

NATIONAL PARKS IN PERIL

THE THREATS OF CLIMATE DISRUPTION



*At stake are the resources and values
that make our national parks the special
places that Americans love.*

the
**ROCKY
MOUNTAIN
CLIMATE**
Organization



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EXECUTIVE SUMMARY

National Parks Most At Peril

- Acadia National Park
- Assateague Island National Seashore
- Bandelier National Monument
- Biscayne National Park
- Cape Hatteras National Seashore
- Colonial National Historical Park
- Denali National Park and Preserve
- Dry Tortugas National Park
- Ellis Island National Monument
- Everglades National Park
- Glacier National Park
- Great Smoky Mountains National Park
- Indiana Dunes National Lakeshore
- Joshua Tree National Park
- Lake Mead National Recreation Area
- Mesa Verde National Park
- Mount Rainier National Park
- Padre Island National Seashore
- Rocky Mountain National Park
- Saguaro National Park
- Theodore Roosevelt National Park
- Virgin Islands National Park/Virgin Islands Coral Reef National Monument
- Yellowstone National Park
- Yosemite National Park
- Zion National Park

THE GREATEST THREAT TO NATIONAL PARKS

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

This report focuses primarily on 25 national parks that we identify as having the greatest vulnerabilities to human-caused climate change. They face 11 different types of risks.

A **loss of ice and snow** is one of the most obvious impacts of a changing climate. Glaciers are melting in our national parks, a handful of



ROCKY MOUNTAIN NATIONAL PARK
PHOTO: JOHN FIELDER

which contain the vast majority of the nation's glaciers. In many national parks, snow-covered mountains contribute to some of the most spectacular scenery in the nation. But higher temperatures, less snowfall, and earlier snowmelt are already leading to declines in mountain snowpack across the West. With less snow, fewer visitors will be able to see snow-capped mountains in parks. Opportunities for cross-country skiing, snowshoeing, and other winter activities in parks also will be reduced. (See pages 7-10.)

For a summary of how losses of ice and snow, and other impacts, are already underway in national parks, see the next page.

Parks in the West and along the Great Lakes face a **loss of water**. In the West, a changed climate will reduce water availability, especially in the summer. The Colorado Plateau, home to our largest concentration of national parks, is expected to get particularly hotter and drier. In Zion National Park, reductions in river flows could change how the Virgin River is continuing to shape Zion Canyon. Water levels of the Great Lakes are likely to fall, affecting ecosystems and recreation in Great Lakes parks. (See pages 11-14.)

The 74 national parks on our coasts face **higher seas and stronger coastal storms**. Depending on future emissions of heat-trapping gases, seas are expected to rise from about 2.3 feet to 3 or 4 feet by century's end. Nearly all of Everglades, Biscayne, and Dry Tortugas national parks and Ellis Island National Monument are less than that above the current sea level. All four parks could be lost to rising seas, representing the first-ever losses of entire national parks. (See pages 15-18.)

How National Parks Are Already Changing

Glaciers are already melting in all national parks that have them, including **Denali**, **Mount Rainier**, and **Yosemite** national parks. All glaciers in **Glacier** National Park could be gone in 12 or 13 years. (See pages 7-9.)

Mountain parks are already losing late-summer streamflows as smaller glaciers produce less meltwater. In one glacier-fed watershed in **North Cascades** National Park, summer flows already are down 31 percent. (See page 9.)

In the West, more winter precipitation is already falling as rain rather than snow, and snow is melting earlier. Western parks already have less mountaintop snow in spring and summer. (See pages 9-10.)

In **Yellowstone** National Park, the winter season for snowcoaches and snowmobiles already is starting in December or even January rather than November. (See page 10.)

The Colorado Plateau already has both drier conditions and the greatest temperature increase in the 48 contiguous states. In **Bandelier** National Monument and **Mesa Verde** National Park, as many as 90 percent of piñon pines have died. (See page 12.)

The coastal barrier island of **Assateague Island** National Seashore, already hammered by rising sea level and coastal storms, is not far from being broken apart by the sea. (See page 16.)

The National Park Service has already had to move **Cape Hatteras** Lighthouse inland to keep it above the rising sea. (See page 34.)

Across the country, more heavy storms already are producing bigger downpours. A heavy downpour in 2006 flooded **Mount Rainier** National Park so much that it was closed for six months. (See page 18.)

Western mountains already are hot enough that tree-killing bark beetles are spreading to higher elevations than before and reproducing faster, in some places with two generations a year instead of just one. In **Rocky Mountain** National Park, nearly all mature lodgepole pine trees are being killed by beetles. (See pages 19-21.)

In **Yosemite** and **Sequoia/Kings Canyon** national parks and other spots across the West, trees of all types and ages are dying at faster rates than before. (See page 21.)

In **Yosemite**, winters have already warmed up so much that the lower-elevation edges of conifer forests are dying out and being replaced by oak and chaparral. (See pages 21-22.)

In **Saguaro** National Park, hotter temperatures already are promoting the spread of buffelgrass, an invasive species that brings wildfire into the desert ecosystem for the first time, threatening saguaros and other native desert species. (See page 22.)

In **Yellowstone** National Park, mountain pine beetles already are infesting higher elevations and before and threatening to wipe out whitebark pines, a mountaintop species. Their nuts are such an important pre-hibernation food for the region's grizzly bears that reduced whitebark pine nuts lower grizzly birth rates. (See page 28.)

Pikas, mountaintop mammals especially sensitive to warm temperatures, already have been eliminated in several of the lower-elevation mountains they used to inhabit. (See page 26.)

In **Yosemite** National Park, mammals already are changing where they live by moving to higher elevations. (See page 26.)

In **Rocky Mountain** National Park, mountaintop tundra areas already are warming up earlier in the spring, which is linked to a 50 percent decline in white-tailed ptarmigan, which live on the tundra year around. (See page 27.)

In **Yosemite** and **Sequoia/Kings Canyon** national parks, conditions already are hotter and drier, apparently driving a 10 percent per year decline in mountain yellow-legged frogs. (See page 29.)

In **Yellowstone** National Park's Firehole River in 2007, temperatures already were hot enough for several days to kill as many as a thousand trout in the largest documented fish kill in the park's 135-year history. (See page 30.)

In **Virgin Islands** National Park, 50 percent of the corals in the park's coral reefs have died since 2006 from causes related to excessive water temperatures. (See page 31.)

In **Yellowstone** National Park, summer heat has already become excessive enough to stress trout, which are coldwater fish, prompting the National Park Service to close 232 miles of rivers to fishing. (See page 37.)

More downpours and flooding are occurring everywhere, as a changing climate already is leading to more precipitation coming in heavy storms. The forecast is for the heaviest precipitation events to continue getting stronger, causing erosion and flooding that threatens resources in virtually all parks. (See page 18.)

An altered climate is leading to a **loss of plant communities** of parks, including a disruption of mountain forests, tundra, meadows, and wildflowers; of desert ecosystems; and of coastal plant communities. In **Saguaro** National Park, saguaros could be eliminated, and in **Joshua Tree** National Park, Joshua trees could be eliminated. (See pages 19-24.)

A **loss of wildlife** in parks is projected to result from a changed climate, as some species may go completely extinct and some local wildlife populations in particular parks may be eliminated or decline sharply. Among the populations that are vulnerable are grizzly bears in **Yellowstone** and **Grand Teton** national parks, lynx, Florida panthers, pikas, mountain and desert bighorn sheep, white-tailed ptarmigan, sooty terns, sea turtles, amphibians, trout, salmon, corals, and butterflies. (See pages 25-32.)

Higher seas, stronger coastal storms, and increased downpours and flooding threaten a **loss of historical and cultural resources** in national parks. At particular risk are **Ellis Island** National Monument in Upper New York Bay, less than three feet above the current high tide level, through which passed the arriving ancestors of 40 percent of all living Americans; the **Statue of Liberty** National Monument, also in Upper New York Bay; and the **Jamestown** National Historic Site, part of **Colonial** National Historical Park in Virginia, where the first European ancestors of today's Americans arrived in 1607. (See pages 33-34.)

National parks in the hottest parts of the country could suffer **intolerable heat**, simply becoming too hot for long stretches of the

year for many people. Under a higher-emissions future, **Big Bend**, **Death Valley**, **Joshua Tree**, and **Saguaro** national parks, **Mojave** National Preserve, and **Lake Mead** National Recreation Area are projected to average more than 100 days a year over 100°F. Those parks, **Biscayne** and **Everglades** national parks, and **Big Cypress** National Preserve are projected to average 90°F or hotter for half or more of the entire year. (See page 35-36.)

As temperatures soar with a changed climate, cooler northern and mountain parks and national seashores could experience overcrowding as people flock to them to escape oppressive heat. (See pages 36-37.)

Hotter temperatures could sharply reduce populations of trout and salmon, which are coldwater fish species, and lead to a **loss of fishing** in national parks. Damage to coral reefs and other marine resources also could reduce sportfishing in coastal parks. (See pages 37-38.)

A hotter climate is also projected to lead to **more air pollution** in parks by worsening concentrations of ground-level ozone, the key component of smog. Many national parks already violate the health-based air quality standard for ozone, and that air pollution problem could get worse with a changed climate. (See page 38.)

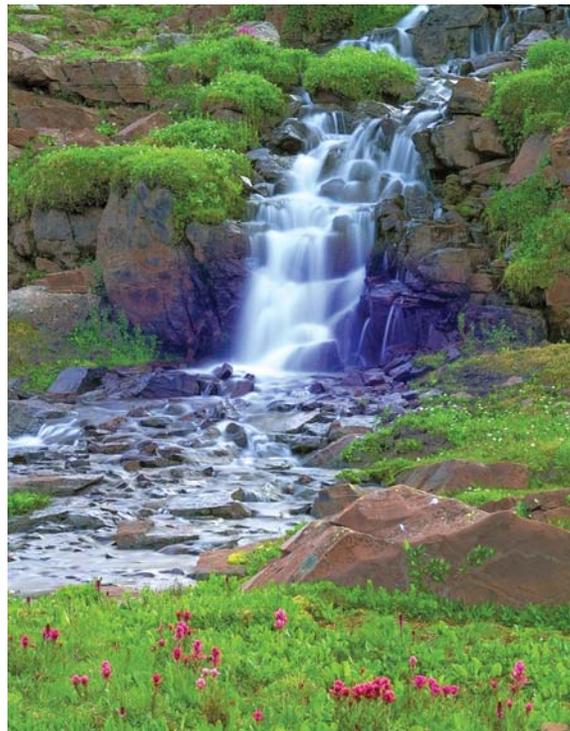


PHOTO: JOHN FIELDER

RECOMMENDATIONS

As the risks of a changed climate dwarf all previous threats to our national parks, new actions to face these new risks must also be on an unprecedented scale. Needed are both actions specific to parks to preserve their resources and actions to curtail emissions of climate-changing pollutants enough to reduce the impacts in parks and elsewhere.

This report recommends 32 actions specific to national parks, including:

- The Congress, the Administration, and the NPS should set aside new national parks and expand existing parks as necessary to preserve for future generations representative and sufficient examples of America's best natural and cultural resources.
- The NPS should promote, assist, and cooperate in preservation efforts beyond park boundaries to preserve large enough ecosystems, crucial habitat, and migration corridors so that plants and animals have opportunities to move and continue to survive in transformed landscapes.
- Congress, the Executive Branch, and the NPS should consider the combined effects of climate change and of other stresses on park resources and values, and work to reduce all the stresses that pose critical risks to parks.
- The NPS should develop park-specific and resource-specific plans to protect the particular resources most at risk in individual parks.
- The NPS should use all its authorities to protect parks from a changing climate, including its "affirmative responsibility" under the Clean Air Act to protect the air-quality related values of national parks.
- The NPS should adopt a nationwide goal of becoming climate-neutral in its own operations within parks, as has been done in its Pacific West Region. The Service should give an even greater priority to reducing the greater levels of emissions coming from visitor activities.
- NPS officials should speak out publicly about how climate change and its impacts threaten national parks and the broader ecosystems on which they depend.
- The NPS should use its environmental education programs to inform park visitors about a changed climate and its impacts in parks and

about what is being done in parks to address climate change and its impacts. The NPS should require concessionaires to do so, too.

- The Congress and the Administration should adequately fund NPS actions to address a changing climate, through the energy and climate legislation now in Congress, through new NPS authority to use entrance fees to reduce emissions of heat-trapping gases and address impacts in parks, and through funding of the Land and Water Conservation Fund.
- The Congress and the Administration should reestablish within the NPS the scientific and research capacity it had prior to 1993, by returning to NPS the programs and staff transferred that year to the U.S. Geological Survey.

Ultimately, to protect our national parks for the enjoyment of this and future generations, federal action to reduce heat-trapping gases is needed so that a changed climate and its impacts do not overwhelm the parks. The federal government must take three essential steps:

- Enact comprehensive mandatory limits on global warming pollution to reduce emissions by at least 20 percent below current levels by 2020 and 80 percent by 2050. This will deliver the reductions that scientists currently believe are the minimum necessary, and provide businesses the economic certainty needed to make multi-million and multi-billion dollar capital investments.
- Overcome barriers to investment in energy efficiency to lower emission reduction costs, starting now.
- Accelerate the development and deployment of emerging clean energy technologies to lower long-term emission reduction costs.



PHOTO: JOHN FIELDER

NATIONAL PARKS MOST AT RISK

Human-caused climate change puts at risk nearly every resource and value that makes our national parks so special. The scenery of parks is being affected as glaciers melt, mountains lose snow-covered peaks, and forests die back. Wildlife is being affected by climate-driven changes in habitat and disruptions of food sources. Cultural resources are being affected as rising seas, stronger storms, and bigger floods erode historic and prehistoric structures and wash away artifacts. Visitor enjoyment is being affected as fishing is prohibited, boating is curtailed, and opportunities for cross-country skiing diminish.

These impacts are imperiling most, if not all, of the 391 parks* in the national park system. This report focuses primarily on 25 national parks that we identify as having the greatest vulnerabilities to human-caused climate change. They were chosen, first, based on how much an altered climate may affect the overall integrity of a particular park's resources and values. Parks at risk of being entirely submerged by a rising sea obviously are in greater overall peril than most parks. Second, the parks on the list reflect both the diversity of the national park system and the variety of threats an altered climate poses to parks. Third, the list was necessarily influenced by the information available about the particular risks individual parks face.

Unfortunately, there usually is very little information about how a disrupted climate may affect an individual park. As the National Park Service (or NPS) and others further assess the impacts of climate change on parks, it may become clear that some parks not on the list actually have greater vulnerabilities than ones on it. This could especially be true for the 17 national parks in Alaska, which so far has gotten hotter at twice the rate of the rest of

* This report refers to all units of the national park system as national parks or parks, even if they are designated as national monuments, national seashores, or something else. All are managed under the same general laws and policies.



DENALI NATIONAL PARK

“We identified the lack of any climatic data within Glacier Bay as a significant gap in knowledge about a very important and basic driver of the physical and biological systems within the Park, a sentiment echoed by many Park staff and researchers alike. Although specific funding for climate monitoring could not be secured, it was an obvious data gap that we have tried to fill by establishing the current network of climate sites.”

— Daniel E. Lawson and David C. Finnegan, Dartmouth College (2008)¹

the country and which is expected to continue getting hotter than elsewhere. But how parks in Alaska will be affected is not yet well documented. For now, **Denali** National Park and Preserve, the one Alaskan park on our list, should be considered as broadly representative of the threats to all parks in Alaska.

The 25 national parks in greatest peril are identified in the chart on the following pages, which also indicates the particular risks faced by each park. There are 11 categories of such risks: a loss of ice and snow, addressed in chapter 2; a loss of water, in chapter 3; higher seas and stronger coastal storms, in chapter 4; more downpours and flooding, also in chapter 4; a loss of plant communities, in chapter 5; a loss of wildlife, in chapter 6; a loss of historical and cultural resources, in chapter 7; and intolerable heat, overcrowding, a loss of fishing, and more air pollution, all in chapter 8.

25 National Parks Most at Peril from

| | Loss of Ice & Snow | Loss of Water | Higher Seas & Stronger Storms | More Downpours & Floods | Loss of Plant Communities |
|--|---|---|---|---|---|
| Acadia NP, ME |  | |  |  |  |
| Assateague Island NS, MD/VA | | |  |  |  |
| Bandelier NM, NM |  |  | |  |  |
| Biscayne NP, FL | | |  |  |  |
| Cape Hatteras NS, NC | | |  |  |  |
| Colonial NHP, VA | | |  |  | |
| Denali NP&P, AK |  |  | |  |  |
| Dry Tortugas NP, FL | | |  |  |  |
| Ellis Island NM, NY/NJ | | |  |  | |
| Everglades NP, FL | | |  |  |  |
| Glacier NP, MT |  |  | |  |  |
| Great Smoky Mts NP, TN/NC |  | | |  |  |
| Indiana Dunes NL, IN |  |  | |  |  |
| Joshua Tree NP, CA | | | |  |  |
| Lake Mead NRA, NV/AZ | |  | |  |  |
| Mesa Verde NP, CO |  |  | |  |  |
| Mount Rainier NP, WA |  |  | |  |  |
| Padre Island NS, TX | | |  |  |  |
| Rocky Mountain NP, CO |  |  | |  |  |
| Saguaro NP, AZ | |  | |  |  |
| Theodore Roosevelt NP, ND | | | |  |  |
| Virgin Islands NP/Virgin Islands Coral Reef NM, VI | | |  |  | |
| Yellowstone NP, WY/MT/ID |  |  | |  |  |
| Yosemite NP, CA |  |  | |  |  |
| Zion NP, UT |  |  | |  |  |

Legend:

NP = National Park

NM = National Monument

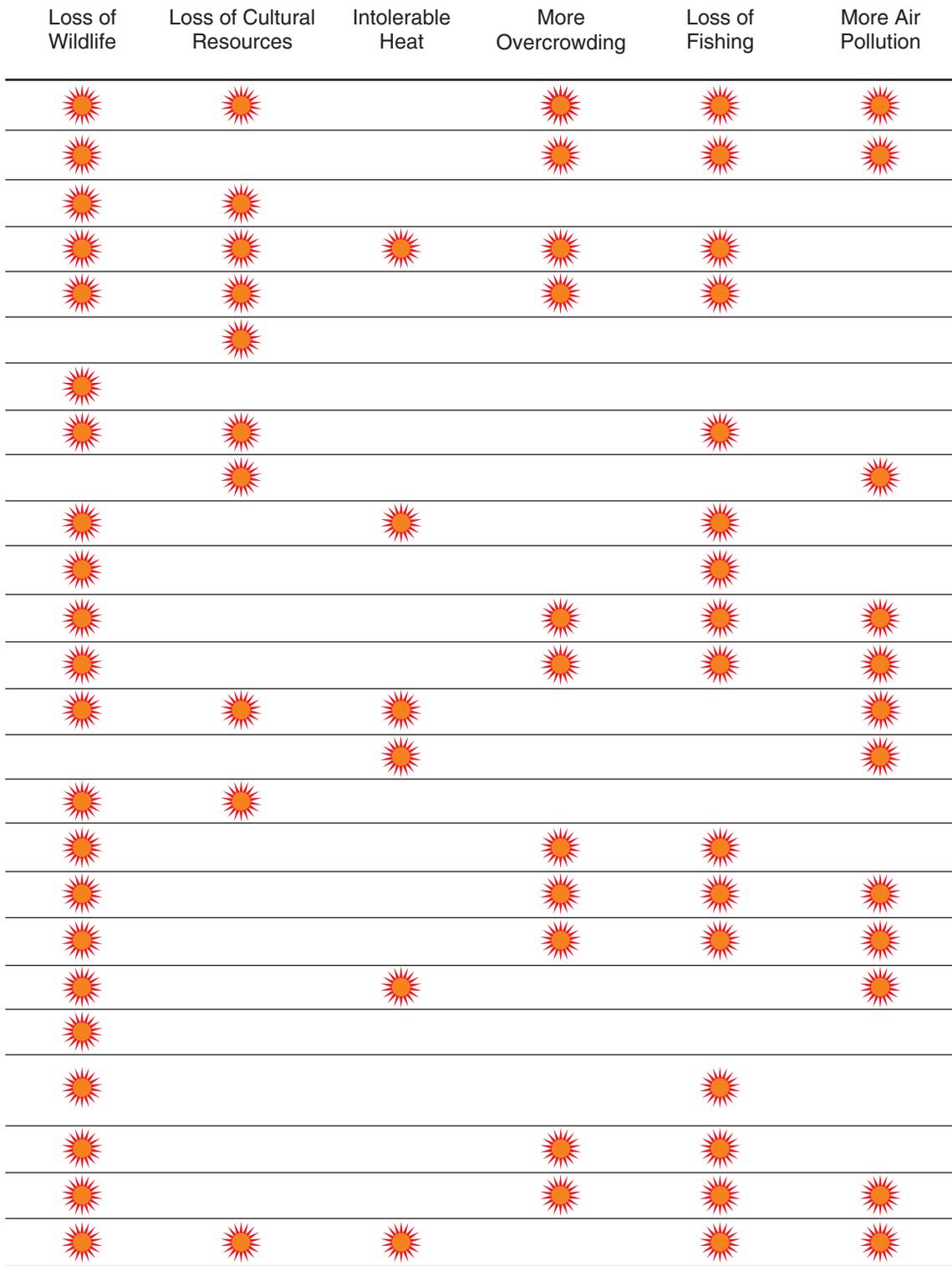
NS = National Seashore

NHP = National Historical Park

NP&P = National Park and Preserve

NL = National Lakeshore

Climate Disruption and the Risks They Face



NRA = National Recreation Area

Locations of Parks Most at Peril



Legend:

- NP = National Park
- NM = National Monument
- NS = National Seashore
- NHP = National Historical Park
- NP&P = National Park and Preserve
- NL = National Lakeshore
- NRA = National Recreation Area