Ohio Department of Higher Education Harmful Algal Bloom Research Initiative

Agency Driven Priorities to Inform Management and Innovation

As highlighted within the request for proposals, due to the nature of this funding, successful proposals MUST include research and/or development in support of Ohio industry, commerce, and business (e.g., water treatment plants, agricultural producers, health care providers, etc.). The priorities listed below accomplish this connection, but we welcome investigators contacting Ohio Sea Grant (fussell.10@osu.edu) to facilitate connections between proposal authors and end-users (e.g., industry, businesses, agencies, etc.).

Ohio Environmental Protection Agency:

- Strategies and tools to evaluate or mitigate HABs and protect (improve) drinking water source quality:
  - Reservoir management projects that assess the efficacy of cyanobacteria control (e.g., algaecides, ultrasound) and/or nutrient reduction (e.g., alum treatments to upground reservoirs, diversion/treatment train wetlands). Prioritize projects that include objective to develop reservoir management plans with Public Water Systems (PWS).
  - Efficacy studies (pilot demonstrations) of emerging technologies and support for transfer of technology to PWS and/or recreational waters. Prioritize technologies for use in drinking water sources with NSF/ANSI/CAN standard 60/61 certification.
  - Projects that couple mitigation strategies with land use best management practices and/or integrate with larger source water protection projects.
  - Data analytics tool for water quality monitoring data that will improve timeliness and efficiency to evaluate and share data.

- Assess outcomes and adoption of drinking water treatment processes for cyanobacteria and cyanotoxins:
  - Document success stories and/or impediments to practical use or adoption.
  - Prioritize projects that include knowledge exchange (e.g., involvement with trade organizations) and cost-benefit analysis for utilities.

- Identification, occurrence, and environmental drivers of emerging cyanotoxins in waters throughout Ohio.
- Tributary trends: What improved methods can Ohio use to track changes in water quality utilizing the tributary monitoring network (as described in Ohio’s 2020 Domestic Action Plan Appendix G, [https://lakeerie.ohio.gov/wps/portal/gov/lec/planning-and-priorities/02-domestic-action-plan/02-domestic-action-plan](https://lakeerie.ohio.gov/wps/portal/gov/lec/planning-and-priorities/02-domestic-action-plan/02-domestic-action-plan))? This work could consider:

  o Temporal and spatial variations within the network.
  o Ability to detect a nutrient input reduction from BMPs programs (such as H2Ohio)?
  o Can the analyses determined from this work be carried out in the future by the state?

Example deliverable: An application that Ohio could use on a regular basis to update these analyses.

*** Investigators will be encouraged to work in collaboration with continued water quality monitoring supported at previously HABRI funded sites (n=4)

- BMPs utilizing ODOT property: Outline a framework on how to reduce nutrients (via concentration and/or flow reductions/ seepage/ evapotranspiration augmentation) on ODOT owned/managed right of ways in the Maumee River watershed. Research could include:

  o Guidelines on project types that would have best impacts on challenging landscapes prone to erosion, salt exposure, and degraded soils
  o Pilot studies to understand the impact of practices with an emphasis on dissolved reactive phosphorus
  o Geospatial analysis (e.g., ACPF) identifying potential placement locations throughout the watershed.
  o Items investigators should consider:

    ▪ Prioritizing projects in areas with a greater likelihood of runoff is encouraged.
    ▪ ODOT/public property information and detailed lidar are available.
    ▪ Acquisition of adjacent properties can be considered when evaluating project placement.
    ▪ Projects need to be considerate traffic safety, flooding, and maintenance.

*** Background information is available upon request from: Josh Griffin (Ohio EPA) joshua.griffin@epa.ohio.gov and Matt Perlik (ODOT) matt.perlik@dot.ohio.gov.

- Urban stormwater nutrient reductions (including dissolved phosphorus). Examples include:

  o Most stormwater BMPs focus on addressing flow volume and sediment loading. How do these practices impact DRP?
  o How does BMP age impact treatment effectiveness?
  o Are there novel stormwater BMPs retrofitting existing infrastructure and/or new developments that address DRP?
  o Model development to evaluate/identify critical sources of DRP runoff and BMP placement locations for urban stormwater (similar to ACPF but for urban landscapes).
  o How to better evaluate/monitor total and dissolved phosphorus and nitrogen loads in urban stormwater (including MS4) areas?
Ohio EPA can assist with connecting researchers with community partners; contact Josh Griffin at joshua.griffin@epa.ohio.gov.

- **Beneficial Use:** Available research indicates that materials high in aluminum and iron content can permanently bind phosphorus in soils and water (examples: foundry sand, drinking water treatment material, sewage sludge incinerator ash, fly ash). Phosphorus binding beneficial uses proposed for study include the following:

  o Create enhanced buffer strips on farm fields by blending waste with existing soil
  o Land apply waste on P legacy farm fields and incorporate into the soil
  o Target top 10% of legacy P fields with the highest P binder waste materials
  o Co-blending waste with manure from CAFOs before land application
  o Co-blending with waste with biosolids from wastewater treatment plants before land application
  o Use filter socks filled with waste and place in ditches along fields where tiles drain
  o Filter treated wastewater with waste at WWTP before it discharges to stream
  o Co-blending waste with sandy Lake Erie Dredge in beach restoration projects
  o Use waste to filter discharge water from confined disposal facilities on Lake Erie (place waste in filter socks or engineer a “bioretention” device)
  o Bioretention soils (co-blending waste in bioretention collection basins and municipal stormwater systems and possibly combined sewer overflow systems)

**Ohio Department of Natural Resources:**

- Increasing our understanding of ecosystem functions within wetlands that have been restored, enhanced, or created with a nutrient-reduction focus:

  o What role do plants and their internal structures play in nutrient removal and cycling within wetland ecosystems?
  o Development of innovative remote sensing technology and interconnected network that monitors wetland ecosystems that can be connected across a broad spatial range and improve our understanding of wetland functions.
  o What hydrological management regimes optimize nutrient sequestration by wetlands? (e.g., seasonal vs continual pumping)
  o What are the tradeoffs between nutrient removal and wildlife benefits among the different wetland management approaches? For instance, what are the effects on biodiversity or other non-nutrient metrics?
  o Do the water management strategies that optimize nutrient sequestration promote or inhibit the formation of diverse and resilient aquatic communities?
  o Evaluate the effect that the wetland water management strategies aimed at optimizing nutrient sequestration have on the use by, and benefits for, native fishes.
  o Evaluation of temporal dynamics of wetland function relative to nutrient processing (i.e., effectiveness at year 1 vs year 5+)
  o Develop an improved wetland ecosystem model for understanding nutrient cycling within non-flow through wetlands (i.e., coastal, flood plain, and/or isolated wetlands).
- Improving our ability to select sites and predict wetland restoration impact at removing and/or sequestering nutrients and sediments within a watershed:
  o Refining, streamlining methodology for P-reduction estimation when planning/prioritizing/siting nutrient reduction wetlands
  o Role of legacy Phosphorous in newly constructed wetlands
  o How to construct an effective wetland (e.g., site selection, characteristics for an effective wetland, etc.)
  o Determine the effectiveness of different wetland types at removing nutrients and sediments

- Understand the social science around wetland restoration efforts:
  o What impacts landowner’s willingness to adopt wetland restoration practices
  o What role does government conservation policies play into this willingness?
  o How do different communities or segments within communities’ view wetland restoration efforts?

**Joint Ohio Department of Natural Resources and Ohio EPA:**

- Improving our understanding how seasonal dredging and placement of dredge material from the Toledo Federal Navigation channel affect nutrient load magnitude and bioavailability in Maumee Bay and impact seasonal western basin HABs. Specifically, research to identify innovative strategies and tools to evaluate the effects of dredging, dredge material placement/management/beneficial use, and dredge timing to reduce HABs.
  o Is there a relationship between the seasonal timing of dredging and dredge material management on western basin HABS?
  o What tools/methods/data need to be developed or collected to assess the seasonal and nutrient load impacts from dredging and dredge material management on western basin HABs?
  o What is the relationship of sediment resuspension and/or internal loading (release of bioavailable phosphorus) on western basin HABs?

- How does Ohio’s 2020 dredge material open-lake placement ban change sediment movement, lakebed sediment dynamics, and phosphorus bioavailability in Maumee Bay?
  o To what extent/magnitude does sequestration of dredge material through upland placement or beneficial use remove particulate/bioavailable phosphorus from the western basin? What factors need to be considered when estimating potential reductions in load?
  o What data/tools/methods need to be collected/developed to assess the seasonal impacts of sequestration on western basin HABs?

*** Background information for these joint priorities is available upon request from Drs Scudder Mackey, scudder.mackey@dnr.ohio.gov (ODNR) and Vanessa Steigerwald Dick, vanessa.steigerwalddick@epa.ohio.gov (Ohio EPA).
Ohio Department of Agriculture:

- Manure-related research questions:
  
  o Amount, proportion, and distribution of manures, chemical fertilizers, and biosolids land applied in the WLEB?
  
  o What does the literature say about the effectiveness of various manure management practices, application methods, application timing, and associated (appurtenant) practices on nutrient loss and runoff for nitrogen and phosphorus? Summarize the existing research and develop research where there are gaps.

- Drainage retention/detention practice (e.g., ponds, basins, wetlands, enhanced waterways, two-stage ditches) research questions:
  
  o Develop best design parameters of nutrient reduction wetlands to be employed within the agricultural drainage system (e.g., retention time, plantings, etc.)
  
  o Acreage need and cost to implement in order to reduce nutrient loading (e.g., field scale, subwatershed, basin)?
  
  o Investigate available and potential implementation and funding drivers to maintain conservation practices for load reduction and water quality benefits (e.g. conservation works of improvement)

- Nutrient application method questions:
  
  o Develop farm operation cost-benefit analysis of subsurface nutrient placement practices including analysis of agricultural economic inputs and yields.
  
  o Development of a smaller dragline system to accommodate smaller farms and cropping systems.

- Agricultural adaptation to climate change effects on nutrient runoff
  
  o Rainfall patterns last 30 years and implications for stormwater management on agricultural landscape?
  
  o Recommendations for incorporation of climate adaptation practices into farm conservation planning?
  
  o Update precipitation curves to use for agricultural conservation practice design.

- Soil Testing:

  Compare current OSU/industry recommendations for nitrogen against soil tests developed to evaluate available nitrogen during the growing season (e.g., Solvita, Haney, etc.)

- H2Ohio program delivery and outcomes questions: Analysis of factors resulting in varying levels of participation by watershed and county (e.g., outreach methods, staffing, partnerships, producer attitudes, etc.)

Lake Erie Commission:

- Technology development in support of DRP reduction.
- Research to support metrics or indicators of ecosystem or economic health in the Ohio Lake Erie watershed. This may include survey based measures of resident satisfaction with, or willingness to pay for, various elements of the Lake Erie ecosystem services, tourism features, or recreation opportunities that may be affected by the presence of HABs. Other possibilities include further development of nearshore indices that include the effects of HABs.

- Social marketing research and development to help the state communicate about nutrient reduction efforts and promote BMP adoption (both urban and agricultural). Investigator will be expected to work with state agency staff to refine the messaging.

**Ohio Department of Health (listed in order of priority):**

- The development of a web-based drainage model application using DRAINMOD for determining appropriate drain spacing for sewage system and agricultural drainage designs for water table management to help reduce nutrient loading.

- Health effects of consumption of low levels of cyanotoxins through drinking water and recreational exposure (including incidental ingestion, inhalation and dermal contact) with particular focus on sensitive populations including children, pregnant women, and nursing mothers, and the ability to eliminate toxins after exposure.

- Impact of total body burden from exposure to multiple cyanotoxins and occurrence of chronic disease, including impacts to neurological and metabolic functions.

- Evaluation of health impacts to dogs or other pets from exposure to cyanotoxins, diagnosis and responsive treatment, and elimination of toxins after exposure.

- Transfer and persistence of cyanotoxins into plants and the food chain, resulting impacts on sport fish populations, residence time of cyanotoxins in sport fish, and the health effects of sport fish consumption containing cyanotoxins.

- Persistence and distribution of cyanotoxins in beach sand and shoreline environments from HAB contaminated water and waterfowl droppings.

- Prevalence and occurrence of all cyanotoxins (other than microcystin) in lakes, ponds and springs used for recreation and private drinking water supplies. These systems are commonly shallower and have less water volume and may be more susceptible to the formation of algal blooms.

- Cost effective treatment technologies for:
  
  o Smaller scale (lower volume) drinking water treatment systems such as ponds or springs
  o Point of use removal for low level detections of cyanotoxins in drinking water