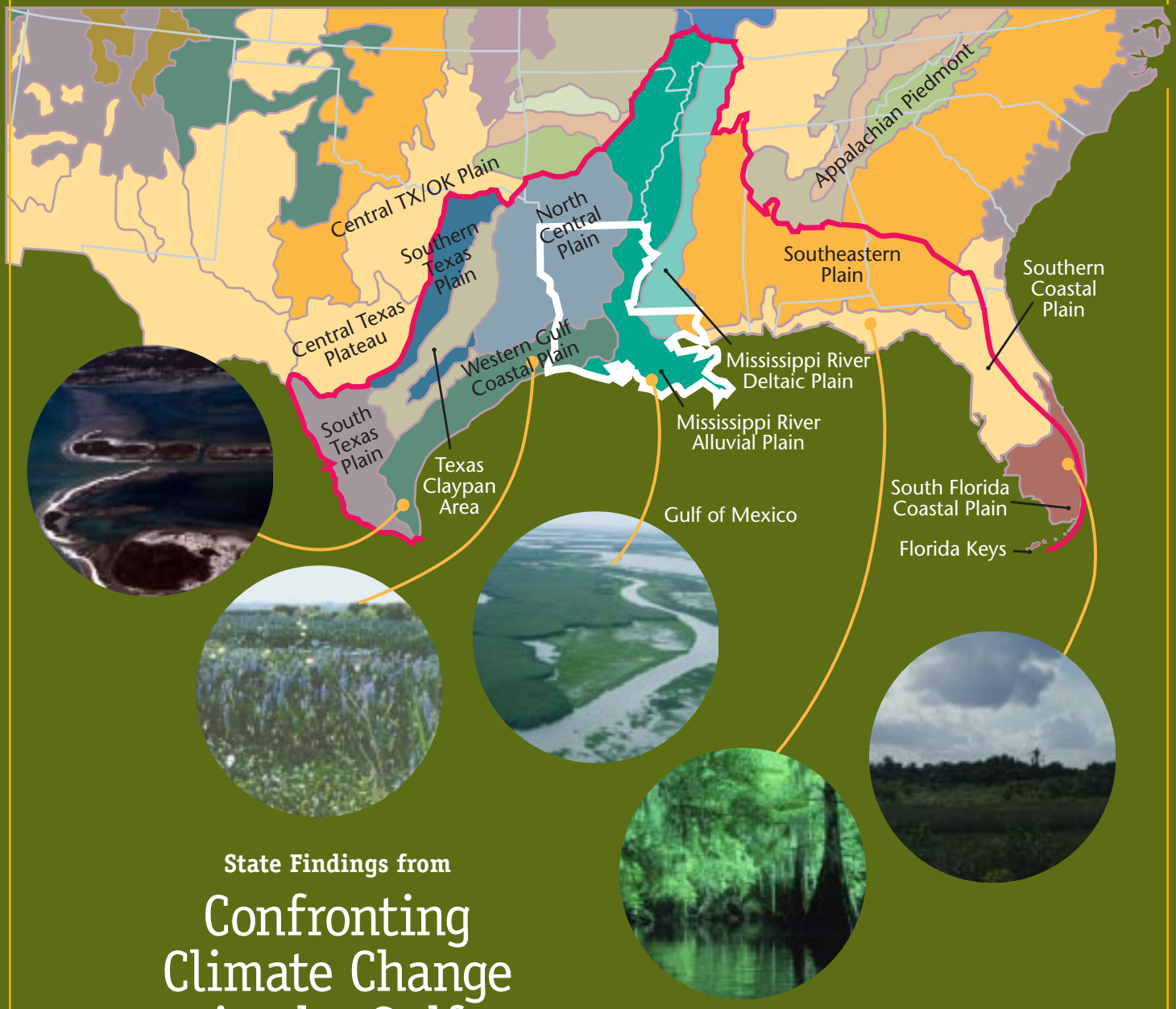
Louisiana



State Findings from

Confronting Climate Change in the Gulf Coast Region

Prospects for Sustaining Our Ecological Heritage

Louisiana's Variable and Changing Climate

Louisiana'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: winter average rainfall has increased slightly and summer totals have decreased somewhat.

Louisiana has a warm and humid climate, with annual rainfall totals ranging from 40 to 70 inches, making rainfall such an integral part of life in Louisiana that the New Orleans pavilion at the 1984 World Trade Fair held in The Big Easy was called "Water." Rainfall is brought by extratropical storms in the winter, and thunderstorms and tropical storms in the summer and fall. Occasionally, Louisiana experiences substantial flooding, especially during hurricanes, but is also familiar with droughts, especially during La Niña events—such as the 25-months-long drought from 1998–2000. Tropical storms strike the Louisiana coast nearly once every four years on average, but hurricane frequency varies by decade and is strongly influenced by the El Niño–La Niña cycle.

Global warming threatens to undermine the massive efforts underway in Louisiana to restore coastal wetlands.

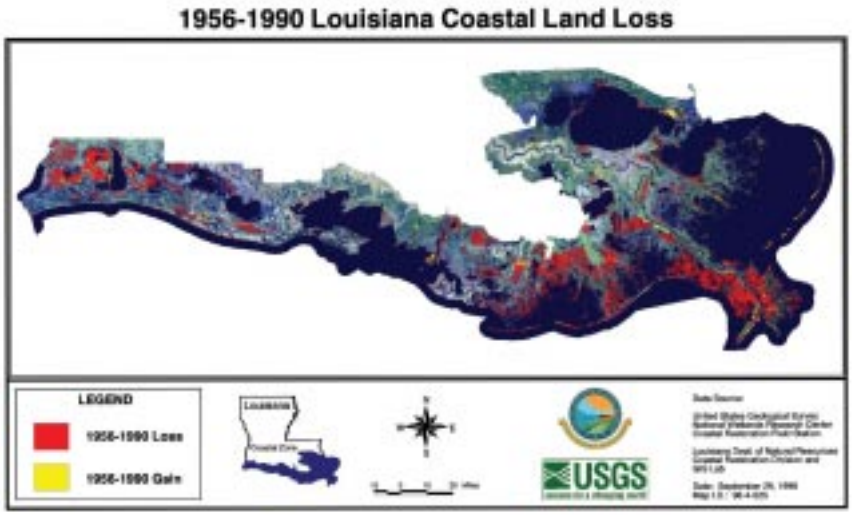
Louisiana's rate of relative sea-level rise is the highest in the United States. Water levels along its coast—from Holly Beach to New Orleans to the Chandeleur Islands—have risen by up to 40 inches over the past 100 years due to a combination of globally rising seas and substantial local sinking of the land (subsidence).

Future Climate Projections

It is possible to assess Louisiana'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 well-being in the Gulf Coast region, the most prudent approach is to assess the potential impacts of both the 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.

Robert Twilley

- *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 Louisiana, 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 21st century. By 2100, ocean levels could be 21–44 inches higher than today, based on a continued average subsidence rate of 8–31 inches per century and a mid-range sea-level rise scenario.
- *Tropical storms:* Hurricane intensity (maximum wind speeds, 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 the Economy of the Bayou State

Wetlands

The mouth of the Mississippi River forms the biggest delta in the United States, with extensive estuaries, coastal marshes, and mangroves. Louisiana's wetlands are already being lost at the alarming rate of 60 acres a day due to sea-level rise, local subsidence, and human interference with coastal processes.

- Continuing subsidence and other human alterations in coastal areas, combined with global sea-level rise, threaten to undermine the massive efforts underway to restore the state's precious coastal wetlands.
- Droughts and lack of freshwater runoff into coastal wetlands due to a changing climate can increase the "brown marsh" phenomenon or marsh dieback, as illustrated by the extended drought from 1998–2000.
- Wildlife species such as waterfowl, alligators, and fur-bearing animals, depend on wetlands. Recreational activities, hunting, fishing and related activities would be negatively affected by an accelerating or even ongoing loss of wetlands.
- Wetlands help retain and purify water, stabilize sediments, and protect coastal areas from storm surges. These natural services are valued at millions of dollars and would be lost as wetlands vanish.
- Tropical species and ecosystems, such as black mangrove areas, are likely to expand northward and establish themselves more firmly in Louisiana, unless human development hinders migration. Species that cannot migrate inland and northward could vanish.

Fisheries

Louisiana enjoys a lucrative fishing and seafood industry. The state's aquaculture, producing food fish, baitfish, crawfish, and oysters, is ranked seventh in the nation.

- Coastal Louisiana—the crawfish capital of the world—is highly sensitive to changes in the availability of fresh water and to saltwater intrusion into the crawfish ponds. Accelerating rates of sea-level rise as well as reduced rainfall in coastal areas will increase the risk of permanent or occasional saltwater intrusion into these ponds, thereby drastically affecting production.
- If runoff from the Mississippi River increases, as some climate models project, the risk of the formation of an oxygen-poor (hypoxic) zone off the coast increases, as could the size of this area, sometimes called the "dead zone." If this occurs, the state's fisheries would be negatively impacted. Shrimp yields, for example, decreased during past hypoxia events.
- Both climate models used in this report project that freshwater input from local rivers flowing into estuaries and bays will decrease in the future. 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 near-shore waters. Where the salt tolerance of species in marshes, mangroves, and seagrass beds may be exceeded, changes in the food web and possible reduction in fish and shellfish productivity must be expected.
- If wetlands can 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.

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. Especially the area south of New Orleans, which is highly developed for residential, industrial, and tourism uses, as well as the international seaports of New Orleans and Baton Rouge, which function as important transportation hubs, and other smaller docks are at risk. Much of the immediate coastal fringe of Louisiana is rural and not overly developed, but 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 Grand Isle.
- 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.
- During major storms, storm surge heights of 3–6 feet could reach as far inland as the Westbank communities across the river from New Orleans if barrier islands and wetlands are lost as buffers. Existing storm protection measures could be rendered inadequate.

Freshwater Resources

Louisiana's current population of almost 4.5 million is projected to increase to about 5 million in 2020. The state's freshwater resources will be increasingly tapped for urban residential and industrial uses, for agricultural irrigation, for prevention of saltwater intrusion into coastal aquifers, and aquaculture and rice ponds, and for the maintenance of healthy aquatic ecosystems. These competing demands on limited water resources are already presenting freshwater management challenges, and any changes in climate, such as rainfall, evaporation, groundwater recharge rates, and/or runoff patterns, will affect ecosystems and all freshwater users.

- In coastal areas, the threat to freshwater resources will come from the combined effect of saltwater intrusion due to sea-level rise and the projected decrease in rainfall. Saltwater intrusion already threatens freshwater withdrawals from the Mississippi River, and other areas such as in Bayou Lafourche.
- In upland areas, competing demands on fresh water

will either be aggravated by decreases in rainfall or slightly alleviated if rainfall increases.

- As global warming proceeds, more extreme rainfall events—a trend already detected—will lead to more frequent extreme runoff events, which can overload sewage systems and result in septic contamination of surface and coastal waters.
- Higher water temperatures will alter aquatic ecosystems by changing aquatic food webs and species communities, and impact water quality by reducing the amount of dissolved oxygen in the water.

Agriculture and Forestry

Agriculture and forestry are both enormously important industries in Louisiana, contributing over $10 billion each year to the state's economy. Each is highly sensitive to climate change.

- In the delta region, where drier conditions are projected, rice production is likely to decrease, given its high sensitivity to increased salinity.
- Under the drier conditions additional irrigation will be required to maintain the production of cotton, soybean, sorghum, hay, sugarcane, and vegetables. (*Note:* The fertilization effect from elevated levels of CO_2 will increase productivity only with sufficient irrigation.) If sufficient irrigation water is not available, production cannot be maintained at current levels.

Because future trends in rainfall and runoff are critical to human and ecological well-being in the Gulf Coast region, the most prudent approach is to assess the potential impacts of both the drier and wetter scenarios.

- The managed shortleaf and loblolly pine tree forests in Louisiana contributed $7.1 billion to the state's economy in 1997. These 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.
- Savannas and grasslands would expand at the expense of forests, particularly in areas further inland from the coast, if the drier climate scenario were to play out. Wetter climate conditions, on the other hand, would increase the productivity of hardwoods at the expense of softwoods, but also favor forest 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.

Denise Reed

Human Health

Health concerns related to global warming result from a complex set of interacting human and environmental factors. These concerns are particularly serious for the elderly and other vulnerable populations, but air and water quality, seafood safety, and storm-related risks are of great concern for all residents and visitors.

- The July heat index is projected to increase most in the southern United States. Metropolitan areas such as Baton Rouge, New Orleans, and Shreveport are particularly vulnerable to more heat waves. They could increase the number of heat-related illnesses and deaths.
- Higher temperatures will also lead to increased production of ground-level ozone, which, when combined with higher concentration of air pollutants and higher pollen counts, could seriously compromise air quality. Cities, such as Baton Rouge, already in non-compliance with federal air quality standards, are likely to face even greater problems.
- Along Louisiana's coast, viral and bacterial contamination of shellfish has repeatedly caused illness (neurotoxic poisoning etc.) and closed important fisheries. The protozoan *Perkinsus marinus* is the most important pathogen threatening the Gulf's significant oyster industry. Prevalence of *P. marinus* has been related to salinity and temperature, with low temperatures and salinities usually limiting infection and higher temperatures and salinities typically increasing it. Climate change is likely to produce conditions that would make *P. marinus* become more common.

Union of Concerned Scientists

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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). Additional experts from Louisiana included Denise Reed (University of New Orleans).

Dr. Robert Twilley (337) 262-1776 • Dr. Denise Reed (504) 280-7395

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