Direct and Indirect Effects of Wildfire on a Douglas-fir Forest

Case Study of the 2013 Knife Creek Wildfire

Technical Report to the Alex Fraser Research Forest, Williams Lake BC

LD Daniels

9/25/2017

Photo: taken by Ken Day on September 12th, 2013 at Knife Creek moments after an initial attack crew was dispatched by the BC Wildfire Service.

Introduction

On September 12, 2013 a wildfire was reported on the Knife Creek block of the Alex Fraser Research Forest owned and managed by the Faculty of Forestry at the University of British Columbia. The fire was initiated by a lightning strike during a thunderstorm two weeks prior to detection. The fire smouldered belowground, with above-ground flaming combustion during warm and dry conditions in mid-afternoon. Although mostly a surface fire, it developed into a crown fire at its center. Parts of three stands that had been pre-commercially thinned in 2012, 1994, and 1989 burned. Surface fuels and coarse wood were abundant in the area treated in 2012. From the point of ignition, the fire burned mostly in the 2012 treatment before spreading into the 1994 and 1989 treatments. Although the weather was warm and dry, wind speed remained low, so the fire spread to only 6.1 hectares in size. It was suppressed on September 15th by a BC Wildfire Service ground crew supported by a water tanker; 40 mm of rain on September 16 ensured the fire was extinguished.

This study, conducted one month after the fire, quantified the immediate, direct effects of the 2013 wildfire. We established permanent sample plots that were re-measured in early summer 2014 to quantify lagged tree mortality following fire and the indirect effects of bark beetle colonization of the trees. This research address four inter-related questions:

(1) What was the effect of the fire on individual crowns, boles and survival in 2013?
(2) Did plot-level tree density and basal are differ between areas that burned as a high-intensity crown fire *versus* low-intensity surface fire or between areas thinned in 2012 *versu*s 1989-1994?
(3) Did tree mortality and colonization by Douglas-fir beetle change between 2013 and 2014?
(4) Did tree size and fire effects to the crown or bole affect mortality or colonization by Douglas-fir beetles?

Monitoring of the permanent plots will quantify longer-term wildfire effects and forest recovery.

Methods

Study Area

This study investigated the forest burned by the 2013 wildfire on the Knife Creek block of the UBC Alex Fraser Research Forest (52°2’71”N , 121°51’96”W), located in the Fraser Dry Cool variant of the Interior Douglas-fir (IDFdk3) biogeoclimatic zone. Elevation ranged from 932 to 952 metres above sea level and the site was generally flat to gently sloping (6%) toward a westerly aspect of 274°. The forest was dominated by 50 to 130 year-old interior Douglas-fir. Lodgepole pine (*Pinus contorta* Douglas) and aspen (*Populus tremuloides* Michx.) snags were present in low density (AFRF 2009).

Research Design

We used a stratified-random research design to establish 18 permanent sample plots, 12 within the burn perimeter and 6 in the surrounding unburned forest (Figure 1). Immediately following the fire, the perimeters of the burned area and the subset that burned as crown fire were recorded using a handheld GPS device and mapped using a geographic information system (GIS). We used this map to stratify the burned area as high-severity (crown fire) and low-severity (surface fire) and to delimit a 100-m buffer of unburned area immediately surrounding the burned area. Sample plots were randomly located in the three strata, with 3, 9 and 6 plots in the high-severity, low-severity, and unburned strata. Using the vegetation resource inventory data for AFRF, the harvesting history of each plot was recorded. Of the 12 within the burn perimeter, the three high-severity plots had been pre-commercially thinned in 2012. Of the remaining nine plots that burned at low-severity, seven plots were thinned in 2012 and two in 1994. Of the six unburned plots, three were thinned in 2012, two in 1994, and one in 1989.

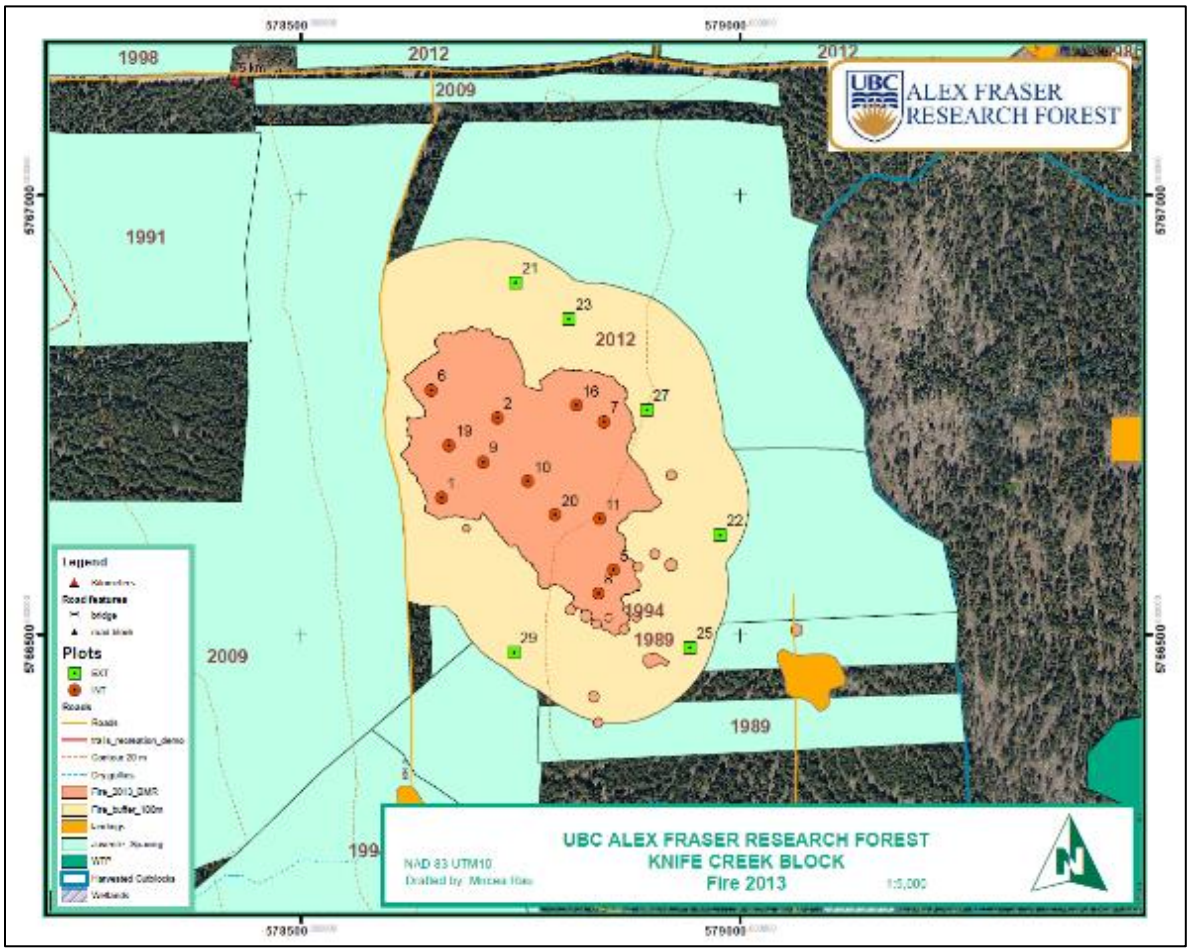

Figure 1. Map of the 2013 Wildfire in the Knife Creek block of the Alex Fraser Research Forest. Permanent research plots were established using a stratified random research design to compare areas impacted by crown *versus* surface fire and unburned areas surrounding the fire perimeter.

Plot and Tree Measurements

The location of each plot centre was recorded and permanently staked with an iron railroad spike labelled with the plot number and sample date. We sampled all living and standing dead trees (diameter at breast height (DBH) ≥12.5cm) in various-radius plots using a BAF4 prism, consistent with forest inventories conducted in the Research Forest. Sample trees were tagged and species, DBH, char height, percent crown scorch, category of crown damage and evidence of bark beetle symptoms were recorded (Appendix 1: Field Protocols). For each tree, crown damage and bark beetle symptoms were re-assessed in July 2014.

Char height (m) on the bark was calculated from three measurements per tree, the highest and lowest visible points of charred bark on the stem, often located on opposite sides of the stem, and the midpoint between them. Three measurements were taken to account for variations in wind, slope and fuel accumulations that cause fire to burn unevenly around tree stems. Bark char height was the weighted average of the three measurements:

$$\text{Bark Char Height} = (H + L + 2M) / 4$$

where, H = the highest point of char, L = the lowest point of char, and M = the observed middle point of char. The middle point M weighted to account for two intermediate points around the circumference of a tree.

Percent crown scorch, estimated to the nearest 5th percentile, quantified the proportion of crown damaged by fire. Crown damage was a qualitative assessment of the degree of scorch. A scale from 0 to 6 was developed to gauge damage based on colors of the needles, branches, and buds. Zero indicated the tree was unaffected by fire and had green foliage throughout the crown and 6 indicated the tree was dead and had no foliage attached. Intermediate classes were based on presence and colour of remaining foliage.

We inspected the circumference of each tree for bark beetle symptoms. Orange-reddish boring dust, pitch tubes, and resinosis are evidence of Douglas-fir beetle. Lighter coloured boring dust was evidence of Ambrosia beetle.

We estimated the percentage of the ground directly affected by fire within a 15-m radius around each plot centre. The degree of damage to the surface fuels was classified, as follows: 0 indicated unburned areas with no visible effect, 1 indicated scorched or charred litter and duff layers but the duff was not altered over entire depth, 2 indicated complete consumption of the litter and duff layers but no change to the underlying mineral soil, and 3 indicated consumption of surface layers and altered mineral soil. For plots in the unburned area only, surface fuel loads were classified base on a six-class system using standard photos used to develop harvesting and thinning treatments in the parts of the Research Forest forming the wildland-urban interface (Appendix 2: AFRF Photo Guides).

Quantifying Fire Effects

Observed ground scorch was used to verify the fire perimeter and compare among fire severity classes. At the plot level, fire effects on individual trees were summarized and tree density and basal area were calculated from the prism data. Mean plot-level tree densities and basal areas were compared among plots stratified by fire severity (high *versus* low *versus* unburned) using analysis of variance (ANOVA) and Tukey's pairwise comparisons and years of thinning (1989–94 *versus* 2012) using t-tests. For the 12 plots within the burn perimeter, we calculated correlation coefficients between density, basal area, percent of the ground burned, and mean percent crown scorch.

Lagged mortality was quantified as the change in number and percentage of trees in each plot and within the burn perimeter between October 2013 and July 2014. The occurrence of Douglas-fir bark beetle and Ambrosia beetle were compared among trees. Based on the 2014 data, contingency tables and chi-squared goodness of fit tests were used to assess the presence or absence of Douglas-fir bark beetles in (a) live *versus* dead trees and (b) trees in stands thinned in 1989–94 *versus* 2012.

Using the subset of 88 trees with in the burn perimeter, we compared mean DBH, crown scorch, and maximum height of char on boles between live *versus* dead trees and trees with *versus* without Douglas-fir bark beetle. Since these data were not normally distributed, we used Mann-Whitney rank sum tests. We applied logisitic regression to identify tree attributes associated with post-fire mortality and colonization by Douglas-fir bark beetle. Only the models in which all attributes are statistically significant are presented in the results. For these models, likelihood curves depict the critical thresholds at a probability of 0.5 (e.g. 50% chance of death or colonization). For all statistical tests, $\alpha = 0.05$.

Results

In October 2013, we sampled 137 Douglas-fir and one lodgepole pine that most likely died before the wildfire, based on its advanced stage of decay (Appendix 3: Tree-level Data). Consistent with the mapped distribution of fire severity, 100% of the ground was scorched in the high-severity plots and there was no ground scorch in the unburned plots (Table 1; Appendix 4: Plot-level Data). Ground scorch was 40% in one plot but 80 to 100% in all other low-severity plots. Fire effects on individual trees was highly variable within and among plots that burned at high- and low-severity (n = 88 trees), with no impacts in the unburned plots (n = 45 trees). Within the burn perimeter, 26 trees had no damage to the crown while the percentage of crown scorch was 5–100% for the remaining trees. Height of char on boles was up to 26.9 m but 90% of mean char heights were ≤5.3 m.

Tree density (98–1270 trees ha^{-1}) and basal area (12–48 m^2 ha^{-1}) varied among the plots (Table 1). Mean values differed significantly among burn severity classes (p = 0.011 and 0.042, respectively; Table 2). On average, trees had the lowest density and basal area in the three high-severity plots. Mean tree density and basal area were significantly greater in the nine low-severity plots; means for the six unburned plots were intermediate and not significantly different from the other two strata. Differences in mean tree density and basal area were not significant between plots thinned in 2012 *versus* 1989–94 (p = 0.250 and 0.855, respectively; Table 2). Within the burn perimeter, plot-level tree density and basal area were significantly positively correlated (r = 0.91, p <0.001), but neither was significantly correlated with percent ground or crown scorch (p >0.05 for all combinations). In the unburned areas, the estimated surface fuel loads were <4 or 4–8 kg m^{-2} in the plots thinned in 1989 (n = 1) and 1994 (n = 2) and 10–15 or >15 kg m^{-2} in the plots thinned in 2012 (n = 3).

Table 1. Plot-level summaries of direct and indirect impacts of the 2013 wildfire in the Knife Creek block, Alex Fraser Research Forest.

Plot ID	Year thinned	2013									2014		
		Burn severity	Ground scorch (%)	Density (n ha^{-1})	BA (m^2 ha^{-1})	Trees (n, %dead)	DBH (cm)	Crown scorch (%)	Char height (m) Max.	Char height (m) Mean	Trees (Δ, %dead)	Beetle (%) D-fir	Beetle (%) Amb
20	2012	High	100	116	16	4 (75)	42±2	100±0	25±2	25±2	+1 (100)	100	100
10	2012	High	100	368	24	6 (0)	38±24	100±0	9±7	6±5	+3 (50)	67	33
9	2012	High	100	98	12	3 (0)	45±14	28±26	5±1	3±1	+0 (0)	67	33
7	2012	Low	100	542	24	6 (0)	27±9	81±38	7±2	5±1	+4 (67)	67	0
11	2012	Low	100	860	24	6 (0)	21±6	95±8	6±1	5±1	+3 (43)	57	0
16	2012	Low	100	921	40	10 (0)	30±13	14±12	4±2	3±1	+2 (20)	100	0
5	1994	Low	95	836	36	9 (0)	26±8	97±7	4±1	3±1	+3 (33)	44	0
2	2012	Low	95	399	28	7 (14)	34±14	1±2	3±1	2±1	+0 (14)	0	0
6	2012	Low	95	1270	48	12 (0)	38±25	34±32	5±1	3±1	+1 (8)	67	17
1	2012	Low	90	904	40	10 (0)	29±11	4±6	4±4	2±2	+0 (0)	20	0
19	2012	Low	80	739	28	7 (0)	24±7	1±4	2±2	2±1	+0 (0)	0	0
8	1994	Low	40	829	36	9 (0)	27±27	13±15	2±2	1±1	+0 (0)	0	0
25	1989	None	0	319	12	3 (0)	25±9	0±0	0±0	0±0	+0 (0)	0	0
29	1994	None	0	1137	36	9 (0)	21±5	0±0	0±0	0±0	+0 (0)	0	0
22	1994	None	0	750	36	9 (0)	26±6	0±0	0±0	0±0	+0 (0)	0	0
27	2012	None	0	360	40	20 (0)	45±13	0±0	0±0	0±0	+0 (0)	0	0
23	2012	None	0	225	28	7 (0)	46±21	0±0	0±0	0±0	+0 (0)	0	0
21	2012	None	0	483	40	10 (0)	49±27	0±0	0±0	0±0	+0 (0)	0	0

Table 2. Comparison of plots among burn-severity classes and between years of stand thinning. Means are followed by standard deviations; superscripts indicate significantly different means (α= 0.05).

Strata	N	Density (trees ha^{-1})	Basal area (m^2 ha^{-1})	Ground scorch (%)
Years of stand thinning				
2012	13	560±354	30±11	74±43
1989/94	5	774±294	31±11	27±42
Burn severity				
High	3	194±151 [a]	17± 6 [a]	100±0
Low	9	811±246 [b]	34± 8 [b]	88±19
Unburned	6	546±342 [ab]	32±11 [ab]	0±0

Initially, three trees were killed by the fire, indicated by 100% crown scorch and no surviving green foliage. In July 2014, another 17 trees had 100% red foliage and were classified as dead. All 20 of the dead trees were standing and 10 showed no external evidence of colonization by bark beetles. Douglas-fir bark beetle had colonized 10 dead and 32 living trees. The occurrence of Douglas-fir beetle in live *versus* dead trees was not different from that expected by chance (X^2 = 0.082, p = 0.775), but it was more common than expected in stands thinned in 2012 (X^2 = 5.164, p = 0.023). Ambrosia beetle also colonized five of the snags and six of the trees with Douglas-fir bark beetle. Of these 11 trees, nine were in the stand thinned in 2012. None of the trees in the unburned plots died or were colonized by bark beetles by July 2014.

Within the burn perimeter, the mean diameters of live and dead trees did not differ significantly (p = 0.096; Table 3), but dead trees had significantly more crown scorch (p < 0.001) and higher maximum char on tree boles (p = 0.001). The probability of death due to wildfire exceeded 50% for trees with ≥ 91% crown scorch (Figure 2). The trees colonized by Douglas-fir beetles in 2014 had wider diameters (p < 0.001), more crown scorch (p = 0.007), and higher maximum char (p < 0.001) than those not colonized (Table 3). The probability of colonization by Douglas-fir beetles exceeded 50% for trees with a diameter ≥31 cm and ≥43% crown scorch (Figure 2).

Table 3. Attributes of living *versus* dead trees and those colonized by Douglas-fir bark beetle within the burn perimeter. Means are followed by standard deviations; superscripts indicate significantly different means (α= 0.05).

Tree status	N	DBH (cm)	Crown scorch (%)	Maximum char height (m)
Dead trees	20	29.7±19.3	91.5±40.0 [a]	9.9±8.8 [a]
Living trees	68	31.3±13.3	27.8±24.6 [b]	4.2±2.6 [b]
Douglas-fir bark beetle	41	38.2±16.4 [a]	55.6±41.6 [a]	7.8±6.6 [a]
No beetles	47	24.6± 9.5 [b]	30.6±43.0 [b]	3.5±2.3 [b]

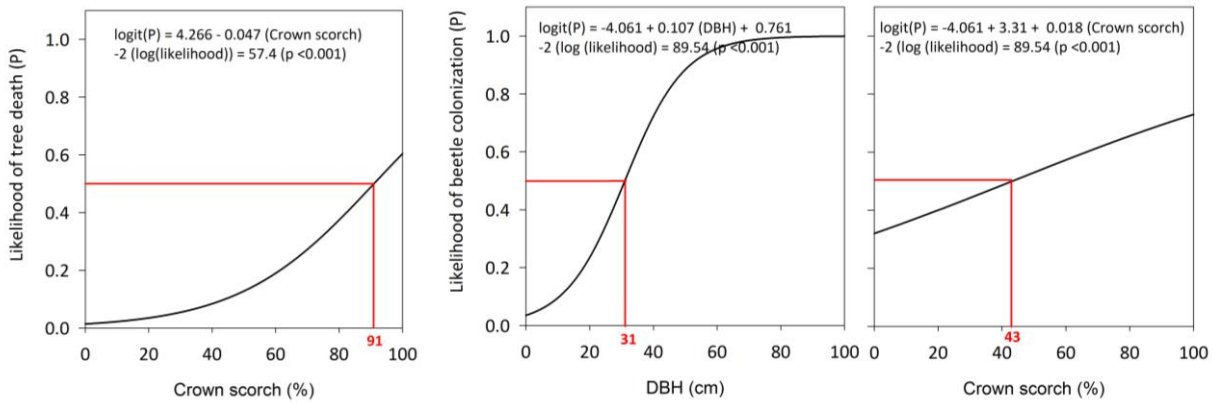

Figure 2. Likelihood models for tree death (left) and Douglas-fir bark beetle (middle and right) colonization one year after the 2013 wildfire at the Knife Creek block. Red lines and numbers depict the critical values above which likelihood exceeds 0.5. The mean values of crown scorch (middle) and DBH (right) were used to calculate likelihood of beetle colonization.

Discussion

Fire Effects on Ground Cover and Individual Trees

The effects of the 2013 wildfire were highly variable among plots and trees, yet largely consistent with the mapped classes of high and low fire severity. In the area classified as a high-severity crown fire, 100% of the ground cover in the plot had burned, exposing mineral soil and damaging fine roots. Impacts on the trees were more variable. Although 100% of the crowns of all trees were scorched, only a few had char along the full length of the bole indicating torching or candling, and only three trees died immediately. Effects were relatively high in another three plots classified as low-severity surface fire where 95–100% of the ground cover had burned, all fine fuels were consumed, and 80–100% of the crowns of most trees were scorched. Ultimately, 17 of 20 trees that died by July 2014 were in these six plots. In the other six low-severity plots, 40-100% of the ground cover had burned but fine fuels persisted, and scorch of tree crowns were variable but much lower, on average.

Variation in Fire Effects Among Plots

Variations in plot-level tree density and basal area reflected pre-fire forest structure rather than post-fire effects. Differences if forest structure between years of thinning and among fire-severity classes were not as expected. We predicted that plots in the area thinned in 2012 would have lower tree density and basal area than plots thinned in 1989–1994. These predictions assumed the same thinning treatments in both years, and small trees had recruited into the canopy and residual trees had released in the stands thinned in 1989–1994. We also predicted that the plots in the area that burned at high severity would have relatively high tree density, suggesting abundant aerial fuels and potentially ladder fuels to facility fire spread to the crowns. However, mean tree densities and basal areas did not differ between thinning treatments. Opposite to predictions, the mean values were significantly lower in the three plots that burned at high-severity than in the low-severity plots. In spite of these significant differences, weak negative correlations between tree density or basal area and percentage ground or crown scorch reflect the high degree of variation observed among plots in all fire severity

classes. Rather than aerial fuels controlling fire effects, surface fuels may have influenced fire spread and severity. The majority of the area burned was thinned in 2012. Visual assessment of the unburned plots and surrounding stands indicated surface fuels comprised of tree tops and branches were abundant in the recently-thinned stand. These fine and small-diameter fuels had opportunity to cure during warm dry fire weather conditions immediately preceding the wildfire.

Tree Mortality and Effects of Fire and Douglas-fir Bark Beetle

Only trees in plots within the fire perimeter died between 2013 and 2014; no trees in unburned plots died. Mortality of 17 of 20 dead trees was evident in 2014 only. On average, crown scorch and height of char on tree boles was greater on dead trees than those that survived, although diameters of living and dead trees did not differ significantly. A high degree of crown scorch, ≥ 91%, was the strongest predictor of tree death. Based on this criterion, the nine trees alive in 2014 with 100% crown scorch were susceptible to lagged mortality.

Fire directly and indirectly, by interacting with Douglas-fir bark beetles, contributed to tree mortality. Ten dead trees had no external signs of Douglas-fir beetle colonization and the ultimate cause of death was most likely fire only, although death was lagged for seven of these trees. Douglas-fir beetle colonized the other 10 dead trees in July 2014, so it is unclear if they ultimately died due to fire (and they were subsequently colonized) or if fire-weakened trees succumbed to beetles. Douglas-fir beetles colonized both live and dead trees at similar rates (e.g., proportional to the availability of live and dead trees). Beetles colonized 31 living trees within the burn perimeter; no trees outside the burn perimeter had signs of colonization in July 2014. On average, Douglas-fir beetles colonized trees with larger diameters, greater crown scorch and higher scorch on tree boles. Diameter ≥ 31cm and crown scorch ≥ 43%, combined, were the strongest predictors of colonization. All trees that exceed the thresholds for these two traits had been colonized by July 2014; however, 35 trees had diameters ≥ 31cm and crown scorch was 50 to 100% on another 13 trees. Of these 48 trees, 22 were within the burn perimeter and 26 were in unburned plots. As the Douglas-fir bark beetle population increases, trees in the unburned plots will become increasingly vulnerable to colonization.

Recommendations

The 2013 wildfire caused direct impacts on trees that were immediate (e.g., crown scorch, bole char, death) and lagged until the 2014 growing season (e.g., death). Indirect impacts were evident in 2014 when Douglas-fir bark beetles affected both dead and damaged live trees within the burn perimeter. We recommend resampling all 137 trees in the 18 plots to assess tree recovery, loss of vigour, and mortality due to fire, beetles, and their interactions as of Fall 2017. The following tree attributes should be re-measured using the 2013/4 field protocols: DBH, status as live/dead, percent crown scorch, crown vigour, evidence of Douglas-fir bark beetles. Whether dead trees are standing snags or downed logs also should be recorded. Documenting the 3-year response will provide important insights to guide management decisions in the extensive Douglas-fir forests affected during the 2017 wildfire season.

Acknowledgements

Thanks to the staff at the Alex Fraser Research Forest, Ken Day, Cathy Koot, and Mircea Rau, for their support by providing background information and assisting with data collection in the field.

Appendix 1: Field Protocols

Species
Douglas-fir (Fd) and lodgepole pine (Pl).

DBH
Tree diameter was measured at breast height to the nearest 0.1cm, 1.3 m from the ground on the uphill side of the tree.

Status and Crown Vigour
Trees were considered either live (L) or dead (D) based on vigour of foliage in the crown:

L Vigorous Crown - Foliage green and no evidence of thinning crown
L Thin Crown - Sparse green foliage remaining
L Flagging - Green foliage predominant but some red needles evident
D All Red Foliage - All foliage present is red.
D No Foliage - All needles have been lost; discoloured needles on forest floor surrounding bole

Crown Scorch
Visual estimate of the percentage of the crown that was scorched and discoloured relative to the estimated total crown volume before fire. Crown scorch was estimated to the nearest 5%.

Crown Damage
A six-class system was applied to categorize the degree of damage to individual tree crowns due to scorch:

0	Unaffected (green)
1	Light (green/yellow)
2	Light/Medium (yellow)
3	Medium (orange)
4	Medium/Severe (red)
5	Severe (brown)
6	Dead (no foliage)

Bole Char Height
The height of charring along the bark was measured to the nearest 0.1m using a laser rangefinder. Three heights were measured per tree:

H	The highest visible point of bark char; maximum char height.
L	The lowest visible point of bark char.
M	The estimated mean height of bark char based on observation around the entire circumference; not the average of H and L

Ground Burned
Visual estimate of the percentage of ground burned within a 15m radius around plot centre.

Ground Damage
The severity of fire impacts on the forest floor was categorized based on depth of burn (Ryan 1982*):

0	Unburned: No visible effect to the soil. Fire did not reside on the area, though some damage may have occurred above ground due to convected or radiated heat.
1	Light burn: Litter and duff layers are scorched or charred, but duff is not altered over entire depth.
2	Medium: Litter is completely consumed and the duff is deeply charred or consumed, but underlying mineral is not visibly altered.
3	Deep burn: Litter and duff are completely consumed and the structure and colour of mineral soil surface are visibly altered.

***** Ryan, K.C. 1983. Techniques for assessing fire damage to trees. In Lotan, J.E., Proceedings of the Symposium on Fire - Its Field Effects. Jackson, WY. Intermountain Fire Council, Missoula, MT. p. 1-11

Fuel Load
Surface fuel loads (kg m^{-2})in unburned plots were visually estimated using photo guides of surface fuel loadings from the AFRF Harvesting and Thinning Guidance for treatments in Wildland-Urban Interface areas of TSA 29 (See Appendix 2).

Status in 2014
Trees were considered either live (L) or dead (D) based on presence of green foliage or presence of all red foliage or no foliage in the crown.

Douglas-fir beetles
Presence (P) or absence (A) of colonization by Douglas-fir beetle was indicated by dark reddish heartwood dust near the bore holes.

Ambrosia beetles
Presence (P) or absence (A) of colonization by Ambrosia beetle was indicated by light sapwood dust near the bore holes.

Appendix 2. Surface Fuel Loading Photo Guide

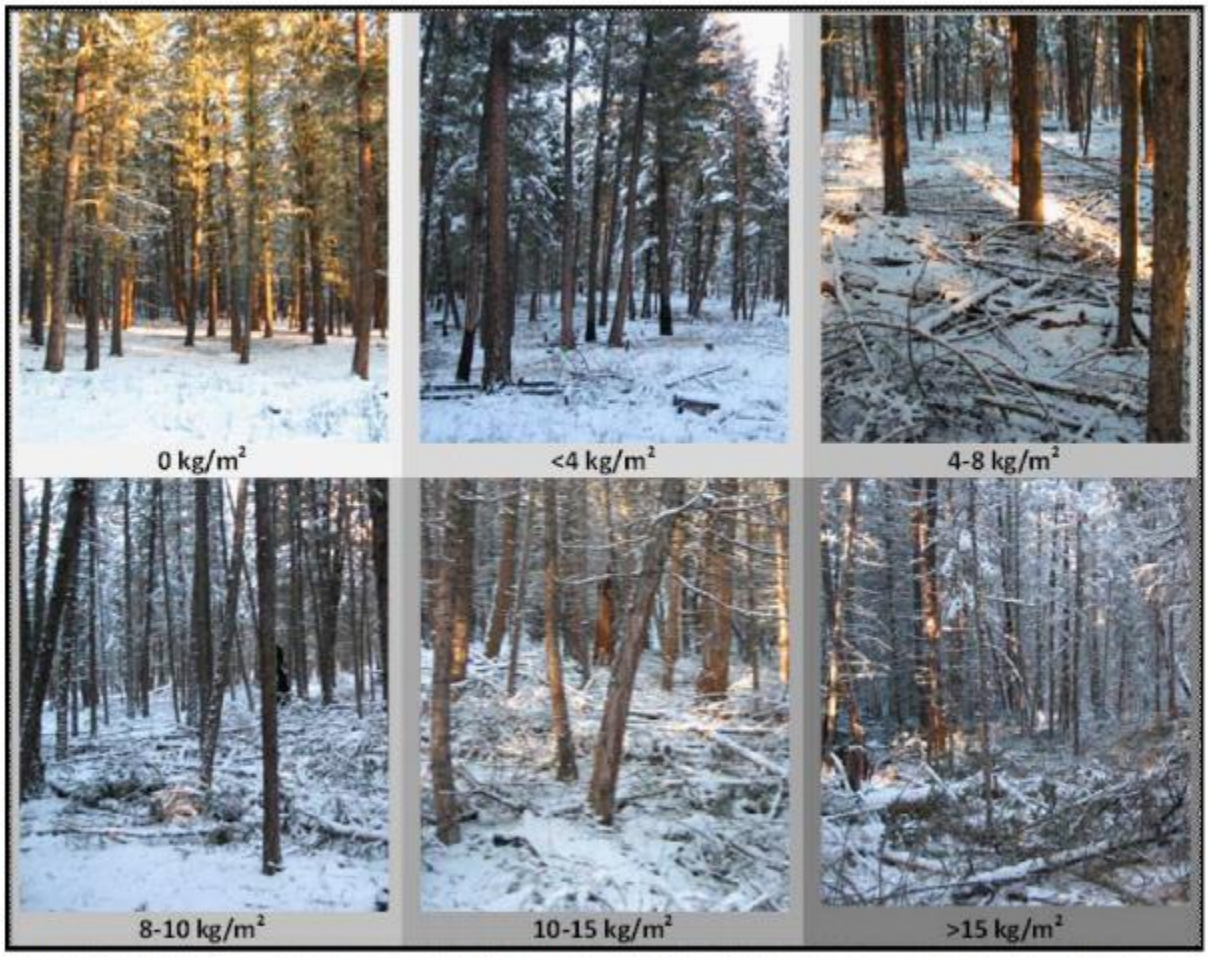

Figure 2: Photo gradient of surface fuel loadings. Surface fuel loading values are subjective observation-based estimates only and require some level of validation. B.A. Blackwell photos, Knife Creek Block, UBC/Alex Fraser Research Forest.

Appendix 3a: 2013 Tree and Fire Data (2013-4 Fire Data AFRF.xls)

Trees at 2013 Knife Creek Forest Fire

Post-fire Data — Date: October 23 - 27th, 2013 — BAF: 4

Team: Vince Luu, Mircea Rau — Slope & Aspect: -6% @ 274 deg

Burn	Zone	Plot #	Tree ID	Tree #	Spc	DBH (cm)	Status (L/D)	C. Damage	C. Scorch (%)	Bark Char (ht cm) H	L	M	Bark Char Avg (ht cm)	Ground Burned (%)	Ground Damage	Notes
B	2012	6	615	1	Fd	23.0	L	1	25	3.1	0.9	2.7	1.9	95	1	some fines burned
B	2012	6	610	2	Fd	23.9	L	1	25	4.7	1.3	2.2	2.4	95	1	some roots burned
B	2012	6	604	3	Fd	71.3	L	1	10	5.9	2.3	3.0	3.4	95	1	fuels 5-15cm (100% charred)
B	2012	6	607	4	Fd	14.3	L	1	20	3.5	0.7	1.7	1.7	95	1	
B	2012	6	602	5	Fd	17.1	L	1	5	3.8	0.8	2.0	1.9	95	2	
B	2012	6	603	6	Fd	74.0	L	0	0	4.8	2.4	3.2	3.2	95	1	
B	2012	6	608	7	Fd	27.6	L	1	25	5.9	0.9	2.6	2.6	95	1	
B	2012	6	606	8	Fd	12.5	L	2	50	3.5	0.1	1.7	1.4	95	1	
B	2012	6	616	9	Fd	41.3	L	4	70	4.0	3.2	3.6	3.5	95	1	
B	2012	6	601	10	Fd	62.3	L	4	70	4.1	2.7	3.1	3.2	95	1	
B	2012	6	90	11	Fd	70.8	L	4	100	6.3	4.2	4.4	4.8	95	1	
B	2012	6	605	12	Fd	16.1	L	1	5	4.9	0.6	1.6	1.9	95	1	
B	2012	2	700	1	Fd	32.9	L	0	0	2.8	0.1	1.5	1.1	95	1	some fines burned
B	2012	2	614	2	Fd	27.7	L	0	0	2.4	0.2	1.5	1.1	95	1	some roots burned
B	2012	2	613	3	Fd	29.0	L	0	0	2.8	1.9	2.3	2.2	95	1	fuels 5-15cm (100% charrred)
B	2012	2	609	4	Fd	28.1	L	1	5	3.2	0.7	3.5	2.0	95	1	
B	2012	2	612	5	Fd	31.6	L	0	0	3.2	0.2	1.6	1.3	95	1	
B	2012	2	618	6	Pl	22.9	D	0	0	1.7	0.2	1.0	0.8	95	1	
B	2012	2	624	7	Fd	64.6	L	0	0	3.7	0.3	2.7	1.8	95	1	
B	2012	16	625	1	Fd	46.2	L	1	5	5	0.4	2.9	2.2	100	2	all fines burned
B	2012	16	629	2	Fd	51.2	L	1	10	7.3	3.2	5.7	4.9	100	2	some roots burned
B	2012	16	630	3	Fd	46	L	1	10	4	3.7	2.9	3.6	100	2	fuels 5-15cm (50% burned)
B	2012	16	620	4	Fd	19.3	L	1	20	1.7	0.4	1.2	0.9	100	2	
B	2012	16	621	5	Fd	30.9	L	2	40	4	1.2	3	2.4	100	2	
B	2012	16	627	6	Fd	28.1	L	1	5	4.1	0.3	1.5	1.6	100	2	
B	2012	16	631	7	Fd	28.6	L	1	5	5.8	0.5	2.6	2.4	100	2	
B	2012	16	628	8	Fd	15	L	1	20	2.4	1.3	1.7	1.7	100	2	
B	2012	16	622	9	Fd	15.7	L	1	20	3.8	1.8	2.9	2.6	100	2	
B	2012	16	626	10	Fd	22.2	L	0	0	4.5	1.1	3.1	2.5	100	2	
B	2012	7	632	1	Fd	37.6	L	1	5	7.9	3.1	5.8	5.0	100	2	all fines burned
B	2012	7	633	2	Fd	22.1	L	3	100	7.5	4.2	6	5.5	100	2	some roots burned
B	2012	7	634	3	Fd	26.5	L	3	100	6.7	1.6	4.8	3.7	100	2	fuels 5-15cm (100% burned)
B	2012	7	635	4	Fd	15.9	L	3	100	4.6	2.6	3.3	3.3	100	2	
B	2012	7	636	5	Fd	23.3	L	3	100	5.1	4.2	3.3	4.2	100	2	
B	2012	7	637	6	Fd	38.8	L	3	80	8.2	4.7	5.2	5.7	100	2	
B	2012	11	619	1	Fd	28.8	L	3	100	7.8	4.4	6.3	5.7	100	2	all fine fuels burned
B	2012	11	649	2	Fd	22.8	L	3	100	5.4	2.5	4.7	3.8	100	2	some roots burned
B	2012	11	650	3	Fd	12.8	L	4	100	6.3	2.1	3.8	3.6	100	2	fuels 5-15cm (60% burn, 40% charred)
B	2012	11	638	4	Fd	23.8	L	2	80	7.0	3.8	5.4	5.0	100	2	
B	2012	11	639	5	Fd	15.8	L	3	90	5.3	2.4	3.4	3.4	100	2	
B	2012	11	640	6	Fd	23.0	L	3	100	6.2	1.1	3.3	2.9	100	2	
B	1994	5	648	1	Fd	18.3	L	2	100	2.1	0.4	1.5	1.1	95	2	all fine fuels burned
B	1994	5	641	2	Fd	22.3	L	2	100	2.6	0.2	2.0	1.3	95	2	no roots burned
B	1994	5	642	3	Fd	37.0	L	2	100	4.8	3.2	3.9	3.8	95	2	fuels 5-15cm (60% burn, 40% charred)
B	1994	5	647	4	Fd	17.5	L	3	100	3.1	1.6	2.6	2.2	95	2	
B	1994	5	645	5	Fd	22.5	L	3	100	2.7	1.6	2.1	2.0	95	2	
B	1994	5	646	6	Fd	38.1	L	2	80	5.4	3.1	4.2	4.0	95	2	
B	1994	5	644	7	Fd	21.9	L	3	100	4.4	2.4	2.8	3.0	95	2	
B	1994	5	643	8	Fd	26.6	L	3	100	4.1	3.0	3.5	3.4	95	2	
B	1994	5	664	9	Fd	28.1	L	3	90	3.2	0.7	1.8	1.6	95	2	
B	1994	8	656	1	Fd	30.8	L	0	0	2.5	1.5	2.1	1.9	40	1	some fine fuels burned
B	1994	8	655	2	Fd	31.7	L	1	15	4.1	1.6	3.0	2.6	40	1	some roots burned
B	1994	8	654	3	Fd	20.7	L	2	60	3.4	0.9	2.0	1.8	40	1	fuels 5-15cm (50% burned, 50% unburned)
B	1994	8	657	4	Fd	13.2	L	0	0	0.2	0.0	0.1	0.1	40	1	60% unburned grass
B	1994	8	653	5	Fd	24.9	L	2	40	1.4	0.0	0.1	0.4	40	1	
B	1994	8	658	6	Fd	36.9	L	0	0	1.0	0.1	0.5	0.4	40	1	
B	1994	8	661	7	Fd	27.3	L	0	0	2.2	0.0	1.2	0.9	40	1	
B	1994	8	662	8	Fd	31.1	L	0	0	2.4	0.0	0.5	0.7	40	1	
B	1994	8	659	9	Fd	26.5	L	1	5	3.1	1.1	2.0	1.8	40	1	
B	2012	20	651	1	Fd	40.5	L	5	100	22.7	22.7	22.7	22.7	100	3	fine fuels burned completely
B	2012	20	652	2	Fd	43.8	D	6	100	25.0	25.0	25.0	25.0	100	3	roots burned completely
B	2012	20	663	3	Fd	40.2	D	6	100	23.7	23.7	23.7	23.7	100	3	fuels 5-15cm (100% consumed)
B	2012	20	660	4	Fd	43.3	D	6	100	26.9	26.9	26.9	26.9	100	3	burned to mineral soil
B	2012	10	697	1	Fd	33.8	L	3	100	5.8	3.8	4.3	4.4	100	3	some fines burned
B	2012	10	696	2	Fd	34.7	L	3	100	5.0	2.1	3.3	3.1	100	3	roots burned completely
B	2012	10	695	3	Fd	21.1	L	3	100	5.7	2.7	3.7	3.7	100	3	fuels 5-15cm (60% burned, 40% charred)
B	2012	10	694	4	Fd	30.3	L	3	100	6.7	2.9	3.5	4.0	100	3	
B	2012	10	698	5	Fd	22.1	L	3	100	5.5	4.6	5.1	5.0	100	3	
B	2012	10	686	6	Fd	85.0	L	3	100	23.8	14.3	15.1	16.9	100	3	
B	2012	9	692	1	Fd	28.8	L	0	0	3.7	1.9	3.0	2.6	100	2	some fines burned
B	2012	9	691	2	Fd	56.0	L	2	50	12.5	3.0	4.9	5.9	100	2	some roots burned
B	2012	9	690	3	Fd	49.7	L	2	35	10.5	2.9	5.3	5.4	100	2	fuels 5-15cm (50% burned, 50% charred)
B	2012	1	688	1	Fd	19.3	L	0	0	2	0.3	1.1	0.9	90	1	80% fines burned
B	2012	1	693	2	Fd	23.7	L	1	15	3.8	0.5	2.4	1.8	90	1	some roots burned
B	2012	1	689	3	Fd	33.7	L	0	0	8.3	2.8	4.8	4.7	90	1	fuels 5-15cm (30% burned, 30%charred, 40%
B	2012	1	685	4	Fd	42.8	L	0	0	6.6	2	3.7	3.6	90	1	
B	2012	1	687	5	Fd	36.3	L	0	0	4.1	0.1	2	1.6	90	1	
B	2012	1	684	6	Fd	19.6	L	1	10	2.4	0.2	1.1	1.0	90	1	
B	2012	1	676	7	Fd	20.1	L	0	0	1.9	0.1	0.7	0.7	90	1	
B	2012	1	677	8	Fd	15.9	L	0	0	0.7	0.1	0.4	0.3	90	1	
B	2012	1	678	9	Fd	24.6	L	0	0	0.7	0.1	0.5	0.4	90	1	
B	2012	1	679	10	Fd	48.8	L	1	10	12.9	1.7	5.9	5.6	90	1	
B	2012	19	683	1	Fd	22.0	L	0	0	0.5	0.1	0.2	0.2	80	1	70% fines burned
B	2012	19	682	2	Fd	26.4	L	0	0	4.2	1.6	2.5	2.5	80	1	no roots burned
B	2012	19	681	3	Fd	36.2	L	0	0	5.2	3.1	4.1	3.9	80	1	fuels 5-15cm (25% burned, 25% charred, 50%
B	2012	19	680	4	Fd	16.0	L	0	0	0.9	0.5	0.7	0.7	80	1	
B	2012	19	674	5	Fd	21.7	L	0	0	2.3	1	1.7	1.5	80	1	
B	2012	19	675	6	Fd	27.2	L	1	10	2.2	0.9	1.8	1.5	80	1	
B	2012	19	673	7	Fd	18.7	L	0	0	0.7	0.3	0.5	0.5	80	1	

Trees at 2013 Knife Creek Forest Fire

Post-fire Data | Date: October 23 - 27th, 2013 | BAF: 4

Team: Vince Luu, Mircea Rau | Slope & Aspect: -6% @ 274 deg

Burn	Zone	Plot #	Tree ID	Tree #	Spc	DBH (cm)	Status (L/D)	C. Damage	C. Scorch (%)	Bark Char (ht cm) H	L	M	Bark Char Avg (ht cm)	Ground Burned (%)	Ground Damage	Notes
Unb	1994	29	671	1	Fd	30.2	L	0	0	0	0	0	0.0	0	0	3/10 trees showed 5-10% defoliation
Unb	1994	29	669	2	Fd	21.0	L	0	0	0	0	0	0.0	0	0	no boring dust
Unb	1994	29	668	3	Fd	19.4	L	0	0	0	0	0	0.0	0	0	surface fuel load <4kg/m2 (~3)
Unb	1994	29	600	4	Fd	14.0	L	0	0	0	0	0	0.0	0	0	
Unb	1994	29	670	5	Fd	25.9	L	0	0	0	0	0	0.0	0	0	
Unb	1994	29	672	6	Fd	19.2	L	0	0	0	0	0	0.0	0	0	
Unb	1994	29	667	7	Fd	18.7	L	0	0	0	0	0	0.0	0	0	
Unb	1994	29	666	8	Fd	22.4	L	0	0	0	0	0	0.0	0	0	
Unb	1994	29	665	9	Fd	21.6	L	0	0	0	0	0	0.0	0	0	
Unb	1989	25	599	1	Fd	15.8	L	0	0	0	0	0	0.0	0	0	14/32 trees showed ~30% defoliation
Unb	1989	25	598	2	Fd	27.3	L	0	0	0	0	0	0.0	0	0	no boring dust, In middle of skidtrail
Unb	1989	25	597	3	Fd	33.1	L	0	0	0	0	0	0.0	0	0	surface fuel load <4kg/m2 (~2)
Unb	1994	22	587	1	Fd	24.5	L	0	0	0	0	0	0.0	0	0	1/8 trees showed ~5%defoliation
Unb	1994	22	591	2	Fd	28.9	L	0	0	0	0	0	0.0	0	0	no boring dust
Unb	1994	22	592	3	Fd	19.4	L	0	0	0	0	0	0.0	0	0	surface fuel load 4-8kg/m2 (~7)
Unb	1994	22	593	4	Fd	33.0	L	0	0	0	0	0	0.0	0	0	
Unb	1994	22	594	5	Fd	20.3	L	0	0	0	0	0	0.0	0	0	
Unb	1994	22	595	6	Fd	36.5	L	0	0	0	0	0	0.0	0	0	
Unb	1994	22	596	7	Fd	27.1	L	0	0	0	0	0	0.0	0	0	
Unb	1994	22	589	8	Pl	21.6	L	0	0	0	0	0	0.0	0	0	
Unb	1994	22	588	9	Fd	25.0	L	0	0	0	0	0	0.0	0	0	
Unb	2012	27	590	1	Fd	47.7	L	0	0	0	0	0	0.0	0	0	Large fire scar 2m tall 40% circ
Unb	2012	27	586	2	Fd	49.1	L	0	0	0	0	0	0.0	0	0	
Unb	2012	27	585	3	Fd	59.4	L	0	0	0	0	0	0.0	0	0	0/0 trees showed defoliation (no regen)
Unb	2012	27	583	4	Fd	32.4	L	0	0	0	0	0	0.0	0	0	no boring dust
Unb	2012	27	582	5	Fd	33.4	L	0	0	0	0	0	0.0	0	0	surface fuel load 10-15kg/m2 (~14)
Unb	2012	27	581	6	Fd	38.0	L	0	0	0	0	0	0.0	0	0	
Unb	2012	27	580	7	Fd	55.3	L	0	0	0	0	0	0.0	0	0	Large fire scar 1.8m tall 25% circ
Unb	2012	27	579	8	Fd	48.7	L	0	0	0	0	0	0.0	0	0	
Unb	2012	27	584	9	Fd	20.6	L	0	0	0	0	0	0.0	0	0	
Unb	2012	27	528	10	Fd	60.0	L	0	0	0	0	0	0.0	0	0	
Unb	2012	23	576	1	Fd	35.5	L	0	0	0	0	0	0.0	0	0	0/0 trees showed defoliation (no regen)
Unb	2012	23	575	2	Fd	36.6	L	0	0	0	0	0	0.0	0	0	
Unb	2012	23	574	3	Fd	38.3	L	0	0	0	0	0	0.0	0	0	surface fuel load >15kg/m2 (~16)
Unb	2012	23	573	4	Fd	37.5	L	0	0	0	0	0	0.0	0	0	
Unb	2012	23	572	5	Fd	33.1	L	0	0	0	0	0	0.0	0	0	
Unb	2012	23	569	6	Fd	91.5	L	0	0	0	0	0	0.0	0	0	
Unb	2012	23	577	7	Fd	46.6	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	568	1	Fd	49.3	L	0	0	0	0	0	0.0	0	0	0/0 trees showed defoliation (no regen)
Unb	2012	21	570	2	Fd	77.7	L	0	0	0	0	0	0.0	0	0	no boring dust
Unb	2012	21	567	3	Fd	22.2	L	0	0	0	0	0	0.0	0	0	surface fuel load >15kg/m2 (~17)
Unb	2012	21	560	4	Fd	43.3	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	562	5	Fd	87.5	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	561	6	Fd	29.3	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	556	7	Fd	78.9	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	555	8	Fd	70.1	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	571	9	Fd	15.2	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	563	10	Fd	53.0	L	0	0	0	0	0	0.0	0	0	
Unb	2012	21	559	11	Fd	15	L	0	0	0	0	0	0	0	0	

Appendix 3b: 2014 Health and Beetle Data (2013-4 Fire Data AFRF.xls)

Trees in 2013 Fires at Knife Creek Block

Post-fire beetle data

Team: Vince Luu, Mircea Rau Date: October 23 - 27th, 2013

Team: Cathy Koot Date: July 16, 2014

Burn	Zone	Plot #	Tree ID	Tree #	Spc	DBH (cm)	Status (L/D) in 2013	Status (L/D) in 2014	Douglas-fir beetles (P/A)	Ambrosia beetles (P/A)	Notes	Other
B	2012	6	615	1	Fd	23.0	L	L	P	A	Vigorous Crown	
B	2012	6	610	2	Fd	23.9	L	L	P	A	Vigorous Crown	
B	2012	6	604	3	Fd	71.3	L	L	P	A	Vigorous Crown	
B	2012	6	607	4	Fd	14.3	L	L	A	A	Vigorous Crown	
B	2012	6	602	5	Fd	17.1	L	L	A	A	Very Thin Crown	
B	2012	6	603	6	Fd	74.0	L	L	P	A	Resinosis Mid-Bole	
B	2012	6	608	7	Fd	27.6	L	L	P	A	Vigorous Crown	
B	2012	6	606	8	Fd	12.5	L	L	A	A	Vigorous Crown	
B	2012	6	616	9	Fd	41.3	L	L	P	P	Very Thin Crown	
B	2012	6	601	10	Fd	62.3	L	L	P	P	Flagging	
B	2012	6	90	11	Fd	70.8	L	D	P	A	Flagging	
B	2012	6	605	12	Fd	16.1	L	L	A	A	All Red Foliage	
B	2012	2	700	1	Fd	32.9	L	L	A	A	Vigorous Crown	
B	2012	2	614	2	Fd	27.7	L	L	A	A	Vigorous Crown	
B	2012	2	613	3	Fd	29.0	L	L	A	A	Vigorous Crown	
B	2012	2	609	4	Fd	28.1	L	L	A	A	Vigorous Crown	
B	2012	2	612	5	Fd	31.6	L	L	A	A	Vigorous Crown	
B	2012	2	618	6	Pl	22.9	D	D	n/a	n/a	This pine was dead before the fire	
B	2012	2	624	7	Fd	64.6	L	L	A	A	Vigorous Crown	
B	2012	16	625	1	Fd	46.2	L	L	P	A	Crown flagging	
B	2012	16	629	2	Fd	51.2	L	L	P	A	Crown flagging	
B	2012	16	630	3	Fd	46	L	L	P	A	Crown flagging	
B	2012	16	620	4	Fd	19.3	L	L	P-only to 20 cm	A	Crown flagging	
B	2012	16	621	5	Fd	30.9	L	L	P	A	Crown flagging	
B	2012	16	627	6	Fd	28.1	L	L	P	A	Crown flagging	
B	2012	16	631	7	Fd	28.6	L	L	P	A	Crown flagging	
B	2012	16	628	8	Fd	15	L	D	P	A	No Foilage	
B	2012	16	622	9	Fd	15.7	L	D	P	A	No Foilage	
B	2012	16	626	10	Fd	22.2	L	L	P	A	Crown flagging	
B	2012	7	632	1	Fd	37.6	L	L	P	A	Crown flagging	
B	2012	7	633	2	Fd	22.1	L	D	A	A	Very Thin Crown	
B	2012	7	634	3	Fd	26.5	L	D	P	A	Very Thin Crown	
B	2012	7	635	4	Fd	15.9	L	D	A	A	All Red Foliage	
B	2012	7	636	5	Fd	23.3	L	D	P	A	All Red Foliage	
B	2012	7	637	6	Fd	38.8	L	L	P	A	Crown flagging	
B	2012	11	619	1	Fd	28.8	L	L	P	A	All Red Foliage	
B	2012	11	649	2	Fd	22.8	L	L	P	A	Crown flagging	
B	2012	11	650	3	Fd	12.8	L	D	A	A	No Foilage	
B	2012	11	638	4	Fd	23.8	L	L	P	A	Crown flagging	
B	2012	11	639	5	Fd	15.8	L	D	A	A	No Foilage	
B	2012	11	640	6	Fd	23.0	L	D	A	A	All Red Foilage	
B	2012	11	619	1	Fd	28.8	L	L	P	A	Crown Flaggin	
B	1994	5	648	1	Fd	18.3	L	D	A	A	All Red Foilage	
B	1994	5	641	2	Fd	22.3	L	L	A	A	Crown flagging	
B	1994	5	642	3	Fd	37.0	L	L	P	P	Very Thin Crown	
B	1994	5	647	4	Fd	17.5	L	D	A	A	All Red Foilage	
B	1994	5	645	5	Fd	22.5	L	L	A	A	Very Thin Crown	
B	1994	5	646	6	Fd	38.1	L	L	P	P	Thin crown	
B	1994	5	644	7	Fd	21.9	L	D	A	A	All Red Foilage	
B	1994	5	643	8	Fd	26.6	L	L	P	A	Thin crown	
B	1994	5	664	9	Fd	28.1	L	L	P	A	Thin crown	
B	1994	8	656	1	Fd	30.8	L	L	A	A	Vigorous Crown	
B	1994	8	655	2	Fd	31.7	L	L	A	A	Vigorous Crown	
B	1994	8	654	3	Fd	20.7	L	L	A	A	Thin crown	
B	1994	8	657	4	Fd	13.2	L	L	A	A	Vigorous Crown	
B	1994	8	653	5	Fd	24.9	L	L	A	A	Crown Flagging	
B	1994	8	658	6	Fd	36.9	L	L	A	A	Vigorous Crown	
B	1994	8	661	7	Fd	27.3	L	L	A	A	Vigorous Crown	
B	1994	8	662	8	Fd	31.1	L	L	A	A	Vigorous Crown	
B	1994	8	659	9	Fd	26.5	L	L	A	A	Vigorous Crown	
B	2012	20	651	1	Fd	40.5	L	D	P	P	All Red Foliage	
B	2012	20	652	2	Fd	43.8	D	D	P	P	No foilage Oct. 2013 yet still attracted bark-beetles in 2014	
B	2012	20	663	3	Fd	40.2	D	D	P	P	No foilage Oct. 2013 yet still attracted bark-beetles in 2014	
B	2012	20	660	4	Fd	43.3	D	D	P	P	No foilage Oct. 2013 yet still attracted bark-beetles in 2014	
B	2012	10	697	1	Fd	33.8	L	L	P	A	Thin crown	
B	2012	10	696	2	Fd	34.7	L	L	P	P	Flagging Crown	
B	2012	10	695	3	Fd	21.1	L	D	A	A	Red Thin Crown	
B	2012	10	694	4	Fd	30.3	L	L	P	A	Thin crown	
B	2012	10	698	5	Fd	22.1	L	D	A	A	Red Thin Crown	
B	2012	10	686	6	Fd	85.0	L	D	P	P	Red Thin Crown	
B	2012	9	692	1	Fd	28.8	L	L	A	A	Resinosis Mid-bole, No Frass evident	
B	2012	9	691	2	Fd	56.0	L	L	P	A	Crown Flagging	
B	2012	9	690	3	Fd	49.7	L	L	P	P	Crown Flagging	
B	2012	1	688	1	Fd	19.3	L	L	A	A	Vigorous Crown	
B	2012	1	693	2	Fd	23.7	L	L	A	A	Vigorous Crown	
B	2012	1	689	3	Fd	33.7	L	L	A	A	Vigorous; Resinosis Mid-bole , No Frass evident	
B	2012	1	685	4	Fd	42.8	L	L	P	A	Vigorous Crown	
B	2012	1	687	5	Fd	36.3	L	L	P	A	Vigorous Crown	
B	2012	1	684	6	Fd	19.6	L	L	A	A	Vigorous Crown	
B	2012	1	676	7	Fd	20.1	L	L	A	A	Resinosis Mid-bole, No Frass evident	
B	2012	1	677	8	Fd	15.9	L	L	A	A	Vigorous Crown	
B	2012	1	678	9	Fd	24.6	L	L	A	A	Vigorous Crown	
B	2012	1	679	10	Fd	48.8	L	L	A	A	Vigorous Crown	
B	2012	19	683	1	Fd	22.0	L	L	A	A	Vigorous Crown	
B	2012	19	682	2	Fd	26.4	L	L	A	A	Thin crown	
B	2012	19	681	3	Fd	36.2	L	L	A	A	Vigorous Crown; Resinosis Mid-bole, no frass evident	
B	2012	19	680	4	Fd	16.0	L	L	A	A	Vigorous Crown	
B	2012	19	674	5	Fd	21.7	L	L	A	A	Resinosis; No Frass evident	
B	2012	19	675	6	Fd	27.2	L	L	A	A	Vigorous Crown	
B	2012	19	673	7	Fd	18.7	L	L	A	A	Vigorous Crown	

Trees in 2013 Fires at Knife Creek Block

Post-fire beetle data

Team: Vince Luu, Mircea Rau **Date:** October 23 - 27th, 2013

Team: Cathy Koot **Date:** July 16, 2014

Burn	Zone	Plot #	Tree ID	Tree #	Spc	DBH (cm)	Status (L/D) in 2013	Status (L/D) in 2014	Douglas-fir beetles (P/A)	Ambrosia beetles (P/A)	Notes	Other
Unb	1994	29	671	1	Fd	30.2	L	L	A	A	Vigorous Crown	
Unb	1994	29	669	2	Fd	21.0	L	L	A	A	Vigorous Crown	
Unb	1994	29	668	3	Fd	19.4	L	L	A	A	Vigorous Crown	
Unb	1994	29	600	4	Fd	14.0	L	L	A	A	Vigorous Crown	
Unb	1994	29	670	5	Fd	25.9	L	L	A	A	Vigorous Crown	
Unb	1994	29	672	6	Fd	19.2	L	L	A	A	Vigorous Crown	
Unb	1994	29	667	7	Fd	18.7	L	L	A	A	Vigorous Crown	
Unb	1994	29	666	8	Fd	22.4	L	L	A	A	Vigorous Crown	
Unb	1994	29	665	9	Fd	21.6	L	L	A	A	Vigorous Crown	
Unb	1989	25	599	1	Fd	15.8	L	L	A	A	Thin crown	
Unb	1989	25	598	2	Fd	27.3	L	L	A	A	Vigorous Crown	
Unb	1989	25	597	3	Fd	33.1	L	L	A	A	Vigorous Crown	
Unb	1994	22	587	1	Fd	24.5	L	L	A	A	Vigorous Crown	
Unb	1994	22	591	2	Fd	28.9	L	L	A	A	Vigorous Crown	
Unb	1994	22	592	3	Fd	19.4	L	L	A	A	Vigorous Crown	
Unb	1994	22	593	4	Fd	33.0	L	L	A	A	Vigorous Crown	
Unb	1994	22	594	5	Fd	20.3	L	L	A	A	Vigorous Crown	
Unb	1994	22	595	6	Fd	36.5	L	L	A	A	Vigorous Crown	
Unb	1994	22	596	7	Fd	27.1	L	L	A	A	Vigorous Crown	
Unb	1994	22	589	8	Pl	21.6	L	L	A	A	Vigorous Crown	
Unb	1994	22	588	9	Fd	25.0	L	L	A	A	Vigorous Crown	
Unb	2012	27	590	1	Fd	47.7	L	L	A	A	Vigorous Crown	
Unb	2012	27	586	2	Fd	49.1	L	L	A	A	Vigorous Crown	
Unb	2012	27	585	3	Fd	59.4	L	L	A	A	Vigorous Crown	
Unb	2012	27	583	4	Fd	32.4	L	L	A	A	Vigorous Crown	
Unb	2012	27	582	5	Fd	33.4	L	L	A	A	Vigorous Crown	
Unb	2012	27	581	6	Fd	38.0	L	L	A	A	Vigorous Crown	
Unb	2012	27	580	7	Fd	55.3	L	L	A	A	Vigorous Crown	
Unb	2012	27	579	8	Fd	48.7	L	L	A	A	Vigorous Crown	
Unb	2012	27	584	9	Fd	20.6	L	L	A	A	Vigorous Crown	
Unb	2012	27	578	10	Fd	60.0	L	L	A	A	Vigorous Crown	
Unb	2012	23	576	1	Fd	35.5	L	L	A	A	Vigorous Crown	
Unb	2012	23	575	2	Fd	36.6	L	L	A	A	Vigorous Crown	
Unb	2012	23	574	3	Fd	38.3	L	L	A	A	Vigorous Crown	
Unb	2012	23	573	4	Fd	37.5	L	L	A	A	Vigorous Crown	
Unb	2012	23	572	5	Fd	33.1	L	L	A	A	Vigorous Crown	
Unb	2012	23	569	6	Fd	91.5	L	L	A	A	Vigorous Crown	
Unb	2012	23	577	7	Fd	46.6	L	L	A	A	Vigorous Crown	
Unb	2012	21	568	1	Fd	49.3	L	L	A	A	Vigorous Crown	
Unb	2012	21	570	2	Fd	77.7	L	L	A	A	Vigorous Crown	
Unb	2012	21	567	3	Fd	22.2	L	L	A	A	Vigorous Crown	
Unb	2012	21	560	4	Fd	43.3	L	L	A	A	Vigorous Crown	
Unb	2012	21	562	5	Fd	87.5	L	L	A	A	Vigorous Crown	
Unb	2012	21	561	6	Fd	29.3	L	L	A	A	Vigorous Crown	
Unb	2012	21	556	7	Fd	78.9	L	L	A	A	Vigorous Crown	
Unb	2012	21	555	8	Fd	70.1	L	L	A	A	Vigorous Crown	
Unb	2012	21	571	9	Fd	15.2	L	L	A	A	Vigorous Crown	
Unb	2012	21	563	10	Fd	53.0	L	L	A	A	Vigorous Crown	
Unb	2012	21	559	-	Fd	15.0	L	L	A	A	Vigorous Crown	

Appendix 4: Plot-level Data

Plot 1

Low-Severity, Surface Fire

Coordinates: LAT +5766659.075, LON +578658.9826 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 904

Basal Area per Hectare: 40 m^2

Ground Burned Area: 90 %

Ground Burned Damage: Light burn: Litter and duff layers are scorched or charred, but duff is not altered over entire depth.

Trees Captured in Plot: 10

Tree DBH Average: 28.5 cm

Crown Scorch Average: 3.5 %

Crown Damage Average: 0.3/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 20 %

Ambrosia Beetle Attack: 0%

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	688	Fd	19.3	L	L	0	1.1	0.9	A	A
2	693	Fd	23.7	L	L	15	2.4	1.8	A	A
3	689	Fd	33.7	L	L	0	4.8	4.7	A	A
4	685	Fd	42.8	L	L	0	3.7	3.6	P	A
5	687	Fd	36.3	L	L	0	2	1.6	P	A
6	684	Fd	19.6	L	L	10	1.1	1.0	A	A
7	676	Fd	20.1	L	L	0	0.7	0.7	A	A
8	677	Fd	15.9	L	L	0	0.4	0.3	A	A
9	678	Fd	24.6	L	L	0	0.5	0.4	A	A
10	679	Fd	48.8	L	L	10	5.9	5.6	A	A

Plot 2

Low-Severity, Surface Fire

Coordinates: LAT +5766749.764, LON +578723.8131 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 399

Basal Area per Hectare: 28 m^2

Ground Burned Area: 95 %

Ground Burned Damage: Light burn: Litter and duff layers are scorched or charred, but duff is not altered over entire depth**.**

Trees Captured in Plot: 7

Tree DBH Average: 33.8 cm

Crown Scorch Average: 13.5 %

Crown Damage Average: 0.1/6

Percent Mortality: 14.3 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	700	Fd	32.9	L	L	0	1.5	1.1	A	A
2	614	Fd	27.7	L	L	0	1.5	1.1	A	A
3	613	Fd	29.0	L	L	0	2.3	2.2	A	A
4	609	Fd	28.1	L	L	5	3.5	2.0	A	A
5	612	Fd	31.6	L	L	0	1.6	1.3	A	A
6	618	Pl	22.9	D	D	0	1.0	0.8	n/a	n/a
7	624	Fd	64.6	L	L	0	2.7	1.8	A	A

Plot 5

Low-Severity, Surface Fire

Coordinates: LAT +5766574.248, LON +578852.3926 (NAD 83 UTM 10)

Pre-commercially Thinned: 1994

Stems per Hectare: 836

Basal Area per Hectare: 36 m^2

Ground Burned Area: 95 %

Ground Burned Damage: Medium burn: Litter is completely consumed and the duff is deeply charred or consumed, but underlying mineral is not visibly altered.

Trees Captured in Plot: 9

Tree DBH Average: 25.8 cm

Crown Scorch Average: 96.7 %

Crown Damage Average: 2.6/6

Percent Mortality: 33.3 %

Douglas-fir Beetle Attack: 44.4 %

Ambrosia Beetle Attack: 22.2 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	648	Fd	18.3	L	D	100	1.5	1.1	A	A
2	641	Fd	22.3	L	L	100	2.0	1.3	A	A
3	642	Fd	37.0	L	L	100	3.9	3.8	P	P
4	647	Fd	17.5	L	D	100	2.6	2.2	A	A
5	645	Fd	22.5	L	L	100	2.1	2.0	A	A
6	646	Fd	38.1	L	L	80	4.2	4.0	P	P
7	644	Fd	21.9	L	D	100	2.8	3.0	A	A
8	643	Fd	26.6	L	L	100	3.5	3.4	P	A
9	664	Fd	28.1	L	L	90	1.8	1.6	P	A

Plot 6

Low-Severity, Surface Fire

Coordinates: LAT +5766779.788, LON +578645.5532 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 1270

Basal Area per Hectare: 48 m^2

Ground Burned Area: 95 %

Ground Burned Damage: Light burn: Litter and duff layers are scorched or charred, but duff is not altered over entire depth.

Trees Captured in Plot: 12

Tree DBH Average: 37.9 cm

Crown Scorch Average: 33.8 %

Crown Damage Average: 1.8/6

Percent Mortality: 8.3 %

Douglas-fir Beetle Attack: 66.7 %

Ambrosia Beetle Attack: 16.7 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	615	Fd	23.0	L	L	25	2.7	1.9	P	A
2	610	Fd	23.9	L	L	25	2.2	2.4	P	A
3	604	Fd	71.3	L	L	10	3.0	3.4	P	A
4	607	Fd	14.3	L	L	20	1.7	1.7	A	A
5	602	Fd	17.1	L	L	5	2.0	1.9	A	A
6	603	Fd	74.0	L	L	0	3.2	3.2	P	A
7	608	Fd	27.6	L	L	25	2.6	2.6	P	A
8	606	Fd	12.5	L	L	50	1.7	1.4	A	A
9	616	Fd	41.3	L	L	70	3.6	3.5	P	P
10	601	Fd	62.3	L	L	70	3.1	3.2	P	P
11	90	Fd	70.8	L	D	100	4.4	4.8	P	A
12	605	Fd	16.1	L	L	5	1.6	1.9	A	A

Plot 7

Low-Severity, Surface Fire

Coordinates: LAT +5766743.538, LON +578843.6773 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 542

Basal Area per Hectare: 24 m^2

Ground Burned Area: 100 %

Ground Burned Damage: Medium burn: Litter is completely consumed and the duff is deeply charred or consumed, but underlying mineral is not visibly altered.

Trees Captured in Plot: 6

Tree DBH Average: 27.4 cm

Crown Scorch Average: 80.8 %

Crown Damage Average: 2.7/6

Percent Mortality: 66.7 %

Douglas-fir Beetle Attack: 66.7 %

Ambrosia Beetle Attack: 0 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	632	Fd	37.6	L	L	5	5.8	5.0	P	A
2	633	Fd	22.1	L	D	100	6	5.5	A	A
3	634	Fd	26.5	L	D	100	4.8	3.7	P	A
4	635	Fd	15.9	L	D	100	3.3	3.3	A	A
5	636	Fd	23.3	L	D	100	3.3	4.2	P	A
6	637	Fd	38.8	L	L	80	5.2	5.7	P	A

Plot 8

Low-Severity, Surface Fire

Coordinates: LAT +5766546.765, LON +578838.0105 (NAD 83 UTM 10)

Pre-commercially Thinned: 1994

Stems per Hectare: 829

Basal Area per Hectare: 36 m^2

Ground Burned Area: 40 %

Ground Burned Damage: Light burn: Litter and duff layers are scorched or charred, but duff is not altered over entire depth.

Trees Captured in Plot: 9

Tree DBH Average: 27.0 cm

Crown Scorch Average: 13.3 %

Crown Damage Average: 0.7/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	656	Fd	30.8	L	L	0	2.1	1.9	A	A
2	655	Fd	31.7	L	L	15	3.0	2.6	A	A
3	654	Fd	20.7	L	L	60	2.0	1.8	A	A
4	657	Fd	13.2	L	L	0	0.1	0.1	A	A
5	653	Fd	24.9	L	L	40	0.1	0.4	A	A
6	658	Fd	36.9	L	L	0	0.5	0.4	A	A
7	661	Fd	27.3	L	L	0	1.2	0.9	A	A
8	662	Fd	31.1	L	L	0	0.5	0.7	A	A
9	659	Fd	26.5	L	L	5	2.0	1.8	A	A

Plot 9

High-Severity, Crown Fire

Coordinates: LAT +5766697.187, LON +578705.3686 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 98

Basal Area per Hectare: 12 m^2

Ground Burned Area: 100 %

Ground Burned Damage: Medium burn: Litter is completely consumed and the duff is deeply charred or consumed, but underlying mineral is not visibly altered.

Trees Captured in Plot: 3

Tree DBH Average: 44.8 cm

Crown Scorch Average: 28.3 %

Crown Damage Average: 1.3/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 66.7 %

Ambrosia Beetle Attack: 33.3 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	692	Fd	28.8	L	L	0	3.0	2.6	A	A
2	691	Fd	56.0	L	L	50	4.9	5.9	P	A
3	690	Fd	49.7	L	L	35	5.3	5.4	P	P

Plot 10

High-Severity, Crown Fire

Coordinates: LAT +5766675.214, LON +578758.0539 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 368

Basal Area per Hectare: 24 m^2

Ground Burned Area: 100 %

Ground Burned Damage: Deep burn: Litter and duff are completely consumed and the structure and colour of mineral soil surface are visibly altered.

Trees Captured in Plot: 4

Tree DBH Average: 37.8 cm

Crown Scorch Average: 100 %

Crown Damage Average: 3.0/6

Percent Mortality: 50 %

Douglas-fir Beetle Attack: 66.7 %

Ambrosia Beetle Attack: 33.3 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	697	Fd	33.8	L	L	100	4.3	4.4	P	A
2	696	Fd	34.7	L	L	100	3.3	3.1	P	P
3	695	Fd	21.1	L	D	100	3.7	3.7	A	A
4	694	Fd	30.3	L	L	100	3.5	4.0	P	A
5	698	Fd	22.1	L	D	100	5.1	5.0	A	A
6	686	Fd	85.0	L	D	100	15.1	16.9	P	P

Plot 11

Low-Severity, Surface Fire

Coordinates: LAT +5766631.053, LON +578835.7166 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 860

Basal Area per Hectare: 24 m^2

Ground Burned Area: 100 %

Ground Burned Damage: Medium burn: Litter is completely consumed and the duff is deeply charred or consumed, but underlying mineral is not visibly altered.

Trees Captured in Plot: 6

Tree DBH Average: 21.2 cm

Crown Scorch Average: 95 %

Crown Damage Average: 3/6

Percent Mortality: 50 %

Douglas-fir Beetle Attack: 50 %

Ambrosia Beetle Attack: 0 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	619	Fd	28.8	L	L	100	6.3	5.7	P	A
2	649	Fd	22.8	L	L	100	4.7	3.8	P	A
3	650	Fd	12.8	L	D	100	3.8	3.6	A	A
4	638	Fd	23.8	L	L	80	5.4	5.0	P	A
5	639	Fd	15.8	L	D	90	3.4	3.4	A	A
6	640	Fd	23.0	L	D	100	3.3	2.9	A	A

Plot 16

Low-Severity, Surface Fire

Coordinates: LAT +5766757.595, LON +578811.0784 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 921

Basal Area per Hectare: 40 m^2

Ground Burned Area: 100%

Ground Burned Damage: Medium burn: Litter is completely consumed and the duff is deeply charred or consumed, but underlying mineral is not visibly altered.

Trees Captured in Plot: 10

Tree DBH Average: 30.3 cm

Crown Scorch Average: 13.5 %

Crown Damage Average: 1.0/6

Percent Mortality: 20 %

Douglas-fir Beetle Attack: 100 %

Ambrosia Beetle Attack: 0 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	625	Fd	46.2	L	L	5	2.9	2.2	P	A
2	629	Fd	51.2	L	L	10	5.7	4.9	P	A
3	630	Fd	46	L	L	10	2.9	3.6	P	A
4	620	Fd	19.3	L	L	20	1.2	0.9	P	A
5	621	Fd	30.9	L	L	40	3	2.4	P	A
6	627	Fd	28.1	L	L	5	1.5	1.6	P	A
7	631	Fd	28.6	L	L	5	2.6	2.4	P	A
8	628	Fd	15	L	D	20	1.7	1.7	P	A
9	622	Fd	15.7	L	D	20	2.9	2.6	P	A
10	626	Fd	22.2	L	L	0	3.1	2.5	P	A

Plot 19

Low-Severity, Surface Fire

Coordinates: LAT +5766715.762, LON +578669.9547 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 739

Basal Area per Hectare: 28 m^2

Ground Burned Area: 80 %

Ground Burned Damage: Light burn: Litter and duff layers are scorched or charred, but duff is not altered over entire depth.

Trees Captured in Plot: 7

Tree DBH Average: 24 cm

Crown Scorch Average: 1.4 %

Crown Damage Average: 0.1/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0%

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	683	Fd	22.0	L	L	0	0.2	0.2	A	A
2	682	Fd	26.4	L	L	0	2.5	2.5	A	A
3	681	Fd	36.2	L	L	0	4.1	3.9	A	A
4	680	Fd	16.0	L	L	0	0.7	0.7	A	A
5	674	Fd	21.7	L	L	0	1.7	1.5	A	A
6	675	Fd	27.2	L	L	10	1.8	1.5	A	A
7	673	Fd	18.7	L	L	0	0.5	0.5	A	A

Plot 20

High-Severity, Crown Fire

Coordinates: LAT +5766638.176, LON +578786.6950 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 116

Basal Area per Hectare: 16

Ground Burned Area: 100 %

Ground Burned Damage: Deep burn: Litter and duff are completely consumed and the structure and colour of mineral soil surface are visibly altered.

Trees Captured in Plot: 4

Tree DBH Average: 42.0 cm

Crown Scorch Average: 100 %

Crown Damage Average: 5.8/6

Percent Mortality: 100 %

Douglas-fir Beetle Attack: 100 %

Ambrosia Beetle Attack: 100 %

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	651	Fd	40.5	L	D	100	22.7	22.7	P	P
2	652	Fd	43.8	D	D	100	25.0	25.0	P	P
3	663	Fd	40.2	D	D	100	23.7	23.7	P	P
4	660	Fd	43.3	D	D	100	26.9	26.9	P	P

Plot 21

Unburned

Coordinates: LAT +5766899.684, LON +578742.4336 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 483

Basal Area per Hectare: 40 m^2

Ground Burned Area: 0 %

Ground Burned Damage: Unburned: No visible effect to the soil. Fire did not reside on the area, though some damage may have occurred above ground due to convected or radiated heat

Trees Captured in Plot: 11

Tree DBH Average: 52.7 cm

Crown Scorch Average: 0 %

Crown Damage Average: 0/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0%
Surface Fuel Load: >15 kg/m^2

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	568	Fd	49.3	L	L	0	0	0.0	A	A
2	570	Fd	77.7	L	L	0	0	0.0	A	A
3	567	Fd	22.2	L	L	0	0	0.0	A	A
4	560	Fd	43.3	L	L	0	0	0.0	A	A
5	562	Fd	87.5	L	L	0	0	0.0	A	A
6	561	Fd	29.3	L	L	0	0	0.0	A	A
7	556	Fd	78.9	L	L	0	0	0.0	A	A
8	555	Fd	70.1	L	L	0	0	0.0	A	A
9	571	Fd	15.2	L	L	0	0	0.0	A	A
10	563	Fd	53.0	L	L	0	0	0.0	A	A
11	559	Fd	15.0	L	L	0	0	0.0	A	A

Plot 22

Unburned

Coordinates: LAT +5766611.915, LON +578975.9558 (NAD 83 UTM 10)

Pre-commercially Thinned: 1994

Stems per Hectare: 750

Basal Area per Hectare: 36 m^2

Ground Burned Area: 0 %

Ground Burned Damage: Unburned: No visible effect to the soil. Fire did not reside on the area, though some damage may have occurred above ground due to convected or radiated heat

Trees Captured in Plot: 9

Tree DBH Average: 26.3 cm

Crown Scorch Average: 0 %

Crown Damage Average: 0/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0%

Surface Fuel Load: 4-8 kg/m^2

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)2	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	587	Fd	24.5	L	L	0	0	0.0	A	A
2	591	Fd	28.9	L	L	0	0	0.0	A	A
3	592	Fd	19.4	L	L	0	0	0.0	A	A
4	593	Fd	33.0	L	L	0	0	0.0	A	A
5	594	Fd	20.3	L	L	0	0	0.0	A	A
6	595	Fd	36.5	L	L	0	0	0.0	A	A
7	596	Fd	27.1	L	L	0	0	0.0	A	A
8	589	Pl	21.6	L	L	0	0	0.0	A	A
9	588	Fd	25.0	L	L	0	0	0.0	A	A

Plot 23

Unburned

Coordinates: LAT +5766856.886, LON +578807.7930 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 225

Basal Area per Hectare: 28 m^2

Ground Burned Area: 0 %

Ground Burned Damage: Unburned: No visible effect to the soil. Fire did not reside on the area, though some damage may have occurred above ground due to convected or radiated heat.

Trees Captured in Plot: 7

Tree DBH Average: 45.6 cm

Crown Scorch Average: 0 %

Crown Damage Average: 0/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0%

Surface Fuel Load: >15 kg/m^2

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	576	Fd	35.5	L	L	0	0	0.0	A	A
2	575	Fd	36.6	L	L	0	0	0.0	A	A
3	574	Fd	38.3	L	L	0	0	0.0	A	A
4	573	Fd	37.5	L	L	0	0	0.0	A	A
5	572	Fd	33.1	L	L	0	0	0.0	A	A
6	569	Fd	91.5	L	L	0	0	0.0	A	A
7	577	Fd	46.6	L	L	0	0	0.0	A	A

Plot 25

Unburned

Coordinates: LAT +5766487.104, LON +578941.3027 (NAD 83 UTM 10)

Pre-commercially Thinned: 1989

Stems per Hectare: 319

Basal Area per Hectare: 12 m^2

Ground Burned Area: 0 %

Ground Burned Damage: Unburned: No visible effect to the soil. Fire did not reside on the area, though some damage may have occurred above ground due to convected or radiated heat.

Trees Captured in Plot: 3

Tree DBH Average: 25.4 cm

Crown Scorch Average: 0 %

Crown Damage Average: 0/6

Percent Mortality: 0 %

Percent Beetle Attacked: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0%

Surface Fuel Load: <4 kg/m^2

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	599	Fd	15.8	L	L	0	0	0.0	A	A
2	598	Fd	27.3	L	L	0	0	0.0	A	A
3	597	Fd	33.1	L	L	0	0	0.0	A	A

Plot 27

Unburned

Coordinates: LAT +5766754.740, LON +578890.7615 (NAD 83 UTM 10)

Pre-commercially Thinned: 2012

Stems per Hectare: 360

Basal Area per Hectare: 40 m^2

Ground Burned Area: 0 %

Ground Burned Damage: Unburned: No visible effect to the soil. Fire did not reside on the area, though some damage may have occurred above ground due to convected or radiated heat.

Trees Captured in Plot: 10

Tree DBH Average: 44.5 cm

Crown Scorch Average: 0 %

Crown Damage Average: 0/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0%

Surface Fuel Load: 10-15 kg/m^2

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	590	Fd	47.7	L	L	0	0	0.0	A	A
2	586	Fd	49.1	L	L	0	0	0.0	A	A
3	585	Fd	59.4	L	L	0	0	0.0	A	A
4	583	Fd	32.4	L	L	0	0	0.0	A	A
5	582	Fd	33.4	L	L	0	0	0.0	A	A
6	581	Fd	38.0	L	L	0	0	0.0	A	A
7	580	Fd	55.3	L	L	0	0	0.0	A	A
8	579	Fd	48.7	L	L	0	0	0.0	A	A
9	584	Fd	20.6	L	L	0	0	0.0	A	A
10	528	Fd	60.0	L	L	0	0	0.0	A	A

Plot 29

Unburned

Coordinates: LAT +5766478.710, LON +578741.2664 (NAD 83 UTM 10)

Pre-commercially Thinned: 1994

Stems per Hectare: 1137

Basal Area per Hectare: 36 m^2

Ground Burned Area: 0%

Ground Burned Damage: Unburned: No visible effect to the soil. Fire did not reside on the area, though some damage may have occurred above ground due to convected or radiated heat.

Trees Captured in Plot: 9

Tree DBH Average: 21.4 cm

Crown Scorch Average: 0 %

Crown Damage Average: 0/6

Percent Mortality: 0 %

Douglas-fir Beetle Attack: 0 %

Ambrosia Beetle Attack: 0%

Surface Fuel Load: 4-8 kg/m^2

Tree #	Tree ID	Spc	DBH (cm)	Status 2013 (L/D)	Status 2014 (L/D)	C. Scorch (%)	C. Damage (0-6)	Bark Char Ht (m)	Fd Beetle (P/A)	Amb. Beetle (P/A)
1	671	Fd	30.2	L	L	0	0	0.0	A	A
2	669	Fd	21.0	L	L	0	0	0.0	A	A
3	668	Fd	19.4	L	L	0	0	0.0	A	A
4	600	Fd	14.0	L	L	0	0	0.0	A	A
5	670	Fd	25.9	L	L	0	0	0.0	A	A
6	672	Fd	19.2	L	L	0	0	0.0	A	A
7	667	Fd	18.7	L	L	0	0	0.0	A	A
8	666	Fd	22.4	L	L	0	0	0.0	A	A
9	665	Fd	21.6	L	L	0	0	0.0	A	A