

## Erskine Fire Inspection Report

**7/16/2016**

The following is my report covering my inspection and investigation of possible electrical effects related to the Erskine Fire.

**Executive Summary:** A set of wires passing through a tree located near the suspected Erskine Fire Area of Origin show clear signs of a significant, explosive, electrical event. However, based on this evidence alone, I cannot tell if the electrical event started the fire or if the fire started by some other means, burnt up the tree, and then caused the electrical event.

**Background:** On Sunday afternoon June 26, 2016, I received a call from (b) (6), (b) (7) (C) of Cal Fire asking me to come help with the investigation of the Erskine Fire. I traveled to Bakersfield, CA that night and reported to an investigation area in Lake Isabella, CA the following morning.

**Description of the scene:** An overall view of the investigation area is shown in Figure 1 where I have overlaid key locations on a Google Earth image of the area. It is my understanding that the area under investigation is normally used as an archery club. The facility has electric power supplied by Southern California Edison (SCE). Distribution from SCE ends at the location in Figure 1 labeled "SCE Pole". A photograph of this pole is shown in Figure 2. A transformer on the pole steps down the distribution voltage (presumed to be 12kV) and delivers a typical, residential, 240 VAC, center-tapped circuit. From the SCE pole, the three-wire service circuit connects to a service entrance panel at the location labeled "service panel" in Figure 1. A photograph of the service entrance equipment is shown in Figure 3. Along with feeding numerous circuits in the building, power from the main panel located behind the service entrance feeds an outdoor light system. A circuit from the main panel delivers power via an underground line to the location labeled "Pole 1" in Figure 1. The wires leading to Pole 1 are shown in Figure 4. The underground line emerges at Pole 1 as shown in Figure 5. Power then flows via overhead lines to Pole 2 adjacent to a playground area and finally to Pole 3. In between Poles 2 and 3, the three-wire circuit goes through a tree as shown in Figure 6. The tree is labeled "AO Tree" in Figure 1. The area in an around this tree was being investigated as a possible Area of Origin and the wires through the tree were being investigation as a possible cause of ignition.

**Evidence of an electrical event:** During my investigation, I found that the three-wire circuit had made contact with the tree and at some point has suffered a significant and explosive electric arc event. One photograph of this is shown in Figure 7. The circuit is comprised of two, solid, aluminum, insulated "hot" wires and one uninsulated ACSR ground/neutral wire. It is clear in Figure 7 that all three of the wires show substantial damage. The two, solid, insulated wires are both broken and bent back at approximately 90 degrees. The fact that the wires are bent so sharply suggests a powerful explosive arc had occurred. The aluminum strands of the ACSR

ground cable are mostly all broken, melted and “bird-caged” back which also suggest an explosive event.

Another view of the tree/wire interaction area is shown in Figure 8. In this photo, we can see a notch in a tree branch where the ACSR ground wire passes by. This suggests that the wire had been pressing on the branch for a long period of time and the branch had grown around the wire.

A view of the wire/tree interaction from the opposite side is shown in Figure 9. In this Figure, we can see the other ends of the broken “hot” wires, more bird-caging of the ACSR ground wire, and a second location (notch) where the tree (main trunk in this case) had grown around the ACSR ground wire.

To preserve the evidence of this electrical event, we had the very helpful crew from SCE remove a section of the tree along with some wire on each side of the tree. The evidence section is shown in Figure 10. Figure 11 shows a closer view of the notch in the tree due to long term contact with the ACSR wire.

**Discussion:** Figure 12 shows an overview of the tree under investigation and Figure 13 shows a closer view of the tree’s lower section. I found that the lower section of the tree was fairly heavily burned. This section showing heavy burning goes up to, but not much above, the area where the wires made contact with the tree. In my opinion, the totality of the evidence is consistent with two scenarios.

In the first scenario, due to the high winds occurring near the time that the Erskine Fire started, the “hot” wires passing through the tree arced to each other and to the bare ACSR wire. Molten and possibly combusting droplets of molten aluminum from all three wires would have dropped to the ground and must be considered as a possible ignition source. In this scenario, long term rubbing of the wires against the tree would have had to damage the insulation on the “hot” wires and motion due to the wind caused the damaged wires to touch. This then led to an explosive arc which then started the fire. Fire on the ground then ignited the lower section of the tree and caused the observed burning up to but not much beyond the height of the wires.

In the second scenario, the fire started on the ground by some other means, burned up the tree, burned the insulated wires which then led to the observed explosive arc.

Based on the electrical evidence alone, I was not able to determine which of the two scenarios is more likely. If all other causes are ruled out by other investigators, then the electrical event is a remaining and obvious possible ignition source. So that would favor the first scenario. However, if other investigators or interviews with witnesses suggest the fire started on the ground by some means, then scenario two becomes more likely and is consistent with my observations.

**Conclusions:** It is clear that at some point in time, a substantial electrical arc event occurred where a three-wire power circuit traversed a tree at the archery club in Lake Isabela, CA. It is possible that this arc event was the cause of the Erskine fire. However, my based on investigation alone, I cannot rule out a second scenario where the fire started by some other means, burnt up the tree to wires, damaged the wires, and thereby caused the wires to arc as an effect of the fire and not the cause.

Respectfully submitted,

(b) (6), (b) (7) (C)

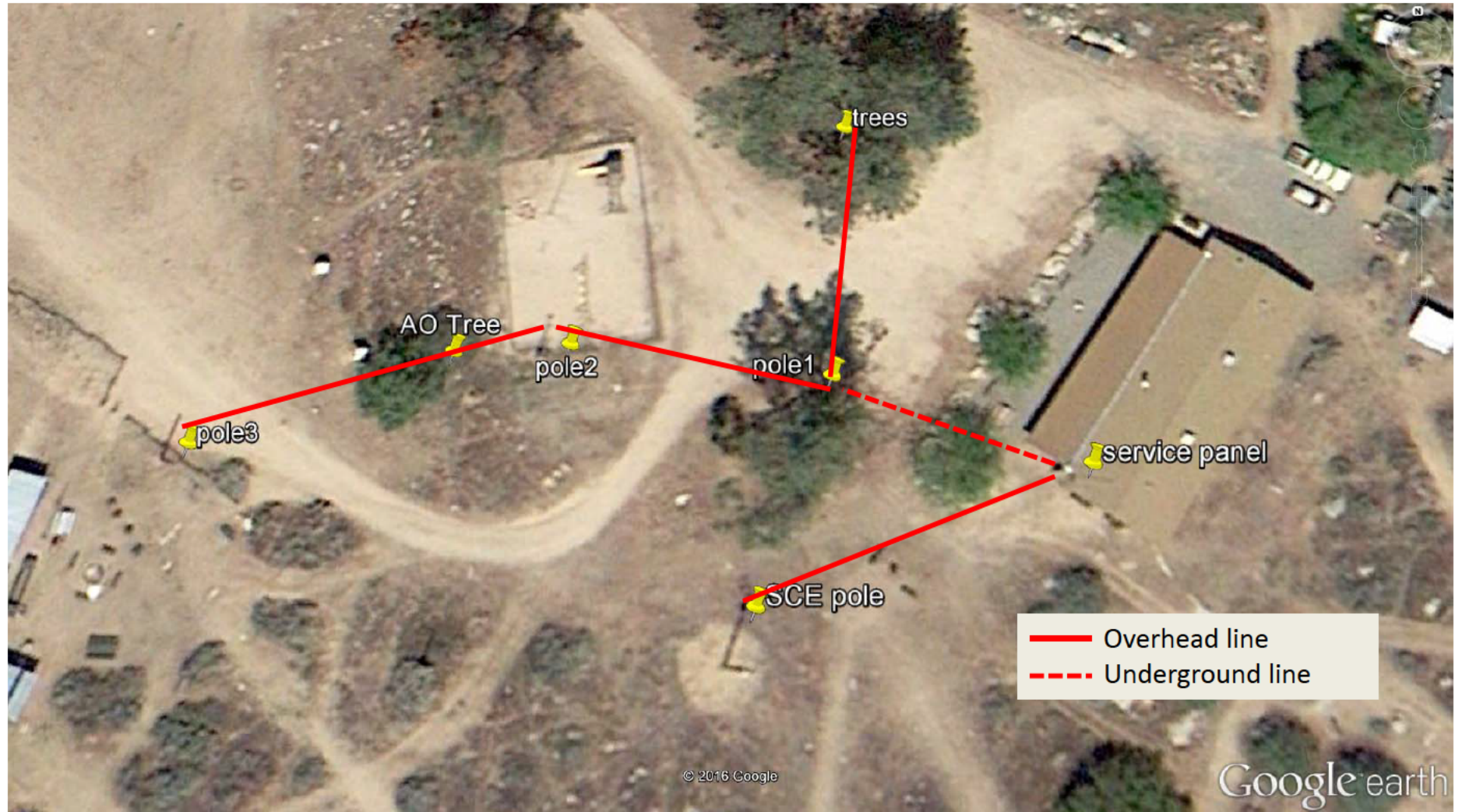


Figure 1. Overview of the Erskine investigation area. Red lines indicate location of customer power lines.



Figure 2. Photograph of SCE distribution pole, transformer, and service feed for the archery range property.





Figure 3. Service entrance from SCE transformer

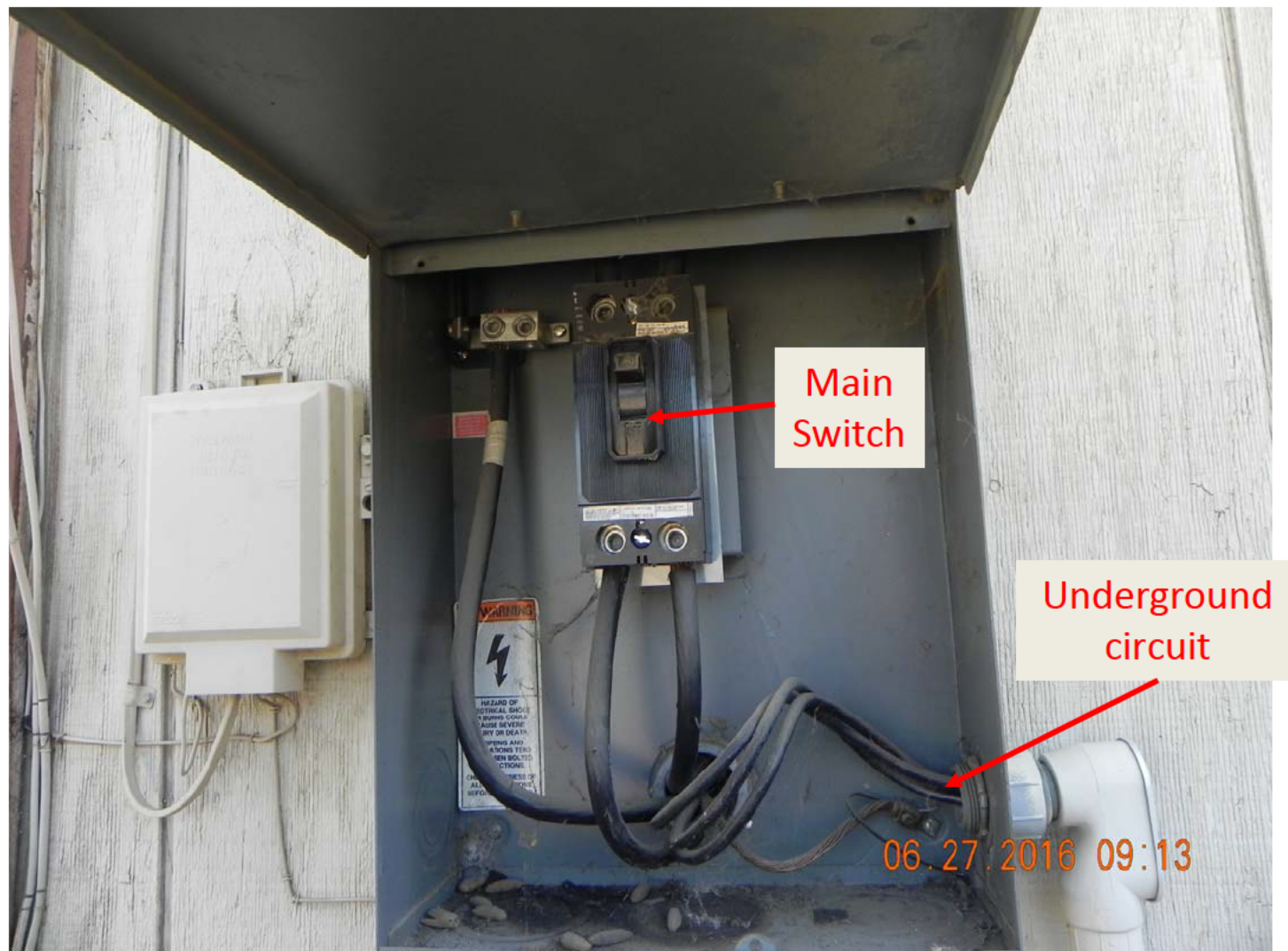


Figure 4. Inside the service entrance panel. Main switch and wire leading to underground run are shown.



Figure 5. Remainder of the power path to the suspected Area of origin





Figure 6. Photograph showing wires going through the tree

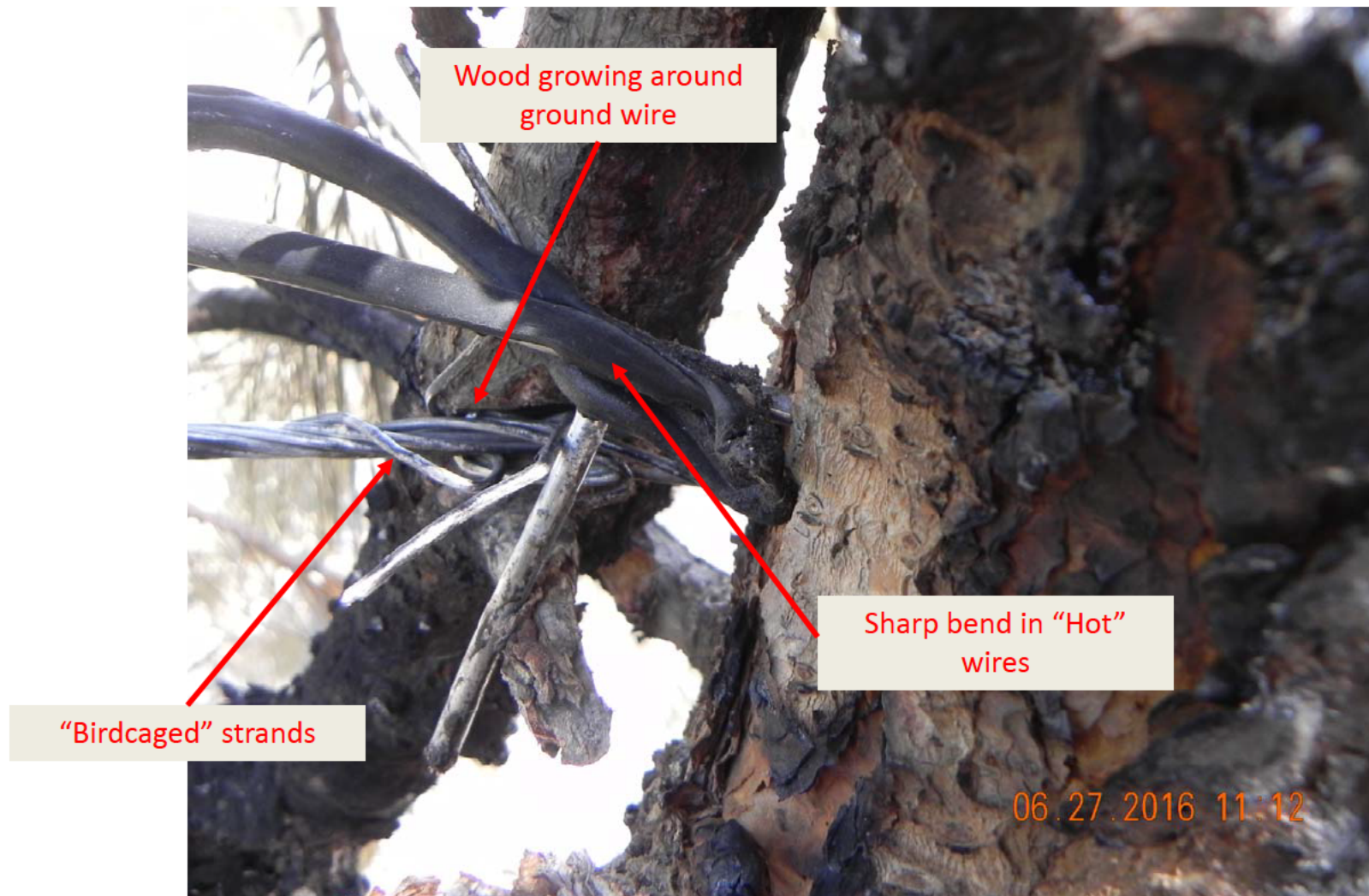


Figure 7. Close-up view of wire/tree interaction area. Several things to note: wood grown over wire, sharp bend in the bend leads, and “birdcaged” strands on ground wire.





Figure 8. Another view of wire/tree interaction again showing wood growing around ground wire, “bird-caging” of ground wire strands, and 90 degree bends in the “Hot” wires.

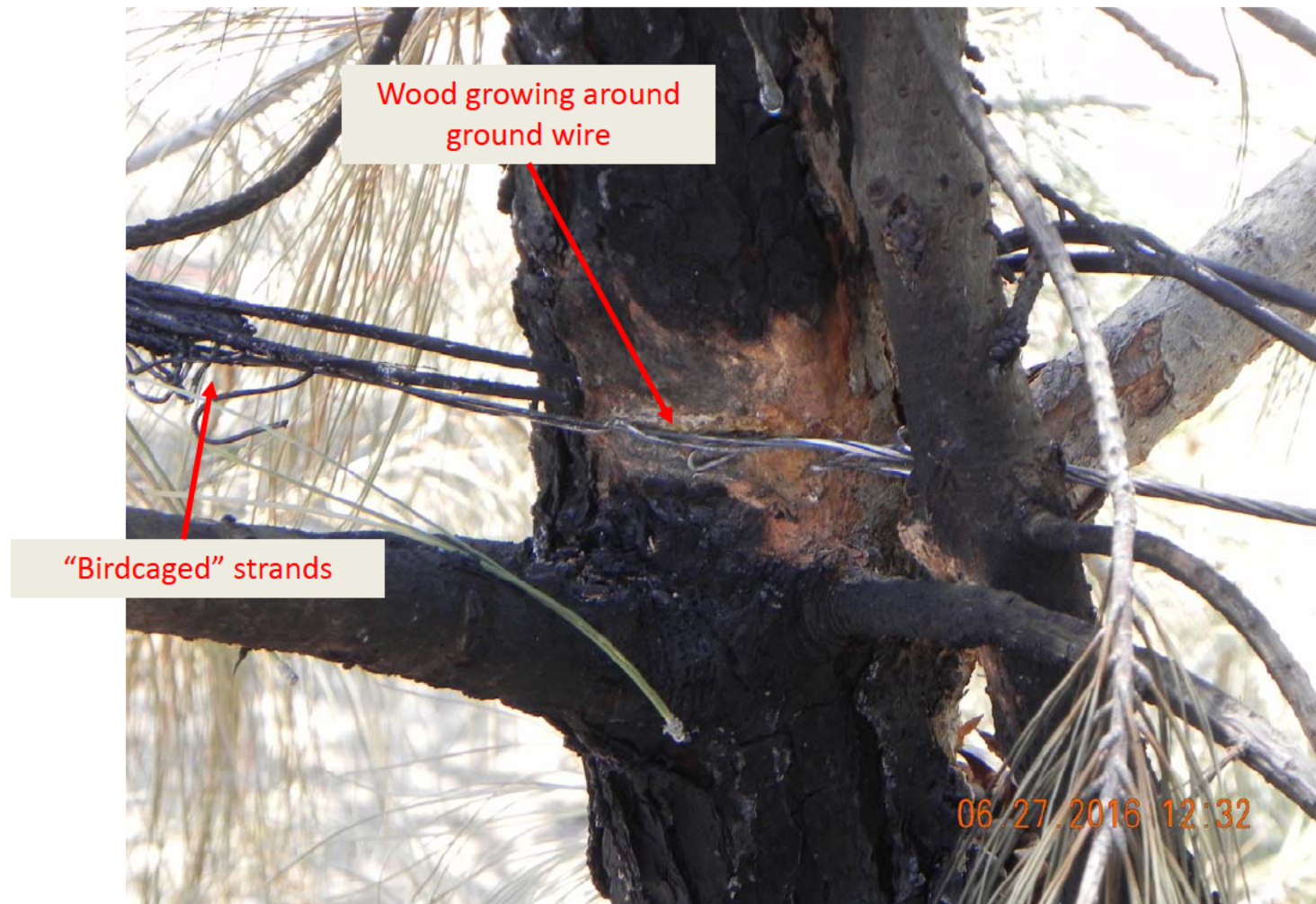


Figure 9. North-side bucket-truck view of wire/tree interaction area. This view shows that the main trunk had also grown around the ground wire.





Figure 10. Wire/tree interaction section were moved from the tree to be help as evidence. This photograph shows the section on the ground.





Figure 11. Notch on the main trunk shows the degree to which the wood had grown around the ground wire



Figure 12. An overview of the tree in the suspected area of origin.





Figure 13. View of the tree's lower section along with the investigation grid.