2026 Western Lake Erie Basin Conference
Poster Abstracts

June 23, 2026
1:00 p.m. ET
Adrian College, Adrian Tobias Center

2026 Western Lake Erie Basin Conference
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Poster Titles

Decision-Ready Harmful Algal Bloom Monitoring Using UAS-Based Radiometric Remote Sensing

Presenter: Andrea Albright (atalbrig@mtu.edu); Michigan Technological University

Keywords: Decision-Ready Harmful Algal Bloom Monitoring Using UAS-Based Radiometric Remote Sensing

Harmful algal bloom monitoring requires timely spatial information to support in situ field sampling and resource management response. Satellite remote sensing has proven valuable for tracking bloom patterns across large systems such as the Great Lakes, but its utility can be limited in smaller inland lakes, narrow rivers, and nearshore areas. A decision-ready monitoring framework is presented that extends established water quality remote sensing approaches by leveraging radiometric sensing from uncrewed aerial systems. The proposed system combines a calibrated radiometer for near-real-time spectral assessment with multispectral imagery for high resolution drone-based mapping. Rapid processed products would provide first-order indicators of chlorophyll concentration, turbidity, and any anomalous spectral conditions to guide targeted field sampling. Post-processed products would include chlorophyll-a, turbidity, total suspended solids, phycocyanin, colored dissolved organic matter, total particulate phosphorus, and particulate organic nitrogen. This tiered satellite-to-UAS approach supports rapid triage monitoring for inland waters and nearshore environments.

Soil Phosphorus Fractionation in the Western Lake Erie Basin on a Diversification Gradient

Presenter: Amelia Clark (aniclark@umich.edu); University of Michigan

Keywords: Phosphorus, Soil Health, Land Management Practice

Phosphorus is stored in soils in a number of different forms, and its relative accessibility is dependent on a variety of soil characteristics and processes as well as plant and microbial activity. Land management practices can influence these processes, but the magnitude and directionality of these effects can vary significantly by region and have only been partially assessed in the Lake Erie watershed.

In this project soil phosphorus test results (Bray, Mehlich, and a modified Hedley protocol) were compared with a set of soil characteristics known to influence phosphorus and a gradient of land management practices as obtained from farmer interviews for a set of sites in the Western Lake Erie Basin (WLEB). Specifically the impact of field scale spatio-temporal diversification on the subset of tests above were analyzed via multiple linear regressions to discuss the potential implications for further research and farming practice.

Evaluation of Post-Harvest Residual Soil Nitrogen Following Corn Production

Presenter: Amber Emmons, Rachel Henry (henry.1394@osu.edu), Heather Torlina, Jocelyn Ruble, Ohio State University Extension
Keywords: Nitrogen, Water Quality, Soil

Given today's economic and environmental concerns, nitrogen (N) management is at the forefront of potential solutions within the agricultural industry. Keeping the N cycle in mind, along with weather variability, it is important to account for N mineralization from organic matter within the soil and account for this in a nutrient management plan. Typical rules are 20 lbs of N release per 1% of organic matter within the soil. Finding the most profitable N application rate per farm can help balance economic and environmental challenges.Fields selected had varying management practices. Soil samples were pulled at a depth of 12 inches, for a total of 20-30 cores, homogenized in the field. Nitrate-N, ammonium-N, and standard soil test analyses were conducted for each sample. After laboratory analysis was completed, incorporation of data into the software R was used for statistical analysis.

Accounting for variability within weather patterns, year to year differences were documented and attributed to the drought conditions Ohio faced in the summers of 2024 and 2025. Due to a flattened N curve, this suggests the drought response was an issue impacting N uptake in the 2025 fields. As expected, in 2023, crops were better adapted to take up soil N than drier years. Comparison of fields in the spring vs fall showcases N losses via leaching and denitrification over the winter months. Spring residual N was lower than fall residual N, with no field leaving higher than 100 pounds of N in the spring, no matter what the application rate was.

Evaluating a Controlled Drainage Decision-Support Tool Using DRAINMOD with Uncalibrated SSURGO and ROSETTA3 Soils

Presenter: Anamelechi Falasy (anamelec@msu.edu), Ehsan Ghane; Michigan State University

Keywords: Decision-support tools, Modeling, Discharge, Drainage

Decision-support tools (DSTs) that integrate hydrologic models are essential for encouraging adoption of controlled drainage by providing reliable, site-specific performance estimates. A major challenge is that soil hydraulic properties required for modeling are often unavailable or uncalibrated. This study evaluated the performance of a controlled-drainage DST by optimizing DRAINMOD simulations using uncalibrated soil properties derived from SSURGO and ROSETTA3.

Model performance was tested across five agricultural drainage sites in the U.S. Midwest (MI, IA, OH, MO), representing 30 site-years of observed subsurface drainage. Three weather datasets—onsite, Daymet, and Prism—were used to assess sensitivity to meteorological inputs. Predicted drainage discharge was compared with measured values to establish baseline accuracy under uncalibrated soil conditions. Additional simulations examined the influence of vertical seepage by comparing runs with and without seepage representation. DRAINMOD parameterized with uncalibrated soils produced good to excellent agreement with observed drainage. Daily mean NSE values were 0.67 (Blissfield), 0.70 (Henry), and 0.86 (Knox_1). Excluding vertical seepage slightly improved the monthly NSE (0.86–0.89) relative to simulations that included seepage (0.75–0.86), though differences were not statistically significant (t-test $p = 0.79$–0.97).Overall, results show that uncalibrated SSURGO and ROSETTA3 soil datasets provide sufficiently accurate hydrologic inputs for DRAINMOD when measured soil data are unavailable. These findings support the practical use of the Controlled Drainage DST for management decision-making across diverse Midwest conditions.

What Do Nutrient Ratios Reveal About Harmful Algal Blooms?

Presenter: Zoe Frankel (zfrankel@umich.edu); University of Michigan

Keywords: Nitrogen, Phosphorus, HABs

Little Long Lake, a lake on the border between Indiana and Michigan, has been struggling with high nutrient levels, harmful algal blooms, and loss of species diversity and native vegetation for the past four years, coinciding with agricultural land use changes nearby. This research aims to determine whether blooms are connected to agricultural runoff from nearby farms, or if they are a symptom of internal nutrient loading, excessive lawn fertilizer use, and faulty septic systems. Lake samples were collected by volunteer scientists from two locations in the middle of the lake, as well as three drains and a dam, from 2022 to 2025. Samples were sent to The Ohio State University Stone Laboratory for analysis of nitrite, nitrate, total nitrogen, total phosphorus, and microcystin content. Nutrient information was then analyzed to find a correlation between nutrient levels and algal blooms. Analysis demonstrates a positive linear correlation between total nitrogen and total phosphorus levels, with a N:P ratio average of 86:1 by moles that does not match typical N:P ratios, suggesting that there may be anthropogenic sources for nitrogen in the lake. This demonstrates that residents should practice septic system care and utilize best practices for lawn management in order to reduce runoff to Little Long Lake.

Characterizing Soil Health in the Western Lake Erie Basin: A Multi-Year Regional Assessment

Presenter: Rachel Henry (henry.1394@osu.edu), Amber Emmons, Jocelyn Ruble, Heather Torlina; Ohio State University Extension

Keywords: Soil health, Water quality

The Western Lake Erie Basin has faced many water quality challenges over time. Nutrient pollution and algal blooms have resulted from non-point source pollution, which includes agriculture. To aid in solving these challenges, producers are implementing soil health concepts within their farming practices to alleviate downstream issues by improving water retention, nutrient cycling, and soil biological diversity. Permanganate Oxidizable Carbon (POxC) testing measures the available soil carbon that feeds soil microbes. Soil respiration measures the activity of the microbes, and wet aggregate stability identifies how well the soil can resist destruction. These three tests lead to a better understanding of the changes soil degradation exhibits over time, showing how conservation practices can aid remediation of the soil, which in turn, improves water quality.

In Northwest Ohio, regional soil sampling at a depth of 8 inches was completed from 2020-2024. These whole-field samples were analyzed at a soil laboratory for the three soil health parameters listed above: POxC, respiration, and aggregate stability. Results were analyzed using the R software to determine trends within fields in the Western Lake Erie Basin. Relationships between different parameters were inspected and classified upon management history and crop yield.

A large majority of fields sampled did not use cover crops and/or no-till or had been using these practices for less than five years. No observed relationships between the mean CO_2 respiration, POxC, or % organic matter were identified in correlation to no-till management. This could be attributed to the short time the practices had been implemented and the slow tendency of soil to change in measurable amounts. Cover crop implementation did show a relationship between the listed parameters, with stronger interactions as implementation time increased.

Exploration of selected soil parameters in future projects should inspect long-term soil changes after implementation of cover crops and no-till practices, and the interactions between both practices.

Grand Lake St. Marys Restored Wetlands and Water Quality

Presenter: Stephen Jacquemin, Morgan Grunden (morgan.jutte@wright.edu), Haley Hoehn, Myles Wheeler, Kenneth Kline, Aaron Selby, Theresa Dirksen; Wright State University - Lake Campus
Keywords: Wetlands, HABs, Nutrient sink, Conservation

Planning of wetland restoration began in the Grand Lake St. Marys (GLSM) watershed (Ohio, USA) after the 2011 Distressed Watershed Ruling, leading to a series of best management practices and natural habitat restoration. In the past decade, over a thousand wetland acres have been restored, equating to ~2-2.5% of the entire watershed in an effort to reduce nonpoint source nutrient laden runoff from surrounding agricultural land. The objective of this study was to estimate nutrient load reductions associated with four restored wetlands in the watershed in 2025. We hypothesized nutrient loads entering GLSM would be appreciably reduced as a result of these systems as demonstrated in years past. To determine nutrient load reductions associated with the systems (Coldwater Creek, Prairie Creek, Beaver Creek, and Big Chickasaw Creek), stream inflows and wetland outflows were monitored weekly for nutrients, sediment, and hydrology. Seasonal average nutrient concentration reductions of up to 96% (nitrogen and phosphorus) and 86% for sediment were observed depending on time of year, stream conditions, and residence time. In all, a total of over 757 million gallons were treated by the four wetlands. Coupling these concentrations with volume, suggests total annual load reductions of approximately 27,000 lbs nitrogen, 1,400 lbs phosphorus, and 168,000 lbs sediment. These data are part of the long-term wetland monitoring initiative at GLSM and have important implications for conservation around the larger Great Lakes and Ohio River Drainage Basins.

Hydro Climatic and Land Use Controls on Nutrient Transport in Two Western Lake Erie Tributaries

Presenter: Drew Kraemer (kraeme25@msu.edu); Michigan State University

Keywords: Nutrients, Land Use, Climate Variability

Harmful algal blooms (HABs) present substantial threats to both ecosystem and public health by deteriorating water quality, promoting eutrophic conditions, and generating toxins that endanger drinking water resources and aquatic organisms. In the Western Lake Erie basin, the frequency and intensity of HABs have increased over recent decades, primarily due to excessive nutrient inputs from tributaries flowing into the lake. In addition, climate variability has amplified the occurrence and magnitude of extreme precipitation events, leading to greater surface runoff and enhanced transport of nutrients and sediments from agricultural lands into tributaries. Therefore, the objectives of this study were to i) characterize long-term climate variability within the Maumee River and River Raisin tributaries; ii) quantify trends in extreme precipitation events across both watersheds; iii) evaluate the effects of extreme precipitation events on nutrient transport; and iv) examine the influence of land use and land cover on nutrient loading in the Maumee River and River Raisin. Meteorological data was obtained from the National Oceanic and Atmospheric Administration (NOAA) to assess temperature and precipitation trends and identify extreme precipitation events. Hydrological and river nutrient concentration data, including TP, NO23, SRP, and TSS, were obtained from Heidelberg University, while streamflow records were collected from United States Geological Survey (USGS) monitoring stations located at Toledo (Maumee River) and Monroe (River Raisin). Analysis of extreme precipitation events incorporated lagged relationships among precipitation, streamflow, and nutrient concentrations to account for delayed pollutant transport processes. Land use and land cover data were also utilized to evaluate watershed-scale impacts on nutrient exports. Detailed findings and their implications will be presented and discussed during the presentation.

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Soil Phosphorus Transformations During Restoration of Wetlands from Row-crop Agriculture in the Western Lake Erie Basin

Presenter: Grace Marina Luo (gluo@umich.edu); University of Michigan

Keywords: Wetland restoration, Soil phosphorus dynamics, Microbial processes, Hydrological controls

Harmful algal blooms in Lake Erie are strongly linked to phosphorus (P) loading from agricultural runoff in the Western Lake Erie Basin (WLEB). Wetland restoration has been increasingly used as a strategy to reduce nutrient export, but short-term soil phosphorus responses during early restoration remain poorly understood, particularly in soils with high legacy P. This study examined how soil type, litter quality, and hydrological conditions interact to regulate short-term soil P dynamics during early wetland restoration. A laboratory incubation experiment was conducted using three soil types (lowland agricultural muck, upland agricultural, and forest reference soils), three litter treatments (high-P litter, low-P litter, and control), and two moisture regimes (aerobic and saturated). Changes in labile phosphorus, inorganic nitrogen, microbial respiration, and extracellular enzyme activity were measured to evaluate underlying mechanisms.

Under aerobic conditions, litter additions increased labile P across all soils, consistent with enhanced microbial mineralization. In contrast, saturation reduced or reversed these responses, particularly in muck soils, where labile P declined sharply despite sustained microbial activity. This pattern, accompanied by reduced nitrate concentrations, suggests a shift toward microbial immobilization under oxygen-limited conditions. Upland and forest soils exhibited more moderate and stable responses, with positive changes in labile P generally maintained across both moisture regimes.These findings demonstrate that phosphorus responses during early wetland restoration are highly soil-specific and driven by interacting hydrological and microbial processes. In organic-rich agricultural soils, microbial immobilization following re-flooding may temporarily promote phosphorus retention during the initial stages of

Assessing Cyanotoxin Presence in Western Lake Erie Tributaries Using SPATT and Lateral Flow Assays

Presenter: Lauren Lynch (llynch@usgs.gov) and Erin Stelzer; U.S. Geological Survey

Keywords: Cyanotoxins, passive sampling, tributaries, lateral flow assays

Cyanobacterial harmful algal blooms (cyanoHABs) in the Western Lake Erie Basin (WLEB) are a frequent ecological and water quality concern, with studies have indicating that blooms may be driven by increased nutrient inputs in agricultural watersheds. While cyanotoxin production is typically associated with bloom formation in nearshore areas of the WLEB, increasing evidence suggests that toxin production may begin further upstream in the watershed. The U.S. Geological Survey investigated the occurrence of microcystin, saxitoxin, and cylindrospermopsin in five tributaries of the Maumee River in Ohio to evaluate whether these upstream tributaries may serve as sources of cyanotoxins to Lake Erie. Solid Phase Adsorption Toxin Tracking (SPATT) samplers use sorbent resins to passively adsorb cyanotoxins. For this study, SPATTs were deployed for two-week periods from December 2023 through December 2025 in tributaries of the Maumee River. Adsorbed cyanotoxins were extracted from the SPATTs and analyzed using lateral flow assays (LFA) to provide time-integrated measurements of cyanotoxins. Preliminary results show cyanotoxins in each of the tested tributaries upstream of Defiance, Ohio, suggesting that cyanotoxin presence is not confined to Lake Erie and occurs within both headwaters and larger streams prior to downstream transport. These detections support the hypothesis that tributaries in agricultural watersheds may play an active role in cyanotoxin production and potentially contribute to downstream cyanoHAB related risks. SPATTs can be used as passive sampling tools to capture sporadic cyanoHABs that are missed by traditional discrete grab sampling, especially in flowing tributary systems where cyanotoxin concentrations can fluctuate rapidly. SPATT and LFA offer a low-cost monitoring strategy that can improve detection and support comprehensive assessments of cyanotoxin occurrence within the WLEB and elsewhere.

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Artificial Wetland Nutrient Dynamics During the Pre-cropping Season

Presenter: Jim Martin (jmartin@adrian.edu), Adrien College; Dennis Busch, Water Resources Monitoring Group, LLC
Keywords: Nutrient cycling, Agricultural nutrient runoff

restoration.
We sampled Nitrate and Phosphate samples from an artificial wetland. The wetland was fed from a tile drain and cubic feet per second discharge was continuously monitored. After major rain/melt events through the winter and spring of 2025 we measured nutrient contents through timed ISCO samplers. Nutrient concentrations entering the wetland system are generally reduced by the time water exits the system into the River Raisin tributary. This pattern is most consistent for phosphate attenuation and is also present for nitrate concentrations across multiple events. The wetland system functions as a biologically and physically active nutrient sink involving sediment retention, microbial processing, and seasonal biological uptake.

Beyond the Outlet: How Lateral Seepage Shapes Controlled Drainage Performance in Sandy Soils

Presenter: Ashkan Tehrani (tehrani5@msu.edu), Michigan State Unviersity

Keywords: DRAINMOD, Subsurface drainage, Lateral seepage, model, Paired-field approach, Water table

Controlled drainage (CD) is used in temperate humid regions to retain water for crop production and reduce nutrient loss. Although several studies have evaluated the effectiveness of CD in sandy soil, its performance when accounting for lateral seepage remains largely underexplored. The objective of this study was to evaluate the performance of CD management on water and nitrate loss reduction in sandy loam soil prone to lateral seepage. Paired-field approach quantified apparent performance of water and nitrate loss based on drainage outlet measurements. Actual performance (drainage discharge plus lateral seepage) was then evaluated by complementing DRAINMOD simulations with observations that partitioned water and nitrate loss between drainage discharge and lateral seepage. The paired-field analysis showed that CD significantly (p-value < 0.01) reduced annual drainage discharge and nitrate-N load by 61% (13.2 cm) and 66% (20.1 kg/ha), respectively, with no significant effect on nitrate concentration (p-value = 0.14). Under CD, lateral seepage substantially increased by 42% and became one of the major water loss pathways, resulting in a lower actual water loss reduction of 19% (4.1 cm) compared to the apparent water loss reduction on an annual basis. Groundwater nitrate concentration showed strong spatial gradients, with significantly higher concentrations in the field than at the field edge (p-value < 0.01), reflecting attenuation along lateral seepage pathway. Accounting for lateral seepage nitrate loss, resulted in a similar apparent nitrate loss reduction of 74% (31.9 kg/ha) compared with an actual nitrate loss reduction of 65% (30.6 kg/ha) on an annual basis. In conclusion, CD management functioned as an effective nitrate-mitigation practice in sandy soil, even though it considerably increased lateral seepage.

Modeling the Impact of Tile Drainage on Phosphorus Transport to Lake Erie at the Watershed Scale Using SWAT+ and Remote Sensing

Presenter: Ashwin Ghimire (ghimire9@msu.edu), Michigan State University

Keywords: Harmful algal blooms, Tile drainage, Phosphorus transport, SWAT+, Lake Erie

Phosphorus enrichment is one of the leading causes of harmful algal blooms (HABs), which continue to threaten water quality in Western Lake Erie and many freshwater systems worldwide. In the Lake Erie region, tributaries such as the Maumee River and River Raisin deliver substantial phosphorus loads in to the lake from agriculturally dominated watersheds. A key factor influencing this nutrient movement is subsurface tile drainage, a common agricultural drainage practice in the Western Lake Erie Basin. While tile drainage improves field drainage and supports crop production, it can also provide a rapid pathway for dissolved reactive phosphorus (DRP) to move from agricultural fields into stream networks and downstream receiving waters.

This study examines how tile drainage influences hydrology and phosphorus transport across field and watershed scales by integrating the Soil and Water Assessment Tool (SWAT). The modeling approach uses detailed spatial information on land use, soil properties, and tile drainage distribution, along with remotely sensed soil moisture products to support model setup, parameterization, and evaluation. Tile drainage is explicitly represented in the SWAT framework to assess its effects on flow pathways, nutrient mobilization, and phosphorus export from agricultural landscapes.Model setup, calibration, and evaluation are currently underway. The expected results will provide improved insight into the role of tile drainage in phosphorus delivery to Lake Erie tributaries and contribute to more reliable watershed-scale nutrient modeling for agricultural regions affected by HABs. Additional methodological details and results will be shared during the conference presentation.

Water Quality Improvements Associated with a Small Wetland on Buckeye Lake (Ohio, USA)

Presenter: Haley N. Hoehn (haley.hoehn@wright.edu)[1], Morgan C. Grunden[1], Silvia E. Newell[2], Ganming Liu[3], Nathan Manning[4], Stephen J. Jacquemin[1]; [1]Wright State Univerisity - Lake Campus, [2]University of Michigan, [3]University of Toledo, [4]Heidelburg University

Keywords: Wetlands, HABs, Nutrient sink, Conservation

Wetlands are becoming an increasing part of nutrient reduction strategies around the Midwestern United States to improve surface water quality. The objective of this project was to assess nutrient reduction potential of a recently constructed (2021) wetland in the Buckeye Lake Watershed (central Ohio). The Brooks Park wetland is a 5-acre restoration that is part of a comprehensive plan to improve water quality in the ~22,000 acre watershed. The wetland is designed so that Murphy's Run (small Buckeye Lake tributary) can entirely flow through a series of pools and shallow vegetated flats prior to entering the lake. During low flow, the site also has the ability to interact with lake backwaters. Surface water samples from the site along with flow monitoring were undertaken for water years 2022-2024. Using FWMC estimates from biweekly/monthly grab samples multiplied by continuously monitored flows, we found average 3-year annual load reductions of 63.4 and 14.2 pounds of dissolved phosphorus and total phosphorus along with 3,518 and 3,152 pounds of nitrate+nitrite and total nitrogen, respectively, associated with the wetland. This indicates that the wetland was an overall nutrient sink, however, reductions were primarily from dissolved nutrients with particulate forms acting as a small source at times. Average annual water volume moving through the wetland was ~1,449,139 m3 with 2% of hydrologic budget being lake backwater. Overall, the site is important for watershed nutrient reduction goals and adding additional wetland surface area to increase residence time and further process particulate nutrients is recommended.

Mapping Cover Crops with Multi-Sensor Satellites to Evaluate Phosphorus Reduction in Western Lake Erie

Presenter: Annmarie Guarino (guarinoa@msu.edu), Michigan State University

Keywords: Cover crop, Remote sensing, River Raisin

Lake Erie's fresh water supports the health, economy, and livelihoods of the millions of people living in both the United States and Canada. However, cyanobacteria-driven harmful algal blooms (HABs) coat the surface of the lake, posing a toxic threat to human health, water quality, and critical ecosystem services. Excessive phosphorus loading from the extensive agricultural landscapes surrounding the lake is widely recognized as a primary driver of these blooms. Particularly, nutrient exports fueled by erosion in the off-season contribute significantly to phosphorus enrichment in Lake Erie.

Cover crops—grown between cash-crop cycles—are an increasingly adopted conservation practice with strong potential to reduce nutrient losses from agricultural fields by limiting runoff and soil erosion. To quantify the watershed-scale effectiveness of cover crops in reducing nutrient transport, it is essential to accurately map their spatial extent across years. Remote sensing offers a powerful approach for detecting annual cover crop coverage, and long-term satellite observations provide the temporal depth needed for robust assessment.

This study has two primary objectives: (i) to develop a new algorithm for detecting the frequency of cover crops in agricultural lands using multi-sensor satellite data from the River Raisin Watershed between 2000 and 2025; and (ii) to evaluate the impact of cover crop adoption over time on phosphorus loading from the River Raisin Watershed into Western Lake Erie using the SWAT+ model. High-quality Normalized Difference Vegetation Index (NDVI) datasets from multiple satellite platforms are being utilized to accurately characterize cover crop presence and phenology. The remote sensing algorithms and SWAT+ simulations are currently under development, and detailed methods, results, and implications will be presented during the talk. Lake Erie's fresh water supports the health, economy, and livelihoods of the millions of people living in both the United States and Canada. However, cyanobacteria-driven harmful algal blooms (HABs) coat the surface of the lake, posing a toxic threat to human health, water quality, and critical ecosystem services. Excessive phosphorus loading from the extensive agricultural landscapes surrounding the lake is widely recognized as a primary driver of these blooms. Particularly, nutrient exports fueled by erosion in the off-season contribute significantly to phosphorus enrichment in Lake Erie.

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Do Phosphorus Availability and Microbial Activity Change with Agricultural Best Management Practices?

Presenter: Hannah G. Kollinger[1] (Hannah.Kollinger@rockets.utoledo.edu), Emma J. Campbell[1], Chloe G. Cash-Cairns[1], Jay F. Martin[2], Kevin E. McCluney[3], Angélica Vázquez-Ortega[3], and Michael N. Weintraub[1]; [1]University of Toledo, [2]The Ohio State University, [3]Bowling Green State University

Keywords: Phosphorus, Soil enzymes, BMPs

Phosphorus (P) inputs into the Maumee River are one of the main drivers of harmful algal blooms in Western Lake Erie. These nutrient inputs are >80% from agricultural runoff. Farmers are incentivized to implement best management practices (BMPs) like planting cover crops and applying fertilizer to the subsurface to reduce P runoff. However, economic and logistical barriers inhibit BMP adoption. Therefore, determining how effective these BMPs are at reducing P mobilization is important to inform priorities for BMP adoption.

Subsurface fertilizer application is a potentially effective BMP because it reduces P concentrations at the soil surface, where it is vulnerable to runoff during precipitation events. Another BMP of interest is planting fall cover crops, which help retain nutrients from fall fertilizing during winter. Cover crops are harvested or terminated before spring planting to recycle nutrients, increase soil organic matter, and stimulate microbial activity. Given the regional incentives to implement these BMPs, we ask: how are P availability and soil microbial activity changed by subsurface P fertilization and cover crops?

To answer this question, three groups of agricultural fields were sampled: broadcast fertilized with and without cover crops, and subsurface fertilized with cover crops (subsurface fertilization without cover crops was unavailable). Each field was sampled at five randomly selected locations at three depths: 0-10, 10-20, and 20-30 cm. Olsen-P (plant-available), and extracellular enzyme activities (phosphatase and β-glucosidase) from fall 2025 and spring 2026 were measured to assess how subsurface application of fertilizer and cover crops affect P availability. Phosphatase and β-glucosidase activity can indicate how the microbial community is working to make soil bound P plant available and to break down organic matter, respectively. Results characterizing changes in P mobility from BMP implementation will inform farmers and policy makers about which practices are most advantageous.

Winter and Spring Nitrification in Western Lake Erie

Presenter: Abigail Reed[1] (akreed@umich.edu), Silvia Newell[1], Casey Godwin[2], and Jenan Kharbush[1]; [1]University of Michigan, [2]Cooperative Institute for Great Lakes Research

Keywords: Winter limnology, Nitrification, Diatoms

Lakes globally, including the Great Lakes, are experiencing shifts in their winter conditions as the climate warms. Due to a historical lack of Great Lakes winter sampling, the impacts of winter regime shift on nitrogen (N) cycling and phytoplankton communities are unknown. We used 15 N tracer methods to evaluate monthly reduced N uptake and

regeneration rates, nitrate uptake rates, and nitrification rates in Western Lake Erie (WLE). N cycling rates followed seasonal patterns. Under-ice nitrification occurred at low and steady rates that support the under-ice nitrate pool for diatoms. Spring nitrification rates were high,which coincided with high external loading of nutrients, high nitrate consumption, and abundant diatoms. Summer nitrification rates were low, but the recycling of reduced N appeared to sustain cyanobacterial-dominated communities after diatom dominance waned. We present preliminary results of a multi-year project aiming to record monthly N cycling rates in eutrophic Great Lakes systems. Our results will inform modelling efforts to understand diatom N demands within WLE and the annual WLE N budget.