

Mt. Shasta's glaciers growing: Warming is bolstering ice on mountain, scientists say

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While it's not California's tallest mountain, the tongues of ice creeping down Mt. Shasta's volcanic flanks give the solitary mountain another distinction. Its seven glaciers, referred to by American Indians as the footsteps made by the creator when he descended to Earth, are the only historical glaciers in the continental U.S. known to be growing.

With global warming causing the retreat of glaciers in the Sierra Nevada, the Rocky Mountains and elsewhere in the Cascades, Mt. Shasta is actually benefiting from changing weather patterns over the Pacific Ocean.

"When people look at glaciers around the world, the majority of them are shrinking," said Slawek Tulaczyk, an assistant professor of earth sciences at the University of California at Santa Cruz. "These glaciers seem to be benefiting from the warming ocean."

Warmer temperatures have cut the number of glaciers at Montana's Glacier National Park from 150 to 26 since 1850, and some scientists project none will be left in 25 to 30 years. The timeline for the storied snows at Africa's Mt. Kilimanjaro is even shorter, while the ice fields of Patagonia in Argentina and Chile also are retreating.

It's a different story at Mt. Shasta, at the southern end of the Cascade Range.

Scientists say a warming Pacific Ocean means more moist air sweeping over far Northern California. Because of Mt. Shasta's location and 14,162-foot elevation, the precipitation is falling as snow, adding to the mass of the mountain's glaciers.

"It's a bit of an anomaly that they are growing, but it's not to be unexpected," said Ed Josberger, a glaciologist at the U.S. Geological Survey in Tacoma, Wash., who is currently studying retreating glaciers in Alaska and the northern Cascades of Washington.

Historical weather records show Mt. Shasta has received 17 percent more precipitation in the past 110 years. The glaciers have soaked up the snowfall and have been adding more snow than is lost through summer melting.

The additional snowfall has been enough to overcome a 1.8 degree Fahrenheit rise in temperature in the past century, according to a 2003 analysis by Tulaczyk, who led a team studying Mt. Shasta's glaciers.

By comparison, the glaciers in the Sierra Nevada, which are about 560 miles south of Mt. Shasta, are exposed to warmer summer temperatures and are

retreating.

The Sierra's 498 ice formations -- glaciers and ice fields -- have shrunk by about half their size over the past 100 years, with those exposed to direct sunlight shrinking fastest, said Andrew Fountain, a geology professor at Portland State University who has inventoried the glaciers in the continental U.S. as part of a federal initiative.

He said Mt. Shasta's seven glaciers are the only ones scientists have identified as getting larger, with the exception of a small glacier in the shaded crater of Washington state's Mount St. Helens. It formed after the 1980 eruption blasted away slightly more than half the mountain's ice, and scientists think it will not grow in area once it stretches outside the shade of the crater.

Glaciologists say most glaciers in Alaska and Canada are retreating, but there are too many to study them all. Four glaciers at Mt. Rainier in Washington state are staying about the same size. Those glaciers -- shielded from the sun on the north and the east sides of the mountain -- have received just enough snow to keep them from shrinking, Fountain said.

But Mt. Shasta's glaciers have been advancing since the end of a drought in the early 20th century. The mountain's smallest glaciers -- named Konwakiton, Watkins and Mud Creek -- have more than doubled in length since 1950.

Mt. Shasta's largest glacier, the Hotlum, grew more than 600 yards between 1944 and 2003 and covers nearly two square miles of the mountain's northeastern face. The Whitney glacier grows up to 4 inches a day in winter and is about 2.4 miles long.

Hikers seeking to cross Mt. Shasta's glaciers -- marked with crevasses as deep as 100 feet -- say they are much larger than the boundaries drawn on geological maps.

"I noticed I was traveling down farther than the maps were showing it," said Eric White, lead climbing ranger at the U.S. Forest Service who has climbed the mountain for 23 years.

Until recently, the same phenomenon that is now benefiting Mt. Shasta's glaciers was feeding glacier growth in southern Norway and Sweden, the New Zealand Alps and northern Pakistan, according to the U.N. Intergovernmental Panel on Climate Change.

In each area, scientists say more snowfall temporarily offset warming temperatures in the 1990s and early 2000s. But rising temperatures since then have begun to shrink those ice fields.

Climate change is causing roughly 90 percent of the world's mountain glaciers to shrink, said Lonnie Thompson, a glacier expert at Ohio State University.

In the Northern Hemisphere, the Earth's frozen ground has decreased by about 7 percent since 1900, according to figures released last year by the Intergovernmental Panel on Climate Change.

"Best that we keep our eye on the big picture," Thompson said of Mt. Shasta's unique position. "The picture points unfortunately (to) massive loss of ice on land, which has huge implications for future sea level rise."

Although Mt. Shasta's glaciers are growing, researchers say the 4.7 billion cubic feet of ice on its flanks could be gone by 2100. For the glaciers to remain their current size, Mt. Shasta would have to receive 20 percent more snowfall for every 1.8-degree Fahrenheit increase in temperature, Tulaczyk said.

Global forecasts show temperatures warming from 2 degrees to 11.5 degrees Fahrenheit by the end of the century if no major efforts are undertaken to reduce the emissions of greenhouse gases. At that rate, California's snowpack and its remaining glaciers are among the most vulnerable of the state's natural resources to climate change.

"In a way, the Sierra glaciers may represent the future of the Mt. Shasta glacier system under a warming climate, showing that if one puts an increased amount of snow in a place that's warm enough, then glaciers will shrink anyway," Tulaczyk said.

Even without global warming, another threat to Shasta's glaciers could come more quickly: a volcanic eruption that could melt them, creating mud flows that could bury the surrounding communities.

Over the past 4,000 years, Shasta has erupted about every 250 to 300 years and did so most recently about 200 years ago, said William Hirt, a geology instructor at the College of the Siskiyous, near Mt. Shasta.