A Fire Scarred Ponderosa Pine
from
Horseshoe Springs, Jemez Mountains, New Mexico

A Report by
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August 30, 2023

In the winter-spring of 2022-2023 an old ponderosa pine that had died some years before toppled to the ground. It had germinated and grown in this spot near Horseshoe Springs for almost 400 years. Over the decades it witnessed many events, including rain and snowstorms, droughts, and wildfires. People had walked beneath its branches and built homes nearby. Men and women on horseback and in wagons, and later in trucks and automobiles, passed by on the old road, only a hundred yards away.

A resident of Horseshoe Springs, Brent Bonwell, noticed that the base of the fallen tree contained a characteristic triangular-shaped fire scar. He wondered if it would be possible to take a cross section and determine the dates of past fires that scarred the tree. He contacted my colleague Dr. Ellis Margolis of the USGS Jemez Mountains Field Station. Dr. Margolis has conducted multiple tree-ring fire history studies in the Jemez Mountains. He suggested they contact me to see if I was interested in tree-ring dating a cross section from the fallen tree.

On June 20, 2023 I met with Brent, and Glen Banks at the fallen tree near Horseshoe Springs (location: 35°52'44.6"N 106°39'26.3"W). On inspecting the exposed face of the fire scar wound I counted at least 9 fire scar events. Brent cut the cross section at approximately one foot about the original ground level.

Figure 1. Brent Bonwell (at left) and Glen Banks (at right) cutting the cross section.

After cutting the section, it was possible to see at least 8 more fire scars that were completely grown over by ring growth.

Figure 2. The re-sectioned Horseshoe Springs sample showing 17 different fire scar dates. Pith date 1643, bark date 2014. In addition to the fire scars, a pitch pocket that was probably caused by a failed bark beetle attack is visible in the left lobe of the healing curl in the 1996 tree ring.

Although a nearly full cross section was obtained most of sapwood around the outer circumference was decayed. Also, there were multiple holes from the feeding by large insect larvae, probably from ponderosa pine borer beetles. Consequently, I re-sectioned the sample on a band saw, saving the most sound wound and the visible fire scars within the heartwood and adjacent sapwood. I then belt sanded the cross sections (two separate ones) using sanding grits of 60 to 400.

A 10 to 30X variable-power binocular microscope was used to view all rings and fire scars. The ring-width series from pith to bark along the most complete and least distorted by the fire scars was plotted using the skeleton plot method. The sample section plot was than crossdated against a Jemez Mountains master tree-ring width chronology. Crossdating was good to fair in parts of the series, particularly in the first few decades (pith date 1643) and after about 1740. The outermost tree-ring date, which is probably the date this tree died from drought and beetle attack was 2014. Locally absent rings were found in several dates, including 1685, 1806, 1817, 1842, 2002, and 2011. The 1806 locally absent ring shows up only in expanded growth of the healing scar over the 1801 ring.

A total of seventeen fire scar dates were determined. The following table summarizes the dates, the within ring position of the scars, and a comparison of the dates with a time series of percentage trees scarred per year sampled across the entire Jemez Mountains from many locations (see Figures 3 and 4).

Fire Scar Date	Scar Position	% Scarred
1752	LE	19.6
1763	ME	19.1
1773	ME	30.4
1795	ME	12.3
1801	EE	33.4
1806	D	21.5
1818	U	20.8
1827	U	0.2
1836	U	9.3
1842	ME	33.2
1847	ME	20.5
1851	ME	30.6
1857	D	3.4
1870	D	14.9
1879	LE	15.2
1896	EE	4.8
1900	D	0.4

The intra-ring scar position codes in the table are as follows: D = dormant season, on ring boundary between two rings; probably a spring fire; EE = early, earlywood; probably a spring or early summer fire; ME = middle earlywood; probably a summer fire; LE = late earlywood; probably a late summer fire; U = fire scar position cannot be determined because too narrow rings.

Summary of Results

The fire scarred tree from near Horseshoe Springs is an excellent example of an old ponderosa pine tree with more than the typical number of clearly recorded fire scars -- a total of 17 recorded fire events. Most fire scars were within the earlywood portion of the ring, indicating fires that occurred between May and July.

The specific fire dates recorded by this tree are also quite typical of the largest fires that spread over the Jemez Mountains during the past 300 years (Figures 3 and 4). It is especially notable that all but four of the seventeen fire dates are also among the largest fires recorded in

the Jemez Mountains among the existing network. This is one of the largest landscape-scale fire scar networks in North America.

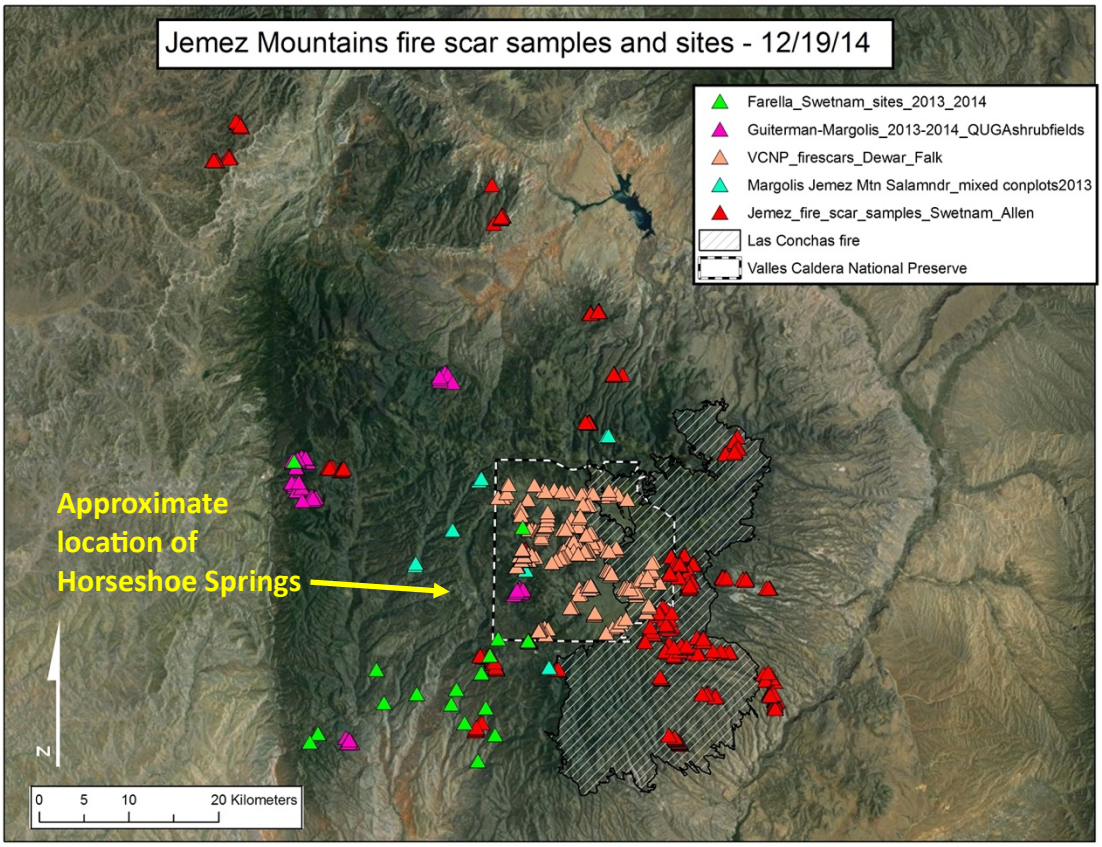

Figure 2. A Google Earth view of the Jemez Mountains showing the location of fire scar sampling sites, as of 2014. Most of the sites shown include 5-10 or more fire scar trees sampled per site. The location of the sampled tree is near the old Horseshoe Springs Forest Service Campground (removed from public access in the late 1960s), and also near the old road that ascended Fenton Hill from La Cueva.

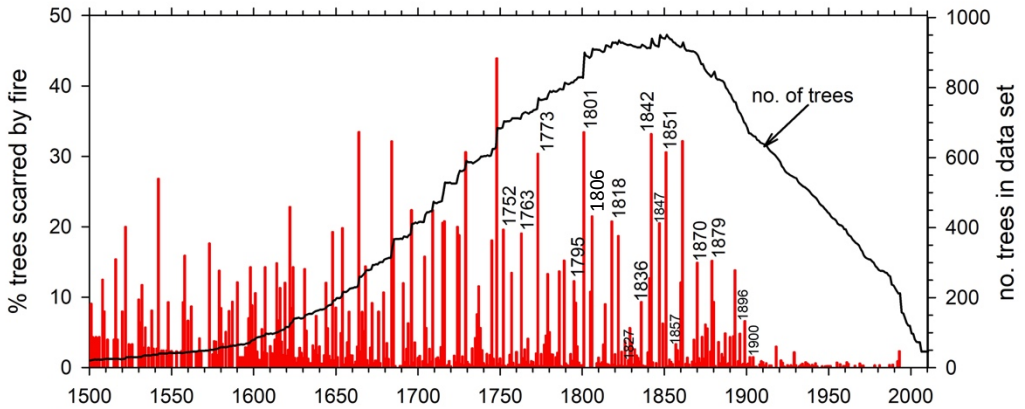

Figure 3. Time series of percentage trees scarred per year in the Jemez Mountains fire scar network, which includes more than 1,200 sampled trees. The seventeen labeled fire scar dates are those recorded by the Horseshoe Springs tree.

The first visible fire scar date of 1752 may not have been the first fire scar that this tree incurred. The open burned face of the wound seems to have been charred back by multiple fires, and so it seems likely that this tree was probably also scarred by the most widespread fire recorded in the Jemez in 1748.

The fire dates matching the lowest percentage of scarred trees occurred in 1827, 1857, 1896, and 1900. Fire scar dates on trees in 1827 and 1900 are rare in the Jemez. More fire scars occur the year before in 1899. On close inspection of the two samples obtained, 1900 is indeed the recorded date. I speculate that these smaller and somewhat unique fires in the Horseshoe Springs area were related to human-set fires as Spanish land grant and later Anglo-American settlers began to build farms and sawmills in this area during that period.

The lack of recorded fires after circa 1900 also reflects the pattern seen across the entire Jemez. Large numbers of sheep were grazed in the Valles, including the "Vallecito de la Cuvea" (as labeled on the 1876 San Diego Land Grant Map), especially after about 1870. They removed grassy fuels that carried fires, and they also created cleared "driveways" where sheep were moved back and forth almost daily between grazed areas and springs. The U.S. Forest Service began systematically suppressing wildfires after 1905, and especially after 1910.

For more information about fire history studies in the Jemez Mountains see the references (and links) listed below.

Finally, it is worth noting that a couple of hundred yards downhill from the Horseshoe Springs fire scarred tree is the record largest Southwestern White Pine (Pinus strobiformis) in New Mexico (location: 35°52'43.5"N 106°39'21.2"W).

Jemez Mountains Fire History publications (partial list):

J.J. Dewar, D.A. Falk, T.W. Swetnam, C.H. Baisan, C.D. Allen, R.R. Parmenter, E.Q. Margolis, and E.J. Taylor. 2021. Valleys of fire: historical fire regimes of forest-grassland ecotones across the montane landscape of the Valles Caldera National Preserve, New Mexico, USA. Landscape Ecology 36:331–352 doi.org/10.1007/s10980-020-01101-w.

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Christopher H. Guiterman, Ellis Q. Margolis, Craig D. Allen, Donald A. Falk, and Thomas W. Swetnam. 2018. Long-term persistence and fire resilience of oak shrubfields in dry conifer forests of northern New Mexico. Ecosystems 21:943-959.

Matthew J. Liebmann, Joshua Farella, Christopher I. Roos, Adam Stack, Sarah Martini, and Thomas W. Swetnam. 2016. Native American Depopulation, Reforestation, and Fire Regimes in the Southwest U.S., 1492-1900 C.E. Proceedings of the National Academy of Sciences, v.113, p.E696 10.1073/pnas.1521744113

Ellis Q. Margolis, Steven B. Malevich. 2016. Historical dominance of low-severity fire in dry and wet mixed-conifer forest habitats of the endangered terrestrial Jemez Mountains salamander (Plethodon neomexicanus). Forest Ecology and Management 375:12–26.

Christopher I. Roos and Christopher H. Guiterman. 2021. Dating the origins of persistent oak shrubfields in northern New Mexico using soil charcoal and dendrochronology. The Holocene 31(7):1212-1220.

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https://www.dropbox.com/s/tuvch9ooiql2tkp/Area3_FireHistory_April2017.pdf?dl=0

Thomas W. Swetnam, Joshua Farella, Christopher I. Roos, Matthew J. Liebmann, Donald A. Falk, and Craig D. Allen. 2016. Multi-Scale perspectives of fire, climate, and humans in western North America and the Jemez Mountains, U.S.A. Philosophical Transactions of the Royal Society B, v.371, p.20150168 10.1098/rstb.2015.0168