

Scientists begin sweeping project to study California redwoods

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ARNOLD — Two of his colleagues dangled on ropes 100 feet above from the gnarled branches of a giant sequoia tree. Steve Sillett could hardly contain his excitement.

"This site is just juicy. It's loaded," said Sillett, gazing up at the ancient canopy at Calaveras Big Trees State Park. "There are amazing lichens up there. There are aphids being hunted by ladybugs. I found a sizable dogwood tree growing from a branch 210 feet off the ground."

The foggy, lost worlds atop the world's biggest trees are about to come into sharper focus.

Concerned that rising temperatures across California could threaten the future of the state's coast redwoods and giant sequoias in the next century, Sillett, one of the nation's top redwood scientists, and a team of researchers have embarked on a first-of-its-kind project to measure how global warming is affecting California's iconic trees.

Over the next three years, the team members, funded by Save the Redwoods League in San Francisco, are climbing immense redwoods and sequoias at 13 locations as part of the \$2.5 million project. The study's locations extend from the remote corners of Jedediah Smith Redwoods State Park near the Oregon border to Big Basin in Santa Cruz County to the timeless groves of Sequoia National Park in the central Sierra Nevada.

Researchers are fitting individual trees — many of which were growing before Europe's medieval cathedrals were built — with sensors to measure for temperature, humidity, rain, fog, light, wind and barometric pressure.

Their goal is to see how the trees respond to changes in temperature and rainfall, along with a reduction in fog, a trend that already is under way.

"These are trees that have inspired people for hundreds of years," said Ruskin Hartley, executive director of Save the Redwoods League. "But what does their future look like? We really don't know."

Detailed data

Sillett is a Humboldt State botanist whose pioneering research climbing redwoods 300 feet tall and higher was featured in the 2007 book "The Wild Trees" by New Yorker writer Richard Preston. As part of the "Redwoods and Climate Change Initiative," he and his colleagues are making 3-D computer models of several trees at each site, meticulously measuring their girth every 15 feet, their bark, every branch larger than two inches in diameter, even the number of cones.

They climb the trees by first shooting an arrow, attached to fishing line, over a large, high branch. Then they tie a nylon rope to one end, and pull the fishing line back over the branch. Finally, they tie one end of the rope to another tree then ratchet up with mechanical ascenders that are commonly used by mountaineers and ice climbers.

Once near the top, they unhitch themselves, secure another rope to the tree and attach to it so they can move around the highest branches.

"It turns out you can't really adequately measure a tree from the ground," said Sillett. "A Christmas tree, maybe. But not a redwood."

The researchers plan to return every three years to take new measurements of the trees' sizes so they can calculate the rate at which the trees are growing, responding to stress and processing water and light.

Scientists also are measuring tree height with laser beams. They hope the project will continue for 100 years.

Redwoods have been around for 120 million years or more. They once lived side by side with dinosaurs, across wide ranges through Canada, Utah, Montana and Southern California.

"There are redwood stumps in the La Brea tarpits," said Todd Dawson, a lead scientist on the team and director of the Center for Stable Isotope Biogeochemistry at UC Berkeley.

"These trees have seen climate change before. But they haven't seen it the way they are seeing it now."

Added Sillett, hiking through thick brush this month in the southern edges of Calaveras Big Trees park: "We just don't know how these trees respond to climate change at all — other than when it's dry, they don't grow as much."

Climate change is already under way. The 10 hottest years since 1880, when modern temperature measurements began, all have occurred since 1998, according to the National Climatic Data Center.

Less of California's precipitation is falling as snow. And a study in February by Dawson and other scientists found a 33 percent reduction in coastal fog over the past 100 years, a critical source of water for redwoods.

Recent modeling by researchers at the California Academy of Sciences shows that if carbon dioxide continues to build in the atmosphere at the current rate — it has increased 30 percent since the mid-1800s due to the burning of fossil fuels — temperatures, rainfall and fog levels at the southern end of the redwood range in Monterey and Santa Cruz counties will become unsuitable to support redwoods by 2100.

Today, coast redwoods exist only along a narrow 450-mile band from Big Sur to the Oregon border. Similarly, giant sequoias live only in parts of the Sierra Nevada.

The ancient trees that survive today — hundreds of which are taller than San Francisco's Coit Tower and the Fairmont Hotel in downtown San Jose — made it through a massive wave of old-growth logging that ran from the 1860s to the 1980s. Only about 4 percent of California's old-growth coast redwoods remain.

In centuries past, warming or cooling resulted in redwoods shifting their ranges and growing in different places. Today, California has 40 million people, and some potential new sites for the trees are developed.

"What can we do? That's the \$64,000 question," said Dawson. "Our hope is that we can understand where the boundaries and tipping points are."

Possible solutions

With better data about how redwoods are reacting, political leaders might encourage programs to preserve land farther north, to plant new groves of redwoods. Or they might change logging rules, or expand controlled burns into redwood forests to reduce fire risk in a drier climate.

As part of the project, Dawson takes thin core samples of the trees, and then analyzes the isotopes of carbon and oxygen in the tree rings. Using that data he can measure wood production, the amount of carbon the trees store and annual growth, and can document monthly climate conditions centuries ago and how trees responded.

So far, Save the Redwoods League has raised about \$250,000 for the project. It also has a \$500,000 matching grant pledge from Ken Fisher of Woodside. Fisher, a columnist for Forbes magazine, started in the 1970s as a forestry major at Humboldt State but switched to economics and today is CEO of Fisher Investments, a privately owned money management firm.

"When you talk to people about what climate change might mean for these forests, there's lots of speculation," he said. "Mostly up to now, people have been making wild guesses. This is really an exciting project because nobody's done it before."