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BY RICHARD ELLIS
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Rock Glaciers Are Utah's Most Resilient Water Source

BENEATH UTAH'S ROCKY AVALANCHE ZONES, THERE ARE OVER 800 ROCK GLACIERS LOADED WITH FRESH WATER. FOR UTAH STATE UNIVERSITY'S SCOTT HOTALING, PHD, THEY'RE A RARE BIT OF CLIMATE

Usually, the story of water in Utah is one of declining snowpacks, dwindling reservoirs, and intractable battles over outdated water compacts. So, when a Climate Resiliency Specialist at Utah State University told me that rock glaciers are "a rare ray of hope in a very hopeless story," my first thought was... what is a rock glacier?

"Rock glaciers, like all glaciers, are essentially frozen rivers," explains Scott Hotaling, PhD, who leads the Climate Change in Mountains research and extension group at USU. "They are large masses of ice covered by debris that flow downhill."

A biologist by training, Hotaling first came across rock glaciers in 2013 while studying alpine watersheds. Rock glaciers appeared to supply cold water—a necessity for many alpine species—during the driest summer months. Yet, no one had studied them in depth. They were considered "a geomorphological oddity," Hotaling says.

Now, scientists know that Utah has more than 800 rock glaciers concentrated in the Uinta, Northern Wasatch, and La Sal ranges. Unlike surface glaciers and snowpack, rock glaciers have remained resilient as average temperatures rise globally.

You've probably seen rock glaciers without realizing. There's a massive rock glacier in the Timpanogos Cirque. Rock glaciers feed Red Pine Lake and White Pine Lake in Little Cottonwood Canyon. In the Uinta range, there are year-round alpine streams and lakes thanks to rock glaciers. Many of those drain into the Provo River, providing water for Wasatch Back farmers, ranchers, fly fishermen, and snowmaking machines.





So, how much water is held in Utah's rock glaciers? "We have no idea," Hotaling says. "And it's a really, really important question."

Rock glaciers remain mysterious because they're difficult to study. Scientists know they form in snowy, constrained spaces where avalanche debris and wet, heavy snow collect. Hotaling describes them as a layer cake of compressed rock and snow.



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The techniques scientists would normally use to study underground geological features don't work on rock glaciers. Radar, which can differentiate between distinct layers of material, isn't helpful because ice and rock are so thoroughly mixed in rock glaciers. Taking an ice core from rock glaciers would be tricky. "As anyone who's used a drill knows," Hotaling explains, "if you're drilling and randomly hit metal or rock, it's really bad for your drill."

Despite those limitations, Hotaling has shown that rock glaciers are resilient. As of this writing, he is wrapping up a study in the Teton Range, on the Wyoming-Idaho border, where he began measuring changes in glacial activity as a graduate student. "We have shown for the first time in the same mountain range, in the same basins, that rock glaciers are stable, while surface glaciers are losing huge amounts of ice every year."

His dataset, collected between 2014 and 2022, reveals that Teton surface glaciers lose 0.8 vertical meters of ice every year on average. "They're only 20 meters thick at the thickest point," he says. "So, you can do some math on how long there will be glaciers in the Teton Range."

Meanwhile, satellite and drone imagery of rock glaciers shows that they aren't shrinking vertically, which suggests that rock glaciers replenish their ice through avalanche and rockfall events and from water percolating into the ice mass and freezing when it's cold enough.

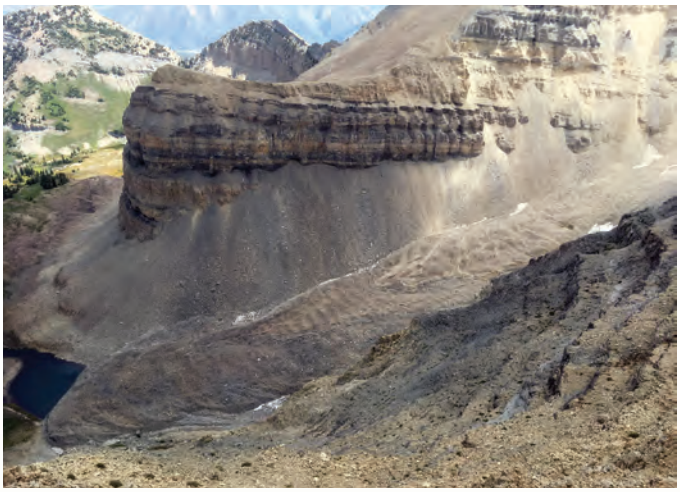
Though hopeful about rock glaciers, Hotaling wants to be clear: they are not a cure for water shortages or a substitute for water conservation and climate change mitigation. They might help us in a pinch, but they come with challenges.

One challenge is water quality. Rock glacier water is naturally higher in nitrates, which are potent fertilizers. When warm temperatures intersect with nitrates in alpine lakes, harmful algal blooms. One of Hotaling's PhD students, Anna Shampain, is currently researching the geochemistry of rock glaciers and their implications for water quality.

A second challenge is how to monitor the health of rock glaciers. The more we depend on them for water, the more data we'll want on their health and longevity.

Towards that end, Hotaling is preparing to launch the Center for Mountain Futures, a research endowment that will fund long-term data collection, advise mountain communities, and create opportunities for students to study mountains. Because federal funding for research is scarce these days, Hotaling is looking for private funding. "I really want to create an entity that can respond to the needs of Utah and respond to the needs of our communities," he says.

If rock glaciers are as resilient as they seem, they could provide precious refugia for mountain species and, when needed, water for human beings. We don't know how much heat they can withstand, however, and we don't want to find out. Don't mistake climate hope for a climate solution.







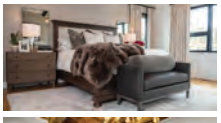
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