Nenana Ridge Experimental Fuel Treatments

PRESCRIBED BURN June 17, 2009

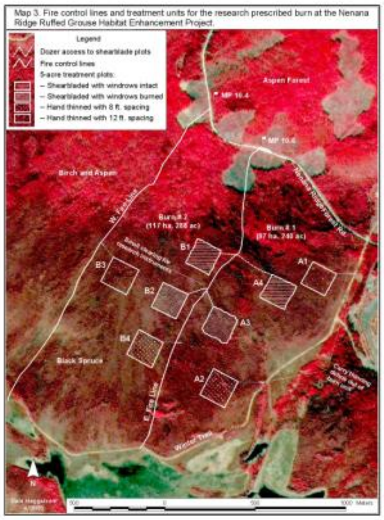

Figure 1. Map of Nenana Ridge burn project (Dale Haggstrom, ADFG).

Chronology

The A-Unit of the Nenana Ridge burn project (Fig.1) was ignited with a test burn at 13:40 on 6/17/09. Winds were light (2 mph, gusting to 6 mph) out of the southwest with a relative humidity of 47% (using Kestrel), and temperature of 69 deg F taken at the overlook. Blacklining began on W and E sides of the unit. Initially, only white smoke (indicating high fuel moistures) could be seen, but by 13:50 the first torching tree crowns were visible from our overlook point approximately 2.2 miles northeast of the burn. Cumulus buildup was providing 100% shading on the project area for the initial firing (and keeping the RH high).

Aerial firing began at 14:23 in the lower A-unit, but after 5 minutes a malfunction in the injector required a short break to repair. Wispy smoke trailed to the NE during this period, and only intermittent torching was observed, with no column development. At 14:55, while the firing ship was refueling, we noticed a slight shift in wind to the SSW and twin columns began to develop on the east and west flanks where hand lighting was continuing. Smoke became darker now and began to loft, with a column height of 2000 feet.
Flame lengths initially (13:00-14:00) averaged 1.5 feet with the little smoke produced drifting NE and dissipating, but by 15:15 we started to observe convection, black smoke, and active crowning (Fig. 2). Helicopter 3AE was in the area filming the behavior during this period. Fire behavior escalated rapidly and by 15:38, the well-developed column was estimated at 5000', advancing above a continuous active crownfire and a 3-acre spot fire into the B-unit was reported. At 15:40 the firing ship 15S returned from fueling. At 15:45 (Fig. 3) hand lighting was completed on the west flank, 15S reported fire had spread all the way to A-1 and helicopter bucket drops were being called on the slopover near B-1.

By 16:10 not much flame was visible although there was still a lot of white smoke and intermittent individual or group torching in interior pockets. Suppression on the slop-over between B-

Figure 2. Fire appearance at 15:15, from 2 miles away.

Figure 3. Fire and column appearance at 15:43 p.m. 6-17-09.

Figure 4 (below). Low severity and partial canopy consumption between A-1 and A-3 in the lower third of the Unit.

1 and B-2 was still in progress. At this time DOF received a complaint about smoke at Denali, but it appears unlikely obscuring smoke would be traveling that far as the column appears to be shearing off at 1000-2000' and drifting and dispersing.

Fuel conditions

Duff sampling for fuel moistures was conducted in the morning on burn day (4 samples in unit B-3, 6 in B-4 and 4 in untreated controls). Live moss moisture content was 44% (gravimetric) in the morning and about 47% at ignition time near the test burn location. This is on the high side: an FFMC of 92 (which RAWS calculated for that day) should translate into 9% live moss moisture on the ground using Lawson's equation, but local site conditions clearly were not that dry, which contributed to the initial difficulty in getting surface fire to spread in the bottom of the unit (Fig.4, 5).

Dead moss moisture content was 100%, a moderate DMC value of 53 (much lower than RAWS reading of 99 for the same index). The upper duff moisture content was 121%, relatively dry

Figure 5. Treatment unit A-2 had taller trees than A-1 (some white spruce) with larger canopies providing a high degree of shading on the forest floor. There was also substantial cover of green horsetail and deciduous shrubs, tending to retard drying of the feather moss in the lower A-Unit.

for this layer and drought code (DC) calculated from this layer was 374, not that far off from the RAWS DC of 303 for the day. Lower duff moisture content was 207%.

Fire Effects & Fuel Treatment Effectiveness

Burn severity was extremely variable from the bottom to the top of the unit. At the southern, lower elevation, portion of the unit burn, severity was much lower, particularly in the tree crowns, which were often unburned (Fig. 4). The middle portions of the A-unit burned with higher severity where drier fuel conditions, more open canopy, convection, and more wind and slope helped build fire intensity.

An inspection of the differential char heights, crown effects, twig curling and foliage damage indicates the main challenge of the head-fire to treatment A-1 was from the SSE, with more easterly component along the east side, which is very close to the east control line. Walking paths created by dragging slash during the treatment in 2006 were evident along the eastern edge and ap-

Figure 6. Unit A-1 SW corner marker showing effects of continuous crown fire which entered the treatment from the south.

Figure 7. Treatment A-1 from the SE corner looking into the thinned and pruned treatment. Grass was too green and did not carry surface fire well, and tree canopies are mostly intact.

peared to slow fire spread to the north. Forest near the SE corner of the treatment appeared to have a more open canopy and flame height here was less (about 15', as reflected in the scorch heights) than adjacent to the SW corner and in the control plots on the S and W side of A-1. There flame height was over 60' based on complete bole char of tallest trees and removal of 100% crown and most small twigs on trees S and W of the treatment (Fig. 6). Burn severity in general could be characterized as a moderate substrate severity (50% duff consumption but little or no mineral soil) and high vegetation severity (vegetation consumed, 100% mortality). Interestingly, about 10m inside the south edge of the treatment scorch height transitions abruptly to 3-6'. Almost all (95%) crown foliage in the 5-acre treatment is intact, reflecting a high resistance to crown fire (Fig. 7). Surface fire did not spread all the way to the north side of the unit, halting about 1/2 way across, and scorch heights near the middle of the unit were 1-3 feet. On the west side of the treatment, the fire only burned about 4 m into the treated area and canopy scorch was nil. Tree density appeared to be a factor in the severity of fire effects seen east of the treatment: where trees were densely stocked the fire damage appeared more severe (Fig. X). Clearly the grassy areas had higher fuel moisture and were poor conductors of surface fire in the treated area.

The A-2 thinned treatment and control plots on the south and west remained virtually untouched by fire, because of sluggish fire spread due to high RH and surface fuel moisture conditions in the lower 1/3 of Unit A (Fig.8). Vegetation in this unit (and south of the unit) was lush with taller trees and lush understory vegetation including horsetail, blueberry, lingonberry and Labrador tea. There were a few spots burning north of A-2, showing deep smoldering and felling trees by burning out the roots.

Figure 8. Hand-lit fire on A-B line failed to carry surface fire more than a few meters toward the interior of the A-unit in it's bottom third. However, when fire penetrated the moister surface fuels the upper duff was dry enough to be consumed, felling trees.

In the shearbladed treatments, the pattern used and the resulting distribution of woody debris had dramatic consequences for fire effects in the units. In the A-4 treatment where fuel was piled into large horizontal windrows and burned, only areas with remnant concentrations of woody material burned, leaving much of the grassy areas between the rows untouched (Fig. 9). In contrast, unit A-3 had woody debris distributed more evenly around the unit, and more remaining since piles were not big enough to burn in the winter. This unit had a high degree of substrate burn severity over much of its surface, particularly in the SE corner where patches of soil appear to be oxidized from sustained heat (Fig. 10, 11).

In conclusion, the experimental burn seemed to provide good information on three styles of fuel breaks currently used in Alaska boreal forest. This is the first operational or experimental test of these fuel treatments in the state.

R. R. Jandt 6/23/09

Figure 11. Pre-burn (6-3-09, above) and post-burn (6-20-09, below) photos of a A-3 plot R1P1 in the shearblade treatment.

Figure 9. Windrow after re-burning in shearblade treatment A-4, NW corner looking SE. Note resistance of grass fuels to surface fire spread, likely due to high fuel moisture.

Figure 10. The southeast quarter of shearblade treatment A-3 showing high rates of consumption of vegetation, duff, and coarse woody debris. Red patches are severely burned areas with oxidized soils.