Skills

Basic lab experience and a desire to learn and be part of a team. Ability to work with a team.

Preferred Skills

Good communication skills.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

PLA01

Biochar as a Reactive Filter Media for Nutrient Recovery from Agricultural Runoff

Institution: University of Wisconsin - Platteville
Location: Platteville, WI
Mentor(s): Joe Sanford
Contact: sanfordj@uwplatt.edu
Keywords: agriculture, water quality, biochar

Project Description

Agricultural runoff from edge-of-fields, silage bunkers, and feedlots is a major contributor of nitrogen (N) and phosphorus (P) to surface waters, driving eutrophication and seasonal hypoxia. This project investigates the use of biochar as a sustainable and cost-effective filter media to recover nutrients from agricultural runoff. The scholar will evaluate how biochar feedstock, production temperature, and activation methods influence nutrient sorption and retention capacities. Laboratory experiments will include batch adsorption tests and flow-through column studies using both synthetic and real runoff samples. The scholar will gain hands-on experience in biochar production and characterization, conducting batch sorption and column experiments, completing nutrient analyses (orthophosphate, total nitrogen, and ammonia) using a Seal Analytical AQ300 Discrete Analyzer, and performing data interpretation. Results from this project will help optimize biochar materials for enhanced nutrient capture and explore opportunities for on-farm nutrient recovery and reuse as soil amendments, supporting circular bioeconomy principles and advancing sustainable nutrient management in agricultural systems.

Project Tasks

Prepare and characterize biochar materials. Conduct laboratory experiments, including batch isotherm tests and flow-through column studies. Analyze of samples for water quality parameters. Compile, organize, and interpret experimental data, including calculation of adsorption capacities and efficiency metrics.

Required Skills

Background or coursework in environmental science, chemistry, soil science, or agricultural engineering.

Basic understanding of nutrient cycling and water quality processes.

Ability to follow detailed laboratory protocols and maintain accurate records.

Preferred Skills

Prior laboratory experience in analytical chemistry.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

RF01

The Impact of Soil Moisture Conditions on Carbon and Nitrogen Transport to Waters

Institution: University of Wisconsin - River Falls
Location: River Falls, WI
Mentor(s): Bahareh Hassanpour
Contact: Bahareh.hassanpour@uwrf.edu
Keywords: nitrogen leachate, carbon and nitrogen emission, soil, water

Project Description

Soil moisture levels in Wisconsin soils have been influenced by extreme climatic conditions such as increased wet and dry years. Soil moisture impacts oxygen availability and redox conditions, impacting nutrient loss. However, these impacts in agricultural soils that are subjected to frequent manure application and plant residue are largely unknown. Understanding and quantifying this loss is crucial in developing nutrient management strategies and predicting water quality and greenhouse gas emissions. In this study, we link nutrient losses through leachate and emission to soil hydrological conditions in Wisconsin agricultural soils.

Project Tasks

Design experiments, taking water and gas samples, running laboratory instruments

Required Skills

Basic knowledge of chemistry

Preferred Skills

Experience in Water Sampling and Sample Analysis

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.

SP01

Ion Exchange of PFAS in Metal-Organic Frameworks (MOFs)

Institution: University of Wisconsin - Stevens Point
Location: Stevens Point, WI
Mentor(s): Joseph Mondloch
Contact: jmondloc@uwsp.edu
Keywords: pfas, water, mofs, ion exchange

Project Description

Per- and polyfluroalkyl species are a class of anthropogenic compounds that are prevalent in the environment. Given their emerging health hazards, strategies are needed to remove PFAS from the environment. Metal-organic frameworks (MOFs) function like molecular sponges and can effectively remove PFAS from water. One of the most attractive features of MOFs is they have readily modified components–metals, linkers, and charge compensating ions. In this project you will investigate how charge compensating ions within MOFs influence the ion exchange of PFAS molecules. Understanding these relationships will help scientists design new and improved sponges for soaking up PFAS.

Project Tasks

Making MOFs, preparing solutions, analyzing ion exchange of PFAS within MOFs.

Required Skills

Students should have at least two semesters of in-person chemistry laboratory.

Preferred Skills

Experience preparing solutions by weighing or dilution, hands on experience with LC-MS methodology, undergraduate research experience.

Note to Applicants: These skills are helpful, but are not requirements. Most can be taught or trained, so if you have a strong interest in this project but lack these skills, you should still apply.