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Essay

by the Michigan Department of Environmental Quality ♦

Topic Code 23

Climate Change and the Great Lakes

Global climate change has been widely discussed in the popular press and scientific literature. A great deal of research has been conducted on climate change, primarily at the global level. General circulation models (GCM) of the world's atmosphere and a doubling of the greenhouse gas, carbon dioxide, have been used to create various scenarios about future conditions overall. Although results of these modeling efforts tend to agree on average global estimates of climate change, regional predictions vary tremendously. In strategic areas such as the Great Lakes basin, one of the most important predicted effects is on water—we will have less of it, and it will be warmer.

The ramifications of such a prediction, should it come about, are far-reaching, and may have considerable economic, social, political, and ecological impacts. Water resource planning and policies that lead to protecting existing water supplies, increasing water use efficiency and addressing present water allocation conflicts, would ease future water management problems as demands increase, even if climate change fails to materialize in the Great Lakes region.

Concerns over the possible regional effects of climate change led the U.S. Congress to direct the United States Environmental Protection Agency to coordinate studies of the potential effects of doubling atmospheric carbon dioxide, the most important greenhouse gas. Similar studies have been initiated in Canada. A number of bilateral symposia were held on the implications of climate change for a number of regions in North America. A major recommendation of the first symposium was that the U.S. and Canada develop an integrated study of the Great Lakes Basin as a pilot project for an international response to global climate change.

Two follow-up workshops were held to develop the components of the bilateral Great Lakes Climate Change effort. Results of the workshops were published in two reports. The Canadian report, "Adapting to the Impacts of Climate Change and Variability," can be obtained by contacting Ms. Linda Mortsch, Atmospheric Environment Service, c/o Inland Waters Directorate, Ontario Region, Room LS11, 867 Lakeshore Road, P.O. Box 5050, Burlington, Ontario L7R 4A6

(telephone 416/336-6417, fax 416/336-8901). The U.S. report, "Great Lakes Climate Change," can be obtained by contacting Publications Department, Great Lakes Environmental Research Laboratory, National Oceanic and Atmospheric Administration, 2205 Commonwealth Boulevard, Ann Arbor, MI 48105 (telephone 313/741-2262).

These reports form the basis for the binational climate change effort, now called the Great Lakes-St. Lawrence Project. This project should be completed in 1997. Project results would aid in the formation of water resource management plans and policies for a warmer uncertain future.

Some of the possible effects on the Great Lakes basin, projected from models and subsequent effects on the environment and society, are basically related to basin runoff, over lake precipitation, and lake evaporation. Although precipitation in the basin is projected to increase slightly, basin runoff decreases and substantial evaporation increases will result in lower lake levels and tributary discharges. Both winter and summer water temperatures are projected to increase, affecting the duration of ice cover, circulation and mixing of the water column, fish communities, and productivity. Wetlands and their benefits will be reduced as water levels fall and shorelines recede.

Hydropower production from Great Lakes waters and their tributaries would also be reduced as water supplies and surface elevations fall. The need to replace cheap hydropower with more expensive electricity from coal-fired and nuclear generating facilities may be required.

Increased water transportation costs would result because of shallower depths in channels and harbors. This would require smaller cargos in larger ships, more trips, and backups at bottlenecks in the system. Dredging and sediment disposal to provide adequate water depths would be costly, especially in areas where sediments are highly contaminated, thus requiring expensive confined disposal. A longer shipping season would result as the climate warms, with longer ice-free periods and less need to stockpile materials for the winter. Industry requiring water for production processes and transportation of raw materials and finished products would likely be adversely affected both regionally and nationally.

Commercial businesses along shorelines would experience conditions similar to those low lake levels of the 1960s. Unusable boat docks, launching facilities, water intakes or discharges would require substantial capital investment to become functional. Extensive private or municipal dredging would be needed and may prove too costly for some operations to persist. Warmer winter temperatures would make operations requiring reliable snow conditions (skiing, snowmobiling, and ice fishing) even more speculative, and decreased river flows in the summer would reduce canoeing opportunities.

Fisheries may be more productive as water temperature in the lakes becomes warmer. Fish communities would become dominated by warm water species in both lakes and streams. Those fish species dependent on wetlands for spawning and nursery purposes would decline. Cold water dependent fish species would be gradually eliminated from water bodies with marginal temperature conditions.

Agriculture could experience a northward expansion to take advantage of fertile soils. Other areas may have increased costs for irrigation, or have very low soil moisture conditions, thus limiting agricultural activity. Costs of shipping bulk agricultural products would increase as lake levels decline.

Riparian activities in many cases are flexible and follow receding water levels and wise beaches, such as swimming, wind surfing, etc. Water access facilities such as boat launches, marinas, and docks would need to be extended lakeward.

Prolonged periods of extremely low water levels in the Great Lakes, as suggested by the climate change scenarios, requires new policies and management strategies for the distribution of benefits among the various users of the system. Presently, the Boundary Water Treaty between the U.S. and Canada mandates a specific hierarchy of uses. The primary interests are domestic and sanitary uses, followed by navigation, power generation, and irrigation. Treaty modification may be necessary regarding the use hierarchy in order to reflect other industrial, commercial, riparian, recreational, and ecological interests. Future water management will probably be directed at retaining more water in the system by regulating lake levels, diverting more water into the system, and preventing increased diversion via Chicago to mitigate climate changes to the south and west.

For a more detailed and extended discussion on climate change with a focus on eastern North America, the 1993 book by David M. Gates, *Climate Change and Its Biological Consequences* (Sunderland, MA 01375: Sinauer Associates, Inc.) is recommended.

For more information, contact **Red Evans** at 517/373-0639.



ABOUT THIS ESSAY

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