

Global environmental effects on the mountain ecosystem at Glacier National Park

by Daniel B. Fagre

“Almost all mountain glaciers are receding as global temperatures increase.”

THE GLACIERS OF GLACIER NATIONAL PARK, Montana, are shrinking and may be gone within our lifetime. At the end of the Little Ice Age (ca. 1850), an estimated 150 glaciers occurred within current park boundaries. By 1968 only 37 were deemed viable or large enough to warrant being named on maps. Until recently, park promotional literature claimed “around 50” glaciers in existence. This tally included a number of smaller, unnamed glaciers. However, by 1993 the largest of park glaciers had shrunk to less than a third of the area they previously covered, and many of the smaller glaciers had disappeared or were no longer large enough to be considered glaciers. The area within park boundaries covered by ice and permanent snow was reduced from 38 square miles (99 square kilometers) to 10 square miles (26 square kilometers). Furthermore, several computer models estimated that all the park’s glaciers would be gone between 2030 and 2050 at current warming rates in the northern Rocky Mountains.

The decline of glacial ice generally is linked to an increase in average summer temperature and a reduction in the winter snowpack that forms and maintains glaciers. Temperatures in the nearby city of Kalispell indicate an increase of approximately 1.4°F (0.8°C) during the past century, but climate records are less complete for high-elevation landscapes within Glacier National Park. However, a weighted average of summer temperatures from climate stations surrounding the park indicates a more dramatic rise of 2.9°F (1.6°C) for the park environment. Furthermore, the period of most rapid temperature rise roughly coincided with rapid glacier recession and increased tree establishment at tree line. The average annual maximum snowpack has significantly declined over the past 50 years; snowpacks melt about 13 days earlier in the spring than they did 50 years ago. Less snow would explain continued glacier melting, but the limited longer-term snow records (1922–present) suggest no overall decline in snowpacks, leaving temperature increases as the likely cause for most of the glacier disappearance.

Scientists with the U.S. Geological Survey (USGS) and their collaborators continue to monitor and study the park’s glaciers. A comprehensive overview of glacier information was published in 2002 by Carl Key (USGS), Dan

Fagre (USGS), and Richard Menicke (NPS). Recently, USGS scientists completed an effort using repeat photography (e.g., comparisons of historical and recent photographs) for 56 sites in the national park. Comparing photographs of 17 of the remaining glaciers reveals that glaciers continue to recede. Thirteen of the 17 glaciers are distinctly smaller when compared with photographs taken at various times in the 1900s. Based on a precision global positioning system survey of Grinnell Glacier, more than 35 acres (17 hectares) have been lost from a relatively small glacier since 1993. Finally, ground-penetrating radar surveys show that glacial ice has thinned by as much as 50% over the past two decades. Therefore, as Grinnell Glacier is both thinner and covers less area, it has less than 10% of the ice volume it had in 1887 when it was first described. All glaciers in the park for which there are recent measurements continue to lose ice volume. This corresponds well with the fate of glaciers elsewhere on Earth: almost all mountain glaciers are receding as global temperatures increase.



The ecological significance of losing glaciers at Glacier National Park includes loss of stream base flow in late summer and higher water temperatures that influence the distribution and behavior of aquatic organisms. Glaciers are very popular features of the park, and a certain sparkle will be gone when the last glacier disappears. ■

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GLACIER NATIONAL PARK ARCHIVES, BY KISER



Glacier recession is evident in this comparison of Grinnell Glacier in 1910 (black and white image) and 1998 (color image). Repeat photography at Glacier National Park has shown a decrease in size among 13 of 17 park glaciers.

U.S. GEOLOGICAL SURVEY, BY KAREN HOLZER