National Parks in Peril
The Threats of Climate Disruption

State Fact Sheet: North Carolina and Tennessee

Human disruption of the climate is the greatest threat ever to our national parks.

At risk are nearly every resource and value that make our national parks so special. In National Parks in Peril, the Rocky Mountain Climate Organization and the Natural Resources Defense Council identify 25 national parks as having the greatest vulnerabilities to human-caused climate change. In North Carolina and Tennessee, Cape Hatteras National Seashore and Great Smoky Mountains National Park are among the 25 parks most at risk. Cape Hatteras is vulnerable to higher seas and stronger storms, more downpours and floods, a loss of plant communities, a loss of wildlife, loss of historical and cultural resources, overcrowding, and a loss of fishing. Great Smoky Mountains is vulnerable to a loss of ice and snow, more downpours and floods, a loss of plant communities, a loss of wildlife, overcrowding, a loss of fishing, and more air pollution. Other parks in North Carolina, including Cape Lookout National Seashore and Wright Brothers National Memorial, face similar vulnerabilities.

Many of these impacts are already happening, as human activities—the emission of heat-trapping gases—are now changing the climate. To preserve our national parks for ourselves and future generations, we need to both stop changing the climate and take actions to preserve the resources and values that make our parks special. For detailed recommendations, see the full report, National Parks in Peril.

Loss of Ice and Snow

As the climate gets hotter, national parks in the North and in mountain ranges are losing ice and snow—one of the most obvious effects of a changed climate on our national parks. Snow-covered mountains in Great Smoky Mountains create what many people consider to be the park's most spectacular scenery. But higher temperatures, less snowfall, and earlier snowmelt are already leading to less snow in parks.

the ROCKY MOUNTAIN CLIMATE Organization

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To read the full report on the impacts of global warming on national parks, visit www.nrdc.org/policy or www.rockymountainclimate.org

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Higher Seas and Stronger Storms

A hotter climate raises sea levels by melting ice from land-based glaciers and ice sheets, which adds more water to the oceans, and by heating water so that it expands in volume, which also pushes sea levels higher. Current estimates are that with a high-emissions future sea level will rise three to four more feet by the end of the century; under a lower-emissions future, the seas are expected to rise about 2.3 feet. A second major risk to coasts and coastal parks comes from stronger coastal storms, including hurricanes. According to a recent U.S. government report, climate models project that further warming of ocean waters will lead to stronger tropical storms.

In a recent report, the U.S. government says that Cape Hatteras National Seashore, already affected by recent sea-level rise and storms, may not be far from being fragmented or undergoing other permanent geological change. With any increase in the current rate of sea-level rise, it is “virtually certain” that the barrier island will experience large changes and degradation. With even a modest increase of an additional inch of sea-level rise every dozen

that the barrier island will experience large changes and degradation. With even a modest increase of an additional inch of sea-level rise every dozen years, it is “very likely”—at least a two-thirds chance—that the seashore will be broken into multiple separate segments.

Cape Lookout and Wright Brothers National Memorial are also vulnerable to higher seas and coastal storms.

More Downpours and Floods

With a changed climate, more precipitation now comes in downpours. The amount of rain falling in heavy storms increased by 20 percent over the past century, while there has been little change in the amount from light and moderate storms. In its recent report, the U.S. Global Change Research Program says there is at least a 90 percent likelihood that heavy downpours will become even more frequent and intense. With an increase in downpours, flooding also is likely to increase. Virtually all national parks in North Carolina, Tennessee, and elsewhere are at risk, as the forecast is for more downpours everywhere. An extreme downpour in Mount Rainier National Park in 2006 illustrates the risk—it caused so much flooding that the entire park was closed for a full six months.

Loss of Plant Communities

An altered climate can lead to fundamental changes in the natural plant communities of parks, including a disruption of mountain forests and wildflowers. In coastal parks, the plant communities of wetlands, intertidal areas, and near-shore ecosystems could be lost to the effects of sea-level rise, stronger coastal storms, storm surges, and saltwater intrusion, all of which are projected to result from a human-changed climate.

Great Smoky Mountains has a greater diversity of native plants than any other national park, including more than 1,660 kinds of flowering plants. “Vegetation is to Great Smoky Mountains National Park what granite domes and waterfalls are to Yosemite and geysers are to Yellowstone,” says the National Park Service. The park is already struggling with invasive plant species that threaten the local ecosystems, a problem which could be worsened by an altered climate.

At Cape Hatteras, the plant communities of the coastal dune ecosystems, marshes, and intertidal areas are at risk.

Loss of Wildlife

For many Americans, the highlight of a trip to a national park is the wildlife they see. But a changed climate could mean less of the wildlife species now in the parks. Some species may go completely extinct, and, local populations in particular parks may be eliminated or decline sharply.

Researchers from Yale University studied the possible effects of climate change on mammals in eight national parks. They projected that a doubling of atmospheric levels of heat-trapping gases could change habitat in the parks enough to eliminate some species. The greatest losses were projected for the southernmost parks in their study, Big Bend and Great Smoky Mountains, where eight species could be lost. They also projected that as many as 29 new species might move into Great Smoky Mountain as habitats change and became suitable to them. A major caveat here, though, is that the researchers did not consider whether there would be geographic or other barriers to species moving into the park. Should as many new species move into the park as the researchers projected, there would be substantial new competition for habitat and food, creating another stress on the native local wildlife.

The beaches of Cape Hatteras provide nesting habitat for sea turtles, but the seashore is vulnerable to sea-level rise and stronger storms and as a result so are the sea turtles.

An altered climate is likely to reduce inland populations of cold-water fish species, including trout and salmon. For trout, a hotter climate is the single greatest threat to their survival; when water temperatures reach the mid-70°s, trout can die. In the southern Appalachian Mountains, over half of the wild trout populations are likely to disappear because of hotter streams. This region includes Great Smoky Mountains, which has 133 miles of streams with native brook trout.

Loss of Historical and Cultural Resources

By preserving some of the best of our historical and cultural resources—buildings, landscapes, archaeological sites, and artifacts—America's national parks provide information about the past and provide important links to the present. Many of these resources are at risk from the possible effects of a climate disrupted by human activities.

Rising seas and stronger coastal storms threaten cultural resources in coastal parks. Cape Hatteras' narrow line of barrier islands erodes under natural conditions from tides, currents and waves. With an altered climate leading to higher seas and stronger coastal storms, the U.S. Global Change Research Program reports that it is virtually certain that barrier islands in the mid-Atlantic region, including those at Cape Hatteras, will erode more quickly. If the rate of sea-level rise accelerates by only a mere 0.08 to 0.28 inches per year, the report says, there is at least a two-thirds chance that some barrier islands will be broken apart. Already, the seashore's Cape Hatteras Lighthouse, the tallest brick lighthouse in the United States, has been moved because of sea-level rise. When constructed in 1870 it was 1,500 feet from the shoreline; by 1998, after natural migration of the barrier island and the 20th century's sea-level rise, it was only 120 feet from the Atlantic Ocean. After a study by the National Academy of Sciences confirmed that the lighthouse was indeed in danger of being inundated by continued rise of the Atlantic, it was moved 2,900 feet inland. That took two years and cost taxpayers $4.6 million. Knowing that even this relocation may prove to be inadequate in the face of rising seas and stronger storms, the National Park Service left steel beams under the lighthouse to make the next move easier.

More Overcrowding

As temperatures soar with a changed climate, to escape oppressive heat enough people may flock to cooler mountain parks and to national seashores to overcrowd them. In these parks, the impacts of additional visitation could include less visitor enjoyment and damage to park resources. Overcrowding could be a significant problem, particularly for those parks that offer a break from heat and are close to major population centers, including Great Smoky Mountains, which has the highest mountains in the Southeast and already more than 9 million visits, and Cape Hatteras.

Loss of Fishing

Fishing is a popular pastime in national parks. But now a changed climate threatens to reduce fish populations and recreational fishing opportunities in the parks. Populations of trout, a cold-water fish, are threatened with widespread declines because of hotter water temperatures. In the future, if populations of trout species decline as precipitously as scientists project, anglers might face more restrictions on trout fishing in Great Smoky Mountain.

At Cape Hatteras, surf fishing is popular, but the beaches where people fish—or access to them—could be lost if the island is fragmented or inundated by sea-level rise.

More Air Pollution

A hotter climate is projected to worsen concentrations of ground-level ozone, a component of smog created when pollutants mix in sunlight. Ground-level ozone has been firmly established to harm people's health, and the U.S. Environmental Protection Agency has set air quality standards at the levels necessary to prevent adverse health effects.

Many people think of ozone as a big-city air pollution issue, but it is a problem in many national parks, affecting both the enjoyment and the health of visitors. In 2005-2007, Great Smoky Mountains was one of 11 national parks with permanent air-quality monitoring stations with levels of ozone violating the national health-based air quality standards for ozone, as recently strengthened by EPA. The park exceeded an older, less stringent health-based standard for ozone more than 300 times since 1990. Ozone levels there are chronically so high that they affect visitors and plants in the park. Because future climate-change driven increases in ozone levels are expected to be greatest where ozone levels already are high, the park is at particular risk of continued, perhaps worsened, levels of unhealthful air.

For documentation of the sources used for this fact sheet, please see the full report, *National Parks in Peril: The Threats of Climate Disruption*, at www.rockymountainclimate.org or www.nrdc.org/policy.