Michigan

Findings from

Confronting Climate Change in the Great Lakes Region

Impacts on Michigan Communities and Ecosystems

Climate Change in the Great Lakes State

Michigan is known for its beautiful beaches, bountiful northern forests, delicious fruit crops, and, of course, automobile manufacturing. This summary highlights the potential impacts of climate change on Michigan's economy, people, and the places they love.

Scientists are now convinced that human activity, primarily burning fossil fuels to produce electricity and drive our cars, is changing our climate. These activities emit gases, principally carbon dioxide (CO_2), that blanket the planet and trap heat. Already, we are seeing signs of climate change throughout the Great Lakes region: average annual temperatures are increasing; severe rainstorms have become more frequent; winters are getting shorter; and the duration of lake ice cover is decreasing.

Climate Projections

The latest, most reliable projections of future climate change combine 100 years of historical data for Michigan with the most up-to-date general circulation models of the Earth's climate system. In general, Michigan's climate will grow considerably warmer and probably drier during this century, especially in summer.

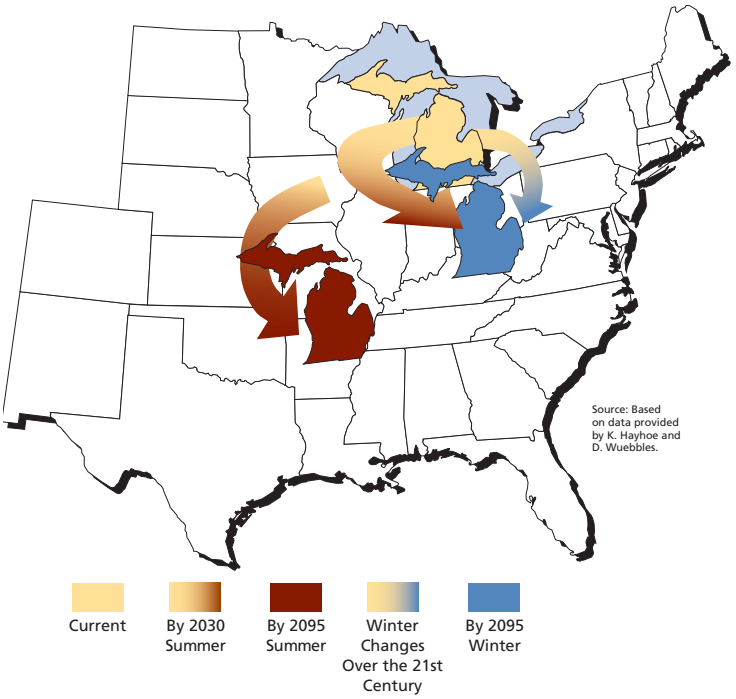
- ***Temperature:*** By the end of the 21st century, temperatures are projected to rise 6–10°F in winter and 7–13°F in summer. This dramatic warming is roughly the same as the warming since the last ice age. Overall, extreme heat will be more common and the growing season could be 8–10 weeks longer.

The number of hot days in Detroit is projected to double or even triple, with years later in the century experiencing 30–50 days exceeding 90°F.

- ***Precipitation:*** While annual *average* precipitation may not change much, seasonal precipitation in the state is likely to change, increasing in winter by 10–25% and possibly changing in summer by +20% to –5%. Thus, Michigan summers may grow drier, with soil moisture declining and perhaps more droughts, because the rainfall cannot fully compensate for the drying effects of a warmer climate.
- ***Extreme events:*** The frequency of heavy rainstorms, both 24-hour and multiday, will continue to increase, and could be 50–100% higher than today.
- ***Ice cover:*** Declines in ice cover on the Great Lakes and inland lakes have been recorded during the past 100–150 years and are expected to continue.

How the Climate Will Feel

By 2030, Michigan summers may resemble those of Ohio in terms of average temperature and rainfall. However, by the end of the century, the Michigan summer climate will generally resemble that of current northern Arkansas. Winters will also change, such that by century's end, they may be much like those in current-day Ohio.



Potential Impacts from Climate Change

Water Supply and Pollution

Michigan depends heavily on groundwater, on fresh water from the three Great Lakes, and on rainfall for agriculture, drinking, and industrial uses. The state's current population of almost 10 million has increased at faster than projected rates over the past decade, continues to grow, and will demand ever more water for all its needs. The projected changes in rainfall, evaporation, and groundwater recharge rates will affect ecosystems and all freshwater users.

- Reduced summer water levels are likely to diminish the recharge of groundwater, cause small streams to dry up, and reduce the area of wetlands, resulting in poorer water quality and less habitat for wildlife.
- Lake levels are expected to decline in both inland lakes and the Great Lakes, as more moisture evaporates due to warmer temperatures and less ice cover.
- Pressure to increase water extraction from the Great Lakes will grow, exacerbating an already contentious debate in the region.
- Development and climate change will degrade the flood-absorbing capacities of wetlands and floodplains, resulting in increased erosion, flooding, and runoff polluted with nutrients, pesticides, and other toxins.

Agriculture

Michigan ranks first in the nation in production of red tart cherries, blueberries, cranberries, and black beans, ranks 11th for corn and soybeans, and is also a dairy and livestock leader. There are likely to be some positive impacts for agriculture from a warmer climate, although current evidence suggests that the negative consequences could outweigh the positive. In general, however, regional development, technological advances, and market

fluctuations have as much influence on farmers as the climate.

Overall, optimal weather conditions are expected to shift northward and eastward in the region, potentially benefiting northern states such as Michigan. Shifts in the distribution of agriculture, however, may be constrained by thin and acidic soils. Climate variability will likely pose greater risk for smaller farms and may thus reinforce the trend toward increasing farm size and industrialization of agriculture in the region. These changes will affect local farming communities, and, in turn, change the character of rural landscapes.

- Increased atmospheric CO_2 and nitrogen, as well as a longer growing season, could boost yields of some crops, such as soybeans, corn, and wheat.
- Extreme events such as severe rainstorms and floods during planting and harvest seasons will likely depress productivity. Similarly, hotter and drier conditions during the main growing season also disrupt production and may require irrigation of currently rain-fed crops.
- For perennial crops such as fruit trees and vineyards, greater climate variability is particularly problematic because adjustments cannot be made as flexibly and long-term investments are at risk.
- Higher ozone concentrations can damage soybeans and horticultural crops, countering positive impacts of a warmer climate.
- Several climate changes may combine to create more favorable conditions for a number of pests. The bean leaf beetle, which eats soybeans, and the European corn borer may expand northward with multiple generations per year.
- Extreme heat and droughts can severely affect livestock health and production.

Human Health

Climate projections suggest that extreme heat periods are likely to become more common in a warmer climate, as will severe storm events.

- Winter cold-related morbidity or mortality will decrease, while summer heat-related morbidity or mortality is likely to increase. The number of hot days in Detroit is projected to double or even triple, with years later in the century experiencing 30–50 days exceeding 90°F. Of even greater concern is the projected 5- to 10-fold increase in extreme heat days (exceeding 97°F, currently averaging less than 5/year) by 2080–2100, which will require improved warning systems and preparation to avoid severe health impacts.
- Higher temperatures and more electricity generation for air conditioning increase the formation of ground-level ozone, likely exacerbating asthma and other respiratory diseases.
- Some waterborne infectious diseases such as *cryptosporidiosis* or *giardiasis* may become more frequent or widespread if extreme rainstorms occur more often.
- The occurrence of many infectious diseases is strongly seasonal, suggesting that climate plays a role in influencing transmission. Some diseases carried by insects such as Lyme disease (ticks) or, more recently, West Nile encephalitis (mosquitoes) have expanded across the region. While this spread is attributed largely to land-use changes, future changes in rainfall or temperatures could encourage greater reproduction or survival of the disease-carrying insects.

Randall McCune, courtesy Michigan Travel Bureau

Property and Infrastructure

Cities and other heavily developed areas are particularly vulnerable to the risks of climate extremes, incurring direct economic losses or requiring costly adaptations.

- More frequent extreme storms and floods, exacerbated by stream channeling and more paved surfaces, result in greater property damage, place heavier burdens on emergency management, increase cleanup and rebuilding costs, and exact a financial toll on businesses and homeowners.
- Storms, and flooding in particular, will require changes in infrastructure. Municipalities in Michigan will have to upgrade water-related infrastructure including levees, sewer pipes, and wastewater treatment plants in anticipation of more frequent extreme downpours.
- Lower lake levels have costly implications for shipping on the Great Lakes, requiring more frequent dredging of channels and harbors and adjusting docks, water intake pipes, and other infrastructure. On the other hand, a longer ice-free season will extend the shipping season.

Lakes, Streams, and Fish

Michigan's numerous rivers and lakes draw millions of visitors each year. Native aquatic plant and animal species will differ widely in their responses to changing water temperature and hydrology.

- Cold-water species such as lake trout, brook trout, and whitefish may decline dramatically as cool-water species such as muskie and walleye along with warm-water species such as bluegill and smallmouth bass expand their ranges northward.
- These disruptions will likely be compounded by invasions of nonnative organisms such as the common carp and zebra mussels, fundamentally changing native fish communities.
- In all lakes, the duration of summer stratification will increase, adding to the risk of oxygen depletion and formation of deep-water "dead zones" for fish and other organisms, although "winterkill" in shallow lakes will likely decrease.
- Lower water levels coupled with warmer water temperatures may accelerate the accumulation of mercury and other contaminants in the aquatic food chain.

Wetlands and Shorebirds

Earlier spring runoff, more intense flooding, and lower summer water levels generally translate into growing challenges for Michigan wetlands, such as in Saginaw Bay, and the species that depend on them. Development and agriculture have already reduced wetland habitat significantly.

- The combined pressures of development and climate change will degrade the flood-absorbing capacities of wetlands and floodplains, potentially resulting in increased erosion, additional water pollution, and delayed recovery from acid rain.
- Wetland losses and changes in flood pulses will likely reduce safe breeding sites for amphibians, migratory shorebirds including some warblers, and waterfowl such as canvasbacks, and may cause many migratory species such as Canada geese to winter further north.
- Increased evaporation will likely shrink wetland habitat. New wetlands, however, may be created along lake edges as water levels drop.

Recreation and Tourism

Tourism is one of Michigan's top income-producing industries. Birders, boaters, campers, hikers, hunters, winter sports enthusiasts, and other visitors to Michigan bring nearly $10 billion into the state annually.

- Millions of anglers will be affected by range shifts, loss of habitat, and increases or declines of their preferred catch, both on the Great Lakes and small inland lakes.
- Loss of habitat or food resources for migratory songbirds, shorebirds, and waterfowl will affect Michigan's multimillion-dollar birdwatching and hunting industries.
- Warmer winters mean trouble for states such as Michigan where winter recreation has long been an integral part of people's sense of place. Communities and businesses dependent on revenues from cross-country or downhill skiing, snowmobiling, and, especially, ice fishing could be hard-hit.
- The summer recreation season will likely expand as temperatures warm further, but extreme heat, heavy downpours, elevated ozone levels, and possible increases in risk from insect-borne and waterborne diseases may dampen outdoor enthusiasm.

Forests and Terrestrial Wildlife

Northern Michigan is still dominated by forests of spruce, hemlock, and fir, and forestry is locally important. Factors other than climate are important drivers of change in forestry and forest ecosystems, but climate change may exacerbate existing stresses.

- Warmer temperatures will likely cause boreal forests to shrink and other forest species to move northward unless hindered by obstacles.

Courtesy of NOAA, Great Lakes

- Increasing atmospheric CO_2 and nitrogen will likely spur forest growth in the short term, but higher concentrations of ground-level ozone, more frequent droughts and forest fires, and a greater risk from insect pests could damage long-term forest health.
- Resident birds such as northern cardinals and chickadees might be able to breed earlier and raise more broods. Bigger resident bird populations, however, could reduce the food available for migratory songbirds.
- Climate warming may benefit some resident mammals such as raccoons, skunks, and the already prolific white-tailed deer. Moose could be negatively affected by warming and increasing numbers of deer-carried parasites.

Climate Change Solutions

Michigan residents, business leaders, and policymakers can help reduce the potential impacts from climate change by pursuing three necessary and complementary strategies:

- ***Reducing heat-trapping gas emissions*** will help curb the threat from a changing climate. This can be achieved, for example, by increasing energy efficiency, switching to renewable energy sources such as wind and biomass, increasing the fuel economy of vehicles, and investing in clean transportation choices. As a first step, Michigan should conduct a heat-trapping gas inventory.
- ***Minimizing pressures on the environment*** by improving air quality, protecting the quality and supply of water resources, protecting habitat, and limiting sprawl.
- ***Preparing for those impacts from global warming that cannot be avoided*** through better planning and emergency preparedness, adaptations in agriculture, strengthening public health response and warning systems, and adjusting flood control infrastructure based on projected precipitation trends.

With foresight, planning, and a commitment to responsible management, Michigan can lead the region in designing effective solutions. It is only fitting that the state whose fate is most closely tied to the Great Lakes themselves should be an exemplary steward of its rich environment and resources in the face of climate change.

Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions
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This fact sheet is based on the findings of *Confronting Climate Change in the Great Lakes Region*, a report published in April 2003 by the Union of Concerned Scientists and the Ecological Society of America. The report was written by regional experts under the leadership of George Kling (University of Michigan). Other experts from Michigan included Donald Zak and Mark Wilson, both at the University of Michigan.

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The full report is available from UCS at www.ucsusa.org/greatlakes or call (617) 547-5552.