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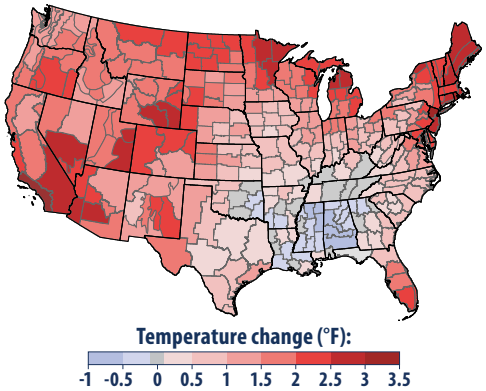
What Climate Change Means for Florida

Florida's climate is changing. The Florida peninsula has warmed more than one degree (F) during the last century. The sea is rising about one inch every decade, and heavy rainstorms are becoming more severe. In the coming decades, rising temperatures are likely to increase storm damages, harm coral reefs, increase the frequency of unpleasantly hot days, and reduce the risk of freezing to Florida's agriculture.

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. South Florida has warmed more than the rest of the state. Source: EPA, Climate Change Indicators in the United States.

Rising Seas and Retreating Shores

Along the Atlantic and Gulf Coasts of Florida, the land surface is also sinking. If the oceans and atmosphere continue to warm, sea level along the Florida coast is likely to rise one to four feet in the next century. Rising sea level submerges wetlands and dry land, erodes beaches, and exacerbates coastal flooding.

Coastal cities like West Palm Beach will likely need to take adaptive measures, such as building larger seawalls, elevating structures, and nourishing beaches, to avoid damage from sea level rise. Credit: Peter G. Merritt, Treasure Coast Regional Planning Council.

Storms, Homes, and Infrastructure

Tropical storms and hurricanes have become more intense during the past 20 years. Although warming oceans provide these storms with more potential energy, scientists are not sure whether the recent intensification reflects a long-term trend. Nevertheless, hurricane wind speeds and rainfall rates are likely to increase as the climate continues to warm.

Cities, roads, railways, ports, and water supplies in Florida are vulnerable to the impacts of storms and sea level rise. Greater wind speeds and the resulting damages can make insurance for wind damage more expensive or difficult to obtain. Whether or not storms become more intense, coastal homes and infrastructure will flood more often as sea level rises, because storm surges will become higher as well. As a result, rising sea level is likely to increase flood insurance premiums.

Changing climate is also likely to increase inland flooding. Since 1958, the amount of precipitation during heavy rainstorms has increased by 27 percent in the Southeast, and the trend toward increasingly heavy rainstorms is likely to continue. More intense rainstorms can increase flooding because rivers overtop their banks more frequently, and more water accumulates in low-lying areas that drain slowly.

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Coral Reefs and Ocean Acidification

Florida's coral reefs are susceptible to warming waters and ocean acidification. Rising water temperatures can harm the algae that live inside corals and provide food for them. This loss of algae weakens corals and can eventually kill them. This process is commonly known as coral bleaching, because the loss of the algae also causes the corals to turn white.

Increasing ocean acidity can also damage corals, as well as fish and other marine species. Ocean acidity has increased by about 25 percent in the past three centuries, and it is likely to increase another 40 to 50 percent by 2100. As the ocean becomes more acidic, corals are less able to remove minerals from the water to build their skeletons. Shellfish and other organisms also depend on these minerals, and acidity interferes with their ability to build skeletons and shells. Coral reefs provide critical habitat for a diverse range of species, and small shell-producing animals are important sources of food for larger animals. Warming and acidification could harm Florida's marine ecosystems, fisheries, and tourism.

Water Resources and the Everglades

Changing climate is likely to increase the need for water. Higher air temperatures increase the rate at which water evaporates (or transpires) into the air from soils, plants, and surface waters. Because irrigated farmland would need more water, the total demand for water is likely to increase more than 25 percent during the next half century. But the amount of available water is unlikely to increase significantly—and it may decrease.

The Everglades are vulnerable to both changing climate and rising sea level. Human activities have impaired this ecosystem by diverting the natural flow of water away from the Everglades to prevent flooding or to supply farmers and municipalities with water. Ongoing efforts to restore the historical flow of water will be more difficult if rising temperatures increase competing demands for water.

Sea level rise poses a particular risk for the Everglades—a vast, ecologically rich area, much of which is within a few feet of sea level. © Chris Lamie; used by permission.

Much of the Everglades are less than three feet above sea level. The rising sea may submerge the low-lying portions. Moreover, as sea level rises, salt water can mix farther inland or upstream into the Everglades, which allows salt-tolerant species like mangroves to spread inland but threatens cypress swamps and other species that do not tolerate salt water. Increasing salinity may also threaten the Biscayne Aquifer, which is the primary source of drinking water for South Florida. The aquifer is recharged by surface water in the Everglades, so saltier water in the Everglades would reach the aquifer as well. The city of Hallandale Beach has abandoned six of its eight drinking water wells, because the water was becoming too salty to drink.

Agriculture

Changing climate will have both harmful and beneficial effects on farming. Freezing temperatures will become very rare in most of the state, which would benefit citrus trees and other fruits and vegetables grown during winter. During summer, however, hotter temperatures are likely to reduce yields of corn and may also reduce yields of sugar, peanuts, and cotton, depending on whether sufficient water is available for irrigation. Higher temperatures are also likely to reduce livestock productivity, because heat stress disrupts the animals' metabolism.

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. Seventy years from now, temperatures in most of the state are likely to rise above 95°F between 45 and 90 days per year, compared with less than 15 days per year today. Higher humidity will further increase the heat index and associated impacts on health.

Warmer air can also increase the formation of ground-level ozone, a key component of smog. Ozone has a variety of health effects, aggravates lung diseases such as asthma, and increases the risk of premature death from heart or lung disease. EPA and the Florida Department of Environmental Protection have been working to reduce ozone concentrations. As the climate changes, continued progress toward clean air will be more difficult.

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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