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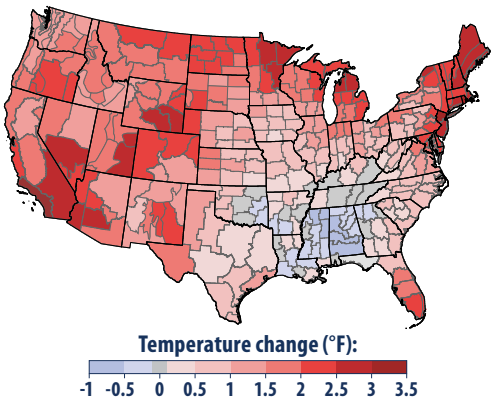
What Climate Change *Means for* New York

New York's climate is changing. Most of the state has warmed one to three degrees (F) in the last century, heavy rainstorms are more frequent, and the sea is rising about one inch every decade. Higher water levels are eroding beaches, submerging low lands, and exacerbating coastal flooding. In the coming decades, changing the climate is likely to increase coastal and inland flooding, disrupt farming and winter recreation, and increase some risks to human health.

Our climate is changing because the earth is warming. People have increased the amount of carbon dioxide in the air by 40 percent since the late 1700s. Other heat-trapping greenhouse gases are also increasing. These gases have warmed the surface and lower atmosphere of our planet about one degree during the last 50 years. Evaporation increases as the atmosphere warms, which increases humidity, average rainfall, and the frequency of heavy rainstorms in many places—but contributes to drought in others.

Greenhouse gases are also changing the world's oceans and ice cover. Carbon dioxide reacts with water to form carbonic acid, so the oceans are becoming more acidic. The surface of the ocean has warmed about one degree during the last 80 years. Warming is causing snow to melt earlier in spring, and mountain glaciers are retreating. Even the great ice sheets on Greenland and Antarctica are shrinking. Thus the sea is rising at an increasing rate.



Rising temperatures in the last century. The eastern part of New York has warmed more than the western part of the state. Source: EPA, Climate Change Indicators in the United States.

Increasing Temperature and Changing Precipitation Patterns

Rising temperatures and shifting rainfall patterns are likely to increase the intensity of both floods and droughts. Average annual precipitation in the Northeast has increased 10 percent since 1895, and precipitation from extremely heavy storms has increased 70 percent since 1958. During the next century, annual precipitation and the frequency of heavy downpours are likely to keep rising. Precipitation is likely to increase during winter and spring, but not change significantly during summer and fall. Rising temperatures will melt snow earlier in spring and increase evaporation, and thereby dry the soil during summer and fall. As a result, changing the climate is likely to intensify flooding during winter and spring, and drought during summer and fall.

Rising Sea Level

Sea level is rising more rapidly along New York's coast than in most coastal areas because the land surface is sinking. If the oceans and atmosphere continue to warm, tidal waters in New York are likely to rise one to four feet in the next century.

As sea level rises, the lowest dry lands are submerged and become either tidal wetland or open water. Wetlands can create their own land and keep pace with a slowly rising sea. But if sea level rises three feet or more during the next century, most existing wetlands along the south shore of Long Island are likely to be submerged.

Coastal Storms

Rising sea level increases the vulnerability of coastal homes and infrastructure to flooding because storm surges become higher as well. Although hurricanes are rare, much of the infrastructure in the New York metropolitan area is vulnerable to flooding. In 2012, high waters during Hurricane Sandy flooded Amtrak, PATH, and subway tunnels, as well as electrical substations, wastewater treatment plants, telecommunication facilities, hospitals, and nursing homes. Wind speeds and rainfall rates during hurricanes and tropical storms are likely to increase as the climate warms. Rising sea level is likely to increase flood insurance premiums, while more frequent storms could increase the deductible for wind damage in homeowner insurance policies.

Breezy Point, Queens, in the aftermath of an electrical fire ignited by floodwaters during Hurricane Sandy. Credit: Andrea Booher, FEMA.

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Shoreline Erosion

Beaches also erode as sea level rises. A higher ocean level makes it more likely that storm waters will wash over a barrier island or open new inlets. The United States Geological Survey estimates that the barrier islands in Southampton would be broken up by new inlets or lost to erosion if sea level rises three feet by the year 2100, unless people take measures to reduce erosion.

Coastal Ecosystems

Rising sea level could disrupt ecosystems along the Atlantic Ocean and adjacent estuaries such as the Hudson River and Long Island Sound. Wetlands threatened by rising sea level currently support clapper rail, sharp-tailed sparrow, marsh wren, and the northern harrier, a threatened species. Beaches along Long Island Sound and other estuaries may be squeezed between development and the advancing sea. Those beaches provide nesting sites for horseshoe crabs, which are a key source of food during spring for migrating shorebirds, such as the endangered red knot. Other shorebirds feed on these beaches throughout the year. Vulnerable tidal flats provide habitat for soft clam, hard clam, bay scallop, and blue mussel.

Bird feeding on invertebrates that inhabit a tidal beach vulnerable to rising sea level along Peconic Bay in Riverhead. © James G Titus; used by permission.

The Great Lakes

Lake ecosystems may also be impaired as the climate changies. Warmer temperatures tend to cause more algal blooms, which can be unsightly, harm fish, and degrade water quality. If severe storms become more frequent, then sewer overflows will become more frequent, and more pollutants are likely to run off from the land into the Great Lakes. Increased algal blooms and water pollution could threaten water supplies and require recreational beaches to be closed more often for health reasons.

One advantage of climate change is that warmer winters reduce the number of days that ice prevents navigation on rivers and in the Great Lakes. Between 1994 and 2011, reduced ice cover lengthened the shipping season on the Great Lakes by eight additional days. The Great Lakes are likely to warm another 3° to 7°F in the next 70 years, which will further extend the shipping season.

Winter Recreation

Warmer winters may bring more rain and less snow to upstate New York. A decline in snowfall would mean less snow cover for recreational industries, like skiing, snowboarding, and snowmobiling, and it would harm the local economies that depend on them. Conversely, the amount of lake effect snow has increased with the longer ice-free season on the Great Lakes. Although scientists are not certain whether this trend will continue, increased snow would benefit winter recreation areas to the immediate east of Lake Erie and Lake Ontario.

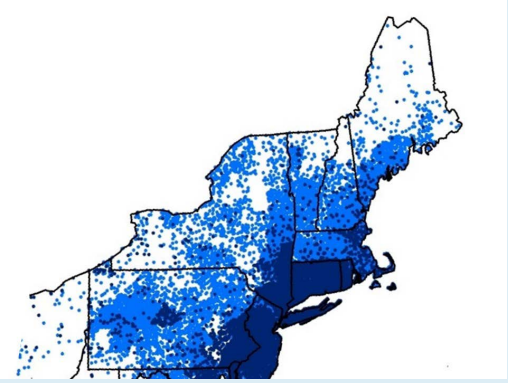
Agriculture

Changing the climate will have both beneficial and harmful effects on farming, but the net effect is unknown. During an average year, longer frost-free growing seasons and higher concentrations of atmospheric carbon dioxide would increase yields for many crops, notably soybeans. But increasingly hot summers are likely to reduce yields of corn, the state's most important crop. Higher temperatures cause cows to eat less and produce less milk, so a warming climate could reduce the output of milk and beef, which together account for more than half the state's farm revenues.

Human Health

Climate change is likely to amplify some threats to human health. Higher temperatures can increase the formation of ground level ozone, a pollutant that can contribute to respiratory problems. Rising temperatures may also increase the length and severity of the pollen season for plants such as ragweed. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor.

The risk of some diseases carried by insects may also increase. The ticks that transmit Lyme disease are active when temperatures are above 45°F, so warmer winters could lengthen the season during which ticks can become infected or people can be exposed to the ticks. Higher temperatures would also expand the area that is warm enough for the Asian tiger mosquito, a common carrier of West Nile virus. The number of cases may or may not increase, depending on what people do to control insect populations and avoid insect bites.



Increase in Lyme disease between 1996 and 2013. Each dark dot shows one case reported in 1996; light dots show 2013. The increased range of the disease has been attributed to factors other than climate change. Nevertheless, additional warming will lengthen the season during which people are exposed to Lyme disease and may allow the disease to spread to colder areas. Source: CDC.

The sources of information about climate and the impacts of climate change in this publication are: the national climate assessments by the U.S. Global Change Research Program, synthesis and assessment products by the U.S. Climate Change Science Program, assessment reports by the Intergovernmental Panel on Climate Change, and EPA's *Climate Change Indicators in the United States.* Mention of a particular season, location, species, or any other aspect of an impact does not imply anything about the likelihood or importance of aspects that are not mentioned. For more information about climate change science, impacts, responses, and what you can do, visit EPA's Climate Change website at www.epa.gov/climatechange.

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