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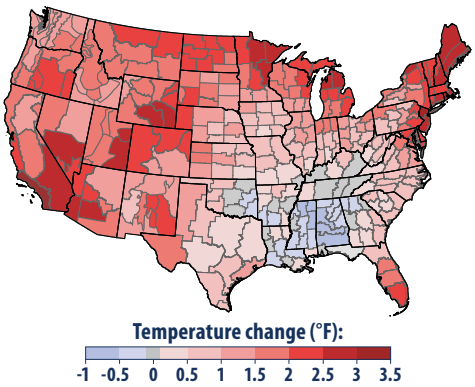
What Climate Change Means for Michigan

Michigan's climate is changing. Most of the state has warmed two to three degrees (F) in the last century. Heavy rainstorms are becoming more frequent, and ice cover on the Great Lakes is forming later or melting sooner. In the coming decades, the state will have more extremely hot days, which may harm public health in urban areas and corn harvests in rural areas.

Our climate is changing because the earth is warming. People have increased the amount of carbon dioxide in the air by 40 percent since the late 1700s. Other heat-trapping greenhouse gases are also increasing. These gases have warmed the surface and lower atmosphere of our planet about one degree during the last 50 years. Evaporation increases as the atmosphere warms, which increases humidity, average rainfall, and the frequency of heavy rainstorms in many places—but contributes to drought in others.

Greenhouse gases are also changing the world's oceans and ice cover. Carbon dioxide reacts with water to form carbonic acid, so the oceans are becoming more acidic. The surface of the ocean has also warmed about one degree during the last 80 years. Although warmer temperatures cause sea level to rise, the impact on water levels in the Great Lakes is not yet known. Warmer air also melts ice and snow earlier in spring.



Rising temperatures in the last century. Northern Michigan has warmed more than southern Michigan. Source: EPA, Climate Change Indicators in the United States.

Heavy Precipitation and Flooding

Changing the climate is likely to increase the frequency of floods in Michigan. Over the last half century, average annual precipitation in most of the Midwest has increased by 5 to 10 percent. But rainfall during the four wettest days of the year has increased about 35 percent. During the next century, spring rainfall and annual precipitation are likely to increase, and severe rainstorms are likely to intensify. Each of these factors will tend to further increase the risk of flooding.

Heavy rains and snowmelt flooded the Tittabawassee River in Midland in April 2015. Credit: City of Midland.

Great Lakes

Changing the climate is likely to harm water quality in Lake Erie and Lake Michigan. Warmer water tends to cause more algal blooms, which can be unsightly, harm fish, and degrade water quality. During August 2014, an algal bloom in Lake Erie prompted the Monroe County Health Department to advise residents in four townships to avoid using tap water for cooking and drinking. Severe storms increase the amount of pollutants that run off from land to water, so the risk of algal blooms will be greater if storms become more severe. Severe rainstorms can also cause sewers to overflow into lakes and rivers, which can threaten beach safety and drinking water supplies. For example, heavy rains in August 2014 led to nearly 10 billion gallons of sewer overflows in southeastern Michigan, much of which ended up in Lake St. Clair and eventually Lake Erie. More severe rainstorms could also cause sewers in Milwaukee and Chicago to overflow into Lake Michigan more often, which could pollute beaches in Michigan.

One advantage of climate change is that warmer winters reduce the number of days that ice prevents navigation. Between 1994 and 2011, the decline in ice cover lengthened the shipping season on the Great Lakes by eight days. The lakes are likely to warm another 3° to 7°F in the next 70 years, which will further extend the shipping season.

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Ice forming on Lake Michigan near St. Joseph. Credit: M. McCormick, NOAA Great Lakes Environmental Research Laboratory.

Winter Recreation

Warmer winters are likely to shorten the season for recreational activities like ice fishing, snowmobiling, snowboarding, and skiing, which could harm the local economies that depend on them. Small lakes are freezing later and thawing earlier than a century ago, which shortens the season for ice fishing and ice skating. Since the early 1970s, winter ice coverage in the Great Lakes has decreased by 63 percent. Warmer temperatures are likely to shorten the season when the ground is covered by snow, and thereby shorten the season for activities that take place on snow. Nevertheless, annual snowfall has increased in much of the Great Lakes region, which could benefit winter recreation at certain times and locations.

Ecosystems

The ranges of plants and animals are likely to as the climate changes. For example, warmer weather could change the composition of Michigan's forests. As the climate warms, the population of paper birch, quaking aspen, balsam fir, and black spruce may decline in the Upper Peninsula and northern Lower Peninsula, while oak, hickory, and pine trees may become more numerous. Climate change will also transform fish habitat. Rising water temperatures will increase the available habitat for warmwater fish such as bass, while shrinking the available habitat for coldwater fish such as trout. Declining ice cover and increasingly severe storms would harm both types of fish habitat through erosion and flooding.

Warming could also harm ecosystems by changing the timing of natural processes such as migration, reproduction, and flower blooming. Migratory birds are arriving in the Midwest earlier in spring today than 40 years ago. Along with range shifts, changes in timing can disrupt the intricate web of relationships between animals and their food sources and between plants and pollinators. Because not all species adjust to climate change in the same way, the food that one species eats may no longer be available when that species needs it (for example, when migrating birds arrive). Some types of animals may no longer be able to find enough food.

Agriculture

Changing the climate will have both beneficial and harmful effects on farming. Higher concentrations of atmospheric carbon dioxide and longer frost-free growing seasons would increase yields of wheat during an average year. But increasingly hot summers are likely to reduce yields of corn and possibly soybeans. Seventy years from now, Michigan's Lower Peninsula is likely to have 5 to 15 more days per year with temperatures above 95°F than it has today. More severe droughts or floods would also hurt crop yields.

Air Pollution and Human Health

Changing the climate can harm air quality and amplify existing threats to human health. Higher temperatures increase the formation of ground-level ozone, a pollutant that causes lung and heart problems. Ozone also harms plants. In some rural parts of Michigan, ozone levels are high enough to significantly reduce yields of soybeans and winter wheat. EPA and the Michigan Department of Environmental Quality have been working to reduce ozone concentrations. As the climate changes, continued progress toward clean air will become more difficult.

Hot days can be unhealthy—even dangerous. High temperatures can cause heat stroke and dehydration, and affect people's cardiovascular and nervous systems. Northern cities like Detroit are vulnerable to heat waves, because many houses and apartments lack air conditioning, and urban areas are typically warmer than their rural surroundings. In recent decades, severe heat waves have killed hundreds of people across the Midwest. Heat stress is expected to increase as climate change brings hotter summer temperatures and more humidity. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor.

The sources of information about climate and the impacts of climate change in this publication are: the national climate assessments by the U.S. Global Change Research Program, synthesis and assessment products by the U.S. Climate Change Science Program, assessment reports by the Intergovernmental Panel on Climate Change, and EPA's *Climate Change Indicators in the United States*. Mention of a particular season, location, species, or any other aspect of an impact does not imply anything about the likelihood or importance of aspects that are not mentioned. For more information about climate change science, impacts, responses, and what you can do, visit EPA's Climate Change website at www.epa.gov/climatechange.