

# Unreplicated responses of Engelmann spruce and the *Dry Alder* complex to manual cutting in the ESSF zone

March 8, 2007

## INTRODUCTION

This report describes trends in conifer and vegetation responses to manual brushing treatment of the *Dry Alder* complex, a common vegetation community on logged sites in the southern interior of B.C. Click here for a description of the *Dry Alder* complex.

The results presented here are for one site. The treatment was not adequately replicated to allow analysis of variance to be completed (a minimum of three replicate sites is required), therefore we can only report trends in responses to the brushing treatment. The reader is cautioned that these results cannot be directly extrapolated to other sites because of the inadequate replication. Nevertheless, the trends in conifer and vegetation responses to manual cutting presented here can provide general information about the effectiveness of this treatment. It is important to understand that brushing outcomes on individual sites may differ from the results presented here.

## STUDY AREA

Table 1. Characteristics of the study site

Location	Upper McKay Creek
BEC unit	ESSFdc/01 (mesic)
Elevation (m)	1500
Slope/aspect	35% North
Logging history	Clearcut 1982
Site preparation	None
Regeneration	Se planted 1987 (10 years-old when brushed)
Brushing treatment	Manual brushing and conifer spacing 1997

## RESULTS

Table 2. A summary of Engelmann spruce responses

Was there an improvement <sup>1</sup> in conifer performance after brushing?	
Survival	No
Vigour	No
Stem diameter <sup>2</sup>	No
Height	No
Leader length	No

1 Based on visual examination of survival and vigour trends and t-test comparisons for diameter, height, and leader length.

2 Stem diameter was measured at the root collar.

## 9-YEAR ENGELMANN SPRUCE RESPONSES

### Engelmann spruce survival and vigour

- Nine years after brushing, when spruce were 19 years-old, survival was 100% in both the control and treatment.
- A slightly higher proportion of spruce had good vigour in the treatment than the control after 9 years, but most trees were of moderate vigour in both plots (Figure 1).

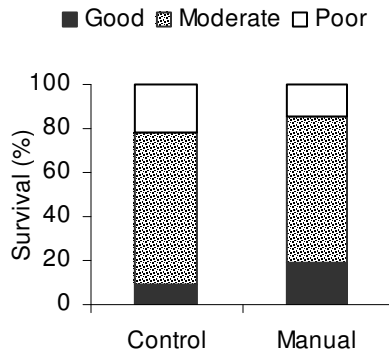


Figure 1. A comparison of 19-year-old spruce survival and vigour in the control and treatment, 9 years after manual cutting.

### Engelmann spruce growth

- One year after brushing, there was a trend of slightly lower diameter growth in the treated area compared to the control but by year 9 the trend was reversed (Table 3).
- Leaders also showed a trend of less growth in the treated area than the control one year after brushing, but this difference disappeared by year 3.
- Height:diameter ratio decreased over time, regardless of whether brushing was done, but the decrease was greater in the treated area than the control. This indicates that treated spruce were becoming sturdier than those in the control.

Table 3. Engelmann spruce response

Response variable	Pre-treatment		1 <sup>st</sup> year response		3 <sup>rd</sup> year response		5 <sup>th</sup> year response	
	C <sup>1</sup>	T	C	T	C	T	C	T
Stem diameter (cm)	3.2	3.1	3.9	3.5	4.8	5.0	7.5	8.4
Total height (cm)	154	142	169	149	203	192	292	278
Leader height (cm)	17	15	24	16	15	21	20	18
H:D ratio	50.6	47.8	46.1	45.0	44.4	39.7	40.5	34.3

1 C = Control T = Treatment

### Engelmann spruce competitive status

- Spruce seedlings were threatened by alder before treatment. A “threatened” crop tree is approximately the same height as the competing vegetation and is likely to be overtopped within two growing seasons.

- Brushing immediately made spruce free of vegetation. Although alder re-sprouted, three-quarters of spruce were still taller than vegetation at the end of the 9 year measurement period (Figures 2 and 3).
- Spruce in the control gradually outgrew alder, and by year 9, the proportion of seedlings that were free of vegetation was the same as in the treatment.

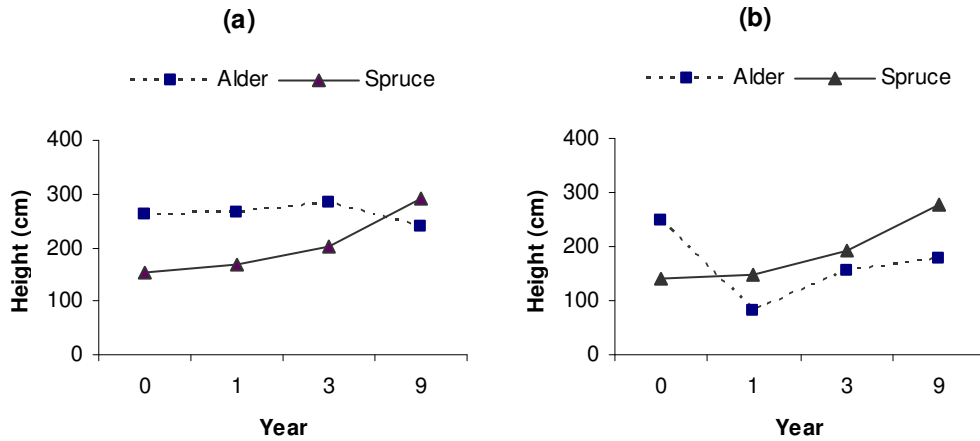


Figure 2. A comparison of the height of alder and spruce seedlings in (a) the control and (b) the manual cutting treatment.

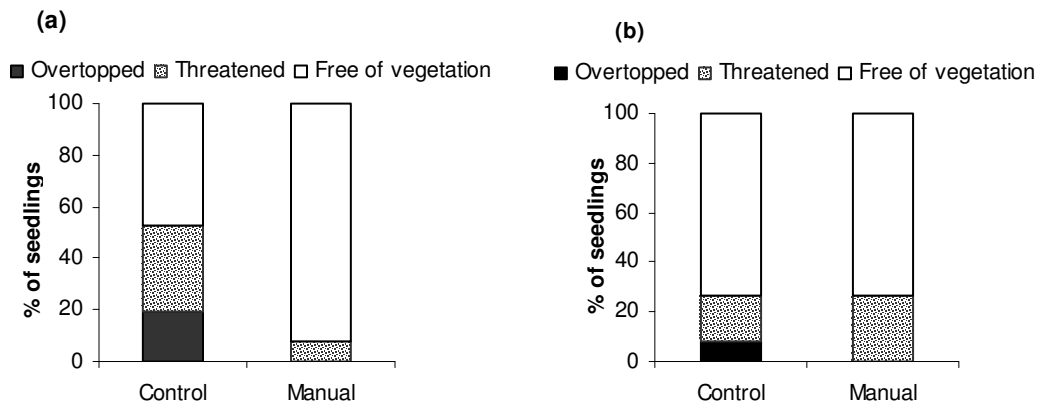


Figure 3. A comparison of spruce competitive status in the control and treatment (a) 1 year and (b) 9 years after manual cutting.

### Conifer stocking

- The minimum required stocking standard (700 well-spaced stems/ha) was met in both the treatment and control 9 years after brushing (Table 4). Spruce was the dominant species in the well-spaced component of the stand, but subalpine fir was also common.
- The two plots had similar numbers of free-growing trees (>1000 stems/ha) 9 years after brushing. About half the free-growing trees were spruce and most of the remainder were subalpine fir.

- Conifers were spaced at the time of brushing, which reduced total stocking in the treatment from 4,837 to 3,523 stems/ha. Density was higher than might be expected after spacing because many seedlings were too small to be cut.
- In both plots, total trees consisted of about 30% Engelmann spruce, 60% subalpine fir, and 10% other species (lodgepole pine, western white pine, and Douglas-fir).

Table 4. Conifer stocking in the treated area and control 9 years after brushing

	Engelmann spruce	Subalpine fir	Lodgepole pine	Western white pine	Douglas-fir	All species
<i>Control</i>						
Total trees/ha	1989	3667	700	39	11	6406
Well-spaced/ha	594	500	89	0	0	1183
Free-growing/ha	483	433	89	0	0	1005
<i>Treatment</i>						
Total trees/ha	1000	2167	217	117	22	3523
Well-spaced/ha	656	472	61	0	0	1189
Free-growing/ha	594	422	72	0	0	1088

#### VEGETATION RESPONSE

- The dominant plant species on this site were Sitka alder and white-flowered rhododendron.
- Alder height was reduced from 249 cm before treatment to 83 cm one year after it was cut. Alder re-sprouted vigorously, and achieved 75% of the control height by the ninth year after cutting. Alder cover was reduced from 31% before treatment to 12%, 20%, and 22%, one, three, and nine years after treatment.
- In the control, alder cover was constant at about 25% throughout the 9 year measurement period. It slowly increased in height for the first 3 years of the study, but as it aged its height began to decline (see Figure 2).
- Most rhododendron plants were not cut during treatment. Cover was about 25% and height 100 cm in both the treatment and control plots throughout the measurement period.
- Fireweed was abundant (20% cover) at the start of the study period, but by year 9 it was scarce (less than 1% cover). There were few other herbs on the site.

#### PRELIMINARY MANAGEMENT IMPLICATIONS

- Brushing was not necessary on this site to achieve good spruce survival. Conifer growth was slow and was not improved by brushing, probably because vegetation competition was less limiting than climate in the ESSF zone.
- Both the treatment and control were stocked with more than 1000 free-growing stems/ha when the stand was 19 years-old. Free-growing status may have been attained earlier, but the survey was not conducted until 9 years after treatment.
- Even though alder resprouted vigorously, after 9 years it had regained only two-thirds of its pre-treatment cover and three-quarters of the control height.
- Readers are reminded that information reported here is based on results from only one site and responses on individual sites may vary considerably.