MIDWEST

Key Messages

In the next few decades, longer growing seasons and rising carbon dioxide levels will increase yields of some crops, though those benefits will be progressively offset by extreme weather events. Though adaptation options can reduce some of the detrimental effects, in the long term, the combined stresses associated with climate change are expected to decrease agricultural productivity.

The composition of the region's forests is expected to change as rising temperatures drive habitats for many tree species northward. The role of the region's forests as a net absorber of carbon is at risk from disruptions to forest ecosystems, in part due to climate change.

Increased heat wave intensity and frequency, increased humidity, degraded air quality, and reduced water quality will increase public health risks.

The Midwest has a highly energy-intensive economy with per capita emissions of greenhouse gases more than 20% higher than the national average. The region also has a large and increasingly utilized potential to reduce emissions that cause climate change.

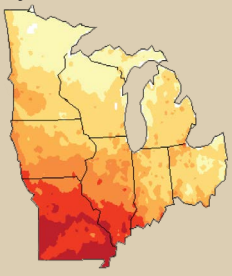
Extreme rainfall events and flooding have increased during the last century, and these trends are expected to continue, causing erosion, declining water quality, and negative impacts on transportation, agriculture, human health, and infrastructure.

Climate change will exacerbate a range of risks to the Great Lakes, including changes in the range and distribution of certain fish species, increased invasive species and harmful blooms of algae, and declining beach health. Ice cover declines will lengthen the commercial navigation season.

The Midwest's agricultural lands, forests, Great Lakes, industrial activities, and cities are all vulnerable to climate variability and climate change. Climate change will tend to amplify existing risks climate poses to people, ecosystems, and infrastructure. Direct effects will include increased heat stress, flooding, drought, and late spring freezes. Climate change also alters pests and disease prevalence, competition from non-native or opportunistic native species, ecosystem disturbances, land-use change, landscape fragmentation, atmospheric and watershed pollutants, and economic shocks such as crop failures, reduced yields, or toxic blooms of algae due to extreme weather events. These added stresses, together

Projected Climate Change

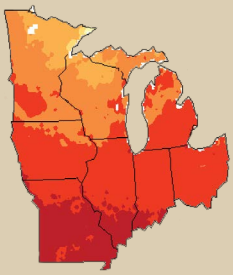
Days Above 95°F



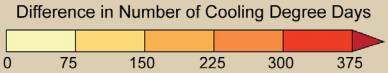
Difference in Number of Days

Temperatures above 95°F are associated with negative human health impacts and suppressed agricultural yields. The frequency of these days is projected to increase by mid-century.

Cooling Degree Days

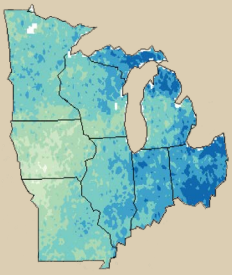


Difference in Number of Cooling Degree Days

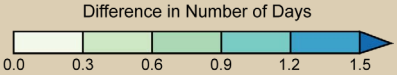


Cooling degree days (a measure of energy demand for air conditioning) are also projected to increase leading to potential increases in the seasonality and annual total electricity demand.

Heavy Precipitation



Difference in Number of Days



The frequency of days with very heavy precipitation (the wettest 2% of days) is also projected to increase, raising the risk of floods and nutrient pollution.

Projections above from global climate models are shown for 2041-2070 as compared to 1971-2000 under an emissions scenario that assumes continued increases in heat-trapping gases (A2 scenario). (Figure source: NOAA NCDC/CICS-NC)

with the direct effects of climate change, are projected to alter ecosystem and socioeconomic patterns and processes in ways that most people in the region would consider detrimental.

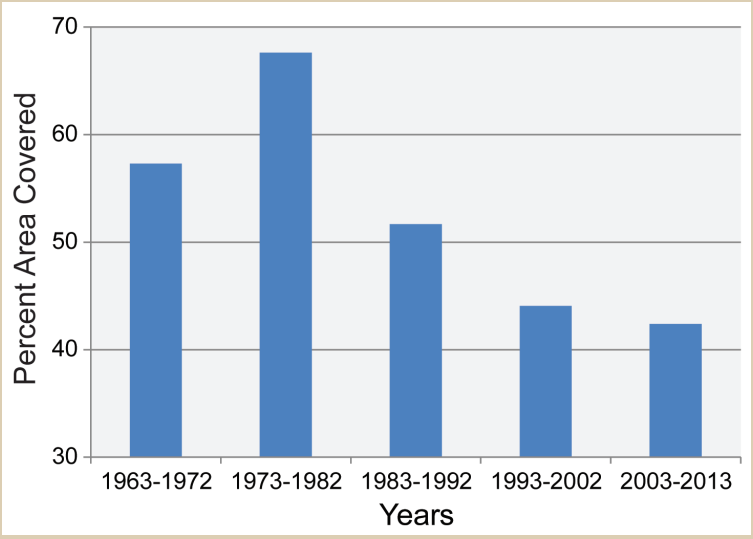
Most of the Midwest's population lives in urban environments. Climate change may intensify other stresses on urban dwellers and vegetation, including increased atmospheric pollution, heat island effects, a highly variable water cycle, and frequent exposure to new pests and diseases. Further, many of the cities have aging infrastructure and are particularly vulnerable to climate change related flooding and life-threatening heat waves. The increase in heavy downpours has contributed to the discharge of untreated sewage due to excess water in combined sewage-overflow systems in a number of cities in the Midwest.[1]

Much of the region's fisheries, recreation, tourism, and commerce depend on the Great Lakes and expansive northern forests, which already face pollution and invasive species pressure – pressures exacerbated by climate change.

Extreme weather events will influence future crop yields more than changes in average temperature or annual precipitation. High temperatures during early spring, for example, can decimate fruit crop production[2] when early heat causes premature plant budding that exposes flowers to later cold injury, as happened in 2002, and again in 2012, to Michigan's $60 million tart cherry crop. Springtime cold air outbreaks are projected to continue to occur throughout this century.[3]

Any increased productivity of some crops due to higher temperatures, longer growing seasons, and elevated carbon dioxide concentrations could be offset by water limitations and other stressors.[4] Heat waves during pollination of field crops such as corn and soybean also reduce yields. Wetter springs may reduce crop yields[5] and profits,[6] especially if growers are forced to switch to late-planted, shorter-season varieties.

Great Lakes Ice Cover Decline



Great Lakes ice coverage has declined substantially, as shown by these decade averages of annual maximum ice coverage since reliable measurements began. Less ice, coupled with more frequent and intense storms,[7] leaves shores vulnerable to erosion and flooding and could harm property and fish habitat.[8] Reduced ice cover also has the potential to lengthen the shipping season.[9] The navigation season increased by an average of eight days between 1994 and 2011. Increased shipping days benefit commerce but could also increase shoreline scouring and bring in more invasive species.[9,10] (Figure source: Data updated from Bai and Wang 2012[11]).

Selected Adaptation Efforts

The city of Cedar Falls' new floodplain ordinance expands zoning restrictions from the 100-year floodplain to the 500-year floodplain to better reflect the flood risks experienced by this and other Midwest cities during the 2008 floods.[12]

Cedar Rapids has also taken significant steps to reduce future flood damage, with buyouts of more than 1,000 properties, and numerous buildings adapted with flood protection measures.

Some cities have begun to incorporate adaptation planning for a range of climate change impacts. Chicago was one of the first cities to officially integrate climate adaptation into a citywide plan. Since the Climate Adaptation Plan's release, a number of strategies have been implemented to help the city manage heat, protect forests, and enhance green design, using techniques such as green roofs.[13]

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