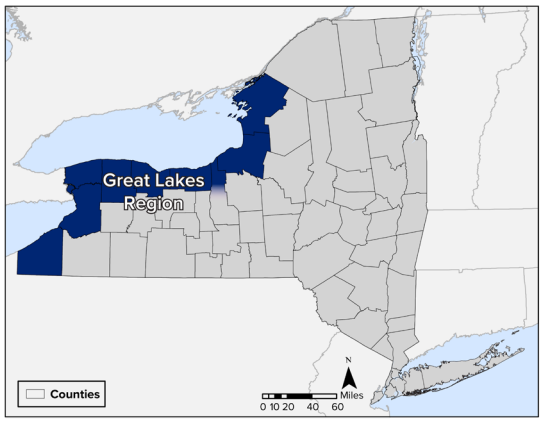
NEW YORK STATE CLIMATE IMPACTS ASSESSMENT

Climate Impact Spotlight: The Great Lakes Region

The New York State Climate Impacts Assessment provides accessible and relevant information on the impacts of climate change across New York State, helping all New Yorkers make climate-smart decisions. This fact sheet summarizes how the climate is changing in the Great Lakes region and how these changes will affect some of the features that make this region unique.

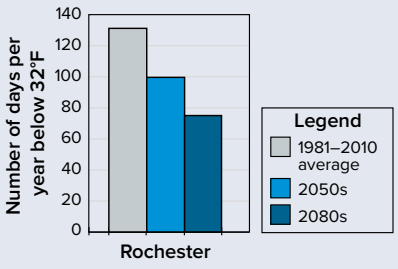


The Great Lakes Region's Changing Climate

Like other northern areas in the state, the Great Lakes region is projected to experience some of the largest increases in average temperatures. By the 2080s, annual average temperatures are expected to increase between 6.1°F and 10.5°F, and winter temperatures are expected to increase between 7°F and 12°F, compared with the 1981–2010 average.

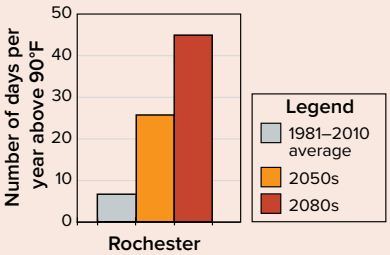
- **Decrease in very cold days.** Rochester, near the center of this region, has historically experienced an average of 131 days per year below freezing (32°F). These cold days are expected to become less common. By the middle of this century (the 2050s), Rochester is projected to have only 75 to 107 days below freezing per year, and by the end of this century (the 2080s), it is projected to have only 39 to 85 days below freezing per year.
- **Increase in extremely hot days.** Rochester has historically experienced an average of 7 days per year over 90°F. This number is projected to increase to 20 to 38 days per year by the middle of this century and to 31 to 66 days per year by the end of this century.
- **More lake-effect snow in the short term, but less snowfall in the long term.** The Great Lakes region often experiences heavy lake-effect snow driven by water from unfrozen lakes evaporating into colder air, then falling as snow over land. Snowfall totals in areas directly east of the Great Lakes often exceed 150 inches per year, and they have increased over the last century. Lake-effect snowfall is likely to continue to increase into the next few decades as warmer water and decreased ice cover promote evaporation. However, as temperatures continue to warm later in this century, more of this precipitation will likely fall as rain instead of snow.
- **More variable water levels.** Water levels in Lakes Erie and Ontario are likely to have more year-to-year variability, with higher highs and lower lows driven by periods of extreme precipitation and drought. Even as annual rainfall totals increase, short-term seasonal droughts could also increase, especially in the summer, as more precipitation falls in heavy bursts with longer dry spells in between. Shoreline flooding could become more common and intense when higher water levels are combined with heavy rainfall.

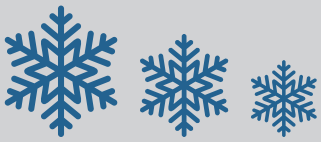
Projections of future climate change depend on the world's future emissions of heat-trapping greenhouse gases. Some of the projections discussed here present a range of numbers, based on those future emissions.



Decrease
in very cold days

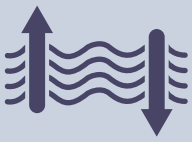
Increase
in very hot days





Decrease
in snowfall in the long term

Increase
in lake level variability



Example Climate Impacts to Some Important Regional Features

Increasing Lake-Effect Precipitation

Lake-effect snow is a common seasonal occurrence in areas east of Lake Erie and Lake Ontario, and severe winter storms can disrupt everyday life in the region. Warmer lake temperatures and reduced ice cover are expected to increase lake-effect snowfall over the next few decades, which could lead to more damage and repair costs to houses, transportation systems, and utility infrastructure, as well as straining emergency services. Severe snowstorms in the region in November and December 2022 are recent examples of these effects. As air temperatures increase during this century, more of this winter precipitation will fall as rain rather than snow. However, even as snowfall totals decline, rain-on-snow events and fluctuations between freezing and warmer temperatures could cause additional stress and structural damage to buildings and infrastructure.

Lake-effect snow may increase in the near term but decrease over the longer term, as temperatures warm.

Rising Temperatures Alter Great Lakes Ecosystems

Changes in air temperature, precipitation, and extreme events pose risks to aquatic ecosystems in Lake Ontario and Lake Erie and their watersheds. For example, heavy rainfall and snowmelt that come with rising temperatures will increase urban and agricultural runoff and impair water quality. Warming waters and more variable lake levels could disrupt native fish populations. Invasive species that are able to expand their range in warmer waters may also harm or outcompete native species. Declines in coldwater fish populations, such as lake trout, will affect recreational fishing and local spending related to this activity. Indigenous populations in the Great Lakes region face impacts from these ecosystem changes, as fishing is both economically and culturally important. In addition, more harmful algae growth in the Great Lakes can create health risks for people when fishing or swimming and can reduce incomes for businesses that depend on fishing, boating, and other water-related activities.

Buildings and roadways in lakeside communities such as Oswego are at risk from flooding.

Changing Water Levels in Lake Erie and Ontario

Fluctuations in water levels can affect buildings and transportation systems along Lake Ontario and Lake Erie. For example, periods of heavy rainfall are expected to increase flood intensity in lakefront communities. In 2017, flooding damaged communities along Lake Ontario as water levels rose about three feet higher than average due to heavy rainfall and large water inflows from the other Great Lakes. Conversely, increasing periods of drought and extreme heat can increase evaporation from the lakes, leading to below-average water levels. This can limit the movement of goods shipped across the Great Lakes. When waters become too shallow along shipping routes, boats need to limit their cargo capacity, which requires more trips and results in higher costs to transport the same amount of cargo.

Impacts on Agriculture

As the climate warms, warmer spring temperatures are projected to cause fruit tree blossoms to open early (known as “early budbreak”). When early budbreak is followed by a late spring frost, it can damage the flowers, leading to crop failure. This is a major concern for apple and grape growers in the region, who have seen significant crop losses in recent years. For example, a week of unseasonably high temperatures in early March 2012 led to budbreak three to four weeks earlier than usual. After several frost events later in the spring, damage to grapes in the Lake Erie region led to economic losses of about $45 to $60 million. Farmers in the region are changing their practices and planting new types of grapes to adapt to warmer temperatures and greater extremes.

Learn More

Explore the New York State Climate Impacts Assessment at https://nysclimateimpacts.org.