Red Rock Prescribed Fire
Klamath National Forest
Escaped Prescribed Fire Review

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Front photo: Aerial view of Red Rock Prescribed Burn taken by Air Attack 05 on 8/13/2009.

Quick View

- **Prescribed Burn Name:** Red Rock
- **Where:** Klamath National Forest, Scott/Salmon Ranger District, Marble Mountain Wilderness, west of Fort Jones, CA.
- **When:** June 25th thru August 21st, 2009.
- **Description:** A planned 206-acre prescribed underburn, to reduce hazardous fuel loadings and re-introduce fire into the wilderness exceeded the capability of the Ranger District and Forest requiring conversion to a wildfire.
- **Ownership:** All USFS ownership and within wilderness.
- **Mechanics of escape:** The prescribed fire became active as seasonal drying occurred. During an extended period of hot, dry weather, the fire behavior exceeded the capability of the District and Forest to manage.

Introduction

Initiated in 2005, the Red Rock prescribed fire project was designed to reduce hazardous fuel loadings and re-introduce fire into strategically located areas of the Marble Mountain Wilderness. Successfully implemented in 2006 and 2007, this third stage of the project would help to connect previous burns with natural barriers.

The original Red Rock burn plan was written in 2005. A change in national direction in January 2008 required all existing burn plans to be updated to comply with the 2008 Interagency Prescribed Fire Planning and Implementation Guide (Guide). An update to the 2005 burn plan was completed on June 11, 2009, and was reviewed by the Technical Reviewer and approved by the District Ranger on June 23, 2009.

Ignition began June 25th and was completed on June 27th, at which time the burn was allowed to creep around within the planned 206-acre project area.

The burn was monitored throughout the summer and resources were inserted during periods of increased fire activity to take action on areas of concern. During a period of hot and dry weather in August, the fire became active and exceeded the capabilities of the District and Forest to manage. The Red Rock prescribed fire was declared a wildfire on August 21st, 2009.

Methods

The USDA Forest Service Manual (FSM) 5140 requires a review of prescribed fires that have been converted to wildfire status. The Klamath National Forest Supervisor requested a lessons learned approach to this review:

"I would like this analysis to use a "lessons learned" approach in understanding what happened with respect to the Red Rock prescribed burn. My key objective for this review is to learn from the positive and negative aspects of what happened, and to identify areas where the Forest can improve its performance with respect to the prescribed fire program. Please refer to FSM 5140 for guidance on elements that should be included in your report."

To meet this request, the review team held two facilitated group discussions. The first was with the District fuels and fire organization; the second with Forest (Supervisors Office) level fuels and fire personnel. The team spoke individually with those unable to attend the group discussions, or wanting follow up conversation.

The team sought to understand this event through the eyes of those involved in plan development, review and implementation and to capture lessons learned. The team gathered and analyzed information from available documents (Project NEPA, minimum requirements decision guide and approved minimum tool decision, Wilderness and Prescribed Fire policy, the Burn Plan, Unit Logs, available fire weather and RAWS data) to assist in the review.

The team compiled the story of the Red Rock Prescribed Fire from group and individual discussions. While every element in the story is supported by the statements of at least two participants, the review team recognizes that there is variation in recollection based on a participant's role and perception. The Review Team read the story to District and Supervisors Office (SO) personnel for validation and considered their comments when completing the final review.

Using these methods the Review Team developed a report that includes:

- The story of the Red Rock Prescribed Burn
- A review of the seven elements required by the 2008 Interagency Prescribed Fire Implementation and Procedures Guide.
- Beyond the Basics-A look at the human and organizational factors.
- Lessons Learned

The Story of the Red Rock Prescribed Burn

Fire personnel on the Klamath National Forest (KNF) have a lot to be proud of. Beginning in 2005 with support from the community, and Regional and National wilderness interest groups, they initiated a project to reintroduce fire back into the Marble Mountain Wilderness. They conducted the first prescribed burn in wilderness in Region 5 in 2006 - the first of several planned entries in the Red Rock basin of the Marble Mountain Wilderness. Again in 2007, they successfully applied fire in the basin. In 2008, due to high fire activity, no prescribed fire was conducted in the Marble Mountain Wilderness.

In 2009, it was once again time to consider prescribed fire in the wilderness. Individuals on the District knew this was a very important project for the District and Forest. The 2005 Red Rock burn plan had been used for the previous prescribed fires but was now out of date due to new policy. The District Fuels Officer recognizes this as an opportunity to get two Fuels Technicians familiar with burn plans, so all three work on updating the burn plan into the format required by the 2008 Interagency Prescribed Fire Planning and Implementation Procedures Guide (Guide). During this process, the Fuels Officer refers to the Guide, but does not fully read it. There are minimal changes or updates as the previous burns were successful and the original burn plan preparer had a good reputation as a burner. Significant change would require new SO review, which would cause delay. Thus, the task to bring the burn plan into compliance with the new required format is largely a cut and paste effort. The burn plan is signed by the preparer on June 11, 2009.

In preparation for burning, several District personnel hike in to set a portable RAWS station and check conditions.

On Thursday, June 18th, the local trail crew reports there was still snow in the area.

On Friday, June 19th a decision is made to implement the burn and preparations are started. Plans are to utilize a combination of hand and aerial ignition.

On Monday, June 22nd, District burn personnel are told they are burning. A few on the District are surprised it came up so fast.

On Tuesday, June 23rd, Fuels Tech 1 hikes into the burn site to coordinate logistical needs including sling loads and a fuel containment basin. On the same day, the Burn Plan is signed by both the Technical Reviewer and District Ranger. Neither is familiar with the Guide.

That afternoon the 174-acre Sims fire breaks out on an adjacent District. A number of local resources, including the helicopter intended for ignition and the local IHC crews are diverted to the wildfire.

On Wednesday, June 24th, the Burn Boss considers calling the burn off because of the Sims fire and the loss of resources, others are having similar thoughts. After consultation with the District Ranger, it is decided to proceed with hand ignition only and drop the portion of the burn that requires helicopter ignition. A helicopter is made available for logistical support.

Thursday, June 25th, the Burn Boss, two Fuels Techs and a hand crew hike into the burn area. A firing operation begins in the evening creating black line against the Pacific Crest Trail (PCT) at the top (south) end of the burn unit. The area of concern is the southern boundary of the basin, a ridge that runs along and into the headwaters of Wooley Creek, an area that has not seen fire in recent recorded history (100 years or so). The Burn Boss indicated that the map in the burn plan was not used for this burn and there was no map of where the burn boundaries were for this project. No one involved in the burn could identify exact burn boundaries of the project. The plan is for ignition to take place in, and for the fire to burn through, the timber stringers which are in the basin.

On Friday, June 26th, a test fire is initiated and due to spot fires that occur, the Burn Boss immediately ceases ignition. By 1530, conditions improve and after a successful test fire, ignition continues down slope into the Red Rock basin. Some single tree torching occurs, yet the crew has to keep adding fire, paying attention to ensure desired fire effects. Weather is monitored regularly throughout ignition.

Ignition continues on Saturday with no reported incidents throughout the day. By the end of the day, they have ignited everything they had wanted to in the 206-acre area and ignition is complete.

On Monday, firefighters patrol and fly out unneeded gear. The Holding Boss and Burn Boss concur there are not any holding issues. The meadows are green and since everyone is running short on food, they decide to hike out. [1] The agreed upon plan now is to let the area continue to burn throughout the summer until it is extinguished by a season ending event. The planned containment lines are the PCT to the south, natural barriers including rock outcroppings and meadows on the east and west, and meadows and the previous prescribed fire from 2006 to the north.

The Burn Boss and local Battalion Chief in consultation with the District Ranger develop a strategy to monitor the burn throughout the summer. The plan is to use visual observations from two staffed Forest Fire Lookouts and aerial reconnaissance. Neither of the Lookouts has a direct view into the drainage, but

[1] The probability of ignition (POI), calculated from 1400 weather observation from the on-site RAWS station was 90. The Burn Plan identifies actions based on POI and MFWS. With a POI of 50 the suggested actions were to mop-up 50 feet and patrol the fire line once a day. When the POI was 70 the suggested action was to mop-up 100 feet and patrol the fire line twice a day

they have a clear view of the basin's ridges. Burn personnel can drive to other vantage points on the District to gain a clear view of the burn area. Air Attack and Helitack, who fly over the area on other missions, help keep an eye on the burn and report their observations. The main area of concern is to the south and not letting the burn cross the PCT. Other than that, pretty much anywhere the fire goes in the basin as long as the fire behavior is okay is fine. They made a conscious decision not to hike resources in to every reported smoke because of the long travel times and the belief that natural barriers and the previous 2006 prescribed fire would hold the burn in place.

On July 3rd, the Burn Boss goes on a fire assignment and Burn Boss 2 takes over command of the Red Rock burn. Burn Boss 2 has not been on the ground on the burn site. He has "read the prescription and the intent, not the entire burn plan." Air Attack flies the prescribed burn and observes no specific problems.[2]

Visual monitoring continues throughout the summer with Lookouts and aerial resources. The local Helicopter module and Air Attack have maps of the burn and report what they see from the air whenever they travel over the project area. They also provide pictures. When lots of smoke is visible, District resources hike in to the burn. Burn Boss 2 consults with the District Ranger whenever there are issues.

On July 22nd, two firefighters hike into the burn and report no problems. [3]

On July 24th, the Lookouts report more smoke than usual.

On July 25th, Air Attack reports that the fire has burned and torched trees along the PCT and a hand crew hikes in to check it out. Burn Boss 2 is in frequent communication with the District Ranger who directs a "conservative MIST" approach to mop-up due to his interest in protecting wilderness values.[4]

July 26th the hand crew reports that the fire is okay and holding, and hikes out. The crew boss recommends to Burn Boss 2 that two people should stay on the burn to monitor it.[5]

On July 28th, the Lookouts report increased interior fire activity.[6]

On the morning of July 29th, Air Attack reports that the Red Rock burn has crossed the PCT with low potential and slow rate of spread. Later in the afternoon Air Attack reports a 20' x 20' spot fire with thunder cells building locally.

[2] The POI is 100
[3] The POI is 80
[4] The POI is 60
[5] The POI is 70
[6] The POI is 80

On July 30th, Fuels Tech 1 plus two firefighters hike in to the burn to contain the 1.8-acre slopover across the PCT.

On July 31st, there is still fire on the south side of the PCT and an IHC squad hikes in to assist the others in improving line and mopping up with blivets and hoselays. After mopping up, they patrol other areas of concern along the PCT and report that fire behavior is not problematic and the burn is meeting objectives.

The District Ranger begins conversations with the Supervisors Office about the ability to convert the prescribed fire to a fire managed for resource benefit if it goes outside the planned unit boundary and/or the project NEPA boundary. They advise him to contact the Washington Office directly to inquire about fire policy and interpretation. The District Ranger makes the inquiry and finds out that plan is not an option.

A couple of District fire employees express concern and suggest to Burn Boss 2 and others that the prescribed fire should be put to bed. Others are feeling the same way, however do not report it to the Burn Boss or to the District Ranger. Burn Boss 2 and the District Ranger are comfortable with what the fire is doing.

On August 1st – 5th, light smoke is reported and the fire is reported to be doing okay.

On August 6th, Lookouts report thunderstorms in the area and some precipitation has occurred in the area of the burn.

Between August 9th and August 11th, Lookouts and aerial reports indicate a slight increase in smoke. [7]

On August 13th, Air Attack observes the Red Rock prescribed fire has smoldering activity on the north side of the PCT and winds are from the south.

By 1500 on August 18th, Lookouts report that the burn is putting up more smoke than at any point since ignition (Fig 1). There are multiple reports of fire activity. Fuels Tech 1 and the DFMO check the smoke from the Scott Bar Mountain Lookout. They report a low intensity backing fire. Meanwhile Burn Boss 2 who is on a day off sees the smoke and decides to return to work the next day.[8]

[7] The POI is 70
[8] The POI is 100

Fig 1-Smoke from Red Rock Prescribed burn viewed from Lake Mtn. lookout August 18th.

On August 19th, Eddy Gulch Lookout reports there was a significant amount of smoke in the southwest corner of the underburn yesterday and there is smoke again today. Burn Boss 2 and the two Fuels Techs fly the project. Aerial reconnaissance locates a new spot to the north surrounded by meadows and in the area prescribed burned in 2006. They report there is low potential on the west side of Red Rock Valley. [9] There is considerable fire activity in the southwest area. There is a lot of heat 50 feet from the PCT and the fire is south of the Shadow Lake Trail. At 1300, FS Pro modeling is initiated. The runs show fire moving to the north and west. Unsure that the runs are reflective of the on the ground conditions, the Supervisors Office (SO) continues to modify and validate the inputs to come up with what is believed to be a more realistic outcome.

On August 20th, the two Fuels Techs fly the project to obtain a good recon, take video and map the fire. The helicopter touches down on the western ridge. Winds are calm. There are four smokes to the north surrounded by meadows.[10]

After a scheduled Forest FMO meeting, a second meeting was conducted with key participants in the Red Rock burn to discuss the project and watch the video. There is concern that the environmental parameters in the plan have been

[9] The POI is 100
[10] POI is 100

exceeded. All concur that the fire and management direction is on track, but decide that they need to button up the southwest end. An order is placed for a Spot Weather forecast and an off-forest crew for the next day. Burn Boss 2 begins planning for actions in case the fire crosses the PCT.

On August 21st at 0600, Fuels Tech 2 and an engine crew begin hiking into Red Rock. At 1000 Fuels Tech 1 and an off-forest crew are briefed by Burn Boss 2. Their task is to secure the southern end. A helicopter has been ordered to assist with bucket work and cargo transport to start at approximately 1200.

The Spot Weather forecast from Redding Predictive Services is received. For eye level winds it indicates "overall light slope winds and light to moderate W to NW winds at ridgetop levels….wind upslope to NE 1-3 mph with occasional gusts 5-7 mph mainly in the afternoon. Ridge winds NNW to NE 4-8 mph."

The Medford weather forecast indicates 20 foot winds predicted "upslope/upvalley 2-4 mph becoming West 6-12 mph in the afternoon. Ridges and upper slopes variable 2-4 mph, becoming West 6-12 mph in the afternoon."

By this time, Fuels Tech 2 and the engine crew have reached a point to view the fire from above Shadow Lake. The fire is actively burning outside the identified burn boundary in stringers from above Shadow Lake back toward the project boundary. Fuels Tech 2 is pushed off the ridge by the smoke and heat into a meadow that, after testing, he determines will not carry fire. He informs Burn Boss 2 that there is quite a bit of smoke and fire and he would like some additional ground resources. Fuels Tech 2 reports, "There is a lot more work than we have people." Burn Boss 2 responds that he would like to see how the helicopter and bucket do before ordering more ground resources.

As Fuels Tech 1 with the off-forest crew drive to the trailhead, Fuels Tech 1 is surprised by the fire activity and how much the fire has moved to the north. The fire appears to be north of the 2006 prescribed fire, and within the wilderness. Fuels Tech 1 and the off-forest crew continue their plan to hike to the south end of the fire. Members of the crew note that the meadows they are hiking through are dry and would not function as a safety zone.

By 1400, two helicopters are working the fire, as it is burning hot toward the north. They are unable to have much effect on the fire.[11]

As the two Fuels Techs assess the fire, fire behavior continues to increase, overwhelming the capability of the crews. Air Attack over the fire recommends aerial removal of the crews in Red Rock as their exit route in is no longer viable.

[11] On site RAWS data for the day shows winds S SE. Maximum wind speed for the day was 7mph. Maximum gust for the day was 14 mph. The 1400 weather from the on-site RAWS: Temp 80 RH 14, Winds SE 5 mph, gust to 12 mph, 10 hr fuel moisture 4. POI 100

About 1600, Burn Boss 2 flies the fire with Air Attack and observes extreme fire behavior as the fire burns through the 2006 project burn towards the north and into the unburned area. He notices a southwest wind on the burn, but had anticipated a N, NE breeze according to the spot weather forecast. At this point, there are two new spot fires 1/8-1/4 mile to the north of the main fire and there is potential for the fire to burn into the Canyon Creek drainage. By that evening, the Red Rock prescribed fire is declared a wildfire (Fig 2).

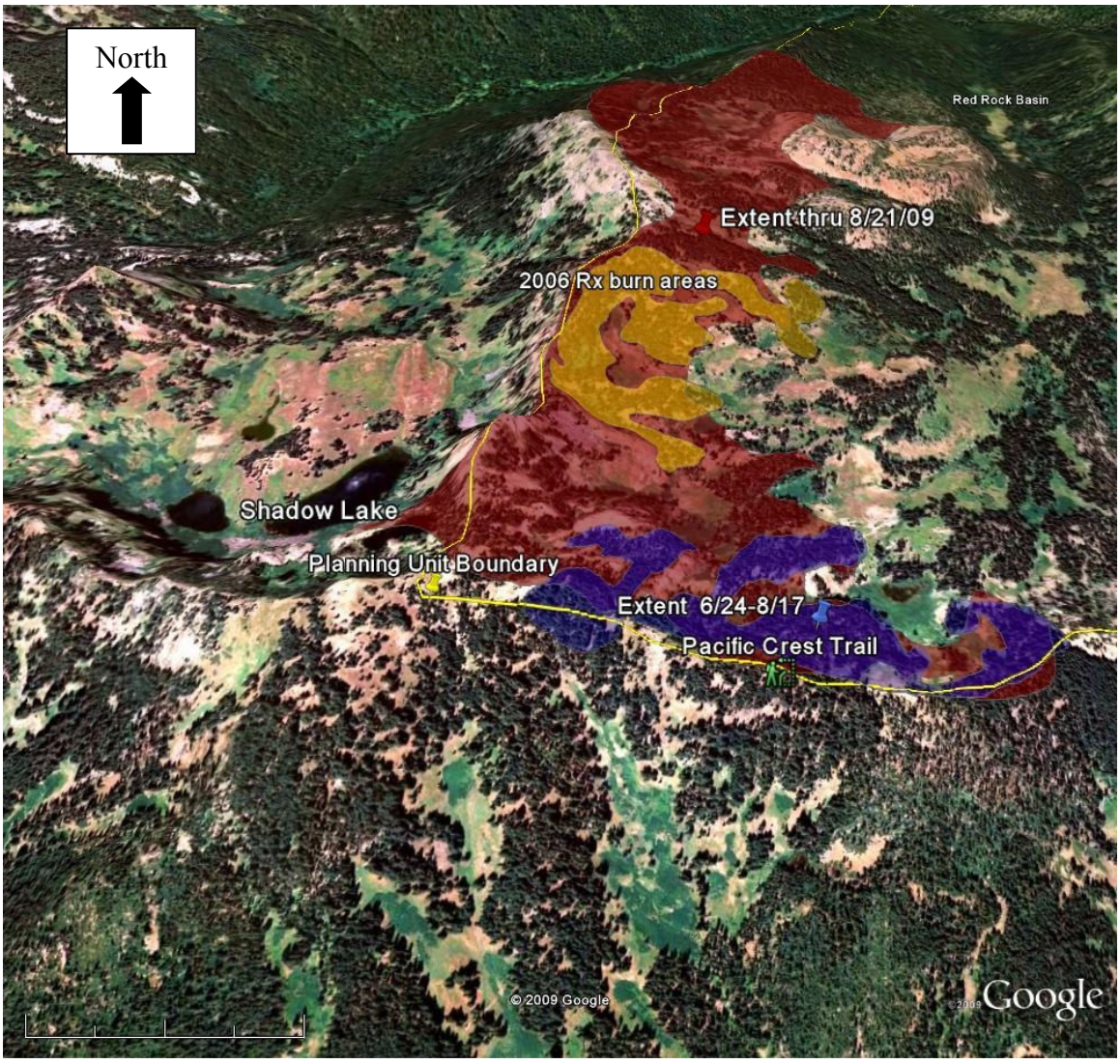


Fig 2. – Map of the Red Rock Project area showing original burn in purple, the 2006 burn in yellow and the escape in red.

Lessons Learned

Paraphrased from discussions with Key District Personnel and Forest Fire staff.

Burn Plan

Plan development

- Start on Burn Plans earlier. Getting plans done earlier allows for more focus on logistics.
- New policy direction provides the opportunity to review and revise the Burn Plan. Can't simply cut and paste from other burn plans; need to re-think the Burn Plan for a specific project.
- The Burn Plan should be your friend. Build the plan to capture your thinking process, so that if you leave and someone else inherits your plan, they have a good chance at success if they read and follow your plan.
- SO can provide more specific direction about what is expected in a burn plan.
- Approach a long-duration prescribed burn as you would a natural ignition managed for resource benefit. How clean a burn is likely/desired, how active will it get? When? Set up a long-term implementation plan, consider Management Action Points and trigger points with actions associated with them.
- Using FSPro has taught us to look for trends in Energy Release Components (ERCs) and winds that set off large fire movements (i.e. as ERCs approach the 90th percentile, fire behavior increases).
- Looking back, need a cut-off date.

Review

- Review a Burn Plan from each of the units, Burn Bosses critique plans, learn together, facilitated by someone who's familiar with current policy.
- Have a Technical Review from off-District, off-Forest. Build pride in making the commitment and promise of a good plan with your signature.

Implementation

Using the Burn Plan

- A Burn Plan should be a *tool* that assists the burn team in successfully accomplishing the objectives, not a hurdle or hoop.
- When parameters are identified in the Burn Plan that suggest action (i.e. mop-up and/or patrol) document decisions and rationale when those actions are not implemented.

Prepare for the unexpected

- Expect the unexpected. Think outside the box. What curves are you going to get?
- Make sure that logistical support for operations is simple and has a "cushion" built in (i.e. logistical considerations in wilderness, oversight of long term operations).
- Put boots on the ground for better sensing, particularly for spring burning when you're not going to put it out. Best reconnaissance and Situational Assessment comes from those with boots on the ground.
- How can we (better) anticipate fire movement?
- Would not want to do summer burning without resources. Have to be completely committed to a summer or long duration burn.
- Need a clear picture of who has responsibility (for monitoring the burn and determining staff on it).
- There has to be a cut-off. On 8/9 it was still rooting around, maybe we should have just made the decision to put it out. When does a fire go from holding to patrol?
- There was a good meeting about the prescribed fire on August 20th. We should have had more of those meetings earlier in the summer.

Leadership and Organizational Structure

- Fill key leadership positions with people who have experience and interest.
- Engage a Prescribed Fire Manager who can keep an eye on the big picture for long duration events, as well as on Districts where there are a number of burns going. Used to have this.
- Engage Districts and Supervisors Office (SO) in a discussion about what 'support' looks like. [This looks different to each, but operating as if they know, so SO efforts are not actually meeting Districts needs.]
- Lessons Learned Center has good videos', but sending out the link is not enough (need interpretation and/or face-to-face interaction)
- Tailor review of Rx lessons learned at Forest meetings to the needs of KNF.
- Take the time we need for burn boss refresher. Add a day to the RX Burn Boss workshop to work on burn plans.
- SO provide more oversight in Burn Plans.
- SO has to commit to Prescribed Fire program: is this what we want to do as a forest? Is it needed? Are we getting the results we want to achieve? What are we learning as a forest? Where do we need to go?
- Line Officers need to be able to rely on technical reviews (they are not the technical experts).

- We are critically deficient in skills for an expanding prescribed fire burning program.
- Definition of roles between SO and Districts – SO review work and support Districts.
- Wouldn't recommend that another Line Officer who doesn't have extensive Prescribed Fire experience to do this burn (training, experience, ability to read vegetation, natural fuel cycle, can fly and tell what the fire will do).
- Hire Prescribed Fire Manager to track all ignitions; manage contingency resources and coordination with GACC; recognize that the Forest Duty Officer may be focused on suppression not Rx fire.
- Should one person simultaneously serve as the District Duty Officer and as the Burn Boss on a long duration event?

Strategic actions

- Identify places in roadless areas where there are gaps between fires on the boundary and natural barriers and plan to close some of those gaps by starting fires in advance of a season-ending event … such as aerial ignitions
- Educating the public and getting them more on board will give us more leeway, more emphasis on education.
- Unclear what is in-season burning for a prescribed fire like Red Rock – what is GACC influence? Unclear what their role is, is SO/District sharing their project; communicating with each other on project/ or receiving permission from GACC.

Review Elements

Required by the 2008 Interagency Prescribed Fire Planning and Implementation Guide.

1. An Analysis of Seasonal Severity, Weather Events, and On-Site Conditions Leading Up to the Wildfire Declaration.

Greenness indicators present a picture of fuel conditions on the Klamath National Forest (KNF) during the time period the Red Rock Prescribed fire was active. These indicators suggest vegetation and large fuels were drier than average predisposing the area to large fire growth (Fig 3).

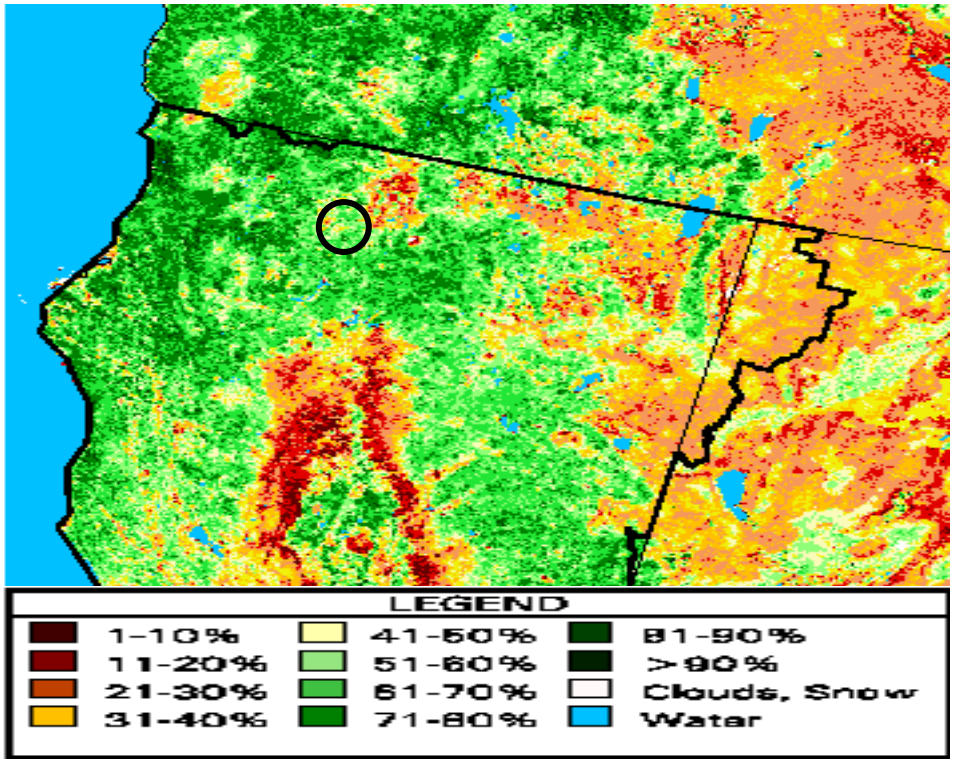


Fig 3 – Relative greenness for northern California during mid- August. The Red Rock Fire area is indicated by a circle.

The moisture of small diameter dead fuels is associated with probability of ignition and fire spread and tends to fluctuate with daily changes in weather. Live and large fuel moistures are associated with season-long or even multi-year weather conditions and have been linked to large fire potential, fire intensity, and resistance to control.

The Energy Release Component (ERC) is a number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. ERC is a cumulative or "build- up" type of index. As live fuels cure and dead fuels dry, ERC values rise providing a good reflection of drought conditions and fire potential. ERC works well as a stable evaluation tool, providing an indication

of how a fire behavior potential is trending up or down over the course a weeks or even months. ERC works well for landscape-scale long duration wildfire and prescribed fire planning. High Elevation ERC values on the KNF had been trending well above average and near record levels prior to a significant rain event late in May (Fig 4).

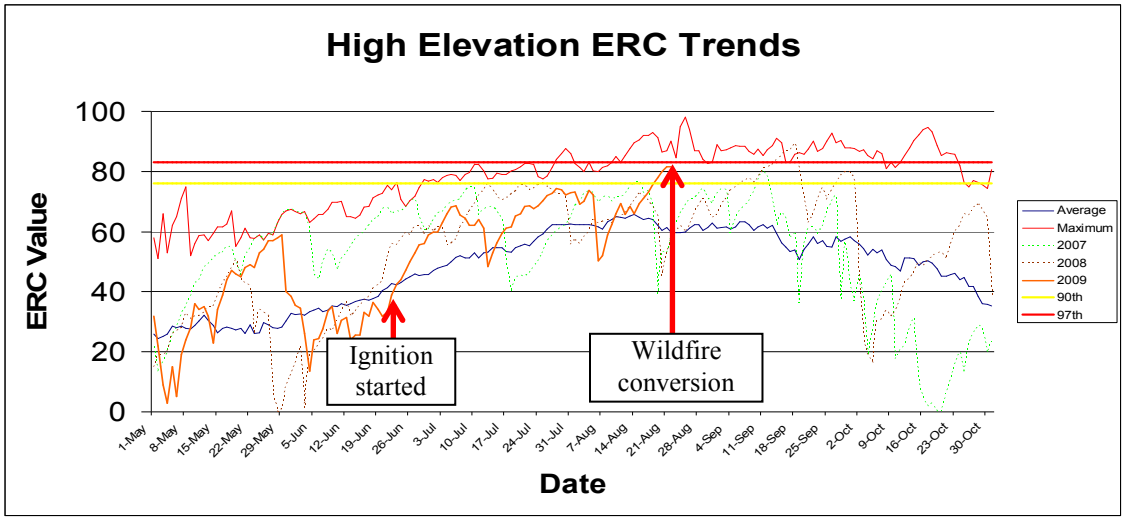


Fig 4 - High elevation ERC values.

At the time of ignition, values were trending just below average and were rapidly increasing. Throughout the summer ERC values pushed toward the 90th percentile mark, rapidly recovering from any precipitation received during thunderstorms. By mid-August, values were at or near the 90th percentile.

Thousand-hour time lag fuel moistures (Fig 5) provide an indication of wildfire potential. As fuel moistures decrease large fire potential, fire intensity, and resistance to control increase.

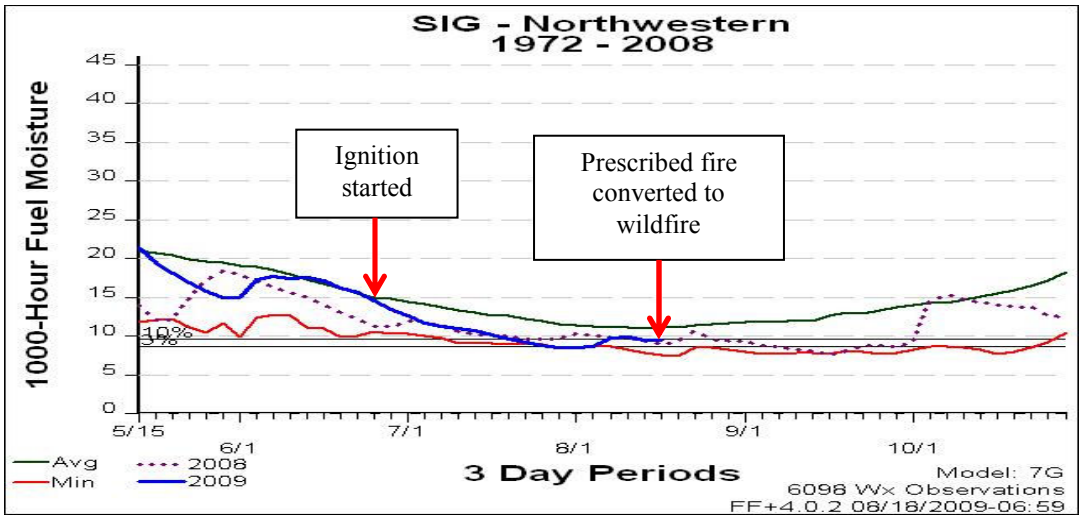
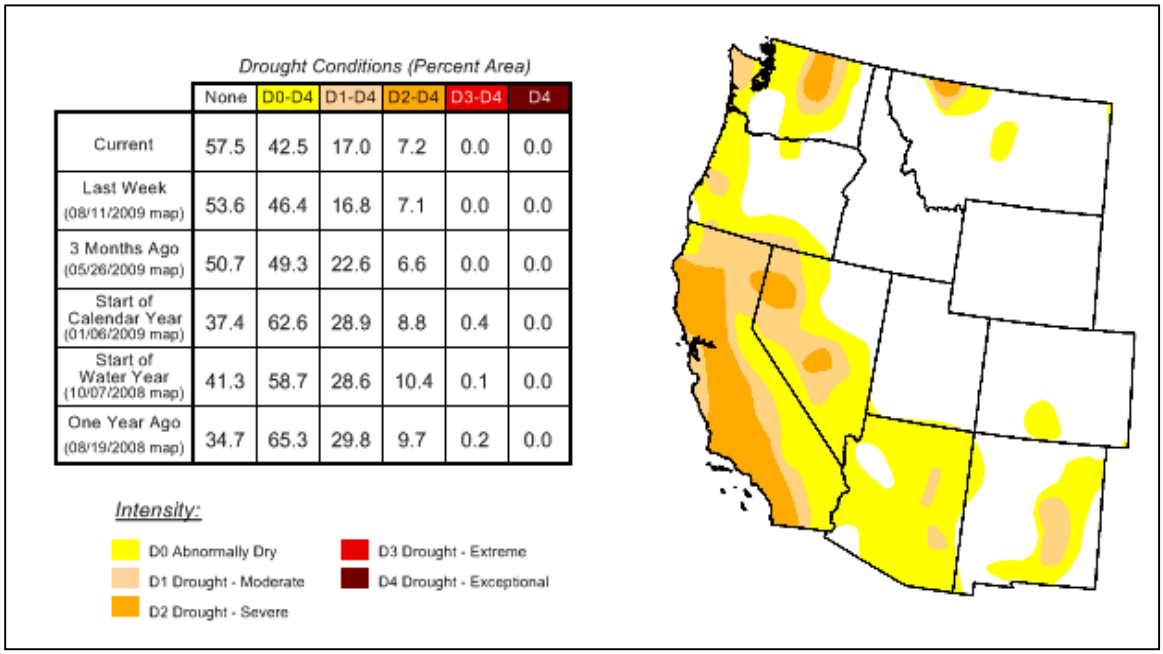


Fig 5 – High elevation 1000-hr Time lag fuels. Note fuels were at or near historic

The Western US Drought Monitor (Fig 6) provides additional evidence that vegetation and large fuels in the Klamath NF were drier than average due to long-term drought conditions.



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	57.5	42.5	17.0	7.2	0.0	0.0
Last Week (08/11/2009 map)	53.6	46.4	16.8	7.1	0.0	0.0
3 Months Ago (05/26/2009 map)	50.7	49.3	22.6	6.6	0.0	0.0
Start of Calendar Year (01/06/2009 map)	37.4	62.6	28.9	8.8	0.4	0.0
Start of Water Year (10/07/2008 map)	41.3	58.7	28.6	10.4	0.1	0.0
One Year Ago (08/19/2008 map)	34.7	65.3	29.8	9.7	0.2	0.0

Fig 6 –Drought Monitor, Western US, August 2009

National, Regional, and local dryness measures all indicate that live vegetation and dead fuels on the KNF were drier than average.

- The National Drought map indicates this area was in a persistent moderate to severe drought.
- Relative greenness was 31-50%.
- ERC values were approaching the 90th percentile.
- 1000-hr TL fuels were near historic minimums.

These measures are indicative of the high potential for a prescribed fire to remain active as a ground and surface fire where there is available fuel. When windpeeds are low, fires burning under these conditions can appear deceptively benign. Moderate winds, change in steepness of slope, or change in fuel conditions (e.g.: fire movement under low-hanging tree canopies) can transition a smoldering surface fire into one that is rapidly spreading at the surface and in the crowns of trees.

2. Analysis of Actions Taken Leading Up to the Wildfire Declaration for Consistency with the Prescribed Fire Plan.

The monitoring and holding plan collectively understood and undertaken by the prescribed fire team was based on aerial monitoring (Air Attack and Helitack when ordered or while on other missions, and occasional fly-overs by burn team members), daily observations from two permanent fire lookouts, and when deemed necessary, observations from two vantage points outside the wilderness that looked into the Red Rock valley. On the ground actions were undertaken when unusual amounts of smoke were visible or aerial reconnaissance indicated the fire was threatening project boundaries. Fire personnel hiked into the area five times during the summer to take holding and mop-up action on the southwestern edge of the fire.

When fire crews hiked into the fire area on August 21st, planning to secure the southwestern corner of the burn, they were surprised to discover the burn had made - and was making - a significant run to the north, through an area burned in 2006 and thought to be a barrier to fire spread.

Interviews and documentation reviewed suggests there was inadequate monitoring of and/or action taken based on weather and fire behavior indices post-ignition. Even as the summer progressed and ERC values on the KNF were reaching the 90th percentile, fire managers were of the opinion the 'fire was doing good' and did not pose a threat. This perception, combined with minimal on-site presence, and a misinterpretation of the amount of precipitation that had occurred over the project area seems to have led to a false sense of security. The Burn Plan contained direction in the Mop-Up and Patrol procedures portion that identified actions to be considered for patrol frequency and mop-up actions based on Probability of Ignition (POI) and mid-flame wind speed. According to this direction the suggested action to mop up 100' and patrol by foot twice a day occurred 39 times during the life of the burn. Had these actions been implemented, it is foreseeable that managers might have had a better awareness of fuel conditions and the escape might well have been avoided.

3. Analysis of Prescribed Fire Burn Plan for Consistency with Policy.

Analysis shows that the Red Rock prescribed burn plan was consistent with Wilderness Policy and the NEPA documents developed for the project.

The Red Rock prescribed burn plan was analyzed to determine its consistency with FSM 5140 and the July 2008 Interagency Prescribed Fire Planning and Implementation Procedures Guide. The following deficiencies were noted:

Complexity Analysis

- The Complexity analysis was completed in October of 2005 and signed in June of 2006. No initial rating was completed.
  [Without an initial rating it is difficult to assess the level of qualification necessary to write the burn plan, and impossible to document the mitigations necessary to meet the identified complexity.]
- The relationship between risk and consequence is not clear in the document.
  [The rationale used for many of the elements does not appropriately address the issues.]

Scheduling

- Inconsistency with times frames identified in the Complexity Analysis, Burn Plan and NEPA and the actual time the plan was implemented.
- The project duration is referenced as “Igniton- 2-4 days expected. Burn-down- 2-3 days expected.”
  [While it was recognized by the SO and the District that the project would be one of long duration – the burn plan does not address this issue. The unit was ignited in late June and had episodic increases and decreases in spread and fire behavior throughout the 57 days.]

Project boundaries

- Policy requires that project boundaries be identified on a map. The burn plan had a map, but it was not valid for this burn.
- There was no map identifying project boundaries for this burn. Participants had different understandings of what the unit boundaries were based on earlier burns and natural barriers.

Contingency Plan

- The Contingency plan does not identify the type or numbers of resources that are needed or the weather parameters/trigger points for which they would be activated.
  [The District and SO did not have a formal procedure in place to track required and available contingency resources.]

4. Analysis of the Prescribed Fire Prescription and Associated Environmental Factors

The single fuel model and loadings utilized in the prescription are not representative of the fuels mosaic present in the project area.

The burn plan utilizes a fuel model 10 with total loading of 134 tons/acre. This is inconsistent with descriptions of the fuel models in Red Rock NEPA documents and with the description of vegetation and fuels in Element 4B of the Burn Plan.

Photos taken for monitoring purposes show different fuel conditions with considerably less loadings (Fig 7).

Fig 7 – Photo of fuels in a monitoring plot with-in the Red Rock burn area.

The prescription was written to address a spring or fall burn window; however, ignition and active spread took place during summer months.

[While the prescription addresses the written prescribed fire objectives such as reducing fuel loadings by quantifiable amounts, retaining a given percentage of ground cover or raising the base crown heights of trees, these differ from "reintroducing fire into the Wilderness" which was perceived by the members of the burn organization to be the primary objective of the burn.]

5. A Review of the Approving Line Officer's Qualifications, Experience and Involvement including Adequate Program Oversight:

The Line Officer (District Ranger) met the appropriate training and qualifications for the complexity of the prescribed burn consistent with FSM 5140.7. The Line Officer's qualifying experience includes previous currency as a Prescribed Fire Burn Boss. The Line Officer has been an agency administrator for prescribed fire and wildfire for the past 15 years.

The Line Officer was involved with the Red Rock Burn in 2006 and 2007. During the 2009 burn, he stayed informed on the operations from ignition through the declaration of the escape.

6. A Review of the Qualifications and Experience of Key Personnel Involved:

Based on IQCS printouts for the key individuals who performed as the Burn Boss, Ignition Specialist, Holding Specialist and Technical Reviewer, all participants were currently qualified to perform in those positions.

7. A Summary of Causal Agents Contributing to the Wildfire Declaration:

During the 57 days that the Red Rock prescribed fire was active fire lookouts and aerial reconnaissance were the primary method utilized to monitor the fires potential for escape. Although everyone involved in the burn had the expectation that it would be a long duration event, no long term planning was completed. The amount of smoke visible to observers was used to interpret the "potential for escape" rather than utilizing on-the-ground observations, on-site RAWS data or seasonal indices. An assumption by those involved that a three year old prescribed burn was an effective barrier to fire spreading to the north, along with a misinterpretation of the amount of precipitation which occurred on the project, may have validated the opinion of fire managers the 'fire was doing good' and did not pose a threat.

Interviews and documentation reviewed suggests there was inadequate monitoring of weather and fire behavior indices throughout the 57 days of the Red Rock prescribed fire, post ignition. The Mop-up and Patrol matrix in the burn plan identifies mop-up standards and resource needs under defined weather parameters (POI and MFWS). It became apparent to the review team the function of the matrix was misunderstood or ignored and identified actions were not undertaken by the Burn Bosses. For 39 of the 57 days that the fire was active

the matrix indicated actions of mop up 50-100 feet and firelines be patrolled 1-2 times a day. (Fig 8) Key personnel did not have “boots on the ground” post

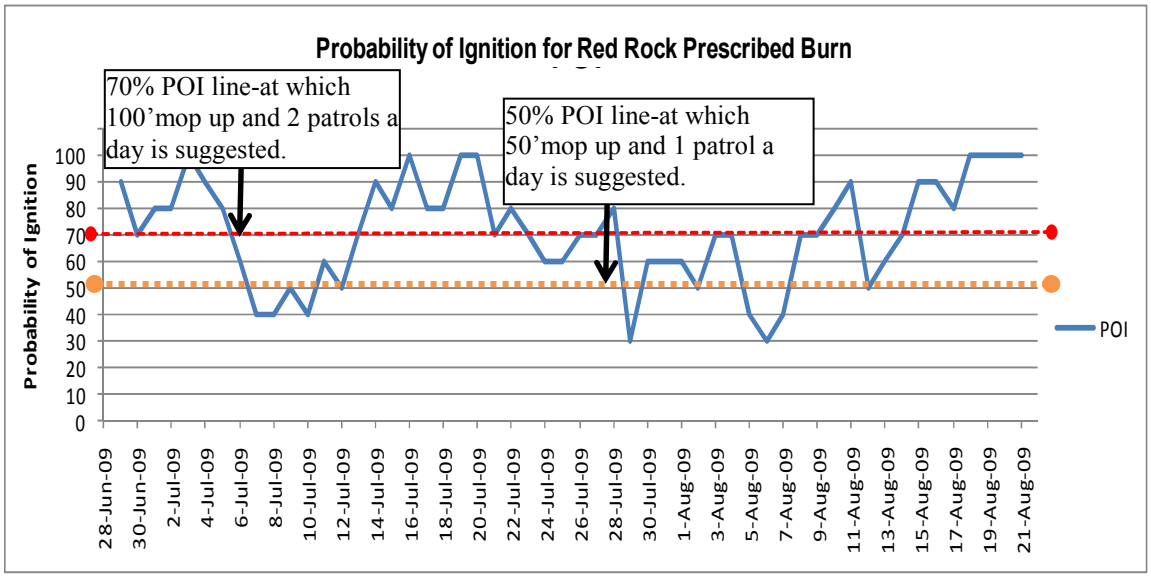


Fig 8. POI and suggested actions. POI was calculated based on 1400 weather from on-site RAWS

ignition to acquire and maintain a hands on interpretation of fuel conditions and fire location.

Spot weather forecasts are required by policy for each day the burn is actively spreading. Spot forecasts were only requested for days of ignition and on the day the fire escaped. Lack of attention to specific weather information caused burn managers to fall behind in their situational awareness. Spot fires to the north of the main burn, did not trigger thoughts that the fire may move to the north.

Mop-up direction and expectations were unclear and/or conflicting to those involved with the Red Rock prescribed fire, particularly as to what tactics were acceptable to use in Wilderness. The District Ranger verbally emphasized a conservative MIST approach to mop up. The Burn Plan stated mop up would be done only as necessary and would utilize minimum impact tactics. The Burn Plan also identified mop-up and holding actions based on POI and MFWS. Some of those involved with the burn held an incorrect assumption certain suppression tactics were not available due to Wilderness.

There was direction that could have been included in the Burn Plan to clarify mop-up tactics in the Wilderness. These include the NEPA analysis and associated approved decision under the wilderness minimum requirements decision guide ("minimum tool") completed for this burn. The minimum tool decision approved portable pumps and chainsaws if non-motorized methods could not safely keep fire within the containment area. Use of a helicopter to drop equipment was approved at the discretion of the Burn Boss.

Beyond the Basics:

> ***How is it that a group of highly qualified and experienced people who are deeply committed to their work, develop and implement a prescribed fire burn plan that does not meet policy and ends up escaping?***

The intent of this section is to pull together the review team's understanding of the context and events, taking into account both operational context (what you live) and hindsight (looking back) to identify and link contributing factors.

The following discussion and diagrams are offered with the hope that they contain enough insight to provoke critical thinking and discussion about both latent (for example organizational policy, procedures, structure and culture) and active (for example, individual skill, attention, team) factors contributing to the escape.

Analysis of Factors Leading to an Inadequate Burn Plan

In the spring of 2009, the District was eager to undertake the Red Rock prescribed fire project. The 2005 burn plan had been completed by a now retired burn boss who was highly regarded. A change in policy meant that the Red Rock burn plan was now outdated. The Fuels Officer responsible for updating the plan was not on the District when the project planning or previous burns took place. A number of key positions at higher levels in both fire and wilderness were in new or acting assignments. However, other members of the District fire organization who had been involved in the 2006 and/or 2007 burns, including the District Ranger, were familiar with the project and area. There was a thought the project was straight-forward and "bullet proof". Given previous success burning in the Red Rock basin, it made sense to simply re-format the burn plan to comply with the 2008 Interagency Prescribed Fire Planning and Implementation Guide (Guide).

> [*In essence, re-formatting was thought of as a paper exercise to meet bureaucratic requirements, rather than an opportunity to substantively re-think the burn plan. Somehow during this process critical information contained in the original plan was lost, for example, the contingency plan. Quick reviews and approvals of the updated 2009 plan by personnel unfamiliar with the Guide allowed these flaws to go unnoticed. Turn-over at the District and SO resulted in loss of continuity of personnel (and thus a broad, collective understanding) in the burn. Inadequate training and supervision, loss of team continuity, and an over-reliance on local experts limited the number and quality of critical eyes on the plan.*]

The District Ranger was a previously qualified prescribed fire Burn Boss, whom many on the District looked up to as a mentor. He had the qualifications to review and approve burn plans of moderate complexity, knowledge of local topography, weather and fuels, and a strong wilderness ethic.

> [The q*ualifications of and confidence in the District Ranger, along with the perspective by fire and fuels managers in the Supervisor's Office that the prescribed fire program was 'owned' by the District, seems to have led to a 'hands-off' approach to oversight and program management by the SO.]*

While these individual, team and organizational factors provide many strengths, in this case, they linked together to create a situation in which an inadequate Burn Plan emerged (Fig 9).

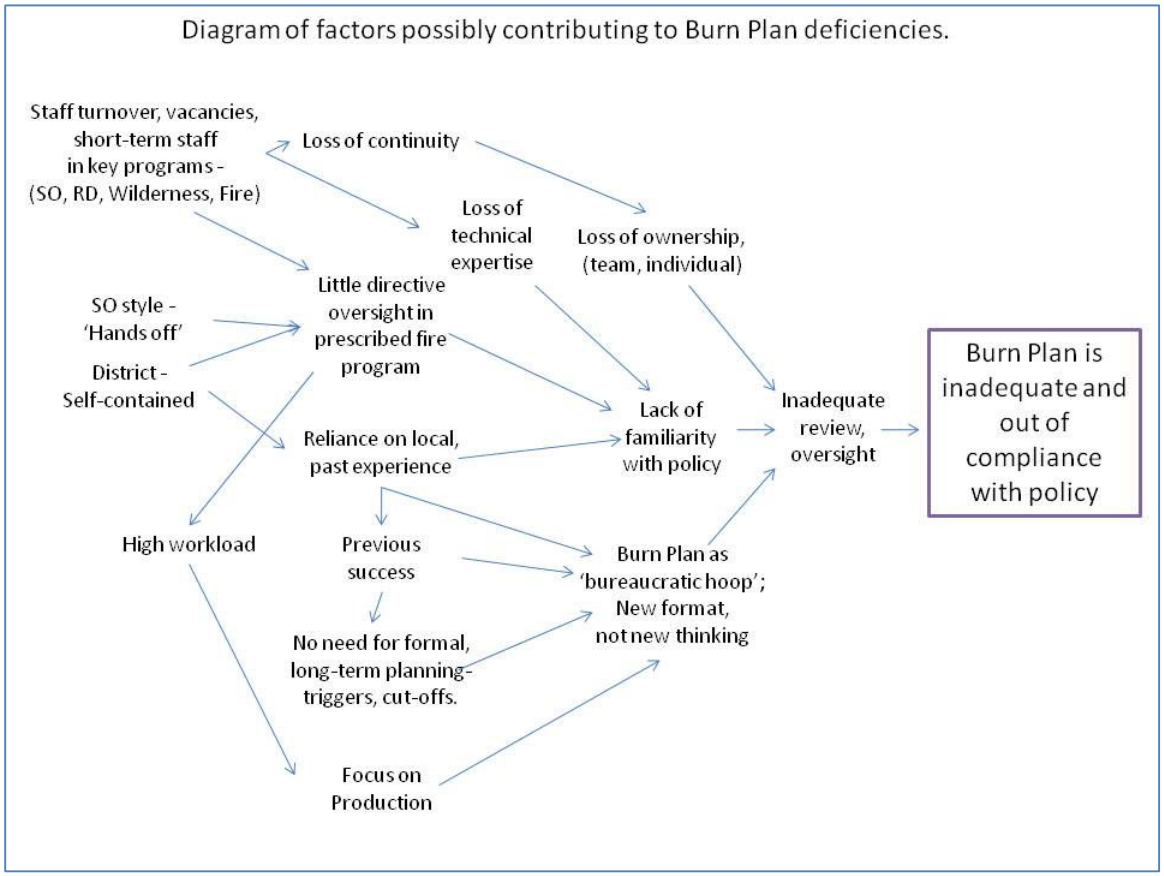


Fig. 9 –Diagram of factors contributing to deficiencies in the Red Rock Burn Plan.

Analysis of Factors Contributing to Escape

The ignition phase of the burn went well. While the burn plan did not address a long duration burn, District and SO personnel all planned for the burn to continue

throughout the summer. All agreed that it would take a season ending event to put the fire out.

> [*The project was thought of as a 'normal' prescribed fire up through the end of ignition, then the District and SO perception of the project changed, and it seems that the project was viewed as a fire with resource benefit for the remainder of the season – except there was no long-term or periodic risk assessment that normally would accompany a long duration event. Since this wasn't a natural ignition, the cues to prompt development of a long term implementation plan or conduct periodic risk assessments were missed*.]

The confusion and/or unclear direction over allowable suppression actions within wilderness (actions defined in the burn plan, actions defined in the minimum tool, and District Ranger direction) resulted in holding actions that were less than those identified in the burn plan. The District chose to use lookouts and viewpoints outside the wilderness to monitor the burn rather than having personnel hike the 3-4 miles up to the fire on a regular basis.

> *[There is also the lingering sense that the value of the Burn Plan was primarily for ignition, instead of a being a tool that contained critical guidance (in sufficient detail and clarity for the transition between different employees) for the duration of an event. This is indicated by the lack of familiarity with the Burn Plan and the 2008 Guide among members of the entire operation.*]

During the 57 days of the burn, team members had their primary assumptions about problematic areas confirmed several times. Prior to mid-August, the only areas that necessitated holding actions were on the southern end of the fire near the PCT.

> *[This appears to have confirmed for them that they had correctly identified where 'failure' was possible.]*

The mop-up and patrol matrix contains suggested actions based on specific weather parameters (probability of ignition and mid-flame wind speed). Burn Boss 2 was familiar with the prescription and intent of the plan, but did not consider or use this matrix. He mentioned that he did not refer to the burn plan and instead used his experience and judgment. Getting into the Red Rock basin was an arduous 2 1/2 hour hike. Because of this, information about fire activity was obtained from a variety of visual sources. Burn Boss 2 and the District Ranger were comfortable with fire activity and fire effects so more intensive monitoring was not utilized. Direction from the District Ranger was to utilize conservative MIST.

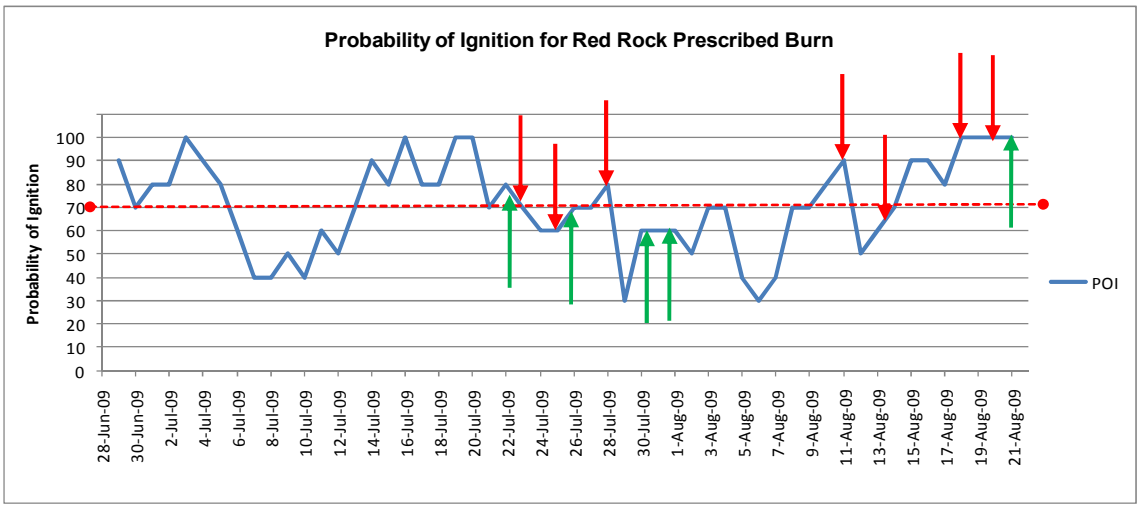


Fig 10 – Graph showing POI on Red Rock underburn with top arrows indicating days of increased smoke and bottom arrows indicating when patrols hiked in.

The graph above (Fig 10) shows the POI for the burn area calculated from the on-site RAWS data. The top arrows indicate reports of increased smoke or fire activity, the bottom arrows indicate when resources were on the ground. The dotted line indicates the break point for suggested actions in the mop-up and patrol matrix of the burn plan. Most of the on-the-ground observations occurred when POI and fire activity were at a level lower than on preceding days. This may have led to a false sense of conditions.

> *[This analysis revealed that the suggested mop-up/patrol action for 39 of the 57 days the project was active was 100 foot mop-up and 2 foot patrols/day. Direction from the District Ranger was inconsistent with these mop-up standards, possibly leading to a hands-off approach to monitoring and mopping up the burn. A misinterpretation of the amount of precipitation received during a thunder storm may have led to a false sense of security even as ERC values for the area were approaching the 90th percentile and POI's were 70-100. With infrequent on-the-ground visits, and no daily calculations of indices, there were few signals to indicate the need to update assumptions about fuel conditions. The critical signal that was missed was the receptivity of fuels in the previous burn from 2006 which the team was thinking was a functional barrier to fire spread to the north. There were spot fires in that area that did not trigger an update of assumptions about the effectiveness of that barrier.*

At an organizational level, the allocation of authority and ownership in the prescribed fire program between District and Supervisor's office seems to have left a structural gap in oversight and support functions. The resulting structure seemed to place the vast majority of authority for the prescribed fire program actions and implementation at the District level. The Supervisor's Office was relying on the District to manage the burn and had a hands off approach.]

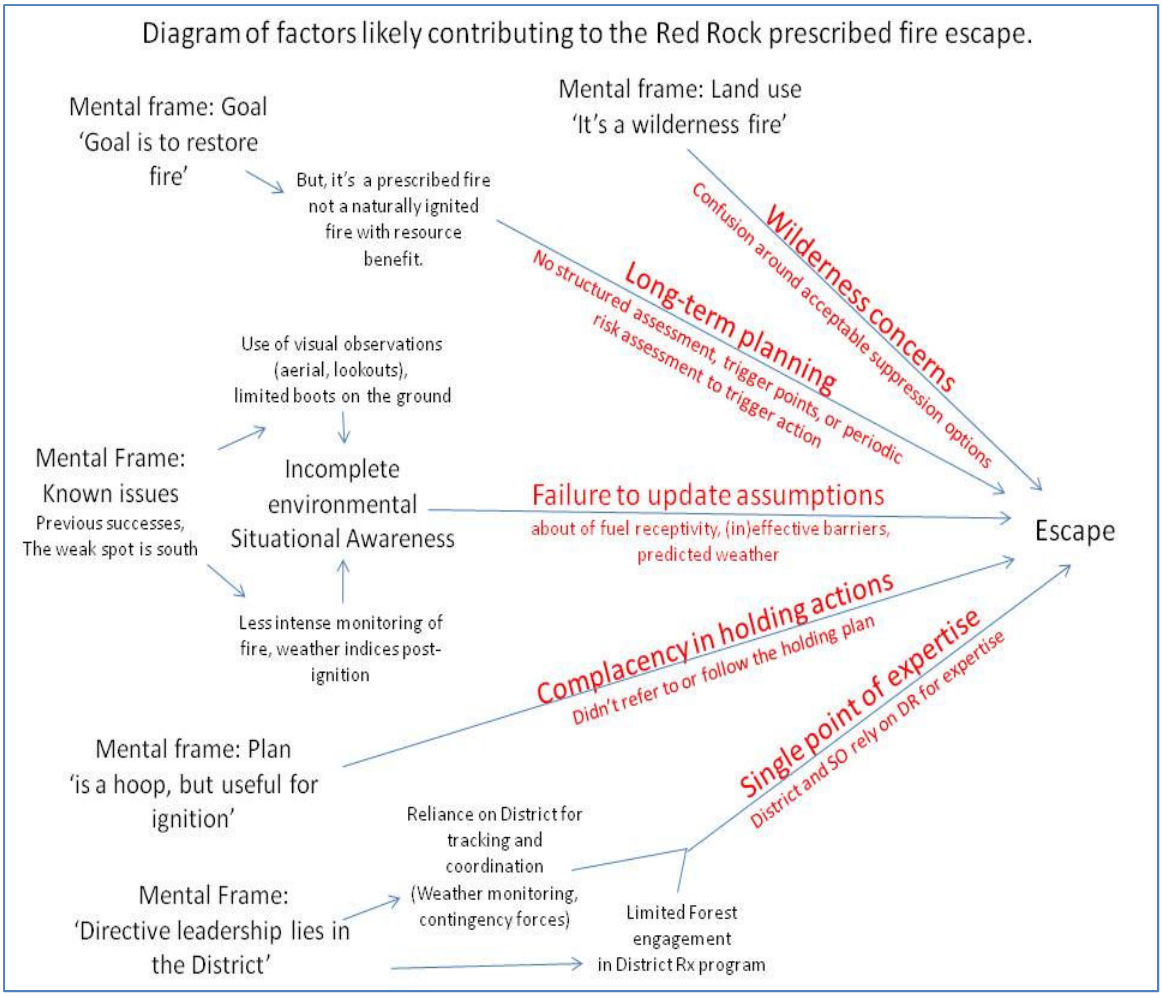


Fig 11 - Factors contributing to prescribed fire escape

Functionally, this reduced the resiliency of the organization by limiting the number of different eyes/perspectives with which to identify and track weak signals. (Fig 11) It also piled multiple levels of reliance (for local expertise, authority, and sensitivity to operations) on one person – a busy District Ranger.