

Science News –September 12, 2007

## Peru's glacier meltdown threatens water supplies

Scientists are looking for ways to predict local water shortages for farms and towns that rely on glaciers.

As glacier meltwater trickles down mountainsides in the Andes, some places in Peru may already be seeing temporary increases in water supply, according to new research published in *ES&T* (DOI: [10.1021/es071099d](https://doi.org/10.1021/es071099d)). But as the ice disappears, researchers say, so will the water that flows from it, and people will be hit especially hard during the dry summers when glaciers normally release water. How severe will local shortfalls be, and how soon will they affect millions of people in South America?



Bryan Mark

People living in Peru's Huaylas Valley get water for drinking and farming from the snowcapped Cordillera Blanca range to the east.

In the city of La Paz (Bolivia) and its suburb El Alto, more than 2 million people get about a third of their drinking water from glaciers—and those glaciers have shrunk by more than half since the 1960s, according to Walter Vergara, a World Bank expert on climate change in Latin America. The situation in less monitored areas is more of a mystery. Satellite images show that glaciers are shrinking, but they don't provide a reliable estimate of how much water is released or where it goes, and climbing glaciers to get better measurements is risky and expensive.

To overcome these limitations, a team led by geographer [Bryan Mark](#) of Ohio State University developed a stable-isotope method that can determine how much of a community's water supply is glacier-fed, without scaling the glaciers. The technique relies on differences in the levels of naturally occurring isotopes of hydrogen and oxygen from glaciers compared with rainwater and other sources. Water samples collected from streams are analyzed for isotope levels by mass spectroscopy to determine the percentage of glacier-fed water they contain and that fraction can be monitored for changes over time.

Mark's team collected 73 samples from streams and springs in northern Peru's Cordillera Blanca range, home to the largest glacier chain in the tropics. The results confirm that about two-thirds of the area's dry-season water supply comes from glaciers, and that glacier-fed streams received an average of 1.6% more water over the period from 2004 to 2006. The data provide a baseline, and whether the small change is "noise in the data will

become obvious with a more complete survey," says [Brenda Ekwurzel](#), a climate scientist and isotope geochemist at the Union of Concerned Scientists.

"It's very time-consuming to get this information in other ways. If you go to a glacier in person, you may get more precise data but only for one glacier," says [Mathias Vuille](#), a University of Massachusetts climatologist, who studies Andean glaciers. Vuille's climate models [project](#) high-altitude warming that could doom some glaciers within the next 10–20 years, eventually melting them completely.

"People have the impression that global warming is making things hotter and that melts glaciers" directly, Mark says, but in the tropics, glacier mass loss is more complicated. The balance of snow and rain during the wet season can help determine whether a glacier gains or loses mass for the year. If there's more snow, glaciers have a bright, white surface that reflects sunlight and reduces melting. Temperature matters, too; warm and dry years tend to melt glaciers more quickly. And during cold and dry conditions glaciers also sublimate, removing glacier ice directly to water vapor.

This doesn't mean global warming is not a factor, Mark says; changes in precipitation and humidity are linked closely to temperature. For example, many glaciologists think that the loss of Kilimanjaro glaciers is likely because of both human-caused warming and reductions in snowfall.

Andean farms rely on glacier water for crop irrigation, and populations depend on it for drinking water as well as hydropower. Instrumentation to monitor water supplies and glaciers is scarce. "Much of the network is quite old and is falling apart," Vuille says. The World Bank and Global Environment Fund are working to install more stations, but these will face harsh weather and vandalism.

Mark says that people in Peru ask him regularly what they should do. It's a tricky question, he says, and politically charged in developing countries that caused little of the current warming. Dams could corral water, but they are expensive and risky in the earthquake-prone Andes. Funneling water into wetlands may be more affordable, Mark says, and some people may have to move. In addition to the human cost, "the entire ecology of the mountains is changing and will change forever," Vergara adds. —[ERIKA ENGELHAUPT](#)

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