CFAES

ADDRESSING LAKE ERIE ALGAL BLOOMS

OVERVIEW OF THE ISSUE

Over the last 15 years, the frequency and severity of harmful algal blooms (HABs) in Lake Erie's Western Basin have increased. These blooms can impact fisheries, recreational industries, and property values. In some cases, toxins from algal blooms have contaminated urban drinking water systems leading to "do not drink" advisories and serious risks to local residents. A number of studies point to runoff of nutrients—particularly phosphorus—from nonpoint sources as an important driver of HABs. Concerns over HABs led to federal and international agreements to reduce runoff of nutrients by 40 percent by 2025. CFAES faculty and staff are deeply involved in the scientific study of the causes of HABs in Lake Erie and in developing effective management practices and technological solutions to address the problem. New and complementary research on HABs is also taking place in the Ohio River Basin, into which two-thirds of the state drains.

A LEADER IN APPLIED WORK ON WATER QUALITY

CFAES faculty and staff help address water quality challenges through four core activities:

SCIENCE Understanding Drivers and Processes of Water Quality Problems

INNOVATION Creating Applied Solutions

COLLABORATION AND EXTENSION Partnering for Impact

EDUCATION Training the Future Workforce

COMING SOON

In fall 2018, CFAES will launch an Ohio Water Quality Initiative to coordinate, support, and expand on the efforts described above. An eight-person task force is designing the initiative. The task force is using extensive input from faculty, staff, and diverse stakeholders to ensure the initiative has grassroots support, is strategic in investments of time and money, and increases the impact and relevance of our work for all Ohio residents.

Science

- **Multi-Model Assessments of BMPs:** Margaret Kalcic and Jay Martin, both in the Department of Food, Agricultural and Biological Engineering (FABE), have coordinated teams of modelers from different universities and engaged with stakeholders to identify the optimal mixes of best management practices (BMPs) capable of helping Ohio meet its obligations under the Great Lakes Compact nutrient reduction agreements.
- **Lake Harmful Algal Bloom Dynamics:** Justin Chaffin, The Ohio State University Stone Laboratory and Ohio State-based Ohio Sea Grant, is studying the physical, chemical, and biological drivers behind the emergence of toxic algal blooms in lakes and rivers.
- **Cyanotoxin Impacts:** Jiyoung Lee, Department of Food Science and Technology (FST), helps monitor HABs at beaches and in drinking water intakes. She also tracks cyanotoxins (toxins sometimes produced by HABs) in irrigation water and dredged sediments, and their potential impact on fresh produce and other crops.
- **Economic Analysis:** Brian Roe, Allen Klaiber, Sathya Gopalakrishnan, Brent Sohngen, and Tim Haab, all in the Department of Agricultural, Environmental, and Development Economics (AEDE), have calculated the economic costs and benefits of reducing HABs to recreation users, homeowners, and Ohio's citizens.

Innovation

- **Monitoring and Detection:** Chaffin and colleagues monitor Lake Erie water quality using real-time data buoys and fixed station sampling sites via Ohio State research vessels, coordinate a charter captain sampling network, and perform microcystin analysis for water treatment plants.
- **Decontamination Methods:** Lee and Libby Dayton and Nick Basta, both in the School of Environment and Natural Resources (SENR), are developing practical, sustainable methods for decontamination of microcystin toxins in water treatment residuals.
- **Revised P-Index:** Through the On-Field Ohio project, Dayton has developed a new phosphorus risk index that farmers in the Western Lake Erie Basin can use to simulate the impacts of changes in tillage, crop rotations, and fertilization practices on phosphorus losses from individual farm fields.
- **Policy Innovation:** Ramiro Berardo, SENR, and Sohngen study the ability of different water quality policy tools to incentivize changes in behavior that could link to significant reductions in nutrient runoff from the Western Lake Erie Basin.

Collaboration and Extension

- **Public-Private Partnerships:** Martin, Kalcic, Ryan Winston, FABE, Greg LaBarge, Ohio State University Extension, Robyn Wilson, SENR, and Roe are working with partners from the The Nature Conservancy, U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS), and agricultural groups to form public-private partnerships to identify and better manage fields with elevated soil phosphorus levels in northwest Ohio.
- **Harmful Algal Bloom Forecasting:** Researchers from Ohio Sea Grant collaborate with Heidelberg University and the National Oceanic and Atmospheric Administration to publicly issue an annual Lake Erie HABs forecast every July, and are working to add information about HABs toxicity to the forecast.
- **Fertilizer Application Certification Training (FACT):** OSU Extension faculty and staff have played the lead role in developing and implementing a training program to meet state requirements for certification of people who apply fertilizers.
- **On-Farm Research and Demonstrations:** CFAES faculty and staff have partnered with farmers in the Western Lake Erie Basin to carry out on-farm research and demonstration projects designed to improve awareness of and confidence in BMPs designed to reduce nutrient runoff to Lake Erie.
- **Collaboration With Other Universities:** CFAES faculty have collaborated with scientists at other Ohio and regional universities to study the drivers and processes underlying the Lake Erie HABs problem. Their work is supported by contributions from the state's farm commodity organizations, and by state and federal grants.
- **Collaboration With State Agencies:** CFAES faculty regularly work with Ohio state agencies to provide scientific advice on the development and formulation of water quality programs.
- **Guiding State Policy:** Work by CFAES faculty has been used to help develop and implement critical state policies, including the Clean Lake 2020 legislation passed in summer 2018. The legislation provides more than $36 million to support monitoring activities and adoption of practices to reduce nutrient runoff into Lake Erie.

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

waterquality.osu.edu

THE CORNERSTONE COLLEGE

The College of Food, Agricultural, and Environmental Sciences (CFAES) plays a critical role in carrying out the land-grant mission of The Ohio State University. For nearly 150 years, our faculty and staff have engaged in research, teaching, and Extension outreach to address real-world problems facing Ohio. We are an independent and objective source of scientific knowledge, and we turn scientific discoveries into practical applications that are made widely available to our state's residents.