Figueroa Mountain Prescribed Burn Escape

Facilitated Learning Analysis

Los Padres National Forest
Santa Lucia Ranger District

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Contents

"The Facilitated Learning Analysis process helps us to maximize learning opportunities presented by unintended outcomes or near miss events. The intent is to improve performance by generating individual, unit, and organizational learning that capitalizes on shared experience—blaming is replaced by learning."

Facilitated Learning Analysis
Implementation Guide
August 2010

1. Introduction

On Nov. 16, 2010, the Los Padres National Forest experienced an escaped prescribed fire on the Santa Lucia Ranger District. In an effort to promote a just culture, the Forest decided that a Facilitated Learning Analysis (FLA) was the most appropriate way to learn from this incident and to share lessons learned with other national forest land managers who share the responsibility of returning fire to the landscape. The Los Padres National Forest arranged for a team to assemble those involved in the escape of the Figueroa Mountain Prescribed Burn to evaluate the factors that lead to the unintended results. In doing so, the FLA involved:

- An onsite evaluation of the physical factors,
- An analysis of the environmental factors, and
- An open dialog with the prescribed fire participants to better understand the human factors involved in the incident.

All of the participants involved with the prescribed fire and the ensuing escape were committed to engaging in proactive land management that carries with it an inherent risk of unintended outcomes. From the project implementers to the program managers and line officers, the Los Padres National Forest should be applauded for its willingness to engage in prescribed fire activities.

The following report is offered in hope that the agency can progress from looking to assigning blame when these events occur to the ideal of sharing experiences and lessons learned in order to promote a high reliability organization.

A. Description of the Event and the Outcome

The Figueroa Prescribed Burn, conducted on Nov, 16, 2010, was part of the 665-acre Figueroa Mountain Project on the Santa Lucia Ranger District of the Los Padres National Forest. This project is designed to meet forest health goals consistent with the Los Padres Land Management Plan, *"Reduce the potential for widespread losses of montane conifer forests caused by severe, extensive, stand replacing fires."*

Facilitated Learning Analysis History and Intent

In 2006, in an effort to help encourage a learning culture and a safety culture within the wildland fire community, the Forest Service Risk Management Council introduced a learning-focused approach into the accident investigation process. In 2007, the Council formalized this concept with two new safety analysis processes: The "Facilitated Learning Analysis" (FLA) and the "Accident Prevention Analysis" (APA). Since then, numerous FLAs and APAs have been conducted throughout the country on incidents that range from vehicle and equipment burnovers to entrapments and shelter deployments.

When used as intended, the APA and FLA will promote a learning culture and support organizational and individual performance, leadership, accountability, and responsibility. Concurrently, the FLA and APA analyses also serve to support program goals for developing a fundamentally sound and doctrine-based organizational safety culture.

The implementation guides for conducting both an FLA and an APA are available on the Wildland Fire Lessons Learned Center's website at: http://wildfirelessons.net/documents/Organizational_Learning_APA_FLA_Guides_2010.pdf .

Within the greater Figueroa Mountain project, Sawmill Unit A consisted of eight acres of previously masticated chaparral and live oak vegetation. Mastication operations had been completed 3 ½ years prior to the prescribed burn's initiation. The plan was to start with a small unit to allow prescribed fire managers to get a feel for how the masticated material would respond to the prescription parameters in the approved burn plan. The burning of masticated material had not been attempted by District personnel previously. Therefore, this burn was viewed as an opportunity to learn best management practices for continuing prescribed fire operations in the remaining units of the project area.

A pre-fire briefing was conducted in which the need to burn slowly and carefully to meet resource objectives was stressed. Following this briefing, the firing team conducted a test fire at the direction of the Burn Boss, who determined that the fire behavior met conditions required to achieve the desired resource objectives.

Lighting continued throughout the morning with successful results, although ignition took more time than was anticipated. At approximately 1230 hours, the Burn Boss and others scouted opportunities to cut the burn off and assure enough time for sufficient burn down before the holding forces would be released. After an evaluation by the Burn Boss, a decision was made to continue the burn to the pump house road, completing Unit A. Firing was completed around 1400 hours.

There were no holding issues throughout the day and the fire was lying down well under weather conditions that were essentially in the midrange of the prescription. Holding forces continued to patrol the fire post-ignition and allowed it to burn down without mop-up in order to achieve a primary resource objective of reducing surface fuel loadings.

Between 1500 and 1600 hours, holding forces were released and a patrol unit plus one person were assigned to monitor and patrol the unit. At approximately 1700 hours, easterly winds developed over the burn area. To address this un-forecasted wind, the Burn Boss ordered the patrol unit to extend its staffing on the project. The Burn Boss then proceeded to the Santa Maria District Office to obtain an updated spot forecast from the Oxnard office of the National Weather Service (NWS).

Easterly winds continued on the burn area and the residual fuels began to burn more actively than had been previously observed on the project. An additional patrol unit was ordered to augment the on-scene patrol unit. This additional unit took action to reduce fire activity in fuel concentrations that had the potential to threaten the control lines.

Although easterly winds continued on the burn, no spot fires occurred. The Burn Boss obtained an updated spot forecast at approximately 1945 hours. Easterly winds were forecast to continue until 0400 hours the next day. The Burn Boss then called the unit Division Chief to advise him of the situation and to verify overtime was authorized for additional holding resources.

At 2100 hours, a spot fire was detected outside the line on the northeast corner of the unit. This spot grew to 2 acres and progressed uphill within the project area. The Burn Boss determined that assigned resources would not be able to contain the fire and declared an escape at 2142 hours. The Burn Boss assumed the role of Incident Commander and ordered additional suppression resources.

The wildfire burned to the top of the ridge on Figueroa Mountain, eventually consuming a total of 74-acres, with 6.5 acres outside of the project area west of the Zaca Ridge Road.

2. Sequence of Events

The Figueroa Mountain prescribed burn project has been on the Los Padres National Forest Program of Work since fiscal year 2009. Funding for implementation, however, had not been available until FY 2011. Preparation of the burn unit, including fireline construction and mitigation measures—such as isolating trees from fuel accumulations and lining downed logs—was accomplished during the summer and fall of 2010 using force account labor.

Originally scheduled for the week of Nov. 8, 2010, the burn was cancelled due to unfavorable weather conditions, including winds forecasted to exceed prescription parameters. On Nov. 15, it was determined that a favorable burn window had become available and pre-burn preparations—including public notifications, smoke management approvals, burn area signing, IAP preparation and staffing—was completed.

Table 1 displays the chronology of significant events derived from interviews of key personnel and unit logs.

Table 1. – Chronology of Significant Events

Time	Event
0800	Burn Boss checks and assures that the spot forecast remains favorable.
0930	Briefing is conducted at Figueroa Station. Firing and Holding forces have break-out briefings and are deployed.
1030	Test fire commences and is deemed to be well within the range required to meet objectives.
1100	Firing continues under favorable conditions.
1200-1230	Burn Boss and others scout a cutoff point and decide to continue to the Pump House Road.
1345-1400	Ignition completed. Holding forces check holding lines and allow for burn down of fuels.
1500	Burn is looking good. Engine 31 released.
1600	Engines 37, 35 and WT3 are released.
1630	Fuels crews North & South are released. Patrol 37 + 1 remain to monitor and patrol. Safety Officer to RON at Figueroa Station to check on burn throughout the night.
1700	Easterly winds surface on burn area. Burn Boss has patrol stay on burn for another hour.
1730	Easterly winds continue at 0-5mph, RH 42%. Decision made to extend patrol throughout the night.
1800	Patrol 38 called for additional night patrol, dispatch is requested to stay open. Burn Boss departs to Santa Maria to get updated forecast from National Weather Service.
1845-1854	Patrol calls Burn Boss—winds continuing at 5-8 mph from the east.
1945	New forecast from NWS calls for winds to continue until 0400 hours at 5-10 mph from the E-NE. Burn Boss calls District Ranger, Division Chief to verify overtime authorization for more resources if needed.
2015	Burn Boss in route back to burn with food for night patrols. Contacted Forest Fuels Officer to ensure it is approved to use fuels funds for extra resources.
2045	Burn Boss talks with Patrol 37, no spots or issues, wind is the same.
2100	Spot is detected outside the line on the northeast side of the burn.
2115	Spot fire is reported to be 2 acres in heavy fuel and moving uphill. Burn Boss calls Division Chief to advise of the situation.
2130	Decision is made to declare an escaped fire.
2142	Escaped fire is logged by dispatch. Burn Boss assumes the Incident Commander position.

3. Conditions

A. General

The burn unit is located approximately one mile from the Figueroa Fire Station, with Figueroa Mountain Road running east and west across the top of the unit. The bottom of the burn unit was accessible via the "Pump house Road" (see Fig. 1.). Hand line had been established on the east and west flanks of the unit. The masticate material had been pulled away from the boles of the trees to minimize the potential mortality from the expected long residence time of the burn.

The burn involved an eight-acre unit within the larger 665-acre project area. The unit is located in Sawmill Basin, a bowl, near the base of the slope leading to Figueroa Mountain. Untreated fuels existed immediately north and east of the burn unit, with a mix of coast live oak, pine, and Manzanita-dominated chaparral as the primary vegetation types.

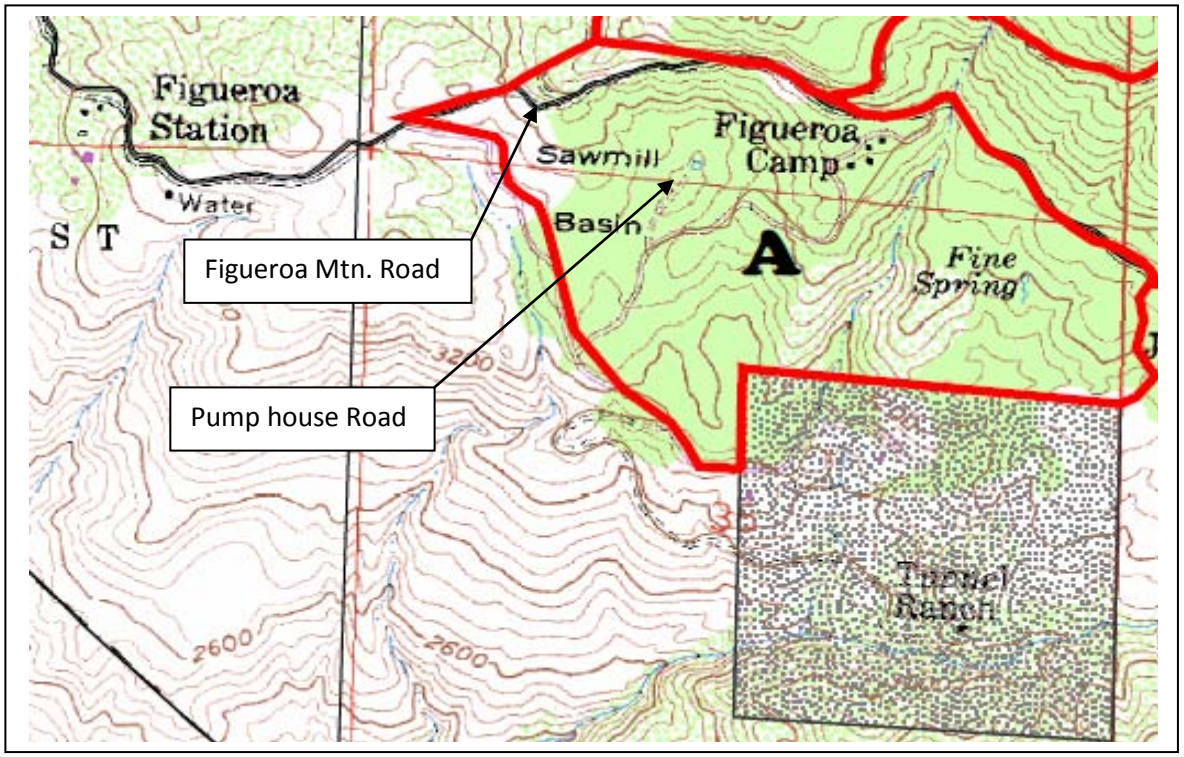

Figure 1. – Sawmill Unit A, Figueroa Prescribed Burn

Figure 2. – Pre-burn fuel conditions (left). Observed prescribed fire activity (right)

Fuels consisted of a mix of three-year old masticated material and herbaceous vegetation under an overstory of coast live oak and pine. Significant decomposition of the masticated material had occurred in the three years since the project was initiated.

B. Seasonal Severity

The burn area had received a total of 2.41 inches of rain between October 1 and the November 16, 2010. On November 8, a total of 0.49 inches of precipitation was recorded at the Figueroa Remote Automated Weather Station (RAWS).

On the day of the burn, "Fire Family Plus" determined the Energy Release Component (ERC) to be 34 and the Burning Index (BI) 33. Based on weather data analyzed for the years 1990 through 2010, these indices represent the 54th and 47th percentiles respectively.

C. Burn Day Weather

A spot weather forecast for the burn was issued on November 15, at 1525 hours by the National Weather Service Office's Oxnard office. The forecast called for temperatures near 63^{o}F at the time of ignition with a humidity of 32%. Temperatures were forecast to increase to 68^{o}F in the afternoon with a minimum humidity of 28%. Winds were forecast to be generally upslope/up valley, 2-5 mph in the morning, increasing to 5-8 mph in the afternoon. Wind direction was northerly at the ridge tops. There was no forecast of easterly winds for the project area on November 16.

Onsite weather observations began at 1030 hours on the day of the burn. Table 2 summarizes the weather observations during the ignition phase of the project. Weather conditions represented the mid-range of the prescription window defined in the burn plan.

Table 2. – Onsite Weather Observations

Time	Dry Bulb (°F)	Relative Humidity (%)	Wind Speed (mph)	Wind Direction	Comments
1030	64	41	2-4	NW	Figueroa Road at Catway Road
1130	67	36	3-5	NW	100 ft down handline
1230	68	44	3-5	NW	Bottom right flank
1330	68	37	4-6	NW	Bottom of the burn
1430	65	44	3-5	NW	Bottom, south aspect

At approximately 1700 hours, east winds began to develop over the burn area. Initially reported at 0-5 mph, the winds remained easterly until the last recorded observation at 1945 hours. East winds were not part of the spot weather forecast. Table 3 summarizes the recorded weather observations between 1730 and 1945 hours.

Table 3. – Weather Observations after East Winds Developed

Time	Dry Bulb (°F)	Relative Humidity (%)	Wind Speed (mph)	Wind Direction
1730	60	42	0-5	East
1845	66	42	5-8	East
1854	-	-	5-10 Gust 15	East
1945	-	-	5-8	East

4. Lessons Learned from the FLA Participants

A. Because personnel assigned to the project had no experience burning in masticated material, the eight-acre unit was viewed as a learning opportunity for future larger burn units within the greater Figueroa Mountain project area. New knowledge of fire behavior in masticated fuels was gained as part of the prescribed fire, including:

- Masticated materials had various depths, with different levels of compactness and therefore had significantly different fire behavior under only moderate environmental changes.
- Wind has a significant influence on fire activity even in these compact fuel beds. During the burn-down phase, significant changes in fire behavior can be expected as windspeed increases.
- Residence time in this fuel type was greater than anticipated. Staffing needs to be commensurate with the time required for mastication units to burn down to a level where they can be placed in patrol status.

B. Based on the residence time of the fire in masticated fuels, there is a need to consider more aggressive holding actions—including the use of hose lays and mop-up as necessary to secure firelines on future projects.

C. The design and layout of the prescribed fire unit was not optimized to provide for the highest probability of holding the burn within the unit boundary. Issues identified include:

- Several “dog-legs” in the fireline existed on the east flank of the burn unit.
- Untreated fuels were positioned immediately upslope from the burn unit, increasing the probability that any escape from the unit would burn in full alignment with the slope to Figueroa Mountain.
- Firelines were not all “dug” to mineral soils in the deeper fuel bed associated with the masticated fuels.
- Opportunities to establish hose lays to support holding operations prior to project ignition were missed.
- Untreated fuels (eyebrow) above the burn unit along Figueroa Mountain Road created a situation where high fireline intensity could develop immediately adjacent to a control feature.

D. The reliability of spot weather forecasts in the project area is questionable. Better relationships need to be established with the forecasters in the Oxnard NWS office to assure that open communication is the norm between forecasters and burners. An update to the changing weather situation on the burn was not provided by the forecast office until a formal request was placed by the Burn Boss. The Burn Boss should be more proactive in the interaction with the forecasters (e.g., prescription parameters, unexpected events) and should call directly to the NWS office when the observed weather begins to depart from the forecast.

E. Decisions on staffing should not be unduly constrained by concerns regarding overtime expenditures. Appropriate levels of funding should be programmed to support prescribed fire operations in the event staffing needs to be augmented to meet the conditions/status of the project.

F. When burning in unfamiliar fuel types (such as masticated fuels), project complexity needs to be accounted for and risks should be minimized until an acceptable level of experience is obtained by the practitioners.

5. Lessons Learned and Recommendations from FLA Facilitators

A. The perception that overtime funding was not available to support the needs of the prescribed fire appears to have influenced the decision on retaining or calling back resources. These perceptions include:

- Only the use of the pre-approved overtime was authorized for the burn.
- Burn overhead felt a need to ask if they had authority to expend additional unauthorized WFHF funds for holding actions on the burn.

B. Sufficient support needs to be in place for all future burns to assure that the overhead is not distracted by simple logistical or planning needs that could be accomplished by others not directly participating on the burn. This support includes such actions as acquiring meals as appropriate for units assigned to the project, obtaining updated weather forecast or securing next day burn approvals from air regulators. These actions could be easily accomplished by personnel not assigned to the project.

C. The Oxnard National Weather Service Office is operating at the northern range of their forecast area. Thus, observed weather has a greater potential to vary from the forecasted weather. The Burn Boss therefore needs to be proactive in requesting weather updates directly from the NWS office when conditions begin to vary from the forecasted. In addition, there is a need to develop a better working relationship with forecasters in the Oxnard Office.

D. With less experienced individuals filling Burn Boss positions, opportunities to have more experienced prescribed fire implementers share their knowledge with the next generation of prescribed fire practitioners is not being fully utilized by the Forest.

E. The level of authority of a Burn Boss has not been clearly articulated by staff and line, or is not understood by prescribed fire practitioners in regards to the use of WFHF funds.

Recommendations

A. A "mentor" from the pool of more experienced Forest Burn Bosses should be assigned to newer Burn Bosses on prescribed fires until a comfort level for burning in this fuel type is developed by the less-experienced employee.

B. The forest should consider the use of a Type 3 engine for the patrol phase of burns in this fuel type to assure that active holding and suppression operations can be rapidly initiated.

C. A conversation should occur between the Burn Boss and the Oxnard Weather Service Office whenever a spot forecast issued. These conversations will help foster a better working relationship between the forecaster and burner, as well as provide an opportunity to directly discuss forecast elements and specific project concerns.

D. A letter of direction should be issued to all Burn Bosses that clearly defines their level of authority regarding the use of WFHF funds to support prescribed fire activities.

6. Lessons Learned from Managers and Leadership

A. Promote a learning, informed and just safety culture. Taking adverse actions on well-intentioned employees will likely hinder the willingness of employees to share what happened, as well as to diminish their ability to learn and share with others from these experiences.

B. Forest leadership needs to be engaged in the proactive management of program funding to ensure reasonable levels of resources are available to support project activities.

C. Even though employees may be fully qualified for their assignments, experience is highly valued. We need to be mindful of the learning curve employees experience when performing new work activities (such as burning units with masticated fuels).

D. Managers and Leadership need to ensure that lessons learned are shared. Ultimately, recommendations and corrective actions need to be implemented and institutionalized into work activities.

E. Escalation of incident complexity requires immediate responses from supervisors, managers and leadership.

Commendable Moments and Outcomes

A. Resources assigned to the burn were mindful that they were unfamiliar with burning in masticated fuel and therefore viewed this burn as a learning opportunity for those involved.

B. Resources provided training opportunities to individuals assigned to both the prescribed burn and the wildfire.

C. The Line Officer was present and engaged during project implementation.

D. All agency policies and practices were followed during the prescribed fire operations and the wildfire.

E. The Burn Boss showed a willingness to acknowledge that the fire had escaped the capacity of the assigned resources and that it needed to be declared an escape fire in order to address the incident's fire suppression needs.

F. Assigned personnel on the prescribed burn maintained high situational awareness as the winds changed. These people actively questioned if they were providing the appropriate response to the escalating burning conditions.

G. Resources proactively evacuated the public from the adjacent campground, assuring public safety during the initial attack phase of the wildfire.

H. All employees embraced the Facilitated Learning Analysis process and the learning that can be achieved by this process.