Fire History of a Ponderosa Pine Stand
Area 3, San Diego Canyon
Jemez Ranger District, Santa Fe National Forest

A Report

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In April 2016 fire scarred cross section samples were obtained from eleven ponderosa pine stumps and logs on the relatively level bench that lies above (west of) the housing development of "Cool Pines" and "Quinn's Haven" (also known as "Area 3"). This bench is just below the cliffs of Virgin Mesa. An old logging road, probably dating to the late 1930s or 1940s, extends from the housing development up onto the bench. Tom Swetnam (Univ. Arizona), Ellis Margolis (USGS), Collin Haffey (USGS), Lane Johnson (USGS) and Dennis Carril (USFS) collected the specimens. This collection was under a permit issued by the Santa Fe National Forest to Johnson, Margolis and Swetnam for collection of tree-ring samples on the Forest.

This area is within the San Diego WUI Project Area that is slated for a forest restoration treatment by the Santa Fe National Forest and Jemez Ranger District (see map in Figure 1). The general area on the bench was searched for suitable fire scarred specimens for sampling and dendrochronological dating. The trees selected were the best-preserved stumps and logs with maximum visible external fire scars in basal wounds. The collection was distributed over an area of about 3 acres (or about 11 acres if specimen TWS-8 is included, see Figure 2).

A chainsaw was used to extract cross section samples. The cross sections were sanded with a belt sander, with belt grits up to 400. All tree-rings and fire scars were then microscopically examined and dated using dendrochronological crossdating methods. All samples were dated at the USGS Tree-Ring Lab in Santa Fe, NM by Lane Johnson and Ellis Margolis. Swetnam also confirmed the crossdating on specimen TWS-8 at his lab (Figure 3).

Summary of Results

The tree-ring series extended back to 1634 (see Figure 4). One tree had a pith date of 1634 and another had a pith date of 1636. Most of the dead trees had outermost ring dates between ca. 1910 and 1950. One specimen (TWS-8, Figure 3) from an old stump cut by crosscut saw and axe had a "bark ring" outermost date of 1940. This may indicate the date of logging of this stand. (In other tree-ring sampling by Swetnam on the lower bench in Area 3, where most houses are located today, an earlier logging of that area is indicated by outermost tree-ring

dates in the early 1880s on remnants of a "log chute" descending from the bench to the valley floor.)

One living small diameter tree (about 8 inches DBH, TWS-7) with a recent looking fire scar was sampled. The date of that fire scar was 1976. Evidence of that fire was present in the general vicinity, with charred logs in some places, other fire scarred trees from the event, and a somewhat more open canopy structure.

Overall, the master fire scar chronology of this collection (Figure 4) shows a common pattern observed in areas of northern New Mexico with a long history of Pueblo, Hispanic, and Anglo-American occupation and land use. Oldest trees in this stand established between the 1630s and 1660s. That is typical of forest areas in the Jemez Mountains that are nearby Jemez ancestral village sites (Liebmann et al. 2016, Swetnam et al. 2016, Farella and Swetnam 2016). The village ruin of Nanishagi is located about 1 mile to the northeast, near the floor of the valley (just down canyon from the Lewis property). This village was apparently occupied at least until the early portion of the Spanish era, when the Mission de San Jose at Giusewa (in Jemez Springs) was constructed and occupied in the 1620s. Numerous Jemez field house ruins are scattered across the benches in Area 3, and check dam remnants are evident in small drainages above and on the benches. This area was undoubtedly extensively occupied and farmed by the Jemez people during the pre-Spanish period and into the early decades of the 17th century, at least.

The Jemez population decreased sharply sometime between the early and late 1600s, with an 80 percent or larger reduction in numbers of people (Liebmann et al. 2016). Trees subsequently established in these formerly heavily used areas, followed by surface fire regimes beginning within 20 or 30 years of de-population (Farella and Swetnam 2016). The first widespread fire scar date in the Area 3 collection was recorded in 1696, appearing on 9 of the 11 sampled trees that were alive at that time (Figure 4). Surface fires then burned regularly through this stand until the early 1800s. The high degree of synchrony of recorded fire dates among the trees is also typical of ponderosa pine forests in the Jemez and the Southwest. This reflects widespread burning. Although most trees are clustered in a relatively small area of about 3 acres, and 11 acres including sample TWS-8, given the rolling topography with no major fire barriers on the benches it is likely that this frequency of surface fires was typical of forest stands across most of Area 3. The Table below summarizes the mean interval (in years) between fires recorded by 2 or more trees (except 1976, which was recorded on one tree, but was included to represent the final fire interval).

Time Period	Mean Fire Interval (yrs)	Max Fire Interval (yrs)	Min Interval (yrs)	No. of Intervals
1690-1820	13.8	22	6	9
1820-1900	39.5	48	31	2
1900-2016	38.5	54	23	2

The decreased frequency of fires after about 1820 may be related to the beginning of increased livestock grazing, especially sheep, by early Hispanic settlers. The Cañon de San Diego Land Grant was a community land grant, and it was approved by the Spanish colonial Governor Fernando Chacon in 1798. The exact timing of settlement by the land grantees in the Jemez Springs area is not entirely clear, but it is likely during this period (i.e., 1790s to 1850s). The relatively level benches in what is now Area 3, with the Sino Spring, adjacent Agua Duerme Spring to the south, and other springs nearby, would have been a good place to bring livestock for grazing. As observed elsewhere in the Southwest, livestock grazing generally decreased or eliminated the spread of surface fires by removing grass fuels and creating many fuel-free trails. There were relatively widespread fires in 1851, 1899, and 1922, although the last two fires may have been less extensive than earlier fires. The final fire, as mentioned earlier, was in 1976, and this was likely much smaller in extent than earlier fires.

In addition to determining calendar years of fires, microscopic inspection of the fire scars can often identify whether the fire occurred during the dormant season (i.e., spring months, before June), during the growth of the earlywood portion of the tree ring (May though early-July) or in the latewood portion of the ring (mid-July to August). In the case of Area 3 collection, out of 100 fire scars examined, 38 could be dated to the approximate season of occurrence. Of these 38 fire scars, 86% occurred either in the dormant season or the early to mid-summer, and 14% occurred in the middle to late summer. This corresponds with observations in other fire scar studies in the Jemez and Southwest, and generally confirms that most areas burned in the drier, late spring to early summer months (May and June), prior to the onset of summer rains. Occasionally, the summer "monsoon" failed or was weak, and during these years late season fires were widespread later in the summer or fall (Margolis et al. 2017, in press).

In general, the fire history in Area 3 after circa 1690 shows that these forests burned most regularly and frequently during the period of lowest human populations and least amount of human land uses (i.e., farming, livestock grazing, and fuelwood harvesting) from about 1680 to 1820. Extensive fires burned about every 14 years, but with intervals as short as 6 years. After Hispanic people and then Anglo-Americans settled in San Diego Canyon, fires occurred relatively rarely (> 38 year intervals). After the 1920s, only small fires burned on this bench before being suppressed by Forest Service fire fighters. The lack of fire in most places in Area 3 for about 90 years is unprecedented in at least 300 years, and probably much longer.

The effects of livestock grazing and then active fire suppression by the Forest Service, plus the extensive logging in this area, has led to establishment of very dense ponderosa pine stands in the subsequent decades, including classic "dog hair thickets" in many places on the benches in Area 3. Forest areas commonly have more than 250 trees/acre, and some areas with thickets have more than 1,000 trees/acre (based on LiDAR measurements of this area by Swetnam). Forest restoration involving removal of most small diameter trees, and if possible, a return of surface fires via planned/prescribed burns, is ecologically justifiable. This is also probably the only way to prevent this forest area from burning, sooner or later (and probably

sooner), with very high intensity crown fire. In addition to the forest resources, homes and human lives at risk from such events, two of the three most important springs which provide water for the residents of Jemez Springs, and their associated water supply infrastructure, are at risk due to these forest and fuels conditions.

References Cited

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Figure 1. Map of San Diego WUI Project area, showing location of fire scar collection.

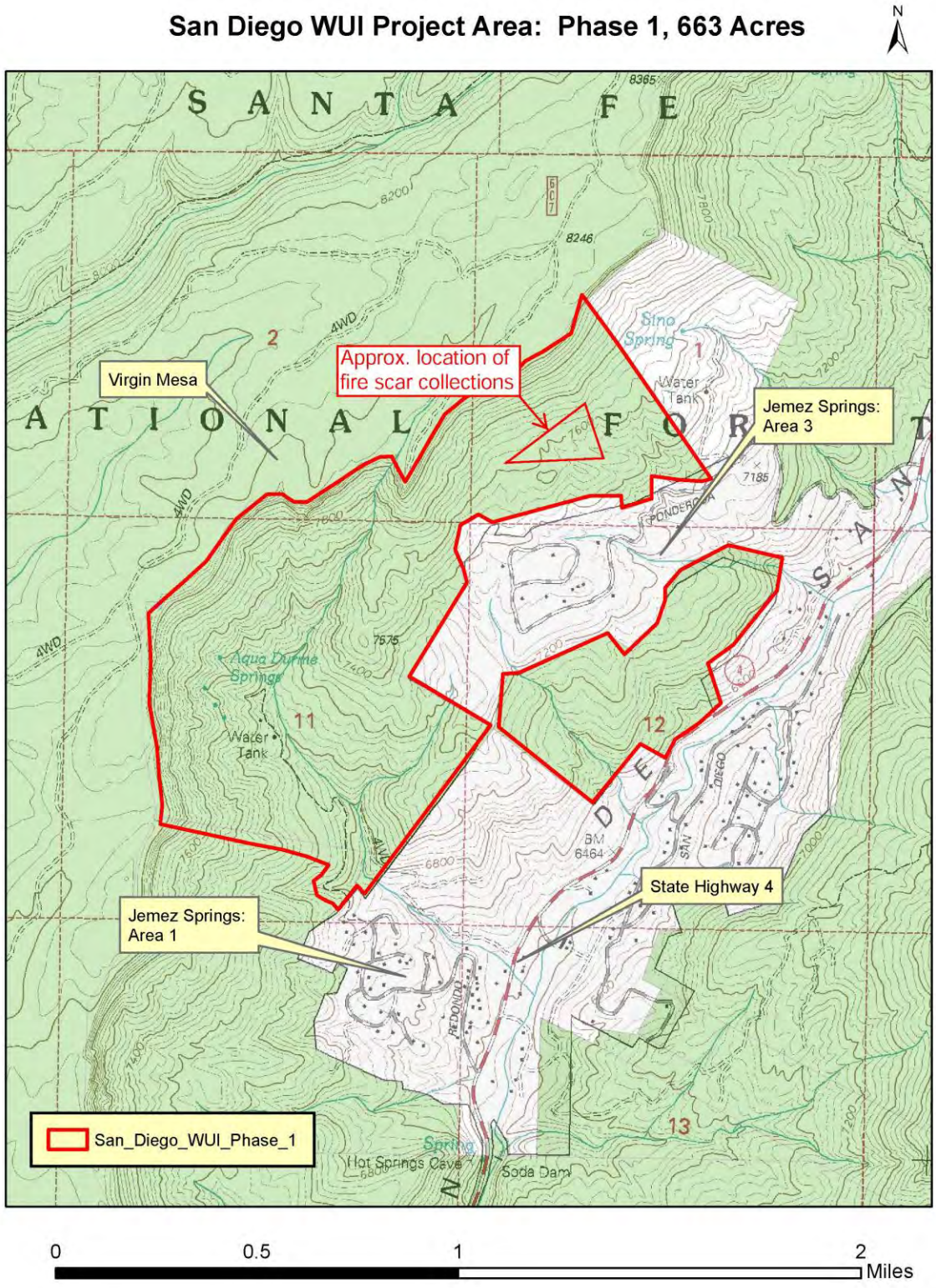

Figure 2. Google Earth view of fire scar collection area in Area 3.

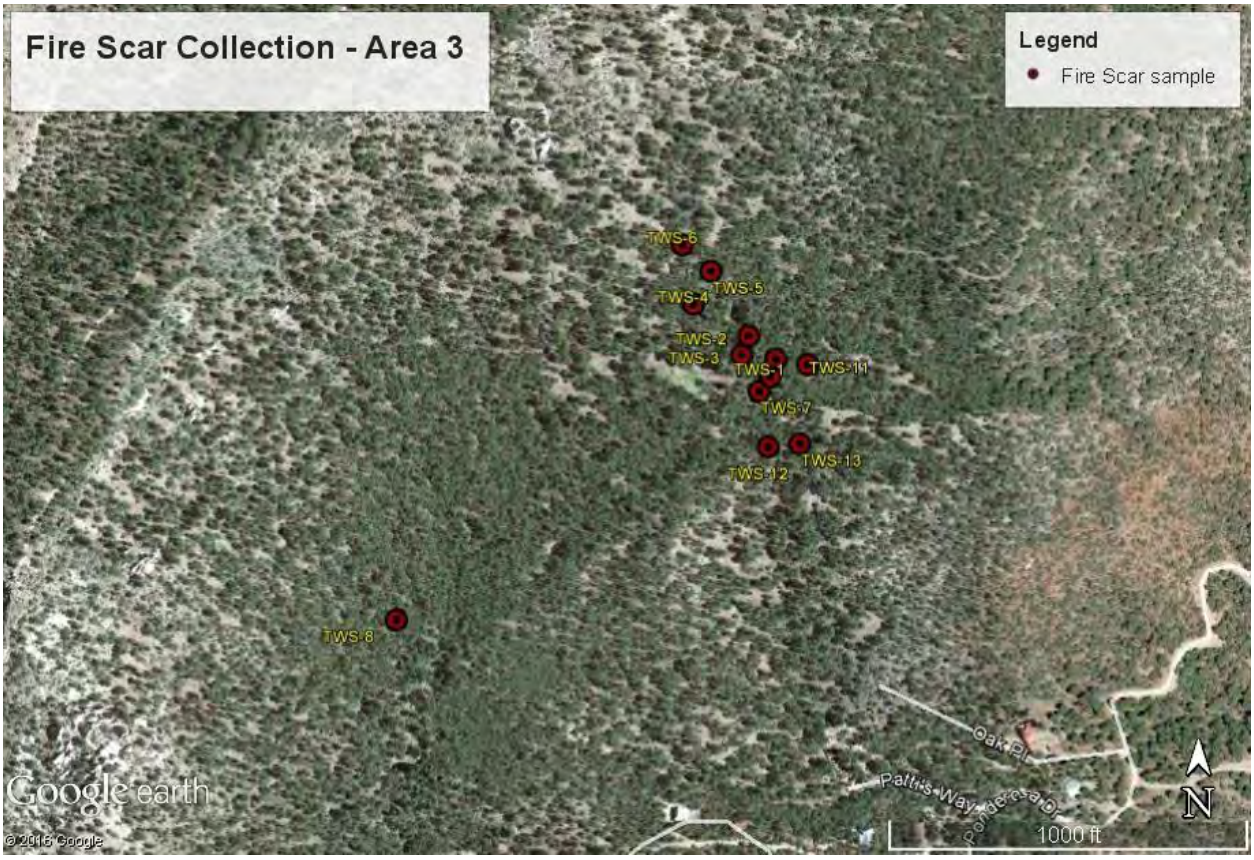

Figure 3. Fire scarred stump and cross section from specimen TWS-8. Only the resinous “heartwood” portion of the stump remains. This stump was cut by crosscut saw and axe in 1940. Multiple fire scars are visible on the “catface”. Beetle or wasp larval galleries were common in the Area 3 samples, and created a challenge in crossdating ring patterns and determining which rings contained the fire scars. Arrows show the individual fire scars on one “wing” of the cross section.

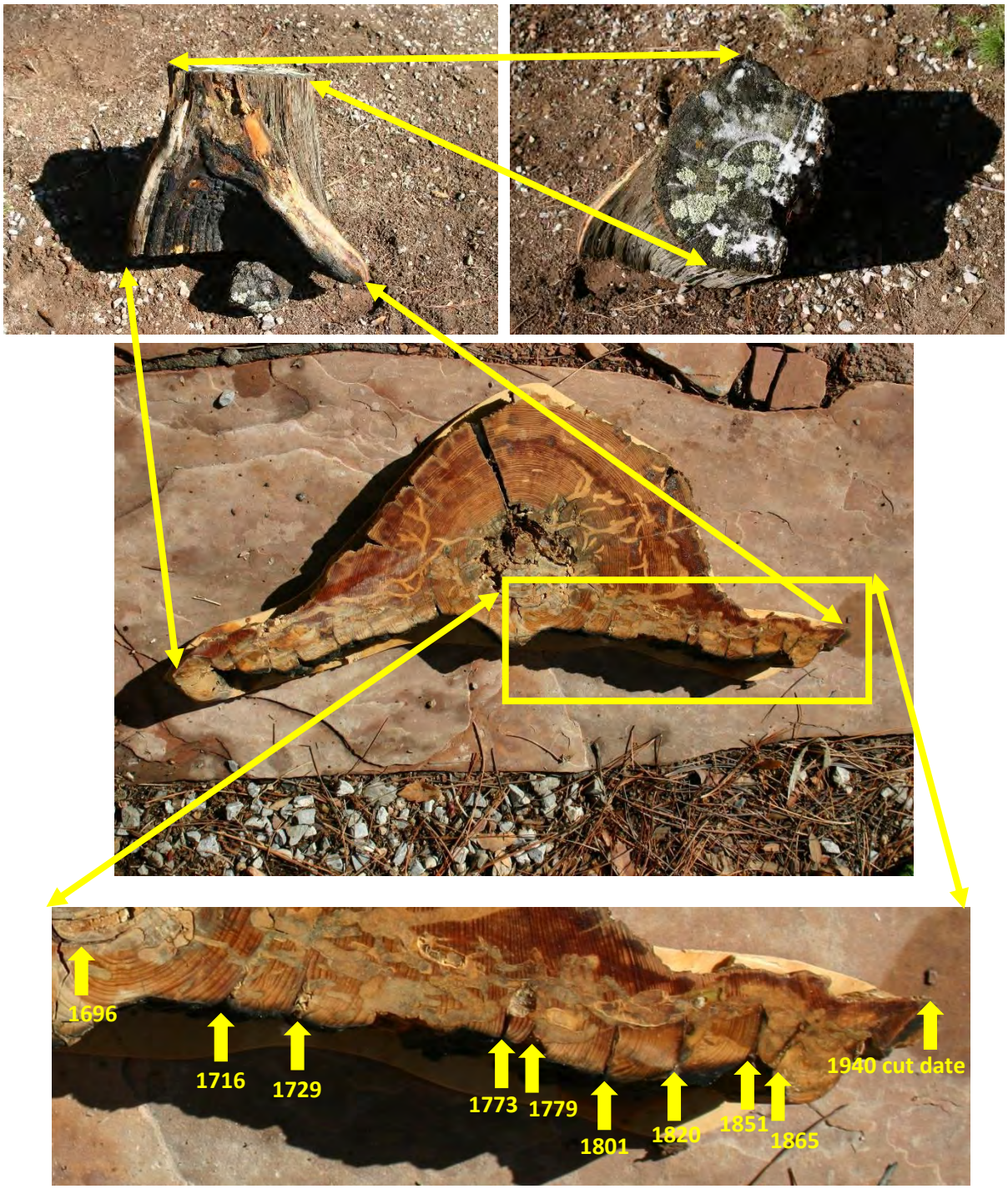

Figure 4. Master fire chronology chart of fire scar specimens from Area 3.