MEDICAL ALERT!

Climate Change Is Harming Our Health in Wisconsin

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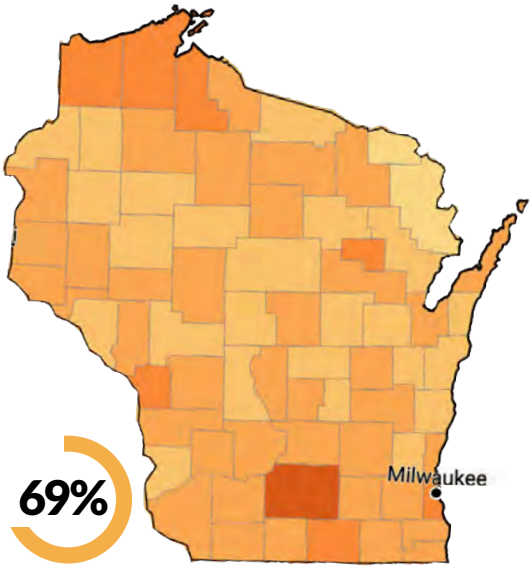
EXECUTIVE SUMMARY

The health impacts of our changing environment may not always be obvious, but they can cause serious harm to people in Wisconsin. More than 2 out of 3 Wisconsinites are aware that global warming is happening. However, they often see climate change as a faraway threat, in both time and place, and as something that does not influence human health directly. The reality, instead, is different: **climate change is already affecting Wisconsin communities, and it's harming our health.** [1,2,3,4,5,6,7,8,9,10]



Statewide, 69% of people are aware that global warming is happening.

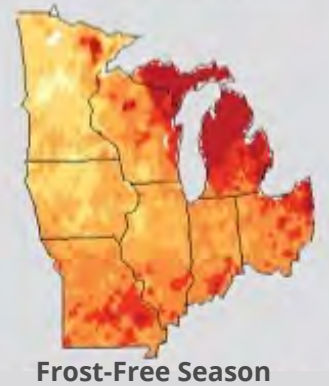
Most Americans are not aware of the health harms associated with climate change, and only 27 percent can name a specific way in which climate change is harming our health.[11] Few are aware that some groups of Americans—including the elderly, immunocompromised people, and children—are most likely to be harmed by climate change.[11,12] There has been relatively little public discussion of the health harms of climate change. But we also know people are eager to hear from health professionals. In fact, 88 percent of people trust doctors and nurses for information, above family and religious leaders.[13]

The evidence of serious health consequences of climate change is clear.[4] This reality is also becoming apparent to practitioners who see an urgent need to share this concern with their patients and with all Wisconsinites. We believe everyone in Wisconsin should know the following:

1. **There is a scientific consensus about human-caused climate change.**[14] The reality of human-caused climate change is no longer a matter of scientific debate.

2. **In communities across the Midwest, climate change is harming our health now.** Doctors and nurses know this because they're seeing the health of their patients being harmed. Public health professionals know this too, because they're seeing increasing rates of health problems associated with climate change in their communities. These harms include heat-related illness, worsening chronic illnesses, injuries and deaths from dangerous weather events, infectious diseases spread by mosquitoes and ticks, illnesses from contaminated food and water, and mental health problems.[15]

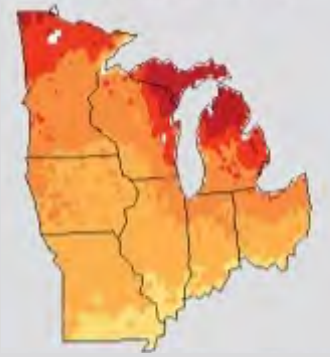
PROJECTED MID-CENTURY CHANGES



Frost-Free Season

Difference in Number of Days

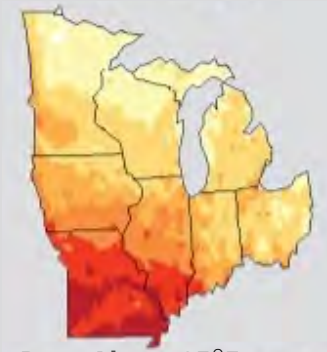
15 17 19 21 23 25



Average Temperature

Temperature Difference (°F)

3.5 3.8 4.1 4.4 4.7 5.0



Days Above 95°F

Difference in Number of Days

0 5 10 15 20 25

Cooling Degree Days

Difference in # of Cooling Degree Days

0 75 150 225 300 375

3. **The health of anyone can be harmed by climate change, but some of us face greater risk than others.** Children, athletes, pregnant women, the elderly, some communities of color, people with chronic illnesses and allergies, and the poor are more likely to be harmed.[12]

4. **Unless we take concerted action, these harms to our health are going to get much worse.** The sooner we take action, the more harm we can prevent, and the more we can protect the health of all Wisconsinites.

5. **The most important actions we can take to protect our health are to reduce heat-trapping pollution by improving energy efficiency and accelerating the transition to clean renewable energy in our Wisconsin communities.** It is well within our power to accomplish this. Efficient buildings and smart energy policies are all essential and achievable.[16]

6. **The actions we take to address climate change will produce important health benefits.** Reducing carbon pollution not only prevents health harms from climate change, it produces many direct health benefits too. Clean energy immediately improves water and air quality.[17,18] Active transportation (e.g. walking and biking) is good for our physical and mental well-being. Eating a more plant-based diet reduces disease and increases life expectancy, and if the foods are locally-grown, it's valuable for communities too.[19]

This report will serve as a basis for our efforts to share with the public and policymakers in government and industry what we know about the ways climate change is harming our health, and the health benefits of climate solutions. In particular, this report will highlight the urgency of this challenge and provide direction on how to respond to climate change to improve the health of the people in Wisconsin today and in the future.

The harmful health risks from climate change vary from region to region, so this report looks at issues that affect Wisconsin specifically. Health professionals have a unique role to play in issuing this alert and closing the gap in public recognition of this serious danger.

IN-STATE PRODUCTION OF 100% CLEAN ENERGY WOULD:[20]

- **Reduce air pollution** and thereby **save $21 billion every year** in avoided health damages
- **Prevent the following incidents of illness in Wisconsin each year:**
    - 1,910 premature deaths
    - 650 respiratory ER visits
    - 1,580 cases of acute bronchitis
    - 49,400 respiratory symptom cases
    - 873,000 minor restricted activity days
    - 148,000 work loss days
    - 34,400 cases of asthma exacerbation
    - 670 hospital admissions
    - 650 heart attacks
- **Create 162,000 net new jobs,** these are good, high paying jobs that will indirectly improve the health of the workers and their families
- **Grow Wisconsin's GDP by 5%, and increase tax revenue by more than $500 million**—funds that can be used to address lots of key state priorities, such as strengthening public health and education systems, which would further benefit the health of all people in Wisconsin

CLIMATE CHANGE IS HARMING THE HEALTH OF EVERY SINGLE PERSON ACROSS THE NATION

HEALTH IMPACTS ARE HERE & THEY ARE SERIOUS

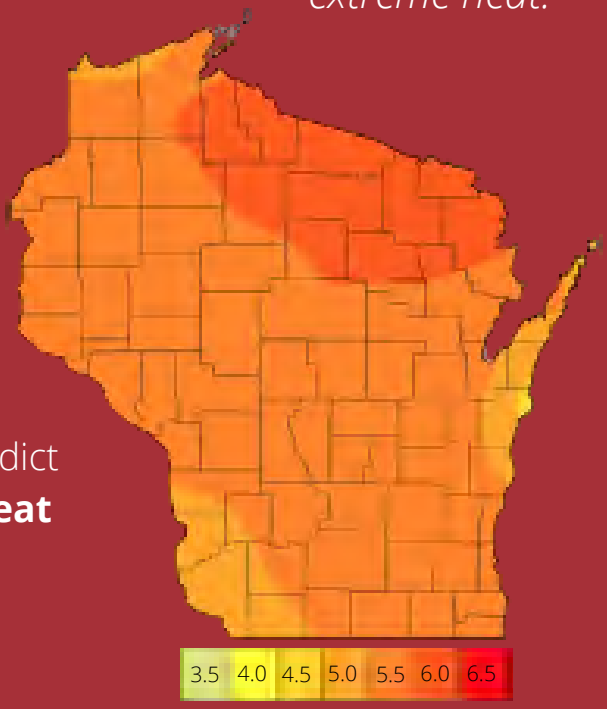
Some of the physical changes in our climate—such as the increased frequency of extreme heat events, extreme weather events, and air pollution—are causing direct harms to health. These changes are also contributing to the spread of diseases and threats to our nutrition and mental health.

While these effects are experienced around the world, in the sections ahead we summarize what is happening to the Wisconsin climate, describe how these changes are harming our health, and identify the groups of Wisconsinites who are most likely to experience harm.

EXTREME HEAT

Those living alone can be isolated and unaware of the dangers posed by extreme heat.

Climate change favors longer periods of hot weather and greater humidity in Wisconsin. University of Wisconsin-Madison scientists predict **extreme heat events will become more frequent and longer lasting in the future.**[21] Even more concerning are days with a high heat index, or a high combination of air temperature and humidity. A heat index greater than 105 degrees is dangerous to health. By 2050, experts predict that Milwaukee will see **3 times as many days with a heat index above 105 degrees.**[22]



Projected Change in Summer Average Temperature (°F) from 1980-2055[22]

HOW DOES THIS HARM OUR HEALTH?

Extreme heat kills more Wisconsinites than other weather disasters (i.e. tornadoes, floods, blizzards) combined.[23] Heat can lead to illness and death from heat stroke and dehydration. It can also worsen chronic diseases that then lead to costly emergency room visits and hospitalizations.

WHO IS BEING HARMED?

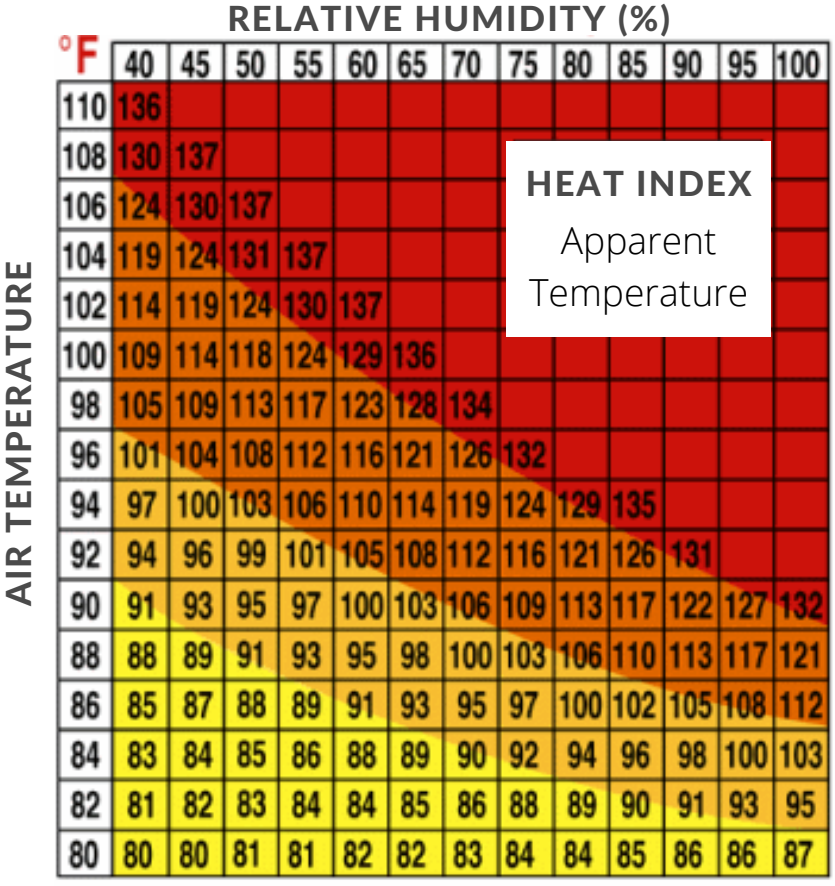
Anyone can be harmed by extreme heat, but some people face greater risk. One of the most susceptible populations to heat is **older adults**. People over the age of 65 are more at risk to heat stress due to poor temperature regulation with age. They are also more likely to have chronic medical conditions that change how the body responds to heat and to be taking prescription medicines that affect the body's ability to control temperature and sweat.[24]

Another population at increased risk are **residents with low economic status** who live in places susceptible to "heat islands"—urban areas that retain more heat than rural areas due to the increased amount of cement and asphalt, and lack of green space.

DIRECT HEALTH HARMS

During a heatwave in 1995, Milwaukee county reported 91 heat-related deaths, many of which occurred in low-income neighborhoods.[25] A 2020 analysis of U.S. cities found that discriminatory housing policies and planning played a significant role in concentrating heat islands in predominantly low-income and communities of color.[26] For people living in low-income households, the heat island effect is further compounded by poor housing conditions commonly without air conditioning. They often also have limited accessibility to medical care, making them even more vulnerable to heat.

Outdoor workers (e.g. construction, farm labor), athletes, military personnel, city dwellers, and people who lack air conditioning (or who lose it during an extended power outage) face greater risk because they are more exposed to extreme heat. **Young children, older adults, and people taking certain medications** are also more vulnerable because they are less able to regulate their body temperature. **Pregnant women** are vulnerable, too, as extreme heat can cause premature birth.[14]



EXTREME DANGER

Heat stroke or sunstroke likely

- Oral body temperature of 104˚F and above
- Often sudden onset of symptoms
- Confusion or loss of consciousness
- Rapid and strong pulse
- Hot, red, and dry/skin
- Headache
- Dizziness
- Nausea/vomiting

DANGER

Sunstroke, muscle cramps, and/or heat exhaustion likely

- Profuse sweating
- Weakness
- Rapid breathing
- Dizziness
- Nausea/vomiting
- Muscle cramps
- Normal mentation
- Body temperature normal or elevated up to 104° F

CAUTION

Fatigue Possible

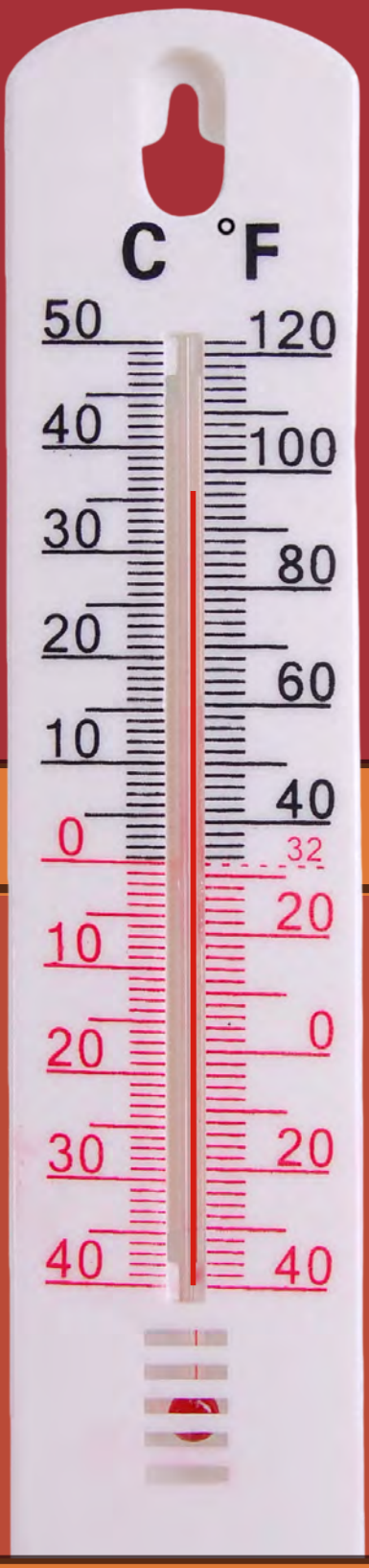
EXTREME CAUTION

Sunstroke, muscle cramps, and/or heat exhaustion possible

In Southern Wisconsin, the number of days over 90°F is projected to double, from 12 to 24 by 2055[27]

HEAT ISLAND EFFECT

Extreme heat deaths are closely tied to social, economic, and physiological vulnerabilities. How we design our cities plays an important role in exacerbating heat-related health problems. In particular, urban environments conduct more heat and retain less water than rural environments. The "heat island effect" describes this phenomenon of environmental heat retention in urban areas. In large cities, the average air temperature can be 1.8 to 5.4°F warmer than its surroundings.[28] The effect is most pronounced at nighttime, when heat usually dissipates and gives way to cooler temperatures. However, **urban environments can remain as much as 22°F hotter than surrounding rural areas.**[28]



IN PARTICULAR, HEAT ISLANDS AFFECT COMMUNITIES IN THE FOLLOWING WAYS:

- Increasing peak energy demands in summer
- Increasing air conditioning costs, including in healthcare facilities
- Increasing greenhouse gas emissions
- Increasing water pollution and property damage because non-porous surfaces increase water run-off
- Increasing heat-related illness & mortality

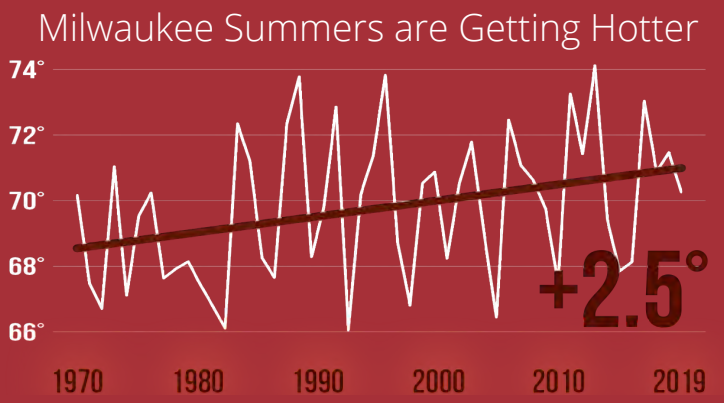
MILWAUKEE

The Milwaukee region is a national leader for the use of green infrastructure practices, using the strategies listed below and more.[29] In 2019, the City of Milwaukee Common Council approved a Green Infrastructure Plan to prioritize urban planning that integrates greenery and reduces the effects of urban heat islands.

WHAT CITIES LIKE MILWAUKEE ARE DOING TO REDUCE HEAT ISLANDS[29]

Creating landscaped medians

- Landscaped medians lower surface and air temperatures by providing shade and cooling through evapotranspiration (evaporation).



Installing green roofs

- Green roofs, or roofing that includes a layer of vegetation, help insulate buildings to reduce cooling costs.

Using permeable pavements

- Permeable pavements like porous asphalt and concrete allow storm water to filter through, rather than collecting on hard surfaces or draining into the sewer system. Pavers can also use a high-albedo pavement (or lighter color surface) to reflect sunlight rather than absorb it.

ANGELA'S STORY

By Angela Hall, an elementary school teacher at the Madison Metropolitan School District for 30 years.

As stagnant, hot air fills the classroom during heat advisories, Angela feels more like she's in "survival mode" than "teaching mode." In her years as a teacher, she has learned the signs of heat exhaustion and heat stroke as students lose their appetites, feel dizzy, and get nauseous. Without air conditioning during summer school, Angela and her fellow teachers have to get creative to supply relief to their students—whether it be bringing oscillating fans from home or taking a trip down the block to the splash park. Without relief, students' ability to learn is fogged and their health is at risk.

Oftentimes, teachers are forced to separate students that are at higher risk of health effects from extreme heat due to medical conditions. After being placed in the library, the only air-conditioned room in the building to protect their health on hot days, these students often express feeling excluded from their peers and friends. However, periodic emergencies stress the importance of these precautionary measures. Angela recalls a scary day when a student's asthmatic symptoms became so bad in the extreme heat that the paramedics were called.

More generally, Angela feels heat takes a major toll on students' ability to learn. It disrupts normal lessons, can cause a sense of lethargy, and makes it difficult for students to concentrate. Students who attend summer school—when extreme heat is most pronounced—are those who fall below a certain proficiency level. For them, summer is supposed to be a time to catch up on school work when in reality, students have to worry about dehydration and heat stroke.

FACT

30% of U.S. schools are not fully air conditioned.[30]

FACT

School air conditioning is unequally distributed: Black and Latino students are significantly more likely to report inadequate air conditioning.[31]

FACT

Students who experience more hot days during the school year perform worse on subsequent standardized exams.[31]

Children bear a greater burden of climate-associated health impacts and they have the most at stake.

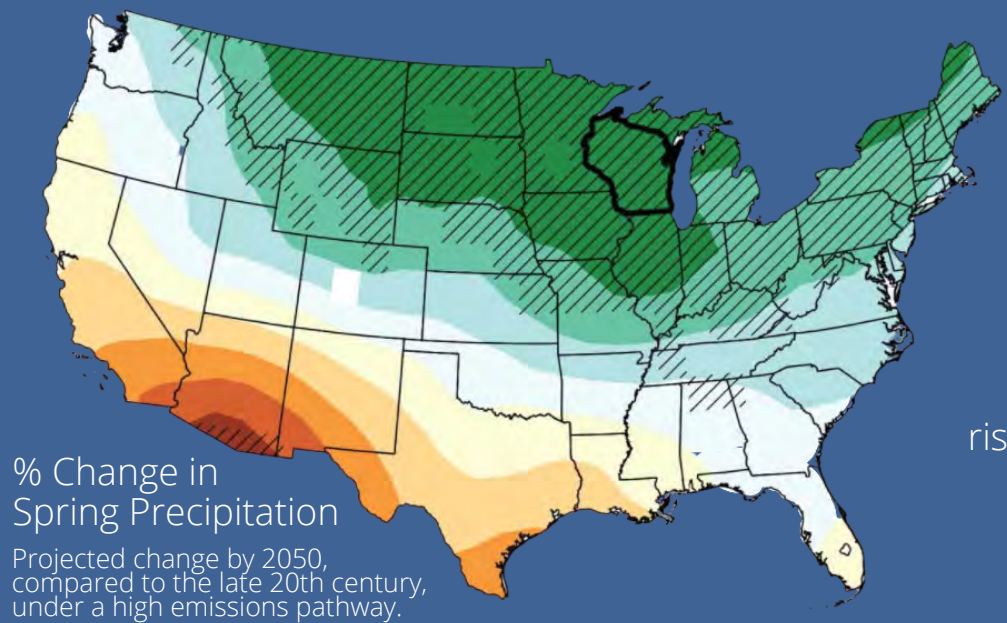
FLOODING

Wisconsin is becoming warmer and wetter.[32] Flooding is expected to become more frequent and intense as downpours, droughts, and warmer water temperatures are increasingly common. In southern and western Wisconsin, annual precipitation is now 7 inches more than the 1950 – 2006 average.[32]

HOW DOES THAT HARM OUR HEALTH?

The human health harms of flooding can include both immediate and delayed health effects.

Approximately two thirds of people living in Wisconsin get their drinking water from groundwater, but these wells receive limited water treatment.[33] This makes them more susceptible to water contamination from extreme precipitation events and increases the risk of waterborne illnesses in those who consume it. **Contamination of drinking water from waste run-off** can trigger outbreaks of water-borne illnesses such as the diarrheal diseases legionella and campylobacter.[34,35] Other immediate health harms include drowning and electrocution, as well as tetanus and wound infections from hazardous waste.[36]



Flooding can also result in longer-term health impacts, such as an increase in vector-borne disease due to standing water. When houses flood, there are also serious concerns of respiratory health risks, including asthma which can be irritated by mold growth.[37]

WHO IS BEING HARMED?

Wisconsinites who rely on well water are some of the most likely to be harmed by water contamination due to flooding. However, municipal water systems are also at risk. The treatment processes for public utilities vary greatly depending on the county and may not disinfect their water for certain bacteria.[38] Those who live in regions more susceptible to flooding are also at risk for the myriad of health risks caused by extreme precipitation. **Anyone** can be impacted by flooding as these events become more common in our state, including healthcare facilities.

JESSICA'S STORY

By Jessica LeClair, MPH, RN, a Public Health Nurse and Clinical Instructor at the University of Wisconsin-Madison.

In 2012, I was working with a low-income neighborhood in Madison to address resident concerns about lack of healthy opportunities for youth. This is one of our most diverse neighborhoods, with residents of many different races, ethnicities, and languages from around the world. At a neighborhood meeting, the local elementary school principal mentioned that **children from this neighborhood were increasingly missing school because of increased asthma symptoms and other breathing problems over the last few years.**

The families shared how their apartment buildings had not recovered from the flooding in 2008, and by 2012 their basements were boarded up due to the mold that had also seeped into the vents. Every time it rained even a few inches, their basements and yards flooded because their apartment buildings are literally sinking into the ground. Many service providers in the meeting wanted to take immediate action! However, families asked that we not call building inspection, talk with the landlords, or get our Environmental Health sanitarians involved because they feared eviction. Madison has very few affordable housing options, and parents told us that they would rather stay in their unhealthy apartments than sleep in their cars.

Rather than place these families at risk of losing their homes, I met with a Madison stormwater engineer who shared that the water table in these neighborhoods is so high because of the lake levels. The lake levels are controlled by the State DNR, who's hands were tied because lakefront property owners want to maintain their docks, boats, and property values. I was told it was beyond the control of the City, and this wasn't an issue that I could work on as a public health nurse because there was no funding stream to pay for nurses to engage in this work.

And that was the end of the story at that time. But, of course, the story is not over. Children are not just missing school; they are ending up in the hospital.

Flood waters in this area contain sewage, bacteria, mold, and agricultural chemicals from a nearby creek. These exposures cause emergency outbreaks. Promoting health and racial equity should be a central component of strategies designed to combat the health effects of climate change.

FACT

In August 2018, Dane county received 9-15 inches of rain in 24 hours. According to county reports, more than 1,600 homes and businesses suffered damage, more than 1,500 vehicles had to be towed, and the estimated total damage was more than $154 million.[39]

FACT

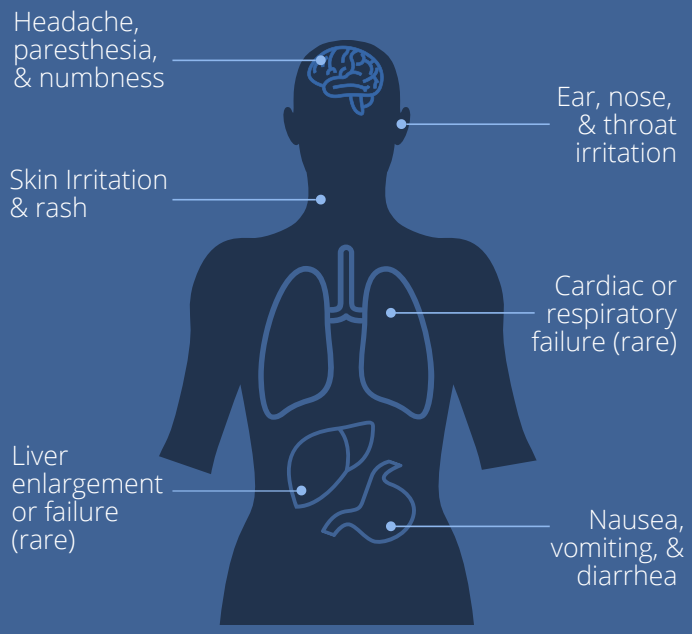
In Wisconsin, a 100-year flooding event in 1961 now happens about every 40 years; and what passed for a 100-year storm in 2011 is now happening every 83 years.[39]

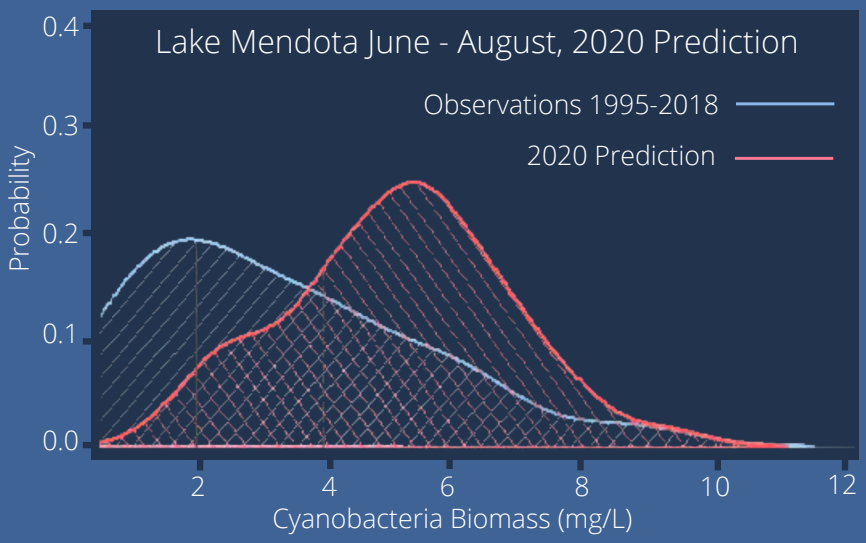
HARMFUL ALGAL BLOOMS

Warmer air and water temperatures are creating environments for harmful algal blooms in our lakes and rivers. With our changing climate, they are predicted to happen earlier in the year and be more severe.[40] Over the last few years, Wisconsin has experienced an increase in average annual precipitation, followed by flooding, which can contaminate waterways with silt, fecal matter, and nitrogen/phosphorus-based fertilizers.[41] These nutrient-rich environments can allow harmful algal blooms to thrive.[42] With over 15,000 lakes and rivers in Wisconsin, harmful algal blooms are becoming a more serious issue for many communities.

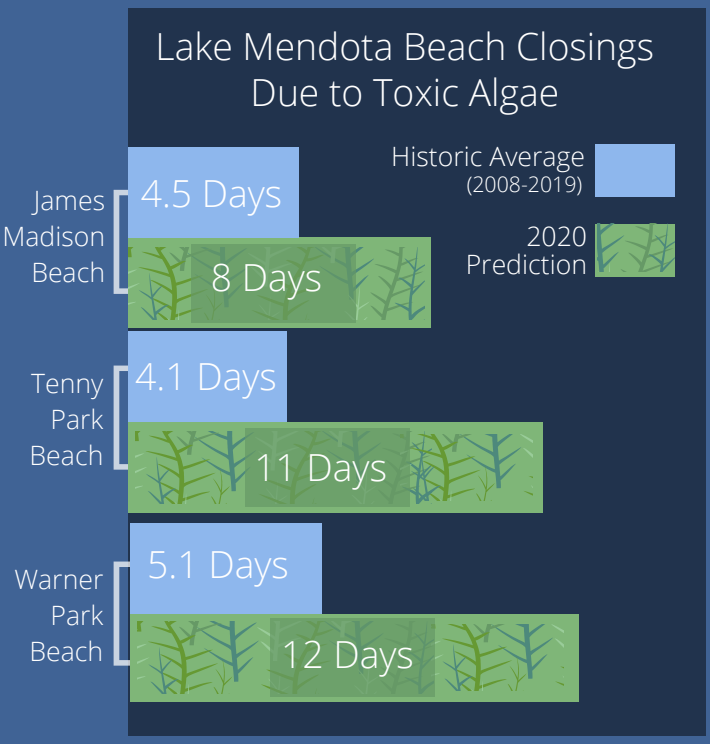
HOW DOES THIS HARM OUR HEALTH?

Blue-green algae can produce toxins that are harmful to human health, such as neurotoxins, liver toxins, cell toxins, and skin irritants.[43] Swallowing contaminated water can lead to vomiting, diarrhea, malaise (feelings of being unwell), muscle twitches, and respiratory failure. Skin contact with contaminated water can lead to rashes and hives.[42] Although severe health symptoms in humans are rare, they are more common in animals, such as dogs and cattle.





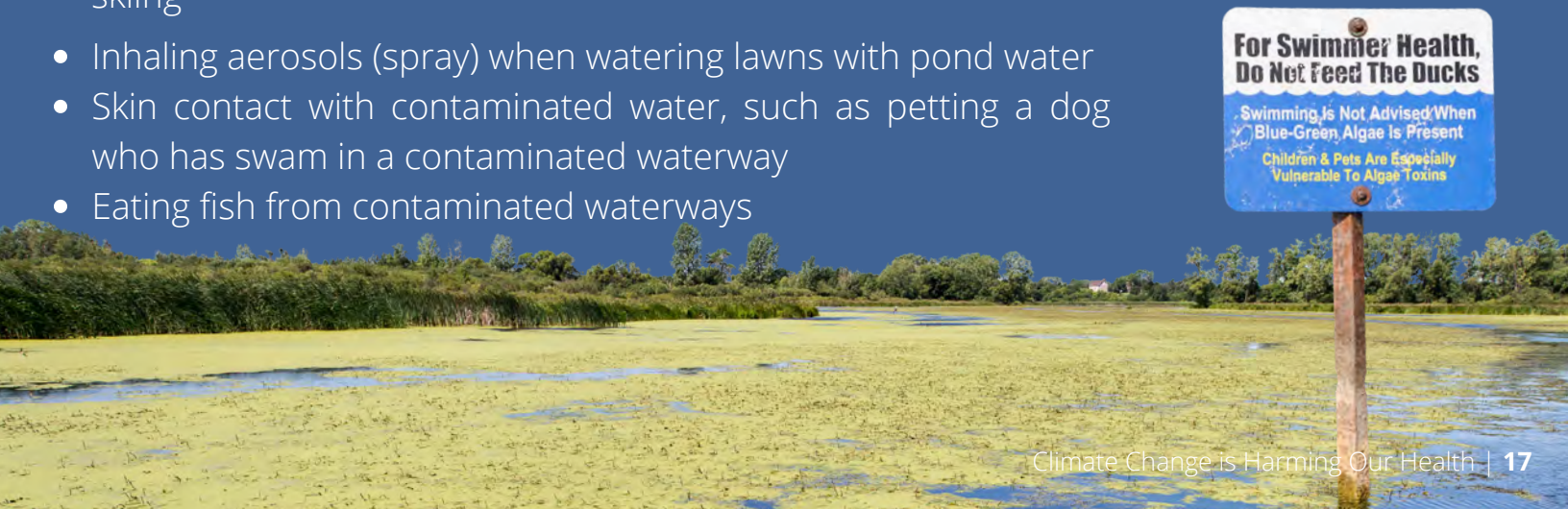
Around the country, blue-green algae poisoning has been fatal to dogs. The toxicity of the algae can produce signs of poisoning in 15-30 minutes, so dog owners around the state should be weary of letting their dogs swim in unsafe waters.[44]



WHO IS BEING HARMED?

While dogs may be experiencing the most direct health effects from blue-green algae, those who interact with recreational bodies of water are also at risk for the health effects of harmful algal blooms. This includes swimmers, boaters, and lakeshore residents. People can be exposed to harmful algae in a variety of ways:[42]

- Accidentally swallowing water that comes from a lake or reservoir with harmful algal blooms
- Drinking untreated water
- Being in the water with harmful algal blooms
- Inhaling aerosols (spray) from water-related activities such as fishing, boating, or jet-skiing
- Inhaling aerosols (spray) when watering lawns with pond water
- Skin contact with contaminated water, such as petting a dog who has swam in a contaminated waterway
- Eating fish from contaminated waterways



CAITLIN'S STORY

By Caitlin Rublee, MD, MPH, an Emergency Physician and Assistant Professor at the Medical College of Wisconsin

John was a middle-aged male who needed oxygen to help him breathe. I met him as he checked into the emergency department late one night. His eyes were fearful; he was sitting up, anxious, and feeling extremely short of breath. The immediate fix was simple: give him oxygen.

Once he was more comfortable, John told me the power went out at his home during the storm. He was not expecting bad weather so he didn't have his back-up generator fueled.

As an emergency medicine physician, I see patients like John every year. Frequently, I have to admit them to the hospital to receive oxygen therapy until a reliable source of power returns. I also have to treat traumatic injuries, lightning strike injuries, heat-related illnesses, and routine emergencies during extreme weather events. Even days after, it is common for patients to need medication refills or contract diarrheal illnesses from contaminated food or water.

As storms and flooding increase, not only will more people be sent to the emergency room, but hospitals may begin flooding as well. My colleagues and I have cared for critically ill patients on ventilators who have had to be evacuated from other hospitals due to severe flooding. We also get concerned about blocked transportation for employees, ambulances, and helicopters during storms. Any delay in critical care, even a short one, can impact the outcome and recovery of a patient.

I believe high quality emergency care should be accessible to all, especially during severe storms. As climate-driven extreme weather events threaten the health of the youngest to the oldest, I am committed to reducing carbon emissions and building climate resilient health care facilities and communities.

FACT

The largest waterborne disease outbreak to date in the U.S. happened in Wisconsin (see below).[45]

FACT

In 1993, Milwaukee experienced its heaviest rainfall in over 50 years. This led to a Cryptosporidium outbreak in the drinking water of 403,000 people and over 50 deaths.[45]

FACT

Changes in the Great Lakes' rainfall and higher lake temperatures have been linked to increases in fecal bacteria levels in those waters.[45]

TICKS AND MOSQUITOES

Disease-carrying ticks and mosquitoes are becoming more widely distributed in Wisconsin as a result of climate change, and ongoing increases in average annual precipitation, longer growing seasons, and warmer annual average temperatures are expected to make this worse.[46,47] Warmer and wetter conditions in Wisconsin can also affect the rate of reproduction of mosquitoes and ticks, and can potentially increase transmission of vector-borne disease—especially during summer. Additionally, increases in precipitation can lead to more widespread breeding grounds for vectors. The changes in weather patterns more broadly can lead to quicker maturation of larvae in warmer and wetter environments like those found in Wisconsin.[47]

HOW DOES THIS HARM OUR HEALTH?

The bite of a tick or mosquito can transfer various pathogens. The vector-borne diseases reported in Wisconsin are both bacterial and viral in nature.

Some of the most common bacterial diseases transmitted by vectors include Lyme disease, anaplasmosis, and babesiosis. Lyme disease is primarily found in the northwestern part of Wisconsin, but cases occur in all counties. The lone star tick has also migrated north to Wisconsin and can cause a rare allergy to red meat.[48] In addition to causing a serious allergy to red meat in some people, the more common health effect of the lone star tick's bite is ehrlichiosis, which can be a potentially debilitating disease.[49]

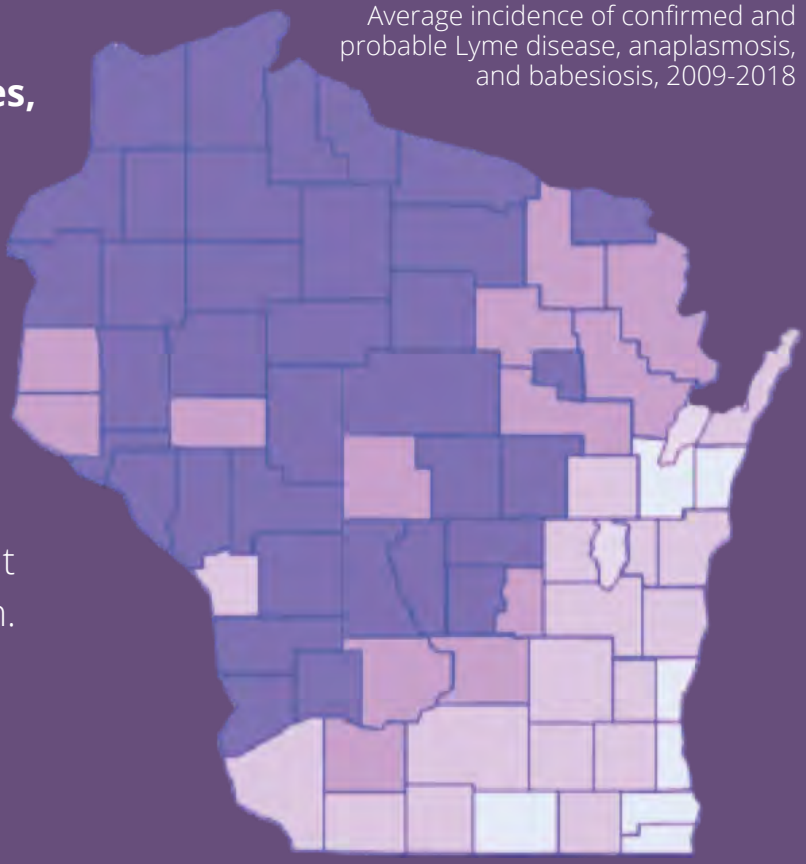
Arboviruses are viruses transmitted by arthropods such as mosquitoes and ticks. In Wisconsin, the most commonly reported arboviral diseases are West Nile virus and La Crosse encephalitis infections.[50]

On occasion, Wisconsin also sees cases of Jamestown Canyon and Powassan virus infections.[51] As weather conditions continue to become more hospitable to disease-carrying mosquitoes, we will likely see increases in disease cases—especially West Nile virus.[52] In particular, warmer winters with fewer hard freezes mean less mosquitoes die off, expanding the period for which West Nile virus can spread. This trend is already observable, with the CDC reporting a 25% increase in neuroinvasive disease from West Nile virus in 2018.[53]

WHO IS BEING HARMED?

Anyone can be harmed by these diseases, but people who spend time outdoors can be especially susceptible to vector-borne disease in Wisconsin. While hikers and hunters frequent densely forested areas, illness-carrying vectors can also linger closer around the forest edge.[54] During times of high vector activity, people need to be aware of the health risks associated with time spent outside, whether through work or recreation.

Average incidence of confirmed and probable Lyme disease, anaplasmosis, and babesiosis, 2009-2018



RISK LEVEL

(Incidence per 100,000 people)

- Highest: ≥ 100 cases
- High: 50 to 99.9 cases
- Moderate: 10 to 49.9 cases
- Low: 0 to 9.9 cases

ANGELA'S STORY

By Angela Weideman, LMFT, Health Director at the Chippewa County Department of Public Health

Chippewa County was in the midst of the COVID-19 pandemic, with over 850 confirmed cases. So, when I delivered our health department update, few Wisconsinites were expecting a reported death to be from a mosquito-borne disease, instead of from COVID-19. The news rattled our community, as our economy is based largely on outdoor tourism, such as fishing, boating, and swimming.

When the woman, who was in her 60s, first reported symptoms, her doctors thought it was likely COVID-19. However, after she passed out a few times, it became clear that her case was growing increasingly serious, and more tests were ordered. The results were surprising, especially for early Autumn in Wisconsin. She came back positive for Eastern Equine Encephalitis - a rare virus that can cause fever, chills, exhaustion, joint and muscle pain, headache, vomiting, diarrhea, seizures, behavioral changes, swelling in the brain, and coma. Her illness progressed rapidly and after going on a ventilator, she passed away, leaving behind a husband and stepdaughter.

Unfortunately, this was not the first phone call I received from a family who had lost a loved-one due to an illness transferred by mosquitoes in our county. My first case came in 2017. The family had lost their son to West Nile. He was a young man, healthy and with no chronic conditions, when suddenly he began experiencing unusual symptoms during hunting season. He ended up in Mayo Clinic on a ventilator before he passed away. The family's sorrow from such an unexpected loss echoed in every word they spoke to me.

This case made me fearful for my own son who loves the outdoors. As the Health Director in our area, I see the risk of mosquitoes increasing as their active season creeps into October and early November. In these colder months, visitors, outdoor workers, and other community members are typically not thinking of mosquito protection. However, the climate is changing. As our county grows warmer and wetter, so, too, grows the risk of these diseases. When I try to inform others of the risk and the importance of reducing standing waters that can act as mosquito breeding grounds, most people look at me like I'm an alien. They tell me, "It is just a bug bite!" or "Mosquito-borne illnesses are only in Africa or somewhere else far-away." But I know all too well that the risk is very real, and it is at our doorstep.

FACT

In 2017, the CDC reported 47 cases of West Nile Virus (WNV) in Wisconsin and 147 deaths nation-wide. However, WNV is underreported, as 80% of cases are asymptomatic.

FACT

Since the 1970s, the mosquito season in Wisconsin has become 14-19 days longer, increasing the risk of disease transmission.[55]

THE HEALTH BENEFITS OF ACTING NOW

Policies and other actions that reduce heat-trapping carbon pollution not only prevent health harms from climate change, they also have numerous beneficial health effects. The benefits from improved air quality, active transport, and better diets far outweigh the cost of clean-energy investments and save lives.[19]

THE HEALTH BENEFITS OF CLEAN AIR

Switching to clean renewable energy and adopting energy efficiency practices will not only save lives in Wisconsin, but across the country. Coal-fired and gas power plants make up 1/3 of U.S. greenhouse gas emissions, releasing particulate matter, and toxic chemicals into our air, water, and soil, therefore harming our health.[56]

Short- and long-term exposure to the tiny particles in air pollution (especially PM 2.5) can have serious effects on health. In addition to exacerbating asthma symptoms, air pollution is a known cause of inflammation and cellular damage.[57] **Replacing coal with solar energy could save 52,000 American lives annually from improved air quality.**[58]

Clean air saves the lives of Wisconsin children

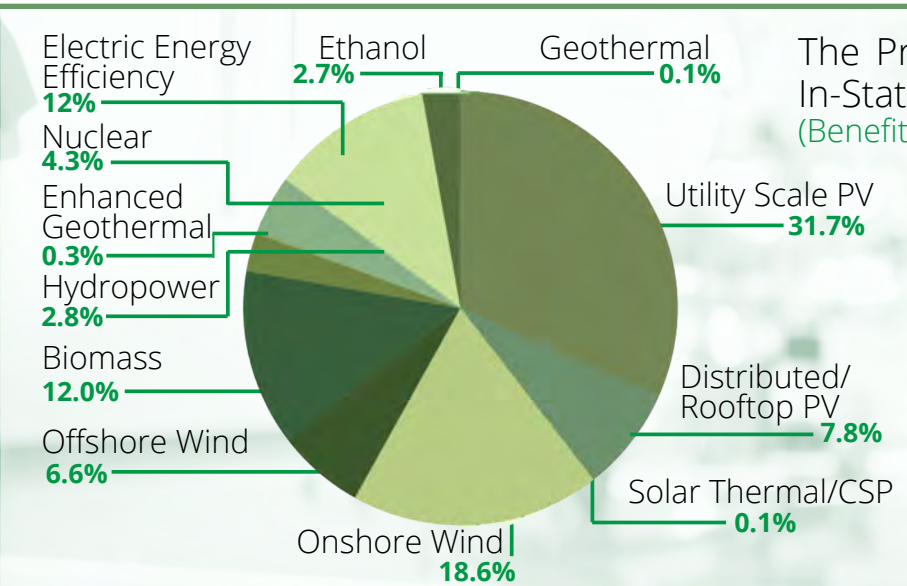
Exposure to air pollution is associated with an increased risk of severe outcomes with respiratory disease. In the current COVID-19 pandemic, researchers are finding that counties in the U.S. with increased exposure to air pollution have higher death rates from COVID-19.[59] The impacts of air pollution on health are serious and warrant action to support low-carbon policies. Therefore, the transition to clean energy is necessary to improve health. Estimates show that by 2050, **one to four million lives across the globe could be saved every year from improved air quality**.[60]

The people in Wisconsin most vulnerable to fossil fuel air pollution include children, the elderly, low-income communities, and people of color. Nationally, nearly six million African Americans live within three miles of a coal-fired power plant and over 1 million African Americans live in counties that face a cancer risk due to toxins emitted by natural gas facilities.[61,62,63] Additionally, high energy costs force low-income families to choose between essential items, and lack of air conditioning puts these families at higher vulnerability to heat illness.

WISCONSIN YEARLY HEALTH SAVINGS ESTIMATES INCLUDE [20]

- 1,910 PREMATURE DEATHS
- 650 RESPIRATORY ER VISITS
- 873,000 MINOR RESTRICTED ACTIVITY DAYS
- 148,000 WORK LOSS DAYS
- 49,400 RESPIRATORY SYMPTOM CASES
- 34,400 CASES OF ASTHMA EXACERBATION
- 1,580 CASES OF ACUTE BRONCHITIS
- 670 HOSPITAL ADMISSIONS
- 650 HEART ATTACKS

Switching to 100% clean energy in Wisconsin alone translates to an economic savings of $21 billion.[20] Over the last half century, the Clean Air Act has saved $30 in hospital room visits for every $1 spent and the estimated health benefits of low carbon policies in the U.S. will offset technology investment costs by 26% to 1050%.[57] According to the International Renewable Energy Agency, the U.S. solar and wind energy industry is creating jobs 12-times faster than the rest of the U.S. economy. Clean energy is estimated to produce at least 162,000 jobs in Wisconsin.[20]



The Proposed Fuel Mix for A 100% In-State Energy Scenario [20]
(Benefits listed above)

THE HEALTH BENEFITS OF CLEAN CITIES

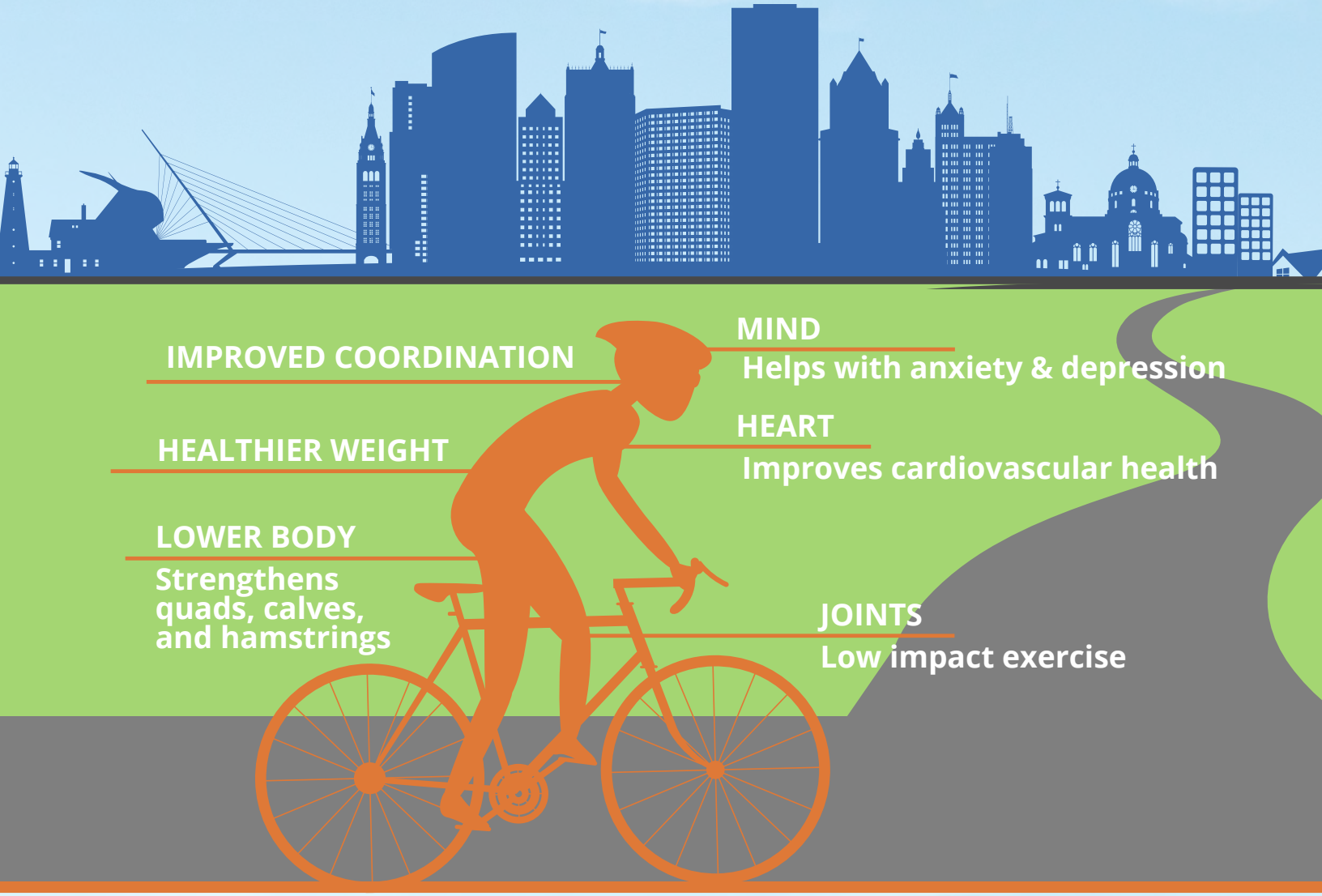
Lack of physical activity is associated with heart disease, stroke, diabetes, obesity, osteoporosis, depression, and all-cause mortality.[19] In 2008, the estimated annual cost of obesity alone in the U.S. was $147 billion.[56] Only 33% of Americans get regular moderate exercise.[56] **Policies that promote active transport would encourage regular physical activity for Wisconsinites, improving wellbeing and reducing healthcare costs.** In cities with the highest levels of biking and walking, obesity, diabetes, and mortality rate declined.[64] Exercise decreases cancer, coronary heart disease, and boosts the immune system.[64]

Exposure to traffic-related air pollution also increases the risk for heart disease, asthma and other respiratory disease, cancer, premature death, adverse birth outcomes, diabetes, and affects lung and brain development in children.[56] In 2015 alone, tailpipe emissions were associated with 385,000 global deaths due to fine particulate matter and ozone, and the cost of adverse health effects was estimated at $1 trillion.[65] Motor vehicle crashes are also the top cause of injury, disability, and death in the U.S. for people 5–24 years of age.[66]Additionally, long commutes and traffic can increase stress and isolation from family and community.[66]

Low-income families have the most to gain from better designed urban areas, as they spend more of their income on transportation, have more exposure to vehicle pollution, and are at higher risk of injury and death due to collisions.[66] Low-income families, that may not have access to cool places or air conditioning, are also those most vulnerable to heat related illness worsened by the urban heat island effect. Better public transport and bike paths reduces pavement coverage in cities and adds greenspace, which lessens heat risks.

A 2012 analysis examined the health effects of transportation choices in the 11 largest metropolitan areas in the upper Midwest. First, researchers modeled air quality improvements if short car trips (five miles round trip) were eliminated during summertime months (June, July, August, and September). Next, they added the health benefits of increased physical activity, assuming half of these short trips could be accomplished by bike instead of car. The results? **Swapping cars for bikes in this scenario, would save approximately 1,300 lives annually across the region from cleaner air and promoting more exercise.**[67]

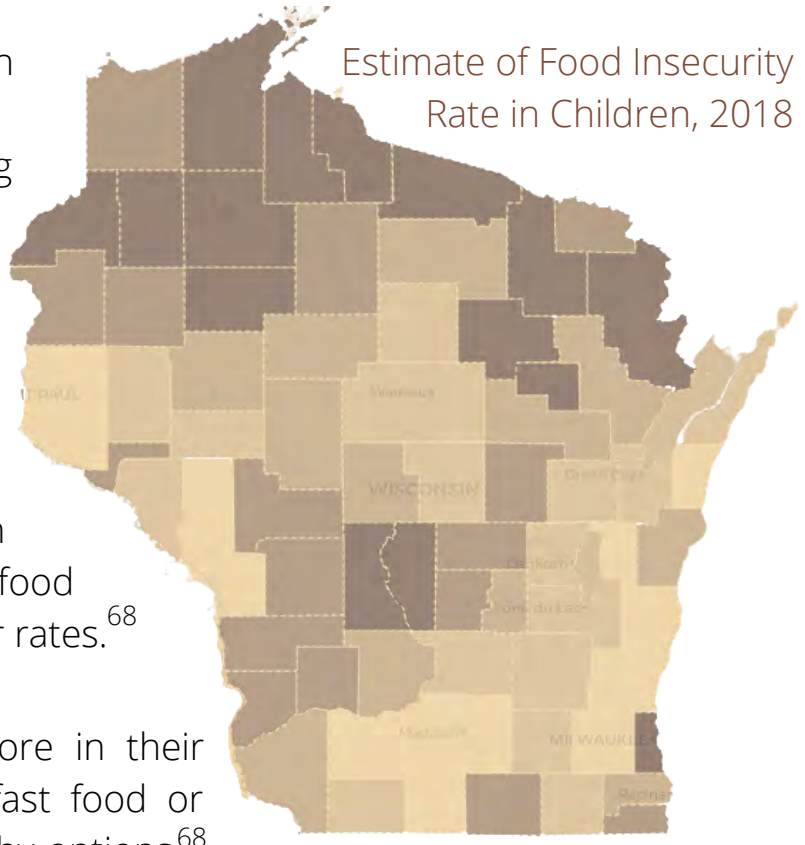
Preliminary analysis by the Health Oriented Transportation (HOT) project based at UW-Madison's Global Health Institute has also run comparative scenarios of biking in Wisconsin. The average cycling mode share for cities across Wisconsin is currently just 1.3%. If bicycle commuting across all cities reached 6% (the current level in Madison), the fitness benefit would save an average of 400 lives per year. Furthermore, if Wisconsin could reach the same level of bike commuting as Davis, CA (at 20%), that would save 900 lives each year.



THE HEALTH BENEFITS OF SUSTAINABLE FOOD SYSTEMS

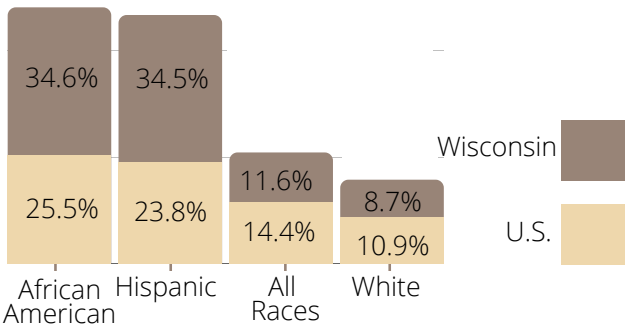
Food insecurity is the lack of access to enough food, or nutritionally adequate foods. Food insecure households are not always struggling with access to food the entire calendar year, but rather this number reflects a household's need to make trade-offs between food and other basic needs, like medical bills and housing. Food insecurity can be found throughout Wisconsin, but it is more common in some rural counties, such as Menominee where 17.5% of residents are food insecure and children experience even higher rates.[68]

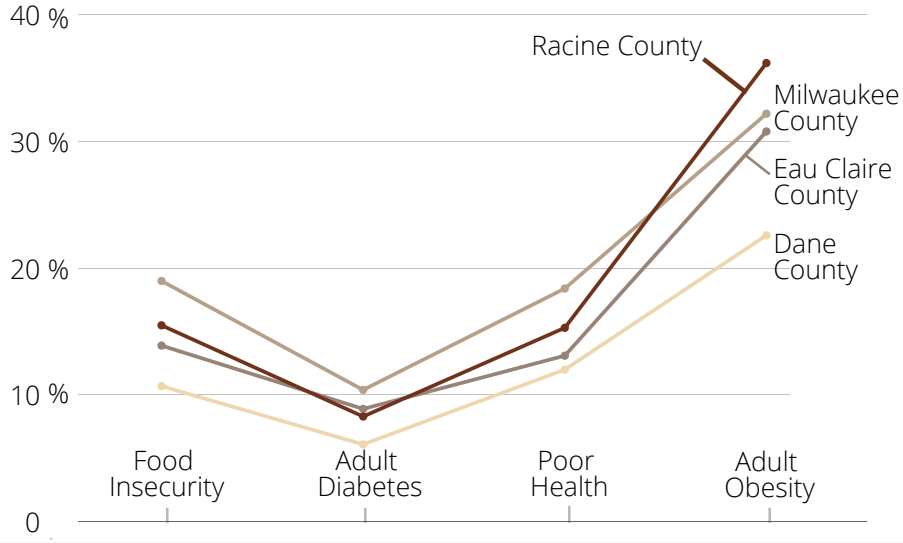
Estimate of Food Insecurity Rate in Children, 2018



If Wisconsinites do not have a grocery store in their neighborhood, they may have to rely on fast food or convenience stores which have limited healthy options.[68] **Food insecurity is associated with high blood pressure, diabetes, hyperlipidemia, heart disease, obesity, and mental health problems.**[69] Children who experience food insecurity are more likely to be hospitalized for asthma.[69] Food insecure children are also at higher risk for obesity, and behavioral or social issues, like fighting, hyperactivity, anxiety, and bullying.[70] Children from food insecure households have been shown to score lower on arithmetic tests and are more likely to have repeated a grade.[71]

Income, access to transportation, availability of grocery stores, race, and geography all impact a household's ability to find food.

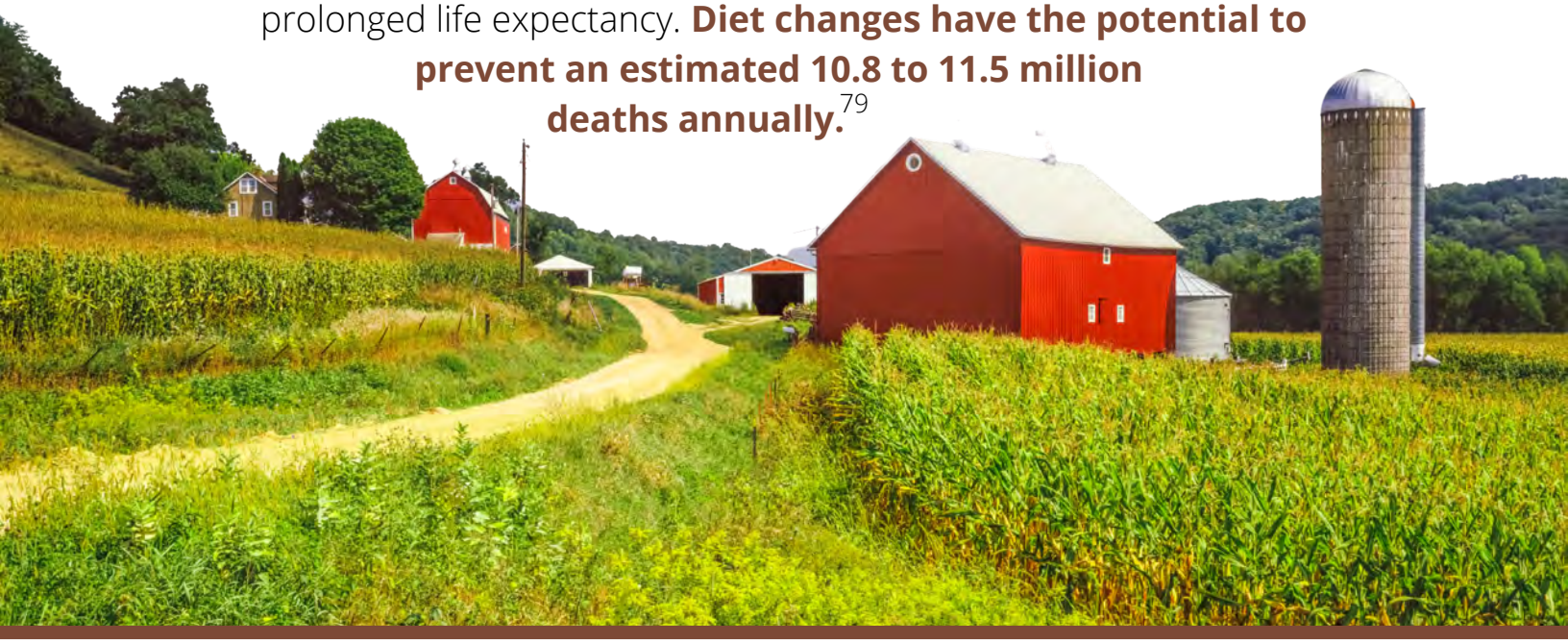




Shifting our food systems to more sustainable methods can have vast human health impacts. Currently, the agricultural industry is a significant contributor of methane and nitrous oxide emissions, which are potent greenhouse gases. Specifically, 8.6 percent of U.S. greenhouse gas emissions can be attributed to the agricultural industry alone.[72] The health impacts of industrial agricultural practices harm more than just air quality. These practices are also associated with antibiotic resistance, water contamination, pesticide illness, and topsoil loss.[73,74] Utilizing sustainable agricultural practices can conserve water, reduce pesticide and fertilizer use, protect topsoil, and store carbon.[75] **Actions to promote sustainable farmland not only benefits the farmer, but consumers.**

Poor eating habits, like consuming processed foods and excess meat are linked to chronic illnesses. In Wisconsin, an estimated 31 percent of adults have diagnosed hypertension and 32 percent of residents are obese.[76] Alarmingly, 19 percent of Wisconsinites report eating vegetables less than once a day, and 32 percent report eating fruits less than once a day.[76] **By adapting a locally sourced, plant-based diet that supports Wisconsin agriculture, people can improve their health while promoting sustainable food systems.** Healthcare systems should incorporate these changes into the food they serve patients and visitors.

Typically, local food systems increase access to healthy fruits and vegetables.[77] In eating less red and processed meats, residents can also reap the benefits of reduced risk of heart disease and cancer.[78] Additionally, consuming less meat reduces methane emissions from livestock production. Overall, simulations suggest that healthy eating in the U.S. could potentially generate billions annually in increased productivity, medical savings, and prolonged life expectancy. **Diet changes have the potential to prevent an estimated 10.8 to 11.5 million deaths annually.**[79]



WHAT WE CAN DO
TO PREVENT AND PROTECT

Every major medical and health association in the United States has declared climate change a public health emergency, including the American Medical Association, American Academy of Pediatrics, and American Heart Association.[80]

In order for Wisconsin health systems to accommodate the additional patients and health demands that will occur due to warming, we need to implement both short- and long-term strategies on the local, state, and national scale. Short-term strategies include strengthening our standard public health system policies and programs, such as monitoring and surveillance.[81] Health care systems must strengthen infrastructure and implement environmentally friendly practices that will promote resilience against extreme weather events.[81,82] Resilience practices must also encompass mental health support and key services for health workers. This must occur alongside strong climate change policy to minimize further warming and health impacts.[81]

The sooner we take action, the more harm we can prevent, and the more we can protect the health of all Wisconsinites.[83] The most important action we can take to protect our health is to greatly accelerate our transition to clean renewable energy in Wisconsin.

In addition to limiting climate change, accelerating the transition to clean energy has the added benefit of rapidly cleaning up our air and our water so that we can all enjoy better health. Who among us doesn't want clean air and water, and better health?

Specific actions that can be taken by different groups to prevent and protect against health harms from climate change, and to promote better health for people across Wisconsin, are identified below:

CLINICAL HEALTH PROFESSIONALS

First and foremost, physicians and other clinicians must provide care to patients who are experiencing climate-related health effects. This may include conversations with patients about the relevance of climate change to their medical condition. **Beyond this, health professionals can discuss these issues with the public and policymakers to assure they understand the importance of action, and they can advocate for policies that will prevent and protect the people of Wisconsin from needless climate and health harms**. Reducing heat trapping pollution is a priority, and vital health infrastructure must be prepared to ensure it is protected from the risks of climate change including floods and storms. Health institutions should focus on reducing energy use, relying on clean energy to the furthest extent possible, and avoiding negative impacts on the environment. Doctors can also encourage medical education at all levels to incorporate climate change-related coursework into health curricula.

PUBLIC HEALTH AND THEIR PARTNERS

Public health professionals are leaders in monitoring, prevention, preparedness, and public communication on health issues. Climate change creates the imperative to do all of these. Examples include crafting early warning systems for heat and extreme weather events, advising hospitals and health systems on preparedness, and collaborating with research institutions to enhance surveillance and community resilience in the face of inevitable climate-related disasters. Public health leaders collect data and create reports that keep other stakeholders aware of how well we're doing, collectively, to prevent and respond effectively to the health harms of climate change. Beyond this, it is important to foster discussions with the public, policymakers and with a range of local and state government agencies on climate-related health issues, and to advocate for policies that will protect the health of people across the state—especially Wisconsin's most vulnerable residents. It is especially imperative that public health professionals work in close collaboration with professionals in other areas of local and state government (including transportation, agriculture, natural resources, zoning, etc.) because their policies and programs can have direct influences on climate change and human health.

GOVERNMENT LEADERS

Leaders in local and state government should immediately begin focusing on preparedness, providing the support needed to build resilience against damaging climate change impacts. In collaboration with leadership in other public works departments, government leaders must also take ambitious steps to prevent the worst health impacts of climate change, including fully embracing clean energy, walkable communities, public transportation, and green building design. The leaders and staff of these branches of government should take every possible measure to engage climate and health in their work so as to ensure their activities are helping to limit climate change and ensure good health. In doing so, they will deliver immediate health benefits for their constituents, from the youngest to the oldest.

ALL OF US

We all should know the risks we face, especially if we live in areas that are particularly vulnerable to disastrous fires, floods, storms, and extreme weather events, and if we or our loved ones are particularly vulnerable to the health harms of climate change for medical or other reasons. Beyond that, we all have the opportunity to be part of the solution. We can reduce the pollution we create by becoming more energy-efficient and wasting less energy, producing clean energy (home or community solar) or purchasing it from an energy company, lessening automobile use in favor of walking, cycling, public transportation use and teleworking, and eating a more plant-based healthy diet. The good news is that taking such steps will improve our health and everyone else's. The final message is for all of us to get involved, from medical professionals, to all professionals, and citizens. Our health depends on it.

Wisconsin health societies, notably the Wisconsin Medical Society, already recognize the health harms of climate change, and are rising to action

WISCONSIN MEDICAL SOCIETY RESOLUTION: PASSED AUGUST, 2020

The Wisconsin Medical Society endorses the following scientific consensus and findings of the 5th Assessment Report of the UN IPCC:

- Anthropogenic warming of the climate should be kept to a maximum of 1.5°C/ 2.7°F relative to pre-industrial levels.• Relative to 2010 levels, global carbon emissions must decrease 45% by 2030 and reach net zero by 2050 to stay under that limit; and be it further

The Wisconsin Medical Society will advocate for equitable policies to limit warming to IPCC recommended 1.5°C/ 2.7°, including:

- Carbon pricing; performance standards; funding for research and development of key carbon reduction measures; and increased funding for mass transit and active transportation.
- Phase-out of fossil fuel subsidies; and be it further

The Wisconsin Medical Society will advocate for policies which assist communities and health systems to adapt to the health impacts of climate change, focusing on those most vulnerable.

WISCONSIN SOLUTIONS
TO PREVENT AND PROTECT

The Starting Point: What Renewable Energy Policies are Already In Place In Wisconsin?

Wisconsin currently has two executive orders that relate to climate change: Order 38, and Order 52

RENEWABLE PORTFOLIO STANDARD (RPS), *VIEW*

This policy, currently in place in Wisconsin, requires all power suppliers to provide retail customers with a certain percentage of electricity from renewable resources. The RPS standard set in 2015 established a 10% statewide target.[84] Although several wind and solar farms are now in development, the state should be encouraged to increase their targets to promote clean air and better population health.

RENEWABLE ENERGY COMPETITIVE INCENTIVE PROGRAM, *VIEW*

This Wisconsin state-run grant program gives funds to Wisconsin organizations for renewable energy systems such as solar, wind, biomass, and geothermal. Groups can increase the amount of renewable energy technology in the state by applying to the program.

Further bold action is necessary to protect the health of Wisconsinites

2019 ASSEMBLY COMMITTEE ON AGRICULTURE, *VIEW*

The Assembly Committee on Agriculture brought forth bills that support farmers throughout Wisconsin. Some assembly bills sought to improve sustainable agriculture by, for example, providing resource conservation technical assistance to farmers. Though the committee's bills failed at the senate joint resolution, these proposed bills give hope that more work on sustainable agriculture will continue.

WISCONSIN SOLUTIONS
TO PREVENT AND PROTECT

Moving Wisconsin FORWARD: Legislative Potential

Although Governor Evers has issued an executive order calling for carbon-free electricity by 2050, executive orders lack the authority and funding privileges that an Act could produce. **Wisconsin legislators should develop binding legislation to transition Wisconsin to clean energy and promote clean air for the health of residents.**

CARBON PRICING, *VIEW*

Carbon pricing is the focus of a recent bill brought to the Wisconsin Legislature that aims to disincentivize the building of power plants. It would charge $50 per ton of carbon emitted from that power plant. Rather than taxing carbon emissions, this bill would assign a dollar amount to the economic harms and socialized costs of carbon dioxide emissions—the primary cause of climate change. By putting pressure on industry to reduce carbon emissions, everyone's health will benefit from less air pollution.

NO MORE FOSSIL FUEL INFRASTRUCTURE RESOLUTIONS AND LAWS

Pipelines and fossil fuel infrastructure extend the timeline for transitioning to clean energy and have disastrous health impacts. Resolutions and laws should be passed to deter multiple oil pipelines that have been proposed through Wisconsin, such as an expansion of Enbridge Line 61 and 66. In 2010, an Enbridge pipeline rupture in Michigan spilled 834,000 barrels of oil into the Kalamazoo river.[85] The Michigan Department of health determined adverse health effects from the spill included cardiovascular, dermal, gastrointestinal, neurological, ocular, renal, and respiratory impacts. The chemical dilutants, benzene and toluene, pumped through these pipelines are also linked to a number of leukemias in adults and children.

CLIMATE-SMART HEALTH CARE IN WISCONSIN, *VIEW*

During flooding and other extreme events, it is critical that Wisconsin health systems remain operational and capable of providing acute, emergency care to those in need. The health care sector also generates nearly 10% of U.S. carbon pollution directly exacerbating the negative climate health impacts it seeks to treat.[86] **Creating more resilient health infrastructure and environmentally friendly hospitals, clinics, and care systems protects Wisconsin jobs, lives, and wellness.**

WISCONSIN SOLUTIONS
TO PREVENT AND PROTECT

Model Legislation from Other States

Other states have passed legislation that Wisconsin can consider when developing policy.

VIRGINIA CLEAN ECONOMY ACT, *VIEW*

This act requires the state's utilities to run on 100% renewable energy by 2045, provides a timeline for retiring old fossil fuel plants, and details energy efficiency regulations. It also also gives the State Corporation Commission authority to review any new projects, in an effort to keep energy rates low for consumers.

CLIMATE LEADERSHIP AND COMMUNITY PROTECTION ACT, *VIEW*

New York's climate plan aims to eliminate its greenhouse gas emissions by 2050. This Act will require the state to reduce pollution 85% below the levels seen in 1990. To do this, New York must get 70% of its electricity from wind, solar, and hydropower by 2030—then shift entirely to carbon-free power 10 years later. If successful, New York will create a "net-zero" economy by offsetting residual greenhouse gas emissions through sustainable solutions.

Local Level Policies and Advocacy for Wisconsinites

PARTICIPATING IN BUDGET DEVELOPMENT

Annual state and local budgets oversee funding to key sectors that influence clean energy and health, such as transit system expansions of bike, pedestrian, and accessible public transport infrastructure. Investments in affordable housing also help families' avoid displacement and long-distance commutes, as they can afford housing nearer to their jobs. **Budget support for resilience measures is needed for Wisconsin communities to protect against the adverse health impacts of climate change and must dovetail with mitigation measures.** Agricultural funding should be utilized to maximize diverse and regenerative practices that reduce reliance on chemical intensive industrial monocultures. Incentives should also be allocated to manure management practices that protect waterways and minimize methane emissions. These practices serve to increase rural resilience to flooding and extreme events and improve water quality and health.

WISCONSIN SOLUTIONS
TO PREVENT AND PROTECT

Urban resilience measures for Green Bay, Appleton, Kenosha, Oshkosh, Janesville, Lacrosse, Waukesha, Eau Claire, Madison, Milwaukee, and Racine include, but are not limited to, community preparedness training, availability of climate-adapted housing, rainwater and gray water capture, food waste reduction systems, and the expansion of green space & tree canopies, green infrastructure, and cool roofs & pavements which reduce the heat island effect and increase flooding resilience.

Budget allocations for Universities can also influence funding for research into technologies and strategies that draw down atmospheric carbon or improve energy efficiency. Additional funds can be funneled into investigating the potential health and equity impacts of various climate strategies. Government leaders can prioritize items within budgets that reduce carbon emissions and better the health of the communities they serve. **Citizens, public health workers, and health professionals can influence the goals of policy makers by advocating for financial allocation to agenda items that have benefits for all.**

THE MADISON FOOD POLICY COUNCIL, *VIEW*

In our state's capitol city, a council has been established to review municipal actions related to reducing food waste through composting, incinerating, and source reduction. By improving our food systems, we can cut back on waste and in turn, prevent the use of excess energy.

WISCONSIN SOLUTIONS
TO PREVENT AND PROTECT

CLEAN ENERGY COMMITMENTS

Various types of 100% clean energy commitments can be put in place to support development. Many Wisconsin leaders or common councils have already passed resolutions like these, but other areas of Wisconsin also remain uncommitted. **When passing a resolution or lobbying for a commitment, health statements are powerful. "Scientists are very clear that our health and safety depend on rapid changes to the way we live and work," read Chair Raj Sjukla's introduction to the Madison proposal, which later passed unanimously.**

Schools boards are another powerful route for clean energy commitments and policies, as children's developing lungs make them more vulnerable to the air pollution produced by fossil fuels. Climate-related health impacts can also harm student performance and reduce learning outcomes. School district commitments to clean energy reduce particulate air pollution in communities and can offset health harms, benefiting students and families.

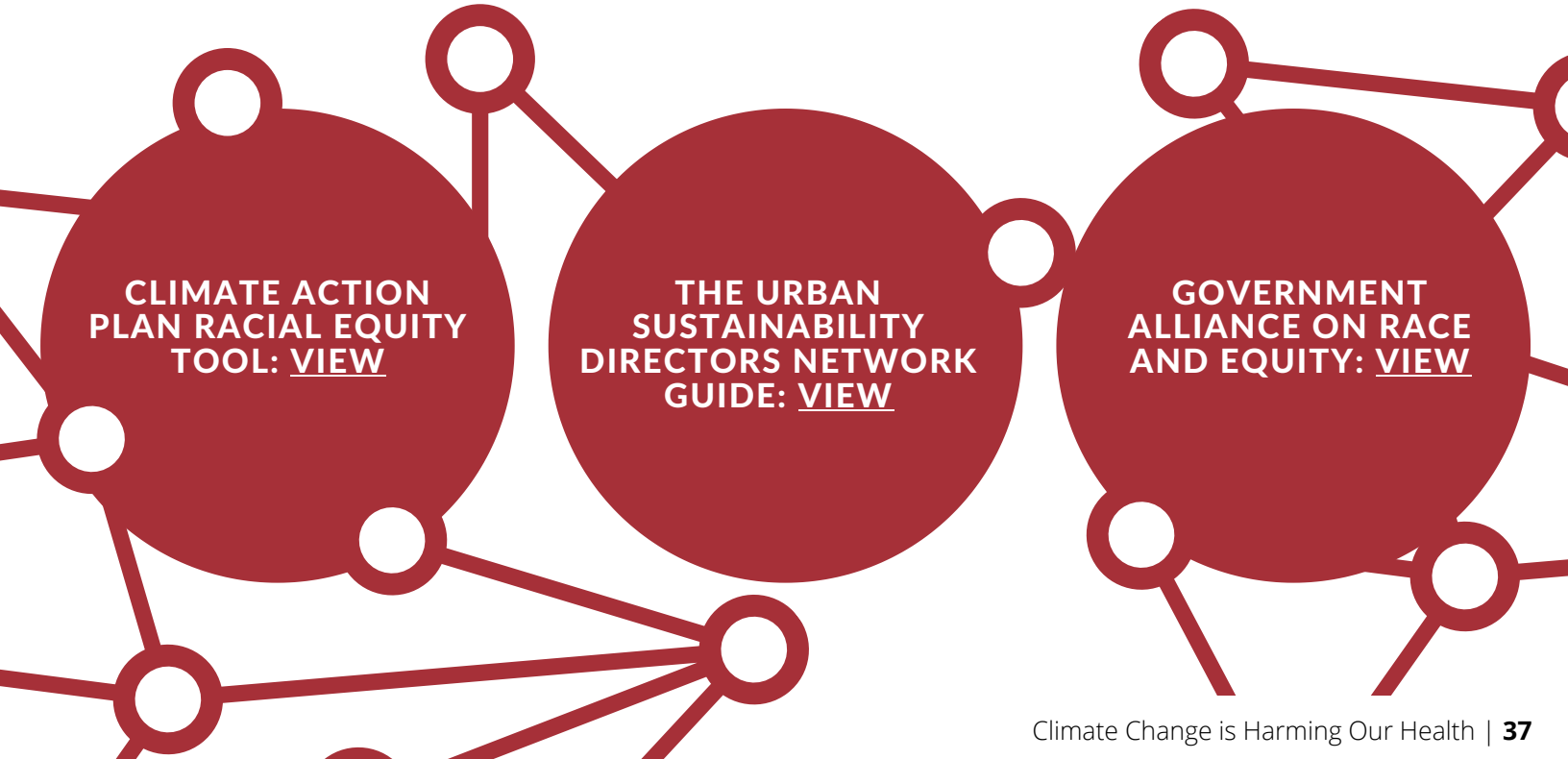
- La Crosse's Commitment
- Eau Claire's Commitment
- Milwaukee's Commitment
- Madison's Commitment
- Fitchburg's Commitment
- Monona's Commitment
- Green Bay School District Commitment
- Madison School District Commitment

WISCONSIN SOLUTIONS
TO PREVENT AND PROTECT

IMPORTANCE OF EQUITY AND ENVIRONMENTAL JUSTICE IN POLICY CONSIDERATIONS

The health impacts of climate change are not felt equally by all. Groups more vulnerable include communities of color, children and pregnant women, the elderly, immigrant groups, indigenous peoples, certain occupational groups, low-income households, and persons living with disabilities or chronic diseases. **When considering climate policy to protect the health of Wisconsin communities, it is imperative that policies address historical injustices and not exacerbate already existing health equity issues.** Regardless of race, income, or other characteristics, environmental justice ensures that all people have access to safe and healthy places to live and work, and that benefits/costs of energy activities are shared fairly across all citizens.

There are multiple guidebooks and tools that can help Wisconsin policy makers incorporate environmental justice into their policies (listed below). Important guidelines include ensuring that the neighborhoods affected by policy are included in the decision-making process. It is also important that investments do not bypass low-income households and appropriate data is used to analyze policy impacts. Potential disproportionate impacts on various groups should be considered in policy making so that economic and health benefits are equitable.



ADDITIONAL RESOURCES

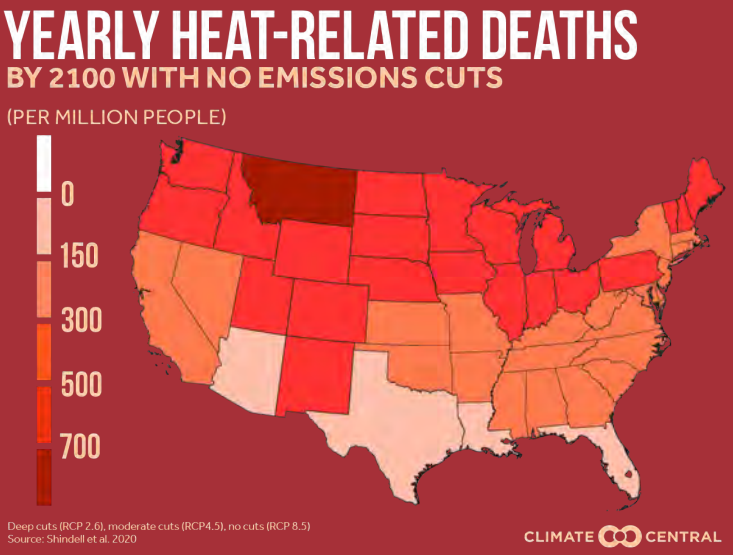
TOOLKITS & MORE

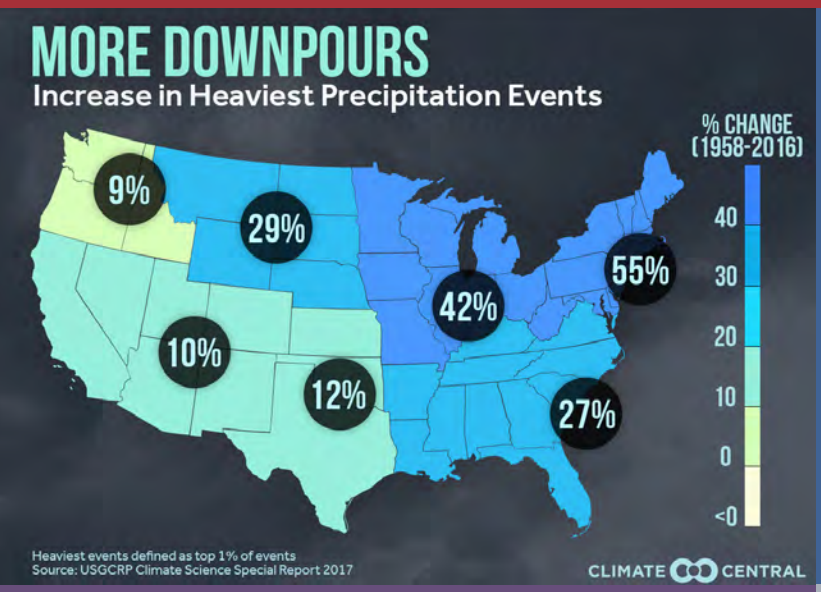
DIRECT HEALTH HARMS

EXTREME HEAT TOOLKIT | Wisconsin Department of Health Services

URBAN HEAT ISLAND EFFECTS & MITIGATION | U.S. EPA

EXTREME HEAT | Climate Central





FLOOD TOOLKIT | Wisconsin Department of Health Services

EXTREME RAIN AND FLOODING | Climate Central

FLOOD CLEANUP AND THE AIR IN YOUR HOME BOOKLET | U.S. EPA

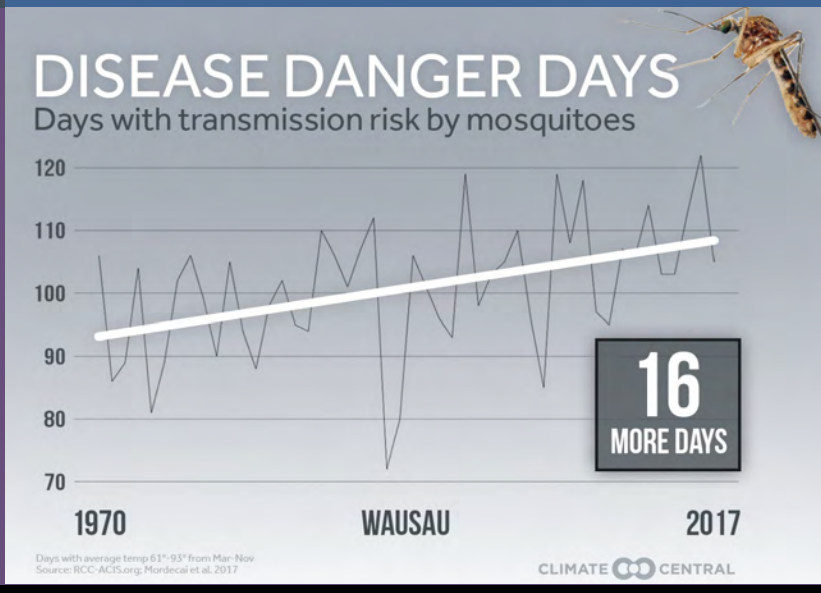
FLOODING | Ready Wisconsin

HARMFUL ALGAE BLOOMS TOOLKIT | Wisconsin Department of Health Services

VECTORBORNE DISEASE TOOLKIT | Wisconsin Department of Health Services

DISEASE DANGER DAYS ON THE RISE | Climate Central

THE TICK APP: APPLE, GOOGLE PLAY | University of Wisconsin - Madison



ADDITIONAL RESOURCES

TOOLKITS & MORE

HEALTH BENEFITS

MINDFUL CLIMATE ACTION | University of Wisconsin- Madison

HUNGER & FOOD SECURITY IN WISCONSIN& DANE COUNTY | Public Health Madison & Dane County

WISCONSIN FOOD SECURITY PROJECT | University of Wisconsin- Madison

HEALTH ORIENTED TRANSPORTATION | University of Wisconsin- Madison

U.S. CALL TO ACTION ON CLIMATE, HEALTH, AND EQUITY: A POLICY ACTION AGENDA

ARRIVE TOGETHER: TRANSPORTATION ACCESS & EQUITY

COUNTY HEALTH RANKINGS

GENERAL CLIMATE & HEALTH

CLIMATE CHANGE, HEALTH & EQUITY | American Public Health Association

HEALTH CARE'S CLIMATE FOOTPRINT | Health Care Without Harm

CONVEYING THE HUMAN IMPLICATIONS OF CLIMATE CHANGE | George Mason University

PRIMARY PROTECTION: ENHANCING HEALTH CARE RESILIENCE FOR A CHANGING CLIMATE | U.S. Department of Health and Human Services

A PHYSICIANS GUIDE TO CLIMATE CHANGE, HEALTH, & EQUITY

2019 LANCET COUNTDOWN ON HEALTH AND CLIMATE CHANGE

PROJECTING CLIMATE & DISEASE BURDEN | CDC

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3. Sarfaty M, Bloodhart B, Ewart G, Thurston GD, Balmes J, Guidotti TL, Maibach E. 2015. American Thoracic Society Member Survey on Climate Change and Health. Annals of the American Thoracic Society, 12(2): 274-278. DOI: 10.1513/AnnalsATS.201410-460BC

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Pg. 5, Maps: USGCRP. 2014. Projected mid-century temperature changes in the Midwest; https://www.globalchange.gov/browse/multimedia/projected-mid-centurytemperature-changes-midwest

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Pg. 26, Map: from Wisconsin Food Security Project, data from Map the Meal Gap; https://foodsecurity.wisc.edu/

Pg. 26, Graphs: Created from Map the Meal Gap 2018 data, accessed at the Wisconsin Food Security Project; https://foodsecurity.wisc.edu/

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A cleaner, brighter tomorrow is possible. We all deserve clean air, water, and a climate that can support us. Let's work together to create a Wisconsin legacy we are proud of.