

FS-057 | Global change in the Great Lakes

LOAN COPY ONLY

CIRCULATING COPY

Sea Grant Depository

**OHIO SEA
GRANT
COLLEGE
PROGRAM**

**Ohio Sea Grant
College Program**
The Ohio State University
1314 Kinnear Road
Columbus, OH 43212-1194
TEL 614/292-8949
FAX 614/292-4364

Sea Grant forms a unique partnership with public and private sectors to combine research, education, and technology transfer for service to the public. Sea Grant provides a national network for universities to meet changing environmental and economic needs in our coastal, ocean and Great Lakes regions.

Ohio Sea Grant, based at The Ohio State University, is one of 29 state programs in the National Sea Grant College Program of the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce. Support is also provided by the Ohio Board of Regents, Ohio State University Extension, other universities, industries and associations.

OHSU-FS-057

This fact sheet summarizes
Global change scenarios for
the Great Lakes region.

1992

This publication is produced
by the Ohio Sea Grant Col-
lege Program (projects E/
AID-2 and M/P-2 under grant
NA90AA-D-SG496).

© The Ohio State University
Printed on recycled paper



The global warming debate

What will the Earth's climate be like in the next century? Will it be warmer, as many scientists predict? How do scientists predict such things? These are just a few questions surrounding the global warming debate.

Some scientists predict that if current emission trends continue, the Earth could be 1.5 to 4.5°C (2.7 to 8.1°F) warmer by 2050. Others believe that the Earth is flexible enough to handle the additional "greenhouse" gases emitted, in large part, by burning fossil fuels and deforestation.

Why are scientists coming up with different answers to the same question?

Climate models

The different answers to the global warming question are partially a result of our relatively limited knowledge and technology.

To predict global climate changes, scientists develop computerized climate models. All models incorporate well-established physical laws and reams of weather data, but they also include scientists' assumptions about unknown areas. As assumptions vary, so do models.

Limited technology also hampers the modeler. Today's best computer is unable to predict climate changes for specific locations; at its best, it can predict climate for a 90,000 square-mile area!

Clearly, there's room for improvement in climate modeling. But there's also room for trust. Whether or not global warming actually occurs, it's important for people to know what the future could hold and how to prepare for it.

Global warming and...

...Water resources

Global temperatures have changed only about 5°C since the last ice age. But now some scientists say the Earth's temperature could increase by as much as 1.5 to 4.5°C in the next 50 to 75 years.

Under this scenario, global warming could change humidity and precipitation patterns, increase water temperature and evaporation and decrease water levels. Even a 2.5 centimeter (about one inch) decline in Lakes Michigan and Huron would mean losing enough water to supply Cleveland for 88 years. Decreased water levels could also turn vital bodies of water into wetlands before their time.

Scientists also predict that because zebra mussels thrive in warmer water, global warming could

exacerbate the infestation in the Great Lakes basin.

...Biodiversity

Scientists estimate that 10 million species inhabit the Earth, but to date, they've identified fewer than 20 percent.

If global warming occurs, biodiversity in the Great Lakes could be endangered. Wetland spawning and breeding grounds could become vulnerable, and water could become increasingly concentrated with pollutants.

Also, the Midwest's "grain belt" could shift into Canada, leaving behind a host of ecological "orphans." Some plants and animals might make the trip, but others would be left to stave off aggressive invaders in a new, unfavorable environment.

...Shipping

Global warming, if it occurs, would threaten Great Lakes shipping. When lake levels drop, ships must carry less cargo to avoid grounding. More trips cost more money. In fact, it's estimated that it costs a ship more than 420,000 tons in reduced cargo per year to sit just one inch higher in the water.

Also, reduced water levels mean more frequent dredging projects, which are expensive, hurt water quality and can threaten dock foundations.

...Agriculture

At first glance, global warming would seem to benefit farmers. Growing seasons could be longer and excess CO₂ in the atmosphere would help produce bigger crops.

But there are problems. Although yields might be larger, studies show that food quality would deteriorate. There could also be a host of new pests, ultimately meaning more herbicides, insecticides and fertilizers, more non-point pollution and higher food costs.

Evaporation and low water levels could dry the soil and make irrigation difficult, and the climatic extremes that would likely accompany global warming could drive some farmers out of business.

...Airborne circulation

Studies show that 20 to 25 percent of the toxins in the Great Lakes didn't come from a drainage pipe but from the sky. These toxins travel from points all over North America and can have devastating effects. They've been linked to cancer in fish, reproductive failure in birds and even low birth weight and neuromuscular problems in infants.

Under the global warming scenario, airborne toxins could become even more hazardous. More severe storms would carry toxins from distant locations. These storms would also stir up polluted areas, resuspending toxins that have been buried for decades.

...Low water levels in estuaries

Estuaries are complex places and are especially important as spawning, breeding, nursing and nesting grounds for many species. Estuaries clean toxins from the water and help reduce floods and erosion by taking in excess water and anchoring soil in plant roots.

If global warming occurs, many wetlands will likely be lost. Without ample prey and nesting grounds, game fish and duck populations will likely fall, affecting anglers, hunters and related businesses.

...Eutrophication

Eutrophication is the aging of a lake, a process by which the lake warms, becomes more shallow and produces more organic material. It usually occurs naturally, but it can be accelerated by pollution and, scientists suspect, by global warming.

Each summer, a lake divides into a warm surface layer, a narrow band called the thermocline and a cool bottom layer. Isolated from the air, the cool water often can't provide enough oxygen for bottom-dwelling organisms.

Under global warming, the bottom layer could get even less oxygen. Warmer conditions could lengthen a lake's stratification period. Storms could mix oxygen into the upper layer more thoroughly and deeply, resulting in a lower thermocline and an even smaller lower layer to support bottom-dwellers. What all this could mean is less oxygen for game fish, many of which are bottom-dwellers.

...Recreation

If global warming occurs, boating, swimming and windsurfing may come to replace snowmobiling and ice fishing. Winter sports enthusiasts may travel to Canada, while tourists from areas where lakes are shrinking may visit the Great Lakes.

Global warming could provide a hospitable environment for invaders, possibly putting popular game fish at risk. It also could dry up popular marshes, make boating and docking more difficult and relocate shorelines away from established camping and picnic grounds.

...Fish populations

If global warming occurs, some fish species could migrate as much as 200 kilometers (124 miles) north of their present location. Southern species could invade the Great Lakes, dramatically changing Great Lakes food webs.

Warmer waters would speed fish metabolism, increasing daily food requirements. If fish couldn't find enough food growth could decline.

Higher algae populations might serve as food for the "hungrier" fish, but this isn't certain. Blue-green algae are common in the Great Lakes, but plankton-eating fish prefer green algae. Ultimately, uneaten algae would die and decompose, robbing bottom-dwellers of valuable oxygen.

Even precipitation and evaporation patterns could affect Great Lakes fish. Degradation of fish habitat could increase

with every violent storm, and plants and animals would be re-exposed to toxins with each dredging project.

Some believe that Great Lakes commercial and sport fishing would benefit from increased fish growth under global warming. But other effects could be very negative.

...Forests

If global warming occurs, it could have devastating consequences for North American trees.

The most serious concern is whether forests could migrate quickly enough to keep up with northward displacement of ecological zones. It doesn't seem likely. Scientists estimate that for a beech to stay in its proper habitat, it would have to migrate 40 times faster than it ever has before.

Also, trees might not be able to migrate across cities, highways and farmland, or even be able to adjust to conditions in new northern climes once they got there. Proposed climate changes could also reduce the chance of offspring survival and cause more forest fires.

All this could have a tremendous economic cost. If softwoods are replaced by hardwoods, businesses that process softwoods could fail. Facilities would have to be adapted to accommodate hardwoods, an expensive proposition.

What we can do

There are three potential responses to global warming. We can wait and see if it happens, assume the worst and begin to make drastic changes now or start to make changes that make sense, whether global warming happens or not.

The latter, though a "middle of the road" choice, seems to make the most sense. Though global warming is still an unknown, we can tackle *known* problems.

Some duties fall to policy makers and regulators, who must set fair water guidelines, protect wetlands, identify and control toxins, determine sources of non-point pollution and reduce chemical damage to forests by the atmosphere, among other things.

But individuals can help, too. Responsible citizens can reduce fossil fuel consumption at home and work, use public transportation, support a conservation group, volunteer to restore habitat or just keep up on environmental issues.

All of us—scientists, industry, private citizens—are quite literally in this together. Only through cooperation, effort and wisdom will we be able to meet the global warming challenge head-on.

Professor Rosanne W. Fortner, Ohio Sea Grant Education coordinator, has led a group of scientists and writers in producing **Global change scenarios for the Great Lakes region**. This series of 11 short articles written for educators, policy makers and the concerned public discusses the possible effects of global warming in greater detail. This fact sheet is a summary of the scenarios. To order a copy of the scenarios, send \$6 (\$9 if outside the United States), payable to The Ohio State University, to:

Ohio Sea Grant Publications
The Ohio State University
1314 Kinnear Road
Columbus, OH 43212-1194