

# NATIONAL PARKS IN PERIL

## THE THREATS OF CLIMATE DISRUPTION

### State Fact Sheet: Washington

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 Washington, Mount Rainier National Park is on the list of most endangered parks. It is vulnerable to a loss of ice and snow, a loss of water, more downpours and floods, a loss of plant communities, more crowding, and a loss of fishing. Other parks in Washington, including North Cascades and Olympic national parks, 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. The Intergovernmental Panel on Climate Change reported in 2007 that glaciers are melting worldwide in response to higher temperatures since 1970. In the United States, glacial melting is concentrated in our national parks, a handful of which contain the vast majority of the nation's glaciers.



To read the full report on the impacts of global warming on national parks, visit [www.nrdc.org/policy](http://www.nrdc.org/policy) or [www.rockymountainclimate.org](http://www.rockymountainclimate.org)

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In Mount Rainier, 25 major glaciers comprise the largest collection of permanent ice on a single U.S. peak south of Alaska. Those glaciers lost 21 percent of their area between 1913 and 1994. The NPS began in 2003 tracking two glaciers' estimated total mass of ice, a more precise measurement of a glacier than its surface area; both glaciers have lost mass every year since the monitoring began. The net loss of water from these two glaciers alone in only six years is estimated at 18 billion gallons, or enough water to cover about 55,000 acres to a depth of one foot.

North Cascades has 312 glaciers, about half of all glaciers in the contiguous United States. All of the park's glaciers are in retreat. Forty-seven glaciers monitored since 1984 have lost an average of 20 to 40 percent of their mass, with five having melted entirely away. Because of the extra summer melting resulting from today's hotter climate, a National Park Service scientist estimates that a winter's snowfall now has to be about 25 percent above average to keep the park's glaciers from have a net loss of ice that year. At the same time, winter snowfalls in the region are already in decline, and are projected to decline much more.

Snow-covered mountains are in many parks, where they contribute to some of the most spectacular scenery in the nation. But higher temperatures, less

snowfall, and earlier snowmelt are already leading to less snow in parks. One study has documented that springtime snowpack levels have declined across most of the West between 1950 and 1997 as a result of higher winter temperatures. Another study attributed about half of the observed reduction in snowpack to the effects of human emissions of heat-trapping gases. Scientists project that springtime peak snowpack levels will continue dropping across the West. In the future, sadly, visitors to Mount Rainier, North Cascades, and Olympic will be less likely to see snow-capped mountains in summer.

### **Loss of water**

In the West, a changed climate likely will bring less snowfall, earlier snowmelt, and hotter and drier summers, reducing water availability, especially in the summer when it is most needed by wildlife, plants, and entire ecosystems. When glaciers disappear and produce no more meltwater, rivers and streams lose reliable late-season flows that are not dependent on the vagaries of the previous winter's snowpack or that summer's rainfall. The National Park Service estimates that as much as 50 percent of late-summer natural stream flows in North Cascades come from glacial meltwater. In one watershed, shrinking glaciers have already reduced summer flows by 31 percent. Mount Rainier could be among other parks suffering a loss of water as glaciers shrink.

### **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 Washington and elsewhere are at risk, as the forecast is for more downpours everywhere.

A recent downpour and flooding at Mount Rainier illustrates the kinds of risks that it and other parks now face. In November 2006, 18 inches of rain fell in the park in 36 hours, washing out roads, destroying trails, severing power, telephone and sewer systems, damaging campgrounds, and, in the Park Service's words, "changing the landscape of the park forever." The entire park was closed for six months, a period of time when about 170,000 people normally would have visited it. North Cascades was affected by this same storm.

### **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, tundra, meadows, and wildflowers.

A recent U.S. government report and the Intergovernmental Panel on Climate Change point out that rising temperatures increase outbreaks of insects in forests. Bark beetles are unusual parasites in that they kill their hosts—when conditions are right, large outbreaks can occur, killing most large trees in a forest. The changing climate is also making it possible for bark beetles to spread faster and higher. Longer, hotter summers have extended reproductive and growth periods, while fewer cold snaps and higher winter temperatures have permitted increased bark beetle survival in winter, spring, and fall, and infestation of higher elevations. As the report from a recent scientific symposium put it, "Mature forests are the loaded gun for severe bark beetle infestations, and weather is the trigger." The bark beetle infestations are in North Cascades National Park, as well as other parks across the West.

A particularly ominous finding is from a team of scientists who recently found in undisturbed western forests that trees of all types and ages are dying faster than they used to. The increase in "background"

tree mortality—not caused by fires, insects, wind, or any other obvious agent of forest change—was documented through examinations of census records of all individual trees in 76 undisturbed forest stands with counts of all living trees as far back as 1955. Some of the studied forests were like those of Mount Rainier, North Cascades, and Olympic. Westwide, eighty-seven percent of the plots had experienced an increase in the rate of tree deaths, with the greatest change in the Northwest, where the average mortality rate had doubled in 17 years. The researchers suggested that higher temperatures and drier conditions—manifestations of a changed climate—may be the reasons for the accelerated tree deaths.

Alpine tundra—a mountain ecosystem that is treeless because conditions are too harsh for tree growth—may be especially vulnerable to a warming climate. Temperature increases have been greater atop mountains than at lower elevations. As mountaintop temperatures warm, plants adapted for survival there may not be able to tolerate the changed conditions and may have no nearby higher, cooler environments in which to disperse. At the same time, forests may move upslope and overtake the tundra as mountaintop conditions become less harsh and trees have a chance to survive there. Mount Rainier, North Cascades, and Olympic are all vulnerable to tundra loss.

Mountain meadows exist where the combination of heavy snow cover in the winter and a short growing season in the summer makes it impossible for tree seedlings to survive. Global warming is likely to reduce snow cover and extend the growing season, shrinking alpine meadows. Scientists have already detected that a loss of mountain meadows is underway in Olympic.

In work that suggests what could happen in national parks in mountains across the West, researchers at the Rocky Mountain Biological Laboratory near Crested Butte, Colorado—the official wildflower capital of the state—have documented how higher temperatures suppress the growth of mountain wildflowers. Using electric heaters to raise summer temperatures of test plots by 4°F for more than a decade, they have observed a reduction in wildflowers and their replacement by sagebrush, normally found in lower-elevation, dryer areas. Another study shows that, paradoxically, earlier snowmelt—a result of warmer winters—actually leads to more wildflowers being lost to frost. With earlier snowmelt, the growing season starts earlier and flower buds open sooner, leaving them exposed to mid-spring frosts. From 1999 through 2006, the percentage of wildflower buds lost to frost doubled, compared to the previous seven years.

In coastal parks such as Olympic, 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.

## **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.

Pikas, which look like hamsters but are more closely related to rabbits, are mountaintop residents unusually sensitive to high temperatures, making them candidates as “early sentinels” to a changed climate. Researchers recently surveying 25 sites in the Great Basin (between the Rocky Mountains and the Sierra Nevada) known to have previously had pika populations failed to find any pikas in nine sites—primarily those at lower, hotter elevations. This raises concerns for the future of the species at Mount Rainier and North Cascades as the climate continues getting hotter. The U.S. Fish and Wildlife Service is now considering whether the species qualifies for protection under the Endangered Species Act because of the threats of climate change.

An altered climate is likely to reduce inland populations of cold-water fish species, including trout and salmon. For trout in the interior West, a hotter climate is the single greatest threat to their survival; when water temperatures reach the mid-70°s, trout can die. Under a high-emissions future, streams in the West could warm up enough to reduce trout habitat by 50 percent or more by the end of the century; losses in some regions of the West could exceed 60 percent. At risk are trout in the streams of Mount Rainier, North Cascades, and Olympic.

Salmon, too, are vulnerable to higher water temperatures, as well as to changes in streamflows and heat-driven increases in diseases and parasites. Studies suggest that perhaps 40 percent of Northwest salmon populations could be lost by 2050. By 2040 in Olympic, water in streams with Chinook and coho salmon could reach about 68°F in summer, high enough to be stressful for fish. On the Skagit River, which flows through North Cascades, by 2080 temperatures could reach 72°F.

### **Loss of 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, including Olympic, where petroglyphs are carved into shoreline rocks.

### **Overcrowding**

As temperatures soar with a changed climate, to escape oppressive heat enough people may flock to cooler northern and mountain parks to overcrowd them. Overcrowding could be a significant problem particularly for those parks that are close to major population centers, including Mount Rainier, North Cascades, and Olympic.

### **Loss of fishing**

Anglers have long enjoyed fishing amid the natural settings of our 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. Already, bull trout fishing is banned in Olympic and restricted in North Cascades. In the future, if populations of other trout species decline as precipitously as scientists project, anglers might face more restrictions on trout fishing in these parks and in Mount Rainier.

Salmon, another type of cold-water fish, are threatened by a hotter climate, too, which could affect fishing for salmon in parks including North Cascades and Olympic.

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.nrdc.org/policy](http://www.nrdc.org/policy) or [www.rockymountainclimate.org](http://www.rockymountainclimate.org).