



Alaska's Shrinking Glaciers

Alaska is one of the most heavily glaciated areas in the world outside of the polar regions. Approximately 21,835 square miles of the state are covered in glaciers—an area nearly the size of West Virginia. Glaciers have shaped much of Alaska's landscape and continue to influence its lands, waters, and ecosystems. Because of their importance, National Park Service (NPS) scientists and partners measure glacier change. They have found that glaciers are shrinking in area and volume over nearly all the state. From 1985 to 2020, glacier-covered area in Alaska decreased by 13%. Over the same period, Lake Clark National Park and Preserve saw a 15% reduction in glacier-covered area. As our climate continues to warm, these changes will continue to occur and likely accelerate, profoundly impacting the landscape of Alaska and our parks for generations to come.

Glaciers in Lake Clark

Lake Clark National Park and Preserve is one of nine national parks in Alaska with glaciers. Lake Clark is located where the Aleutian and Alaska Ranges meet, dividing the park between the climates of Interior Alaska and the northwestern Gulf of Alaska. Glaciers covered 849 square miles (2,200 km²) of Lake Clark in 2020 (Figure 1), which was 151 square miles (391 km²) or 15% less than in 1985. This rate of loss was greater than the 12% loss estimated for the 1950s to 2000.

The Aleutian Range, part of the Pacific Ring of Fire, was formed mainly by volcanic activity, and many of the range's volcanoes remain active and erupt frequently. In Lake Clark, Redoubt and Iliamna volcanoes are active and glaciated. Redoubt Volcano had a major eruption in 2009. Starting in late summer of 2008, it had a series of eruptions that ejected hot gases, rocks, and ash that covered many of the park's glacial surfaces. The eruptions also produced a *lahar*, a flow of hot ash, water, glacial ice, and rock from the eroding volcano, that flowed rapidly over the Drift Glacier and down the Drift River to inundate the valley below (Figure 2).

In volcanic eruptions like this, the clean ice of nearby glaciers is covered with debris from ash fallout. Even very distant glaciers can be affected when ash clouds reach high into the atmosphere. When ash cover is thin, even barely visible, it accelerates the melting of the glacier surface by increasing the absorption of solar radiation. In contrast, when ash cover is thick, it insulates the ice below and results in less ice melting. However, these impacts are generally short-term and small compared to the overall loss of glacial area due to a warming climate (Figure 3).

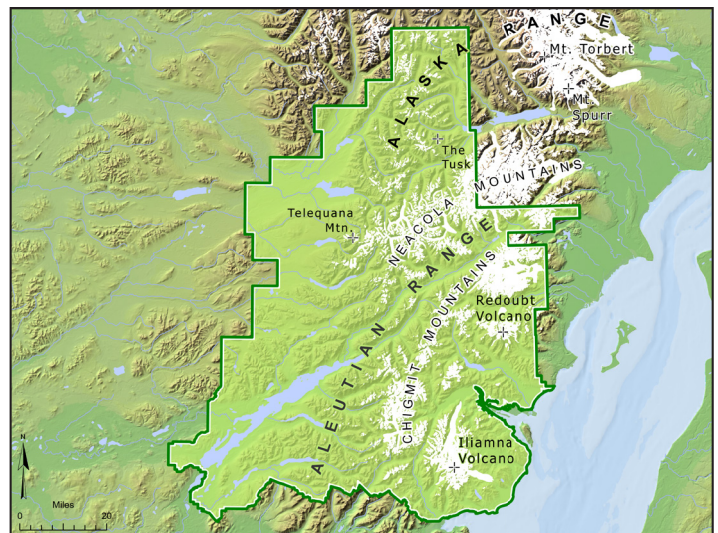


Figure 1. Map of Lake Clark National Park and Preserve showing glacier-covered area (in white) and volcano locations. In 2020 about 13.5% of the park was covered by glaciers.



Figure 2. Drift Glacier, on the north side of the Redoubt Volcano, after the 2008/2009 eruption, which covered the glacier surface with debris. The resulting lahar eliminated the upper glacier and scoured the lower glacier.

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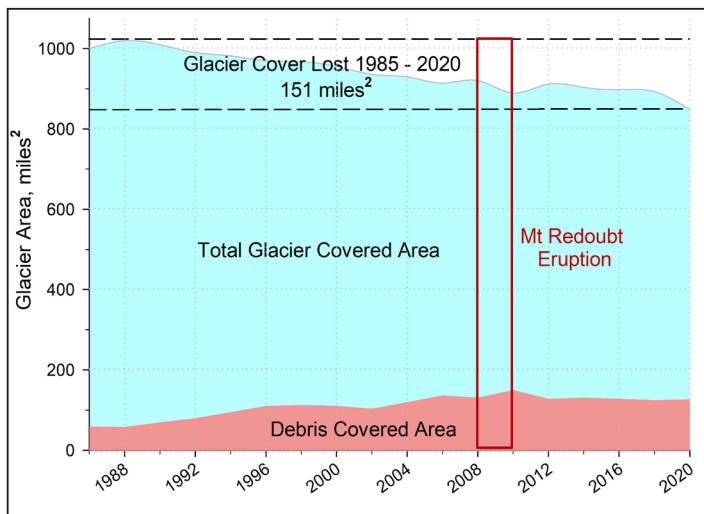


Figure 3. Between 1985 and 2020, Lake Clark’s total glacier-covered area decreased by 151 square miles (391 km²) or 15%—from about 1,000 square miles to about 849 square miles. Over the same period there was an increase in debris-covered surfaces, which is often associated with glacial loss. The red bar in the figure highlights the time of the 2008/2009 Redoubt eruption, which contributed to a loss of overall glacier-covered area and an increase in debris, but did not significantly alter the long-term trend of loss in glacier-covered area.

Statewide Glacier Change

Alaska’s high-latitude and high-elevation mountain ranges have historically had average annual temperatures cold enough to sustain glaciers. However, global air temperatures are increasing, and Alaska and other high-latitude regions are warming faster than the average global rate. Data from NOAA’s National Centers for Environmental Information ([ncei.noaa.gov](https://www.ncei.noaa.gov)) indicate Alaska’s statewide average annual temperature has been increasing by 0.6°F per decade since 1950. As temperatures warm, the elevation at which snow and ice remain frozen is getting higher, with more rain and less snow at lower elevations. The effects are most visible at a glacier’s lowest elevations, where most glacier termini are rapidly retreating.

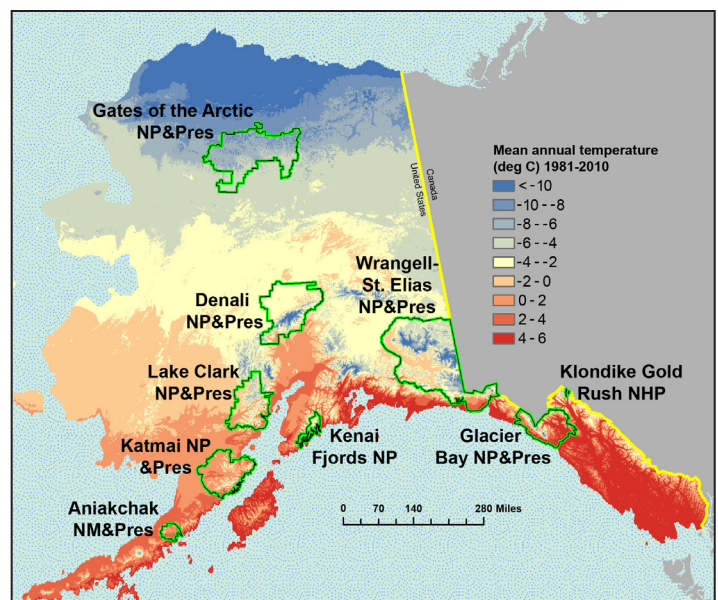


Figure 4. Mean annual temperatures (1981–2010) in Alaska, with park outlines in green. Note that the light and medium orange-shaded areas indicate annual average temperatures near the 32°F/0°C freezing threshold—the area corresponding to many glaciers. Data from PRISM Climate Group 2018.

From 1985 to 2020, glacier-covered area in Alaska decreased by 13%, or 3,253 square miles (8,425 km²). Glaciers within national parks in the state (parks shown in Figure 4, along with average annual temperatures) decreased by 8% from the 1950s to the early 2000s. From 1985 to 2020, the largest changes in glacier-covered area in Alaska occurred at elevations of 2,625–7,218 feet (800–2,200 m) and in southern Alaska—the region that encompasses the greatest glacier-covered area. Little change was seen in the relatively small glaciers of the Brooks Range in northern Alaska.

Because of the importance of Alaska’s glaciers and the implications of glacier loss, including for how we manage parks, glacier monitoring and assessment will continue to be a critical, ongoing activity of the NPS and its partners.

For More Information

Loso, M. and others. 2014. [Alaskan national park glaciers—status and trends](#). Final report.

Roberts-Pierel, B. and others. 2022. [Glacier-covered area for the state of Alaska, 1985–2020, Version 1](#).

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Roberts-Pierel, B. and others. 2022. [Changes over the last 35 years in Alaska’s glaciated landscape: A novel deep learning approach to mapping glaciers at fine temporal granularity](#).