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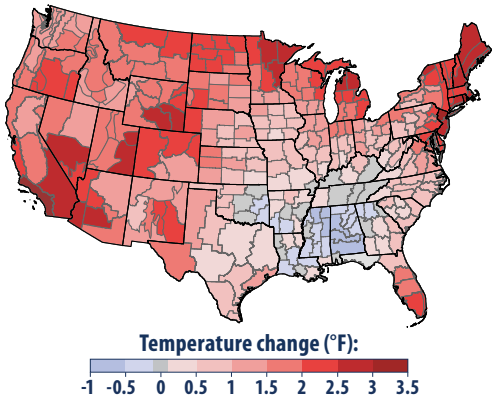
What Climate Change *Means for* Alabama

In the coming decades, **Alabama** will become warmer, and the state will probably experience more severe floods and drought. Unlike most of the nation, Alabama has not become warmer during the last 50 years. But soils have become drier, annual rainfall has increased in most of the state, more rain arrives in heavy downpours, and sea level is rising about one inch every eight years. Changing the climate is likely to increase damages from tropical storms, reduce crop yields, harm livestock, increase the number of unpleasantly hot days, and increase the risk of heat stroke and other heat-related illnesses.

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 (F) 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. While most of the earth warmed, natural cycles and sulfates in the air cooled Alabama. Sulfates are air pollutants that reflect sunlight back into space. Now sulfate emissions are declining, and the factors that once prevented the state from warming are unlikely to persist.

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.



Changing temperatures in the last century. While most of the nation has warmed, Alabama and a few other states have cooled. Source: EPA, Climate Change Indicators in the United States.

Rising Seas and Retreating Shores

Sea level is rising more rapidly in Alabama than most coastal areas because the land is sinking. If the oceans and atmosphere continue to warm, sea level along the Alabama coast is likely to rise eighteen inches to four feet in the next century. Rising sea level submerges wetlands and dry land, erodes beaches, and exacerbates coastal flooding.

Coastal 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.

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. 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. Many cities, roads, railways, ports, airports, and oil and gas facilities along the Gulf Coast are vulnerable to the combined impacts of storms and sea level rise. People may move from vulnerable coastal communities and stress the infrastructure of the communities that receive them.

Hurricane Katrina's storm surge destroyed homes and roads on Dauphin Island in 2005. Credit: FEMA.

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Precipitation and Water Resources

Annual precipitation in Alabama has increased 5 to 10 percent since the first half of the 20th century. Although rainfall during spring is likely to increase during the next 40 to 50 years, the total amount of water running off into rivers or recharging ground water is likely to decline 2.5 to 5 percent, as increased evaporation offsets the greater rainfall. Droughts are likely to be more severe, because periods without rain may be longer and very hot days will be more frequent.

Flooding, River Transportation, and Hydroelectric Power

Flooding is becoming more severe in the Southeast. 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. While some rivers such as the Tennessee have dams to help prevent flooding, other rivers either have no dams or have dams with too little capacity to significantly reduce flooding. Heavy rains have caused the Pea River to flood Elba several times, and the Alabama River flooded two thousand homes in Selma and Montgomery during 1990.

Droughts create a different set of challenges. When reservoirs release water for navigation along the Tennessee or Black Warrior rivers, too little water may be available for lake recreation or hydropower. Low flows from drought occasionally limit navigation along the Alabama River. During severe droughts in the Mississippi River's watershed, however, navigation can potentially increase on the Tennessee-Tombigbee Waterway, which provides an alternative route to the Gulf of Mexico.

Flooding of a small stream in June 2014 destroyed this roadbed in Foley. Credit: Patsy Lynch, FEMA.

Droughts also affect the amount of electricity that Alabama Power and the Tennessee Valley Authority (TVA) can produce from their hydroelectric dams, which account for about 8 percent of the electricity produced in the state. During the 2007 drought, total production from the TVA's hydroelectric plants fell by more than 30 percent, which forced the TVA to meet customer demand by using more expensive fuel-burning power plants.

Agriculture and Forest Resources

Changing the climate will have both harmful and beneficial effects on farming. Seventy years from now, Alabama is likely to have 30 to 60 days per year with temperatures above 95°F, compared with about 15 days today. Even during the next few decades, hotter summers are likely to reduce yields of corn. But higher concentrations of atmospheric carbon dioxide increase crop yields, and that fertilizing effect is likely to offset the harmful effects of heat on soybeans, cotton, wheat, and peanuts—if adequate water is available. More severe droughts, however, could cause crop failures. Higher temperatures are also likely to reduce livestock productivity, because heat stress disrupts the animals' metabolism.

Higher temperatures and changes in rainfall are unlikely to substantially reduce forest cover in Alabama, although the composition of trees in the forests may change. More droughts would reduce forest productivity, and climate change is also likely to increase the damage from insects and disease. But longer growing seasons and increased carbon dioxide concentrations could more than offset the losses from those factors. Forests cover more than two-thirds of the state. Oak, hickory, and white pine trees tend to be most common in the northern part of the state, while loblolly pines are more common in the southern forests. As the climate warms, forests in southern Alabama are likely to have more white pines and oaks, and fewer loblolly pines.

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 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 Alabama Department of Environmental Management have been working to reduce ozone concentrations. As the climate changes, continued progress toward clean air will become 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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