



Dying birch trees, minimal snowpack, and ice-free lakes are just some...

## Impacts of Midwest Warming



### The Science Is In

Recent reports by the U.S. Global Change Research Program, the National Academy of Sciences, and the United Nations Intergovernmental Panel on Climate Change, give a clear indication of a warming world and related changes in our global climate system. The climate is changing, and there is little scientific doubt that most of the temperature increases since the mid 20th century are due to greenhouse gases produced by human activities. Taking action now will diminish the risks associated with climate change, and reduce the likelihood of catastrophic and far more expensive consequences.

### A Changing Climate

Change has always been a powerful force of nature. National parks help us understand how much change influences our lives by illustrating how interconnected we are with our environment.

In the last 100 years, the Earth's surface temperatures have risen an average 1.33°F (0.74°C). More than 20% of this change has occurred since 1996, with eleven of the last twelve years ranking among the twelve warmest years on record.

Current warming is occurring in most regions across the globe and is largest at high latitudes in the Northern Hemisphere.

James Hansen, NASA's chief climate scientist has said "We are getting close to a tipping point...Several degrees of temperature rise are unavoidable. The changes will be substantial, but something to which we can probably adapt. However, if we stay on a business as usual path for another decade, the impacts will be dire."

### Temperature and Precipitation

The Northern Midwest, including the upper Great Lakes region, has warmed by almost 4°F (2°C) in the 20th century.

Data for Lake Michigan, Huron and Superior show that summer water temperatures are increasing. Lake Superior's summer surface water temperatures have increased by 4.5° F (2.5°C) since 1980.

The timing of Lake Superior's summer overturn is now two weeks earlier than expected in 1980.

Overturn occurs when the lake reaches a uniform temperature and the water completely mixes from top to bottom.

Based on climate model predictions, summer temperatures in the Great Lakes region are projected to rise by at least 5.4°F (3°C), and as much as 19.8°F (11°C) by 2100. Projected temperature changes vary depending on the model and scenario, however all projections indicate warming for the region. Extreme weather events such as heat waves, droughts, tornadoes, and thunderstorms may also become more frequent.



Ice is forming later and melting earlier on lakes and streams in the Great Lakes region. This contributes to greater evaporation and falling lake levels in the Great Lakes.

Ice is forming later and melting earlier on lakes and streams in the Great Lakes region. Two-thirds of the winters between 1988 and 2003 in the Midwest had temperatures above the long-term average. Winters are getting shorter in the Great Lakes region. The last spring frost is coming earlier and the first autumn frost is coming later. Snow cover in the northern hemisphere has declined about 5% since 1975.

The combination of reduced winter ice, warmer lake temperatures, and greater evaporation leads scientists to believe that the level of Lake Superior will fall from a few inches to several feet. A warmer lake could mean increased algae growth and significant changes in species composition.

## The Ecological Effects



Warmer temperatures might be related to declining moose populations.

Great Lakes species favoring cool climates are shifting their ranges up in elevation and to the north. Plant and animal communities adapted to warm climates are expanding. Cool adapted tree species such as sugar maple and paper birch are projected to lose habitat in the U.S. and shift largely to Canada. More southern species such as oaks, hickories and pines may see an expansion of potential habitats.

Warming temperatures increase problems related to insects and disease. Because insects and pathogens have shorter life spans than most forest vegetation, they can respond more rapidly to climate change. A longer growing season may mean that more generations of pests can attack vegetation, while shorter and warmer winters will allow more pests to survive. If vegetation has been stressed by drought or fire, it is also more susceptible to disease and infestation.

The disruption of coordination in timing between life cycles of predators and prey

may be the greatest impact on wildlife species attributable to climate change. Changes in climate are having significant effects on breeding range, winter distribution, and the timing of migration for many bird species in North America. Studies at Aldo Leopold's "Shack" in central Wisconsin show that the arrival of the first robin has advanced 1.2 days per decade over the last 60 years. Insects that birds depend on for their food have also appeared earlier in some areas, but the birds and their prey are not always "in synch." Where predator, prey, and vegetation do not adapt at the same rate, these ecological communities may be impacted.

Scientists think that due to vegetation shifts and thus habitat shifts, parks may experience unprecedented shifts in mammalian species. Several researchers have concluded that rapid changes are possible over the next 20 to 50 years. Warming temperatures might already be related to the significant decline in moose populations in northern Minnesota and at Isle Royale National Park since the 1980s.

## New Faces In New Places

Researchers tell us that climate warming will cause changes in the types of tree species that grow in midwest forests. Forest composition in Apostle Islands National Lakeshore and in Michigan's Upper Peninsula is predicted to change from northern hardwood/boreal mix to more southern species (model predictions under a 5°C increase in mean annual temperature). Paper birch habitat may virtually disappear from the area under some climate change scenarios.

Research shows wood ticks, wild turkeys, badger, opossum, and flying squirrel are extending their ranges north. Warming climate may also be contributing to increasing range of gypsy moths and other exotic insect species.

As lake temperatures increase, the number of exotic species, such as zebra mussels and sea lamprey, will likely increase. Zebra mussels have already been documented to cause major changes in water clarity leading to unnatural algae growth in some areas.

Distribution of fish will change according to the temperature of water. Warm water fish such as bass will expand northward, while trout and other cold water fish will decrease. Increasing temperatures and potential storminess will disrupt the shallow waters in which many fish, including whitefish, spawn. Seasonal wetlands, important habitat for many plants and animals, may dry up. These changes will threaten the abundance of native fish.

## Recreation, Health and Safety

Climate change will create longer seasons for popular warm weather activities like swimming, camping, boating, and kayaking. Lower lake levels mean wider beaches for visitors to enjoy. The season for winter recreational activities, however, will get progressively shorter as snow and ice decreases.

Increasing frequency and intensity of severe storms and floods will impact people visiting National Park Service areas. These storms may also pose threats to historic structures, roads and trails, archeological sites, administrative facilities, and other park resources and infrastructure.



Falling lake levels may make docks and boat ramps unusable.

As spring arrives earlier, mosquitoes and black flies will begin hatching earlier in the season and may take longer to die off as winters become shorter. This will be a nuisance to visitors and may increase the risk of mosquito transmitted viruses to visitors.

Changes in fish communities will change the recreational fishing experience. Increases in severe storm events may impact campers boaters and hikers, and increased summer temperatures may lead to more heat related illnesses.

Although periods of drought will exist, researchers also predict an increase in intense, short-duration rain storms characterized by violent winds, lightning, high waves, and/or flash floods, creating hazardous conditions for visitors.

Rising temperatures and earlier springs are likely to increase the occurrence of forest fires, lengthen the fire season and contribute to larger fires. This could in turn increase atmospheric carbon contributions from forests.

Park and other recreational facilities may be inadequate for new conditions. Recreational infrastructure such as fixed docks and boat ramps may be too high as lake levels decline. Shallow water at docks and anchorages may limit access by deeper-draft boats. Decreasing lake levels will make some areas of the lakes inaccessible to many watercraft. Navigational hazards and new sand bars may be exposed.

## What Difference Can We Make?

- Become knowledgeable about climate change and how individual actions can make a difference. Share this bulletin with a friend.
- Use public transportation at home, to and around parks, forests and wildlife refuges. Walk, use mass transit, carpool with friends, or ride a bike whenever possible.
- Purchase solar and wind generated power and "carbon credits" to help offset your emissions.
- When it is time to replace the family vehicle, consider one that gets more miles per gallon than your present vehicle.
- Convert home and office lighting to compact fluorescent bulbs. Turn off unnecessary lights.
- When buying an appliance, look for the Energy Star® label identifying energy-efficient models.
- Buy products that feature reusable, recyclable, or reduced packaging to save the energy required to manufacture new containers and reduce greenhouse gas emissions from landfills.
- Educate others. Let friends and family know about these practical, energy-saving steps they can take to save money while protecting the environment. Calculate your carbon contribution at: <https://www.greentagsusa.org>
- Encourage your company to join Waste Wi\$e recycling programs, and sustainable practices programs.
- Encourage scientific research and public discussion on global warming and solutions such as energy efficiency and alternative energy.

For more information go to: <http://www.nps.gov/climatefriendlyparks/>  
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