

Global Climate Change Impacts in the United States

A State of Knowledge Report

*Authoritative, plain language significant
update to previous assessments*

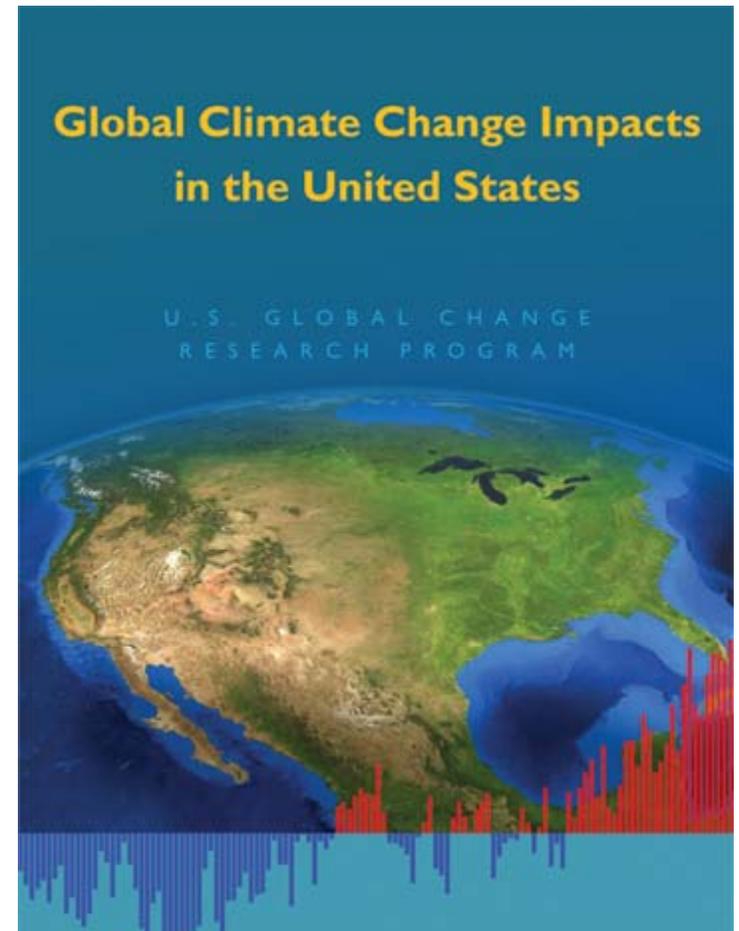
- How has climate already changed?
- How is it likely to change in the future?
- How has climate change affected us where we live and work?
- How is it likely to affect us in the future?

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American Planning Association

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•globalchange.gov/usimpacts

Impacts of Climate Change

Climate change is apparent now across our nation. Trends observed in recent decades include rising temperatures, increasing heavy downpours, rising sea level, longer growing seasons, reductions in snow and ice, and changes in the amounts and timing of river flows. These trends are projected to continue, though larger increases would result from higher levels of heat-trapping gas emissions, and smaller increases from lower levels of these emissions. The observed changes in climate are already causing a wide range of impacts, and these impacts are expected to grow.

Sea Ice and Permafrost

Risks and costs in Alaska increase as thawing of permafrost damages roads, buildings, and forests, and declining sea ice increases coastal erosion and threatens the existence of some communities.



Forests

Forest growth is generally projected to increase in much of the East, but decrease in much of the West as water becomes even scarcer. Major shifts in species are expected, such as maple-beech-birch forests being replaced by oak-hickory in the Northeast. Insect infestations and wildfires are projected to increase as warming progresses.



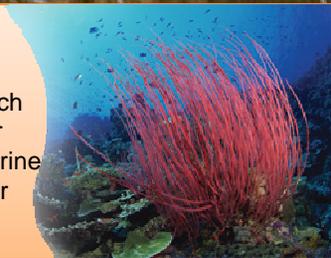
Coldwater Fish

Salmon, trout, and other coldwater fish will face additional stresses as water temperatures rise and summer streamflows decline. Ecosystems and the tourism and recreation they support will be adversely affected.



Coral Reefs

Rising water temperatures and ocean acidification threaten coral reefs and the rich ecosystems they support. These and other climate-related impacts on coastal and marine ecosystems will have major implications for tourism and fisheries.



Interacting Stresses

Population shifts and development choices are making more Americans vulnerable to climate change impacts. An aging populace, and continued population shifts to the Southeast, Southwest, and coastal cities amplify risks associated with extreme heat, sea-level rise, storm surge, and increasing water scarcity in some regions.



Impacts of Climate Change

Responses to climate change fall into two major categories. "Mitigation" focuses on reducing emissions of heat-trapping gases and particles to reduce the amount and speed of climate change. "Adaptation" refers to changes made to better respond to present or future climate conditions in order to reduce harm or take advantage of opportunities. Both are necessary elements of a comprehensive response strategy.

Heavy Downpours

More rain is already coming in very heavy events, and this trend is projected to increase across the nation. Such events are harmful to transportation infrastructure, agriculture, water quality, and human health.



Agriculture

Increasing heat, pests, floods, weeds, and water stress will present increasing challenges for crop and livestock production. ecosystems will be lost.



Heat Waves

Heat waves will become more frequent and intense, increasing threats to human health and quality of life, especially in cities.



Coastal Communities

Sea-level rise and storm surge will increase threats to homes and infrastructure including water, sewer, transportation, and communication systems. Many barrier islands and coastal marshes that protect the coastline and support healthy ecosystems will be lost.



Water and Energy

As warming increases competition for water, the energy sector will be strongly affected as power plants require large amounts of water for cooling.



Energy Supply

Warming will decrease demand for heating energy in winter and increase demand for cooling energy in summer. The latter will result in significant increases in electricity use and peak demand in most regions.



Water Supply

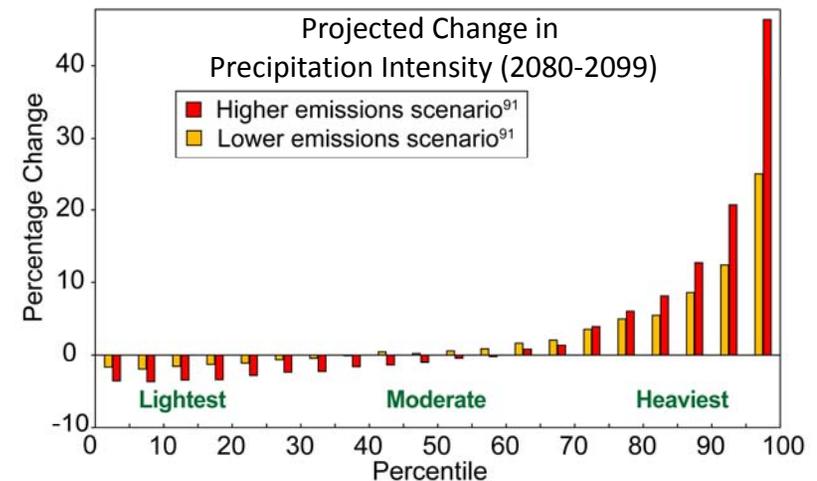
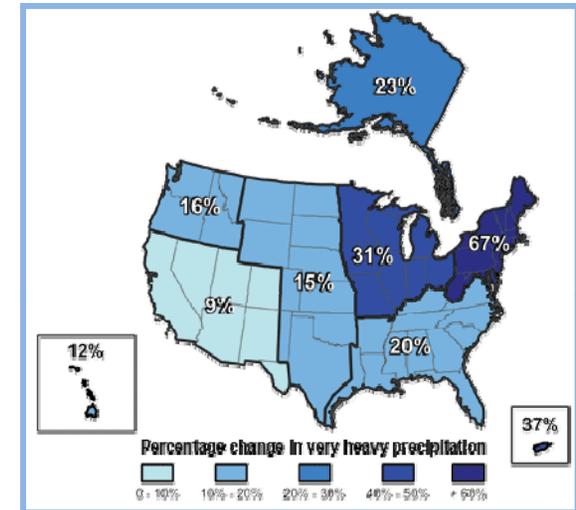
Reduced summer runoff, increased winter runoff, and increasing demands will compound current stresses on water supplies and flood management, especially in the West.



Climate changes are underway in the U.S. and are projected to grow

- Temperature rise
- Sea-level rise
- Increase in heavy downpours
- Rapidly retreating glaciers
- Thawing permafrost
- Longer growing season
- Longer ice-free season in the ocean and on lakes and rivers
- Earlier snowmelt
- Changes in river flows

Observed Increases in Very Heavy Precipitation (1958 to 2007)

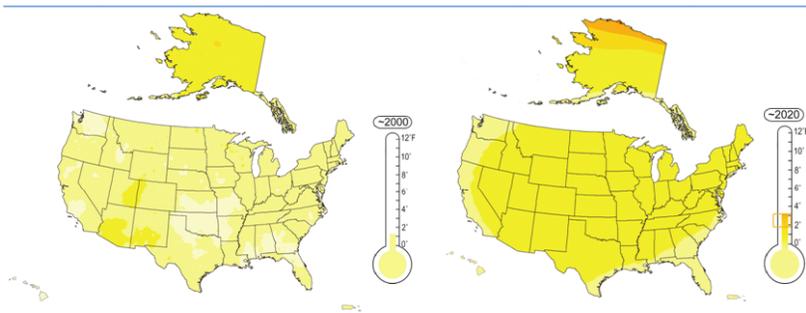


Climate changes are underway in the U.S. and are projected to grow

Significant impacts on:

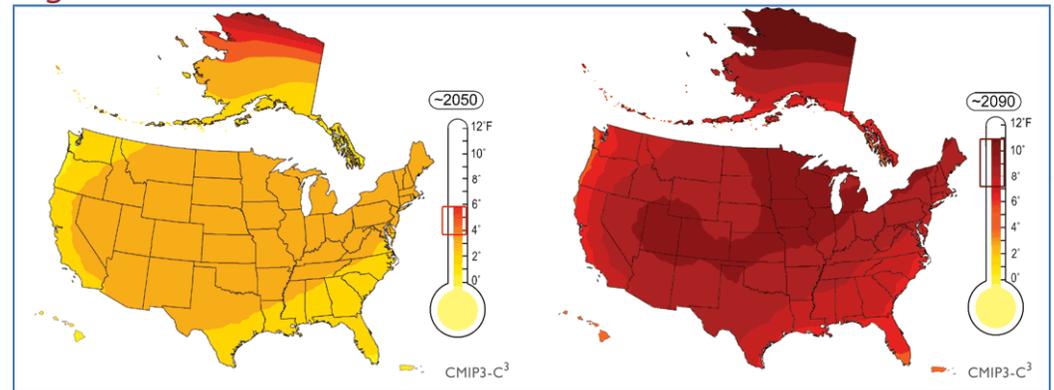
- Water resources
- Energy supply and use
- Transportation
- Agriculture
- Ecosystems
- Human health
- Society

Present-Day Change (1993-2007)

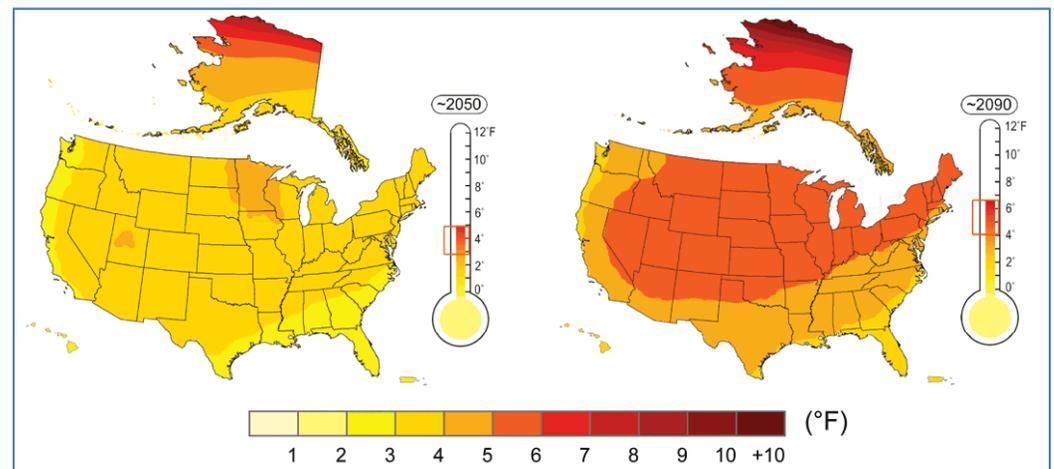


Near-Term Projected Change (2011-2029)

Projected Temperature Change (°F)
from 1961-1979 Baseline
Mid-Century (2041-2059 average) End of Century (2081-2099 av.)
Higher Emissions Scenario



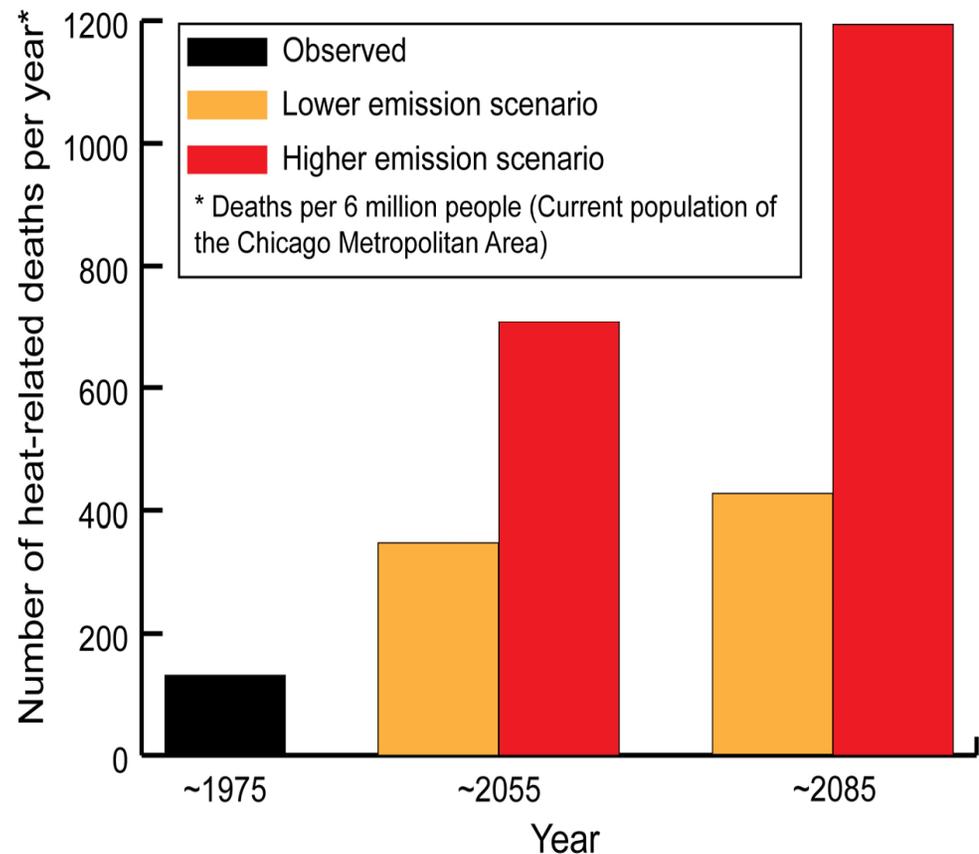
Lower Emissions Scenario



Threats to human health will increase

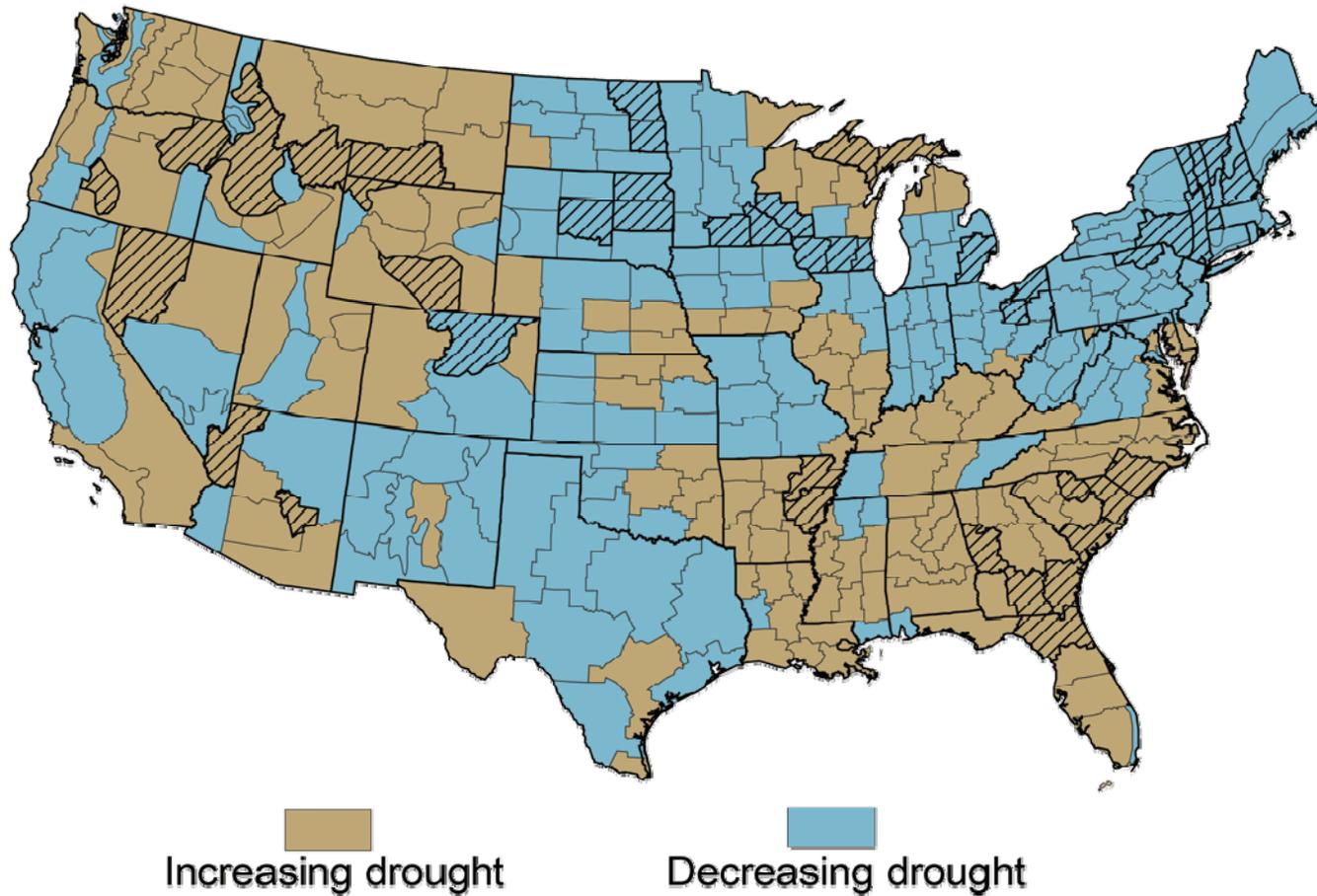
- Heat stress
- Water-borne diseases
 - Heavy downpours
 - Higher temperatures)
- Reduced air quality with adverse health effects
- Extreme weather events
- Diseases caused by insects and rodents
- Increased pollen production and prolonged pollen season in a number of plants with highly allergenic pollen

Projected Increase in Heat-Related Deaths in Chicago



Climate and Water: A Current & Future Issue

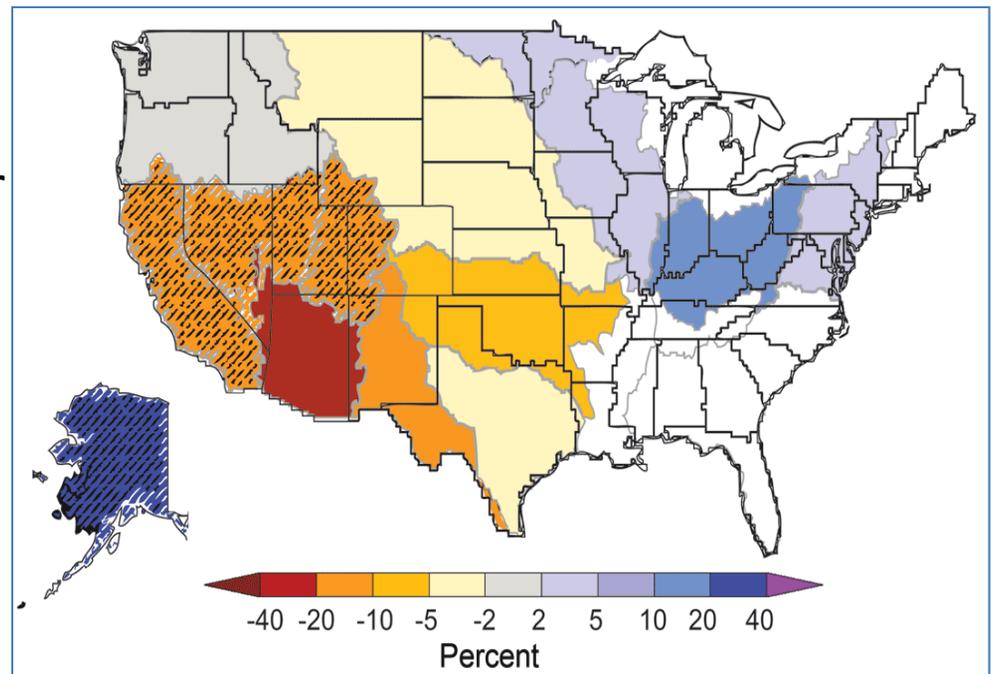
Observed Drought Trends 1958-2007



Climate change will stress water resources

- Reduced summer runoff, increased winter runoff, and increasing demands will compound current stresses on water supplies and flood management, especially in the West
- Less snow, more rain
- Wet areas get wetter – floods
- Dry areas get drier – drought
- Declines in mountain snowpack
- Increased competition for water
- Implications for many sectors
 - Agriculture
 - Human health
 - Ecosystem management
 - Energy

Projected Changes in Annual Runoff



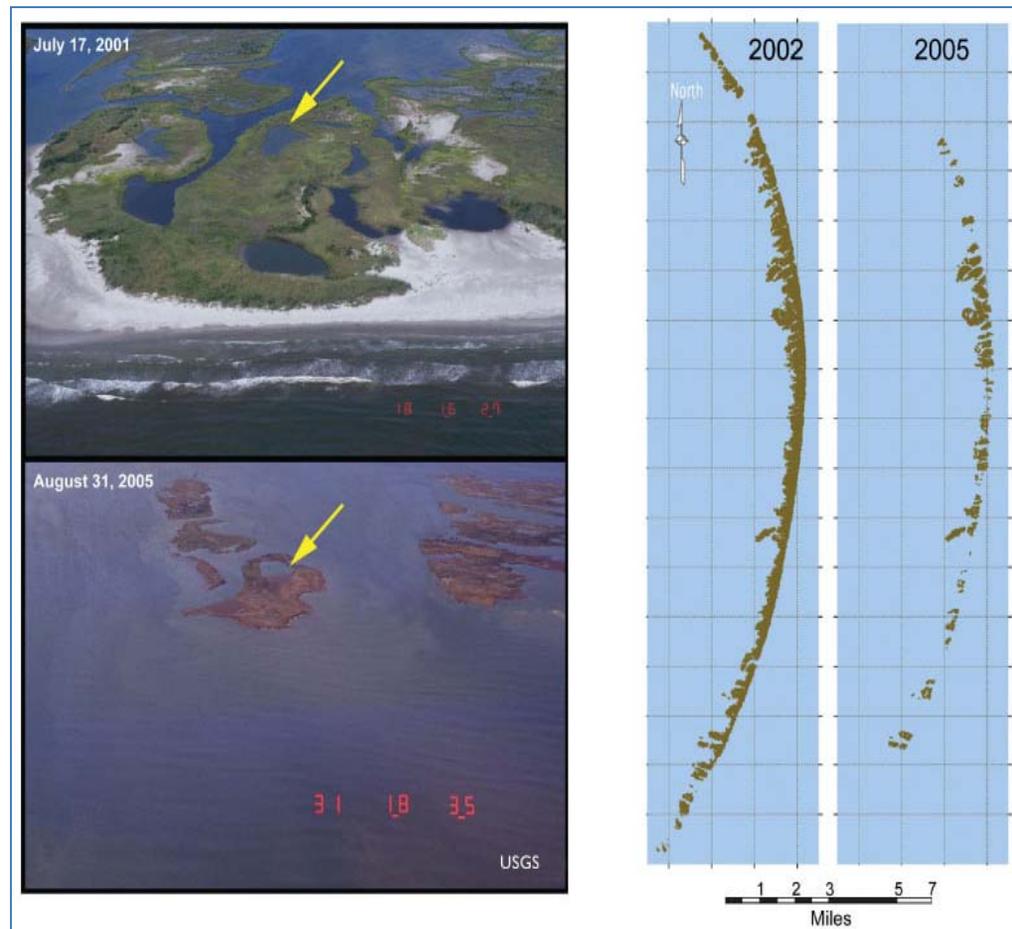
Agriculture will face challenges from increased heat, pests, water stress, diseases, and weather extremes.



Coastal areas are at increasing risk from sea-level rise and storm surge

Land Lost During 2005 Hurricanes

- Sea-level rise
- Storm surge
- Erosion
- Flooding

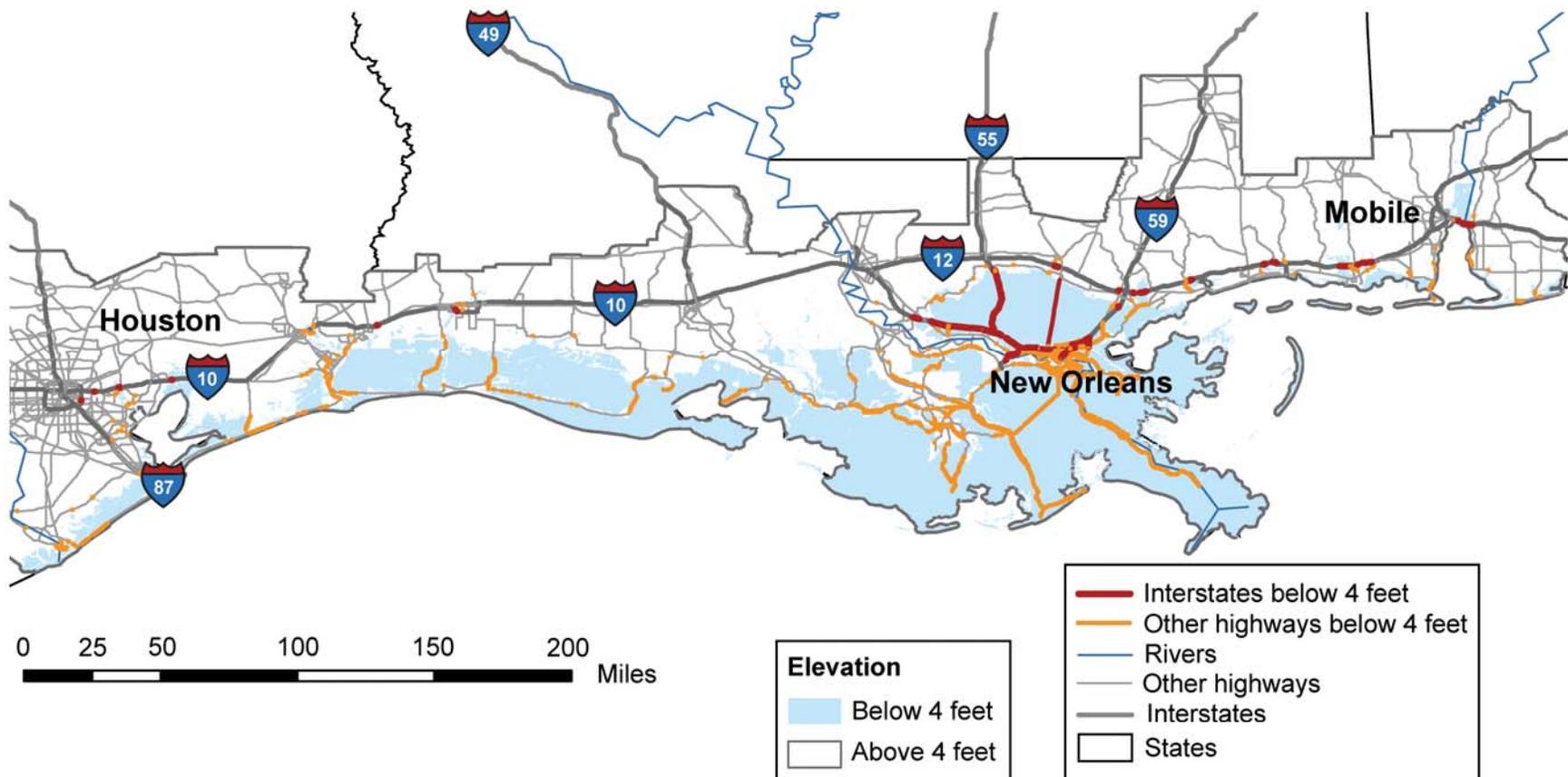


Chandeleur Islands, east of New Orleans, before and after the 2005 hurricanes

217 square miles, 85% of the island's land mass was lost

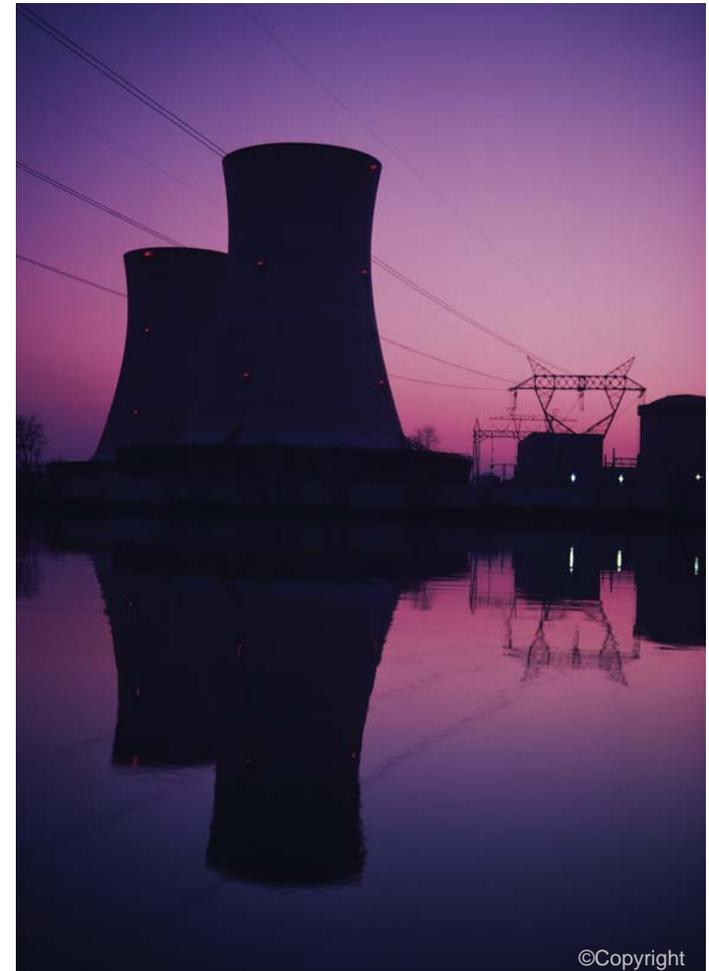
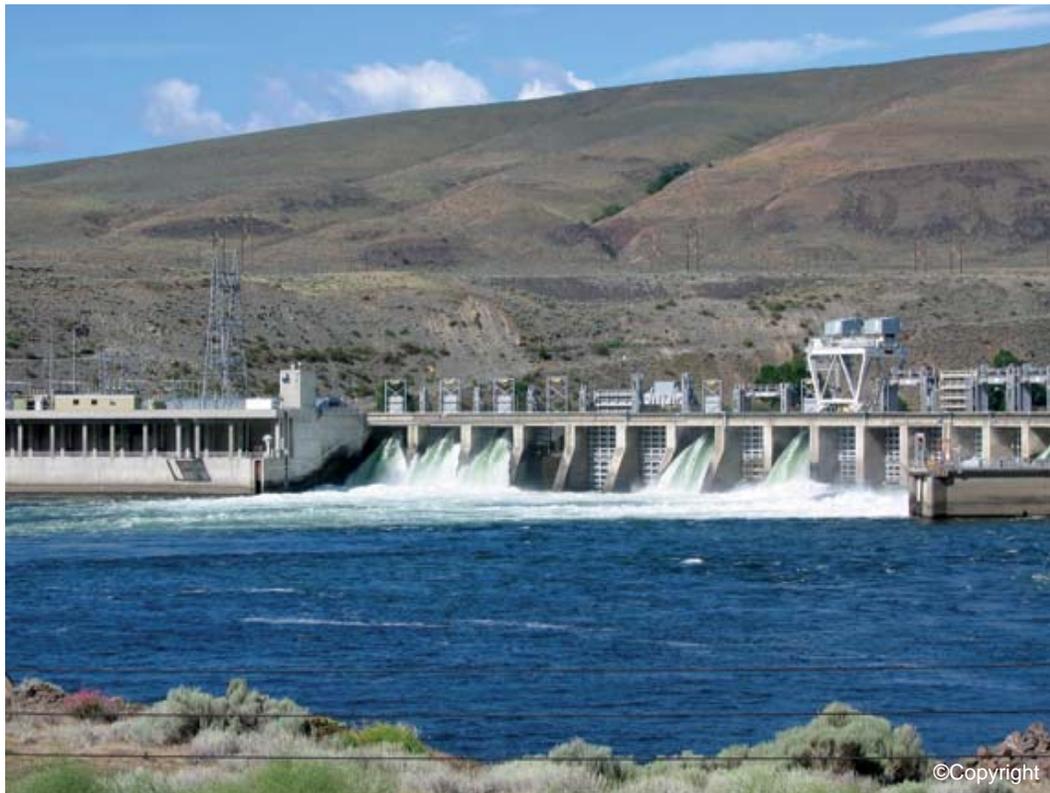
Energy and transportation infrastructure in coastal areas faces increasing risk.

Gulf Coast Area Roads at Risk from Sea-Level Rise



Various effects of climate change will interact, compounding and amplifying impacts.

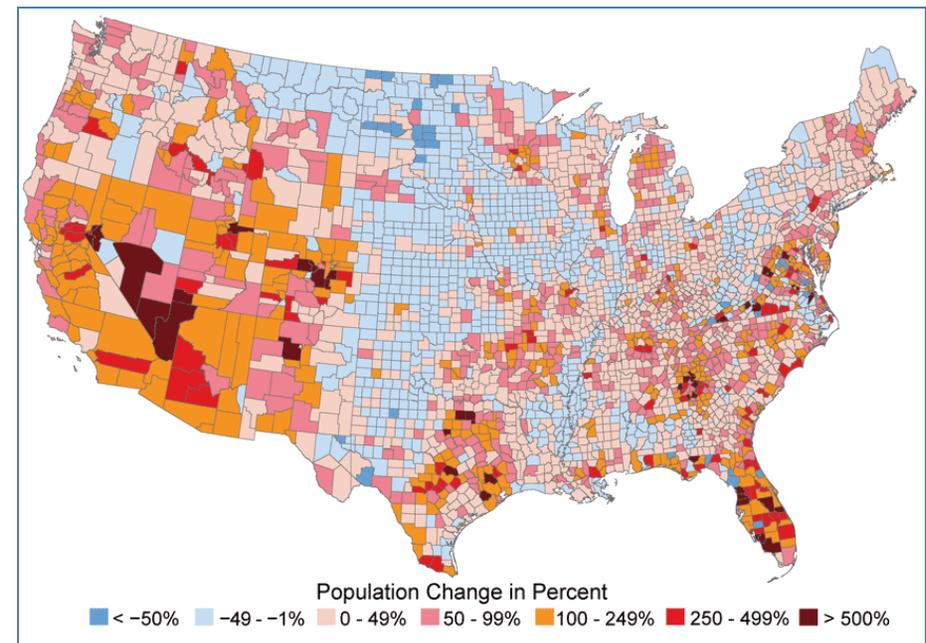
Water and Energy Interactions



Climate change will interact with many social and environmental stresses

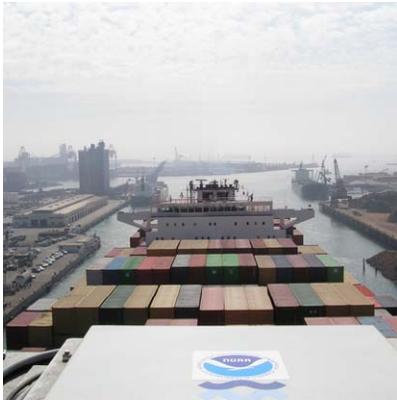
- Social trends can increase our vulnerability to climate change
 - Concentration of development along vulnerable coasts
 - Aging of U.S. population
 - Increasing urbanization
 - Population growth in Southeast, vulnerable to hurricanes, sea-level rise, and heat stress
 - Population growth in Southwest, vulnerable to increasing water scarcity and wildfires
- Impacts on people, infrastructure, and climate sensitive resources and sectors
- Development choices affect impacts of and vulnerability to climate change

Population Change, 1970 to 2008





The Rising Demand for Climate Services



Commerce



Coasts



Recreation



Ecosystems



Hydropower



Farming



Wind Energy



Private Sector