

# MONO COUNTY / Performing high-altitude research on global warming

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Chronicle / Lance Iversen

Research Scientist Jeff Holmquist from White Mountain Research Center tosses a netted Quadrant used to trap bugs in a small area that are later vacuumed up and counted as part of the Gloria Project. 25 researchers from throughout the country converged on University of California Crooked Creek Research Center in the White Mountain's, southeast of Bishop Ca. Scientist and researchers are taking part in a global consortium on climate research called Gloria. 7/25/06 in BISHOP. By Lance Iversen/San Francisco Chronicle MANDATORY CREDIT PHOTOGRAPH AND SAN FRANCISCO CHRONICLE/ MAGS OUTPhoto: By Lance Iversen

Stately corpses of bristlecone pine trees, some dead for 2,000 years but still refusing to lie down, stood watch last week as botanist Ann Dennis and a crew of naturalists stepped off plots on the shoulders of 14,246-foot White Mountain Peak near the Nevada border.

Working more than 10,000 feet above the sunbaked floor of the Owens Valley, the scientists were transforming one of California's highest mountaintops into a living laboratory of climate change.

Dennis and her colleagues are part of a global network of mountain-climbing researchers, all using precisely the same methods to observe the impact of global warming at high altitudes on five continents simultaneously.

"This is an international effort to deal with an international problem," Dennis said.

High mountain environments may be uniquely suited to the globe-spanning, cookie-cutter approach. They support many of the same types of species, forced to eke out a meager existence in the most punishing conditions imaginable.

And because of those difficult conditions, above-tree-line and sub-alpine environments are for the most part free of obvious human impacts that can mask evidence of global warming's impact on the ground.

"It's pretty unusual to find the same kind of place all around the world, but you can find alpine environments in the tropics, and on every continent," said Connie Millar, a climate change scientist with the U.S. Forest Service.

Researchers kept one eye out for lightning strikes and thunderstorms as they scurried among the gnarly bristlecone roots, often dropping to their hands and knees to record every plant growing within a carefully marked grid.



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Botanist volunteers taking part in the Gloria project, descend from a hill in the White Mountains as they map and count vegetation among a stand of dead and living Bristlecone pine trees as part of the Gloria project. 25 researchers from throughout the country converged on University of California Crooked Creek Research Center in the White Mountain's, southeast of Bishop Ca. Scientist and researchers are taking part in a global consortium on climate research called Gloria. 7/25/06 in BISHOP. By Lance Iversen/San Francisco Chronicle MANDATORY CREDIT PHOTO AND SAN FRANCISCO CHRONICLE/ MAGS OUTPhoto: By Lance Iversen

The plant census will be recorded in a central archive and repeated every five years, always using the same methods.

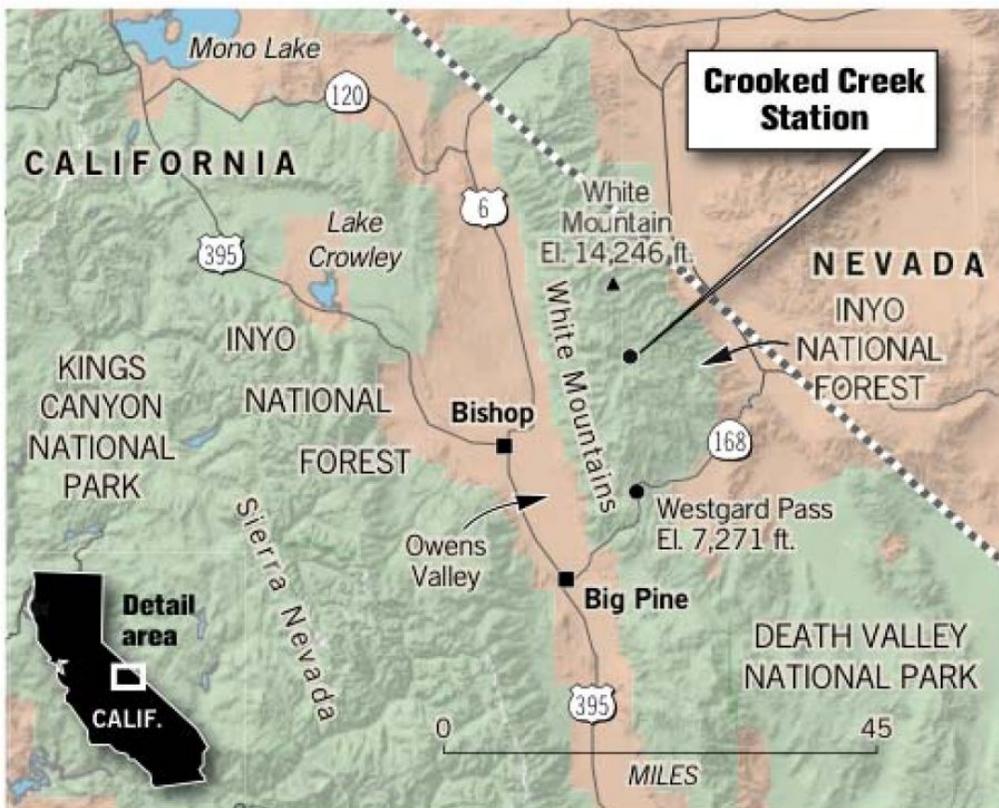
Eventually, the data may show how plants at similar altitudes all over the world are responding to the same global signal of rising temperatures and higher concentrations of carbon dioxide in the atmosphere.

The project is known as "GLORIA," for the Global Observation Research Initiative in Alpine Environments. Based in Vienna, operating mostly with volunteer staff and donated funds, organizers have set up about 40 research sites so far, including two in the White Mountains, one in the Sierra Nevada and one in Glacier National Park. A site at Lake Tahoe is planned.

This location was chosen partly because of UC's White Mountain Research Station, which includes dormitories, laboratories and one of North America's highest-elevation weather stations on the White Mountain summit.

The station, designated as the first North American master station in a network that also includes stations in South America, Europe, Asia and Australia, is sponsoring climate-related research that goes well beyond the plant census.

The first intensive field sampling in this expanded effort was carried out last week, when about 25 scientists and field assistants fanned out from the UC facility's Crooked Creek Station, at 10,200 feet amid ancient bristlecone forests.



Source: ESRI. TeleAtlas. USGS

GUS D'ANGELO / *The Chronicle*

Crooked Creek Station. Chronicle graphic by Gus D'Angelo

Such ecosystems may be among the earliest bellwethers of climate change. Rare high-altitude plants, well adapted to a colder climate, may not take long to succumb as rising temperatures pull other species higher and rearrange species interactions at the summit.

"Everything's on a real climatic knife edge already, so small changes can make big differences in what you see," said Stuart Weiss, a freelance consulting ecologist from Menlo Park.

The famous bristlecones have endured countless challenges over the millennia, yet always seem to muster one more burst of life when spring warms the rocky dolomitic soil. Growing seasons may expand and shrink, but the trees carry on, their growth rings faithfully recording the bad years alongside the good.

No one knows how much different the latest episode of climate change may turn out to be, nor how well the magnificent pine trees -- some of which can reach ages of 4,500 years or more -- might fare. But one difference is clear already: For a while, at least, the bristlecones won't be the only ones recording what happens.

Jeff Holmquist and Jutta Schmidt, a husband and wife team affiliated with the UC laboratories, set out in a meadow with insect nets and a custom-made "throw trap," a contraption the size of a large pizza box made of netting tied to a frame of pipe wrapped in lengths of garden hose.

Holmquist tossed down the trap, and while Schmidt held the netting in place, fired up a portable leaf blower to suck up all the insects inside the netting.

It will take the pair at least a week to count and identify all they caught, to serve as a baseline to compare against future samples from the same locations. The impact of climate change on insect density may be one of the more critical aspects of high-mountain ecology, given the importance of insects in the food chain. It's also a tricky business to study.

"It's going to take some major changes, over a very long time, for us to detect a real difference," Holmquist said.

For one thing, the bugs hate being caught. They tend to dive down into the base of the plants when the leaf blower comes around. Schmidt used clippers to trim the grass, but it still looked like quite a few insects managed to escape this year's census.

Another crew, led by John Smiley, site manager of the White Mountain Research Station, spent a day chasing after butterflies, part of an annual nose-count being tied in with the GLORIA field studies.

He was helped by Derham Giuliani, 75, a retired naturalist from nearby Big Pine; Paul McFarland of the environmental group Friends of the Inyo; and Sean Schoville, a UC Berkeley graduate student.

By the end of a single day, the four men had sampled six locations from 12,700 feet to 10,200 feet, counting 460 butterflies of 18 species.

"The simplest thing you can say about butterflies is they follow their host plants," Smiley said. "There's gonna be changes, but we don't really know how mobile they are."

As the insect crews worked, Dennis and her main crew of GLORIA naturalists established a fresh set of study plots, lower down from the summit among the bristlecone. They chose the sites to include more species in lower elevations than the standard GLORIA study sites.

Those other plants might be the first ones to reach the mountaintops once the climate warms enough.

Nobody knows yet how the alpine plants might manage the new competition. One idea, however, is that as low-elevation plants move up the slopes, the bristlecone and other high-altitude species will be crowded to extinction, "moving up to heaven," as the Austrian leader of the GLORIA project, Georg Grabherr, likes to put it.

Field studies are finding evidence of unexpected changes, however, such as plants moving downward into ravines where water may be more plentiful, or skipping over some sites because of soil preferences.

Still other plants with slow methods of seed dispersal may have trouble keeping pace with the rapid rise in temperatures, even if better conditions are just a few hundred yards up a mountain side.

And some of the most commonly seen plants on mountaintops also are found at lower elevations, suggesting that some alpine species may do fine in a warmer world

"It's going to be more complicated than just a simple matter of everything moving to higher elevations," said Adelia Barber, a UC Santa Cruz graduate student who studies the bristlecone and assisted in the GLORIA project.

Some changes may be very hard for some distinctive species that favor California's thin mountain air.

Weiss and a geologist collaborator, Chris Van de Ven of Albion College in Michigan, have created computer models showing that the bristlecones face big trouble if average temperatures keep going up as expected.

If temperatures rise by 6 degrees Fahrenheit, which many experts say is likely this century, about two-thirds of the bristlecones' ideal habitat in the White Mountains effectively will be gone.

Established trees may linger on, the same as they have managed to do for thousands of years. But seedlings from their cones may have a very difficult time carrying on the family tradition of longevity.