

Here today, Gone tomorrow?

Geologist Jon Riedel monitors four glaciers in the North Cascades National Park and found that 13 percent of the park's glacier area has melted since 1993.



The photo of the south side of Forbidden Peak on the left was taken Sept. 27, 1960. The photo on the right was shot on Sept. 21 2005.

courtesy of Jon Riedel

North Cascades National Park is home to 312 glaciers, more than any other park in the lower 48 states. These monsters of ice slowly carve out the intricate system of valleys in the park and fill the surrounding streams and lakes with chilled blue water.

However, these reminders of an icy past may not have a long future in the North Cascades.

"They're retreating pretty fast and it's because the summers and winters are warmer," NPS geologist Jon Riedel said. "A lot of times we're getting rain on these glaciers in the late fall or even winter when they would normally be accumulating snow."

In order to determine how much the park's glaciers are retreating, Riedel began monitoring four glaciers in 1993, each in a different watershed. The northernmost is Silver Glacier up along the U.S.-Canada border, followed by Noisy Creek Glacier, North Klawatti Glacier, and Sandalee Glacier near Stehekin.

Each glacier has its own unique relationship to climate, Riedel said, based on its surrounding topography and elevation. The type of rock underneath the glacier and the slope of the mountain are especially important. Shade is also a key factor, which is why most of the remaining glaciers in the park are hiding on the north side of many peaks.

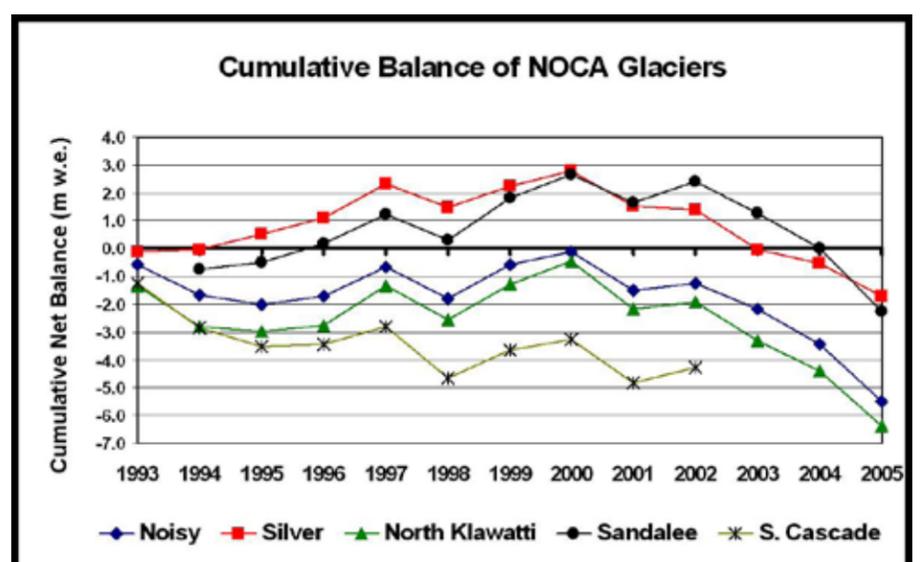
Measuring all the variables involved in the survival of a glacier would be time consuming and nearly impossible. So Riedel focuses on the most important factor: snow accumulation.

"To get at that direct signal between climate and glacier behavior, we focus on what happens on the surface," he said. "It's like your checkbook budget: if we account for how much water [snow] the glacier accumulates in the winter and how much it loses in the summer, we come up with a balance. If it's positive, then more snow was gained in the winter than was lost in the following summer."

To get these measurements, Riedel and his team journey to each of the four glaciers three times per year: first in late April (the end of the accumulation season), then in June and again in September (the end of the melt season). Roads and trails to these remote areas are impassable most of the year, requiring the team to helicopter in for April and September measurements.

In April, the team measures the thickness of the winter snow accumulation with an old metal tank antenna. Measuring stakes are then drilled into the glacier with a backpack-mounted steam drill. These stakes are used to determine how much snow and ice melted over the course of the summer.

"In any long-term monitoring, you have to have methods that are fairly easy to follow and straight forward," Riedel said, "so that they can be repeated and you can compare measurements from 1993 to 2007."



All four glaciers in the study have carried a negative balance since 2002. If these glaciers are losing snow, that means nearby streams and lakes are losing a major source of cool water in the summertime. For example, in Thunder Creek, glaciers produce as much as 45 percent of summer runoff, Riedel said.

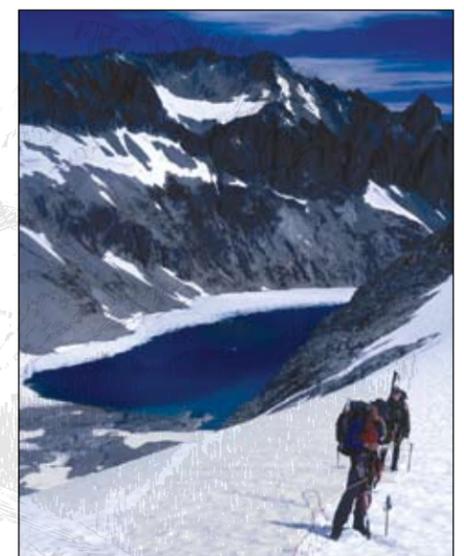
"We call it the buffering capacity," he said. "It protects our lakes and streams from low flow."

With summer temperatures a degree warmer compared to 100 years ago, Riedel estimates that glaciers will need roughly 125 percent of normal snow pack in order to break even each year. The snowstorms in January 2007 put the glaciers at 150 percent of normal snow pack, but the dry, sunny weather in February lowered that down to 120 percent.

Riedel said he was not originally optimistic about this year's snowfall, but a flurry of late-February storms have changed his opinion.

ABOVE: All of the glaciers being monitored have been losing mass since 2002. The South Cascade Glacier is monitored by the USGS.

BELOW: Monitoring on the Silver Glacier.



courtesy of Jon Riedel

"As I watch the snow accumulate outside my window," he said in an e-mail on the last day of February, "I am now quite sure that we will be near normal snowpack when we visit the glaciers in April."