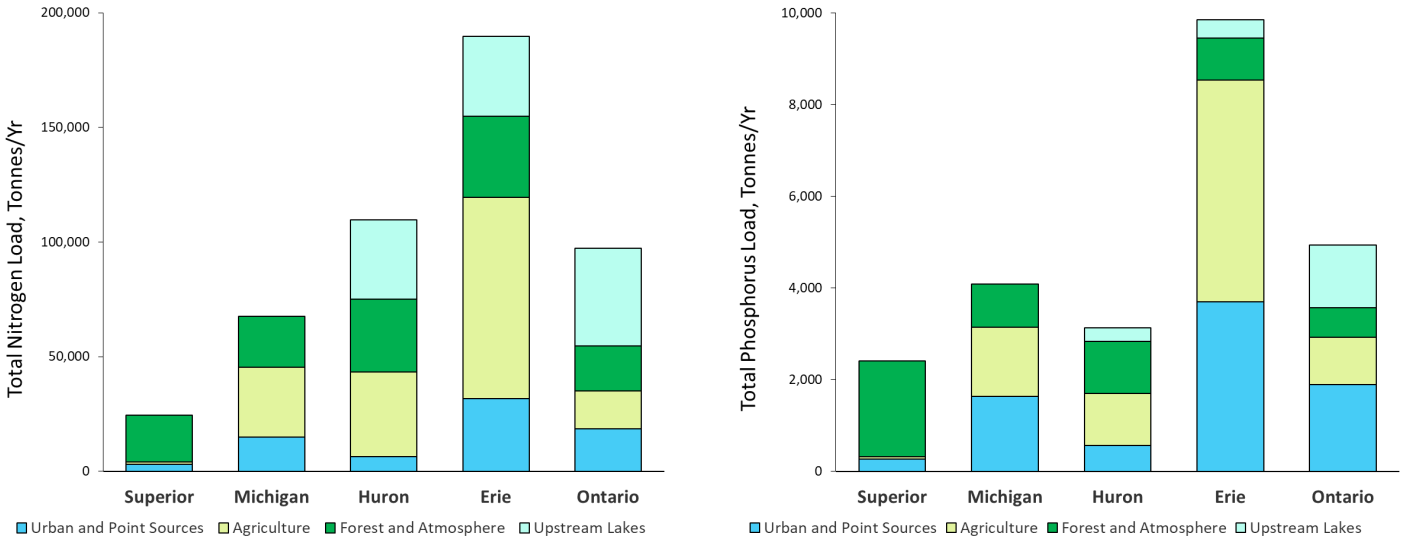
Great Lakes HABs Collaborative

Science & Policy Workshop *TAKEAWAYS*

ON APRIL 9-10, 2024, THE GREAT LAKES COMMISSION HOSTED AGENCY OFFICIALS, scientists, and legislators to chart a way forward on how to reduce and mitigate harmful algal blooms (HABs) throughout the Great Lakes-St. Lawrence River basin. This multidisciplinary group discussed nutrient management programs, systems in place to respond to HABs, and potential methods for improving water quality. While this document is not a comprehensive review of the HABs issue, it is intended to provide a summary of workshop discussions.

Nutrient reduction

Phosphorus and nitrogen are important nutrients that are essential to the growth of crops in our region but can contribute to the growth of HABs when released to surface water. Local, state/provincial, and federal partners have worked for decades to address sources of nutrient pollution, initially targeting reductions from point sources like wastewater effluent and with specific focus on phosphorus. With point sources better managed, nonpoint source runoff has become the biggest contribution to total nutrient loss. These nonpoint sources and sources of nitrogen have become increasing concerns in recent years as HABs affect treasured bodies of water.



Figures: Total nutrient loads compared by source from 2000-2014 for both phosphorus and nitrogen displayed for each Great Lake. [Robertson, D.M., Saad, D.A., Benoy, G.A., Vouk, I., and Schwarz, G.E., 2019. Phosphorus and nitrogen transport in the binational Great Lakes Basin estimated using SPARROW watershed models. Journal of the American Water Resources Association. 1–24.]

Local Soil and Water Conservation Districts (in IL, IN, MN, NY, OH), Conservation Districts (in MI, PA), Lands Conservation Department (WI), and Conservation Authorities (Ontario) are key local conservation organizations that serve as the "front line" for engagement with agricultural producers interested in best management practices (BMPs) to reduce nutrient loss. States and provinces are increasingly dedicating additional resources to efforts to keep nutrients on the land. Workshop participants identified:

- Direct support to local conservation organizations through soil and water committees or boards, often administered through state or provincial departments of conservation and/or agriculture such as the Soil & Water Conservation Committee in New York, Ontario's On-Farm Climate Action Fund (OFCAF), and the Board of Water and Soil Resources' SWCD Grants in Minnesota; or competitive award mechanisms like Clean Water Indiana.
- Facilitated farmer-led councils on water quality issues, such as Wisconsin's Producer-Led Watershed Protection Grants program.
- State-funded programs (like H2Ohio and the Wetlands Conservation Program in MI) supporting structural BMPs such as constructed or restored wetlands that are often too costly for landowners to implement on their own.
- Wastewater treatment improvements also reducing nutrient pollution from point sources, an approach taken in Michigan to meet the Western Lake Erie Basin Collaborative Agreement's aspirational goal of a 20% reduction in phosphorus contributions to Lake Erie by 2020.
- State agencies utilizing the Agricultural Conservation Planning Framework. In addition, through Michigan's Adaptive Management Plan to Reduce Phosphorus Loading to Lake Erie, and Ohio's 4R Nutrient Stewardship Certification Program states are prioritizing fields for placement of the right practices in the right place to reduce nutrient loss.

HABs monitoring & treatment

Identifying when and where HABs occur and whether treatment is feasible was a key consideration of workshop participants as ideas were shared:

- The NYSDEC's NYHABS Map and Illinois EPA's HAB GIS platforms were developed to enable citizen identification of suspected HABs and for staff evaluation. In addition to a form for submitting information on a suspected HAB, both platforms provide links to other state programs and information.
    - Visual assessments provided by NYHABS allow for the initiation of beach closures which is quicker than testing.
- Ontario requires all Water Treatment Plants (WTPs) with surface water intakes to have an algal monitoring plan in place. Ontario's Drinking Water Surveillance Program is an open data source which includes sampling for algal toxins available through 2019.

- The Wisconsin Department of Health Services supports a statewide program to report HABs-related illnesses for people and animals.
- The U.S. Army Corps of Engineers' Engineer Research and Development Center (ERDC) shared updates from the USACE Freshwater HABs R&D Initiative including projects to develop technologies for HAB detection, prevention, and management:
    - Detection: early detection through rapid, portable, multipurpose techniques. Examples include improving satellite sensing techniques; rapid molecular-based assays, and near-real time field test kits.
    - Prevention: proactive treatment of overwintering cyanobacteria. Examples include biological approaches using cyanophages (viruses) to target cyanobacteria, preventative treatment of overwintering cells in sediments, and application of reservoir operational strategies to prevent HAB formation.
    - Management: developing and demonstrating cost-effective HAB management technologies ranging from chemical-, physical, and biological-based approaches to remove, destroy, or neutralize cyanobacteria cells or toxins. Examples include bacterial remediation of algal toxins, development of novel 3-D printed photocatalytic oxidation devices, algal harvesting and conversion of biomass to biofuel, and improved uses of algaecides and nanobubble ozone technologies.

Innovative policies to consider

Jurisdictions within the Great Lakes basin recognize the complexities within environmental issues. The varied factors affecting water quality often span agencies from agriculture to natural resource management and from health departments to drinking water technicians. To address wicked issues related to water quality, states and provinces are collaborating to prioritize goals and leverage funding to address HABs in innovative ways. Workshop attendees shared these considerations:

- Cross-agency initiatives focused on water quality and nutrients help to bridge water managers and nonpoint program specialists with agriculture and natural resources colleagues in new ways (e.g., H2Ohio/ Pennsylvania HABs Task Force).
- Ohio and Minnesota have developed innovative research partnerships and programs supporting university research in alignment with resource manager needs. Ohio's Harmful Algae Bloom Research Initiative brings together state agency partners to identify state priorities put forth for researchers to address and provides funding for the projects.
- Multiple jurisdictions have dedicated funding for water quality programs that provide significant resources for protection and restoration activities through a range of innovative funding mechanisms including bonds, various tax structures, and opt-in (or out) passes for recreation access. Water royalties were also identified as a potential avenue for future funding.

Resource needs by job type

Workshop participants across jurisdictions were asked to discuss issues directly impacting their work. These conversations generated a list of resource needs by job type for the region to better address HABs. This table reflects the lists of resources identified during the discussions:

Job Type	Resource Need
Agricultural Agency Staff	▪ Funding without complicated strings attached ▪ Ability to set meaningful performance measures ▪ Consistent methods to reliably estimate nutrient reductions ▪ Increased funding for local conservation staff capacity
Water Quality Agency Staff	▪ Budget prioritization between monitoring and response ▪ Improved techniques to test for different HAB types/toxins ▪ Reduction of testing technique knowledge gaps ▪ Ability to evaluate how algaecides and other mitigation measures could potentially worsen toxic conditions ▪ Screening of HABs treatment/phosphorus control emerging technologies to reduce "snake oil" pitches seeking approval for surface water application
Agricultural/ Water Agency Leaders	▪ Nonpoint source regulatory options (voluntary measures are not enough) ▪ Reduction of red tape to implement projects ▪ Increased collaboration and innovation to reduce silos and the "way it's always been done" ▪ Research on when/where to respond to HABs
Legislators	▪ Increased capacity/funding/skilled workers to address both prevention and treatment ▪ More time to engage/learn about technical issues within limited terms of service and political shifts
University Scientists	▪ Funding for monitoring to understand if practices are effective ▪ Breaking down phosphorus paradigm to bring full complexity of blooms to forefront (i.e. factors that influence HABs beyond the presence of excess phosphorus)
All Participants	▪ Help with education and outreach to convey the complexity of HABs across the region and communicate progress within the context of relevant reduction goals ▪ Assistance to initiate and support community science programs

Science considerations

Workshop participants noted the need for continued scientific research to understand the influences in bloom formation, effectiveness of prevention and mitigation, and factors in toxicity. These topics were specifically noted as being important knowledge gaps:

- The role of nitrogen in the formation and toxicity of algal blooms
- An understanding of how effectively agricultural conservation practices perform during large yet brief storm events, which are becoming increasingly frequent
- The climate change impacts of freshwater lake acidification, increased water temperatures, and extended warm seasons on harmful algal bloom dynamics and duration
- The connection between HABs and human health, including the chronic health effects of HABs ingestion, inhalation, or dermal contact
- An understanding of the extent to which legacy phosphorus from tributaries and eroding streambanks is a factor within nutrient loads and HABs formation
- Development and testing of the effectiveness of novel technology to prevent and manage HABs