

ISSUE BRIEF

CLIMATE CHANGE AND HEALTH IN MICHIGAN

Climate change is altering seasonal patterns, making hot days more intense, and increasing the frequency of extreme weather events like the historic 2014 flooding in Metro Detroit.¹ As a result, Michiganders face a variety of health impacts, including more heat-related illnesses, breathing and heart troubles, food and water contamination, traumatic injuries, mental health challenges, and exposure to infectious diseases.² These threats will only increase as big polluters and our transportation systems continue to pump climate-changing pollution into the air.

We can protect ourselves from these impacts by implementing cleaner and more efficient energy strategies and preparing more effectively for future climate and health disasters.³ We must also ensure that communities and health departments have the resources they need to deal with present-day health threats.⁴

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CLIMATE CHANGE THREATENS MICHIGAN'S WATER QUALITY

Algae-filled water isn't just unappealing—it's also bad for our health. Harmful algal blooms form when some species of naturally occurring algae rapidly accumulate in bodies of water and produce toxins. Swimming in or swallowing contaminated water can cause symptoms including skin irritation, diarrhea, vomiting, and liver damage.⁵ Lake Erie has seen a recent increase in bloom severity, with record-breaking blooms in 2011 and 2015.⁶ In 2014, a severe bloom in the lake made it unsafe for about 500,000 people in Ohio and 11,575 people in southeast Michigan to drink or bathe in tap water for three days.⁷

Runoff from commercial fertilizer and manure has been the main driver of harmful algal blooms in Lake Erie to date.⁸ That runoff adds excess nutrients to the lake water, promoting algal growth. Now, the rising temperatures and changing rainfall patterns associated with climate change are making some blooms worse.⁹ Higher temperatures speed the growth of some species of algae and promote toxic species over nontoxic ones.¹⁰ Heavy rain can also make algal blooms more likely by washing animal wastes, artificial fertilizers, and other nutrient-rich pollution into rivers and lakes.¹¹

From 2010 to 2014, 17 weather stations in Michigan recorded an annual average of just over one day with two inches or more of rain. That's more extreme rain days per year than at any time since record-keeping began in 1900.¹² (For context, these stations historically have experienced one to two extreme rain days every two years.¹³) Under continued high emissions of carbon pollution, the state could experience at least 0.5 more days of heavy precipitation per year by the period from 2041 to 2070, compared to the period from 1971 to 2000.¹⁴

Climate change could also increase the frequency of what are currently considered 100-year floods, which are severe floods with a 1 percent chance of occurring in a given year.¹⁵ Between 2040 and 2060, some of Michigan's Upper Peninsula and northern Lower Peninsula could see 25 to 500 percent more 100-year floods relative to the period from 1950 to 2000.¹⁶

Increases in extreme precipitation and flooding will likely lead to more contaminated runoff and more failures of Michigan's aging and badly managed drinking water, stormwater, and wastewater systems.¹⁷ Heavy precipitation preceded more than two-thirds of the waterborne disease outbreaks in the United States from 1948 to 1994.¹⁸ *Giardia* and other pathogens caused gastrointestinal illnesses in more than half of the outbreaks preceded by heavy rain.¹⁹ In July 2018, record rainfall fueled a 1,000-year flood in the western Upper Peninsula. This rainfall led to unhealthy bacterial concentrations at 17 beaches in the area, prompting closures or contamination warnings.²⁰

Detroit and Port Huron are two of the nearly 860 cities across the United States with combined sewer systems.²¹ These outdated systems, which carry sewage and stormwater in the same pipes, are designed to overflow

during heavy rain or snowmelt.²² In 2016 alone, combined sewer outfalls in 12 Michigan counties discharged more than 10.7 billion gallons of untreated or partially treated water during storms.²³ That's the equivalent of more than 16,000 Olympic swimming pools.²⁴ The sewage and other contaminants dumped by combined sewer outfalls into rivers, lakes, streams, and streets can cause a variety of illnesses. For example, after heavy rains in August 2016, at least two people in Detroit were diagnosed with hepatitis A, an infectious liver disease, after coming in contact with sewage in their flooded basements.²⁵ In nearby Ohio, a study from 2010 to 2014 found that combined sewer overflows near homes increased the odds of childhood emergency room visits for gastrointestinal illnesses by 16 percent.²⁶

Extreme rainfall also threatens the estimated 2.6 million people in Michigan who get their drinking water from private household wells, which are minimally regulated.²⁷ In addition, private wells are not typically treated for bacterial contamination, which can occur when heavy rains trigger extensive runoff.²⁸

Climate-related water and sewer system failures may be more common in low-income communities that already struggle with maintenance and repairs. In a 2016 survey of Michigan's drinking water systems, 55 percent of local jurisdictions experiencing high fiscal stress reported aging and breaking pipes. In contrast, 30 percent of jurisdictions with low fiscal stress reported the same issues. In addition, 30 percent of jurisdictions with high fiscal stress reported water quality or safety threats, compared with 15 percent of those with low fiscal stress.²⁹ One study found that the Michigan counties of Clare, Gogebic, Houghton, Iosco, Iron, Isabella, Lake, and Wayne are the ones most vulnerable to loss of drinking water access after a flood.³⁰ Six of those eight counties have child poverty rates 5 to 19 percent higher than the state average. In Lake County, Michigan's poorest, 70 percent of black children and 43 percent of white children live in poverty.³¹

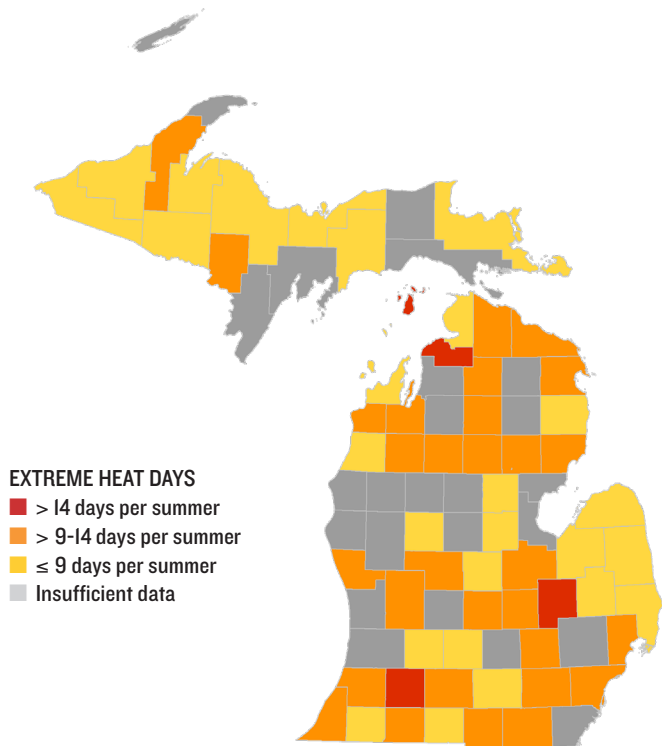
EXTREME HEAT IS BAD FOR MICHIGANDERS' HEALTH— AND COULD BECOME MORE DEADLY

Michigan summers are getting longer and hotter and could become even more dangerous in just a few decades. Nationally, the risk of mortality during heat waves increases about 2.5 percent for every 1 degree Fahrenheit increase in the intensity of heat waves, according to one study of 43 U.S. cities from 1987 to 2005.³²

In Michigan, average maximum temperatures have climbed more than 2 degrees Fahrenheit since 1895.³³ Daily summer highs at Detroit Metropolitan Airport averaged 82.3 degrees Fahrenheit from 2008 to 2017, compared with 80.6 degrees Fahrenheit in the 1960s.³⁴ From 2007 to 2016, 61 percent of Michiganders lived in counties that experienced an average of more than nine extreme heat days per year, more days than expected on the basis of local historical averages (Figure 1).³⁵

FIGURE I. AVERAGE NUMBER OF EXTREME HEAT DAYS EACH YEAR IN MICHIGAN COUNTIES, 2007–2016

“Extreme heat days” are defined as June, July, and August days from 2007 to 2016 on which the maximum temperature at a given weather station fell within the top 10 percent of readings at that station. We used the June, July, and August days from 1961 to 1990 to calculate the top 10 percent of temperature readings. Nine extreme heat days per summer, on average, would be expected if temperatures were stable.³⁶



Heat and humidity already pose a range of threats to Michigan residents, from minor illnesses such as heat cramps to deadly conditions such as heatstroke or heat-related heart problems.³⁷ From April through August 2016, Michigan’s emergency rooms recorded 3,945 visits for dehydration and other heat-related issues.³⁸

In Michigan, the risks of heat-related illnesses and deaths will grow as climate change fuels more intense, frequent, and longer heat waves.³⁹ For example, from 1975 to 2010, the Detroit metropolitan area experienced an average of approximately 65 excess deaths per year on dangerously hot summer days.⁴⁰ If we continue on our current trajectory of global carbon emissions, the Detroit metropolitan area could experience an annual average of 760 excess deaths on dangerously hot days by the 2040s.⁴¹

Anyone can get sick from extreme heat, but outdoor workers, young children, older adults, people experiencing poverty, and people with chronic diseases like diabetes and kidney disease are particularly vulnerable.⁴² About 27 percent of Michigan adults reported having two or more chronic health conditions in a statewide Behavioral Risk Factor Survey in 2015.⁴³ One-third of Michiganders had high blood pressure, a risk factor for kidney disease.⁴⁴ A study of

Ingham, Washtenaw, and Wayne counties found that heat wave days increased the odds of hospitalization for kidney disease by 37 percent among people of color from 2000 to 2009. In contrast, there was no increase in hospitalization odds among white people.⁴⁵

Finally, heat vulnerabilities associated with age, occupation, and socioeconomic factors are more pronounced in cities, which are warmer than surrounding areas because of the urban heat island effect.⁴⁶ This phenomenon, which adds to the warming fueled by carbon pollution, is caused by elements of the urban built environment, including tall buildings that block airflow and heat-absorbing surfaces like asphalt. In Detroit, for instance, daily summer temperatures from 2004 to 2013 were 3.8 degrees Fahrenheit higher on average than in nearby rural areas.⁴⁷ One study from 1990 to 2007 explored how extreme heat affected residents in eight Michigan metropolitan areas. The study found that extreme heat increased the odds of cardiovascular deaths by 17 percent among adults aged 65 years and older who lived in hotter ZIP codes.⁴⁸



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CLIMATE CHANGE PUTS MICHIGAN’S PROGRESS TOWARD CLEANER SKIES AT RISK

Michigan’s air quality has improved since the 1970s, largely because of federal pollution limits.⁴⁹ Even so, Detroit, Berrien County, and parts of Allegan and Muskegon counties currently exceed the U.S. Environmental Protection Agency’s standard for concentrations of ozone, the main component of smog.⁵⁰

Smog exacerbates asthma.⁵¹ In Michigan, an estimated 195,000 children and 849,200 adults already suffer from this complicated and costly disease.⁵² In 2012 alone, asthma generated an estimated \$2,514 in medical costs per Michigan asthma patient and a cumulative cost of \$92.4 million in lost work and school days in the state.⁵³

Unfortunately, climate change could undermine the state’s progress toward cleaner air and make it harder to meet air quality standards.⁵⁴ Rising temperatures speed up the chemical reaction between sunlight and pollution from sources like power plants that forms smog.⁵⁵

The burden of worsening air quality will fall heavily on low-income people and communities of color.⁵⁶ According to a study in the Detroit urban area, air pollution—largely from vehicles—caused an estimated 660 premature deaths and \$6.5 billion in health impacts per year from 2011 to 2015.⁵⁷ Across the study area, about 7 percent of residents identified as Latino or Hispanic, 66 percent identified as African-American or black, and 37 percent lived below the poverty line.⁵⁸ Health burdens from nitrogen oxide, a precursor of smog, were particularly concentrated in ZIP codes with higher percentages of Latino and low-income residents.⁵⁹ Nationally, Latino children are twice as likely as non-Latino white children to die from asthma.⁶⁰

MOSQUITO- AND TICK-BORNE INFECTIONS ARE INCREASING

Rising temperatures and changes in rainfall enable ticks and mosquitoes to live in new places and be active earlier in the year.⁶¹ That’s bad news for the more than 64,300 Michiganders with outdoor occupations such as farming, landscaping, and highway construction.⁶² It also affects the millions of Michigan residents who enjoy outdoor activities like visiting parks and picnicking.⁶³ Local health agencies in Michigan may not be prepared to handle the scope of the increasing threats from tick- and mosquito-borne diseases.⁶⁴ A recent national survey of 573 local health departments found that 90 percent of them needed improvement in the basics of mosquito control.⁶⁵

West Nile virus, which is typically spread by mosquitoes, was first reported in Michigan in 2002, and a total of 1,164 cases have been reported in the state since then.⁶⁶ The disease causes symptoms like vomiting and fatigue in about 1 in 5 infected people. About 1 in 150 infected people develop severe neurological illnesses (neuroinvasive disease) that can be fatal.⁶⁷ Michigan had the 17th-highest rate of West Nile virus neuroinvasive disease in the country in 2016.⁶⁸

Rising temperatures are already extending the geographic range and active season of mosquitoes that can carry West Nile virus in the United States.⁶⁹ In Michigan, for example, Asian tiger mosquitoes (a nonnative species that can transmit diseases including West Nile virus and yellow fever) were officially documented for the first time in August 2017.⁷⁰ Climate change could also improve the

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FIGURE 2. COUNTIES IN MICHIGAN WHERE BLACKLEGGED TICKS WERE REPORTED (FEWER THAN SIX TICKS OF A SINGLE LIFE STAGE) OR ESTABLISHED (SIX OR MORE TICKS OR TWO LIFE STAGES) IN 1996 AND 2015.

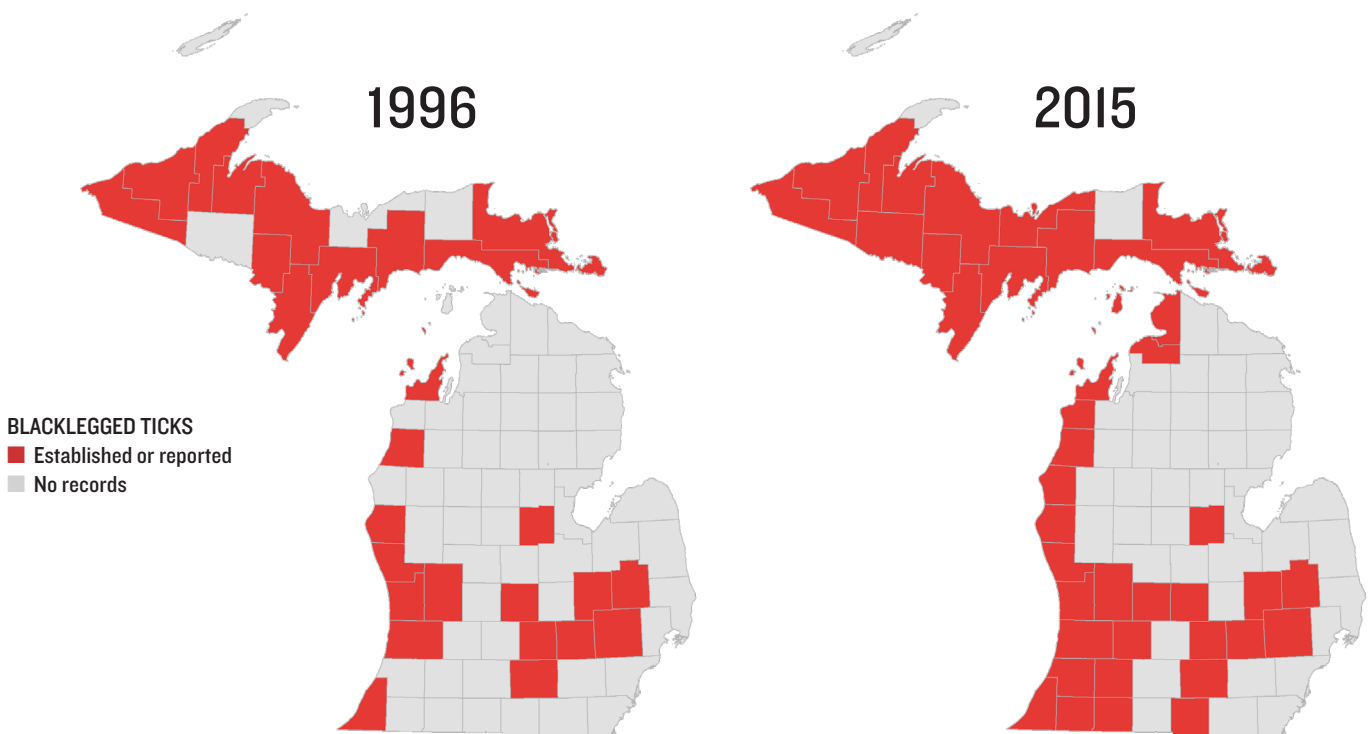


Figure adapted from Eisen et al., *Journal of Medical Entomology* 53 (2016).

ability of mosquitoes to carry West Nile virus, accelerate the replication of the virus, and increase transmission risk between mosquitoes.⁷¹ Extremely hot years projected between 2036 and 2049 could substantially increase the annual number of neuroinvasive West Nile cases in Michigan by shortening the incubation period for mosquitoes and increasing biting rates, among other factors.⁷²

Lyme disease, the most common tick-borne illness in the United States, causes flulike symptoms in its early stages.⁷³ Later on—weeks or months after a bite by an infected tick—people with untreated Lyme disease can suffer debilitating muscle and joint pain, headaches, memory problems, and even fatal heart damage.⁷⁴ In Michigan, 1,156 confirmed or probable cases of Lyme disease were reported from 2008 to 2016.⁷⁵ Blacklegged ticks, which can carry the bacteria that cause Lyme disease, are expanding to new counties in Michigan. In 1996, the ticks were reported or established in only 27 of Michigan’s 83 counties; this had increased to 40 counties by 2015 (Figure 2).⁷⁶ Collection of blacklegged ticks by Michigan residents suggests the ticks may have spread to an additional 17 counties by 2017.⁷⁷

Lyme disease cases are also spreading to new areas of the state, potentially due to a combination of climate change, increases in tick-friendly habitat, and local increases in populations of deer and mice that carry ticks.⁷⁸ From 2000 to 2014, Lyme disease cases expanded from just one county in the Upper Peninsula to counties throughout the Upper Peninsula, along the eastern shore of Lake Michigan, and along the Indiana border.⁷⁹

ACTING ON CLIMATE CHANGE CAN PROTECT OUR HEALTH

The good news is that cutting back on fossil fuels and switching to cleaner energy will help limit the dangerous effects of climate change and protect our health.

Michigan has already cut its total carbon dioxide emissions, achieving a reduction of approximately 15 percent from 2005 to 2015.⁸⁰ From 2007 to 2015, Michigan’s wind and solar power plants averted about 7.3 million metric tons of carbon dioxide emissions, equivalent to the emissions from about 17.8 billion passenger vehicle miles.⁸¹ These renewable power plants also averted more than 18,000 metric tons of sulfur dioxide and about 7,600 metric tons of nitrogen oxides.⁸²

In 2017, Michigan increased incentives for energy efficiency and targets for renewable energy.⁸³ The state also now requires electric utilities to submit regular integrated resource plans, which are documents showing how utilities plan to meet future energy needs and comply with environmental regulations.

But there’s a lot more to do. For instance, while Michigan is retiring most of its coal-fired power plants, it is replacing some of that coal with natural gas, another fossil fuel.⁸⁴ Utilities in Michigan should increase investments in wind, solar, and energy efficiency instead of new natural gas plants.

Transportation was Michigan’s second-largest source of carbon dioxide pollution in 2015, after power plants.⁸⁵ Therefore, the state should develop and implement a clean transportation plan that promotes a diverse set of travel options beyond single-occupant vehicles. Such a plan could deliver numerous health benefits, including less traffic-related stress, improved response times by paramedics, higher birth weights because of improved air quality, and fewer premature adult deaths thanks to increased physical activity.⁸⁶ It could also deliver substantial economic savings. Increasing the percentage of light-duty electric vehicles in Michigan from 0.17 percent in 2015 to 55.7 percent in 2050 could save drivers a cumulative total of \$23.1 billion in vehicle operating costs from 2030 to 2050, according to one estimate.⁸⁷

The state also needs more detailed plans to address today’s climate change impacts. Michigan’s Climate and Health Adaptation Program (MICHAP) works with the Centers for Disease Control and Prevention’s Climate-Ready States and Cities Initiative to “anticipate, prepare for and respond to a range of climate sensitive health impacts.”⁸⁸ In 2016, MICHAP updated a strategic climate and health plan that was initially developed in 2010.⁸⁹ The updated plan lists several potential strategies the state can take to protect public health. Examples include increasing green space to reduce the urban heat island effect and developing early-warning systems for waterborne disease outbreaks. As the plan points out, however, the state needs to turn the preliminary list of strategies into detailed, implementable projects and programs.⁹⁰ MICHAP is working to do that now, informed in part by stakeholder meetings and pilot projects that can help identify effective and feasible health interventions.⁹¹

City governments can also play an important role in keeping people safe from climate change. For example, Detroit developed its 2017 Climate Action Plan through a grassroots process led by the Detroiters Working for Environmental Justice.⁹² The plan recommends more than 100 action steps for Detroit’s residents, businesses, and city government. These actions include educating health care providers about climate-related health threats and updating the vulnerability assessments used to guide emergency response plans. An economic analysis found that implementing just 11 of the steps on a citywide scale could result in millions of dollars’ worth of economic benefits.⁹³

The bottom line is that Michigan residents have much to gain from climate action—and lives to lose if we fail to cut our emissions and build resilience to the damage already done.

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