Climate Change

National Park Service
U.S. Department of the Interior

Southeast Region

Impacts on National Parks in the Southeast

What Scientists Say

According to the Intergovernmental Panel on Climate Change (IPCC), "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level." Climatologists believe the magnitude and pace of these and other probable changes are unprecedented in human history.

The southeast United States is already experiencing the effects of climate change, including:

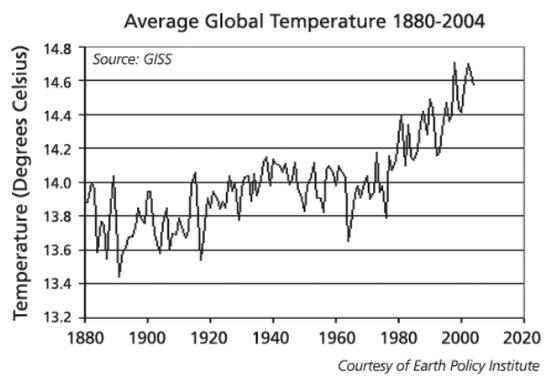
- rising air temperatures
- rising sea levels
- shifting species ranges
- rising ocean temperatures
- acidification of water bodies
- changing weather patterns

The consequences of these climate changes have significant implications for the natural and cultural resources in our National Parks and will greatly affect the visitor experience.

Temperature and Precipitation

Eleven of the last twelve years (1995–2006) rank among the warmest on record. The warming trend over the last fifty years is nearly twice that for the last hundred years. Scientists agree that air temperature will continue to rise. Current models forecast an increase ranging from 3°F to 10°F, and temperatures appear to be currently tracking at the higher end of this range.

Although precipitation is harder to forecast, it is generally agreed that in the Southeast it will become erratic with fewer but larger rain events.



Sea-Level Rise

Sea-level rise—one of the more certain consequences of climate change—has a significant impact on coastal areas. The IPCC predicts that global sea levels will rise 7 to 13 inches in the next century due both to the melting of the Greenland ice sheet and polar ice caps and to seawater expanding as it warms. Many scientists believe the IPCC estimates are too low, and that sea-level rise may exceed this prediction if rapid changes in polar ice flow continue.

All coastal parks in the Southeast are prone to flooding, inundation, and erosion. Most of Dry Tortugas, Biscayne, and Everglades National Parks, as well as Timucuan Ecological and Historic Preserve have elevations below 3 feet. Over half of Cumberland Island and Cape Hatteras National Seashores are vulnerable to sea-level rise.

Similarly, a great many cultural and historic resources, including Fort Massachusetts at Gulf Islands National Seashore and Fort Jefferson at Dry Tortugas National Park, are threatened by rising sea levels. Some cultural resources could be moved out of harms way, as was the Cape Hatteras lighthouse in 1999 at the cost of millions of dollars. The National Park Service and the nation as a whole will have to decide which resources it can afford to save.

The rate of sea-level rise may be just as important as the extent. For example, mangrove trees stabilize sediments by accumulating soil and effectively raising ground elevation. If the rise is slow, mangroves may be able to keep pace. But, if the rise is too rapid, mangroves and coastal freshwater could be inundated with seawater.

Species Shifting Ranges

In response to the warming trend, some plant and animal species that evolved in cooler temperatures will shift northward or to higher elevations. Others may be unable to migrate because of topography or human land-use. Also, species whose entire populations are found at high elevations, such as those in the Great Smoky Mountains National Park, may get "squeezed" off the peaks or plateaus—leading not only to their loss in the parks, but to their extinction.

Species remaining in their traditional ranges may experience more competition from nonnative flora and fauna. A warming climate also contributes to the range expansion of invasive and pest species, such as fire ants, pine beetles, kudzu, and privet. Scientists believe that with frequent droughts, tree die-offs, and fires, forests could contribute more carbon dioxide (CO_2)—the primary global-warming gas produced by humans—to the atmosphere than they remove.

Ocean Warming and Acidification

Researchers have documented an unprecedented rise in atmospheric CO_2 and near-land air and sea-surface temperatures. According to the IPCC, the latter may increase 2°F to 5°F by 2100. Scientists are concerned that the health and vitality of ocean ecosystems are threatened by ocean warming.

In 2005, abnormally warm waters badly damaged coral reefs in the eastern Caribbean. For most coral species and many other reef organisms, several weeks of warm water—just 2°F above peak summer temperatures—cause harm. When this happens, the symbiotic algae that live within coral cells are ejected, causing the white skeletons to become visible through the coral tissue in a phenomenon known as "bleaching." This can increase the coral's susceptibility to disease and severely impact the entire coral-reef ecosystem.

Scientists have also linked high sea-surface temperatures to sea grass die-offs. Higher sea temperatures could fuel algal blooms or promote marine diseases.

Oceans provide a valuable service by absorbing CO_2 from the air, which slows the warming of the Earth's atmosphere. In the past two hundred years, oceans have absorbed about 525 billion tons of CO_2—nearly half of all fossil-fuel emissions. But because CO_2 also lowers water pH, scientists are concerned that oceans are absorbing too much CO_2 and becoming much more acidic. Increased ocean acidity threatens shells, the protective coatings and skeletons of tiny organisms (including those that make up corals), oysters, mussels, and crabs. Even organisms without shells, including fish in egg and larval forms, appear susceptible.

More Intense Weather Events

Sea-surface temperature rise can greatly affect the weather and cause storm events to become more common. Because hurricanes strengthen over warm water, scientists believe that their frequency and intensity will increase. The Southeast is expected to experience more active hurricane seasons, such as in 2005 when ocean water was abnormally-warm. Hurricane Wilma, the strongest Atlantic storm ever recorded, was one of four major hurricanes to strike Florida that year. That same season Hurricane Katrina battered Louisiana, Texas, Mississippi, and Alabama. These storms caused huge human and financial costs, as well as tremendous ecological damage from coastal erosion and saltwater intrusion (contamination of fresh groundwater by saltwater).

Hope for the Future

The National Parks have initiated a variety of strategies to help mitigate the effects of and adapt to climate change.

Monitoring Long-Term Changes

One critical step is to inventory and monitor major biotic and abiotic natural resources. Reliable information allows parks to take corrective actions before climate change severely degrades or causes irreversible damage to an ecosystem's integrity. Organized into networks linked by geography and shared natural resource characteristics, parks work together to identify and monitor the highest priority and most appropriate vital signs and track the condition of their natural resources over time.

Increasing Efficiency of Facilities/Operations

Southeast parks are taking steps to minimize the impact of their operations. Blue Ridge Parkway, Little River Canyon National Preserve, and Great Smoky Mountains and Mammoth Cave National Parks have built highly energy-efficient visitor or education centers. Parks have installed alternative energy sources, such as the wind turbine at Cape Hatteras National Seashore, and numerous photovoltaic (solar) arrays; the one at Dry Tortugas National Park powers an entire island. Parks are leading the way with recycling and green-purchasing programs, and forging ahead with renewable energy and energy-efficiency plans.

Protecting Natural Areas

Dry Tortugas National Park, Buck Island Reef National Monument, and Virgin Islands Coral Reef National Monument are among the parks that have designated 'no-take' areas to protect ecosystems and help them become more resilient to the effects of climate change. For example, managers are using these areas to monitor the impacts of climate-change on coral reefs over time.

Creating Climate Friendly Parks

The National Park Service and the U.S. Environmental Protection Agency are partnering to make National Parks models of climate stewardship and education. The Climate Friendly Parks program

- educates park employees about climate change, air pollution, and their role in reducing air pollutants;
- develops a plan for each park to reduce emissions of greenhouse gases and other air pollutants; and
- explains to the public how climate change and air pollution affect parks, how parks mitigate and adapt to the effects, and how individuals can reduce their own greenhouse emissions.

The Everglades and Great Smoky Mountains National Parks are participating in this program.

Reduce Your Impact on the Climate

In its 2007 report, the IPCC expressed with greater than 90 percent certainty that most of the observed warming over the past half-century was caused by human activities; they noted energy production as a contributor. By reducing energy use to a basic level, offsetting the emissions we do generate by recycling, and investing in clean alternative energies, we may move toward carbon "neutrality" and not further compromise global resources.

You can begin with some simple steps:

- use public transportation whenever possible;
- unplug computers and electrical devices when not in use;
- change to energy-efficient light bulbs and appliances;
- consider supporting habitat conservation efforts; and
- learn more about climate change.

Here are some web sites to get started...

www.nps.gov/goga/naturescience/upload/sb-climate.pdf

www.nps.gov/ever/naturescience/sfnrc.htm

www.epa.gov/climatechange