

ILLINOIS

ASSESSING THE COSTS OF CLIMATE CHANGE

CLIMATE TRENDS IN ILLINOIS

Climate change is projected to cause higher temperatures and more frequent precipitation in Illinois. This may result in a continued decline in the water levels over the Great Lakes-St. Lawrence Seaway, an important manufacturing shipping route. This change could create economic losses for the manufacturing sector because lower water levels are likely to increase shipping costs. Lower water levels in Illinois lakes, river and streams also may affect the housing, transportation, and agricultural sectors.

OVERVIEW

In the coming decades, a changing climate could affect the Illinois economy. The most recent climate modeling predicts warmer temperatures and lower water levels for much of Illinois. These changes could be more pronounced if global emissions of greenhouse gases are not reduced. Shipping, trade and water resources may be affected in a variety of ways and could see billions of dollars in losses. Since state economies are directly linked to those of neighboring states and regions, policymakers may wish to consider both state and regional policies to address climate change.

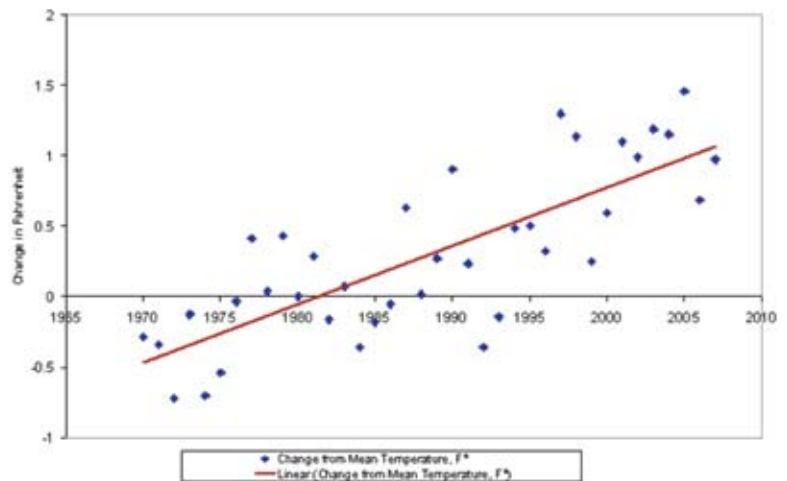
Historic Perspective

According to a report by the U.S. Global Change Research Program, the average temperature in the Great Lakes region increased by 4° F during the last century.¹ Figure 1 demonstrates the rise in mean temperature for August during the past four decades in Illinois.

Annual precipitation has increased by approximately 20 percent in Illinois during the last century.² Higher temperatures, however, have increased evaporation rates—

which more than counteract the extra precipitation—resulting in lower water levels in Lake Michigan and the other Great Lakes. Although lake levels have varied considerably during the last 100 years, water levels have declined in the last 35 years. Although it is impossible to determine if the decline is linked to climate change, researchers at the National Atmospheric and Oceanic Administration state that the correlation of a warming climate, along with decreased water levels, may make the link plausible; planning for lower water levels in the coming century might be prudent.³

Figure 1. Change from Average Temperature in F° in August, 1965 – 2005



Source: National Oceanic and Atmospheric Administration, 2007.



Climate Outlook

The climate outlook for the Midwest includes a continued warming trend, with temperatures increasing by 5° F to 10° F by the end of the 21st century. The greatest change is expected in the average minimum daily temperatures, although daily high temperatures also are likely to increase. Chicago currently experiences three consecutive days with nighttime temperatures above 80° F and daytime temperatures of over 100° F once every 50 years. This pattern could occur on average once every 10 years until the 2030s and then every other year.⁴

The length of the snow season (the number of days with snow cover) is expected to decrease by 50 percent, although precipitation is forecast to increase from 20 percent to 40 percent in the Midwest. Despite the projected higher precipitation, increased evaporation from high temperatures is predicted to lower water levels in the Great Lakes. Throughout the century, the Great Lakes may experience a water level drop of up to 5 feet, which may cause problems for the Great Lakes-St. Lawrence Seaway.⁵

MAJOR ECONOMIC IMPACTS

Shipping

Manufacturing, which accounts for nearly 14 percent of the Illinois gross state product employed more than 680,000 workers in 2006.⁶ The U.S. Department of Commerce estimates that the Illinois manufacturing sector produces more than \$105 billion. Illinois relies heavily on water transport; almost 123 million tons of goods and materials were shipped via water in 2001 and many of the shipments traveled the Great Lakes-St. Lawrence Seaway.

Water transportation is an efficient, inexpensive shipping option for Illinois manufacturers. If water levels continue to drop along the route, however, expensive channel dredging could be necessary. A water level drop of 1.5 feet to 3 feet could necessitate dredging along the entire Great Lakes-St. Lawrence shipping route at a cost of between \$92 million and \$154 million annually by 2030.⁷

Infrastructure

The greatest risk to Illinois infrastructure stems from the projected increase in heavy precipitation. In fact, flooding could impose the most costly damages in the state. Since 1983, Illinois has suffered more than \$287 million in annual flood damage. The Insurance Information Institute reported that insured catastrophic losses were \$272 million in 2007, ranking the state fifth in the nation.

Flood damage has increased in recent years; flood losses incurred between 1985 and 1999 accounted for nearly 75 percent of all damages during

the 44 years between 1955 and 1999.^{8,9} Much of the increase is attributed to a robust real estate market, particularly in the Chicago area.

The dramatic price increases in lakefront housing in and around Chicago further increases flood loss potential. Lakefront houses can be affected in two ways. As Lake Michigan water levels drop, the property value may be diminished. Floods caused by heavy precipitation also can occur. Depending on lake water levels and stormwater management practices, heavy precipitation may lead to flooding of the lake's streams and tributaries and could cause significant economic loss. In 2006, direct Illinois premiums written in federal flood insurance topped \$26.3 million.¹⁰

Flooding may occur more frequently as precipitation levels increase. A study of the Mid-Atlantic region found that a 1 percent increase in annual precipitation results in a 2.8 percent increase in damages, as measured by previous insurance loss data.¹¹ According to the Illinois State Water Survey, a 10 percent change in precipitation produces a 20 percent to 25 percent change in stream flow. Thus, increased precipitation is likely to increase the probability of flooding.

Chicago's lakeshore marinas also are at risk. As water levels drop, the nine lakefront marinas that currently are operating at near capacity may be in jeopardy. Chicago marinas are operated by a private firm and estimated to be a \$3.6 million enterprise.¹² If lower lake levels decrease access or require a major marina overhaul, the boating industry and associated businesses could suffer.

Agriculture

Crop production in Illinois employs nearly 10,000 people; an additional 3,000 are employed in agriculture and forestry support activities.¹³ Agricultural products accounted for \$8.9 billion in sales for 2002. The market value of crops sold topped \$6.8 billion, while milk products accounted for \$265 million.¹⁴ It is difficult to predict how increases in carbon dioxide will affect Illinois agriculture, but the effect of increased rainfall is clearer. Researchers predict that heavier rainfall resulting from climate change will increase runoff and soil erosion.¹⁵ Both factors could impose higher costs on agricultural production. A study using county-level data and examining potential damages from climate change on Midwest agriculture found that a 4.5° F temperature increase and a 7 percent increase in precipitation could decrease the net profit of the agricultural sector by \$9 billion annually. A more accurate model, which uses long-term climate variation, estimates that includes long-term climate variation projects that the actual annual losses could be much higher, approximately \$41 billion.¹⁶

Another agricultural concern is the potential for drier weather due to higher temperatures. The percentage of irrigated farms



in 2002 was 2.8 percent, an increase from 2.6 percent in 1997.¹⁷ If drought becomes a concern, more farms will need to invest in expensive irrigation equipment. Heavy rainfall can cause flooding and cause economic damage for farmers.

Water Resources

As temperatures increase, water availability in Illinois could become an important concern. In addition to precipitation, Illinois receives surface water from rivers that flow through Indiana and Wisconsin and from Lake Michigan. Water levels affect pollution levels that, in turn, affect water treatment costs. The effects of climate change, such as more frequent flooding, are likely to increase Illinois water treatment costs. A 2004 U.S. Environmental Protection Agency survey found that Illinois needed \$15.2 billion in 2004 to meet water quality standards set forth in the Clean Water Act.¹⁸ If additional pollutants in Illinois increase these costs by 10 percent, the state could require an additional \$1.5 billion to meet federal requirements.

Human Health

Higher temperatures across the state could threaten human health. The elderly and the poor are among the groups with the highest mortality rates during heat waves, since they often lack air conditioning and access to health care. The deadliest heat wave on record occurred in 1995 and resulted in 753 deaths in Illinois.¹⁹ It also caused major power outages, which disabled air conditioning. The problem occurs more often in urban settings, where temperatures can be 7° F higher than in surrounding suburbs and rural areas.

A Johns Hopkins study shows a link between higher-than-average precipitation and instances of waterborne disease.²² More annual precipitation and intense storms can damage septic tanks and water treatment plants, increasing the risk of harmful particulates and chemicals in groundwater.²³

CONCLUSION

Since the threat of flooding could increase as the climate changes, planners and policymakers may wish to promote research to assess which areas face the greatest risk and to determine how land management practices and flood response plans can be modified to mitigate the effects of flooding when it occurs.

If Great Lakes water levels fall as predicted, connectivity along the Great Lakes-St. Lawrence shipping route could be affected and result in losses for the Illinois shipping industry and other sectors that rely upon it. More detailed research related to the climate's effect on decreasing water levels and potential effects on the shipping industry would help in allocating resources and developing plans to respond to these changes.

An assessment of the local effects of climate change on the state's supply of fresh water for drinking and agriculture will help plan for changes in water availability. Since the changing climate could impose significant costs on the agricultural sector, policymakers may wish to encourage research that helps in creating state-specific assessments on how changes in temperature and precipitation may affect agriculture. This information could provide a foundation for creating plans that will help the Illinois agricultural sector adapt to changes and avoid economic losses.

MISSING INFORMATION AND DATA GAPS

The effects of continued climate change will likely be widespread in Illinois. Comprehensive economic effects remain elusive, however. For example, the additional economic cost is unknown if the Great Lakes-St. Lawrence waterway can no longer support fully loaded cargo ships. Since temperature and climate variation can affect species distribution and migration, it is difficult to estimate the economic damages to agriculture and the wildlife recreation industry from habitat changes. Human health likewise depends upon many interrelated environmental, social and economic factors that are affected by climate change. More research in these areas and the potential health effects could support an effective state response.





NOTES

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