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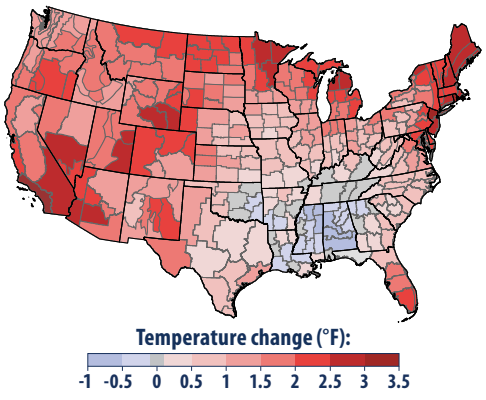
What Climate Change *Means for* New Jersey

New Jersey's climate is changing. The state has warmed by about three degrees (F) in the last century, heavy rainstorms are more frequent, and the sea is rising about one inch every six years. Higher water levels are eroding beaches, submerging low lands, exacerbating coastal flooding, and increasing the salinity of estuaries and aquifers. In the coming decades, changing the climate is likely to increase coastal and inland flooding, harm coastal and inland ecosystems, disrupt fishing and farming, 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. New Jersey has warmed more than twice as much as most of the nation. 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 New Jersey has increased 5 to 10 percent in the last century, and precipitation from extremely heavy storms has increased 70 percent in the Northeast 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. So changing the climate is likely to intensify river flooding during winter and spring, and drought during summer and fall.

Rising Seas and Retreating Shores

Sea level is rising more rapidly along the New Jersey shore than in most coastal areas because the land is sinking. If the oceans and atmosphere continue to warm, the sea is likely to rise eighteen inches to four feet along the New Jersey shore in the next century.

As sea level rises, the lowest dry lands are submerged and become either tidal wetland or open water. Many wetlands will be submerged, but not all: the freshwater wetlands along the Delaware River upstream from the Commodore Barry Bridge build their own land by capturing sediments carried by the river, and these wetlands are likely to keep pace with the rising sea during the next century. Nevertheless, most salt marshes between Cape May and the Meadowlands are unlikely to keep pace if sea level rises three feet. Wetlands along Delaware Bay in Cumberland County are even more vulnerable, and likely to be lost if the sea rises two feet. Tidal flats are also likely to become open water.

Beaches 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 barrier islands of the New Jersey shore from Bay Head to Cape May would be broken up by new inlets or lost to erosion if sea level rises three feet by the year 2100, unless people take actions to reduce erosion. Bay beaches may also be eliminated in some areas. Many of Delaware Bay's beaches are narrow, with wetlands immediately inland. Along parts of Delaware Bay and bay sides of most barrier islands, people have built walls and other shore protection structures that eliminate the beach once the shore erodes up to them.

This beach in Pennsville along the Delaware River could be lost as sea level rises, if the shore erodes up to the shore protection wall to the right. © James G. Titus; used by permission.

Coastal Ecosystems

The loss of tidal marshes could harm fish and birds that depend on a marsh for food or shelter. Blue crab, perch, weakfish, flounder, and rockfish rely on the tidal marshes in Delaware Bay to hide from predators and to feed on mussels, fiddler crabs, and other species. Sea turtles and shorebirds also feed on some of the species that inhabit these marshes. Great blue herons, black ducks, ospreys, red-winged blackbirds, and several other bird species also use the salt marshes in Delaware Bay. As marshes erode, fish may benefit initially as more tidal channels form, which would make more of the marsh accessible. But after a point, the continued erosion would make less marsh available, so populations of fish and birds could decline. In Barnegat Bay and Little Egg Harbor, the rising sea is already eroding and submerging small marsh islands, which are important nesting areas that protect common terns, black skimmers, and oystercatchers from land-based predators.

The loss of bay beaches and tidal flats would also threaten some species. Delaware Bay is a major stopover area for six species of migratory shorebirds that feed on its beaches and tidal flats, including most of the Western Hemisphere's red knot population. Nearly a million birds feed on the horseshoe crab eggs on the bay's sandy beaches. Diamondback terrapin nest on estuarine beaches in New Jersey.

Changing temperatures could also disrupt ecosystems. For example, if water temperatures exceed 86°F during summer, eelgrass could be lost, which would remove a key source of food for many fish.

Saltwater Intrusion

As sea level rises, salt water can mix farther inland or upstream in bays, rivers, and wetlands. Because water on the surface is connected to ground water, salt water can also intrude into aquifers near the coast. Soils may become too salty for the crops and trees that currently grow in low-lying areas.

Storms, Homes, and Infrastructure

As sea level rises, coastal homes and infrastructure flood more often because storm surges become higher as well. Although hurricanes are rare, homes along the ocean are vulnerable to erosion and storm waves. The bay sides of several barrier islands are so low that some streets and yards flood at high tide when strong winds blow from the east. During Hurricane Sandy, flooding and storm waves destroyed coastal homes and recreational facilities, washed out roads, inundated rail tunnels, and damaged essential power and wastewater management infrastructure.

A flooded restaurant on Long Beach Island. © James G. Titus; used by permission.

Seaside Heights in the aftermath of Hurricane Sandy. Official White House photo by Sonya N. Herbert.

Wind speeds and rainfall intensity during hurricanes and tropical storms are likely to increase as the climate warms. Rising sea level is likely to increase flood insurance rates, while more frequent storms could increase the deductible for wind damage in homeowner insurance policies.

Fishing and Farms

Changing the climate may harm commercial fishing in New Jersey. Higher ocean acidity would impair the ability of young scallops and surf clams to build shells, and potentially reduce the populations of these two shellfish, which account for about two-thirds of New Jersey's commercial fishing revenues. Higher acidity in estuaries, as well as the loss of wetlands and eelgrass, could harm crabs and hard shell clams, which account for another 15 percent of fishing revenues. As ocean temperatures rise, some fish species are moving northward or into deeper waters to remain within their normal temperature ranges.

Climate change may also pose challenges for agriculture: some farms may be harmed if more hot days and droughts reduce crop yields, or if more flooding and wetter springs delay their planting dates. Other farms may benefit from a longer growing season and the fertilizing effect of carbon dioxide.

Human Health

Hot days can be unhealthy—even dangerous. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor. High air temperatures can cause heat stroke and dehydration, and affect people's cardiovascular and nervous systems. Warmer temperatures can also increase the formation of ground-level ozone, a component of smog that can contribute to respiratory problems. Rising temperatures may also increase the length and severity of the pollen season for plants such as ragweed.

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.

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. Depiction of trade names does not constitute endorsement of the product. 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.