

Indiana

Climate Change in the Hoosier State

Indiana, located “at the crossroads of America”—the center of the industrial and agricultural heartland—is also rich in natural beauty. Its crown jewel, the Indiana Dunes National Lakeshore, is one of the most biologically diverse of all national parks and draws many to the shores of Lake Michigan. Busy cities, small towns, and active farming shape the image of the rest of the state. This summary highlights the potential impact of climate change on Indiana’s economy, its 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 (CO₂), 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.

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Climate Projections

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

- **Temperature:** By the end of the 21st century, temperatures are projected to rise 8–12°F in winter and 7–15°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.

- **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 and decreasing in summer. Indiana, then, may well see drier soils and perhaps more droughts.

- **Extreme events:** The frequency of heavy rainstorms, both 24-hour and multi-day, will continue to increase.

Potential Impacts from Climate Change

Water Supply and Pollution

Indiana depends on groundwater, on fresh water from Lake Michigan, and on rainfall for agriculture, drinking, and industrial uses. As the state’s population of about 6 million (2000) continues to grow, projected changes in rainfall, evaporation, and groundwater recharge rates will affect all freshwater users in the state.

- Lake levels are expected to decline in both inland lakes and Lake Michigan, as more moisture evaporates due to warmer temperatures and less ice cover.
- Reduced summer water levels are likely to diminish the recharge of groundwater, cause small streams to dry up, and reduce the area of wetlands, resulting in poorer water quality and less habitat for wildlife.
- 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

Indiana ranks among the top states nationwide in feed crop (corn), soybean, and tobacco production. It is also a top producer of poultry, eggs, certain vegetables, and livestock. There are likely to be some positive impacts for agriculture resulting 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.

- Increased atmospheric CO₂ and nitrogen as well as a longer growing season could boost yields of some crops, such as soybeans and corn.
- Severe rainstorms and floods during planting and harvest seasons will likely depress productivity. Similarly, hotter and drier conditions during the main growing season also disrupt production and may require irrigation of currently rain-fed crops.
- Higher ozone concentrations can damage soybeans and horticultural crops, countering positive impacts of a warmer climate.
- Several climate changes will likely combine to create more favorable conditions for a number of pests and pathogens.
- Extreme heat and droughts can severely affect livestock health and production.

Human Health

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

- Winter cold-related morbidity or mortality will decrease, while summer heat-related morbidity or mortality is likely to increase. Of particular concern is the large projected increase in extreme heat days (exceeding 97°F) by 2080–2100, which will require improved warning systems and preparation to avoid severe health impacts.
- Higher temperatures and more electricity generation for air



U.S. Army Corps of Engineers

conditioning increase the formation of ground-level ozone, likely exacerbating asthma and other respiratory diseases.

- Some waterborne infectious diseases such as *cryptosporidiosis* or *giardiasis* may become more frequent or widespread if extreme rainstorms occur more often.

- The occurrence of many infectious diseases is strongly seasonal, suggesting that climate plays a role in influencing transmission. Some diseases carried by insects such as Lyme disease (ticks) or, more recently, West Nile encephalitis (mosquitoes) have expanded across the region. While this spread is attributed largely to land-use changes, future changes in rainfall or temperatures could encourage greater reproduction or survival of the disease-carrying insects.



Indiana's wetlands (*see photo*), which have already been significantly reduced by development and agriculture. Many migratory birds, shorebirds, and waterfowl depend, for example, on the wetlands of the national lakeshore. Loss of habitat or food resources will thus affect those species and Indiana's birdwatching and hunting industries.

Property and Infrastructure

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

- More frequent extreme rainstorms and floods, such as the one shown in Ft. Wayne, 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 Indiana will have to upgrade water-related infrastructure including levees, sewer pipes, and wastewater treatment plants in anticipation of more frequent extreme downpours.

- Lower lake levels on Lake Michigan require more frequent dredging of channels and harbors and adjusting docks, water intake pipes, and other infrastructure.

Recreation and Tourism

Numerous Indiana parks, streams, and rivers offer a wide variety of recreational opportunities and tourist attractions for campers, hikers, anglers, wildlife watchers, and hunters. Nearly 2 million visitors came to Indiana Dunes National Lakeshore in 2002 alone.

- Anglers on Lake Michigan, inland lakes, and Indiana's many streams will be affected by range shifts, loss of habitat, and increases or declines of their preferred catch. For example, the range of warm-water fish such as smallmouth bass or bluegill is likely to expand northward, while cold-water species and even some cool-water fish may disappear from southern parts of the region.

- The duration of summer stratification of lakes will increase, adding to the risk of oxygen depletion and formation of deep-water "dead zones" for fish and other organisms.

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

- Lower water levels coupled with warmer water temperatures may accelerate the accumulation of mercury and other contaminants in the aquatic food chain.

- Earlier spring runoff, more intense flooding, and lower summer water levels generally mean growing challenges for

Climate Change Solutions

Indiana's 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 and manufacturing through programs such as the Indiana Energy Efficiency Fund, reducing dependency on coal-fired utilities by switching instead to renewable energy sources such as wind and bioenergy, increasing vehicle fuel economy, and investing in mass transit in urban areas.

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

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

Through a commitment to responsible management, Indiana could lead the region in designing effective solutions. It is only fitting that the state priding itself on its community-oriented ethic should become an exemplary steward of its rich environment in the face of climate change.



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). The regional climate analysis was led by Donald Wuebbles (University of Illinois at Urbana-Champaign).

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