Ashland Forest Resiliency Project 2019 Prescribed Burn Fire Effects Monitoring Report

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Units: USFS AFR Underburn Units 2c and 7c

Burn Dates: 2c – 4/27/2019; 7c – 3/17/2019

Acres Burned: 63 acres total: 2c - 57 ac, 7c - 6ac

Fuel Types: Timber litter, timber understory

Main Fuel Models: TL2/TL3, TU1/TU2

Burn Boss: Robert Marshall (2c) and Kristofer Colbenson (7c), Forest Service, SMRD

FEMO: Lyndsey Lascheck

Overview and Summary

This report provides a record of 2019 prescribed fire implementation and objective attainment to inform adaptive management of future burns. It covers Forest Service burn units 2c and 7c, comprising 63 total acres in the Ashland, Oregon watershed within the Siskiyou Mountain Ranger District (SMRD) of the Rogue River Siskiyou National Forest. The burns were completed in early spring 2019 as part of the Ashland Forest Resiliency (AFR) project, a partnership of the U.S. Forest Service (USFS), City of Ashland (COA), Lomakatsi Restoration Project (LRP), and The Nature Conservancy (TNC). AFR prescribed burns are intended to meet both fire management and ecological goals by reducing fuel loads and fire risk, and by reintroducing beneficial fire for forest restoration while protecting sensitive wildlife habitat. Prescribed burning in 2019 met these landscape-scale goals as well as specific burn objectives for retention of mature trees, habitat features and soil-protecting ground cover. Mortality of understory trees and shrubs was *slightly* higher than intended in Unit 2c, while consumption of surface fuels fell short of the target range in 7c.

Prescribed Fire Objectives

The two 2019 units were covered by two different USFS burn plans ([AFR Group 1 Burn Plan, 2014, Unit 7c;](#) [AFR Group 2 Burn Plan, 2017, Unit2c](#)) and reflect updates to AFR burn objectives. Most resource and prescribed fire objectives are the same between the Group 1 and Group 2 plans except burn objectives 2, 5 and 8 as noted below:

1. Reduce litter and light surface fuels (1 to 100-hr) by 30 - 80%
2. *Understory trees and shrubs:*
    -   7c: Reduce understory trees (< 5" DBH) and shrubs by 30 - 80%
    -   2c: Retain > 30% of shrubs and understory trees (< 5” DBH)
3. Limit mortality of intermediate trees (5-12" DBH) to < 40%
4. Retain > 90% dominant/codominant trees (> 12" DBH)
5. *Legacy tree mortality:*
    -   7c: Minimize mortality of legacy trees
    -   2c: Retain > 97% of conifers > 30” DBH and hardwoods > 20” DBH
6. Retain overall effective ground cover (EGC) for the unit based on soil erosion hazard class:
    Moderate (< 35% gradient) > 60% cover year-1; Severe or higher (> 35% gradient) > 70% cover year-1
7. Retain approximately 90% large down logs or snags (>20" diameter)
8. *Leave area impacts:*
    -   7c: Minimize fire intensity in leave areas
    -   2c: Minimize fire intensity in leave areas, with crown scorch of canopy trees < 20%
9. Retain an unburned strip of duff 25’-50’ wide and coarse woody material within 50’ of perennial streams.

Unit Descriptions

The 2019 portion of Unit 7c spans a steep SE aspect hillslope between the 2060 and Reeder Reservoir access roads. In 2018, 22 acres of Unit 7c above the 2060 road were burned (Map 1); the 2019 burn covered the remaining downslope portion of the unit. This portion of 7c is steep and relatively moist and shady. The stand is dominated by mature to small-diameter Douglas-fir with a notable component of black oak. A series of drainage gullies cut through the unit. The unit was recently thinned and pile-burned, but unburned piles remained after those treatments. Grasses and low groundcover are abundant in much of the fuelbed, with TL3 and TU1 fuel models most common pre-burn.

Unit 2c is bounded by the 2060 Road on its S and SW edges and by Road 300 along the SE perimeter; private land borders most of the northern edge (Map 1). A hilltop in the NW corner of the unit creates a range of aspects from W through S and E, with moist drainage gullies cutting through the E aspect and shaded conditions along the northern boundary. The unit was recently thinned and pile burned, with relatively open stands across most of the unit. Madrone is common and abundant, dominating some areas, with Douglas-fir and white fir in cooler settings and Ponderosa pine on ridges and south slopes. Pre-burn fuel models included TL3 and TL8 under conifers and TL2 or TU1 in madrone-heavy stands. Madrone, shrub and conifer regeneration formed a large proportion of the understory pre-burn. Map 1 shows the final unit perimeters, acres, topography, and forest roads for Unit 2c.

Burn Implementation and Fire Behavior Summary

Both burns were led by Forest Service staff and accomplished in a single day during early-spring dry-weather windows in mid-March for 7c and late-April for 2c. Handlines were established along all unit boundaries not defined by roads or trails, with minor adjustments from the plan perimeters. Ignitions were completed between 1000 and 1800. Fire weather, smoke and fire behavior remaining within prescription for both burns, except RH was below the burn plan specifications at the time of initial test burns. Due to high moisture, ignitions on both burns were paused or adapted early in the day to allow for further drying of fuels after initial attempts did not produce desired fire effects.

For Unit 7c, ignitions began as strip firing, especially at the top of the unit and on the south end where there was more sun and drying. As crews worked into the downslope gullies and bottom half of the unit, strip ignitions were not carrying, and they switched to targeted lighting of fuel accumulation "jackpots". Ignitions were not attempted on the furthest downslope third of the planned unit (Map 1) because the fuelbed was too moist and shaded to burn. Six of the planned 10 unit-acres were completed in a partial mosaic burn that was mainly effective at consuming fuel accumulations. Flame lengths remained low, 6" – 12" on average; spread was typically slow and discontinuous.

Unit 2c ignitions were adapted throughout the burn to handle the range of aspects, fuel types, weather and rate of drying during operations. After initial attempts did not produce the desired burn, firing crews were moved onto drier southern aspects and stacked in strip firing patterns to build heat. As the day progressed, fuels dried down and winds picked up creating more active fire. Ignitions switched to dash or dot firing in pine or heavy madrone litter and were slowed down by mid-afternoon to reduce intensity. By late afternoon, lighters were once again using stacked strip firing to complete the unit as temperatures declined and RH began recovering. Flame lengths were generally low, 1' – 2', with ROS at 1 ch/hr except during faster runs up to 7 ch/hr in well-aerated pine or madrone litter.

The Burn Implementation Unit Logs section below provides specific timelines of events, decisions, fire behavior, smoke, and ignition patterns for units 2c and 7c. Table 2 summarizes hourly fire weather and calculated fuel metrics (fine dead fuel moisture and probability of ignition) for each of these burns. For reference, Tables 3a and 3b provide copies of the burn plan prescription ranges for weather, fuel moistures and fire behavior.

Fire Effects Monitoring Method

Our fire effects monitoring tracks the success of burns relative to the prescribed fire objectives listed above. Each objective is linked to a specific monitoring indicator recorded in pre- and post-burn plots, with additional metrics to characterize the unit and fuels, and repeat photographs to document fire effects. Monitoring plots are 0.1 acre, circular, and distributed across the units to capture the range of fuels, topographic settings, stand types and fire effects (Map 1). We establish plots and collect pre-burn data in advance of the burn dates. A qualified FEMO or Burn Boss maintains records of fire weather, smoke and fire behavior, and ignitions during the burn. The final perimeter of each completed burn unit is GPS-mapped post-burn. Post-burn data and photos are collected in the fall to allow time for tree mortality and ground cover conditions to develop. We use post-burn unit walk-throughs to assess objectives not captured at the plot scale, and to verify that plot data are adequately representative. The full AFR FEMO monitoring method is available at: AFR 2017 Fire Effects Monitoring Method.

Monitoring Results and Performance on Objectives

The 2019 AFR burns solidly met almost all burn objectives, with only two exceptions: fuel reduction was low in Unit 7c while understory mortality was slightly high in Unit 2c. Table 1 provides a side-by-side summary of pre- and post-burn unit conditions followed by fire effects monitoring results for all objectives by unit. Objectives for limiting tree mortality and retaining large logs, snags and effective ground cover (objectives 3 – 7) were well within the target range for both burns. Higher residual moisture in 1000-hour and larger fuels during these early spring burns likely benefited the retention of large down logs and snags. Neither unit contained habitat leave areas (Fisher blocks) or perennial streams (Map 1), so objectives 8 and 9, intended to minimize impacts to special habitats, were met by default. The burns were safely conducted with no reported injuries, accidents, holding issues or negative smoke impacts.

Unit 7c had limited carry and consumption of surface fuels. Only about 35% of the unit area was blackened by the burn. Fire effects in 7c did not meet the 30% – 80% target for surface fuel reduction, with only 25% of 1 – 100-hour fuels consumed on average for the unit. Even so, the burn did accomplish a reduction in predicted wildfire intensity (flame length) as estimated from fuel model assignments before and after burning (Table 1).

Fuel reduction in Unit 2c was highly effective, achieving a 65% drop in 1 – 100-hour surface fuels even after seasonal litter-fall. Active fire in Unit 2c combined with a relatively abundant and low-height understory component, led to a reduction of the understory cover just below the retention limit (objective 2). Understory cover includes trees < 5" DBH and all shrubs except groundcover species; except re-sprouting madrone were not included in our pre- or post-burn understory cover data. The 2c burn generated enough heat to kill most of the understory in the unit (see repeat photos at the end of this report). It is inherently difficult to achieve a burn that effectively reduces surface fuels while retaining live understory cover. This requires controlling the intensity of the burn within a tighter range than necessary for either objective alone. With 65% of surface fuels consumed and 28% of live understory retained, the 2c burn performed well on balancing those two objectives (Table 1).

Our monitoring found one incident of legacy tree mortality in the 2c burn. A 32" DBH Ponderosa pine apparently burned out at the base and fell when fire got inside the bole from an existing basal burn scar. Pre-burn, the tree was leaning heavily and was prone to this type of mortality in either wildfire or prescribed burning. The hollow base of the tree was then sawed open by crews after the tree fell to extinguish the bole fire. No other legacy tree mortality was observed in the unit and the burn still meets objective 5 for legacy tree retention.

Table 1. Summary of before-and-after burn unit conditions and burn objective accomplishment for AFR Units 2c and 7c. Objectives for 2c, from the Group 2 plan are in the far left column and objectives for unit 7c, Group 1 burn plan, are at the far right. For comparison, the three objectives that differ between the two burn plans (2, 5 and 8) are in italics. For fire effects, **results in bold are solidly within the target range**.

	Unit 2c	Unit 7c
Burn Date	4/27/19	3/17/19
Unit Acres [1]	57	6
Primary Aspect [2]	SE	SE
Average % Slope	29%	52%
% Unit Area Burned	82%	35%
Average Wildfire Flame Length (ft) pre-Burn [3]	4	4
Average Wildfire Flame Length (ft) post-Burn [3]	2	3
Average % Canopy Closure pre-Burn	72%	57%
Average % Canopy Closure post-Burn	67%	57%
FEMO Monitoring Plot Sample Size [4]	6	2

Burn Objectives Unit 2c - 2017 Group 2 Burn Plan	2c Target	Unit 2c	Unit 7c	7c Target	Burn Objectives Unit 7c - 2014 Group 1 Burn Plan
1. Litter and light surface fuel (1 - 100 hour) reduction [5]	30% - 80%	**65%**	25%	30% - 80%	1. Litter and light surface fuel (1 - 100 hour) reduction [5]
2. *Retain* cover of understory tree (< 5" DBH) and shrub [6]	*> 30%*	28%			
			75%	*30% - 80%*	2. *Reduce* understory tree (< 5" DBH) and shrub cover [6]
3. Limit intermediate tree (5 - 12" DBH) mortality [7]	< 40%	**1%**	**0%**	< 40%	3. Limit intermediate tree (5 - 12" DBH) mortality [7]
4. Retain dominant/ codominant trees (> 12" DBH) [7]	> 90%	**94%**	**100%**	> 90%	4. Retain dominant/ codominant trees (> 12" DBH) [7]
5. *Retain* conifers > 30" DBH and hardwoods > 20" DBH [8]	*> 97%*	**> 97%**			
			0%	*< 5%*	5. *Minimize* mortality of legacy trees [8]
6. Retain effective ground cover targets for the relevant slope and year post-burn [5]	> 60% yr-1 (< 35% slope)	**99%**		> 60% yr-1 (< 35% slope)	6. Retain effective ground cover targets for the relevant slope and year post-burn [5]
	> 70% yr-1 (> 35% slope)		**97%**	> 70% yr-1 (> 35% slope)	
7. Retain large down logs or snags (>20" diameter)	> 90%	**95%**	**99%**	> 90%	7. Retain large down logs or snags (>20" diameter)
8. *Minimize fire intensity (as crown scorch) in leave areas* [2]	*< 20%*	*n/a*	*n/a*	*low-none*	8. *Minimize fire intensity in leave areas* [2]
9. Retain duff and coarse wood next to perennial streams [2]	50' buffer	*n/a*	*n/a*	50' buffer	9. Retain duff and coarse wood next to perennial streams [2]

Footnotes: 1 - GPS mapped post-burn and calculated in GIS. 2 - Assessed from GIS unit map. 3 - Based on Scott and Burgan (2005) fuel model reference, assuming wildfire conditions of very low fuel moisture and 14 mph midflame winds. 4 - For unit 2c, one plot fell in a moist draw where fire had not carried; based on post-burn walk-through, this plot was given less weight (0.5) in data summary to avoid over-representing unburned conditions. 5 - Includes post-burn litter-fall from scorched canopy as 1-hour fuels and ground cover. 6 - Reported as percentage of the pre-burn cover remaining post-burn; excludes understory cover from re-sprouting madrone for the 2c retention objective – but includes re-sprouting madrone in understory cover for 7c reduction version of objective. 7 - Post-burn mortality field-interpreted as trees with > 95% crown scorch; may underestimate actual mortality rates. 8 - Legacy mortality and large log/snag retention were assessed during post-burn monitoring and are estimates, not based on inventory.

Table 2. Hourly fire weather observations and calculated fine dead fuel moisture (FDFM) and ignition probability for Units 2c and 7c burns. Red text indicates conditions in the high fire intensity prescription range, blue text for low fire intensity; black text is in the desired prescription range.

FIRE NAME: AFR 2c		OBSERVER: Lyndsey Lascheck												DATE: 4/27/2019
TIME	LOCATION	Elevation	Aspect	% Slope	Dry Bulb (F)	%RH	Dew Pt.	Wind Dir.	Wind mph/gust	% cloud cover	% canopy cover	FDFM (shaded)	Prob. Of Ignition %	Comments (Fire behavior, smoke, etc.)
1015	Test Fire	4200	WNW	15	50	50	34	NW	light	0	40	12	30/20	
1100	N side	4200	NE	20	53	40	31	W	very light	0	70	11	30/20	
1200	Top of knob (N Part)	4200	E	20	59	27	25	variable	light	0	60	9	60/30	some smoke overhead
1300	Southwest	4100	SW	40	60	26	24	upslope	light/4	50% smoke	60	9	50/30	some smoke overhead
1400	Southwest	4100	E	40	59	22	30	upslope, W gusts	light/5	75% smoke	60	8	50/40	smoke hanging in understory, hard to find smoke-free location for Wx
1500	Southwest	4100	S	40	68	23	23	NW	light/9	0	70	10	50/30	
1600	Eastern	4000	E	35	60	29	30	upslope	light	50% smoke	80	10	30/30	
1700	NE corner	3880	NE	40	62	34	33	NW	light	25% smoke	70	10	30/30	Sun below ridge, fuels shaded
1800	E of unit (below 300 rd)	3800	SE	50	59	37	32	variable	light	50% smoke	60	11	30/30	Ignitions complete

FIRE NAME: AFR 7c		OBSERVER: Kristofer Colbenson												DATE: 3/17/2019
TIME	LOCATION	Elevation	Aspect	% Slope	Dry Bulb (F)	%RH	Dew Pt.	Wind Dir.	Wind mph/gust	% cloud cover	% canopy cover	FDFM (shaded)	Prob. Of Ignition	Comments (Fire behavior, smoke, etc.)
1000	Test Fire, NW corner	3075	E	60	54	49	--	upslope	2 - 3	0	>50%	11	20	First test fire attempt
1047	NW corner of unit	3075	E	60	61	39	--	upslope	3 - 5	0	>50%	10	30	Second test fire attempt
1252	NW corner of unit	3075	E	60	65	32	--	upslope	1 - 2	0	>50%	9	30	
1430	NW corner of unit	3075	E	60	62	25	--	n/a	0	0	75%	9	30	Ignitions completed at 1405

Table 3a. Fire weather and fuel moisture prescription range parameters. These are the same in both burn plans.

	Acceptable Prescription Range		
	Low Fire Intensity	Desired Fire Intensity	High Fire Intensity
Temperature (°F)	45-55	56-75	76-86
Relative humidity (%)	45-35	34-25	24-20
Mid-flame wind speed (mph)	0-3	4-7	8-12
Wind direction (azimuth°)	N, W, E	N, W, E	N, W, E
1-hr fuel moisture (%)	15-13	12-10	9-7
10-hr fuel moisture (%)	17-15	14-12	11-9
100-hr fuel moisture (%)	19-17	16-14	13-11
1000-hr fuel moisture (%)	>20	19-17	16-14

Table 3b. Fire behavior acceptable prescription ranges. These are the same in both burn plans.

	Acceptable Fire Behavior Range		
	Low Fire Intensity	Desired Fire Intensity	High Fire Intensity
Fuel Model(s): __TL3__			
Rate of Spread (chains/hour)	<1.5	1.6 – 2.5	2.6 – 3
Flame Length (in feet)	< 1	1-2	2-3
Scorch Height (in feet)	<1	2-10	11-15
Probability of Ignition (%)	<15	16-30	31-60
Spotting Distance (in miles)	<0.1	0.2	0.2

Burn Implementation Unit Logs – Timelines and information below were recorded by Lyndsey Lascheck (FEMO) for Unit 2c and by Kristofer Colbenson (RXB2) for Unit 7c.

Time	AFR 2c Operations and Observations Timeline – April 27, 2019
940	Briefing at the 2060 & 300 spur road junction by RXB2(t) Colbenson for burning AFR Unit 2c. All resources were assigned to either holding, firing, or FEMO. Weather, objectives, communication, desired fire behavior, and operations plans were reviewed.
1028	Test fire in the NW corner of the unit: 0.5'-1' FL; ROS <1 ch/hr. Ignitors dotting in litter, grass, and shrubs with fire coming together very slowly. Seedlings up to 4' tall consuming. Smoke lifting ~150' heading east
1037	Fire not carrying in green grass on N line, even in litter between grass & shrubs.
1038	Wind shift from SW
1045	RXB2(t) reassess tactics because the fire isn't carrying well on the North line. Resources are shifted to the southerly aspect where the sun is hitting the fuels.
1115	Ignitors move to SE aspect and strip in pine litter 0.5' FL; ROS: <1 ch/hr. Fire behavior still below desired so operations hold to wait for drying.
1145	Ignitions start again; RH=26%. 0.5'-1' FL; ROS backing in pine litter <1 ch/hr; ROS heading in pine litter 6 ch/hr
1200	3 lighters stacked, head stripping
1215	6 lighters stacked, 10' apart, head stripping
1230	0.5'-2' FL; ROS heading in madrone litter & grass = 1 ch/hr. South aspect with more slope and pine litter is carrying well, consumption is patchy everywhere else. Low residence time.
1250	Two lighting squads: one has 3 people stacked on S aspect in pines, the second has 5 people stacked on east aspect where it's shadier with more madrone and Douglas-fir. Head strips in pine litter 2' FL; ROS: 7 ch/hr. Scorching boles 6'-10' up.
1310	wind gusts upslope; dash ignitions in pines
1320	dots not carrying in madrone, heading carrying ok; ignitions switch to 2 teams of 3 bump floating, splitting along the main ridge on the East side of the unit
1453	winds gusting on ridge from NW 9mph
1500	dotting in pine litter and madrone flanking 0.5' FL; ROS: 1.5
1508	fire scorching up 25; on 2 Doug-firs
1517	Advised to slow down on the ridge and let dots connect before taking another pass. Smoke obs: brown at base liftin ~1000' heading SE
1545	Transition RXB2 from Marshall to Zumhoff
1550	Head strip in madrone litter 2"-6" FL; ROS: 1 ch/hr. Pine needles flanking 4" FL; ROS: 0.5 ch.hr. madrone litter heading 1' FL; ROS: 6 ch/hr
1630	stripping 10' apart 3 people deep to build heat on east side
1655	10'-50' strips 3x stacked
1715	0.5'-1' FL; ROS: 3 ch/hr heading in litter
1800	ignitions complete
Time	AFR 7c Operations and Observations Timeline – March 17, 2019
1000	Test fire start, NW corner of unit
1010	Fire not meeting Rx. Hold ½ hour to see if it improves
1045	Second test fire. Good – continued. Flames 1' – 2', smoke dispersion good
1340	Ignitions to bottom of unit. Average flame length for burn 6" – 12", max 1', ROS 4 ch/hr. No torching/crowning, fire whorls, spotting or escape. Smoke rising up and dispersing
1405	Ignitions complete
1511	All resources released
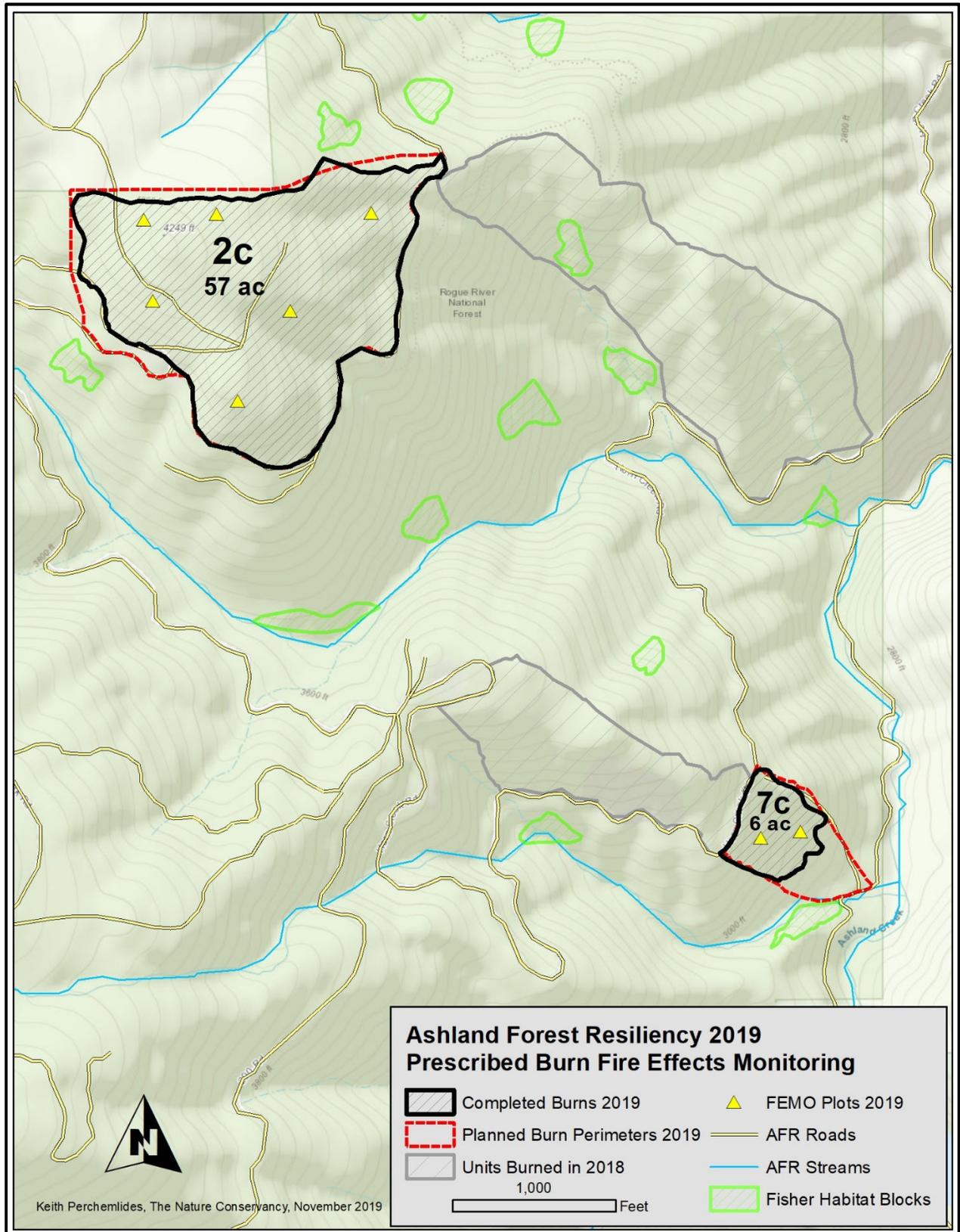
Map 1. Final perimeters and acres of AFR 2019 burn units (black), planned unit perimeters (red dashed), forest roads, streams, and topography. Adjacent burns completed in 2018 are shown in grey, including the majority of unit 7c above the road and west of this year's burn. Nearby Fisher block leave areas are green and fall outside of the units. The lowest portion of 7c bounding the Section 20 tributary to Ashland Creek was planned but not burned due to high fuel moistures. Yellow triangles show locations of 2019 fire effects monitoring plots providing the main data for this report.

Representative before-and-after fire effects and fire behavior photographs

Repeat photographs showing consumption of pine litter, surface fuels and understory shrubs and tree saplings in Unit 2c.

Repeat photographs documenting consumption of madrone litter and small diameter surface fuels in Unit 2c – note the new cover of madrone litter from crown scorch and seasonal leaf-drop in the post-burn photo.

Repeat photographs showing minimal surface fuel reduction but noticeable consumption of fuel accumulations in unit 7c.

Unit 2c burn: Active fire spreading from dot ignitions in pine/madrone litter (above); backing fire consuming litter and small diameter surface fuels in mixed pine/Doug-fir stand (below). (Photos: Lyndsey Lascheck)