

Mississippi



State Findings from
**Confronting
Climate Change
in the Gulf
Coast Region**

Prospects for Sustaining
Our Ecological Heritage

Mississippi's Variable and Changing Climate

Mississippi's climate has always been variable and sometimes extreme—and climate change may intensify this historical pattern. Average state temperatures have varied substantially over the past century, with a warming trend of about 1°F since the late 1960s. Extreme rainfall events, primarily thunderstorms, have increased during the 20th century. While rainfall totals have changed little, seasonal trends are apparent—summers have become slightly drier and winters slightly wetter.

Mississippi has a warm and humid climate, with annual rainfall ranging from 50 to 65 inches. Rainfall is brought by extratropical storms in the winter, and thunderstorms and tropical storms in the summer and fall. Occasionally, Mississippi experiences substantial flooding, especially during hurricanes. Tropical storms strike the Mississippi coast on average once every 12 years, but hurricane frequency varies by decade and is strongly influenced by the El Niño–La Niña cycle.

Sea level along the Mississippi coast—from St. Louis Bay to Pascagoula—has risen by as much as 8 inches over the past 100 years.

Future Climate Projections

It is possible to assess Mississippi's vulnerability to a rapidly changing climate, even though extracting state-specific information from global climate model projections entails significant uncertainty. Therefore, scientists use a variety of models and other scientific methods to project plausible

climate futures as a basis for impact studies. For the US Southeast, the climate projections from the best available climate models agree on temperature and sea-level increases, but differ on changes in precipitation in some parts of the region. Because future trends in rainfall and runoff are critical to human and ecological

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well-being in the Gulf Coast region, the most prudent approach is to assess the potential impacts of both a drier and wetter scenario. The following climate projections are derived from models produced by the Canadian Climate Centre and the U.K.'s Hadley Centre.

- **Temperature:** Maximum summer temperatures could increase by 3–7°F, with the July heat index—a measure combining temperature and humidity to represent the temperature actually felt—increasing by 10–25°F. Minimum winter temperatures could increase from less than 3° to about 10°F. The freeze line is likely to move north.

- **Precipitation and runoff:** In the immediate coastal

regions of Mississippi, rainfall is likely to decrease, along with soil moisture. In upland areas, one model projects the area to get wetter; the other, drier, so the impacts of both scenarios should be assessed. Where drought conditions increase, so does the risk of wildfires.

- **Sea-level rise:** Sea level is projected to rise at a faster rate over the coming century. By 2100, ocean levels would be 15 inches higher than today based on a continued average subsidence rate and a mid-range sea-level rise scenario.

- **Tropical storms:** Hurricane intensity (maximum wind speeds and rainfall totals) could increase slightly with global warming, although changes in future hurricane frequency are uncertain. Even if storm frequencies and intensities remain constant, the damages from coastal flooding and erosion will increase as sea level rises.

Potential Impacts from Global Warming on the Environment, Human Health, and Economy of the Magnolia State

Agriculture

Mississippi's agriculture—a \$4.8 billion industry—is fourth in the nation in corn and cotton production and fifth in poultry production. It also produces rice, soybeans, and vegetables. All of these farm products are highly sensitive to changes in temperature and especially to changes in rainfall and the availability of fresh water for irrigation.

- Under the drier conditions projected for the immediate coastal zone additional irrigation will be required to maintain the production of cotton, soybeans, sorghum, hay, and vegetables. If sufficient irrigation water is not available, production cannot be maintained at current levels. (*Note:* The fertilization effect from elevated levels of CO₂ will increase productivity only with sufficient irrigation.)

- Under the drier conditions projected for the immediate coastal zone, rice production is likely to decrease, given its high sensitivity to decreased water availability and increased salinity.



US Department of Agriculture

- Where areas of the state become warmer and wetter, fertilization by CO₂ could increase yields; yet these same conditions also facilitate the spread and persistence of agricultural pests, requiring increased pest control.

Forestry

The managed shortleaf and loblolly pine tree forests in Mississippi contributed \$7.1 billion to the state's economy in 1997. This important industry in Mississippi is highly sensitive to climate change.

- Natural and especially managed forests are vulnerable to drought and fire in areas that could become drier. As temperatures rise, the capacity of trees to absorb and store carbon decreases.

- If the drier climate scenario were to play out, savannas and grasslands would expand at the expense of forests, particularly in areas further inland from the coast. Wetter climate conditions, on the other hand, would increase the productivity of hardwoods at the expense of softwoods, but also increase the risk of forestry pests such as Southern pine bark beetle.

- Increased fire frequency under drier conditions would require that forest managers change their forest and fire management practices, including changes in tree species, stand density, fertilization, and rotation length. Extreme, long-lasting droughts would seriously damage forests in the long-term.

- Frequent disturbance from storms would favor the spread of invasive species, such as tropical soda apple, cogon-grass, and Chinese tallow over native species.

Recreation and Tourism

National parks, forests, and seashores—as well as the unprotected natural heritage of the state—form the basis of Mississippi's tourism and recreation sectors. Global warming can affect them in multiple and often synergistic ways.

- Rising sea levels will increase coastal erosion along the mainland and National Seashore, leading to beach loss where sediment supplies are low and to increased risk of damages from severe coastal storms. Beach tourism would be directly affected and significant investment would be necessary to maintain beaches.

- Wetland loss due to increased rates of sea-level rise and limited ability of wetlands to migrate inland could reduce habitat for waterfowl and other wildlife essential to hunting, trapping, and recreational fishing.

- The few remaining wet prairies provide valuable habitat for several endangered species, such as the Mississippi sandhill crane. Should global warming produce drier conditions, the chance of wildfires would increase, thereby helping to maintain these prairies, but possibly eliminating some of the nesting grounds.



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Fisheries and Aquaculture

Mississippi has the most valuable aquaculture industry in the United States, producing food fish, baitfish, shrimp, crawfish and oysters. It is valued at \$290 million annually. The state also has the second largest fishing industry of the five Gulf states, which is largely dependent on intact coastal wetlands and clean coastal waters.

- Both climate models used in this report project that freshwater input from local rivers flowing into estuaries, bays, and lagoons will decrease in the future (due to decreased precipitation). In addition, demand on scarce freshwater resources will increase. The combination is likely to result in problems with extreme salt concentrations, less nutrient input, less frequent flushing, and thus overall lower water quality in nearshore waters. Where the salt tolerance of species in marshes, and seagrass beds is exceeded, changes in the food web and possible reduction in fish and shellfish productivity must be expected.

- Aquaculture requires plenty of fresh water. With most inland ponds dependent on surface freshwater sources, either unchanged rainfall totals or any decline in rainfall or freshwater availability would negatively impact pond operations in a warmer world.

- If wetlands are able to migrate inland as sea level continues to rise, the yield of estuarine-dependent fisheries, such as shrimp, will increase or decrease depending on the size and quality of the new habitat over time.

Freshwater Resources

Mississippi's current population of almost 2.8 million is projected to increase to about 3.1 million by 2025. The state's freshwater resources will be increasingly tapped for urban residential or industrial uses, irrigation, the prevention of saltwater intrusion in coastal aquifers, and the maintenance of healthy aquatic ecosystems. Competing demands on limited water resources will increase freshwater management challenges with or without climate change.

- Greater freshwater losses due to increased temperatures and evaporation will magnify the water resource challenges

of the future if rainfall stays at current levels. Where rainfall amounts decline, especially during critical times of the growing season, drought and widespread freshwater shortages could increase.

- More extreme rainfall events, a trend already detected, create their own challenges—extreme runoff could overload the sewage systems, leading to septic contamination of surface and coastal waters and negative consequences for health and the fishing industry.

- Where saltwater intrudes into coastal groundwater sources due to sea-level rise, freshwater resources could be further affected. Where saltwater intrudes into freshwater marshes, vegetation with low salt tolerance would be decimated, changing the composition and functioning of these ecosystems.

- Higher water temperatures impact aquatic ecosystems by changing aquatic food webs and species communities. Higher water temperatures also reduce the amount of dissolved oxygen in the water, diminishing water quality, and in extreme cases, killing fish.

Coastal Development and Infrastructure

As development and economic activity in coastal areas has increased, so, too, has societal vulnerability to coastal hazards. Global climate change will likely exacerbate that vulnerability. Gulfport, Biloxi, and other seaports and coastal communities—which are highly developed for residences,

Higher temperatures lead to increased production of ground-level ozone and smog, exacerbating respiratory diseases.

industry, and tourism—are at risk. While some of the immediate coastal fringe of Mississippi is rural and not overly developed, the low-lying areas face growing challenges from sea-level rise.

- Accelerating sea-level rise due to global warming will increase the rate of erosion—an already significant threat to homes, roads, and other infrastructure along the shorefront of the state's barrier islands, such as Ship Island and along the mainland coast, for example near Gulfport and Biloxi.

- Accelerating sea-level rise will also increase storm surges, even if hurricanes and tropical storms do not become more intense. Thus, greater economic losses from storms, as well as higher repair and maintenance costs (e.g., for port and industrial facilities or beach replenishment) must be expected in the future.



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Human Health

Health concerns related to global warming result from a complex set of interactions among human and environmental factors. Extreme heat, air and water quality, seafood safety, and storm-related risks are of great concern for all residents, but particularly for the elderly population and the poor.

- The greatest increase in the July heat index is projected for the southern United States. Mississippi—especially Jackson and other urban areas—is particularly vulnerable to more heat waves. As a result, Mississippi is likely to see an increase in the number of heat-related illnesses and deaths, especially among the elderly, the very young, people whose health is already compromised, and the very poor, who are unable to protect themselves from the heat.

- Higher temperatures also lead to increased production of ground-level ozone and smog, exacerbating asthma and other respiratory diseases.

- The risk of water-borne illnesses can increase with warmer temperatures and extreme rainfall and runoff. The incidence of gastrointestinal diseases, respiratory diseases, and skin, ear, and eye infections, however, is determined only in combination with human factors, such as the effectiveness of water and sewage treatment and the responsiveness of the public health system. Thus, climate-related health risks will place greater demands on public health resources.

- Vulnerability to climate change and water-related health risks is particularly severe in areas where water supply and quality, waste disposal systems, and power supplies for heating and cooling are already substandard.



This fact sheet is based on the findings of *Confronting Climate Change in the Gulf Coast Region*, a report published in October 2001 by the Union of Concerned Scientists and the Ecological Society of America. The report was written by 10 regional experts under the leadership of Robert Twilley (University of Louisiana-Lafayette). Experts from Mississippi included Richard Miller (NASA).

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The full report is available from UCS at www.ucsusa.org or call (617) 547-5552.