

Healthy Waters



Healthy Waters Series: #5

Climate Change Effects on Healthy Waters

Climate-- is it changing or isn't it? Didn't the ice go out on one of the latest dates ever this spring? But that was just a weather event and not necessarily indicative of local climate. If we look instead at the average of such weather events, daily temperature highs and lows, inches of rainfall, storms, etc., averaged over several years and decades we begin to detect changes in climate. We see that the average annual temperatures in northern Minnesota have increased 1.8 degrees in the summer and 3.1 in the winter in the past century, mostly in the last 50 years. Annual precipitation in Minnesota has increased by about 3.1 inches in the past century.

Obviously, the earth's climate has changed many times in the distant past. The one factor that can explain the current abrupt rise in global temperatures is an entrapment of solar energy by the earth's atmosphere referred to as the greenhouse effect. Several natural and manmade gases and fine particles contribute to this blanketing effect, but carbon dioxide (CO₂) is the most important based on its efficacy, long half-life and abundance. Natural sources and sinks exist for CO₂ but changes in land use have reduced sinks such as tropical forests and combustion of fossil fuels (coal, oil, natural gas) has elevated atmospheric concentrations from 280 to 390ppm since the industrial revolution. It is now higher than it has been in the last 800,000 years and rising exponentially.

Changes we are detecting at this time are considered only the early signs of climate change effects. Globally or nationally we are seeing higher degrees of change when moving poleward from the equator. Glaciers worldwide are melting at increasing rates, and sea levels are rising. Evidence is mounting that storm events and heat waves are becoming more numerous and intense. While Minnesota is projected to see a continued increase in rainfall and storm runoff, the southwestern U.S. is likely to become dryer and water deficits more severe. In North America, the ranges of plants and animals, including pests and pathogens, are expected to move northward, perhaps resembling those hundreds of miles south by the end of this century, if conditions like photoperiod, water chemistry, soils and rainfall are suitable. Sometimes they won't be.

A 2011 MNDNR document entitled *Climate Change and Renewable Energy: Management Foundations* reviewed the state of knowledge on current changes in Minnesota resources related to climate. These changes included:

- √¹ A 30% reduction in ice cover on the Great Lakes between 1973 and 2008.
- √¹ Ice-on dates for Minnesota lakes occurred 7.5 days later and went off lakes earlier between 1979 and 2002.
- √¹ Warm water fish, notably largemouth bass and bluegill, are becoming more common in northern Minnesota lakes.
- √¹ A coldwater fish called cisco that has been common in larger and deeper lakes in Minnesota declined by 42% since 1975.
- √¹ Winter ranges of several duck species have moved over 150 miles north in the last 40 years.

Looking forward, annual temperatures in Minnesota are projected to increase by 5-9⁰F by the end of this century, and rainfall to increase by 7-11%. Water temperature-related changes such as aquatic plant and undesirable algae growth will intensify. Fish and other aquatic animal assemblages will increasingly reflect those in lakes and streams south of here or diminish to the point of extinction. These changes will simultaneously promote the spread of invasive species such as Eurasian water milfoil, buckthorn, garlic mustard and 'new' ones that thrive under disturbed conditions. Future changes in total precipitation are harder to estimate or model and less certain. However increased intensity of rain events is likely, resulting in erosion, scouring, sedimentation and further disruption of biological communities, particularly in streams.

So what do we do in the face of such changes? Heightened attention to existing Best Management Practices and conservation measures and will be important for dealing with these effects. Careful planning based on the best scientific information on current and anticipated future effects is critical in this regard. A 2010 Minnesota Pollution Control Agency report entitled *Adapting to Climate Change in Minnesota* describes initial efforts to develop response strategies through cooperative planning with the Minnesota Department of Health, MNDNR and several other state agencies. One would hope that such documents or strategies will stimulate stronger support for reducing the causes of climate change, as well as just dealing with anticipated effects.

This article was written by John Eaton, a retired Fisheries Research Biologist for the U.S. Environmental Protection Agency, on behalf of the Civic Engagement Team of the Leech Lake Watershed Restoration and Protection Project. John's research included the study of effects of climate change, acid rain and various pollutants on aquatic ecosystems. He lives on Kabekona Bay of Leech Lake with wife Barbara. The next article in the Healthy Waters series: Healthy Waters for Sustainable Communities and Quality of Life.