Giant Sequoias Yield Longest Fire History from Tree Rings

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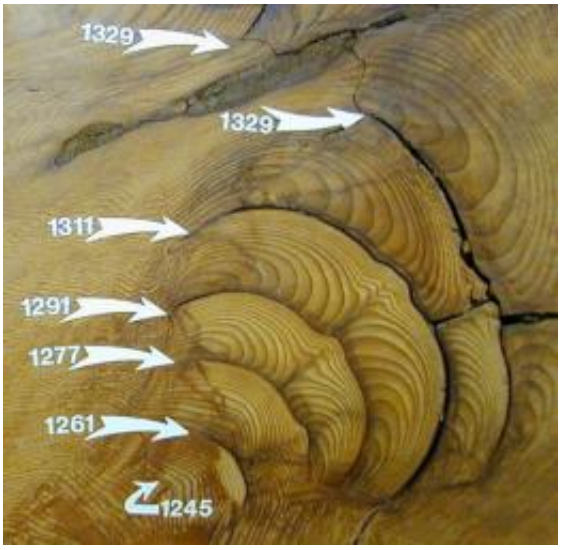

This cross-section of a giant sequoia tree shows some of the tree-rings and fire scars. The numbers indicate the year that a particular ring was laid down by the tree. (Credit: Tom Swetnam)

(PhysOrg.com) -- California's western Sierra Nevada had more frequent fires between 800 and 1300 than at any time in the past 3,000 years, according to a new study led by Thomas W. Swetnam, director of UA's Laboratory of Tree-Ring Research.

A 3,000-year record from 52 of the world's oldest trees shows that California's western Sierra Nevada was droughty and often fiery from 800 to 1300, according to a new study led by University of Arizona

researchers.

Scientists reconstructed the 3,000-year history of fire by dating fire scars on ancient giant sequoia trees, Sequoiadendron giganteum, in the Giant Forest of Sequoia National Park. Individual giant sequoias can live more than 3,000 years.

"It's the longest tree-ring fire history in the world, and it's from this amazing place with these amazing trees." said lead author Thomas W. Swetnam of the UA. "This is an epic collection of tree rings."

The new research extends Swetnam's previous tree-ring fire history for giant sequoias another 1,000 years into the past. In addition, he and his colleagues used tree-ring records from other species of trees to reconstruct the region's past climate.

The scientists found the years from 800 to 1300, known as the Medieval Warm Period, had the most frequent fires in the 3,000 years studied. Other research has found that the period from 800 to 1300 was warm and dry.

"What's not so well known about the Medieval Warm Period is how warm it was in the western U.S.," Swetnam said. "This is one line of evidence that it was very fiery on the western slopes of the Sierra Nevada - and there's a very strong relationship between drought and fire."

Droughts are typically both warm and dry, he added.

Knowing how giant sequoia trees responded to a 500-year warm spell in the past is important because scientists predict that climate change will probably subject the trees to such a warm, dry environment again, said Swetnam, a UA professor of dendrochronology and director of UA's

Laboratory of Tree-Ring Research.

During the Medieval Warm Period extensive fires burned through parts of the Giant Forest at intervals of about 3 to 10 years, he said. Any individual tree was probably in a fire about every 10 to 15 years.

The team also compared charcoal deposits in boggy meadows within the groves to the tree-ring fire history. The chronology of charcoal deposits closely matches the tree-ring chronology of fire scars.

The health of the giant sequoia forests seems to require those frequent, low-intensity fires, Swetnam said. He added that as the climate warms, carefully reintroducing low-intensity fires at frequencies similar to those of the Medieval Warm Period may be crucial for the survival of those magnificent forests, such as those in Sequoia and Kings Canyon National Parks.

Since 1860, human activity has greatly reduced the extent of fires. He and his colleagues commend the National Park Service for its recent work reintroducing fire into the giant sequoia groves.

The team's report, "Multi-Millennial Fire History of the Giant Forest, Sequoia National Park, California, USA," was published in the electronic journal *Fire Ecology* in February. A complete list of authors and funding sources is at the bottom of this story.

To study tree rings, researchers generally take a pencil-sized core from a tree. The oldest rings are those closest to the center of the tree. However, ancient giant sequoias can have trunks that are 30 feet in diameter - far too big to be sampled using even the longest coring tools, which are only three feet long.

To gather samples from the Giant Forest trees, the researchers were

allowed to collect cross-sections of downed logs and standing dead trees, he said. It turned out to be a gargantuan undertaking that required many people and many field seasons.

"We were sampling with the largest chain saws we could find - a chain-saw bar of seven feet," he said. "We were hauling these slabs of wood two meters on a side as far as two kilometers to the road. We were using wheeled litters - the emergency rescue equipment for people - and put a couple hundred pounds on them."

To develop a separate chronology for past fires, co-authors R. Scott Anderson and Douglas J. Hallett looked for charcoal in sediment cores taken from meadows within the sequoia groves.

"We can compare the charcoal and tree-ring fire records. It confirms that the charcoal is a good indicator of past fires," Swetnam said.

Such charcoal-based fire histories can extend much further into the past than most tree-ring-based fire histories, he said. The charcoal history of fire in the giant sequoia groves extends back more than 8,000 years.

Increasingly, researchers all over the world are using charcoal to reconstruct fire histories, Swetnam said. Many scientists are analyzing the global record of charcoal to study relationships between climate, fire and the resulting addition of carbon dioxide to the atmosphere.

Provided by University of Arizona