NORTH SCHELL ESCAPED PRESCRIBED FIRE

FACILITATED LEARNING ANALYSIS

Humboldt-Toiyabe National Forest • June 2012

CONTENTS

The objective of this FLA is to focus on learning with the hope that this document might help to prevent future unintended outcomes in the prescribed fire program.

1. EXECUTIVE SUMMARY

The North Schell Prescribed Fire project area is located in the Schell Creek Range, 20 miles northeast of Ely, Nevada on the Humboldt-Toiyabe National Forest. The project set out to reduce white fir encroachment in aspen stands to restore aspen vigor, improve wildlife habitat, and restore fire's natural role in areas where fire suppression has allowed fir encroachment.

The prescription called for high-intensity crown fire to consume the fir trees. A test fire was conducted on June 9 using hand-ignition in an isolated stand about 20 acres in size. The results were favorable, with the desired high-intensity fire consuming the fir trees and minimal control problems.

On June 12, crews began aerial ignition with a helicopter on the target area, a fir stringer with intermittent aspen, approximately 600 acres in size. Ignition occurred in the upper-most portion of the stand.

Once the ignition area began to grow in intensity, short-range spotting started to occur, spreading fire brands below the main fire—encouraging downhill fire spread. Southwest winds continued to increase and encourage downhill fire spread.

This pattern continued, eventually consuming the entire stand in about 3 ½ hours without any further ignition required. As the fire ran out of conifer trees to burn, firefighters spread out downwind of the main fire and started to extinguish small spot fires that had landed in the surrounding sagebrush and mahogany. All of these spots occurred within approximately 400 yards from the main fire's edge and were easily controlled.

Fire Spots into Slot Canyon

As nighttime was approaching and crews headed for their vehicles, a spot fire was detected approximately 0.75 mile down drainage, positioned in the mouth of a treacherous ravine. Unable to attack the fire in the fading light—due to the fire's location in a slot canyon with steep walls, hazardous footing, and potential for rolling debris—firefighters left the scene with the plan to assess and attack this new spot in the morning.

Firefighters returned in the morning, June 13, to find the spot fire had spread overnight across various cliff bands, some of which could not be safely accessed. Over the next several days, helicopter bucket drops and handcrews were used to extinguish hotspots where accessible. Bucket drops were used to cool the fire in inaccessible areas. By June 15 the majority of the fire had nearly burned itself out in the cliffs—leaving only a few areas of scattered heat. At this time, the fire was still within the project area and continued to be managed as a prescribed fire.

Log Rolls into Muncy Creek

On the afternoon of June 16, a burning log rolled down the cliffs and spread fire into the bottom of Muncy Creek. Helicopter bucket drops were used to cool the fire that evening and a plan was put into place to attempt control of these spots the following day.

The next morning, June 17, critical fire weather conditions developed before crews could initiate action. By 0930 hours, winds had increased and the fire began to spread rapidly to the east down Muncy Creek. At 1135 hours, the fire was declared a wildfire. Final fire size was 12,047 total acres, including 480 acres of private lands and 3,343 acres of Bureau of Land Management (BLM) lands. One residence and several historic structures were also damaged or destroyed by the resulting wildfire.

Lessons Learned from the Escape Outcome

In reviewing the circumstances of this event and the individual lessons learned by those involved, the review team identified several workplace conditions, human performance factors, and key decisions related to the outcome. Key among these contributing factors:

1. The administrator of the work unit encouraged production which set the tone and attitude for the entire work unit to strive for getting the job done. While operational protocol, adherence to the approved plan, and safety requirements were met at all times, participants did express that, ideally, they wish they could have been more thorough in their analysis of the project.

2. Another prominent condition appeared to be this work unit's unfamiliarity with prescribed fire planning for high-intensity crown fire, as well as the project's scale. This was the first attempt by this unit to initiate crown-fire in white fir—which has a propensity for long-range spotting. In addition, this was the largest prescribed fire project undertaken by this work unit in terms of:
    - Overall planning area,
    - Acres to be treated with prescribed fire, and
    - Number of distinct treatment units.

    This group found that the currently accepted planning techniques developed primarily for singular, or well-defined burn units, did not translate readily to the landscape-scale. The organizational structure on the Forest also played a role in limiting the work unit's access to technical expertise and external assistance while planning for this project.

3. Risk Management decisions factored heavily into the eventual outcome on this event. Most closely aligned with the outcome was a series of risk management decisions to not deploy firefighters or large helicopters to engage spot fires in a steep, dangerous cliff band. These decisions represent deliberate choices to accept a perceived lower risk from one outcome (injury or damage from escaped fire) rather than accept the more immediate and perceived higher risk of another outcome (injury/death of a firefighter or pilot, or acceleration of fire spread due to heavy-helicopter operations).

This Facilitated Learning Analysis narrative reveals the challenges faced by the personnel involved, including the tensions and pressures that influenced decisions by the Line Officer, Fire and Fuels Staff, and the prescribed fire implementation team. The Chapter 5 Lessons Learned Analysis examines the situation that this workgroup encountered. This section of the review analysis encourages the reader to identify similarities with their own workplace and consider what they might do in a similar situation—knowing what occurred on this particular event.

Purpose, Process, and Intent of this Facilitated Learning Analysis

U.S. Forest Service policy requires that all prescribed fires that have been declared a wildfire must be reviewed. The Regional Forester for the Forest Service's Intermountain Region chose to utilize the Facilitated Learning Analysis (FLA) process as the methodology for executing the review. The intention was for the Humboldt-Toiyabe National Forest and Intermountain Region to learn as much as possible from this event and the experiences of those involved. The focus of an FLA is learning and not blame.

This review follows the guidelines established in the 2012 FLA Guide and also addresses the seven elements of a Declared Wildfire Review specified in the Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide which serves as U.S. Forest Service prescribed fire policy by reference in FSM 5140 (Appendix B).

Personnel intimately involved in the prescribed fire up until the time of wildfire declaration were interviewed to gain their perspective of the events leading up to the escape. A facilitated group dialogue was completed at the project site with as many of these people as possible. In this way, employees had the opportunity to revisit the scene and corroborate their perspectives and stories. This was a very valuable opportunity for introspection and learning.

This FLA attempts to reconstruct the story of what occurred, from the planning stages through project execution. It contains lessons learned by the participants as well as analysis by the FLA Team—examining conditions that shaped the event and, thus, likely contributed to the eventual outcome.

Once again, the objective of this FLA is to focus on learning with the hope that this document might help to prevent future unintended outcomes in the prescribed fire program.

The FLA Team commends all those people who were interviewed who set aside their personal anxieties and defenses to openly share a very difficult event so that others might learn from it.

2. INTRODUCTION

A. Project Location

The North Schell Prescribed Fire area is located on the Humboldt-Toiyabe National Forest (H-T), Ely Ranger District, approximately 20 miles northeast of Ely, Nevada (Figure 1). The site is characterized by rugged, mountainous terrain, ranging in elevation from 6,830 feet above sea level (ASL) in Muncy Creek drainage, to heights approaching 9,000 feet ASL along ridge tops.

Steep topography dominates the project area, which is marked by numerous cliffs and ridgelines. Relief in excess of 1,000 feet, with slopes exceeding 100 percent, is present in canyons along the South Fork of Muncy Creek, upstream from its confluence with Muncy Creek.

Vegetation consists of discontinuous stringers of mixed conifer dominated by white fir, aspen, and lesser limber pine, as well as mountain sagebrush communities dominated by mountain big sagebrush with areas of mahogany.

In addition to these live components, scattered snags and dead and downed logs are present along slopes and in valley bottoms. The surrounding valleys outside of the project area are dominated by pinyon/juniper and sagebrush communities.

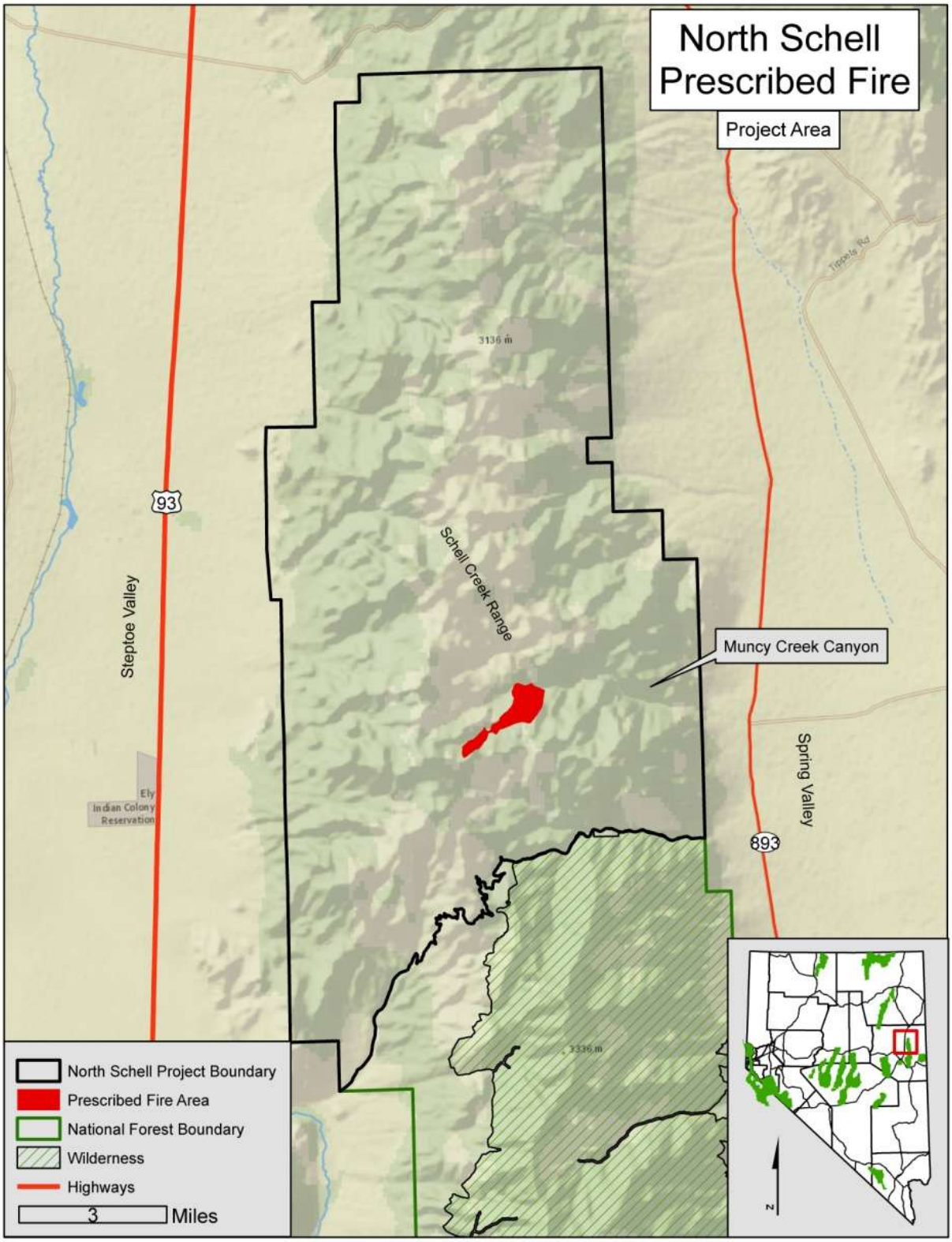


Figure 1. North Schell Prescribed Fire Vicinity Map.

B. Project Description

The North Schell Prescribed Fire was a long time coming. An assessment of the vegetation condition on the North Schell Creek Mountain Range identified vegetation communities in a declining state of health. Initial conceptualization of the project began in 2007. The formal NEPA planning commenced in 2010.

The project area consists of a 78,000-acre landscape of which nearly 12,000 acres are identified to be treated with prescribed fire. For implementation planning purposes, the project area was subdivided into 20 distinct prescribed fire "units". This first prescribed fire treatment was to occur in Unit 8.

The intended goal for prescribed fire in Unit 8 was to reduce white fir encroachment in aspen stands. The desired outcome was to burn in a mosaic pattern across the landscape with desired patch sizes large enough to protect aspen regeneration from ungulate browsing (approximately 800 acres). Prescribed fire treatments could include ground ignition using drip torches or aerial ignition using helicopters—helitorch or plastic sphere dispensers (PSD).

After multiple episodes of public scoping and comment, an environmental analysis was completed in January 2012. At the end of the planning process, no unresolved resource conflicts were identified.

3. THE STORY

A. Background

The employees of the Ely Ranger District actively engaged the public to inform citizens of the plan to implement prescribed fire in the area. In particular, the Ely District Ranger put significant effort into engaging the community.

> *"This was the first sign of life with the Forest Service."*
>
> **Local Stockman/Rancher**

Nevada's history as a hot-bed of contention during the "Sagebrush Rebellion" of the 1980s and 1990s is always on the minds of federal employees working in Nevada. This is especially true with the Ely District Ranger, who has a particularly strong connection to the community.

As a youth, Ely was the District Ranger's home town. Beginning in 2010, the District Ranger had been actively promoting the project at every opportunity. He was passionate about the need to treat these areas with prescribed fire to restore forest health. Through these very active public outreach efforts, the project gained broad-based support within the community.

This support was particularly strong among area ranchers, who agreed with the need to actively manage encroaching white fir. Previously, many ranchers expressed frustration with what they perceived to be a lack of interest or effort by the Forest Service in pursuing actions to improve conditions on the Forest. They were now encouraged with the level of coordination and cooperation being demonstrated by the Ely District—and were in full support of this project.

By the time the environmental analysis was approved in January of 2012, the District Ranger felt that public support was at its peak and that the time was right to initiate prescribed burning.

Fire and Fuels Staff Recognizes This Project is Unique

At the beginning of spring 2012, the District personnel were encouraged to complete planning requirements to prepare for implementation on the first of many "islands"—isolated stands of white fir within the project area. The Fuels Technician was assigned as the trainee burn plan preparer, under the guidance of the Fuels Specialist.

Immediately, it was recognized by the Fire and Fuels Staff that this project was unique in that—prior to this—they had not yet attempted to plan for a prescribed fire project of this scale: 12,000 acres of burning scattered across a 78,000-acre project area. While the staff did have considerable experience fighting wildfire in white fir/mixed conifer, they did not have experience in planning or implementing stand-replacement prescribed fire in this particular fuel type. The Fuels Technician spent considerable time researching other burn plans and sought advice from various local sources, as well as extensive Internet research.

After reviewing the area maps and conducting field reconnaissance, a stand of white fir with intermixed aspen, approximately 600 acres in size within an area identified as "Unit 8" by planners, was selected for this initial entry.

The draft prescribed fire plan was reviewed and edited several times by the Fuels Specialist as well as the Fire Management Officer, who, combined, had more than 60 years of fire and fuels experience. By the middle of April 2012, the prescribed fire plan was eventually ready to undergo formal technical review.

Subsequently, Mother Nature provided a mix of warm, dry, windy weather starting in May. Such conditions occurred earlier than typical for the high-elevation project area. While site conditions favorable to burning arrived earlier than normal, planning delays resulting from a variety of factors—both internal and external—postponed the team's ability to commence burning activities in May, which was the team's preference. Therefore, as May transitioned to June, time was more compressed to catch what was left of favorable burning conditions before the fast-approaching summer heat arrived.

B. Difficulties, Complications, and Delays

In late April 2012, the prescribed fire burn plan was submitted to an experienced Burn Boss from a neighboring agency for technical review. By May 23, the review had still not been complete. (All for legitimate reasons, but an unforeseen delay nonetheless.) Eventually, the review was shifted to another Burn Boss from the same agency. The technical review was completed and signed on June 1. This review process resulted in an unforeseen delay of nearly a month.

Meanwhile, the Regional Office requirement to complete a Project Aviation Safety Plan (PASP) for aerial ignition with a helicopter was also burdened with delays. Because the Forest Aviation and Training Officer position was vacant, a Helicopter Foreman had to be recruited to assist with completing the plan. Unfortunately, the Region had recently adopted a new PASP form which was not known to any Forest personnel. The first submittal to the Region for approval of the PASP was submitted on April 1. However, this was returned to the fire planners with a request to resubmit using the updated PASP

form. The revised PASP was sent to the Region for approval on May 30. As potential ignition days approached, it remained uncertain whether the PASP would be approved in time to ignite Unit 8 this spring.

> *"If we don't do this burn, the agency will lose face in the community."*
>
> **District Ranger**

While ATV/UTVs permitted access to the site for field reconnaissance, full-size vehicle access was still limited due to poor road conditions. This was a logistical problem for the team that would have required a significant ATV/UTV shuttle operation to transport the ignition and holding crews up to Unit 8, thus increasing the complexity of the operation and decreasing effectiveness if engines and other equipment could not reach the burn site. While not a definitive delay, there was an urgency to improve road access relayed from the Fuels staff to the District Ranger.

As of June 1, these repairs had not been made to the road. It was uncertain if the team would need to rely entirely on ATV/UTV access or if full-size vehicle access would be able to access the site.

As perceived burn windows passed due to these delays, the District Ranger's angst heightened. He stated, "If we don't do this burn, the agency will lose face in the community." Thus, his project leaders definitely felt pressure to execute this project. They knew the District Ranger was not interested in excuses. The culture of their work unit prides itself on action and effectiveness. They knew their only recourse was to proceed and rely on their experience, mettle, and strict adherence to prescription parameters for success. "If it has to get done, it has to be right," recounted the Fuels Specialist.

New Concerns Arise

As the drive toward initiation of the project continued, the District Ranger and staff were understandably frustrated as several opportunities to start the project came and went due to planning and logistical delays.

As delays pushed their start date back, the Fire and Fuels Staff began to take heed of weather conditions and other indicators. They began to question whether they would be able to execute the burn before conditions turned unfavorable. On May 31, the District Ranger and staff met to review the project status.

In particular, the District Ranger wanted to know whether these delays could be overcome to allow the project to be executed at the earliest opportunity. The Fire and Fuels Staff, however, wanted to express their growing concerns with the increasing risks of igniting the fire. These concerns included the quickly warming and drying weather as well as a recent report from a neighboring Forest in Utah that burning conditions in the high-elevation mixed conifer had been more aggressive than predicted—causing control problems on a similar project.

Furthermore, the Fuels Specialist and Fuels Technician were cautious that the early trends toward a hot/dry summer would mean there would be residual burning for weeks after the ignition. This would require them to conduct extensive mop-up and patrol. If this happened, it would distract them from

several other additional summer projects, such as administering contract work for mechanical fuels treatments.

The Fuels Specialist said: “We didn’t want to babysit this thing all summer.” Nevertheless, the District Ranger was adamant that a spring burn was an opportunity that should not be missed. His direction was clear: “If we are in prescription then we need to burn.” To the specialists, they felt their concerns fell on “deaf ears.”

Plans and Logistics Move Forward

The Fire and Fuels Staff regrouped and decided that even with the challenges and compressed timeframes, there was a still a chance to implement a burn that would meet project objectives and also comply with accepted standards of quality and safety.

Continued reconnaissance of the location and field data collection into the first week of June provided enough information to give the team confidence that they could execute a successful, safe burn.

Weather forecasts were obtained and a clear weather window appeared for the weekend of June 9 and into the following week. The technical review of the prescribed fire plan only revealed minor adjustments, which also helped to encourage the team that their plan was appropriate.

The Complexity Analysis was finalized, resulting in a final rating of “Moderate.” This also indicated to team members that they were not taking a very large risk. On June 7, the burn plan was reviewed and approved by the District Ranger. Improvements to the access road had been completed, allowing for vehicle and equipment to drive to the prescribed fire site the following day, June 8.

The clock was ticking and opportunity was quickly fading as the Fire and Fuels Staff determined that by June 15 conditions would no longer be favorable for burning. A weather window was identified between June 9 thru12. The plan was to execute a hand-ignition test fire to determine if prescribed fire objectives could be met. If so, they would follow-up with aerial ignition of the larger targeted area.

The Go/No-Go Checklist for hand ignition was completed June 9. The project was poised to begin. The team was still waiting on approval of the Project Aviation Safety Plan (PASP) required to allow the use of aerial ignition.

C. Implementation

June 9, 2012 – Test Fire Initiated

To take advantage of cooling temperatures and increased relative humidity to ensure control, the test fire was planned for 1800 hours. The project team met at the District Office around 1000 hours for various briefings, to gather supplies, and to obtain a spot weather forecast. The spot weather forecast called for a Red Flag Warning for gusty winds and low humidity through 2000 hours. The forecast also called for mostly sunny skies, temperatures ranging from 52-60^{o}

Resources Assigned

Prescribed Fire Manager – RXM1 (FMO)
Burn Boss – RXB2 (Fuels Specialist)
Burn Boss Trainee – RXB2-T (Fuels Technician)
Firing Boss – FIRB
- Ignition Crew (5 person)

Holding Boss – SRB
- Hand Crew (6 person)
- 1 Engine with 3-person crew

2 Road Guards
2 Radio Operator/Human Repeater

F during the day, falling to 23-31 F at night, and 20-foot winds from the west at 15-25 mph, with occasional gusts to 45 mph. These conditions met parameters at the “high” end of the acceptable prescription range. Winds were predicted to lessen considerably as night moved in, as would the temperature while relative humidity was expected to increase.

Actual observed conditions at time of test burn were closer to the “low” end of the prescription. Wind direction was predominantly from the north less than 20 mph, RH near 30 percent, and temperatures well below 60° F.

Figure 2. Test Fire ignition shortly after 1900 hours.

The test burn site consisted of a 20-acre swath of white fir and aspen surrounded by sage and mahogany at an elevation of 8,600 feet ASL. Main questions to be answered by the test fire were: 1) would they get the fire to kill white fir? and 2) could spotting from white fir be held in check by elevated moisture levels in the sage and mahogany?

Hand ignition using drip torches was initiated in the northwest corner of the area at 1853 hours—after winds died down to acceptable levels. The test fire ignition was complete at 2030 hours.

Flame lengths approaching 100 feet in height were obtained and most spotting occurred within a 30-yard pattern outside the test fire perimeter. A single spot that landed in dead mahogany several hundred feet to the southeast caused mild concern but was easily controlled.

Crews were pleased that burn objectives were met, sage held off fire spread outside the burn perimeter as predicted, and downwind spotting was minimal. Holding crews successfully tended to these spots.

It was noted by the team that the fire did not readily move through the stand on its own. Additional lighting was required to move the fire through the entire stand.

An After Action Review (AAR) of the day’s events was positive and the crew’s attitudes were bolstered by the success of the test burn.

All personnel camped out overnight near the fire and commented on the evening chill as temperatures dropped to below freezing.

Figure 3. Test Fire exhibiting desired intensity.

June 10 – Test Fire Mop-up and Patrol

Resources Assigned
Same as June 9

Weather conditions were calm throughout the day. The test burn site was all but dead as crews arrived on site in the morning.

Again, confidence was high. A small pocket of uninvolved fir within the test area was hand ignited around 1200 hours. This burn lasted less than 30 minutes. The remainder of the day was spent monitoring hot spots and mopping up along the edges of the test burn area.

While no problems or surprises were encountered, personnel noted from this experience that time of day for a larger burn area should be earlier—to generate heat necessary to burn the stand edges more cleanly to reduce re-burn potential.

Crews returned to the District Office that night. Weather forecasts for the project area were updated.

Figure 4. Test fire area the morning of June 10th. Crews gridding surrounding area for spots.

June 11 – Monitoring

Resources Assigned
Same as June 9

Crews returned to the site and monitored the test burn area, performing minor mop up. Today's weather window for aerial ignition was good, and there was hope that logistics and the PASP could be coordinated in time to initiate aerial ignition. This, however, did not happen. While the PASP was approved today, it was not available in time to initiate aerial ignition.

Suitable weather conditions were forecasted two days out (June 13). Therefore, while their preference would have been to ignite today, there was still an opportunity to ignite tomorrow. Thus, there was not much concern over this delay.

The RXB2-T and RXB2 performed one last reconnaissance of the project area to view the fuels and determine the optimum time to start aerial ignitions—based on the test fire results, weather forecast, and expected fire behavior.

June 12 – Aerial Ignitions Begin

Resources Assigned

Prescribed Fire Manager – RXM1 (FMO)
Burn Boss – RXB2 (Fuels Specialist)
Burn Boss Trainee – RXB2-T (Fuels Technician)
Firing Boss – FIRB
- Ignition Crew (5 person)
Holding Boss - SRB
- Hand Crew (5 person)
- 1 Engine with 3-person crew
1 Type 3 Helicopter with 9-person crew
2 Road Guards
1 Radio Operator/Human Repeater

Figure 5. Aerial ignition begins June 12 at approximately 1500 hours.

The crew met at the District Office at 0700 hours to discuss helicopter ignition activities for the day. Weather conditions for the day were within prescription. The plan was to start ignition at 1300 hours. The helicopter equipped with a PSD went airborne to start ignition at 1415 hours.

It became immediately apparent that the PSD machine was malfunctioning as no fire activity was seen. The helicopter returned to the helibase to make the necessary equipment adjustments and returned to the air at approximately 1500 hours to resume ignition.

Figure 6. Aerial ignitions complete at about 1545 hours. Fire is allowed to spread on its own .

Ignition was focused along the upper-most portion of the stand along the southwest corner to try to build heat and take advantage of the steep slope by bringing strips of fire downslope in a controlled fashion. Fire activity was slow to pick up. Additional balls were dropped along the northwest edge of the stand. Approximately 2,000 balls were dropped in the first load and the helicopter returned to base to refill. Back in the air by 1615 hours, the helicopter was en route to drop more balls, but the RXB2 and RXB2-T noticed an increase in fire activity and instructed the helicopter to disengage. Squirrely winds began to take shape as the afternoon progressed and a predominant southwest wind surfaced over the burn area. Initially, the wind simply influenced the spotting by pushing the upper end of the column over and starting new spots below the main fire. Eventually, as the fire became established farther down slope, the wind overcame the slope influence and pushed the main fire cross-slope and downhill to the northeast.

Figure 7. Fire intensity in ignition area increases and fire begins to spread at about 1630 hours.

V I D E O

To see a 2-minute video of the North Schell Prescribed Fire spreading down drainage shortly after ignition, please click on this link:

http://youtu.be/Vcgn6RJU4JA

Figure 8. Aided by wind and fuels, fire continues to move to northeast and is established below Faun Trail Road at about 1830 hours.

The project crew noted that the burn was meeting objectives as white fir stands were fully engaged and the surrounding sage did not support fire.

Discussions between staff acknowledged a chance to hold this burn above the Faun Trail access road (Figure 10). This was desirable as it would be less time consuming to monitor the fire there as opposed to if it spread below the road to the northeast. This "best case scenario", however, was not realized because the fire continued to be driven by the southwest wind downhill across the Faun Trail to the south slopes of what the burn team referred to as "Mahogany Ridge".

As the conifer fuel continuity diminished to the northeast, the fire lost steam and began to die out. However, the strong southwest winds pushed spot fires out farther than anticipated. Smoke plumes also became problematic as they were being pushed northeast by the winds, preventing the helicopter from performing bucket drops to help contain spot fires until after 1830 hours.

As nightfall ensued, discussions between RXB2 (Fuels Specialist), RXM1 (FMO), and the District Ranger were held to determine resources needed to manage these spot fires. Initially, it appeared that spot fires were accessible and could be managed by hand crews and water drops from the helicopter.

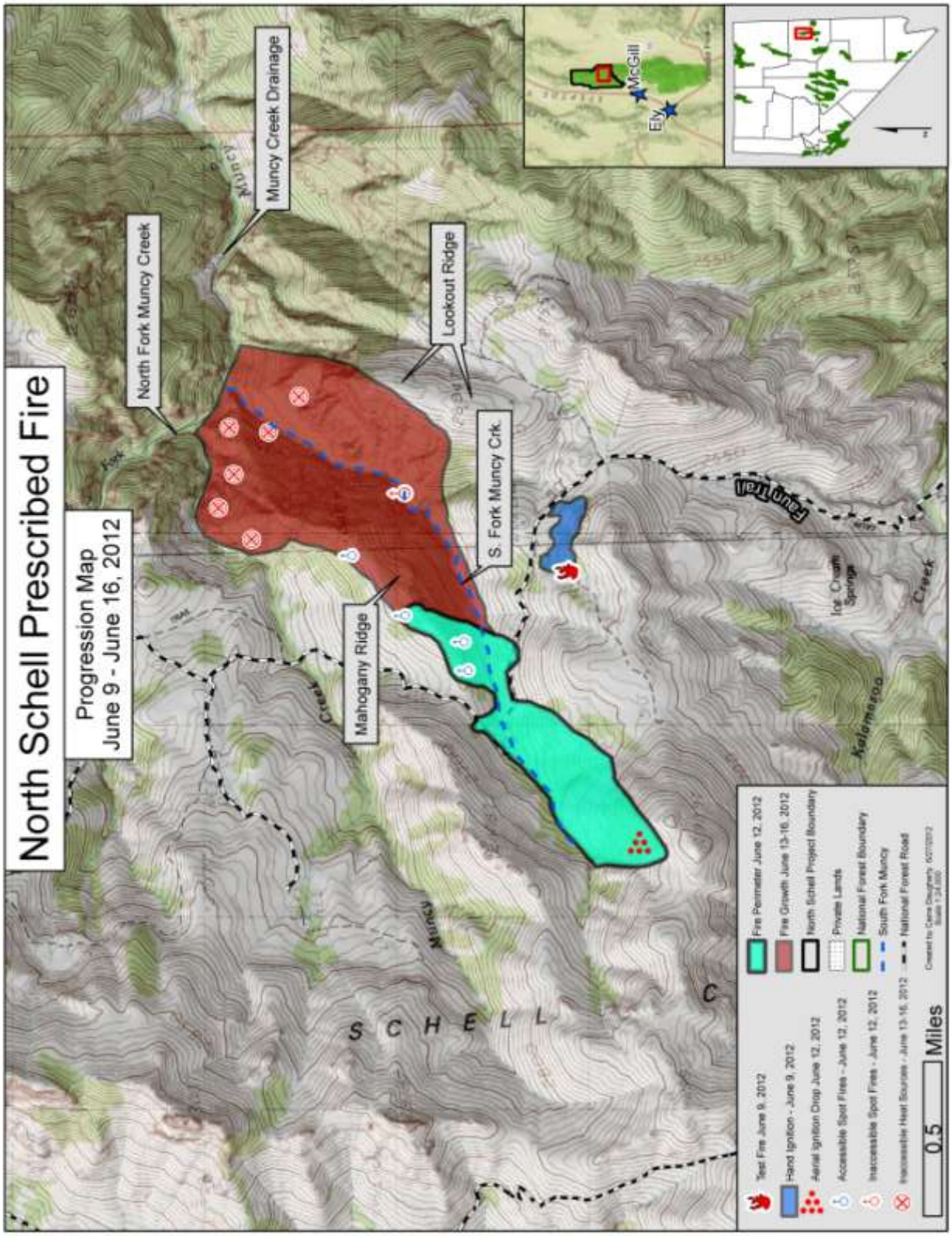
Because the Faun Trail Road had been burned over, the RXB2 and others located on an observation post on "Mahogany Ridge" were forced to walk cross slope to egress the site at dusk. This route was opportunistic. During the hike out, crew members saw the glow from a spot fire deep in a slot canyon of the South Fork of Muncy Creek, almost 0.75 miles northeast from the edge of the burned conifer stand. There was not an attempt to suppress the spot due to fading light and the hazard of the steep terrain and potential for rolling debris in the low light conditions.

Figure 9. Spotting into the sparse fuels on "Mahogany Ridge" is visible between 1830 and 2000 hours on June 12.

This spot fire caused concern due to its inaccessible location and the prevailing winds. An incoming RXB2 who was slated to take command of the fire the following day thought at this time: "How do you put that fire out?"

Although the spot was outside the targeted burn area, it was still within the overall project area and holding plan, thus did not require the activation of contingency actions or declaration of escape.

Figure 10. Prescribed fire progression map shows fire perimeter and generalized spot locations. Slot canyon location is depicted in center-bottom of reddish perimeter.



June 13-15 – Mop-up, Patrol and Monitoring

Resources Assigned

Prescribed Fire Manager – RXM1 (FMO)

Burn Boss – RXB2

Burn Boss Trainee – RXB2-T (Fuels Technician)

Holding Boss - SRB

- Hand Crew #1 (8 person)
- Hand Crew #2 (3 person)
- 1 Type 3 Helicopter with 9-person crew
- 1 Engine with 2-person crew
- 1 Interagency Hotshot Crew (20 person)
- 1 Type 2 IA Crew (20 person)

2 Road Guards; 1 Radio Operator/Human Repeater

Figure 11. View from near test fire site on June 13 looking northeast into South Fork Muncy Creek where fire has spread overnight from spots low in draw up into surrounding cliff bands.

The project staff and crews spend the next three days in a mop-up, patrol and monitoring mode. The principal objective was to hold the spot fires in check using ground crews and air support.

Another qualified RXB2, on-site since project initiation, transitioned into the Burn Boss leadership role on June 13. The initial RXB2 (Fuels Specialist) returned to the Ely office to complete project documentation, provide logistical support, and seek additional resources. The RXB2, RXB2-T, and RXM1 met at 0730 hours to discuss the day's operations. At 0830 hours, crews met at the helibase and headed up Faun Trail Road to the site. Due to the uncertainty of how the fire in the slot canyon had evolved overnight, crew angst was high as they arrived on site on June 13. The RXB2 and crew found the fire had moved up both "Mahogany Ridge" and another feature they referred to as "Lookout Ridge" (Figure 12), as well as deeper into the canyon bottom. An Interagency Hotshot Crew (IHC) arrived to assist with spots on "Lookout Ridge". Other holding forces formed a similarly sized crew that worked spot fires on "Mahogany Ridge". The helicopter was available, as needed, to perform bucket drops in support of crews.

Figure 12. Scattered smokes across north face of "Mahogany Ridge" on June 14.

Helicopter reconnaissance confirmed that personnel could not safely access the spots in the cliffs or canyon floor because of the steep terrain—presenting the hazard of rolling debris hitting firefighters below.

Although spots flared up on "Mahogany Ridge", these fires generally burned themselves out by consuming available fuels. By nightfall on June 13, crews on both ridges had successfully kept spot fires in check. District personnel returned to Ely for the night, the IHC spiked out near the fire, and all involved knew that management of this fire was going to be a long-term ordeal.

Thursday's events (June 14) were quite similar to the previous day's, marked by new spots flaring up on both ridges and either being held by ground and air forces or burning themselves out in inaccessible locations.

> *"…water was hard to come by; I didn't know where to get it."*
>
> **Burn Boss**

Crew focus was to keep fire from progressing east off "Lookout Ridge" and getting down into the main stem of Muncy Creek. Although motivated to put out all visible spot fires, crews could still not find safe approaches into cliff bands. They, therefore, left these locations to helicopter bucket drops or natural attenuation.

Figure 13. June 15th. Looking back to the southwest, inaccessible spots are in the foreground and test fire/aerial ignition areas are visible in the background.

After two days, it became apparent that the prolonged cycle time required to get the helicopter from the dip tank staging location at the helibase back to the fire, coupled with the 80-90 gallon capacity water bucket that a Type 3 helicopter could provide was less than ideal. This dilemma and whether to solve it with a Type 1 helicopter capable of 1,000 gallon water-drops was the focus of much conversation over the next several days. A concern that rotor-wash and overwatering spots on steep slopes would push burning material downhill—resulting in greater spread—was measured against the benefits of increased water delivery. Ultimately, a decision was made to pursue pre-approval of additional funding for a Type 1 helicopter with a 1,000 gallon capacity if fire activity increased. For now, though, it seemed that the status quo was quite manageable with the resources on hand.

The weather forecast for Friday, June 15, was quite different from preceding days as thunderstorms with a marked rise in relative humidity were predicted. Anticipating the need for a day-off, the RXM1 (FMO) brought in a relief Duty Officer and the two of them visited the fire area to orient the incoming Duty Officer.

The Type 3 helicopter flew a brief reconnaissance over the area to identify hot spots and new smoke, but was grounded due to erratic winds that evolved later in the day. Fire activity was observed on the northwest slope of "Mahogany Ridge" for the first time, but had not progressed to the main stem of Muncy Creek.

The fire had "hung-up" in the rocks for three days and appeared to be in check. However, this

Figure 14. Helicopter recon on June 15 verifies smoke near confluence of South Fork Muncy Creek and main Muncy Creek. View looking down stream to the east.

condition did not emerge without a lot of hard work by the crews. It became apparent to the Fuels Specialist and RXM1 that, as the days progressed since ignition, their conversations with the Line Officer were increasingly superficial. They perceived that the Line Officer did not grasp the seriousness of the spot fires and their potential implications. However, by the end of this day, even the RXM1 was becoming more comfortable with the fire status. The RXM1 took June 16th as a day-off to manage fatigue and meet agency work-rest guidelines.

Figure 15. On June 16, fire is still "hung up" in cliff bands—inaccessible to firefighters at 1203 hours.

June 16 – Roll-out

Resources Assigned

Burn Boss – RXB2

Burn Boss Trainee – RXB2-T (Fuels Technician)

- Hand Crew #1 (4 person)
- Hand Crew #2 (3 person)
- 1 Type 3 Helicopter with 9-person crew
- 1 Engine with 4-person crew
- 1 Type 2 IA Crew (20 person)

2 Road Guards; 1 Radio Operator/Human Repeater

The RXB2-T and Relief Duty Officer flew a recon flight at 0830 hours to size-up spot fires on both ridges. Conditions looked favorable on “Lookout Ridge”, but it appeared that several spots were continuing to spread around the northern-most base of “Mahogany Ridge”. The helicopter continued dropping buckets, trying to keep these spots in check. Hand crews were deployed on each ridge to monitor and fight spots as they developed in accessible areas. A lookout was staged to observe fire activity threatening to enter the North Fork of Muncy Creek. It should be noted that throughout the five days of operations on this project, crew safety was paramount. There were still several inaccessible spots that could not be reached safely by hand crews. Field managers did not waiver from this strategy of avoiding hazardous terrain.

Figure 16. Increased fire behavior in the cliffs above Muncy Creek at 1343 hours on June 16. Firefighters witness log roll out from cliffs near this area about 1500.

By 1500 hours, it became clear that the helicopter bucket work had to increase its efficiency or spot fires down in the canyons would be lost. The RXB2-T hiked into Muncy Creek to locate an alternate dip site. A site was located and equipment was moved. The new dip site was operational by 1700 hours, increasing the buckets per fuel cycle from 8 to nearly 20. As the RXB2 was standing on an observation point on the north end of “Mahogany Ridge”, a loud crashing noise in the trees below caught his attention. A burning log had rolled-out into the main fork of Muncy Creek. This started a new spot fire in the drainage bottom that became immediately problematic. This portion of Muncy Creek was dry and surrounded by abundant dead/down fuels as well as flammable grass and conifers. At 1830 hours, the RXB2-T hiked down to see

the scale and scope of this new problem to determine options to initiate a counter action.

The log roll created two new fires in the creek bottom and a third fire 15 feet above. But most troubling was the presence of abundant, continuous fuels, including standing live and dead white fir and downed logs. The RXB2 immediately called for bucket drops of water on this location. While this water cooled the fire, it was not enough to extinguish these new starts.

Figure 17. Helicopter attempting bucket drops on new spot developing at bottom of Muncy Creek on June 16 at 1728 hours.

Crews hiked out of the location by 1940 hours to regroup. RXB2-T contacted the District Ranger to arrange a meeting first thing the next day (Sunday morning, June 17) to discuss options. It should also be noted that the evening forecast issued on June 16 called for a Fire Weather Watch for winds the next day.

June 17 – The Escape

Resources Assigned

Prescribed Fire Manager – RXM1 (FMO)
Burn Boss – RXB2
Burn Boss Trainee – RXB2-T (Fuels Technician)

- Hand Crew #1 (7 person)
- Hand Crew #2 (3 person)
- 1 Type 3 Helicopter with 7-person crew
- 1 Engine with 3-person crew
- 1 Type 2 IA Crew

2 Road Guards; 1 Radio Operator/Human Repeater

A meeting between the RXM1, RXB2, RXB2-T, Fuels Specialist, and the District Ranger occurred at the District Office at 0700 hours. The Spot Weather forecast issued at 0717 hours called for Red Flag Warning conditions to start at 1100 hours with 20-foot winds out of the southwest at 25 mph, with gusts to 45 mph in the afternoon.

Various options to attack the multiple fires in Muncy Creek were proposed. Principal management considerations during these discussions were whether the project had the personnel and monetary resources available to hold the fire in Muncy Creek. A decision was made to gather hose and pumps to deploy a sprinkler system to pump water from a wet portion of Muncy Creek about 1,200 feet to the new spot fires and surrounding fuels. The RXB2-T left to gather necessary water-handling supplies before heading to the site.

Figure 18. Spot fires in bottom of Muncy Creek from June 16 gain momentum on morning of June 17 at 1047 hours.

The RXB2 left the meeting at 0735 hours and traveled to the site. At approximately 0900 hours, he observed strong easterly winds at the edge of the valley, east of the project location. At the same time, he saw smoke travelling east down Muncy Creek from the project area. He questioned these apparent contra-indicators and

called the Fuels Specialist back in Ely with these observations.

When the RXB2 arrived at the site, he was informed by the Type 2-IA crew of the fire activity. The helicopter was used for a brief reconnaissance flight. Observations confirmed that a substantial fire located in the bottom of Muncy Creek could not be contained with available resources. The RXB2 called crews back to the staging area at the valley edge prior to 0930 hours.

At 0930 hours, the RXB2-T overheard a radio relay on his way to the site that stated: "…fire up and running in main Muncy Creek drainage".

Figure 19. Fire has been declared wildfire at 1135 hours. This is view of fire making aggressive run to the east down Muncy Creek at 1233 hours.

The RXB2-T arrived on site and received a quick briefing. He traveled up to "Lookout Ridge" to gain his perspective of what the RXB2 observed and reported. The RXB2-T saw strong winds pushing the fire well into the main Muncy Creek drainage. The RXB2-T contacted the Fuels Specialist in Ely to report these findings.

In the meantime, the RXB2 and RXB2-T initiated actions to protect crews and individuals/structures from the impending danger down valley in Muncy Creek drainage.

At 1030 hours, the FMO and Fuels Specialist met with the District Ranger to discuss the situation and the information coming in from the field. Various options for continued management were discussed.

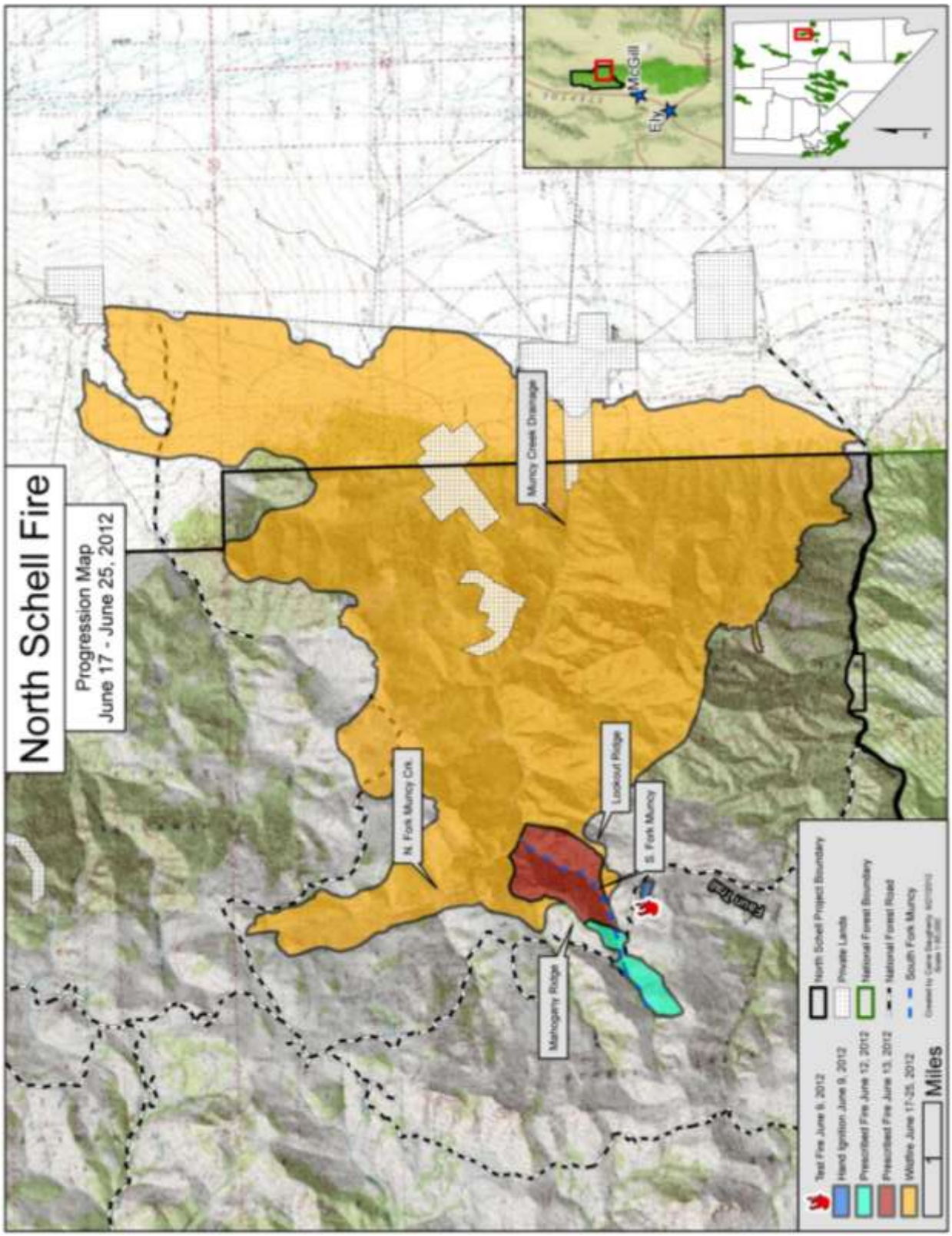
At this time the fire was roughly four miles from the project area boundary.

At one point, they walked out of the building and looked up at the fire area where two distinct columns were visible.

The FMO stated: "This complexity is far beyond my capacity to manage with the resources on-hand." They declared the prescribed fire to be a wildfire at 1135 hours and ordered a Type 3 Incident Management Team and additional resources to respond.

Figure 20. Suppression resources taking action along the 893 Road at 1851.

Figure 21. North Schell fire progression map.



4. LESSONS LEARNED BY THOSE INVOLVED

Interviews were conducted with key personnel involved with the North Schell Escaped Prescribed Fire. At the conclusion of each interview, each person was asked a series of questions regarding what they learned for themselves from this event and what they believe the greater wildland fire community and agency could learn from the event.

The following are the subsequent lessons that the participants shared with the FLA Team that they believe could benefit others.

A. PRESCRIBED FIRE PLANNING

- Spend more time "gaming out" all possible scenarios where fire movement can give you problems. For instance, identifying and addressing contingencies for fire in inaccessible areas.
- Develop a long-term management plan for a landscape-scale prescribed fire when you know you will have areas of lingering heat for a long time.
- Elements in the burn plan should be more thought provoking to encourage planner to provide useful site-specific information. Current template is tedious and requires duplicate information.
- Adjust wind speeds in your prescription to mitigate spotting potential.
- Identify potential water sources (pump/dip sites) ahead of time and have them ready for use before they are needed.
- Have clearly defined due dates for planning document reviews and completion. Make them known.
- Complexity Analysis process may not be the proper tool for long-term prescribed fire management. Currently, it is too subjective, lacks specificity, and does not allow for continued periodic assessment during implementation.

B. PRESCRIBED FIRE OPERATIONS

- Keep your eye on the "Big Picture". Don't focus on the immediate area around the unit/stand when problem areas may exist some distance from the burn unit.
- Utilize modeling outputs to adjust your operational focus. Spotting distances were greater than the team anticipated, but were within the range identified in the prescribed fire plan.
- Utilize all the holding tools available. Don't think that use of SEATs or other resources is prohibitive just because it is a prescribed fire.
- Be mindful of the location of receptive fuels relative to the burn unit. 1,000 hour time-lag fuels in the "Mahogany Ridge" area turned out to be more receptive than originally anticipated.
- Recognize that when you have relatively inexperienced personnel there is a learning curve that detracts from efficiency. Prepare to go slow.
- The selection of a test burn location with several advantages such as accessibility, representative fuels, and isolation from other receptive fuels resulted in low probability of escape and high probability of success.

- Utilize an Incident Action Plan for prescribed fire operations—rather than the full burn plan—to improve transfer of pertinent operational information.
- If water drops (from helicopter) are ineffective, stop using them.

C. INTERNAL/EXTERNAL PRESSURES AND COMMUNICATIONS

- As a whole, our agency should emphasize quality of outcomes (meeting qualitative objectives) over target accomplishments (acres burned).
- Engage internal and external players early on (partners, cooperators, managers, etc.).
- Don't let internal and/or external pressures get in the way of decision making.
- Make extra efforts when faced with new fuel types or prescriptions to network and collaborate with other practitioners and seek out their input and experience.
- Ensure that Agency Administrator has full complement of information on contingency planning and potential consequences from various actions/events. Communicating the situation is key to developing everyone's situational awareness.

D. THE DISTRICT RANGER'S LESSONS FOR OTHER AGENCY ADMINISTRATORS

- Communication is key. Don't assume that everyone is on the same page, particularly when you may have some lingering questions or concerns. Take the time and discuss the project or situation in detail with key staff involved. If needed, involve a third party with a fresh set of eyes for a different perspective—even if on an informal level.
- Recognize when you may be anxious or frustrated regarding progression of a project or activity. At those moments, it is most important to take a step back, take a deep breath, and do not allow that anxiety and/or frustration to influence your decisions or overlook possible red flags.
- Play the "What-If" game. The fire organization frequently uses sand table exercises to play the "What-If" game related to fire suppression. More recently, we have become more involved in these exercises as we look to manage fire. As we implement projects like the North Schell Prescribed Fire, and particularly landscape-scale projects, we need to do more "game playing" with all parties involved—or with those who may be affected.
- Know yourself and how you affect others. Each of us has unique personalities which can affect other people and employees in many ways. As a Line Officer on this incident, I have a strong personality and am very mission driven. With my personality type, sometimes employees are hesitant to raise concerns or push back when it is needed. It is a constant challenge to recognize these internal traits and work to minimize the impacts they may have on others. A major part of this self-assessment process is to continually take a step back from the situation at hand and consider the bigger picture. I find that this is often easier said than done and is a continual struggle.

5. LESSONS LEARNED ANALYSIS

The Lessons Learned Analysis (LLA) is the FLA Team's analysis of relevant facts and lessons learned by the participants. Its aim is to try to understand the conditions that may have contributed to the outcome.

This section of the FLA relays the FLA Team's analysis of the mental, cultural, and organizational workplace conditions (decisions, actions, behaviors, attitudes, latent and upstream factors) that enabled the unintended outcome to occur.

For this prescribed fire escape event, the FLA Team grouped these conditions into three categories:

- Leadership,
- Planning, and
- Risk Management.

You Need to Put Yourself in the Participants' Place

Throughout the analysis, the FLA Team members performed a "substitution test," asking themselves: *"Could another competent employee or supervisor meeting the agency's qualification standards make the same decisions leading to the same (or possibly worse) outcome?"*

As you read this FLA, ask yourself: *'Would I behave any differently? Given the information that was available at the time, would I make the same or different decisions?'*

In reading this FLA report, the reader is asked to try and understand why it was that people saw things the way they did. Recognize that because you know the outcome, you are already affected by "hindsight bias"—or the distorted idea that you could have predicted it.

To really learn how susceptible you may be to such an event, you need to put yourself in the participants' place and consider how you would react—if you had only that information that they had available to them at the time. If you recognize similarities in your reactions, then consider that it is plausible that you may be at risk of experiencing a similar—or worse—outcome, unless you are alert to the conditions presented below and take action to mitigate them.

A. LEADERSHIP

Reputation in the Community

For decades, the federal land management agencies in this area have been criticized by various interest groups as being unresponsive to concerns, as well as being inefficient in taking the necessary actions to improve resource conditions. The District Ranger has many local ties to the area. Since taking the post, he has invested considerable time and effort into communicating with the public and key user groups on this, as well as other projects.

The Ranger believes that he has made significant progress in building the District's reputation as a work unit that can initiate action quickly and execute efficiently. This notion is supported by the pride that the District staff has expressed in their ability to get meaningful work done on the ground in an efficient manner. The FLA Team talked with community members and area ranchers who also commented that the reputation of the Ely Ranger District within the community had become more favorable over the years—as the level of cooperation and engagement by the District had increased.

The Ranger's belief was that failure to execute the prescribed fire—if conditions were favorable—would result in damage to the District's reputation within the community. On numerous occasions, the District Ranger commented to staff that if this project could not be completed as planned, the agency would "lose face" with the public.

Besides guarding against a potential loss of reputation, there were also rewards to be gained, that encouraged the drive toward initiation of the project. Community leaders, permit holders, and private land owners were well-advised and largely in support of the North Schell Restoration Project. The strength of the relationships that had been forged between the Ely Ranger District and the community members over the preceding years likely added to the Ranger's confidence that the community support for the project was high and that the timing for taking action—at least from a social/political point of view—would probably never be any better.

The potential benefit of further strengthening relationships within the community by successfully accomplishing this prescribed fire was a strong incentive that likely influenced the Ranger's attitude toward striving for at least some accomplishment that spring. The Ranger was excited to begin the implementation of this prescribed fire to, once again, demonstrate that this work unit could be trusted to get projects done that provide value to the community.

As An Agency, Do Our Constituents Trust Us to Get the Job Done?

It is easy to see how the desire to strengthen the once-strained relationships and to avoid the damage to an improving reputation in the community could encourage the Ranger to accept a higher risk by striving for ignition during the spring. It is also easy to understand that the length of time it took to move from planning to implementation could create an increased sense of pressure to get the project started.

The decision document was signed in January of 2012, six years from the time the idea was originally brought forward, and two years from when the NEPA analysis began in earnest.

If we continually talk about what we plan to do, yet we don't ever do it, this certainly has the potential to erode our reputation as an agency that provides value to the community. So as an agency, do our constituents trust us to get the job done, or is our reputation that of a bureaucracy so mired in process that we cannot deliver the goods?

How do think your work unit and/or agency is perceived in your community?

Do you and your coworkers feel a need to prove that the work you do has value?

This FLA Team believes that the pressure exerted by this stigma of "the ineffective government bureaucracy" is not unique to this District or Forest. Rather, it is likely that every unit in the agency struggles to overcome this reputation on a daily basis.

Confidence that Indicators Matched Prior Experience

As a result of the District Ranger's involvement with prescribed fire in similar vegetation types on other locations within the Region, he felt he had a solid understanding and experience with crown fire in this timber fuel type. This experience contributed to the Ranger's confidence that the project could be executed as planned.

> *"I tend to resist changing my decisions once I make them."*
>
> **District Ranger**

The mild winter that the project area received resulted in the high country (above 8,000 feet) becoming accessible sooner than in a typical year. However, conditions at these higher elevations were in full "green-up". Although recently reported "Red Flag" conditions were occurring, the conditions up at these upper elevations were not particularly volatile, according to live and dead fuel moisture samples from the area collected by District Fire and Fuels Staff (1,000 hour FM = 14%, sage LFM = 170%). At these moisture levels, green sage—that has very little dead material mixed in with it—is almost impossible to ignite. This matched the District Ranger's previous experience, reinforcing the belief and expectation that the burn could be accomplished this spring.

While fuel moisture in the brush was an important indicator to success, so was the spotting potential and location of receptive fuels relative to the predominant wind. So why did the live fuel moistures significantly boost confidence, while spotting potential had little effect on the decision to proceed with this project? One possible reason is the "anchoring" effect (see Appendix C).

"Anchoring" is the tendency to rely too heavily, or "anchor", on a past reference, or on one trait or piece of information when making decisions. That first piece of information typically provides a person's first approximation (anchor) and then all adjustments after that become incremental—based on additional information.

So when that first notion was set—*"Conditions are looking favorable for a spring burn, let's do this!"*—it would take a lot of contrary information to move that anchor. In fact, the District Ranger recognizes this trait in himself, commenting to the FLA Team: "I tend to resist changing my decisions once I make them."

Closely aligned with the "Anchor Effect" is "Confirmation Bias" (Appendix C), or the tendency for people to favor information that confirms their beliefs or hypotheses. The effect is stronger for emotionally charged issues and for deeply entrenched beliefs. For example, when the prescribed fire staff built the plan and strategy for executing the fire, they planned for certain fire behavior, spotting, spot directions and distances—including the belief that the sage brush had high enough live fuel moisture to not carry fire and that the fire resources on scene could hold the fire. Their descriptions of the test fire behavior highlighted the fact that the fire spotted cross-slope and uphill. Little, however, was made that the spots occurred in the downwind direction or that they occurred in dead/down mahogany which would have been disconfirming evidence as there was significant dead/down mahogany in the downwind direction on "Mahogany Ridge" on the day of the aerial ignition.

What techniques for avoiding the Anchoring Effect and/or Confirmation Bias do you think might work best for you and your co-workers?

Is it possible to start a discussion fresh and unbiased every time new information is presented?

All of us are susceptible to the influence of the Anchoring Effect and Confirmation Bias, but we can defend against it by being aware of this tendency and consciously seeking out ways to give new information or views adequate consideration when compared to our first notions or beliefs.

Preference for Spring Burning

The Fire and Fuels Staff tend to favor prescribed fire in this area during the fall due to the opportunity to burn in advance of storm fronts that typically bring rain or snow, thus limiting the number of days with active fire on the ground. However, District biologists as well as the District Ranger's own research and experience suggested that applying prescribed fire to this vegetation type would be more successful in meeting resource objectives in the spring rather than in the fall because aspen survival would be better assured. Typically, there is more moisture in the soil in the spring than fall, which protects the root systems from fire. Administratively, fall burning tends to be less favorable to the recreating public. Such projects can conflict with the heavy use during the fall's big game hunting seasons. For these reasons, the District Ranger saw a number of advantages to executing prescribed burns in the spring in this location over the fall and was willing to accept the risk of having an active fire to manage going into the summer months.

So, is it more important to favor the ideal vegetative outcome or the ideal fire control outcome? Neither outcome is guaranteed. Live fuel moistures are typically lower in the fall, making the overall fuel complex more volatile. Escape fires can and do occur in the fall. Even with a spring burn, vegetative response may not be as good as desired. Soil moisture in the fall can also be comparable to spring conditions—depending on fall rains. What does your experience tell you on your unit?

Delays Add Frustration which Interferes with Effective Communication

Project proponents usually expect extended timeframes and downstream delays when completing NEPA documentation due to stringent outreach, scoping, and analysis requirements. When completing internal planning documents such as the prescribed fire plan, however, unexpected delays are viewed as something we should have more control over. Therefore, when delays occur, they are seen as standing in the way of getting work done, which heightens frustrations at all levels. In the case of the North Schell Prescribed Fire, the delays that occurred raised anxiety with the implementation team and especially with the District Ranger, who really wanted this project to get off the ground.

Does your unit favor one season over another for prescribed burning?

What do you think the risk trade-offs associated with that preference are?

The prescribed fire plan was prepared and sent off-unit for technical review. Wildfire activity and an unforeseen family emergency precluded the original reviewer from

completing the review. Another qualified off-unit Burn Boss eventually completed the technical review. What was originally planned to be a one week turnaround ended up taking more than a month. In addition, Regional policy requires that a Project Aviation Safety Plan (PASP) be completed for aerial ignition operations on prescribed fires. Fire planners experienced several delays in getting their aviation plan approved and had to forego at least one viable burn day (June 11) while awaiting approval of the PASP. Vehicle access was also a challenge. The access road was finally improved the day before implementation was to begin. This presented increased anxiety for all personnel involved.

As the project area became accessible, the District Ranger, as well as his staff, became concerned as several prescribed fire opportunities came and went due to planning and logistical delays. As delays pushed their start date back, the Fire and Fuels Staff was also becoming more and more concerned with being able to implement the project this spring. Signals or indicators they were picking up on included: a) Spotting potential of the fuel type; b) The potential duration of the project; c) Current weather patterns trending toward hotter and drier; d) Recent wildfire activity in the area; and e) A recent escape prescribed fire in similar fuel type on a neighboring forest. The District Ranger met with the Fire and Fuels Staff to discuss his concern over these missed opportunities, while the Fire and Fuels Staff members wanted to discuss their growing concern with worsening conditions.

The FLA Team's understanding of the interaction was not that the Fire and Fuels Staff came to tell the District Ranger that they should not proceed, but rather they hoped that by presenting these indicators that risk was on the rise, a discussion of whether or not to postpone the ignition would result. Unfortunately, the communication between the District Ranger and staff on this day was ineffective as neither side could see through their collective frustration to understand the other's view. The staff did not feel that their concerns were being given consideration. In fact, they felt insulted that their considerable fire experience seemed to be dismissed. Similarly, the District Ranger felt as if his experience and knowledge of this type of prescribed fire was ignored, discounted, and not respected by the staff.

The end result was that the staff was unable to convince the Ranger that their concerns were relevant. Thus, the decision to proceed—that they had agreed upon months before—remained in effect without reexamination. The District Ranger directed the Fire and Fuels Staff to continue monitoring when the project area would meet the written prescription and implement the prescribed fire at that time. He stated, "If we're in prescription, we're burning."

"The Gap":

The difference between how supervisors/managers understand risk and how workers actually manage risk.

Was there a Gap in this instance?

Have you had similar experience on your work unit?

As subtle pressures and growing frustrations slowly crept into the work environment, effective communications began to break down. As a result, a "Gap", the difference between how supervisors/managers understand risk and how workers actually manage that risk, began to grow wider (see Appendix C). The ways in which risk is managed by workers is never fully known to management. There is always a "Gap". When communication barriers become prevalent, management becomes even less informed on what types of risks are being assumed by workers

Is it possible for cumulative frustration to broaden "The Gap" in your workplace?

How about on a wildland fire assignment where you are in a command or supervisory position?

Do you have an effective strategy for dealing with frustration and guarding against overlooking important information when you're at your wit's end?

attempting to produce the outcomes of which management has tasked them.

Evidence of how broad the difference was between the staff's perception of risk and the Ranger's were revealed in both individual and group discussions. In retrospect, even though fire behavior models and other indicators revealed the potential for long-range spotting, the Ranger commented: "I don't think I fully appreciated the spotting potential as much as the staff did." While the staff revealed that they did not consider themselves well versed with prescribed fire in this particular fuel type, this came as a surprise to the Ranger who did not consider that would have been the case given the considerable overall fire experience of the two primary staff members (more than 60 years combined).

Frustrations, strained relationships, and barriers to communication are common in almost any work environment. Consider your typical work environments and the frustrations that you have dealt with recently—and could experience again. Are there similarities to this event?

B. PLANNING

Project was the First of its Kind in a New Fuel Type for this Organization

The Fire and Fuels Staff revealed that this was their first large, landscape-scale, multi-unit, prescribed fire project in aspen/mixed conifer fuels. While the staff had many years of wildfire management experience in white fir, they had no practical experience planning for or executing a prescribed fire project of this scale in this fuel type. A staff member commented that: "We had a hard time wrapping our heads around developing a landscape-scale plan and didn't know where to start."

"New area, new fuel type for us."

Fuels Specialist

As it turned out, compressing such a large task into a "normal" burn plan writing timeframe reduced their ability to spend the time needed to carefully analyze and link each element of the prescribed fire plan.

The Fire and Fuels Staff planners stated that their timeframe for developing previous prescribed fire plans— all smaller-scale projects—was, typically, six months. The fuels planners applied this same "rule-of-thumb" in this case, expecting that planning the 78,000-acre North Schell Restoration Project prescribed fire plan with multiple burn units in unfamiliar fuels would require similar timeframes as it took to plan for smaller treatment areas in fuel

What is a realistic timeframe for planning a single burn unit project on your unit?

How would that timeframe change for a large planning area that had multiple units to be burned over the course of several years?

What would you pay the most attention to if you were tasked with planning a high-intensity prescribed fire with long-range spotting potential?

types in which they were familiar. Without any other guidance, it seemed reasonable to expect that the timeframe for developing a quality plan would be similar to that for previous projects.

As it turned out, it was an immense task to have a large, multi-unit plan prepared in time for spring burning. However, burning one or more of the North Schell units was the only prescribed fire they needed to execute in the spring. Planning to execute just one prescribed fire in the spring season may have also reinforced their belief that developing this large plan in a normal timeframe was reasonable.

In addition, there was a lack of both experience and external guidance available to them on what practices have been proven to work—or pitfalls to avoid—when planning to ignite a crown-fire in this fuels type. As the participants look back, there are a number of things they would now do differently. Of course, none of these "lessons" were known to them at the time.

A Highly Autonomous Work Unit Accustomed to Getting Things Done on Their Own

The Ely Ranger District is remotely located in east-central Nevada, far from the Forest Supervisor's office in Sparks, Nevada. The District's remoteness has produced a highly autonomous, self-reliant unit. When planning prescribed fire projects, its staff members typically work on their own or in partnership with the Bureau of Land Management.

When developing the North Schell Prescribed Fire Plan, the self-reliant staff did extensive Internet research into planning and implementing aspen/mixed conifer prescribed fires. However, they did little in the way of seeking out peers who have done this type of work in the past. In hindsight, local planners felt they would have benefited by doing more outreach for assistance from other Forests or other Regions. This may have provided them valuable information on different approaches to planning that they had not considered on their own.

The FLA Team examined what resources were available to the planners that may have helped them fill in their knowledge gaps. Our analysis suggests that professional networks were weak and the local unit did not feel informed enough about who else was undertaking similar projects to seek out other experts with pertinent knowledge. They made good use of the resources at their disposal, but were at a disadvantage by not being well-connected to a larger network of prescribed fire professionals, either nationally or regionally.

Besides their physical isolation, the FLA team also noted that there is functional isolation resulting from the organizational structure. At the Forest level, the Resource Staff Officer has program responsibility for hazardous fuels while the Fire Staff Officer oversees the fire suppression program. However, the Resource Staff Officer does not have technical expertise in prescribed fire operations, but the Forest Fire Staff Officer does.

How robust are your prescribed fire networks?

Where can you go for assistance if you are faced with a new prescribed fire challenge?

How can your formal and informal support networks be improved?

At the District level, the hazardous fuels program is a separate program from fire suppression, with the Fuels Specialist and Fire Management Officer holding equal grades, each reporting directly to the Line Officer, and each working with their respective staff officer at the Forest level—the FMO with the Fire Staff and the Fuels Specialist with the Resource Staff.

When asked about these relationships, the Forest Fire Staff commented to the FLA team that while he does provide technical assistance upon request, workplace culture generally frowns upon one staff officer inserting themselves uninvited into another staff officer's program area. In other words, it would be considered poor etiquette for the Fire Staff to assert their expertise without a request for assistance from either the District Fuels personnel or Resource Staff Officer. The District's view of the situation is that there is no "Fuels" person at the Forest Supervisor's Office, thus they are left to their own devices. Compounding this disconnect between expertise and program responsibility is the fact that the Resource Staff officer position has been vacant with "actings" filling the position since January 2012. Because of this discontinuity at the Forest level, communications from the Regional Fuels Program Manager to the Humboldt-Toiyabe National Forest began to go directly to the fuels specialists at the District level rather than through the Forest.

Therefore, by design, the organizational structure lends itself minimal forest-level guidance and oversight, thus reinforcing the districts' autonomy concerning prescribed fire. Because the expertise and responsibility at the Forest level do not coincide, the District does not have a Forest-level counterpart to work with in planning and implementing prescribed fire.

Technical Review and Complexity Analysis Reaffirm That a Large Risk was Not Being Taken

The FLA Team concluded that the complexity analysis process for the prescribed fire was followed appropriately, which resulted in a 'Moderate' complexity rating.

A preliminary complexity analysis is required to be made early in the planning stages. This is to identify potential concerns that may be mitigated during the plan preparation process. When the plan is nearing completion, a final analysis is completed and a final complexity rating is made. This final complexity rating is used to determine the qualification level for the Burn Boss.

The complexity analysis for the North Schell project showed no changes to the preliminary analysis. Thus, additional mitigation measures were not identified during the planning process. This contributed to the belief that a large risk was not being taken.

The prescribed fire plan technical review evaluates the content of each plan element. It ensures that the plan's stated goals and objectives can be safely and successfully achieved when properly implemented.

Is it accurate to believe that "High Complexity" projects result in more adverse outcomes than "Moderate Complexity" or that a "Moderate Complexity" project a safer project?

If the technical reviewer is unable to visit the actual burn site, does that impact the quality of his/her review?

It is noteworthy that while the Burn Boss doing the technical review was from the local area, he/she was not intimately familiar with the specific site and was unable to visit the site, due in part to the tight time constraints on getting the plan approved.

The technical review for the North Schell Prescribed Fire Plan did not reveal any major flaws or concerns.

Participants stated that this increased their confidence that the plan met all the requirements and that it must be adequate.

Belief that the Planning Process is Cumbersome and the Prescribed Fire Plan is of Low Operational Value

The participants revealed that their attitude toward prescribed fire planning is that the time and energy it takes to develop these plans can be better utilized in other functions to prepare for implementing the burns. They felt some elements in the plan are not valuable to implementing the burn. The staff believed that the complexity analysis is cumbersome, is too subjective, and should be replaced.

The FLA Team agrees with the technical aspects of their argument. There is definitely room for improvement in the current complexity analysis and Interagency Prescribed Fire Plan template. The worrisome part for the FLA Team, however, is that the interagency template is intentionally general in nature to allow the planner the flexibility to increase or decrease the amount of analysis as appropriate for the project. The danger of allowing this flexibility is that it can provide for a self-fulfilling outcome. If planners do not expect to gain any value, then the planning template will allow them to produce exactly the product they expected.

What is your attitude toward prescribed fire plan writing?

Is it an opportunity to identify potential problems and deal with them? Or, does the process simply get in the way of you doing your job?

Do you think the approach a prescribed fire planner takes can impact the value of the plan—even the potential outcome?

The notion that excessive planning interferes with the management of risk is not uncommon and not unique to this unit. In fact, it is probably more of the norm than we would like to believe. However, some suggest that instead of interfering with risk management, the primary way we manage risk is through proper planning. If this is the case, then could it be that an approach where planning is thought of as interfering with risk management may itself present a barrier to conducting thorough analysis and mitigation of risks?

Viewing the prescribed fire plan as a "pencil exercise", something to be filled in—rather than an integral component of risk management—could predispose the preparer to missing key items during the preparation of the plan. This could also have corresponding implications during implementation.

> *"Next time, I'll spend more time gaming-out different scenarios."*
>
> **Fuels Specialist**

The Dilemma of the Efficiency-Thoroughness Trade-off

The participants revealed to the FLA Team evidence of the continual struggle between efficiency and thoroughness. (See "ETTO" – Appendix C.) Related to the task of prescribed fire planning, fire planners must use experience and judgment to estimate the balance between the level of detail needed in planning and making efficient use of their time.

The Interagency Prescribed Fire Planning and Implementation Guide allows for varied levels of detail and minimal guidance on the correct level of detail or balance to allow flexibility for projects of varying complexity, scope, and size. There is an understandable desire among planners to provide only as much detail in their planning as they believe necessary—while not spending more time than necessary to get the job done.

Prescribed fire plan elements are linked. Missteps in one element can cause cascading effects throughout the prescribed fire planning and implementation process. The North Schell Prescribed Fire planning staff provided what they believed was enough detail to address what their experience and judgment told them. It makes sense that because the Fire and Fuels Staff had a high comfort/familiarity with wildfire in the white fir fuel-type, it would seem reasonable to not belabor the planning process with excessive detail to increase efficiency and meet time constraints.

They produced what they believed was an adequate plan for igniting and holding Unit 8. However, their inexperience with planning a large landscape-scale burn in a normal time frame did not provide an opportunity to adequately complete a thought-provoking analysis to game out unit-specific risk, hazards, and subsequent holding and contingency needs.

Instead, they focused on addressing risk and hazards associated with fire threatening or exceeding the project boundary.

In retrospect, one planner stated: "Next time, I'll spend more time gaming-out different scenarios."

What kind of trade-offs do you and your work group make when balancing safety and production, thoroughness and efficiency, etc.?

Do you have your own definition of how "good" is "good enough" when it comes to burn plan analysis?

Does it change based on the particular project? If so, how?

Holding and Contingency Planning for Large Project Areas

The staff believed that having relatively small and generally isolated conifer stands to ignite located in such a large project area provided many opportunities to manage potential escaped fire issues. In a listing of "Pro's and Con's," the staff cited "Large Landscape" as an advantage that they held in favor of implementing the project. A coarse-scale view of the project shows discontinuous stringers of flammable fuels interspersed among areas that are sparsely fueled, rocky, and not readily able to burn at higher live fuel moistures. This view contributed to the sense of confidence that any fire outside of primary ignition areas could be easily managed. A finer-scale exam of the North Schell Unit 8 may have revealed that the extent of spotting potential under a strong southwest wind was more likely than what a coarse-scale view would provide.

The Holding Plan was written with this idea in mind—that the large landscape and varied fuels and terrain would offer many opportunities for control. Specific holding features were not identified. Rather, general guidance and significant discretion was provided to the Burn Boss to determine which holding features would be utilized on each particular unit. Even after fire entered the slot canyon, the prescribed fire team held onto the belief that they had the advantage of a large landscape to work in—providing time to evaluate, assess, develop, and adapt their Holding Plan.

It is also worth mentioning that the staff is used to adapting to changing fire situations in wildfire. This situation—in which they were actively adapting their plan to adjust to the changing fire scenario—is a familiar condition to them. There was also an attachment to the plan and strategy that they had developed, as well as a belief in their ability to mitigate risks due to their experience. In hindsight, however, the advantage was thwarted by fire entering an inaccessible area—which kept them from mopping up the fire before then next critical fire spread event arrived.

The Contingency Plan is the portion of the plan that considers possible but unlikely events and the actions needed to mitigate or respond to those events. The participants revealed—and the FLA Team agreed—that the Contingency Plan did not game out any contingencies other than the exposures and risks of the fire leaving the project area. In retrospect, there is a case to be made for planning to initiate contingency actions even when the fire doesn't threaten the project boundary, but, rather, does something else contrary to the intent of the plan.

During the time between June 13-16, the Contingency Plan was never initiated and the actions were guided primarily by the Holding Plan. In reviewing both the Holding and Contingency plans, the FLA Team did not find any established Management Action Points (MAPS) useful in identifying when operations may be drifting away from the intentions of the plan.

Management Action Points are commonly used to ensure situational awareness is continually updated by forcing us to monitor factors such as weather and location of the fire on the landscape. Having a MAP creates a physical/temporal "line in the sand" requiring an action or further analyses. It is a concept very well understood by the local unit in managing long-term wildfire events.

Can you think of a Management Action Point that would have been useful in either the Holding or Contingency plan for this event?

However, because prescribed fire has not traditionally used such a concept, the planners did not give the notion much consideration.

In response to this event, the participants wish they would have had a plan that more closely resembled a long-term management plan for a wildfire. Such a plan would have placed considerable effort into establishing action points based on planning for what the fire has the potential to do—not just what we would like it to do.

C. RISK MANAGEMENT

Under Prediction of Fire Behavior and Spotting Potential

Knowing the outcome, we know that after the upper end of the fir stand was ignited by PSD, the actual fire behavior created a column which bent over from the southwest winds aloft—causing spotting downhill, which accelerated spread downhill. The fire then spread to the bottom sooner than expected with much more intensity than expected. The Fire and Fuels Staff ran the "BEHAVE" models, demonstrating the potential for downwind spotting of up to 0.75 of a mile. The spot weather forecast called for southwest winds. The staff also knew that the probability of ignition on the exposed fuel bed was 80 percent—demonstrating a receptive fuel bed.

Looking back now, why did it make sense for the staff not to attend to the risks of a spot fire downwind/down canyon? In answering that question, we must consider that in describing "sensemaking", Dr. Karl Weick proposes that as humans we cannot possibly cope with all the data and information that the world is throwing at us at a given moment (See Appendix C). Instead, we have to select that information which seems most important. The following is an exploration of the factors the participants keyed in on as revealed to the FLA Team.

Prior to implementation, the Fuels Technician had a conversation with a Wildland Fire Module leader from a neighboring Forest who had been on a prescribed fire recently in similar aspen/conifer fuels. The module leader reported witnessing spotting in the range of 300-500 yards (about 0.25 miles). Later on, when the test fire was ignited, this range was confirmed with the farthest spots falling into this range—providing strong evidence that the modeled outputs may be over-predicting the spotting potential.

Interviews also indicated that the prescribed fire staff felt that if spotting problems occurred, they would be upslope/up-canyon. Why? Again, much of the reasoning was based on the fire behavior observed from the test fire. The test fire was on a gentle slope. The team noted that it did not spread aggressively. Igniters had to continually light strips to spread fire throughout the stand. The farthest spot from the test fire was slightly uphill and cross-slope of the test fire. Based on that observation, the staff expected fire behavior on the main burn—which was much steeper—to make uphill crown runs with little backing fire spread, with a need to strip fire from top down. Basic fire behavior suggests that fire spreads most aggressively upslope with lesser spread downhill. A more robust calculation that factors in wind speed and direction relative to the slope is required to anticipate fire spread when wind

and slope are not in alignment. Indeed, much of the topography in the upper end of the main fire area would match a firefighter's description of a "chimney" or place where convective heat would be drawn uphill rapidly. To some degree, this topographic set-up is believed to have shifted their attention to look for problems with aggressive fire spread and spotting along the uphill (west) edge. When, *in hindsight*, it was the downhill (east) edge that turned out to be the problem.

Participants reflected that the information on expected spotting distance from a trusted source, combined with verification from their own test fire, may have resulted in discounting the potential spotting as modeled. Thus, their expectation was narrowed that spotting would likely be uphill from the fire and limited to an area of roughly 0.25 miles—rather than the actual 0.75 miles in the downhill direction that occurred. It should be noted that this is not an unusual adjustment. Fire Behavior Analysts often advise firefighters that the model outputs should be used as guidance in the absence of actual observations and that verifiable observations are a better indicator of expected fire behavior in most cases.

Another reason why the prescribed fire team may have underestimated spotting potential is that their fuel moisture measurements and experience with the test fire confirmed their belief that spotting potential was low in the surrounding sage and mahogany. The test burn fire behavior did demonstrate several small spots in the sagebrush and these spots did not spread. There was one small fire that had some potential southeast of the test burn in dead/down mahogany which had minimal spread and was easily suppressed by the holding crew.

These spot fires from the test burn were all confirmation that in a day or so when igniting the main burn area that there was a high probability of controlling any spot fires emanating from that ignition—and, thus, a low probability of escape. The prescribed fire staff had confirmation that their strategy and tactics were sound and within what was planned. It "made sense" to them because they had seen their strategies work on the test fire.

What do you put more faith in, a calculated fire behavior prediction, or personal observations of fire behavior in similar circumstances?

How good is your intuition when slope and wind are not aligned?

Participants suggested to the FLA Team that these confirming indicators may have distracted their attention from the larger area at risk by limiting their ability to perceive that there was a risk of spotting beyond the 300-500-yard range and in the downhill/downwind direction where receptive dead/down fuels were present.

Deliberate Risk Management Decisions

The prescribed fire staff deliberately chose to not put firefighters at risk in chasing spot fires in the slot canyon. The Holding Plan described the response to fire in hazardous terrain. The staff would accept the risk of escape outside the project area over risk to personnel in this cliff band area, which is noteworthy. This is not to say that they simply gave up. They did attempt to access these spots with their best available resource, a highly trained Interagency Hotshot Crew. This crew confirmed their initial impressions that attempting to access these spots was a risky endeavor that was very likely to

result in injury to firefighters. The consequence of not attending to the spot fire in the slot canyon was that additional fire eventually spread out of the canyon.

As spot fires occurred, the staff evaluated the potential benefit of ordering a heavy helicopter, but opted not to order this resource due to perceived risk of throwing heat off cliffs down into the draw bottom without the ability to safely deploy ground forces there. This decision was consistent with positive risk management on the site. There is certainly a case to be made that the increased water delivery may have been successful in stopping the fire. However, conventional wisdom also suggests that water drops cool, but firefighters extinguish—which still would not be possible without the ability of firefighters to access the drop sites. There are also many documented cases of fire behavior accelerating due to the increased airflow created by large aircraft. Therefore, the participants' concerns are not unfounded.

So, did it make sense to continue managing the fire as a prescribed fire even after it had become established in the cliffs? That depends on if you estimate the chance of that log rolling into the bottom of Muncy Creek as extremely low—or, as inevitable?

Those involved with this event held the expectation that the fire in the cliff bands would get "hung up" and was likely to burn itself out before finding new fuel to consume. They also estimated that a heavy helicopter with large water loads and significant rotor-wash would encourage the spread of these isolated hot-spots down into the drainage bottom—where they didn't want fire. They, therefore, chose to continue utilizing the smaller helicopter with the light rotor wash and minimal water carrying capacity.

What if this fire hadn't escaped and burned itself out on the cliffs? Would the choices have made sense then?

Is the quality of the decision the same— regardless of the outcome?

Their assumptions were confirmed for several days, each day—from June 13 to 15—there was less and less heat in the cliffs. Hence, electing to not employ the large helicopter appeared to the prescribed fire team to be a sound strategy.

The decisions described above represent deliberate choices to accept a perceived lower risk from one outcome (injury or damage from escaped fire) rather than accept the more immediate and perceived higher risk of another outcome (injury/death of a firefighter or acceleration of fire spread from large water drops and rotor-wash).

Optimism and a Positive Work Ethic

The culture on the Ely Ranger District is engrained to go the extra mile. District personnel are accustomed to being asked to do the same or more work with fewer people. They are accustomed to driving longer distances to their work sites than most any other location in the Forest Service. They are proud of their ability to accomplish tasks in the face of adversity. The challenge of conducting a prescribed fire in a new environment, fuel type, and very large landscape within a tight timeframe was simply another opportunity for this unit to adapt and to overcome.

Other reviews and investigations have labeled the projection of a positive work ethic as the "can-do" attitude and have suggested that this trait is particularly visible in the Fire and Fuels programs. One of the characteristics of the positive work ethic is that it instills a powerful sense of optimism.

Optimistic people get work done that is difficult to accomplish. But does the eagerness to take on the next challenge also mean that the fear of failure must be set aside? Recall the discussion on the efficiency-thoroughness trade-off. If fear of failure commands the day, then valuable work does not get done. However, if the drive to accomplish the task is so strong that hazards are downplayed, this can lead to accepting unnecessary risks. This is the place where “can-do” can devolve into “make-do”. Obviously, had this work unit been more fearful of the risks associated with this prescribed fire, they would not have initiated it to begin with. But consider how many thousands of acres of valuable treatments they have accomplished over the years that have benefited wildlife, ecosystem function, and reduced hazardous fuel accumulations. Would that have been possible if their actions were governed entirely by fear of an adverse outcome?

The staff knew there was a high probability of short- to medium-range spot fires to the north and northeast of the main burn along “Mahogany” and ”Lookout” ridges. However, they felt their ability to contain spots was high—given the condition and arrangement of the surrounding fuels—and their success dealing with spot fires from the test burn.

The participants told the FLA Team that they were very optimistic with the behavior and results of the test burn and their ability to hold the fire.

Adding to this optimism, they had a helicopter for water drops on site and their weather forecast called for up to two days of moderating weather after the ignition, allowing them ample time to secure the main fire and address any spots that would occur.

Once the main fire was ignited, the spotting in the slot canyon shook that optimism. However, their outlook improved over the next few days as they successfully controlled spots on “Mahogany Ridge” and the fire in the cliffs appeared “hung-up”, likely to burn out before reaching Muncy Creek.

The role of management, supervisors, and crew leaders is to instill the sense that the biggest part of our job is doing the job right. The challenge is accepting risk commensurate with reward—finding that place where we use measured caution and are not blindly governed by either fear or optimism.

The FLA Team found that this unit worked very hard to accomplish that balance and the prescribed fire team made mention of both their fears that they could fail, as well as their optimism that they could get the job done.

Despite their optimism and drive to succeed, the prescribed fire staff told the FLA Team that their goal—considering all of the adversity they were faced with—was to do the job “right” and get it done safely. One participant stated: *“Doing the job right is what keeps us moving forward”.* After the fire escaped, however, one participant remarked: *“If it doesn’t feel right, then it probably isn’t right”*—reflecting the continual struggle between being optimistic and eager to get work done, yet cautious enough to recognize the risks that are present.

The Role of Chance in Risk Management

The FLA Team members acknowledge that chance could have played some role in this event. However, we are unable to comment on the degree. The areas that spot fires could have become

Ultimately, a burning log rolled into the bottom and the strategy failed.

Does this mean it was not the best available strategy?

What other options do you see if you had to deal with scattered heat in these cliffs?

established within 0.75 miles of the ignition area are almost all accessible by holding forces. Only a very small area, the slot canyon, had the potential to go unchecked due to poor access.

The likelihood of spots landing in that particular area on any given day will vary, depending on wind speed, direction, the quantity and quality of embers—as well as some element of chance related to an ember landing on receptive fuels on a discontinuous fuel bed. While the risk increased as wind direction and speed forecast for the burn day aligned with the slot canyon, the occurrence of the spotting in that area was still not inevitable—although more likely than with a different wind direction.

Additionally, the fire did hold on the cliffs for at least two days and was very nearly starved of fuels there. The chance occurrence of a single log burning out and rolling downhill into receptive fuels cannot be computed accurately. Intuitive estimates vary greatly depending on the observer.

Without being able to accurately describe the probability of either the spotting in the slot canyon or the eventual log roll off the cliffs into Muncy Creek, it is not possible for this FLA Team to quantify what role chance or “bad luck” played in this event. We only acknowledge that it cannot be ruled out.

6. SUMMARY CONCLUSION

After careful consideration of the underlying factors involved with this event, the FLA Team supports the notion that another operator with similar experience and skill placed in a similar situation could have made the same choices as each of those involved with this event. While risks were present and, in fact, were on an increasing trend, the choice to ignite was not a reckless act done without regard to common safety practices. Rather, this decision was made within the parameters set out in the approved plan.

There is no such thing as elimination of risk when dealing with wildland fire, only the choice between which of several risks to accept. The risk of having the fire spot into an area where firefighters could not extinguish it was estimated by the personnel involved to be very small, while the risk of losing additional wildlife habitat and credibility with the community seemed likely.

A judgment was made that the benefits of igniting the fire were greater than the risk of injury or escape, given their expectations of predicted fire behavior. The FLA Team found that while environmental conditions were trending toward higher risk, the implementation team had established criteria developed in accordance with approved practices and they adhered to those criteria.

The subsequent likelihood that the fire would continue to spread and roll out of the cliff bands was also judged to be smaller than the likelihood of injuring persons by attempting to suppress the fire in the

cliffs, or of accelerating the spread if they were to attempt to extinguish them with water drops from a large helicopter.

These judgments were made knowingly and deliberately. While, ultimately, the fire did escape and resulted in a number of negative consequences, the choices made by participants were within policy and consistent with agency and societal values to work toward improved forest health conditions while favoring protection of human life over that of either property or natural resources.

7. RECOMMENDATIONS

A. Interagency Prescribed Fire Planning and Implementation Procedures Guide

The FLA Team recommends that the Intermountain Region (Region 4) work with the Forest Service's Washington Office Fire and Aviation Management staff (WO-FAM) to examine more closely the guidance provided to Prescribed Fire Planners related to large, landscape-scale projects. The Region and WO-FAM may want to request that the National Wildfire Coordinating Group (NWCG) consider adding guidance on planning and implementing landscape-scale prescribed fire projects in the next revision of the Interagency Prescribed Fire Planning and Implementation Procedures Guide (IA RX Guide).

Considerations for Update of the IA RX Guide:

- Add guidance on how to plan for and implement large, landscape-scale, long-term prescribed fire projects.
- Provide discussion on the links between plan elements and the cascading effects of missteps.
- Emphasis is placed on the links between the prescription, holding and contingency elements related to areas inside a large project boundary, as well as the boundary itself.

B. Prescribed Fire Complexity Analysis

The FLA Team recommends that the Intermountain Region work with WO-FAM staff to examine the utility of the current Prescribed Fire Complexity Analysis. If areas of potential improvement are identified, the Region and WO-FAM may want to ask the NWCG to consider a review and update of the current Prescribed Fire Complexity Analysis.

Considerations for Prescribed Fire Complexity Analysis:

- Consider creating a complexity analysis that is less subjective in determining operational complexity and risk, yet flexible enough for national application.

- Consider aligning the current prescribed fire complexity analysis more closely with the wildfire complexity analysis so that it might:
    - Allow for continual update throughout the life of the prescribed fire project.
    - Improve familiarity and ease of use if a similar tool were used for both wildfire and prescribed fire operations.

C. Determine Common Factors in Escapes and Success in this Fuel Type

The FLA Team recommends that the Intermountain Region consider a review and evaluation of the prescribed fires in this region that have been implemented in the mixed-conifer fuel type, requiring high-intensity fire behavior to achieve objectives within the last ten years. This would include revealing what common factors have led to successful implementation and what factors appear to be common in escaped prescribed fires—or other unintended outcomes that occur in this complex fuel type. Based on this review, determine the need for one of more of the following: information exchange, training needs, informational workshops to promote learning and assist practitioners in project planning and implementation, formal or informal publication, etc.

An examination of a number of events with similar circumstances could reveal commonalities that can improve future outcomes more clearly than a singular escape review. Considering that the Intermountain Region has conducted several escaped prescribed fire reviews since 2002 in this fuel type and season, there is likely a good deal to be learned from these events that may pertain to other Forests within the Region.

D. Enhance Connectivity and Interaction among Fire and Fuel Professionals

The FLA Team recommends that the Intermountain Region consider taking steps to enhance the connectivity and interaction among all prescribed Fire and Fuels professionals throughout the geographic area.

The Fire and Fuels Staff stated that they had a hard time wrapping their heads around this large project. Furthermore, they said that they did not feel that they knew where to go to find others who might provide useful advice. There are examples of Prescribed Fire Consortia and formal prescribed fire/fuels workshops and events in other Regions or agencies that could be considered as models for enhancing the connectivity of fuels professionals with their counterparts in this geographic area.

8. FLA TEAM MEMBERS

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9. APPENDICES

APPENDIX A. CHRONOLOGY OF EVENTS

Date	Time	Event
6/7/2012	Day	North Schell Burn Plan signed
6/8/2012	All day	Access road improved to allow better access for crews and resources
6/9/2012	1900	Ignition of test burn (hand ignition only)
6/9/2012	2030	Ignitions complete, continue to monitor burn, ensure meeting objectives
6/10/2012	1200	Lit one additional patch in test area to clean up “dirty burn”
6/10-6/11	All day	Continue to monitor test burn area, mop up, clean up edges
6/11/2012	Day	Project Aviation Safety Plan signed; weather forecast good for 6/12
6/12/2012	0700	Crews meet at District Office; weather forecast favorable; all resources available
6/12/2012	1415	First aerial ignition attempt; PSD failure; return to helibase for fix
6/12/2012	1500-1530	Helicopter returns to burn site; resume aerial ignition; release ~2000 balls
6/12/2012	1630	Fire begins to build along upper-most portion of the stand and begins to move down drainage
6/12/2012	1711	First observations of spotting on “Mahogany Ridge”; main fire moving NE toward Faun Trail Road
6/12/2012	1729	Spots observed below Faun Trail Road
6/12/2012	1830	Fire moves northeast of road, impacting several stringers of aspen; embers are pushed by southwest wind over to “Mahogany Ridge”; helicopter bucket work commenced.
6/12/2012	2030	Personnel observed “glow” in slot canyon; precipitous terrain, inaccessible, getting dark
6/13/2012	Day	Alternate RXB2 oversees field crews; Monitor and address spotting on Mahogany and Lookout Ridges; Interagency Hotshot Crew (IHC) arrived on scene to work Lookout; Ely district resources engaged on Mahogany; helicopter bucket on both ridges; ridges secure at end of day; no way to put people in drainages
6/14/2012	Day	Fire activity calm, continued helicopter work and work by hand crews ; Type 2-IA crew arrived in PM to replace IHC; conditions secure by nightfall
6/15/2012	Day	Thunder-storms forecast; IHC demobed; crews continued to work both ridges; erratic winds produced by storm front; no helicopter work possible
6/16/2012	Day	Crews continued work on spots on both ridges; helicopter bucket work continued on North Muncy Creek; bucket dip site changed to increase efficiency of drops
6/16/2012	1500	Log rolls down into bottom of Muncy Creek. Helicopter continued to work until available hours exhausted ~1830; problems in precipitous drainage can’t be accessed by personnel; Fire Weather Watch for winds issued for 6/17
6/17/2012	0700	Meeting with Ranger, RXM1, RXB2, RXB2-T, Fuels Specialist to discuss options and determine action plan; Spot Weather forecast calls for Red Flag Warning for wind @ 1100
6/17/2012	0900	Drift smoke from Muncy Creek seen heading east, notable volume
6/17/2012	0930	Helicopter flying recon in Muncy Creek drainage; large smoke plume observed; RXB2 calls off crews, retreat to staging area, eye-level winds from west pushing 20 mph
6/17/2012	1000	Fuels Specialist notified of conditions in Muncy Creek, structure protection down drainage in Muncy Creek ordered
6/17/2012	1030	RXM1 and District Ranger meet to discuss incoming information. Step outside and see two distinct smoke columns from fire area.
6/17/2012	1135	Declared wildfire, request T3 IMT and additional resources to respond

APPENDIX B. DECLARED WILDFIRE REVIEW ELEMENTS FROM INTERAGENCY PRESCRIBED FIRE PLANNING AND IMPLEMENTATION GUIDE

ANALYSIS OF SEASONAL SEVERITY, WEATHER EVENTS, AND ONSITE CONDITIONS LEADING UP TO THE WILDFIRE DECLARATION

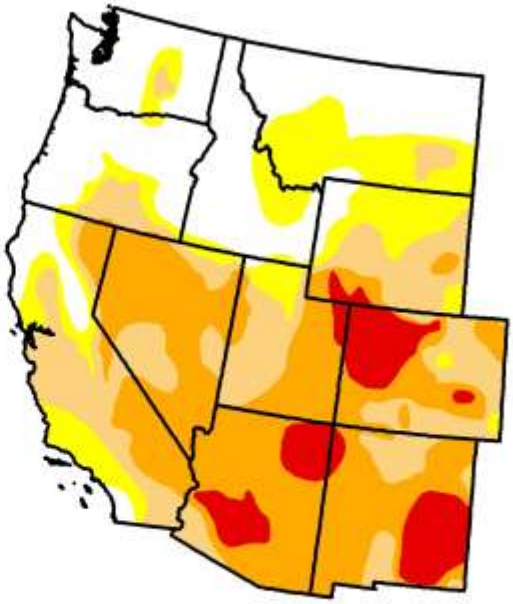
U.S. Drought Monitor

June 19, 2012
Valid 7 a.m. EST

West

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	26.24	73.76	58.33	37.40	7.88	0.00
Last Week (06/12/2012 map)	30.80	69.20	54.39	33.06	5.92	0.00
3 Months Ago (03/20/2012 map)	38.04	61.96	47.33	22.70	3.39	0.94
Start of Calendar Year (12/27/2011 map)	48.49	51.51	20.05	12.22	2.67	0.78
Start of Water Year (09/27/2011 map)	66.72	33.28	19.04	14.99	9.30	3.81
One Year Ago (06/14/2011 map)	78.53	21.47	17.94	14.04	9.85	5.22



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

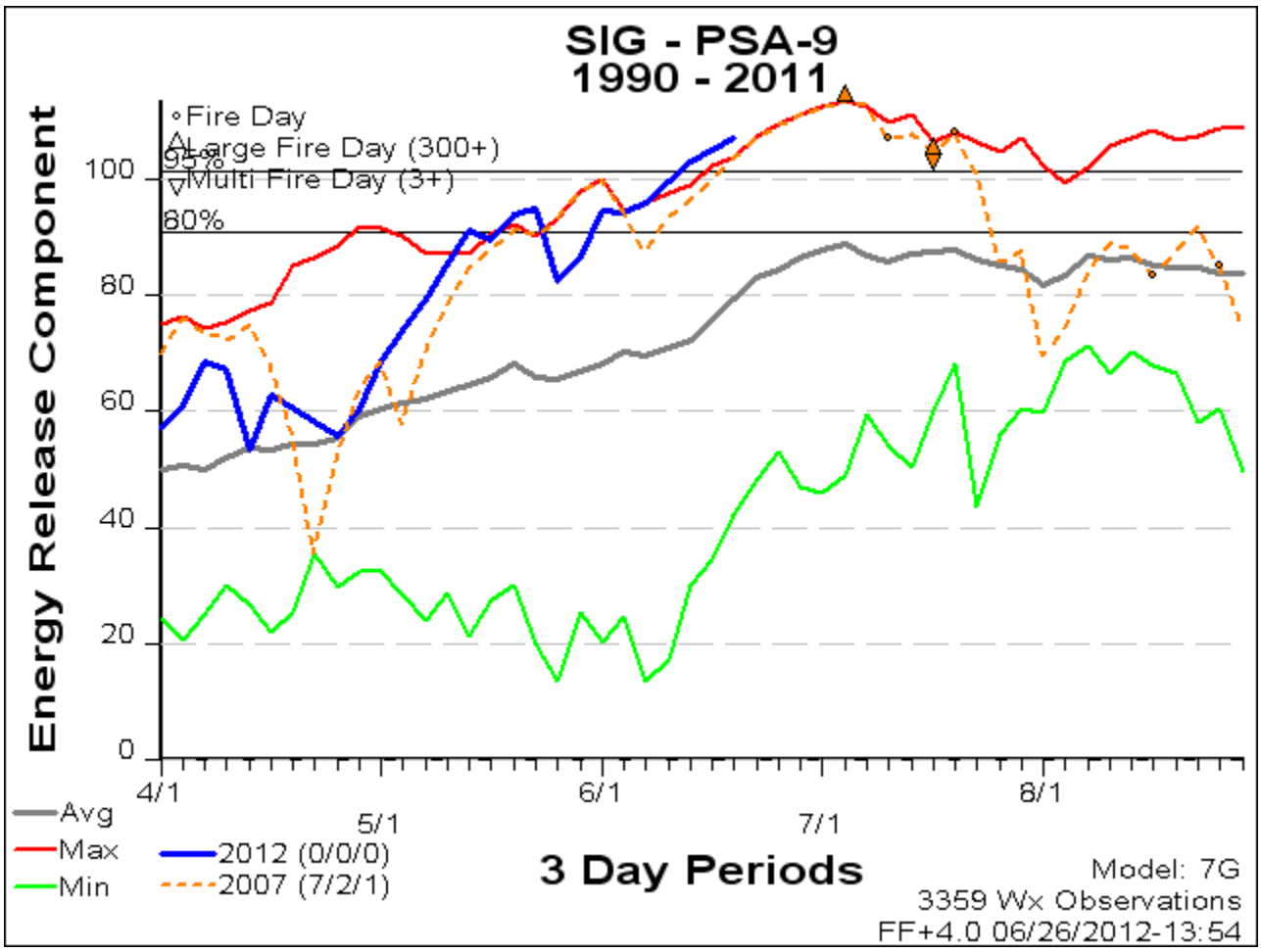
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu

Released Thursday, June 21, 2012
Richard Heim, National Climatic Data Center, NOAA

The U.S. Drought Monitor showed “Moderate Drought” for the area. The U.S. Drought Monitor is a broad-scale analysis tool and does not provide site-specific information.

The National Fire Danger Rating System (NFDRS) index used to track the combined effects of fuel dryness on fire potential is known as the Energy Release Component (ERC). The following graph displays current ERCs and compares them to historical readings (1990-2011).



Explanation of Lines and Symbols in this ERC Graph

The black line marks the 80th and 95th percentile level of ERC. (Typically, large fires become more frequent when these values are above the 80th percentile.) The bold red line indicates the historic maximum values. The green line represents minimum values. The grey line is the computed average for that date. The heavy solid blue line signifies the values for the current year (2012). The dashed orange line shows values for the chosen analog year (2007)—which was a very active fire season in the Great Basin.

The small colored circles signify that a single fire was reported that year (2007). The small triangle pointed down signifies a multiple (more than 3 fires) fire day. The small triangles pointed up signify a large (greater than 300 acres) fire for that date in that PSA (Predictive Service Area).

The ERC for PSA-9, East Central Mountains, Special Interest Group (SIG) was near the 95th percentile on June 09, 2012. Prior to the second ignition, the ERC had exceeded the 95th percentile. On the day of the escape, the ERC remained above the 95th percentile.

WEATHER

During the month of May (2012), Red Flag Warnings were issued for Zone 455 on the 15th, 17th, 21st, 22nd, 24th, and 25th. There was also a Red Flag Warning issued on June 4th. This represents a total of seven days—from May 1st through June 6th—in which Red Flag Warnings were issued, all due to the combination of gusty winds and low humidity. There were no missed events as Red Flag criteria were met in all cases.

The prescribed fire team obtained multiple site-specific spot weather forecasts obtained from the National Weather Service for the North Schell Prescribed Fire. Spot weather forecasts were obtained June 09th, 10th, 11th, 12th, 13th, 14th, 15th, 16th and 17th. Red Flag Warnings were issued for the area on June 09th and 17th. The spot weather forecasts, H-T Portable RAWS #5 observations, and onsite weather observations on the key dates of June 09th (ignition of the test fire), June 12th (aerial ignition), and the morning of June 17 (wildfire declaration) are summarized in the following tables.

PREDICTED WEATHER

	June 09th Red Flag Warning	June 12th	June 17th Red Flag Warning
Sky Weather	Mostly Sunny	Mostly Sunny	Mostly Sunny
Max Temp. (°F)	52-60°	66-74°	75-80°
Min. Relative Humidity (%)	14-17%	7-10%	5-10%
20' Winds (mph)	Breezy. Winds becoming west 15 to 25 mph. Gusts up to 35 mph increasing to 45 mph in the afternoon.	Southwest winds 10 to 20 mph with gusts to 25 mph.	Breezy. Southwest winds 10 to 15 mph increasing to 20 to 25 mph with gusts to 45 mph in the afternoon.
Mixing Height (ft.)	11,500 – 12,500 feet AGL	15,700 – 16,700 feet AGL	16,500 – 17,500 feet MSL
Transport Winds	West 35 to 45 mph	West 17 to 27 mph	West 23 to 33 mph

ONSITE PORTABLE RAWS OBSERVATIONS (H-T PORTABLE #5)*

	June 09th 1759 - 2059	June 12th 1159 - 2059	June 17th 0559 - 1159
Temperature (°F)	36-46°	66-75°	63-76°
Relative Humidity (%)	15-22%	7-11%	12-21%
Wind Speed (mph)	10-16	5-11	8-16
Wind Direction (Degrees)	57-72° (Northeast)	112-182° (South, Southeast)	130-161° (Southeast)
10 hr FM gr	4	2-4	4-5

**Wind gusts were not accurately recorded on H-T Portable RAWS throughout the dates listed. Therefore, gust observations are not recorded within the above table. The prescribed fire team was aware of this and utilized onsite weather observations to document wind gusts.*

Temperature on June 12th at time of aerial ignition (approximately 1430 hours) was 68 degrees and climbed to 75 degrees by 1559 hours, according to the portable RAWS onsite.

ONSITE WEATHER OBSERVATIONS

	June 09th 1830-1930	June 12th 1300 - 1930
Temperature (°F)	34-40°	65-73°
Relative Humidity (%)	27-32%	9-17%
Wind Speed (mph)	3-8 gusts to 15	5-10 gusts to 15
Wind Direction	Northwest	North, northwest morning becoming southwest at 1430

TOPOGRAPHY AND ASPECT

The elevation of the project area ranges from approximately 6,800 feet to 9,000 feet. All aspects are represented within the project area. Topography is rugged, mountainous terrain that contains steep slopes, rock, and cliffs.

FUELS

The fuels outside the area targeted for ignition vary greatly from those within the targeted area. Target fuels were white fir which has encroached on previously dominant aspen stands. Adjacent fuels consisted of mountain sagebrush, mountain shrub species, grasses, forbs, mountain mahogany, scattered white fir, and transitions to pinyon-juniper with the decrease in elevation.

ONSITE FUEL MOISTURE OBSERVATIONS

Collection Date: June 06, 2012	
Species / Size Class	**Average Percent Moisture**
Sagebrush FM (%)	170.2%
White Fir FM (%)	101.2%
1000 hr FM (%)	13.8%

DISCUSSION

On the SIG-PSA 9 ERC graph above, it should be noted that the RAWS stations that this graph is derived from are located at a much lower elevation than that of the North Schell Prescribed Fire Area. RAWS associated with this graph: Cedar Pass (elevation 7,185); Cattle Camp (elevation 7,300); Pan Cake (elevation 5,200); Current Creek (elevation 5,580); and Coyote Wash (elevation 5,720). Cedar Pass is mentioned in the prescribed fire plan, but it is over 1,000 feet lower in elevation than the project area. This graph is useful in depicting the volatility of the fuels lower in the Muncy Creek drainage where the escaped fire began accelerating at about 7,500 feet and moved down toward the drier valley bottom. However, the onsite fuel moisture samples indicate that conditions were not particularly critical at the project site, which was well over 8,000 feet elevation. Thus ERC values predicted by the available SIG

group cannot be relied upon to reflect conditions on the North Schell project area as weather and fuels status at elevations above 7,500 feet are not accounted for by the existing RAWS network.

Besides the weather conditions required to meet Red Flag criteria, fuels conditions must also be met before the National Weather Service (NWS) issues this warning. The NWS gets this information from the Western Great Basin Coordination Center which collects information from Fuels Specialists throughout the state of Nevada. If fuels are considered to be dry enough to be in "critical status", a Red Flag Warning will be issued when weather criteria are met. If fuels are not in "critical status", aggressive burning—even with the critical weather criteria—is not expected. Thus, the Red Flag Warning will not be issued for those locations.

It is not uncommon during the spring for an elevation limit to be identified that delineates critical fuel conditions occurring below, as lower elevations dry out ahead of higher elevations. It was recognized by local Fire and Fuels Staff and this FLA Team that the conditions onsite of the North Schell Prescribed Fire located above the 8,000-foot elevation were not particularly volatile with brush and grass in full "green-up" condition. In fact, the Western Great Basin Fuels Status page did not indicate that any fuels in Fire Weather Zone 455 were in critical status as of May 10th and only updated the fuel status as critical below 8,500 feet starting on June 27th.

It is assumed that the NWS must have received a verbal confirmation from the Western Great Basin Coordination Center that, in general, fuels throughout the state were in critical status. This would be appropriate if all but the highest elevations across the state were in critical status, but would still be a generalization that does not accurately depict the conditions on these high elevation sites.

ANALYSIS OF PRESCRIBED FIRE PRESCRIPTION AND ASSOCIATED ENVIRONMENTAL PARAMETERS

This table (below) displays the North Schell Prescribed Fire burn plan environmental prescriptions and actual conditions during the first and second ignition periods.

	Allowable Burn Plan Conditions	Test Fire June 09, 2012 1900	Aerial Ignition June 12, 2012 1430
Temperature (°F)	45-85°	38°	68°
Relative Humidity (%)	8-40%	30%	17%
Mid-flame wind speed (mph)	5-25	5-10	3-5
Wind direction	All	Northwest	Variable
1-hr fuel moisture (%)	3-13	8% Unshaded 10% Shaded	3% Unshaded 7% Shaded
10-hr fuel moisture (%)	3-14	Unavailable.	Unavailable
100-hr fuel moisture (%)	5-15	Unavailable.	Unavailable.
1,000-hr fuel moisture (%)	N/A	14	14
Live fuel moisture (%)	80-120+	Sagebrush 170.2 White Fir 101.2 June 06 Observations	Sagebrush 170.2 White Fir 101.2 June 06 Observations
PIG (%)	Any	Shaded 20% Unshaded 30%	Shaded 50% Unshaded 80%
Spotting Distance (miles)	0.1-0.5	n/a	n/a

ANALYSIS OF ACTIONS TAKEN LEADING UP TO THE WILDFIRE DECLARATION FOR CONSISTENCY WITH THE PRESCRIBED FIRE PLAN

The North Schell Prescribed Fire Plan combined planning and operational needs for prescribed fire implementation in units across a large landscape. The plan's appendixes were intended to provide specific unit information within the project. A treatment unit narrative was developed for North Schell units 5-9 (North Schell Prescribed Fire Plan, Appendix 1). The FLA Team found that the information in this narrative was general in nature leaving the Burn Boss significant discretion to adjust actions. However, it also lacked unit-specific analysis, planning and actions that would have been useful to the Burn Boss in anticipating and reacting to potential problems.

The North Schell Prescribed Fire was implemented in Unit 8 according to the plan. The plan required that the test fire be located in a representative location and in an area that could be easily controlled. The decision by implementation personnel to choose the test fire's location was based on vegetation which most represented the project area, and ease of holding the fire. The aerial ignition was carried out according to the plan and within prescription at the "high" end. (See the Analysis of Prescribed Fire Prescription and Associated Environmental Parameters.)

The prescribed fire plan allows for a southwest wind component with spotting potential of up to 0.5 miles within the burn unit and up to 0.75 miles outside the area at critical holding points (element 7 Prescription). Aerial photography shows that the edge of the target stand in Unit 8 is within 0.5 miles of receptive white fir leading into the inaccessible areas of the South Fork Muncy Creek drainage. The Holding Plan identified short-term holding opportunities and activities to hold prescribed fire within the entire project area around units 5-9. The Contingency Plan for these units addresses actions to be taken if the fire crossed—or threatened to cross—the entire project boundary. However, the Contingency Plan did not link with the prescription and Holding Plan to provide information to identify trigger points and actions related to the spotting potential for the area surrounding the specific units, in this case Unit 8. As a result, it did not analyze long-term issues, address actions to be taken or resources needed if spot fires ignited and, in the inaccessible areas of the Muncy Creek drainage, created a long-term management scenario (i.e. identification of water dip sites, initiate indirect holding actions, etc.).

When a spot fire was observed farther down into a slot canyon of the South Fork of Muncy Creek the RXB2 was required to develop a plan on how to manage it with minimum decision support from the plan. Additional personnel were ordered and used to contain and manage the spots as part of extended holding operations. Contingency actions did not take place until June 17th.

Due to safety concerns, the decision was made not to place people down in the area of the spot but instead to monitor it. It appeared that the fire should be held from further growth due to the rocky and sparsely fueled area. During the next two days, attempts were made to check the fire's spread toward Muncy Creek. During this time, the prescribed fire stayed within environmental and fire behavior parameters, and well within the project boundary. It continued to be managed as part of the holding operations.

Once it was determined that the fire was threatening to leave the project area, the Contingency Plan was executed and the declaration of a wildfire was made as prescribed in the plan.

ANALYSIS OF PRESCRIBED FIRE PLAN FOR CONSISTENCY WITH POLICY

The FLA Team reviewed the North Schell National Environmental Policy Act documentation and Prescribed Fire Plan.

The plan was developed as a training assignment by a Prescribed Fire Burn Boss Type 2 trainee (RXB2-T) under the supervision and oversight of a qualified RXB2. These persons also implemented the prescribed fire as the Burn Boss and Trainee.

The team found that the prescribed fire plan was consistent with the objectives in the NEPA decision document as well as with interagency and Forest Service policy requirements.

The prescribed fire Agency Administrator Pre-Approval Checklist was completed before operations began. The Prescribed Fire Go-No Go checklists were completed by required personnel before test fire ignitions began on June 9th and aerial ignitions on June 12th. The Project Aviation Safety Plan was approved by the region at the time that the Aerial Ignition checklist was complete on June 12th.

APPROVING OFFICER'S QUALIFICATIONS, EXPERIENCE, AND INVOLVEMENT

The Approving Officer was the District Ranger, who was qualified to approve prescribed burn plans per FSM 5140, having attended Local Fire Management Leadership training. In addition, he has attended Fire Ecology and Ecosystem Management, R4 Wildland Fire Use Workshop, and S-580 Advanced Wildland Fire Applications training.

Per USFS policy, authority to approve prescribed fire plans resides with the Forest Supervisor who may delegate to District Rangers with appropriate training and qualifications. A letter of delegation is on file for the District Ranger dated April 25, 2011 delegating him this authority.

In addition, the District Ranger has worked as a prescribed fire burn crew member on previous projects on other Forests and was Interdisciplinary Planning Team Leader on several prescribed fire projects prior to becoming a District Ranger.

He was heavily involved in the public scoping of the NEPA analysis and worked diligently to build support for the project within the community. He was at the burn site for the test fire on June 9th and the aerial ignition on June 12th. After ignition on the 12th, his involvement was limited to periodic briefing from staff up until he had to confer with staff on consideration of a wildfire declaration, starting the evening of June 16th.

QUALIFICATIONS OF KEY PERSONNEL INVOLVED

The FLA Team found that all personnel involved in the North Schell Prescribed Fire were qualified for the positions held during implementation.

The burn plan preparer and technical reviewers were qualified at the RXB2 level, commensurate with the "Moderate" complexity level of the prescribed fire.

SUMMARY OF FACTORS CONTRIBUTING TO THE WILDFIRE DECLARATION

- Scheduling: burning close to seasonal thresholds and in advance of quickly worsening weather (becoming hotter/drier).
- Wind speed and direction relative to long-range spotting potential in conifer fuels and receptive dead/downed fuels downwind.
- Spotting into inaccessible terrain which prevented firefighters from taking control actions.
- Prescribed fire plan found to be of limited use for dealing with prescribed fire executed over the course of several days or even weeks. The plan did not provide for Management Action Points (MAPS) useful in guiding actions in response to long-range spot fires into inaccessible areas or for continual update of project complexity and associated management and resource needs as events unfolded.

APPENDIX C. HUMAN PERFORMANCE CONCEPTS

The following are definitions and/or additional information regarding concepts or key points presented in "The Story" or "Lessons Learned Analysis" sections of this document.

Anchoring Effect

"Anchoring" or "focalism" is a cognitive bias that describes the common human tendency to rely too heavily, or "anchor," on one trait or piece of information when making decisions.

During normal decision making, anchoring occurs when individuals overly rely on a specific piece of information to govern their thought-process. Once the anchor is set, there is a bias toward adjusting or interpreting other information to reflect the "anchored" information. Through this cognitive bias, the first information learned about a subject (or, more generally, information learned at an early age) can affect future decision making and information analysis.

For example, as a person looks to buy a used car, he or she may focus excessively on the odometer reading and model year of the car, and use those criteria as a basis for evaluating the value of the car, rather than considering how well the engine or the transmission is maintained.

McRaney, David. 2011. You Are Not So Smart, http://youarenotsosmart.com/the-book/
Ariely, Dan. 2008. Predictably Irrational the Hidden Forces That Shape Our Decisions, HarperCollins. http://danariely.com/

Confirmation Bias

"Confirmation Bias" is the tendency of people to favor information that confirms their beliefs or hypotheses. People display this bias when they gather or remember information selectively, or when they interpret this information in a biased way.

The effect is stronger for emotionally charged issues and for deeply entrenched beliefs.

A series of experiments in the 1960s suggested that people are biased toward confirming their existing beliefs. Later work re-interpreted these results as a tendency to test ideas in a one-sided way, focusing on one possibility and ignoring alternatives. In certain situations, this tendency can bias people's conclusions. Explanations for the observed biases include wishful thinking and the limited human capacity to process information. Another explanation is that people show confirmation bias because they are weighing up the costs of being wrong, rather than investigating in a neutral, scientific way.

Confirmation biases contribute to overconfidence in personal beliefs and can maintain or strengthen beliefs in the face of contrary evidence. Poor decisions due to these biases have been found in military, political, and organizational contexts.

Montier, James. 2002. Behavioural Finance: Insights Into Irrational Minds and Market, John Wiley and Sons.
Ariely, Dan. 2008. Predictably Irrational the Hidden Forces That Shape Our Decisions, HarperCollins.
Schwind, C., and Buder, J. (in press). Reducing confirmation bias and evaluation bias: When are preference-inconsistent recommendations effective – and when not? Computers in Human Behavior.

The "Gap"

The term "gap" represents the difference between work as imagined by leadership and work as performed by the practitioner.

Leaders give their intent; practitioners interpret the intent and carry out the work. A gap between intent and implementation will always be present. The magnitude or specific details of the gap are important when determining the significance of the outcomes that may result from the gap.

In practice, there are several reasons or conditions that contribute to the magnitude of the gap:

- Administrators are very busy and must bounce between several high priority items.
- Administrators are usually not highly knowledgeable in technical aspects of how work is accomplished.
- Administrators are often more than happy to delegate management or oversight to subject matter "experts." This can result in not being fully aware of the hazards and risks associated with the strategy and tactics being employed.

We accept that the "gap" is tolerable due to positive reinforcement of repeated acceptable outcomes. When managers are uninformed as to the workers methods, they reward the workers who produce results assuming that they were performed in an acceptable manner. Only when the outcome is unacceptable to the manager is there an examination of why the gap was tolerated.

Dekker, S. (2006). Resilience engineering: Chronicling the emergence of confused consensus. In E. Hollnagel, D. D. Woods and N. Leveson (Eds.), Resilience engineering: Concepts and precepts. Hampshire: Ashgate. http://www.ashgate.com/default.aspx?page=583

David Woods, Cook Richard 1999 The New Look at Error, Safety and Failure A Primer for Health Care

Efficiency-Thoroughness Trade-Off

The "ETTO Principle" reflects the common trait that people in their work naturally adjust what they do to match the conditions - to what has happened, to what happens, and to what may happen. It proposes that it is normal for people in work situations to adjust their performance by means of an efficiency-thoroughness trade-off (ETTO) - usually by sacrificing thoroughness for efficiency. The trade-off can be due to a lack of time, lack of resources, work and company pressures, lack of information, etc. The ability of people mutually to adjust their performance is the reason why things go right. Yet in some cases the adjustments may combine in an unforeseen way and lead to adverse outcomes. These outcomes are nevertheless due to the very same processes that produce successes, rather than to errors and malfunctions. The ETTO Principle precludes the need for specialized theories and models of failure and 'human error' and offers instead a viable basis for more effective and just approaches to both reactive and proactive safety management.

Hollnagel, E., 2009. The ETTO Principle: Efficiency-Thoroughness Trade-Off. Ashgate. http://www.ashgate.com/default.aspx?page=637andcalcTitle=1andtitle_id=8666andedition_id=12000

Woods, D. D. and Branlat, M. (2010a). How Adaptive Systems Fail. In E. Hollnagel, Paries, J., Woods, D.D., and Wreathall, J., Eds., Resilience Engineering in Practice. Ashgate, Aldershot, UK, pp. 127-143.

Optimism Bias

"Optimism bias" (also known as unrealistic or comparative optimism) is a bias that causes a person to believe that they are less at risk of experiencing a negative event compared to others. There are four factors that cause a person to be optimistically biased: their desired end state, their cognitive mechanisms, the information they have about themselves versus others, and overall mood. The optimistic bias is seen in a number of situations, including people believing that they are less at risk of being a crime victim, smokers believing that they are less likely to contract lung cancer or disease than other smokers, and first-time bungee jumpers believing that they are less at risk of an injury than other jumpers. Although the optimism bias occurs for both positive events, such as believing oneself to be more financially successful than others and negative events, such as being less likely to have a drinking problem, there is more research and evidence suggesting that the bias is stronger for negative events. However, different consequences result from these two types of events: positive events often lead to feelings of well-being and self-esteem, while negative events lead to consequences involving more risk, such as engaging in risky behaviors and not taking precautionary measures for safety.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. Journal of Personality and Social Psychology, 39, 806-820.

Weinstein, N.D. (1984). Why it won't happen to me: perceptions of risk factors and susceptibility. Health Psychology, 3, 431-457.

Weinstein, N. D. (1989). Optimistic biases about personal risks. Science, 246, 1232-1233.

Weinstein, N.D. and Klein. (1996). Unrealistic optimism: present and future. Journal of Social and Clinical Psychology, 15, 1-8.

Sensemaking

"Sensemaking" is about how people make sense of situations. When faced with problems, people construct meaning. The meaning of a situation is both created and interpreted through sensemaking.

"Sensemaking" refers to how we select events in the world to pay attention to and how we use language to name those events. According to Karl Weick, who popularized the term "sensemaking" in organizations, as humans we cannot possibly cope with all of the data and information that the world is throwing at us at a given moment. Instead, we use past experiences, our values, our perceptions of risks and consequences to select and to name what seems important about the present.

In addition to explaining sensemaking, Weick notes that in organizations, ambiguity and uncertainty are two occasions that give rise to sensemaking. In situations of ambiguity the sensemaker is faced with multiple options; whereas, in situations of uncertainty the sensemaker lacks bases of interpretation. Sensemaking refers to finding meaning in small cues, discovering coherence among meanings, and checking with others to confirm or disconfirm hunches. Sensemaking is driven by both beliefs and actions. People see what they believe, and those beliefs become the basis for action.

One objection people have raised to the idea of "sensemaking" is that it can sound like we can just decide in our minds what reality is. Weick says that the world does indeed present us with "brute facts." In this incident, one of those undeniable brute facts involves the long-distance spot fires down-canyon/downwind from the main burn.

Weick Karl E. 1995 Sensemaking in Organizations