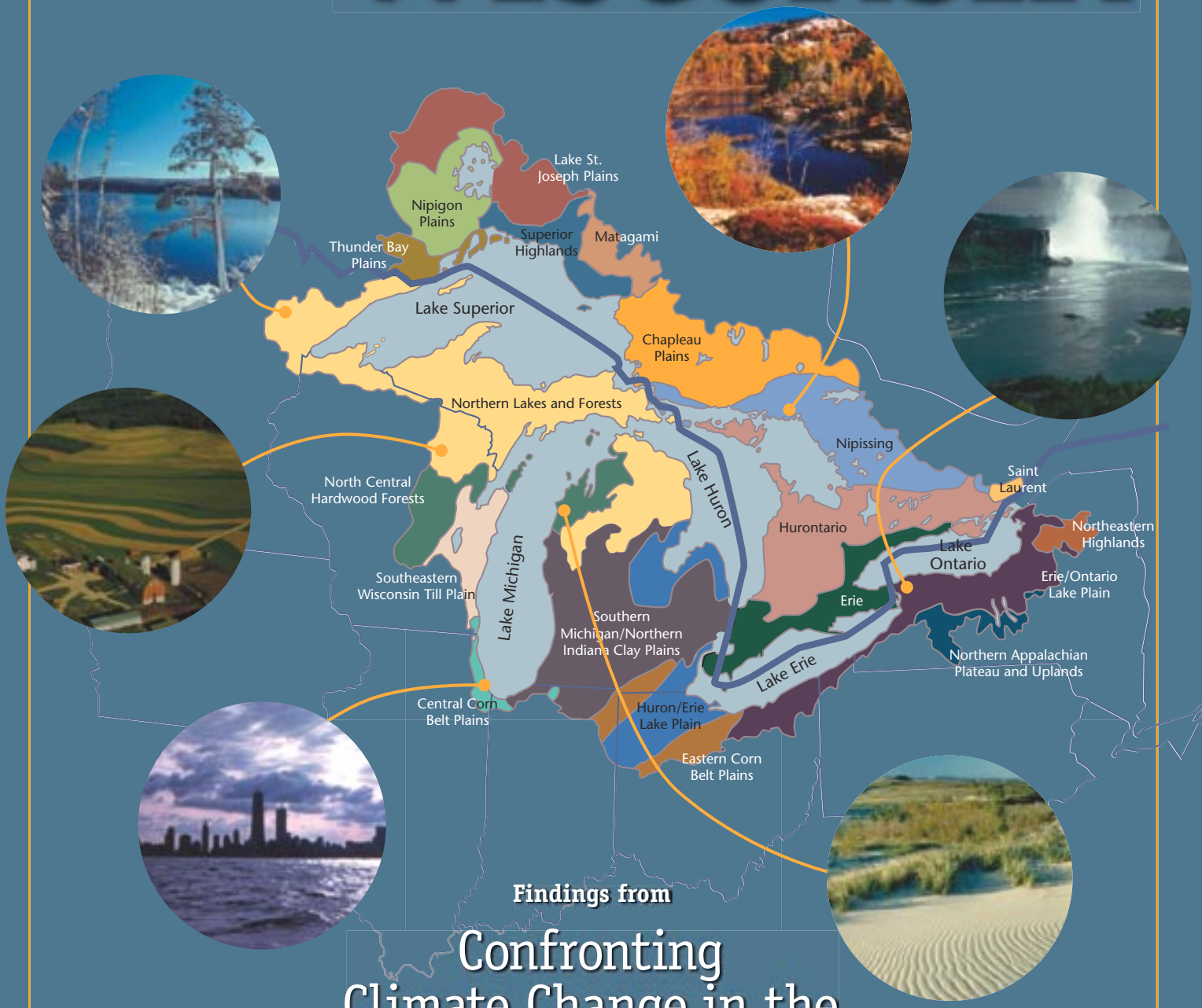
# Wisconsin




**Findings from**

## Confronting Climate Change in the Great Lakes Region

Impacts on Wisconsin Communities and Ecosystems

# Climate Change in America's Dairyland

Wisconsin's northernmost border is defined by Lake Superior, while the allure of Lake Michigan draws vacationers to the ever-popular Door County. Renowned for its dairy farms and world famous cheese, Wisconsin's streams and smaller lakes are also highly cherished. This summary highlights the potential impact of climate change on Wisconsin's economy, people, and the places they love.

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

# Climate Projections

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

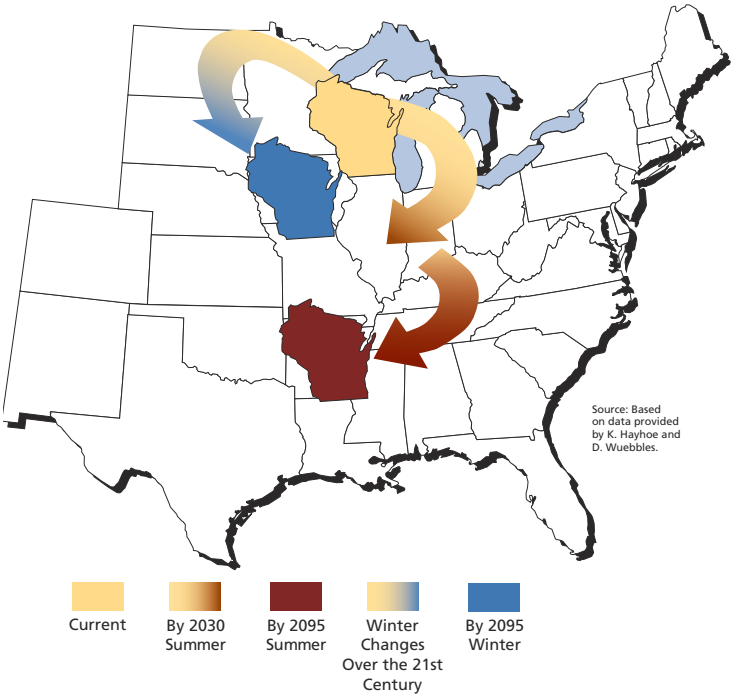
- ***Temperature:*** By the end of this century, temperatures will rise 6–11°F in winter and 8–18°F in summer. This dramatic warming is roughly the same as the warming since the last ice age. Overall, extreme heat will be more common and the growing season could be 4–7 weeks longer.

Warmer winters mean trouble for Wisconsin, where winter recreation is part of people's sense of place.

- ***Precipitation:*** While annual *average* precipitation may not change much, the state may grow drier overall because rainfall cannot compensate for the drying effects of a warmer climate, especially in the summer. Seasonal precipitation in the state is likely to change, increasing in winter by 15–30% and decreasing in summer by up to 20%. Wisconsin, then, may well see drier soils and perhaps more droughts.
- ***Extreme events:*** The frequency of heavy rainstorms, both 24-hour and multiday, will continue to increase, and could be 50–100% higher than today.
- ***Ice cover:*** Declines in ice cover on the Great Lakes and inland lakes have been recorded during the past 100–150 years and are expected to continue.

# How the Climate Will Feel

These changes will dramatically affect how the climate feels to us. By 2030, Wisconsin summers may resemble those of Illinois in terms of average temperature and rainfall. By century's end, the Wisconsin summer climate will generally resemble that of current-day Arkansas, and the winter will feel much like current-day Iowa.




# Potential Impacts from Climate Change

## Water Supply and Pollution

Wisconsin depends heavily on groundwater, on fresh water from inland lakes and Lakes Michigan and Superior, and on rainfall for agriculture, drinking, and industrial uses. As the state's population grows to six million by 2025, projected changes in rainfall, evaporation, and groundwater recharge rates will affect all freshwater users in the state.

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

## Agriculture

Wisconsin ranks first in the country in cheese production and second for milk. The state's farmers also raise a great deal of corn, hay, and soybeans. There are likely to be some positive impacts for agriculture from a warmer climate, although current evidence suggests that the negative consequences could outweigh the positive. In general, however, regional development, technological advances, and market fluctuations have as much influence on farmers as the climate.

Overall, optimal weather conditions are expected to shift northward and eastward in the region. Wisconsin agriculture may benefit from warmer temperatures and a longer growing

season, but may be constrained by declining soil moisture and thin and acidic soils. Climate variability will likely pose greater risk for smaller farms and thus may reinforce the trend toward increasing farm size and industrialization of agriculture in the region. These changes will affect local farming communities, and, in turn, change the character of rural landscapes across the state.

- Increased atmospheric $CO_2$ and nitrogen as well as a longer growing season could boost yields of some crops, such as soybeans and corn.
- Warmer summer temperatures suppress appetite and decrease weight gain in livestock; warmer winters and less snow cover likely will reduce the quantity and quality of spring forage, and thus, milk quality.
- Severe rainstorms and floods during planting and harvest seasons will likely depress crop productivity. Similarly, hotter and drier conditions during the main growing season also disrupt production and may require irrigation of currently rain-fed crops.
- Higher ozone concentrations can damage soybeans, countering positive impacts of a warmer climate.
- More flooding can result in increased soil erosion and runoff of agricultural wastes.
- Several climate changes will likely combine to create more favorable conditions for a number of pests and pathogens. The (soy)bean leaf beetle and the European corn borer may expand northward.

## Human Health

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

- Winter cold-related morbidity or mortality will decrease, while summer heat-related morbidity or mortality is likely to increase. The number of hot days is projected to increase, with years later in the century experiencing 30 or more days exceeding 90°F. Of even greater concern is the projected increase in extreme heat days (exceeding 97°F). By 2080–2100, Wisconsin may experience up to 20 such days annually, which will require improved warning systems and preparation to avoid severe health impacts.
- Higher temperatures and more electricity generation for air conditioning increase the formation of ground-level ozone, likely exacerbating asthma and other respiratory diseases.
- Some waterborne infectious diseases such as *cryptosporidiosis* or *giardiasis* may become more frequent or widespread if extreme rainstorms occur more often. Milwaukee experienced such a *cryptosporidium* outbreak in 1993, when extended rainfalls and runoff overwhelmed the city's municipal drinking water purification system, causing 403,000 cases of intestinal illness and 54 deaths.
- The occurrence of many infectious diseases is strongly seasonal, suggesting that climate plays a role in influencing transmission. Some diseases carried by insects such as Lyme disease (ticks) or, more recently, West Nile encephalitis (mosquitoes) have expanded across the region. While this spread is attributed largely to land-use changes, future changes in rainfall or temperatures could encourage greater reproduction or survival of the disease-carrying insects.

Minnesota Extension Service, Don Breneman

## Property and Infrastructure

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

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

## Lakes, Streams, and Fish

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

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

## Wetlands and Shorebirds

Earlier spring runoff, more intense flooding, and lower summer water levels generally translate into growing challenges for Wisconsin wetlands. Already, development and agriculture have significantly reduced wetland habitat.

• The combined pressures of development and climate change will degrade the flood-absorbing capacities of wetlands and floodplains, resulting in increased erosion, additional water pollution, and delayed recovery from acid rain.

• Changes in flood pulses, as well as wetland losses in productive estuaries such as Green Bay and in inland marshes such as Horicon National Wildlife Refuge will likely reduce safe breeding sites for amphibians, migratory shorebirds, and waterfowl.

• Increased evaporation will likely shrink wetland habitat, although new wetlands may be created along lake edges as water levels drop.

### Recreation and Tourism

Birders, boaters, hikers, hunters, winter sports enthusiasts, and other visitors are drawn to Wisconsin's lakeshores and inland waters. Tourism and recreation comprise one of the state's top income-producing industries, tallying nearly $7 billion a year.

• Millions of anglers and charter fishing outfits will be affected by range shifts, loss of habitat, and increases or declines of their preferred catch, both on the Great Lakes and small inland lakes.

• Loss of habitat or food resources for migratory songbirds, shorebirds, and waterfowl will affect Wisconsin's multimillion-dollar birdwatching and hunting industries.

• Warmer winters mean trouble for Wisconsin, where winter recreation—such as Madison's Kites on Ice Festival or the northland's famous American Birkebeiner ski race—has long been an integral part of people's sense of place. Skiing, snowmobiling, and, especially, ice fishing businesses could be hard-hit.

• The summer recreation season will likely expand as temperatures warm further, but extreme heat, heavy downpours, elevated ozone levels, and possible increases in risk from insect- and waterborne diseases may dampen outdoor enthusiasm.

### Forests and Terrestrial Wildlife

Northern Wisconsin's forests are another important economic sector, employing 74,000 workers and generating more than $18 billion in shipments. Factors other than climate are important drivers of change in forestry and forest ecosystems, but climate change may exacerbate existing stresses.

• Warmer temperatures will likely cause the northernmost forests of spruce, hemlock, and fir to shrink and other forest species to move northward unless hindered by obstacles.

• Increasing atmospheric $CO_2$ and nitrogen will likely spur forest growth in the short term, but higher concentrations of ground-level ozone, more frequent droughts and forest fires, and a greater risk from insect pests could damage long-term forest health.

John J. Magnuson

• Resident birds such as northern cardinals and chickadees might be able to breed earlier and raise more broods. Bigger resident bird populations, however, could reduce the food available for migratory songbirds such as grosbeaks.

• Climate warming may benefit some resident mammals such as raccoons, skunks, and the already prolific white-tailed deer. Moose could be negatively affected by warming and more deer-carried parasites.

## Climate Change Solutions

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

• ***Reducing heat-trapping gas emissions*** by increasing energy efficiency in buildings, investing even more heavily in renewable energy such as wind, and enhancing clean transportation choices.

• ***Minimizing pressures on the environment*** by improving air quality, protecting the quality and supply of water resources, protecting habitat, and limiting sprawl.

• ***Preparing for those impacts from global warming that cannot be avoided*** through better planning and emergency preparedness, adaptations in agriculture and shipping, strengthening public health response, and adjusting infrastructure.

With smart planning and a commitment to responsible management, Wisconsin can be a solutions leader and an exemplary steward of its rich environment and resources in the face of climate change.

Union of Concerned Scientists

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This fact sheet is based on the findings of *Confronting Climate Change in the Great Lakes Region*, a report published in April 2003 by the Union of Concerned Scientists and the Ecological Society of America. The report was written by regional experts under the leadership of George Kling (University of Michigan). Experts from Wisconsin included John J. Magnuson and Richard Lindroth, both at the University of Wisconsin.

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