Climate Change and Chicago's Water Systems

Lake Michigan and its waterways support a wide variety of commercial and recreational uses. Visitors to Chicago marvel at the beauty and accessibility of the lakefront. The city's waterways and the parks along them contain a large number of important plant and animal species. In order to understand the impacts of climate change on the Chicago region, it is essential to understand the effects of climate change on these water systems.

Changes in Water Systems

How will changes in precipitation affect the water systems in the Chicago area? Researchers examined changes to river flow, lake levels, ice cover, water quality, and aquatic ecosystems in the Chicago area. They found that Chicago can expect the following changes:

Increased peak river flow: Under a higher emissions scenario (i.e., if fossil fuels remain humanity's primary energy source and emissions continue unabated), there could be a a major increase in peak river flow in the Illinois River over the next century. Under a lower emissions scenario (i.e., if humans switch to alternative fuels and conserve energy), only a slight increase in peak river flow is expected.

The Chicago River is not included in this study because it is so highly managed that it is difficult to separate the potential effects of climate change from those due to human intervention.

Impacts of this change: Flooding can damage crops and cause soil erosion, contaminate the water supply, promote infectious disease, disrupt transportation, and lead to property damage or loss. Increased peak river flow would increase the risk of flooding and flood damage in the Illinois River basin (**Figure 1**), including potential damage to homes and public buildings and public infrastructure such as roads and bridges.

Figure 1 Flooding near the Illinois River during the Midwest flood of 2007.

Decreased lake levels: Although lake levels vary naturally from year to year, long-term trends can, nonetheless, be discerned. Under the higher emissions scenario, the average level of Lake Michigan could decrease by up to 1.5 ft. by the end of this century. This drop would be caused by warmer temperatures and decreased ice cover, leading to more evaporation (**Figure 2**).

Impacts of this change: Lower lake levels would lead to

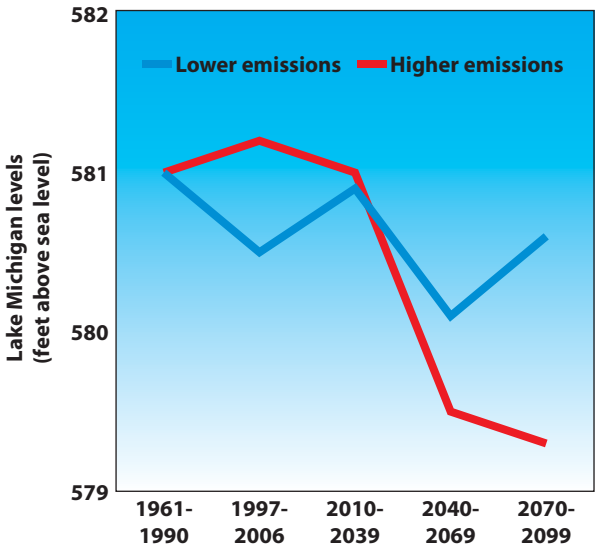

Figure 2 Changes in the level of Lake Michigan under higher (red) and lower (blue) emissions scenarios.

This research was commissioned to advise the Chicago Climate Task Force in the development of the Chicago Climate Action Plan. It does not represent official City of Chicago policy.

beach expansion. However, lower lake levels may require dredging of shallow channels, with implications for both commercial shipping and recreational boating.

Decreased ice cover: Lake temperatures are likely to increase. During the winter, this means that ice cover on Lake Michigan would continue to decrease. This change has already been observed, as shown in **Figure 3**.

Impacts of this change: Less ice cover in the winter means increased evaporation, which could lead to even lower lake levels. Ice formation protects wetlands and aquatic ecosystems, so less ice cover could harm ecosystems. Reduced ice cover would limit ice fishing on inland lakes, although it would extend the sport-fishing season. On the positive side, less ice cover in the winter would open more of the Great Lakes to shipping and recreational boating.

Decrease in water quality: As heavy precipitation events become more common, Chicago's drainage systems may be unable to contain the excess water. Overflowing stormwater can cause combined sewer overflows and can pollute nearby lakes and rivers.

Impacts of this change: Cryptosporidiosis is one of the most prevalent diarrhea-causing diseases in the world. During a 1993 cryptosporidiosis outbreak in Milwaukee, 403,000 cases were reported, and 54 people died. This outbreak was preceded by the heaviest rainfall in fifty years in the area. If more heavy precipitation events occur, outbreaks like this one would happen more often. In addition, beaches could be contaminated more often over the coming century, and there could be more swim bans in the future than there are now.

Damage to Aquatic Ecosystems: Warmer lake surface temperature could inhibit the mixing between the oxygen-rich surface waters and the nutrient-rich

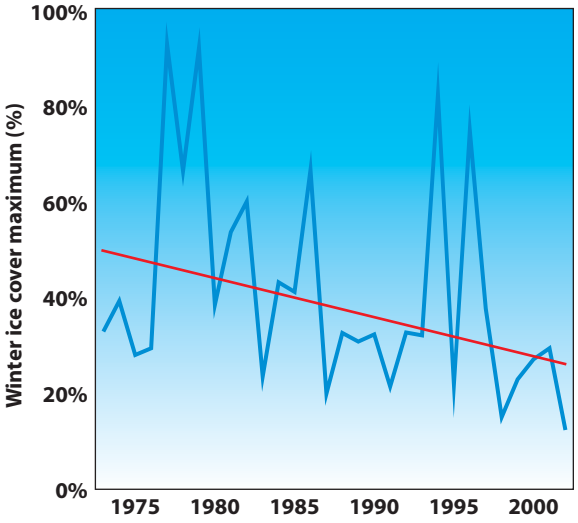

Figure 3 Decreases in winter ice cover on Lake Michigan *(Source: Assel, 2003).* The red line represents the average.

deep waters. Oxygen levels in the deep waters would be reduced, and the amount of nutrients available to support the growth of plankton living in the surface waters could be limited. Since plankton are the basis of the aquatic food chain, they are essential for the survival of many species of fish. In Lake Michigan, as the lake level declines, coastal wetlands would be less accessible. Also, as the lake warms, invasive species currently limited to the warmer regions of the lake may be able to expand their territory.

Impacts of this change: Warmer waters may reduce numbers of sport fish, and affect fishing in the Chicago area. Altered habitats would affect species such as walleye and trout. These and other desirable cold-water species may migrate to deeper and more northerly waters. Changes to coastal wetlands would affect the breeding habits of many species of fish. There may also be unpleasant algae blooms, making drinking water smell and taste "fishy," and increasing water treatment costs. Increased algae growth would also result in more frequent swim bans.