Effects of Prescribed Burning on Aspen Mortality and Vigour

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The Dieleman grassland on Grouse Mountain near Smithers was burned in May 2002 by the BC Ministry of Forests and Range (Veenstra and Haeussler 2002). Immediately after the burn we located 5 plots within areas of young aspen adjacent to the grassland and flagged 8-10 trees in the following categories: unburned, lightly burned (singed base, low scorch height) and severely burned (charred, partially consumed tree base and roots, higher scorch height) (Figs. 1-2). One plot was subxeric and located on shallow soils near bedrock, three plots were submesic and located on shedding sites with moderately deep soils or colluvium, and one plot was mesic and located in deep soils on a slightly receiving site. No unburned trees were found on the subxeric plot nor on one of the submesic plots.

Figure 1. *Unburned, lightly burned and severely burned aspen trees were flagged immediately following the Grouse Mountain burn in May 2002.*

In August 2002 and June 2008 we relocated the ribboned aspen trees and assigned each tree a vigour rating based on foliage condition and the amount of live crown. The vigour ranking was not based on the degree of scarring on the trunk. 0 = dead, 1 = poor, 2 = fair, 3 = good, 4 = excellent. No trees were rated as excellent. In 2008 we also noted the frequency and size of aspen suckers within the plot.

Repeated measures ANOVA was used to test for differences in mortality rate and aspen vigour by year and burn severity. We used linear regression to test for a relationship between aspen mortality and vigour and the soil moisture regime.

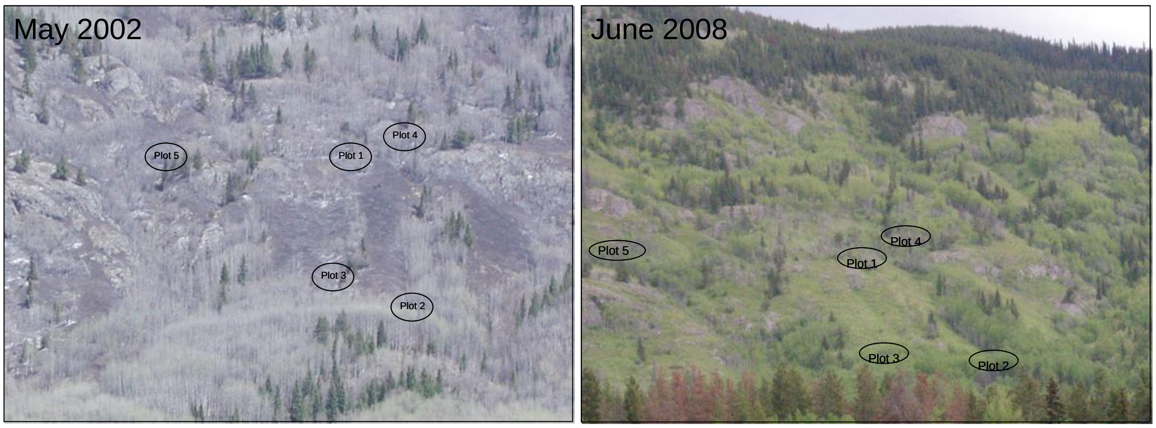

Figure 2. *Grouse Mountain grassland burn showing approximate location of five aspen monitoring plots in May 2002 (immediately after burn) and June 2008.*

Results:
The mortality rate in August 2002, four months after the burn, was 0 for unburned trees and averaged 8 % for lightly and severely burned trees. By 2008 (6 years after the burn) the mortality rate averaged 5 % for unburned trees and almost 50% for lightly and severely burned trees. There was no significant difference in the mortality rate between lightly and severely burned trees at either date (p = 0.89) (Fig 3).

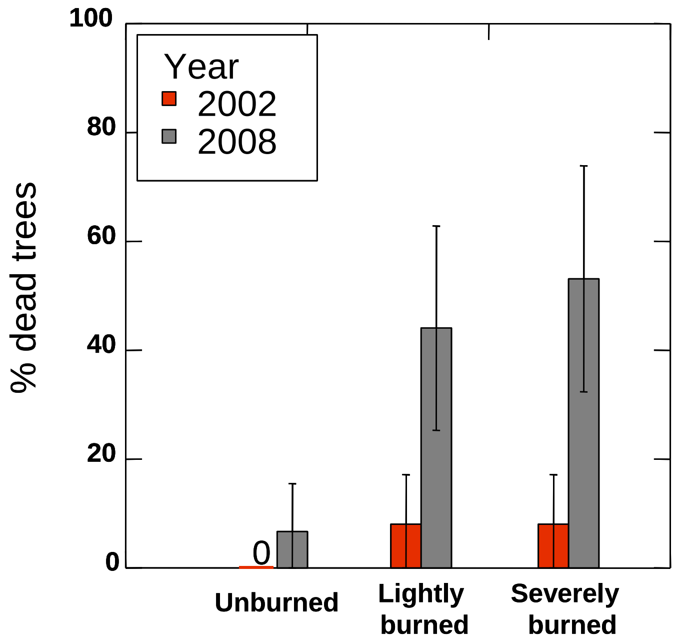

Figure 3. *Mortality rate of aspen trees by burn severity 4 months (2002) and six years (2008)*

after the Grouse Mountain burn.

The vigour of live aspen trees was significantly higher in 2008 (2.4 on average) than in 2002 (2.1 on average) ($p = 0.03$). However, there was no significant difference in tree vigour by burn severity ($p = 0.37$) and burn severity did not affect the difference in live tree vigour between 2002 and 2008 ($p = 0.79$) (Fig. 4).

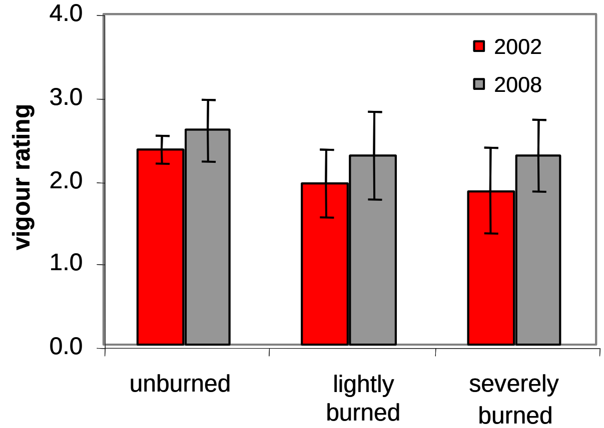

Figure 4. *Mean vigour of live aspen trees by burn severity 4 months (2002) and 6 years (2008) after the Grouse Mountain burn. 1 = poor, 2 = fair, 3 = good.*

The soil moisture regime significantly affected both the 2008 mortality rate ($r^2 = 0.50$; $p = 0.03$) and the vigour of live aspen trees ($r^2 = 0.53$; $p = 0.04$). Subxeric sites had 90% mortality and mean vigour of 1.5 (poor to fair) for live trees, submesic sites averaged 37% mortality and mean vigour of 2.4 (fair to good), and mesic sites had 10% mortality and mean vigour of 2.7 (good to fair).

Both dead and live aspen trees had heavy scarring on the trunks initiated by fire damage, cambial feeding by moose, or storm damage. Decay fungi increased the severity of these scars. Many trees with severe cambial damage had healthy crowns (fair to good condition) while other trees with similar or less stem damage were dead.

Aspen suckering was low in all plots, with the fewest suckers observed in mesic and submesic plots with well-developed understories of peavine, aster and snowberry and relatively intact aspen overstories. The highest frequency of aspen suckers was observed in the drier, open-canopied plots with less-developed understories. In these plots we observed approximately 0.1 – 0.2 sucker per m^2, but all suckers were less than 1 m tall with basal diameters of 0.5 – 3 cm. Those that emerged above the understory were heavily browsed by ungulates. Although the site is within a range lease, there was no evidence of recent cattle grazing.

Conclusions

A low to moderate severity spring ground fire in young south-facing aspen stands of the SBSdk subzone can cause significant aspen mortality with limited respouting. The trees take several years to die as a result of decay fungi entering fire scars. However, some trees recover well from fire scarring. Stressed trees growing in dry habitats are much more likely to die after burning than healthy trees growing on moist sites. This is likely due to a combination of tree vigour and fire intensity. There is a high degree of variability in individual tree response to the burn, but the condition of site and the aspen trees prior to the fire seems to be a better predictor of mortality than the degree of basal fire scarring immediately after the fire. Suckering after low intensity wildfires does not appear to be sufficient to replace the canopy trees and is greatly inhibited by both understory vegetation and ungulate browsing.

References:

Veenstra, V. and S. Haeussler. 2002. Grouse Mountain post burn vegetation inventory. Report on a grassland restoration prescribed burning project. Prepared for Bulkley-Cassiar Forest District, BC Ministry of Forests, Smithers, B.C.

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