Grand Teton

National Park Service
U.S. Department of the Interior

Grand Teton National Park
John D. Rockefeller, Jr.
Memorial Parkway

Disappearing Glaciers

Middle Teton Glacier. *NPS Photo.*

Glaciers

A glacier is a river of ice flowing slowly downhill due to gravity. Ice slides over bedrock eroding the surface below, and deforming under its own weight. If the ice quits moving, the remaining snow and ice become a permanent snowfield or remnant glacier.

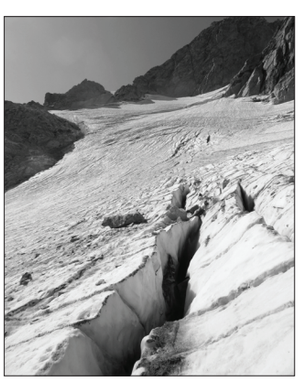
An active glacier is a balance between winter snow accumulation and summer melt. If accumulation outpaces melt for a number of years, the glacier will advance. If the reverse is true, the glacier will retreat, meaning the toe will melt back faster than the glacier is flowing.

Importance

Glaciers respond to climate trends providing a visual and measurable record of change—glaciers advance with cooling temperatures and retreat with warming. Currently, meltwater from the glaciers provides an important late-season water source, and a year-round source of cold water key for native aquatic species. As glaciers disappear, this important water source will disappear.

In addition to ecological benefits, glaciers are also an iconic part of the Teton landscape providing aesthetic and recreational value. Imagine Mount Moran no longer flanked by five glaciers—the Skillet Glacier gone forever.

Modern Glaciers



Crevasses on Middle Teton Glacier. *NPS Photo.*

There are up to eleven glaciers in the park today. Ten glaciers named on area maps include Teton, Middle Teton, Teepe, Schoolroom, Petersen, Skillet, Falling Ice and Triple. Scientists recently identified another unnamed glacier below Glacier Peak bringing the total to eleven. Some of these glaciers may no longer be moving and are now remnant glaciers.

Measuring glacier movement is difficult, but crevasses can indicate that ice is likely moving. Crevasses form when the brittle upper layer of the glacier cracks as the more ductile ice beneath flows over obstacles or around corners. Imagine bending a Snickers bar slowly. The brittle chocolate fractures while the caramel and nougat bends.

Glaciers flow, on average, inches to feet per day. Smaller glaciers with flatter surfaces, like the ones in the park, move slowly—probably less than a few inches per day in the summer. In winter, the ice freezes to the bedrock so glacial flow ceases. Studies from the 1960s and 70s measured Teton Glacier flowing about 30 feet (9.1 meters) per year—averaging a few inches (<10 cm) per day during the summer.

Timing

The park's modern glaciers are not remnants of the larger Pleistocene Ice Age glaciers that shaped the Teton Range's canyons and valley-floor lakes. Those glaciers disappeared by 10,000 years ago. Instead, current glaciers developed during a recent cold period known as the Little Ice Age that lasted from about 1300 to 1850.

Ice Thickness

Glacial ice flows over uneven bedrock. Even with surface data, estimating ice thickness is difficult. Researchers can use ground-penetrating radar to calculate ice thickness, but these surveys are costly and time-intensive.

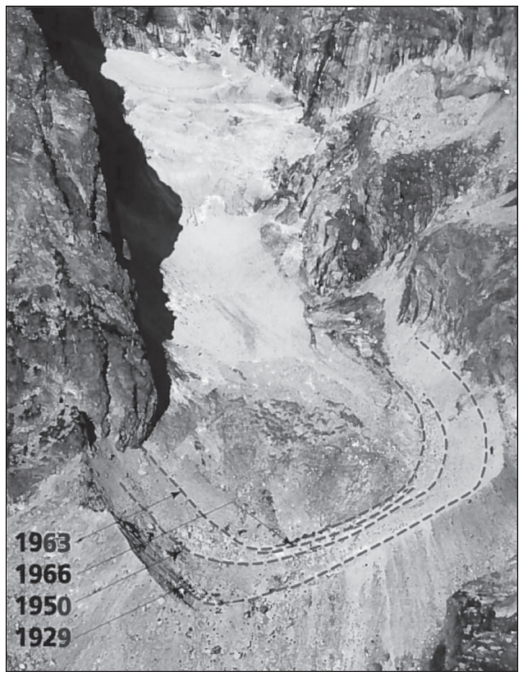
The park's glaciers likely range from less than one hundred to a few hundred feet thick. The only known field measurement of ice thickness was done in 1966, and the Teton Glacier was 64 feet (19.5 meters) thick near its terminus.

Retreat & Disappearance

When Fritiof Fryxell first surveyed the park's glaciers in the late 1920s, the ice was already retreating. The terminal moraines he mapped marked the 1850 glacial maxima of the Little Ice Age. Even though the glaciers are retreating, there have been a few brief glacial advances in 1975–83 and 2006–09. Some people in the late 1970s feared another ice age!

Methods to track glacial retreat include measuring decreases in the length of the glacier, surface area and ice volume. One study of the Teton Glacier measured 104 feet (32 meters) of retreat from 1954 to 1994. Another study from the late 1980s estimated 600 feet (183 meters) of retreat and 160-200 feet (49-61 meters) of thinning since 1929.

The park's glaciers are small but they do vary in size, shape, aspect and slope making predictions of their disappearance difficult. The smallest glaciers, such as Teepe Glacier, have likely stopped moving and may disappear within decades. Larger glaciers, such as the Teton and Middle Teton glaciers, may last for more than one hundred years. Ongoing studies of ice volume change will quantify how quickly glaciers are melting.



The Teton Glacier moraine, visible as the sharp-crested ridge, marks the glacier's maximum extent during the Little Ice Age. More recent ice terminus positions are noted. *Reproduced with permission from Creation of the Teton Landscape.*

On-going Studies

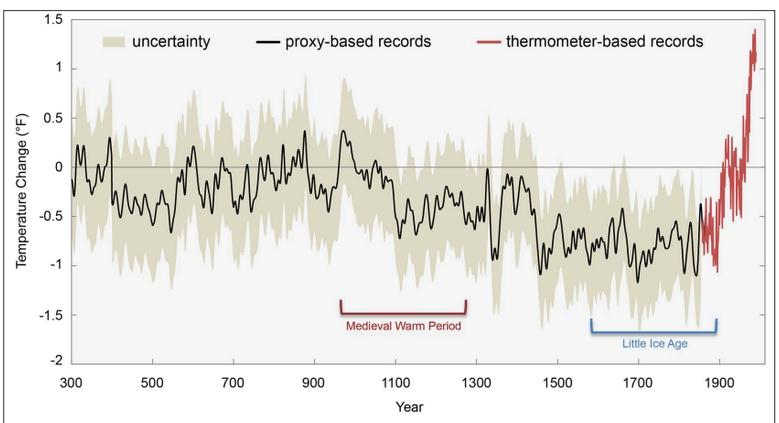
Jenny Lake climbing rangers and park GIS staff measure GPS points on the surface of Middle Teton Glacier. *NPS Photo/M. Tyson.*

Researchers are currently measuring ice loss and mapping surface changes for several park glaciers. Park GIS staff teamed with the Jenny Lake climbing rangers to collect hundreds of GPS data points to generate a map of a glacier's surface. Annual surveys will allow scientists to determine how much ice volume is lost and changes to the glacier's surface. The team surveyed Schoolroom Glacier in 2014, and Middle Teton Glacier in 2015 and 2016 with plans to continue.

Daily images from time-lapse cameras provide records of snow pack and ice melt in a safe and time-effective manner. Currently, Teton, Middle Teton, Falling Ice and Petersen glaciers have cameras, with the possibility of expansion to cover more glaciers.

Climate Change

Glaciers respond in large part to winter precipitation adding new snow and ice, and summer heat melting snow and ice. Yearly weather varies greatly, but climate change models predict increased rainfall and decreased snowfall at a given elevation in winter and warmer temperatures in summer. The models indicate glaciers will retreat. Climate began warming after 1850 but accelerated due to increased levels of greenhouse gases since the start of the Industrial Revolution. In short, human-caused climate change has greatly accelerated the glacial retreat.



1700 years of global temperature change. Before 1850, temperature estimates from proxy data. After 1850, thermometer-based data. *NOAA Climate.gov*