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World's Oldest Ponderosa Pine Found in Utah Fire Study

"1765…1772…1777…1780…1782." Stan Kitchen recites from memory a partial list of drought years as indicated by the narrowness of growth rings that form each year on trees. Kitchen is a research botanist for the USDA Forest Service, Rocky Mountain Research Station, at the Shrub Sciences Laboratory in Provo, where he studies the link between fire and climate. By examining the record of fires and drought recorded in the rings of more than 800 trees in the Wah Wah Mountains, west of Milford, he has become intimately familiar with the history of the last several centuries of drought and fire for this remote and rugged location.

Photo: Doug Page

Stan Kitchen and Forester Clint Reese measure the world's oldest ponderosa pine in the Wah Wah Mountains.

Kitchen uses a chain saw to remove a wedge of wood from near the base of selected trees, leaving the tree circumference about 80 percent intact so it continues to live. Samples are also taken from stumps, logs and snags. He brings these samples back to his lab for sanding and processing so the annual rings can be easily identified. One of the trees he sampled in 2003 turned out to be the oldest known living ponderosa pine in the world. Kitchen took a sample from this tree at about 12 inches above the ground. The inner-most ring of the sample dates to the year 1075, making this tree at least 933 years old. But it probably took an additional 10 to 20 years to grow to the height of the sample, making the tree perhaps 950 years old.

To obtain ring data the samples are prepared and closely examined. The lighter colored wood in the rings is called "early wood" because it forms early in the season, and the darker strips are called "late wood" because they form later in the season. Each year a tree grows a strip of early and late wood, equaling one growth ring. Counting these rings reveals the tree's age. However, during

INSIDE THIS ISSUE:

drought years there are often "missing rings." Under his microscope, Kitchen can see rings that are just one cell wide. So even when the tree fails to grow an obvious ring, he can often follow the ring around the sample to find a place where it separates, showing that there was indeed a year recorded there. By correlating the dry years between samples, he builds what is called a Master Chronology. This technique is used to date all wood over time in a particular watershed.

Stan Kitchen uses a special microscope to study tree rings in a sample taken from the world's oldest known ponderosa pine at the Shrub Sciences Laboratory in Provo.

Ponderosa pine has a broad natural range that includes much of the western United States and parts of southern British Columbia and northern Mexico. It is said to be the most important pine in the Rocky Mountains for wood products. I mentioned to Kitchen that I found it surprising that the oldest ponderosa in the world would be located on a dry rocky slope in western Utah. I visited the largest ponderosa pine tree in the world near Mt. Adams in Washington State a few years ago, so I would have guessed that the oldest ponderosa would come from a similar site. But Kitchen pointed out that the oldest trees of any particular species are typically located on marginal growing sites, not the more productive sites that yield the largest of a species. Perhaps the largest trees grow fast and die young.

Although there is no "official record" of the oldest trees in the world, the accepted record keeper, according to Kitchen, is Rocky Mountain Tree Ring Research, a non-profit research organization in Fort Collins, Colorado. The Old Tree List is available on their Web site at http://www.rmtrr.org/oldlist.htm. The list focuses mainly on North America, and reading it held some surprises for me. Compared to other tree species, Kitchen's ponderosa pine only made the "youngster" category, being less than 1,000 years old. The list begins with 4,000 plus-year-old bristlecone pines from Nevada and California, includes several 3,000 to 4,000-year-old sequoias in California, a handful of 2,000 to 3,000-year-old trees, mostly in California, and more than two dozen trees in the1,000-year-old plus category from around the West and other parts of the world. Utah has three other trees on the list including two pinyons at 1,101 and 973 years old and a Douglas-fir at 843 years old. Not on the list is an aspen that Dr. John Shaw aged at over 300 years near Bear Lake; very possibly the oldest of its kind.

The annual rings in a tree sometimes record the fires that burn at the base of the tree without killing it, although not all fires may be recorded on an individual tree. The fire must be hot enough or of long enough duration to scar the tree. Ponderosa pine typically has

This core sample shows the annual rings, with date marks added, from another ancient ponderosa pine.

thick bark and can survive a fire that burns at its base. The sample from Kitchen's oldest ponderosa recorded just two fires in this part of Lawson Canyon during the almost 1,000 years of the tree's existence. I found it surprising that both of the fires occurred in the same century, the 1500s. According to Kitchen, other trees in the watershed recorded as many as 10 fires. Conversely, a sample taken from an old ponderosa pine stump in Rose Spring Canyon 20 miles to the south, contained tree ring evidence of 30 fires recorded between 1407 and 1828.

Forester Clint Reese measures the oldest known ponderosa pine.

I asked Kitchen to speculate on why there was such a big difference in fire activity within and between drainages. First he explained that no tree should be considered a complete record of the fires experienced in an area. Differences within drainages are often due to differences in factors like aspect, soil depth, and slope. All of these affect the way that fuels accumulate and consequently the behavior of fires when they occur. He also said that differences among drainages could be due in part to the influence of Native Americans who were known to intentionally and perhaps accidentally start many fires in some places. Rose Spring Canyon has a water source, while the nearby Lawson Canyon does not. Therefore, Rose Spring Canyon was more likely to have been inhabited or visited by people and would likely have had more human-ignited fires over the years. Despite these clues, he said more information is needed before any hard conclusions can be drawn.

Another interesting thing about the record of the two fires in the 1500s is that the tree grew more in the years immediately following fires, as competition for water and nutrients was curbed by the removal of surrounding trees and shrubs. This is a typical response to fire for surviving trees; similar to a forest thinning response.

This leads to one of the more important findings of Kitchen's study; he says "My research shows that over time the forest structure is changing, especially since the pattern of frequent surface fires ended in the 1800s." In addition to what he sees in the tree rings, he has also noticed the presence of Douglas-fir "skeletons" or snags in these canyons, but few living trees of that species. He sees a similar pattern in the sagebrush and mountain-mahogany trees on portions of these sites. Skeletons are present, but few living plants. The forest is becoming crowded with pinyon, juniper, and white fir trees. If the current density of trees and shrubs had been present when wildfires ran through these stands, these older ponderosa pine trees would not be alive today. The severe crowning fire that is generally observed in these crowded forests today would have

most certainly been lethal to these old trees.

This part of the Wah Wah Mountain range is public land administered by the USDI Bureau of Land Management (BLM). Kitchen has been cooperating with BLM's Southwest Utah Zone Forester Doug Page on identification of these ancient trees in southwestern Utah. Page is concerned about the future of these ancient pine trees and believes that more active management can help to protect them. The abundant vegetation around the base of the trees can act as ladder fuel in the case of a wildfire, allowing fire to climb into the canopy and kill the tree. Although this oldest of pines has survived wildfires in the past it may not survive them in the future.

Page said that "by mechanically removing a portion of the competing species from the site, primarily pinyon, juniper and white fir, and thereafter using fire to maintain a more open setting," the BLM could maximize the trees' chances for long-term survival.

by Darren McAvoy

Ponderosa Pine Identification

Leaves: Needles in groups of two and three; 3" to 10" long.
Cones: Each scale armed with a short, sharp spine.
Bark: Dark brown to black on younger trees: older trees have large, thick plates, orange to cinnamon-red, separated by deep furrows; inner bark has a vanilla smell.
General: Native to mountainous areas in southern two-thirds of Utah and throughout the West. Resists fires with thick bark. Drought resistant. Shade intolerant.

Engelmann Spruce Idendification

Leaves: Needles borne singly about 1" long; evergreen; blue-green to dark green.
Fruit: a papery cone that hangs down; about 1" long (blue spruce cones are 2.5 to 4" long).
Bark: red to purple brown; made up of thin scales.
General: Approximately 95 percent of Utah's spruce are Engelmann Spruce; blue spruce (Utah's official state tree) makes up about 5 percent of our spruce.