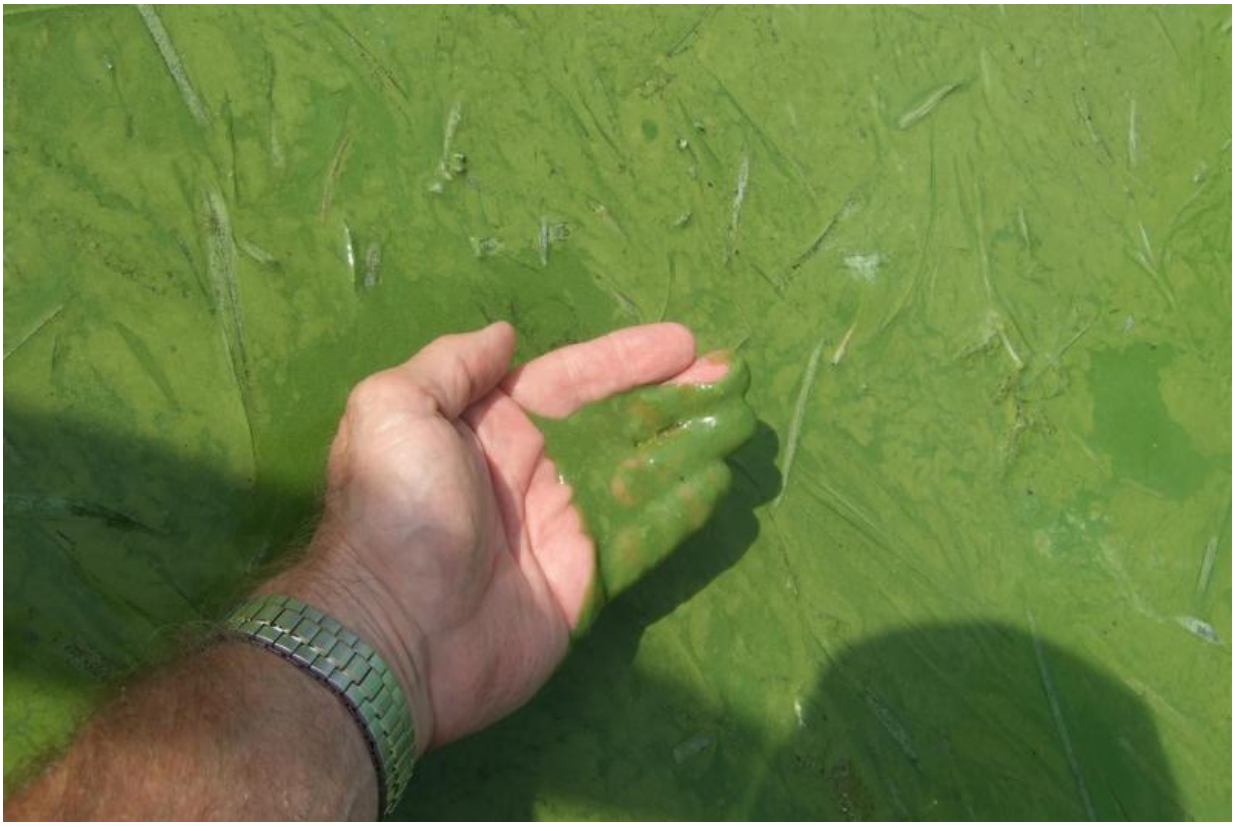
Number of severe algal blooms in Lake Erie to double, forecast says

December 16 2015, by Pam Frost Gorder



Harmful algal bloom as seen from the research docks of The Ohio State University's Stone Laboratory on Gibraltar Island in Lake Erie in 2013. Credit: Jeff Reutter, courtesy of Stone Laboratory.

By the latter half of this century, toxic algal blooms like the one that cut off drinking water to the city of Toledo in 2014 will no longer be the

exception, but the norm, a study suggests.

While researchers have long suspected that climate change will lead to stronger and more frequent blooms, a new fusion of climate models and watershed models has proven those suspicions right: For Lake Erie, at least, the number of severe blooms will likely double over the next 100 years.

The findings hold implications for hundreds of coastal regions around the world where nutrient runoff and climate change intersect to make toxic algae a problem.

Government agencies need to have more than just historical records at their disposal when they set guidelines to reduce nutrient inputs, said Jay Martin, professor of ecological engineering at The Ohio State University.

For example, Ohio, Michigan, and Ontario, Canada, have agreed to reduce phosphorus runoff by 40 percent over the next 10 years. The reduction is meant in part to lower the chance of another toxic bloom affecting Toledo.

"Right now, we can only make recommendations based on the past, but the climate is not a constant. We need to look to climate models of the future to protect water quality in Lake Erie and around the world," said Martin, who also heads the university's Field to Faucet water quality program.

"Maybe 40 percent is not enough of a reduction."

In fact, the study suggests that nutrient reductions alone might not be enough to stop blooms like the one in 2014 from recurring in Lake Erie, said Noel Aloysius, the postdoctoral researcher who presented the team's

results Wednesday, Dec. 16, at the American Geophysical Union meeting in San Francisco.

Aloysius was joined by Hans Paerl of the Institute of Marine Sciences at the University of North Carolina at Chapel Hill, who presented complementary findings from the United States and China.

Nutrient reductions won't have as much of an impact on Lake Erie as researchers would expect, the Ohio State study suggests.

A duck swims through a harmful algal bloom near The Ohio State University's Stone Laboratory on Gibraltar Island in Lake Erie in 2009. Credit: Stone Laboratory.

That's because climate change supercharges algae the way anabolic steroids supercharge athletes, Aloysius explained.

"Our assessment of climate in the region reveals less winter snow, more heavy spring rains and hotter summers," he said. "Those are perfect growing conditions for algae. We can reduce phosphorus by 40 percent, but the algae won't suffer as much as you might hope."

Martin and Aloysius are at the midpoint of a two-year study—the first to combine global climate change models with a watershed model to predict how climate change will influence algal blooms in an individual coastal region: in this case, the Maumee River Watershed and Lake Erie.

Lake Erie may contain only 2 percent of the total water in the Great Lakes, but it holds 50 percent of the fish, including game fish that support a $1.7 billion tourism industry. It also provides drinking water for 11 million people, and its watershed drains through the heart of Midwest agriculture. In fact, 75 percent of the 6,600-square-mile Maumee Watershed is covered with fields of corn, soybeans and winter wheat.

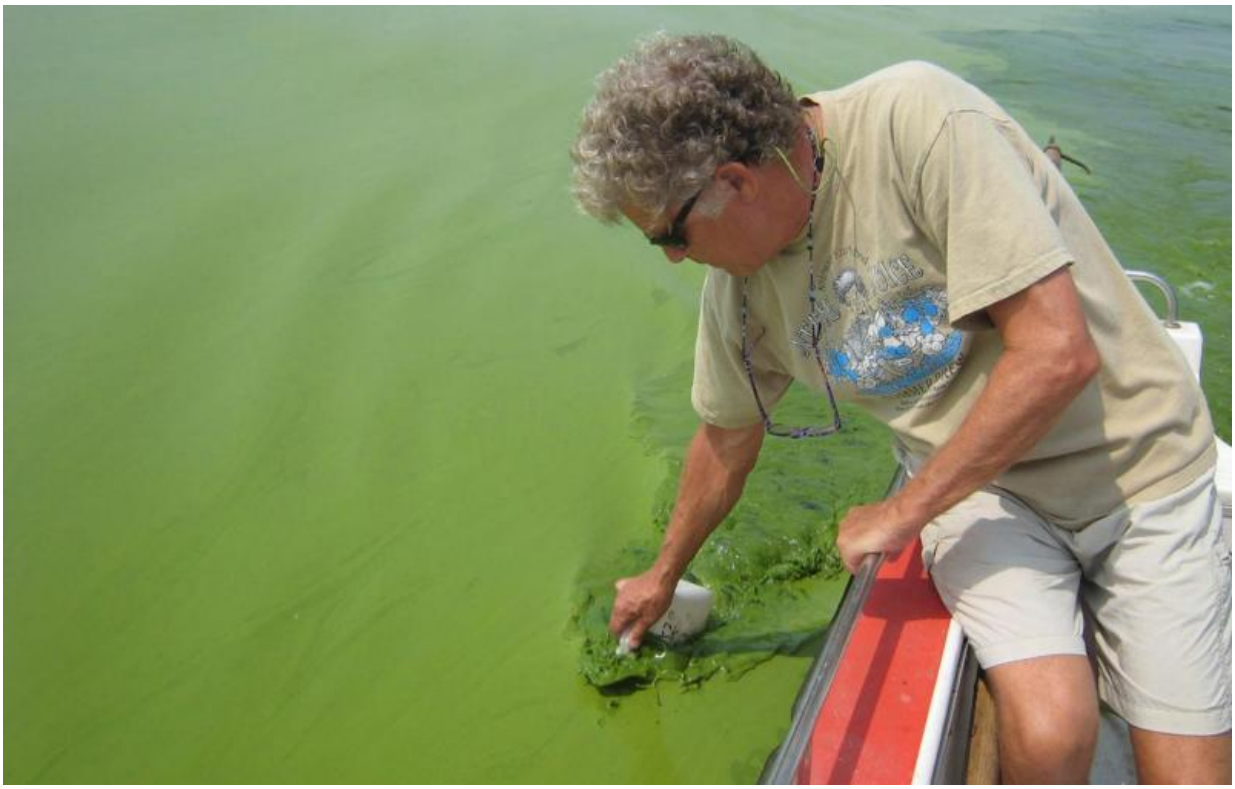
While the health of Lake Erie is so important to the states and Canadian provinces that surround it, toxic algae is a problem around the world. This study provides forecast methods that could be applied to those areas as well.

One such area is China, where urban populations and agriculture are booming.Paerl, professor of marine sciences at UNC-Chapel Hill, studies Lake Taihu, the third largest freshwater lake in China.

Five times smaller than Lake Erie and nine times shallower, Lake Taihu

is more easily overrun by toxic algae—a great test case for algae problems that the United States will likely experience in decades to come.

"Lake Taihu is a 'looking glass' for how severe algal blooms are likely to get when excessive nutrient loading synergistically interacts with warming," Paerl said. "Our Taihu research has taught us that both phosphorus and nitrogen inputs should be reduced for controlling algal bloom proliferation."



Hans Paerl of the University of North Carolina at Chapel Hill samples water during a harmful algal bloom in Lake Taihu, China. Credit: Hans Paerl, University of North Carolina at Chapel Hill.

That's because many lakes have already experienced decades of nutrient over-enrichment from accelerating use of chemical fertilizers and expanding wastewater discharge from urbanization worldwide.

These lakes, he said, have a "legacy of storage" of both nutrients in their sediments.Paerl's team is evaluating a variety of algae mitigation and control strategies, including artificial mixing and enhanced freshwater flushing of impacted lakes and reservoirs, as well as the use of algaecides, flocculants and sonic treatments to arrest blooms.

"It should be noted," he said, "that no matter what types of physical or chemical treatments we use to mitigate blooms, they should be accompanied by nutrient input reductions."

To assemble their forecast for Lake Erie, Ohio State researchers selected a series of climate model outputs from the Intergovernmental Panel on Climate Change's Fifth Climate Change Assessment and coupled them with watershed and bloom prediction models, combining variables like stream flow, rainfall, and temperature with landscape topology, soil types, cropping practices and drainage management. Richard Stumpf at the National Oceanic and Atmospheric Administration's National Centers for Coastal and Ocean Science led the development of the bloom prediction model.

Currently, Martin and Aloysius are working with Ohio State University Extension, the School of Environment and Natural Resources and the School of Communication to get a clearer picture of how stakeholders' anticipate the Maumee Watershed ought to be managed. Then they will incorporate these stewardship plans into the models.

Ultimately, the researchers want to identify farming or water management practices that reduce nutrient runoff without adversely affecting agricultural production.

"Farmers need to be very efficient to make a living," Aloysius said. "If we can help them use less fertilizer, that represents a cost savings, but if the solution involves applying fertilizer in a way that keeps tractors running longer, then they're buying more fossil fuel. So we need to balance financial and environmental costs."

Provided by The Ohio State University