North II Prescribed Fire Conversion Review

June 18th, 2021

Region 6, Fremont - Winema National Forest

Table of Contents

Executive Summary

The Fremont-Winema National Forest, Chiloquin Ranger District, in Klamath County, Oregon planned on burning 3,278 acres in the North II project area over 2 days. They began blacklining operations on May 4th, 2021. The primary fuels within the units were grass, shrubs, and timber litter. The objectives were primarily hazardous fuels reduction in the wildland urban interface. Prep work was completed to reduce fuels in certain areas to protect values at risk, as well as some prep work along unit boundaries.

Ignitions were initiated on May 4th, with a goal to blackline the unit in preparation for aerial ignition on May 5th. On the afternoon of May 4th, several spot fires were detected and worked by holding forces. In the late afternoon/early evening, a slopover occurred and became established in another unit that was scheduled to be burned at a later date. The slopover was worked through the evening of May 4th, with a plan to complete containment on May 5th, then continue with prescribed fire operations and aerial ignition.

On the morning of May 5th, two holding groups were identified, one to work on the large slopover, and another to monitor the blacklining operation from the previous day. By noon it was determined that the objectives of the burn were not being met, and that more resources would be needed to contain the slopover before a predicted frontal passage on the evening of May 6th. At 1223 the North II Prescribed Burn was declared a wildfire, became the Meadow Fire, and was contained at 832 acres on May 12th, with no fire growth mapped after May 5th.

Per policy, the Fremont-Winema National Forest assembled a review team to learn from this event, provide recommendations to help prevent future escaped prescribed burns, and provide feedback to the Forest's fuels program to improve prescribed fire planning and implementation.

The members of the review team included:

- Ben Curtis – Fire Management Planning Specialist, FBAN, LTAN, RO – R6, Review Team Leader
- Barry Kleckler – Fire Planner, RXB2, FBAN(t), Ochoco NF and Prineville BLM
- Brett Brown – Fire Planner, RXB2, Rogue River – Siskiyou NF
- Brett Smith – Fire Planner, FBAN, Fremont – Winema NF and Lakeview BLM
- Matt Haskins – Fuels Specialist, RXB2, Lakeview BLM
- Travis Baker – Fuels AFMO, RXB2, RXB1(t), Fremont Winema NF

The Interagency Prescribed Fire Planning and Implementation Procedures Guide directs the following items be analyzed during any Declared Wildfire Review:

- An analysis of the seasonal severity, weather events, and on-site conditions leading up to the wildfire declaration.
- An analysis of the prescribed fire plan for consistency with agency policy and guidance related to prescribed fire planning and implementation.
- An analysis of prescribed fire implementation for consistency with the prescription, actions, and procedures in the prescribed fire plan.
- The approving agency administrator's qualifications, experience, and involvement.
- The qualifications and experience of key personnel involved.

Background

The Fremont-Winema NF is currently implementing a strategy to increase the pace and scale of landscape restoration. Prescribed fire use has increased on the Chiloquin Ranger District, going from an average of 480 acres per year of prescribed fire underburning 10 years ago, to successfully completing more than 780 acres per year in the last 5 years.

The forest received Joint Chief's funding for the North II project in 2019, and had already completed approximately 2,500 acres of prescribed fire in the project area.

Project Location

The project area is located on the Chiloquin Ranger District of the Fremont-Winema National Forest, northeast of the community of Chiloquin Oregon within Region 6 of the USDA Forest Service. This project was designed to address the intents of the *Cohesive Strategy* and the Healthy Forest Restoration Act (HFRA) by reducing hazardous fuel levels on National Forest lands near the town of Chiloquin and in the Sprague River Valley Community in Klamath County. Both Chiloquin and the Sprague River Valley were identified as communities at risk in the *Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk from Wildfire.*

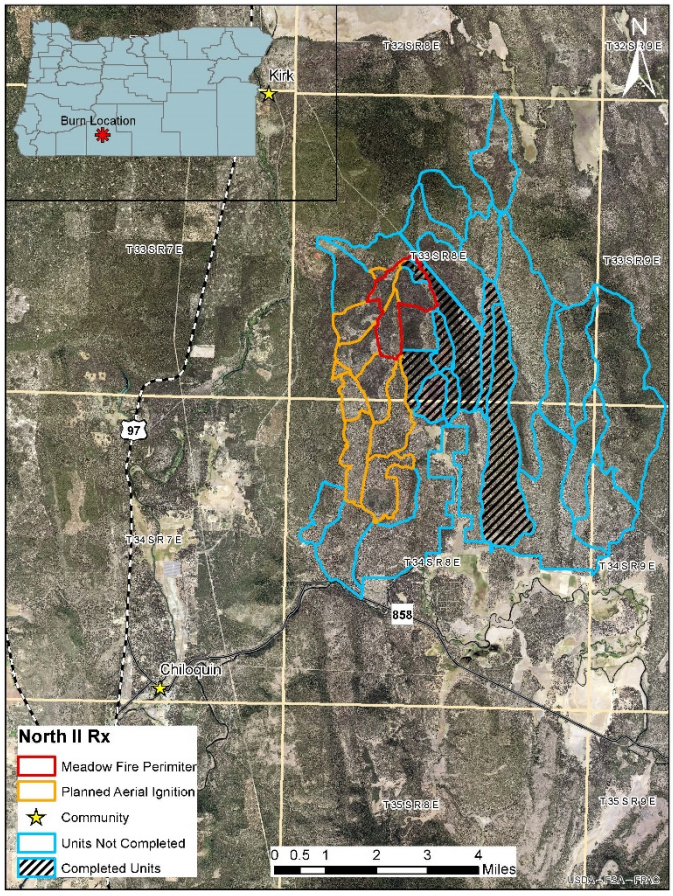

Figure 1. Project Vicinity Map

The Ninemile North WUI Fuel Reduction project area resides approximately 13 miles northwest of the town of Sprague River and 5 miles to the northeast of Chiloquin. The city of Chiloquin, located in south central Oregon, is about 20 miles north of Klamath Falls and boasts a population of approximately 755 individuals; however, the community itself covers a much larger outlying area where approximately 3,000 or more residents live. Chiloquin sits at an altitude of 4,178 feet and is nestled into a small valley on the eastern front of the Cascade mountain range along the Williamson River. The Project area lies just north of the confluence of the Williamson and Sprague Rivers. Chiloquin Ranger District can be characterized as having a high desert climate and a vegetation type consisting of primarily ponderosa pine stands intermixed with stands of pure lodgepole, and mixed conifer stands containing white fir, ponderosa pine, lodgepole pine, and sugar pine.

Project Details

The North II prescribed fire project falls under the umbrella of the Ninemile North WUI Fuel Reduction Project which also included commercial and non-commercial thinning, mechanical and manual brush reduction treatments and hand piling. The prescribed fire project could be described as the final piece of the overall fuel reduction project as the mechanical and hand treatments have been completed. Prescribed fire is being utilized to finish reducing overall fuel loading and ladder fuels to reduce wildfire hazard to the Sprague River Valley Community, reduce excess vegetation to increase the health and vigor of remaining trees, and improve the quantity and quality of mule deer forage through regeneration of decadent bitterbrush.

The North II prescribed fire project consists of approximately 24,000 acres, of which 17,353 acres are classified as Wildland Urban Interface (WUI) due to proximity to essential infrastructure and private land as identified by the local fire protection district. Private lands exist directly adjacent to the project on the south end and within .5 to 2 miles on all sides. The project is broken into 27 primary burn units ranging in size from 41 acres to more than 2,500 acres. Units are bounded mainly by existing roads and can be broken into subunits by utilizing other existing roads, skid trails, natural barriers, and manmade control features such as dozer and handline. Multiple burn units have previously been accomplished during the 2018 and 2019 seasons, mostly along the east side of the project area. Topography within the project is characterized as gradual with only minor elevation changes of +-500' and slopes ranging from flat to 15% with a few isolated slopes reaching up to 25%.

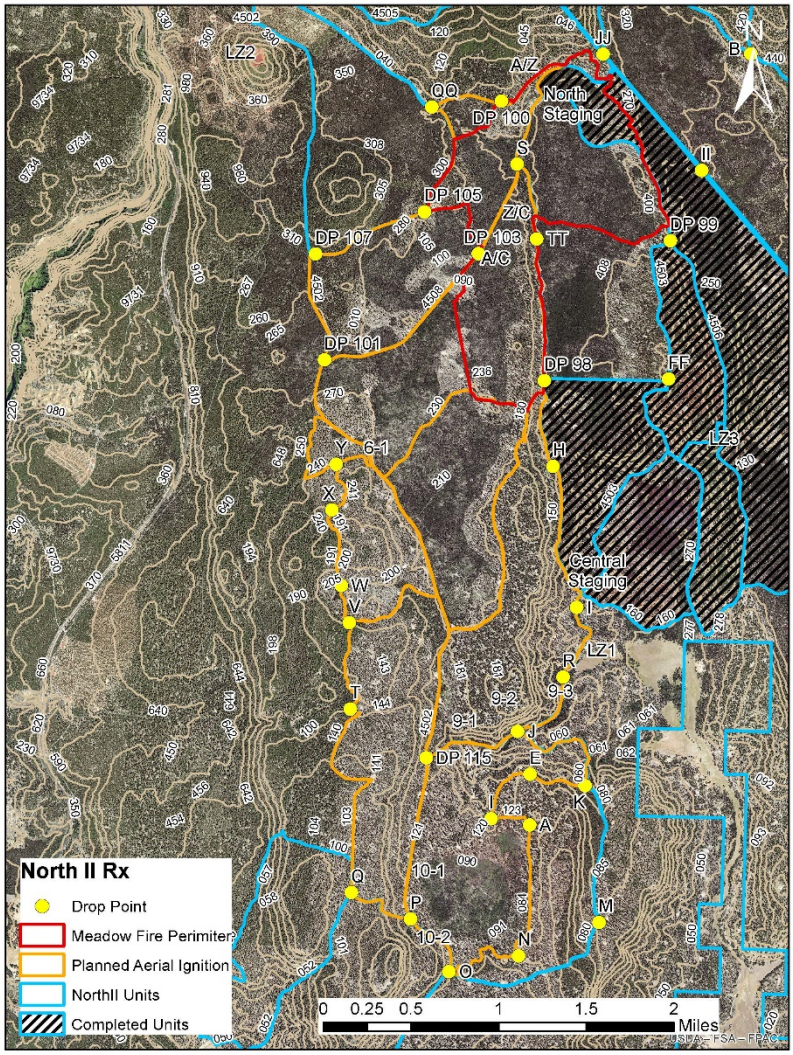

Figure 2. North II - Operations Map

Vegetation type and stand structure across the project area can be characterized as predominantly open single storied stands of

ponderosa pine with a bitterbrush and sagebrush understory interspersed with multi-storied stands of thick lodgepole pine and aspen. Surface fuels consist of long needle pine littler, remaining activity fuels, brush, and pockets of heavier dead and down material primarily in the lodgepole stands.

Figure 3. Open pine stand with mechanical treatment (left) in contrast to untreated pine with lodgepole understory (right).

Social/Political Concerns

Private lands directly adjacent to the project area present some concern in the event that the prescribed fire burns on to them, however; support of prescribed burning by adjacent landowners could be characterized as generally favorable.

Smoke management concerns exist due to the proximity of the Klamath Falls SSRA which lies approximately 20 miles to the south of the project area and is classified as a Non-Attainment Area. The Class 1 airsheds of Crater Lake National Park, Sky Lakes Wilderness, and Mountain Lakes Wilderness must also be considered for this project due to their relative proximity to the burn. The communities of Sprague River and Chiloquin, while not identified SSRA's, must also be considered as smoke impacts to these areas are likely. In general, the public does not welcome prescribed fire smoke but understands that burning under favorable conditions is preferrable to smoke from a wildfire.

The project area is on former reservation land of the Klamath Tribes. The tribes highly value the natural resources within the burn area and numerous Native American heritage sites exist within its boundaries that must be protected. Other cultural sites unrelated to the tribes exist within the project area and must be protected as well.

Last year's (September, 2020) Two Four Two Fire, located less than 5 miles from the project area, burned into the communities of Chiloquin and Fort Klamath causing evacuations and significant damage to infrastructure and natural resources as well as long term smoke impacts. The community is even more aware of the need for prescribed fire and fuel treatments after the fire but concerns with fire and smoke are still high.

Goals/Objectives of the Project

The treatment objectives in ponderosa pine communities were to move existing stand conditions towards single-story, open, park-like conditions, once common but are now lacking, and to reduce susceptibility to large scale, stand replacing wildfires. The overall goal was to reintroduce fire to a fire adapted ecosystem for the benefits of reducing natural and activity generated fuel accumulations, encourage a more natural/historic fire regime, and create forage heterogeneity for wildlife benefit. The resource and prescribed fire objectives from the plan are listed below.

Resource Objectives

- Reduce hazardous fuel loadings and continuity of surface fuels which will decrease the potential for stand replacing wildfires.
- Introduce prescribed fire into the unit in such a manner that it creates a mosaic of burned and unburned fuel which will increase forage heterogeneity for wildlife and decrease the continuity of hazardous surface fuels.
- Ensure test plot of aspen stand is burned with desired effects to promote new growth.
- Keep fire out of the lined section of aspen.
- Keep fire out of lined Archaeological sites.

Prescribed fire objectives

- Reduce fuel loadings within the 0-3" diameter size classes by 40% to 80% immediately post burn.
- Reduce fuel loadings within the 3"- 6" diameter size class by 20% to 40%
- Retain as much large down woody material (8" and larger) as feasible at the highest prescription range
- Retain existing large diameter snags (>18" DBH) regardless of species type

- Reduce ladder fuels in areas where they are a threat to large diameter trees.
- Limit mortality of all live trees (>21" DBH) to less than 6% after 1-year post burn.
- Reduce overstocking of understory trees <12"DBH by 50% in all species except aspen.

Chronology of Events

The chronology of events leading up to the wildfire declaration on May 5th, 2021 was established from notes taken by key personnel, dispatch logs, and during the site visit on June 3rd , 2021. Times should be considered approximate.

May 2

- Decision is made to prepare for and initiate prescribed fire in the North II project area. Notifications made by zone FMO and RXB2.

May 3

- All key prescribed fire organization members along with multiple local resources are on scene at the project area. Identification of Areas to Protect (ATP) and preparation for next-day ignitions commences through the day.
- Some members of the prescribed fire organization observed the burn unit and surrounding area for first time this day.
- Holding concerns were communicated and discussed with prescribed fire organization – decision is made to initiate some additional mechanical preparations the following morning prior to ignitions.

May 4

1030 Resources identified in daily incident action plan (IAP) are on scene.

1115 Operational briefing commences.

1145 Go/No-Go document is completed by phone with RXB2, RXB2 (t), and Agency Administrator.

Firing Boss (FIRB) and Holding Boss (HOLD) conduct operational breakout sessions. The previously discussed firing plan changes around this time. Decision is made to utilize three firing groups instead of one. Changes in firing plan are communicated with HOLD and adjustments made. Test fire timing is delayed slightly to accommodate redistribution of holding resources.

1230 Test fire is initiated near point Delta (DP 98 on map).

1250 Test fire is determined to be meeting objectives and ignitions continue with three groups along east boundary of unit.

1300 Continuing ignitions, favorable conditions, no holding issues noted.

1500 Ignitions continue to progress north and encounter a significant fuel change (open ponderosa changes to denser mixed conifer with lodgepole) near point "TT", ignitions slow and consolidate into one burn group. A few small spot fires across control lines to the east are discovered and easily controlled.

1645 Intermittent torching and “pulsing” fire behavior is observed between points TT and Sierra. Multiple spot fires across containment lines to the east of burn unit occur. Holding resources are able to control the spot fires with moderate to high efforts and time commitment. Ignition operations are paused.

1725 No new spot fires had been discovered for 15-20 minutes and ignitions slowly continue north from point Sierra.

1735 Fire is reported to be advancing towards eastern control lines in a “pulsing” manner, multiple spot fires develop across control lines to the east and slopover occurs just north of point Sierra.

1755 Holding resources are not able to effectively control spot fires and return to control lines.

1810 RXB2, with FIRB/HOLD concurrence, activates alternate plan to construct dozer line from point TT east to point Charlie (DP 99 on map). FIRB is transitioned to Dozer Operator and another fully qualified individual assumes the role of FIRB. No further RX ignitions are planned for the day, all resources focus on direct/indirect holding operations.

2230 Indirect line is complete from TT to C (DP 99 on map). Fire behavior has moderated. South side of slopover has been effectively contained, east side is contained by road systems. North side of slopover has indirect roads in the area, no direct action is taken on north side of slopover at this time.

2400 All resources released and off the unit.

May 5

0730 Resources arrive on scene and observe minimal fire growth overnight. Operational briefing takes place with two holding bosses (east/west) developing holding plan. Holding resources are assigned all around the unit. Holding plans include many options including direct and indirect suppression strategies and potential for incorporation of slopover utilizing prescribed fire ignitions.

0900 Fire behavior is observed to be increasing with occasional single tree torching and short-range spotting.

1000 Holding resources note significant increase in frequency of torching, spot ignitions, and spotting distance.

1054 Zone FMO and Unit Aviation Officer (UAO) are on helicopter reconnaissance flight of project area.

1123 After reconnaissance flight, Zone FMO and UAO have multiple phone calls with forest fire management and leadership to discuss needed resources for fire containment, probability of success, and potential for wildfire declaration.

1200 Forest fire management and leadership contact Regional fire management and leadership to advise of the developing situation. Wildfire declaration and suppression is agreed upon as an appropriate course of action.

1223 The North II prescribed fire is declared a wildfire and named the Meadow Fire.

Review Item 1 - An analysis of the seasonal severity, weather events, and on-site conditions leading up to the wildfire declaration.

The winter/spring of 2021 has been very dry throughout much of Oregon, with south-central Oregon being exceptionally dry. Accumulated precipitation in the Klamath Basin for January through April has ranked at or near the bottom 10% observed since records began in 1895.

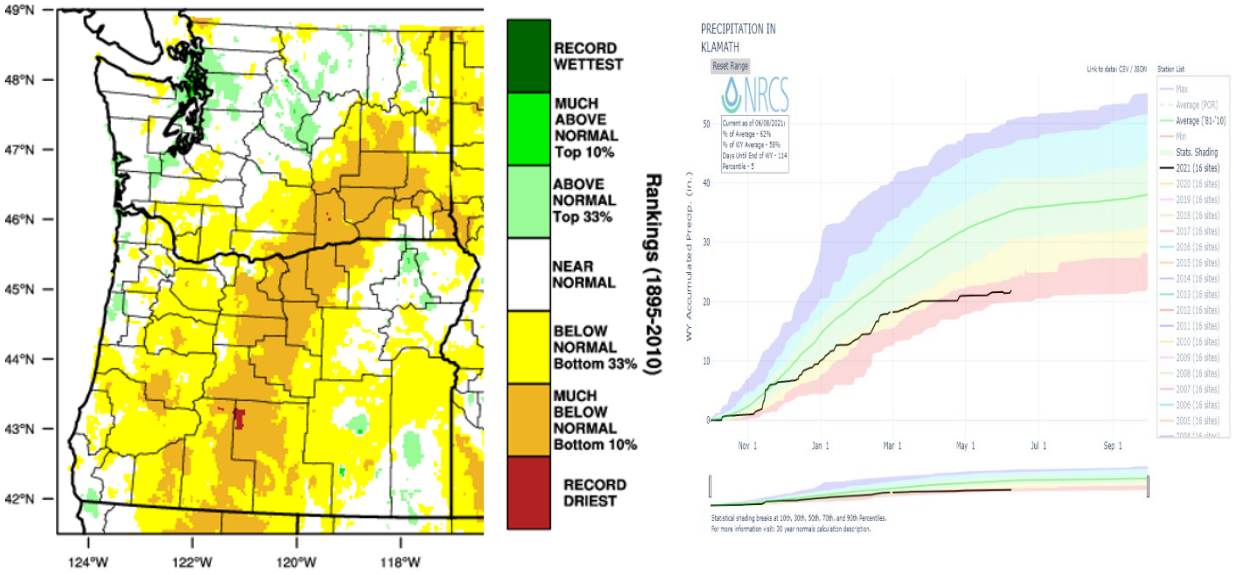

Figure 4. Left: mapped precipitation percentiles for the PNW Jan-April 2021. Right: Precipitation received since Oct 1, 2020 compared to average in the Klamath Basin.

With the low accumulated precipitation to begin the year following a much below average water year for 2020, the Governor of Oregon signed a Drought Declaration for Klamath County on March 31st. Drought was declared in neighboring Lake County on April 26th. The US Drought Monitor classified the entire area as being in extreme to exceptional drought on its April 27th map of Oregon.

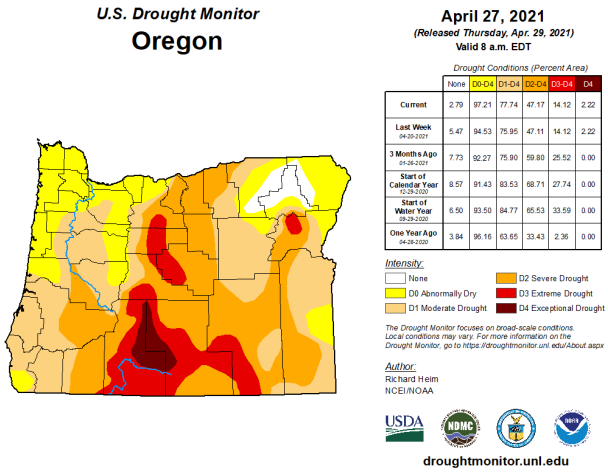

Figure 5. Drought Monitor - Showing Oregon as of 4/27/2021

Though the winter snowpack was near normal for the upper elevations of the Klamath Basin, a warmer than average April led to early snowmelt. In early April, firefighters in the area noted that pre-greenup fuel conditions were similar to what they had experienced the previous fall. Prescribed fire operations took place throughout April on the Fremont-Winema NF, along with the 1,600 acre wind-driven Ponina Fire, which burned within 30 miles and in similar fuel types at 4,500 ft elevation on April 18th. While some prescribed fire units nearby and in similar fuel

types experienced holding issues, in general, prescribed fires were ongoing throughout south-central and central Oregon into early May.

In the last week of April, fire managers for the Mazama Zone (Chiloquin and Chemult Ranger Districts) started making plans for implementation on one of two units the following week, either the LoMi or North II projects, based on forecasts for wind direction.

Daily Spot Weather Forecast requests for the prescribed fire area began on Friday, April 30th, anticipating an ignition date of Monday, May 3rd. Primarily the forecast for Tuesday, May 4th stayed static - forecasting temperatures in the high 60's, relative humidity in the mid-teens and light winds generally from the north. However, the extended forecasts shifted from high winds with a chance of precipitation Thursday through the end of the week to eventually forecasting a dry cold front passage late Wednesday through Thursday.

The humidity forecasted to be under 20% for the day of the burn is accounted for in the "High Fire Intensity" Prescription Range, though this just accounts for RH < 20% but does not specify a low acceptable RH.

	Acceptable Prescription Range			outside area at critical holding point
	Low Fire Intensity	Desired Fire Intensity	High Fire Intensity	minimum acceptable moisture
Temperature (°F)	<50	70	80	
Relative humidity (%)	>40%	25%	<20%	
Mid-flame wind speed (mph)*	0-8	2-6	0-10	
Wind direction (azimuth°)	Primarily a westerly component will be needed to keep smoke out of SS areas.			
1 hour fuel moisture (%)	>10%	6	4%	4
10 hour fuel moisture (%)	>12%	8	<6%	5
100 hr. fuel moisture (%)	>13%	10	<11%	8

*Average mid flame wind speed will be a two minute average and will include the effects of gusts.

Figure 6. Acceptable Prescription Range from North II Burn Plan

On-site weather observations were taken the day of the prescribed fire (5/4). Humidity's on the day of ignitions never reached the low levels predicted in the Spot Forecast. Holding resources described changing winds along the perimeter higher than "light and variable" and attribute this to more open stand conditions than where the weather was being taken in the shade.

On-Site Weather Observation for 5/4/2021										
Time	1200	1230	1300	1400	1500	1600	1700	1800	2130	2200
Temp	55	60	66	66	71	71	70	69	53	48
RH	47	37	26	23	20	23	23	26	50	63
Winds	Light/Variable	Light/Variable	Light/Variable	Light/Variable	Light/Variable	Light/Variable	Light/Variable	Light/Variable	Light/Variable	Light/Variable
Find Dead FM	8	6	6	6	6	7	8	9		
POI	40%	50%	50%	50%	50%	40%	40%	30%		
Weather observations were taken around the burn site throughout the day by on-site FEMO.										

Table 1. On-site weather observations 5/4/2021

Fuel moistures were monitored leading up to the burn from an established site on the Chemult Ranger District and by utilizing Calimus RAWS as specified in the Burn Plan. The Burn Boss stated that 10 and 100 hr fuel moistures were being estimated by adding a couple of percentage points to the fine dead calculations. Fine dead fuel moistures measured the day of the burn would result in an estimate of 10 hr – 8% and 100 hr – 10% correlating within the "Desired Fire Intensity" prescription range.

The prescribed fire location is located at approximately 4600' elevation. The Calimus RAWS is located approximately 9.5 miles to the southeast of this area at an elevation of 6629'. Based on elevation, Fire Managers had retained the Snow Flag setting for the Calimus RAWS until May 1st affecting modeled dead fuel moisture. In contrast, the Chiloquin RAWs is located approximately 11 miles to the southwest, at an elevation of 4420', and fire managers turned off the snow flag in March. The following table shows a comparison of modeled dead fuel moisture using the Chiloquin vs Calimus RAWS.

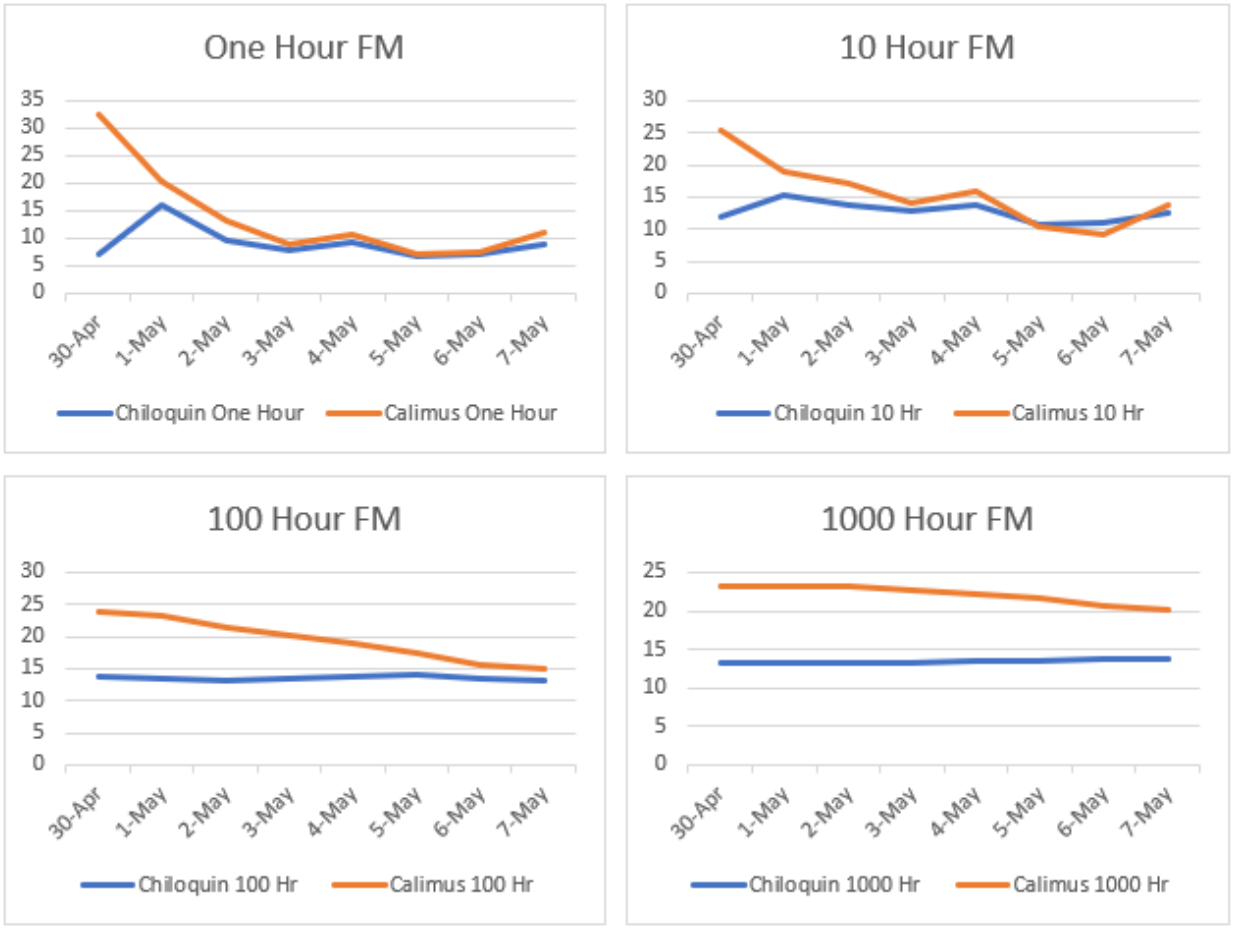

Figure 7. Fuel Moisture Comparison between Calimus and Chiloquin RAWS. Note the wide range in 100hr and 1000hr FM.

The prescribed fire occurred prior to green-up with no live fuel moistures being measured on-site.

Review Item 2 - An analysis of the prescribed fire plan for consistency with agency policy and guidance related to prescribed fire planning and implementation.

The burn plan was reviewed to determine consistency with the PMS 484. All elements were addressed in the plan, however, some elements did not meet guidance in the PMS 484.

- Element 1: The burn plan was amended from the initial document, but no signed and dated amendments were attached to the prescribed fire plan (PMS 484 page 18)
- Element 2b: Preliminary Question A was marked "No" in the Field Copy of the Burn Plan, but as noted above, the April 17, 2021 Drought Map indicated that the area is experiencing exceptional drought conditions and was noted in local drought declarations.
- Element 6: Total cost is not estimated (PMS 484 page 23)
- Elements 15, 16, & 17: Does not note site specific plan information for each unit (PMS 484 page 18: "A Programmatic Moderate/High Complexity Plan (may be known as a Multiple Unit Plan) is used for prescribed fire projects with multiple ignition units that can be ignited separately or concurrently. Each unit has site-specific information developed for applicable plan elements such as ignition, holding, and contingency prior to technical review and approval").

Review Item 3 - An analysis of prescribed fire implementation for consistency with the prescription, actions, and procedures in the prescribed fire plan.

A review of the burn plan was done by the declared wildfire review team and the prescription, actions, and procedures outlined in the plan were compared with available documentation from the operational periods leading up to the declaration and the narratives given by the RXB2, RXB2(t), DAFMO, Holding boss, and FIRB during the site visit the team underwent on June 3rd.

Prescription

Both environmental and fire behavior prescriptions are used in the burn plan and the prescriptions are divided by low, desired, and high prescription ranges. Timing of the burn is dependent on the environmental prescription being met, preferably in the spring or fall, but with no hard seasonality restriction outside of limited operating periods when burning within restriction distances for raptor nests. The prescriptions from the burn plan are shown below.

Environmental

The following prescription defines the upper, lower, and desired ranges for weather and fuels parameters that will meet objectives while maintaining control of the burn. The Calimus RAWS station (and potentially a mobile RAWS station on-site) will be used to assist management to determine when local fuels and weather parameters are within prescription. All burning will be conducted within the

following weather and fuel conditions:

	Acceptable Prescription Range			outside area at critical holding point
	Low Fire Intensity	Desired Fire Intensity	High Fire Intensity	minimum acceptable moisture
Temperature (°F)	<50	70	80	
Relative humidity (%)	>40%	25%	<20%	
Mid-flame wind speed (mph)*	0-8	2-6	0-10	
Wind direction (azimuth°)	Primarily a westerly component will be needed to keep smoke out of SS areas.			
1 hour fuel moisture (%)	>10%	6	4%	**4**
10 hour fuel moisture (%)	>12%	8	<6%	**5**
100 hr. fuel moisture (%)	>13%	10	<11%	**8**

*Average mid flame wind speed will be a two minute average and will include the effects of gusts.

Figure 8. Acceptable Prescription Range from Prescribed Fire Plan

Fire Behavior

The Fire Behavior Prescription defines the desired fire behavior based on modeled results. Modeled results can be found in Appendix E. Actual fire behavior will deviate from the modeled results in small areas throughout the project area and is acceptable within the environmental conditions listed previously. Significant or consistent deviation from the modeled results is not within prescription.

Figure 9. Acceptable Fire Behavior Conditions from Prescribed Fire Plan

GS2 fuel model	Acceptable Fire Behavior Conditions			Outside area at critical holding points(high)
	Low fire intensity	Desired fire intensity	High fire intensity	
Spotting Distances (miles)	0 to 0.1	0.1 to 0.2	0.1 to 0.2	
Rate of spread (chains/hour)	.4	3.8	6.7	7
Flame length (feet)	.5	3	7	8
Probability of Mortality--% **	>6%	>6%	>6%	

** Tree mortality as predicted by the Behave Plus modeling program is often over-predicted. Despite this, modelled and expected mortality probabilities are near 6% for PINPON in the 12"dbh size class for the highest prescription ranges. Probability of mortality drops below 5% for larger (21" DBH) trees. If wind reaches 6 mph and 1 hour fuel is 5 or less a significant increase in tree mortality will occur. If weather parameters are approaching these conditions reevaluate and consider terminating the burn.

- Element 2B: Go/No-Go checklist was filled out the day of the burn, but the box was checked for conditions in or adjacent to the ignition unit have not changed. This year the project area was in an extreme drought condition and this was not addressed during the Go/No-Go decision.
- The environmental prescription states under wind direction that "Primarily a westerly component will be needed to keep smoke out of SS areas". The spot weather for the day of the burn was calling for north transport winds. However, consultation with ODF smoke management was occurring and the planned tonnage was likely light enough to not have influenced smoke sensitive areas had the burn gone as planned.
- The burn was conducted during the timeframe outlined in element 8.

- All pre-burn considerations were completed prior to ignition. Control lines were completed and prepped adequate to what the burn boss wanted; however, noted concerns from holding about line location and the quality of prep that was done in certain areas were not addressed beyond the burn boss being comfortable with the way they were.
- Notifications as outlined in the plan were made.
- Resources were briefed prior to ignitions. However, immediately after briefing, plans changed and required resources to re-configure and additional consultation between ignitions and holding to occur.
- More than the required minimum organization outlined in the plan were onsite during burn day.
- The ignition and holding plans were followed as outlined in the burn plan.
- Contingency resources identified in the plan were contacted but none responded within the 1hr timeframe identified in the burn plan. Contingency resources from ODF showed up the next day. As well, the Chiloquin Rural Fire Department that was listed as a contingency resource does not have an agreement that allows them to participate in Rx Fire. Other contingency resources were listed as on-site and those were utilized.
- The burn was declared a wildfire after consultation between the DFMO, Fire Staff, Agency Administrator/District Ranger, UAO, and SORO and was independent of the Burn Boss. Element 18 of the plan states that the Burn Boss will be the one to declare the Rx fire a wildfire after communication and concurrence with the DFMO, Forest FMO, District Ranger, Agency Administrator, and Lakeview dispatch. The Burn Boss had reached out to the FMO indicating that he needed some "management support", but never indicated that he was declaring the burn a wildfire, after which the decision was made independent of RXB2.

Figure 10. Area where slopover occurred.

- Smoke management procedures were followed and coordination with ODF Smoke Management occurred prior to and during the burn.
- Element 20 of the burn plan states that "observed fuel moistures will be documented in the project documentation folder". The environmental prescription is based on 1hr, 10hr, and 100hr fuels which were not adequately monitored or documented prior to burning. Fine dead fuel moisture was calculated on burn day but only the shaded fuel moisture was recorded. No unshaded fine dead, 10hr, or 100hr, fuel moistures were recorded prior to or during burning. Analysis of fine dead fuel moistures, based on weather observations from the day of the burn, put unshaded fuel moistures at 3% which falls outside the environmental prescription range.

Review Item 4 - The approving agency administrator's qualifications, experience, and involvement.

Approving Agency Administrator: The District Ranger, the Agency Administrator who approved the prescribed burn plan for the North II Prescribed Fire Project, was found to have the required qualifications, experience, and authority to approve burn plans at the Moderate complexity level per the R6 RLOT 2021 Region 6 FS Agency Administrator Roster for wildfire and prescribe burn certification.

Review Item 5 - The qualifications and experience of key personnel involved.

Key Burn Personnel: The prescribed fire Burn Boss, Burn Boss trainee, Firing Bosses, Holding Bosses, Incident Commander and Division Supervisors involved in the implementation of the prescribed burn and wildfire were found to have the required qualifications, experience, and authority.

No additional findings related to qualifications, experience or authorities were found.

Recommendations

Through the review process, the team identified findings that they categorized as contributing or non-contributing to the conversion of the prescribed fire to a wildfire. Based on these findings, the team developed recommendations and lessons learned.

While not included as individual findings below, the team noted some discrepancies between the PMS484 and North II Burn Plan, as well as some deviation between what was written in the plan and how it was implemented. Refer to elements 2 and 3 above for specific examples.

Non-Contributing Factors

Finding 1

While this element did not contribute directly to the wildfire declaration, the guidance in the burn plan was not followed.

Discussion/Implications: Element 18 in the North II Burn Plan states that the "Burn Boss may declare the project a wildfire… This notification will be a process of communications and concurrence with the District Fire Management Officer, Forest Fire Management Officer, District Ranger, Agency Administrator, and Lakeview Fire Dispatch Center." The Burn Boss was not consulted about declaring the North II prescribed burn a wildfire, the decision was made by District and Forest Fire Management Officers and the District Ranger, in consultation with the Regional Office.

Recommendation: The review team recommends applying a standard across the forest on who will make the wildfire declaration and amending current burn plans to reflect this forest standard.

Finding 2

While the organization on the burn exceeded the minimum organization needs, the method to determine the minimum organization was not clear to the review team. Similarly, the method to determine contingency resource needs was not clear, nor was the contingency plan clear on what resources were required. The plan appeared to be a list of what resources may be available in the area. It is difficult to determine that line building capability would meet the expected fire behavior and rates of spread noted in the prescription elements. The dozer listed under minimum resources is interchangeable with an engine, but those resources do not have the same capability. Additionally, there is note stating that if the dozer is not available consideration should be made to increase holding resources by adding 5-10 personnel in its absence. The Chiloquin Fire Department Water Tender is listed as a contingency resource, but there is no mechanism in place to order or pay this resource for prescribed fire use.

Discussion/Implications: Clearly identifying what fire behavior may be expected inside and outside the unit is critical to identifying the resources needed to bring the fire back under control. While the prescription notes the expected fire behavior, it is difficult to determine how this information was used to determine minimum organization or contingency resource needs.

Recommendations: The review team recommends clearly stating what contingency actions will be taken in the event of fire outside of the planned control lines for the day. Base minimum resource requirements and contingency resource needs off required line construction rates or efficacy based on

expected fire behavior. If line production rates will not be an issue due to the use of existing barriers, roads, or lines as contingency actions, clearly describe that plan and resources needed to hold those lines. Consider developing minimum organization and contingency resource needs for low, desired, and high prescription ranges.

Finding 3
Changes to the prescribed fire plan were made between when it was written and implemented, but the changes were not documented in an amendment.

Discussion/Implications: The initial burn plan with a technical review date of 9/27/2018 only mentioned potentially using aerial ignition for maintenance burning, while the burn plan used for implementation included the potential for aerial ignition to be used for initial entry. The complexity analysis was changed to cover this, as well as having other sections added to meet policy for aerial ignition, such as the Project Aviation Safety Plan/Mission Planning Worksheet. While there were other changes to the burn plan, major changes to ignition methods including ground ignition to aerial ignition are a common reason for a burn plan amendment.

Recommendations: The review team recommends documenting major changes to prescribed fire plans through an amendment, including a written justification on whether a new technical review needs to be completed.

Finding 4
The Burn Boss and Burn Boss trainee spent an extended amount of time on the phone with smoke management. When they completed the call and returned to the burn, they had some concern with the lighting pattern being used and made changes directly with holding and lighting resources.

Discussion/Implications: While smoke management is a critical component of prescribed fire, any distractions during burn operations can lead to a loss of situational awareness. In this instance, when the discussion with smoke was concluded and the Burn Boss and Trainee returned to the line, they felt immediate changes to the firing pattern were necessary and made those changes before notifying the Firing and Holding Bosses. Unit logs from resources noted that this caused some concerns.

Recommendation: The team recommends being aware of distractions and ensuring that they don't limit situational awareness. If phone calls with smoke during burn operations occur regularly, consider delegating those discussions to someone not involved with supervising burn operations.

Contributing Factors

Finding 1
No onsite fuel monitoring was completed leading up to the prescribed fire, rather offsite fuel moisture monitoring and the Calimus RAWS were used. Fine dead fuel moisture calculations were completed during prescribed fire implementation and used to estimate 10, 100 and 1000 – hour fuel moistures.

Discussion/Implications: Klamath County and most of Oregon is experiencing prolonged drought, with Klamath County being categorized as "Exceptional Drought" in April leading up to the burn. Calimus RAWS is located at 6629' and was "snow flagged" until May 1. Utilizing this weather station to monitor fuel moistures would not have given an accurate estimate of all fuel moisture categories, but particularly

in 100 and 1000 – hour fuel moistures. By using these calculations, an accurate picture of the drought conditions on the unit could not be fully recognized.

These extremely dry fuel conditions for both live and dead fuels may have contributed to unexpected fire behavior in the area where the prescribed fire crossed containment lines. Through interviews, onsite personnel indicated that they typically try to keep fire out of dense lodgepole in the spring to limit mop-up concerns. In this instance, these areas of thick lodgepole burned at higher intensity than anticipated.

Recommendations: The review team recommends implementing standard practices to determine fuel moistures prior to implementing prescribed fire and determining what the impacts of long-term exceptional drought, if present, will have on live fuel moistures. Fuel moisture monitoring should be incorporated as part of the burn plan and recorded as documentation in the prescribed fire record.

The District should also evaluate burn plans to determine better RAWS site correlation to the prescribed fire units, considering elevation, greenup dates and snow flags. As an alternative, utilize an onsite Portable RAWS.

Finding 2
The North II Prescribe Fire Plan covers 27 units that encompass roughly 24,000 acres. This plan breaks this broad area into two fuel models; 60% GS2 Moderate load, dry climate grass-shrub and 40% TL8 Long-needle litter. Though it does mention areas of lodgepole and aspen in the fuels description, no modeling was competed to account for these fuel models in the prescription. Fuel models in locations that exhibited problem fire behavior were determined by the review team to exhibit fire behavior consistent with timber understory fuel models rather than timber litter models.

Discussion/Implications: It is difficult to encompass the range of fire behavior that is likely to occur over 24,000 acres with only two fuel models. IFTDSS runs included in the burn plan show that more fuel models were present in the project area, but those fuel models were not used in prescription development.

Recommendations: The review team recommends the District re-evaluate the prescribed fire plan for the North II project and determine if more fuel models need to be incorporated into the modeling documentation and prescribed fire prescription range. Onsite evaluation of problem areas, critical holding points and drastic changes in vegetation type or fuel loading should be identified and incorporated in the prescribed fire plan.

Finding 3
The district had a general plan to progress from east to west across the project area, tying into previously burned units to limit the opportunity for escape. The decision to alter this plan to facilitate the use of aerial ignition caused changes to previously identified and prepped holding locations.

Discussion/Implications: When it was determined that aerial ignition would be used, units were identified that were favorable for aerial ignition. This left a gap between previously burned units and this spring's planned burn units where the slopover was able to get established. It was mentioned during the site visit that the prep work that had been done the year before had not considered the change in burn unit progression. The road where the slopover occurred had not been prepped the year prior because it would have been an interior road or would have had a previously burned unit on the

east side, mitigating holding concerns. The decision to modify burn unit progression to accommodate aerial ignition determined that a road with limited pull-outs and turnaround opportunities and thick fuels on both sides of the line be used. The holding boss brought up concerns with holding the road, but the decision was made to proceed with blacklining it in preparation for aerial ignition the next day.

Recommendations: The Review team recommends that the use of aerial ignition be done at the right time, in the right location, for the right reasons. Pressure to utilize a specific tool should not override concerns about line location, prep quality, or burn unit progression. Plans to utilize aerial ignition should be considered well in advance when prepping units, determining holding lines, and deciding on burn unit progression.

Finding 4
During the site visit, key personnel expressed frustration with finding the Areas to Protect and implementing the needed protection measures. The provided maps did not adequately identify the locations of all ATP's, necessitating more time focused on interior values at risk rather than areas of concern to holding.

Discussion/Implications: The day before the prescribed fire all operational personnel spent the day on site to get familiar with the unit, ensure ATP areas were protected and holding lines prepped. The RXB2(T) described the ATP identification as a "rabbit hole" that kept most resources busy most of the day trying to locate them. Maps had not been updated with information regarding these sites and resources indicated that only two of the 11 sites on the map were located and had the necessary protection measures implemented. It was roughly 1400 before Holding was able to assess the new control line and identify the area between TT and North Staging as a holding concern. Resources were not able to put any work into this piece of line until the next morning.

Recommendations: The review team recommends earlier coordination with heritage to identify ATP sites on the ground well ahead of implementation occur. This would include updating maps, coordinating between heritage personnel and fire onsite and sharing information so resource protection can be better factored into site preparation on future prescribed fires.

Finding 5
Several personnel discussed a 12-hour duty day limitation for project work, and it was noted in the AAR that line officer approval was needed to exceed a 12-hour shift. Some personnel involved felt that staffing the burn overnight would have potentially reduced the need for additional resources the following day.

Discussion/Implications: It is unclear where this 12-hour shift limitation originated. Forest leadership has not issued any such local policy or practice but did note a previous District Ranger, that left over 5 years ago, had indicated that resources should not exceed 12 hour shifts on project work if possible. This 12-hour shift guidance influenced start times for resources, ignition plans, and whether to leave resources out on the burn overnight.

Recommendations: The review team recommends directly clarifying this 12-hour shift impression felt by resources. It is important to recognize the need to manage fatigue, however, the team recommends that decisions be based on the conditions and needed actions to address those conditions, and not on time frames that are not reflected in manual or handbook direction.

Finding 6
Through interviews, site visits with key personnel, unit logs and documentation; the review team determined that the staff felt a lot of pressure to complete the prescribed fire despite many factors adding up to the classic swiss cheese model.

Discussion/Implications: Key personnel expressed feeling a lot of pressure leading up the prescribed fire implementation. Many expressed that some of this pressure was placed on them by their own desire to complete the project, building on past success. Other pressure felt by the unit was based on attempts to implement prescribed fire earlier in the season that were delayed due to unfavorable smoke, weather, or fuel conditions, missing prescribed fire entirely during 2020, wanting to complete the burn ahead a frontal passage forecasted for the weekend, and wanting to treat more acres to avoid another fire like the Two Four Two Fire. Personnel also indicated heavy pressure to incorporate aerial ignition to complete more acres, reduce smoke impacts and build on past success. Media and social media outreach efforts to highlight the work being done also added pressure to complete the project.

While several personnel mentioned concerns and reservations about what they were seeing or feeling, the pressures, whether perceived or real, added up to a feeling that the prescribed fire was going to go forward despite reservations.

While no one should feel pressure to burn for any reason, the reality is that limited burn windows, lengthening fire seasons, increasing pace and scale of restoration work, other assigned duties (hiring, preparedness work, administrative duties) and the personal commitment many feel to accomplish good work, result in pressures felt by personnel implementing prescribed fires that should be recognized. It was noted by participants in the review that they feel like they are “at capacity”, and this is not uncommon to hear in the wider fire and fuels community.

Recommendations: The team recommends recognizing that pressure to complete projects come in many forms. Recognizing when those pressures are influencing decision making requires listening when concerns are brought up and ensuring they are addressed. Being clear and speaking up about pressure felt to accomplish a project or task, despite individual or group reservations, remains important and critical to success. Having an environment where it is possible to speak to these concerns is a cornerstone of functioning as a high reliability organization. While the hesitancy about sharing concerns has decreased in recent years, relying on contingency plans to alleviate misgivings should prompt more discussion.

Acknowledgement

In addition to the recommendations above, the team would like to commend the Chiloquin Ranger District on the increase in prescribed fire use over the last several years and recommends that continue. The willingness of the participants to be open and honest while using this event to learn will pay dividends as they continue to advance their prescribed fire program. Additionally, recognizing that objectives were not being met within a burn unit, the decision to make the wildfire declaration to secure the needed resources before the fire left the project area is commendable and speaks to making appropriate decisions to address the needs of the situation.