

DAVIS FIRE

Fire Behavior and Fire Effects Analysis



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September 3, 2010

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Davis 5 Prescribed Fire Unit

The Davis 5 unit lies on the windward side of the continental divide directly south of Stemple Pass on the Lincoln Ranger District (Figure 1). The unit is approximately 537 acres and is composed of upland grasslands and timbered stands. Vegetation composition within the parks includes bunchgrasses intermixed with forbs. Subalpine fir and lodgepole pine are the dominant trees in addition to whitebark pine along the ridges. Both pine species have high mortality from the mountain pine beetle. The red needles are still mostly attached in the lodgepole pine while the needles have fallen off the whitebark pine as it has been dead a longer period of time. The majority of the lodgepole pine was successfully hit by the mountain pine beetle in 2008.

The understory vegetation is predominantly grouse whortleberry and beargrass in addition to a duff and litter layer ranging between two to five inches. Elevation ranges between approximately 6200 ft to 7400 ft on a southwest/west aspect. This unit was slashed with chainsaws in 2008 to reduce ladder fuels and create a burnable fuelbed. General unit objectives include: (1) enhancing whitebark pine habitat by reducing conifer competition, (2) enhancing parks by pushing back the conifer seedwall and rejuvenating bunchgrasses, and (3) reintroducing fire to the landscape.

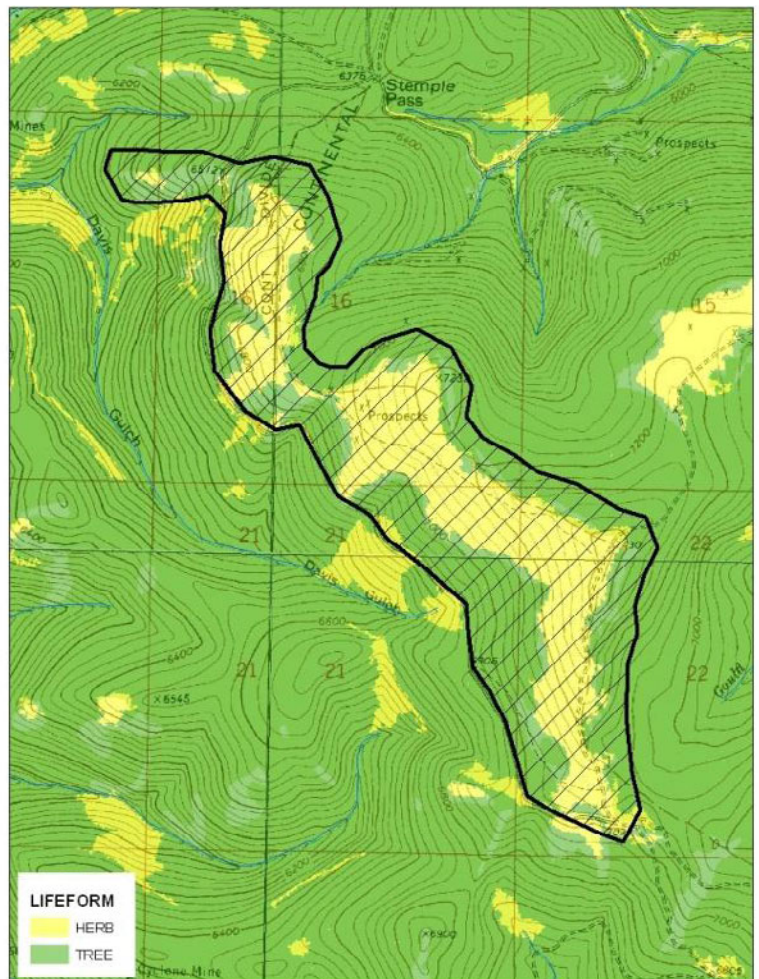


Figure 1. Davis 5 prescribed burn unit

Timelag fuel moistures are portrayed in Table 1 as collected on August 23, 2010 with a moisture probe. Herbaceous fuel moisture was relatively high (approximately 80% as a conservative estimate).

Table 1. Average fuel moistures

Fuel Shading	10-hr	100-hr	1000-hr
Shaded	9%	14%	24%
Exposed	8%	11%	16%

Fire Behavior and Weather

Ignition was initiated August 25, 2010 using driptorches. The weather observations for August 25 are shown in Table 2.

Table 2. On-site weather observations for August 25

Date	Temp (F)	Eye-level Winds (mph)	Wind Direction	Relative Humidity
8/25 1000	64°	3-5, gusts to 10	SW	48%
1100	66°	7-8, gusts to 10	SW	32%
1200	70°	7-9, gusts to 11	SW	27%
1300	70°	3-5	SW	35%
1400	74°	3-5	SW	31%
1545	74°	5-7	SW	29%
1630	75°	5-7, gusts to 10	SW	25%

The prescribed fire did not carry continuously through the parks due to the high herbaceous moisture (Figure 2). The red-needled slash from activity fuels and some natural fuels were the predominant medium to carry fire in the timber. At about 1415, a small area (approximately 2 acres) within the burn unit torched which threw embers approximately ¼ mile to a receptive fuelbed including punky coarse woody debris (Figure 3). Aggressive suppression actions were utilized on the slopover and ignition within the burn unit immediately ceased.



Figure 2. Davis 5 unit, looking north



Figure 3. Group torching within Davis 5 unit

The spot fire gained momentum in subalpine fir and burned uphill in an overstory composed of mostly pole to medium size classes of lodgepole pine and fairly continuous subalpine fir ladder fuels. The fire burned towards Granite Butte Lookout and lost momentum once the canopy cover decreased at the edge of a park (Figures 4 and 5). At this point the crown fire could not be sustained and the fire dropped to the ground after it had burned approximately 20 acres.

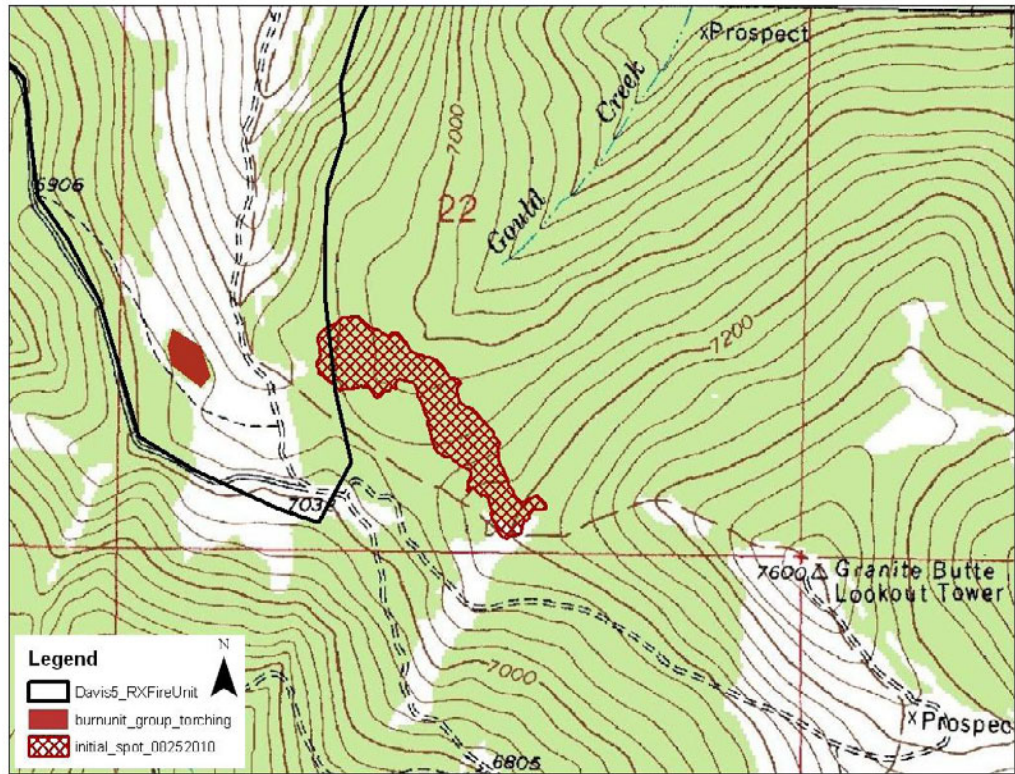


Figure 4. Location of group torching within the unit and the initial spot fire

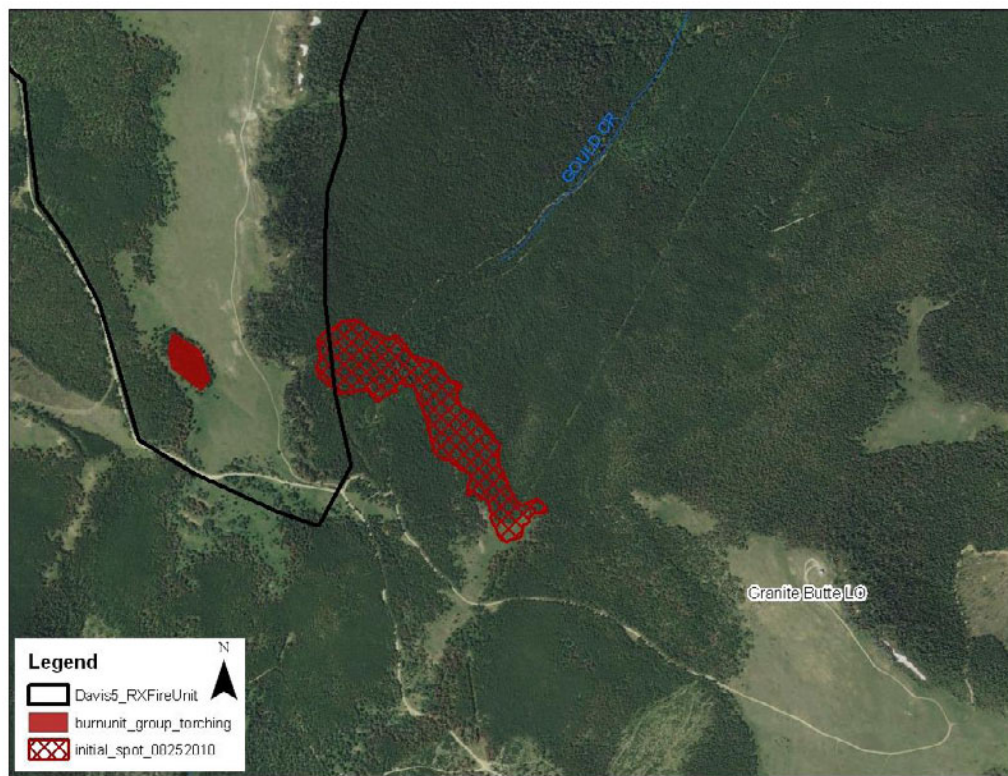


Figure 5. NAIP imagery

On August 26, fire behavior within the spot fire was minimal until mid-day. The west and south sides of the spot remained secure. Just before 1300, fire activity increased in the vicinity of the north/northwest quadrant of the spot fire. Either the initial spot fire or an unknown additional spot fire produced a big push on the east aspect above Gould Creek (Figures 6 - 9). This aspect included a significant amount of subalpine fir along with multiple age classes of lodgepole pine. Less than 1/3 of the lodgepole pine on this aspect was dead. In the early afternoon it was declared a wildfire.



Figure 6. Early afternoon on August 26 as fire activity started to increase



Figure 7. Backing fire against the predominant winds on the east aspect above Gould Creek



Figure 8. Looking up Gould Creek towards the initial spot fire and Granite Butte Lookout



Figure 9. The whitebark pine on the ridgetop near Granite Butte Lookout burning on August 26

High temperatures in the afternoon were about 80°, the lowest relative humidity was less than 19 percent, and winds were predominantly southwest shifting to west mid-afternoon due to an approaching cold front. By mid-afternoon the west aspect had adequately heated and the fire started to wrap around this slope below Granite Peak Lookout. The west aspect had more red-needled lodgepole pine than the east aspect, up to 75 percent in individual stands with approximately 50 percent of the lodgepole on the west aspect dead (Figure 10).



Figure 10. West aspect below Granite Butte Lookout as viewed from the ridge

The parks on Black Mountain (Figure 11) burned in a mosaic of backing fires from numerous spot fires. The Black Mountain spots were from embers lofted a considerable distance.



Figure 11. Spot fires burning in the parks on Black Mountain, the eastern edge of the fire

The active fire behavior had stopped by 1900, burning approximately 1,900 acres during the burning period on August 26. Land ownership is displayed in Figure 12.

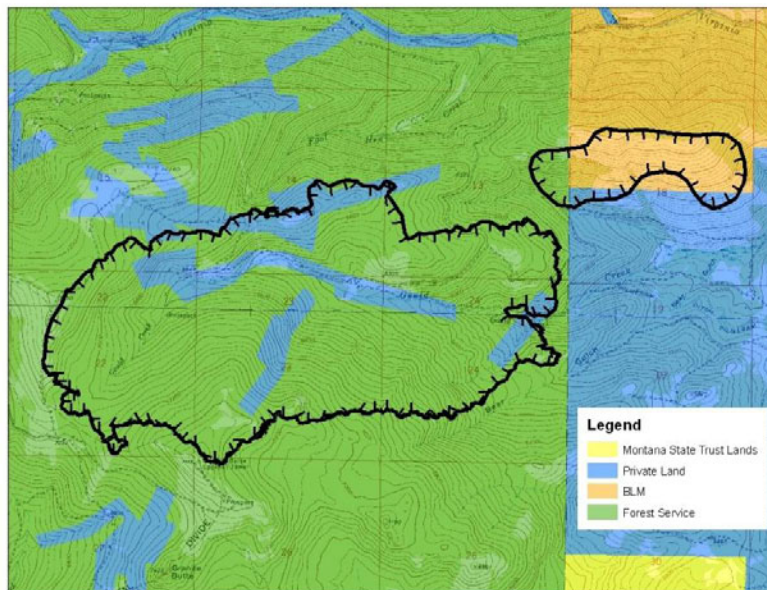


Figure 12. Davis Fire land ownership

Fire Behavior Discussion

Dead and live fuel moisture was relatively high, so it is likely that lower fuel moistures may have produced a larger fire and possibly more spot fires. The spotting and fire spread were definitely promoted by subalpine fir rather than lodgepole pine. The subalpine fir was predominantly in the Gould Creek headwaters, the moist east aspect, and along Gould Creek (Figure 13). The remainder of the fire area was dominated by lodgepole pine with Douglas-fir comprising the overstory in the lower elevations. While much of the lodgepole was mature, there were numerous pole stands intermixed most likely due to the significant mining activity that occurred in Gould Creek.

It seems logical that a red-needled lodgepole stand requires similar conditions as a green lodgepole stand to support crown fire, including adequate winds. However, based on the Davis Fire it appears that the crown fire may have had faster rate of spread and possibly initiated easier due to the combustibility of the red needles.

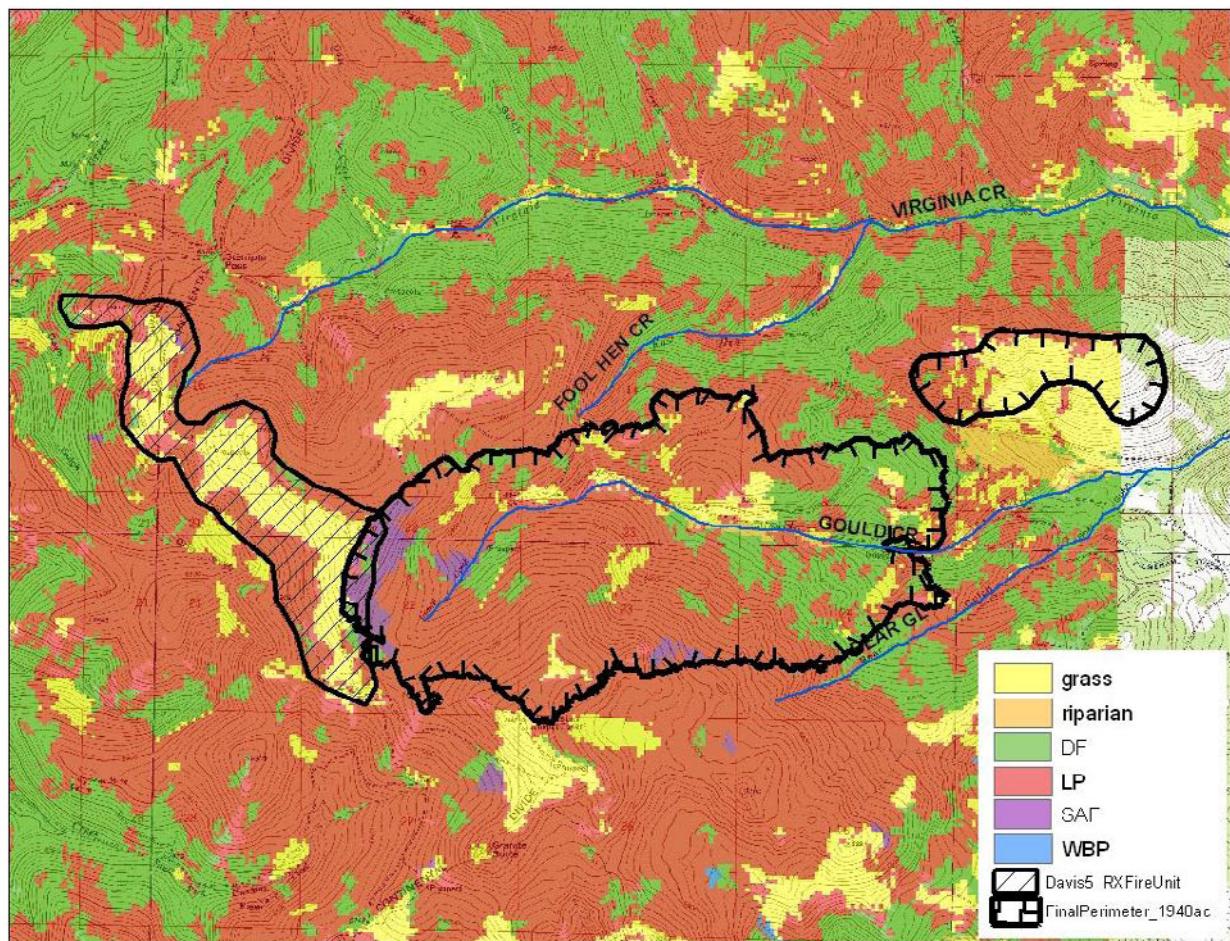


Figure 13. Dominant vegetation types within the fire area

In some areas the fire spread in a pulsing fashion as it consumed small areas ranging in size between $\frac{1}{4}$ to 2 acres, threw multiple embers, and consistently spread from these spot fires. The lofted embers that landed in receptive fuelbeds of punky rotten logs progressively spread until coming into contact with subalpine fir regeneration which helped initiate crown fire. On the east aspect, the fire spread to

the east as a head fire pushed by southwest/west winds but also burned westward as a backing fire, promoted by the subalpine fir and the intensity of the fire front. Fire spread on the west aspect was hindered by the southwest/west winds but eventually this aspect did burn.

There were two large post-fire “green” islands composed of 50 percent live lodgepole pine and 50 percent red-needled lodgepole pine in Gould Creek (Figure 14). It appears that these islands did not burn due to the presence of alder. The upper green island is a wetland located in a concave depression that was slightly protected from fire. The lower green island is located on the slope with a slight aspect shift from northwest to northeast which protected this area from southwest/west winds. Further to the east on the west aspect was an additional spot fire started from embers that landed in a clearcut, burned through the coarse woody debris until reaching the adjacent stand, and burned about 10 acres as a crown fire (Figure 15).



Figure 14. Green island south of Gould Creek



Figure 15. Clearcut and adjacent 10-acre spot fire

Model Calibration

Fire behavior modeling was performed in FARSITE to gauge the effects of winds, spotting, and the performance of the data. A combination of data was used including forest data and LANDFIRE data on private land. The Galena RAWS, near Boulder, was used for the weather (wtr) and wind (wnd) files which were updated using on-site weather observations. The Galena RAWS is situated on a ridgetop at 6860 feet.

In essence, 30-mph winds overpredicted fire growth for August 26 when the spotting frequency was set to 2 percent. Simulations using 20-mph winds with 2 percent spotting frequency also overpredicted fire growth (Figure 16). When the winds were kept at 20-mph but the spotting frequency was decreased to 1 percent the simulated fire growth for August 26 was quite close to the actual fire growth. Predicted flamelengths and types of fire from FARSITE are shown in Figures 17 and 18 for 20-ft winds and 1 percent spotting frequency.

While the flamelengths are fairly accurate compared to the actual flamelengths, the amount of crown fire was dramatically underestimated. The modeled crown fire activity was more accurate when 30-mph winds and 2 percent spotting frequency were used (Figure 19).

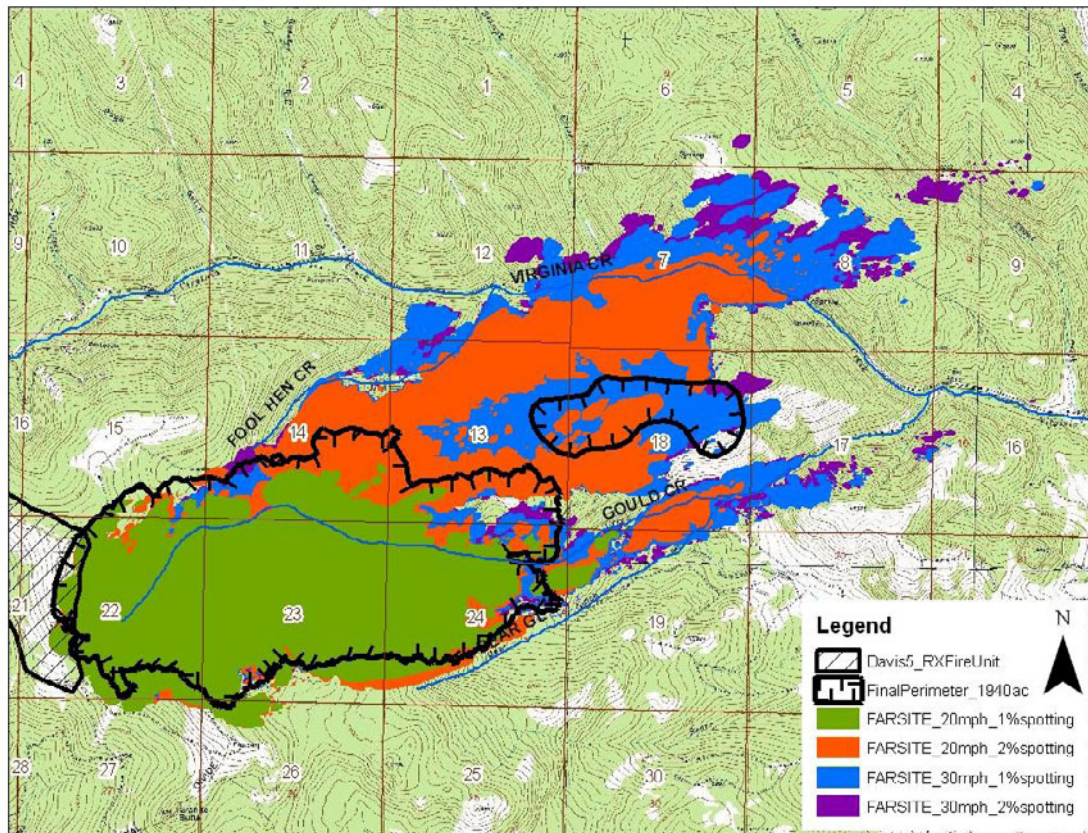


Figure 16. Four FARSITE simulations for August 26 that altered 20-ft windspeeds and spotting frequency

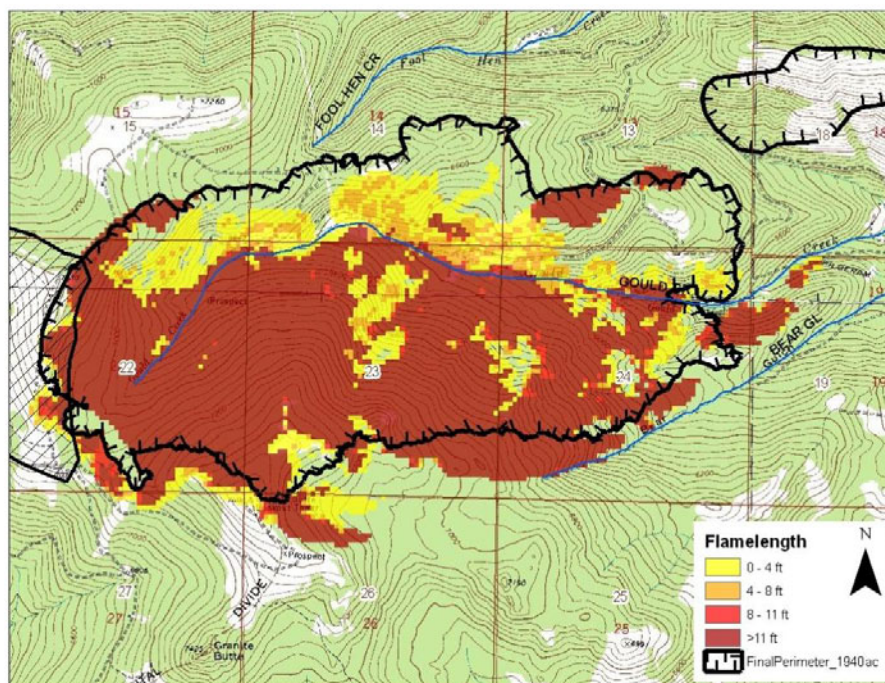


Figure 17. Predicted flamelengths from FARSITE for 20-mph winds

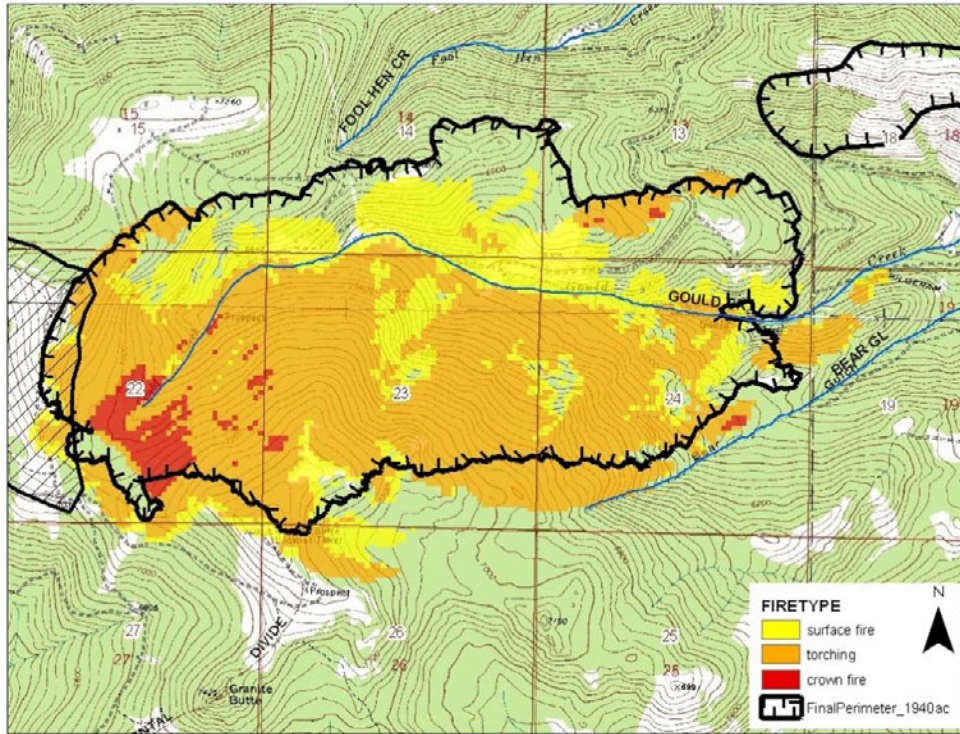


Figure 18. Predicted types of fire from FARSITE for 20-mph winds

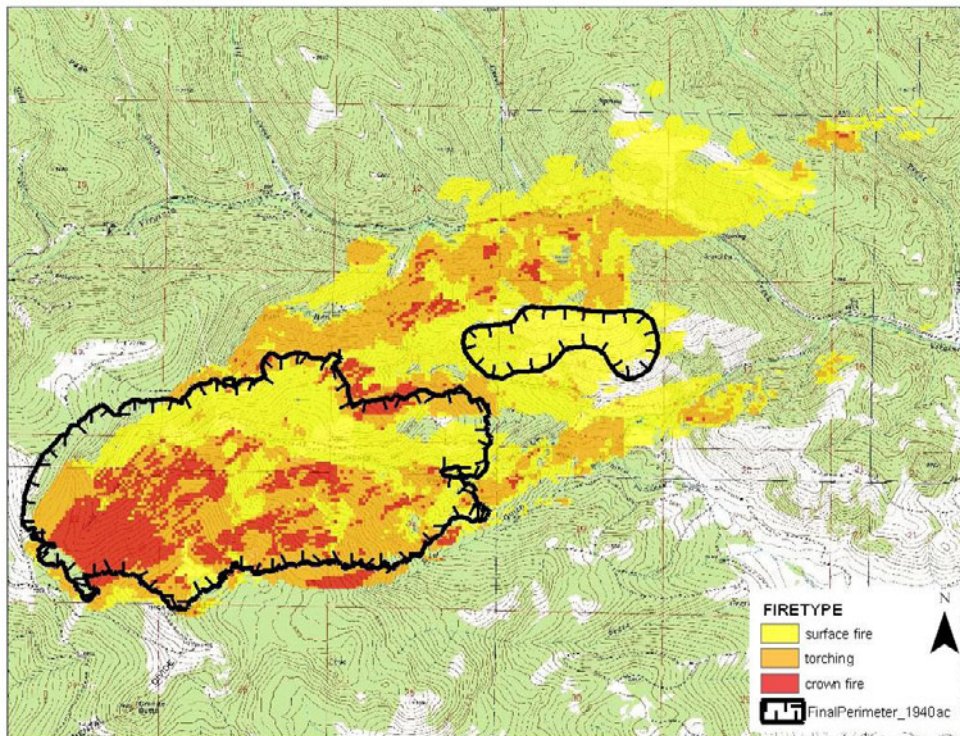


Figure 19. Predicted types of fire from FARSITE for 30-mph winds

Fire Occurrence

There have been quite a few fires in the Davis Fire area as shown in Figure 20. Mostly these fires were size class A and B with two class C fires. Due to fire management direction and adjacent private land, all fires within this area were actively suppressed if detected. If fires had been allowed to burn the age class mosaic in the subalpine fir and lodgepole pine would have been more diverse and likely there would be fewer mature stands which has direct implications to current fire behavior.

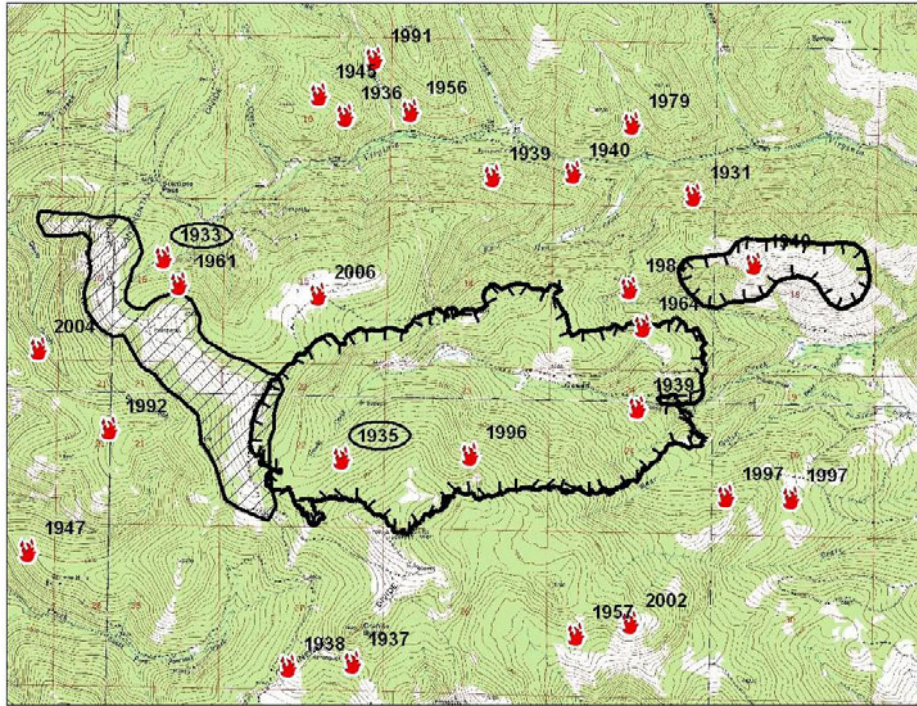


Figure 20. Fire occurrence in the Davis Fire area from 1920 to present, Class C fires circled

Fire Effects

The Davis Fire had a significant amount of stand-replacing fire (Figure 21), but certainly within the expected range for these vegetation types. Under normally occurring weather and winds, stands dominated by subalpine fir and mature lodgepole pine tend to burn as a crown fire in the Northern Rockies.

Fire Severity

Effects to the overstory and the understory were both examined. Overstory fire severity was classified as high on approximately 75 percent of the fire as defined by the effect to the tree canopy. In these areas the needles were mostly consumed as well as the small branchwood. The remainder of the fire area is best classified as low overstory severity in which the effects to the canopy were quite minimal. There was not a great deal of mixed severity. Effects to the understory vegetation were also high as most of the understory vegetation was consumed by the fire.

Effects to the soil surface were variable. In the eastern half of the fire area, all or a portion of the duff layer remains. In the western half of the fire, there are variable amounts of duff remaining and mineral soil is exposed in some areas, especially the east aspect in the Gould Creek headwaters. There is scattered coarse woody debris remaining. The meristematic tissue of the beargrass appears viable and should exhibit growth immediately.



Figure 21. Stand-replacing fire as seen from Fool Hen road on August 27

Douglas-fir

Douglas-fir dominated the lower elevations of the fire area. These stands tended to have varying amounts of lodgepole pine but generally the proportion was less than 25 percent. The amount of pre-fire canopy cover was a determining factor in understory composition. Stands having canopy cover greater than 30 percent tended to have a duff and litter component. The understory within the Douglas-fir stands included pinegrass, Oregon grape, and beargrass. In general, a portion of this duff layer still remains and very few areas have mineral soil exposed.

Areas of lower canopy cover generally did not have a duff component and tend to be quite rocky, which probably limited tree growth and productivity. These areas have very little post-fire vegetation remaining. The productive, moist Douglas-fir sites within the Davis Fire are expected to recover within the next few years. Pinegrass, Oregon grape, and beargrass can sprout from rhizomes following fire providing the duff layer remains. Pinegrass and Oregon grape can also establish by seed from off-site sources. Douglas-fir is expected to recolonize from adjacent seed sources.

Lodgepole Pine/Subalpine Fir

The understory vegetation in the lodgepole pine and subalpine fir included grouse whortleberry and beargrass with a duff layer varying between 2 to 4 inches in depth. These vegetation types are expected to recover well due to adequate available moisture and post-fire response of the key species. Grouse whortleberry and beargrass can effectively spread post-fire via rhizomes providing that a portion of the duff layer remains. There is expected to be a flush of lodgepole seedlings from viable serotinous cones that will soon blanket the fire area.

Riparian Vegetation

Within the riparian areas, the fire truly burned in a mosaic fashion with some stretches having low severity and other stretches with nearly complete vegetation consumption. Common riparian species within Gould Creek include willows, alder, aspen, cow parsnip, and bluejoint. The riparian vegetation is expected to recover within the next few years; strong response from willows and aspen are expected. Much of the aspen is on private ownership along Gould Creek. Should aspen advancement occur on the

HNF or old clones become viable and initiate suckering, preventative actions such as temporary fencing could be considered to protect the aspen from elk until it can sufficiently recover.

Noxious Weeds

There are several small populations of noxious weeds including Canada thistle and spotted knapweed, mostly on the private in-holdings along Gould Creek. Post-fire rehab should include treatment of these noxious weeds should they spread to the HNF.

Conclusion

The Davis Fire presents an interesting example of fire behavior in subalpine fir, partially dead lodgepole pine with multiple age classes, and moist site Douglas-fir vegetation types. This has been summer of moderate temperatures and intermittent moisture that has kept live herbaceous and live woody moistures fairly high and dead fuel moistures at a moderate level. Although the understory vegetation in the uplands has been consumed within the majority of the burn area, immediate vegetation response is expected due to available moisture and the ability of grouse whortleberry and beargrass to recover via rhizomes following fire. In addition, riparian vegetation including willows and aspen are expected to recolonize burned areas within the next few growing seasons.