

Unreplicated responses of Engelmann spruce and the *Subalpine Herb* complex to grazing in the ESSF zone

March 8, 2007

INTRODUCTION

This report describes trends in conifer and vegetation responses to grazing of the *Subalpine Herb* complex, a common vegetation community on higher elevation logged sites in the southern interior of B.C. [Click here](#) for a description of the *Subalpine Herb* complex.

The results presented here are for two sites. The treatment was not adequately replicated to allow analysis of variance to be completed (a minimum of three replicate sites is required). Instead, trends in treatment responses were described for the brushed and untreated areas. 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 grazing 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 sites

Location	Caribou Mountain	Camp Creek
BEC unit	ESSFdc2/01(07) (subhygric)	ESSFmw2/01 (submesic)
Elevation (m)	1720 m	1650 m
Slope/aspect	15% East	25% Northwest
Logging history	Clearcut 1973-77	Clearcut 1984
Site preparation	None	Broadcast burn 1986
Regeneration	Se planted 1992 (immediately after grazing)	Se planted 1992 (immediately after grazing)
Brushing treatment	Cattle grazing 1992	Sheep grazing 1992 and 1993

RESULTS

Table 2. A summary of Engelmann spruce responses

Was there an improvement ¹ in conifer performance after brushing?	Caribou Mountain	Camp Creek
Survival	No	No
Vigour	No	No
Stem diameter ²	No	Yes
Height	No	No
Leader length	No	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.

5 YEAR ENGELMANN SPRUCE RESPONSES

Engelmann spruce survival and vigour

- Before grazing, most seedlings at both sites were of moderate vigour. Five years later, more than 60% of the seedlings were of poor vigour or dead, regardless of treatment. At Caribou Mountain, the decline in vigour was greater in the grazed area than the control, whereas at Camp Creek the decline was greater in the control than the grazed area.
- At Caribou Mountain, 5-year survival was 58% in the control and 44% in the grazing treatment. Mortality and damage were attributed mainly to cattle trampling in the treatment and to vegetation press in the control. Cattle use of the area in subsequent years resulted in further damage to both treated and control spruce.
- At Camp Creek, 5-year survival was 78% in the control and 69% in the treatment. No damage was attributed to the sheep grazing treatment, but vegetation press had resulted in mortality or damage to 95% of seedlings in both the control and grazing treatment after 3 years. Broken stems resulting in crooks and forks were the most common injuries.

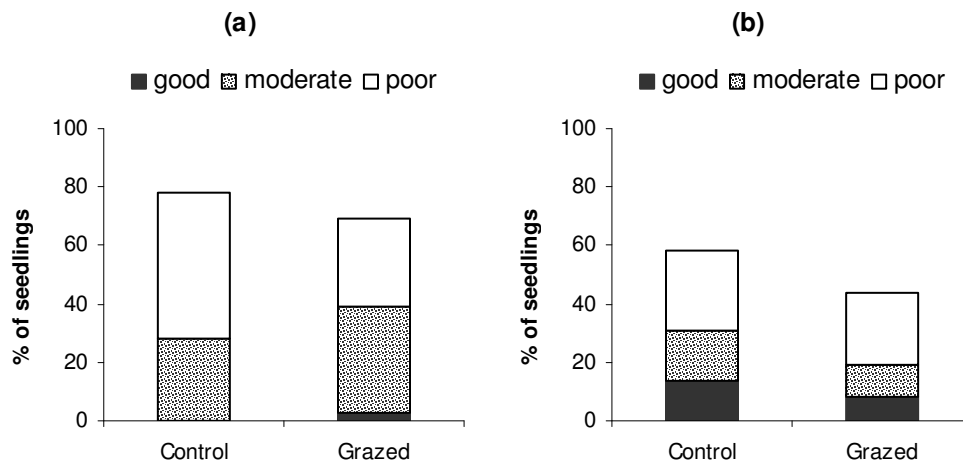


Figure 1. A comparison of spruce survival and vigour in the control and treatment at (a) Camp Creek and (b) Caribou Mountain 5 years after grazing.

Engelmann spruce growth

- Spruce height was not affected by the grazing treatments (Figure 3). Height growth was slow regardless of brushing (leader length averaged 3-9 cm).
- At Caribou Mountain, there was little difference in spruce diameter between the grazing treatment and control. In contrast at Camp Creek, diameter growth in the treatment was better than in the control (Figure 2).

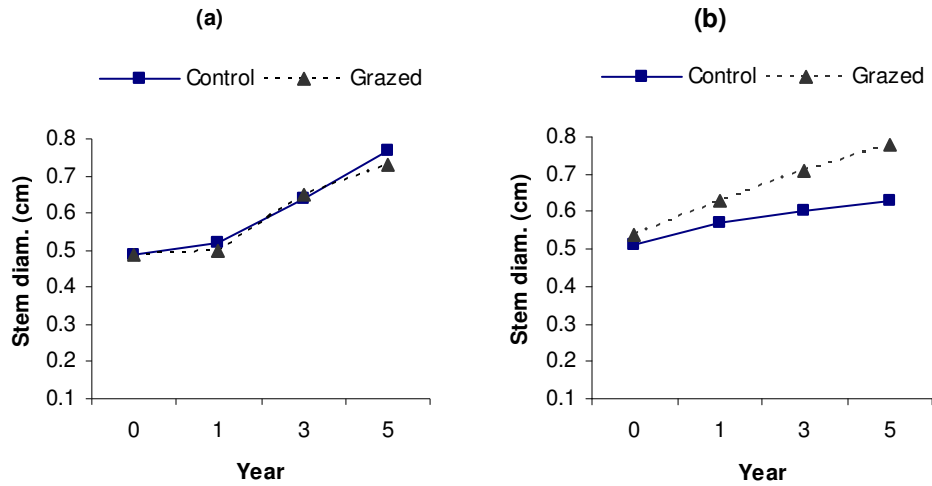


Figure 2. A comparison of spruce diameter in the control and treatment at (a) Caribou Mountain and (b) Camp Creek from pre-treatment (year 0) to 5 years after grazing.

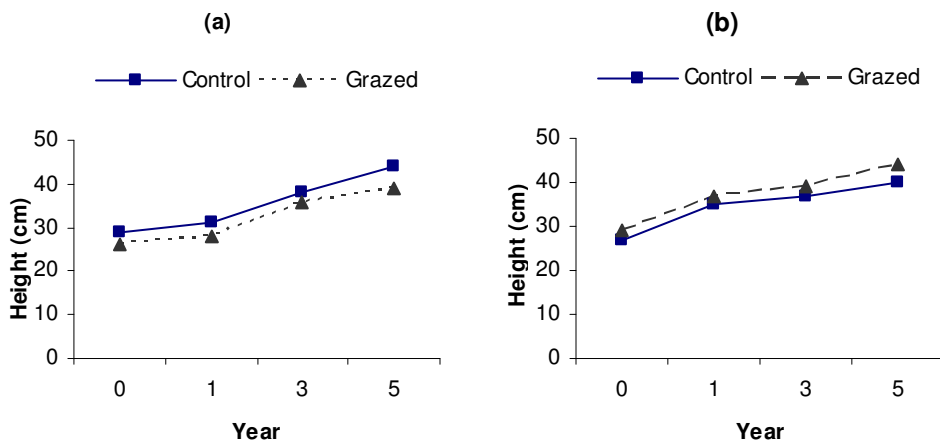


Figure 3. A comparison of spruce height in the control and treatment at (a) Caribou Mountain and (b) Camp Creek from pre-treatment (year 0) to 5 years after grazing.

Table 3. Engelmann spruce growth responses

Response variable	Pre-treatment		1 st year response		3 rd year response		5 th year response	
	C ¹	T	C	T	C	T	C	T
CARIBOU MOUNTAIN								
Stem diameter (cm)	0.49	0.49	0.52	0.50	0.64	0.65	0.77	0.73
Total height (cm)	29	26	31	28	38	36	44	39
Leader length (cm)	-	-	6	6	3	4	4	3
CAMP CREEK								
Stem diameter (cm)	0.51	0.54	0.57	0.63	0.60	0.71	0.63	0.78
Total height (cm)	27	29	35	37	37	39	40	44
Leader length (cm)	-	-	8	9	3	2	2	2

1 C = control T = treatment

Engelmann spruce competitive status

- One year after grazing, most spruce seedlings at both sites were taller than the vegetation (Figures 3 and 4), but by year 3, 58% of seedlings at Caribou Mountain and 97% of seedlings at Camp Creek were again overtopped (data not shown).
- Five years after brushing, most seedlings at both sites were still threatened by vegetation regardless of whether brushing was done.

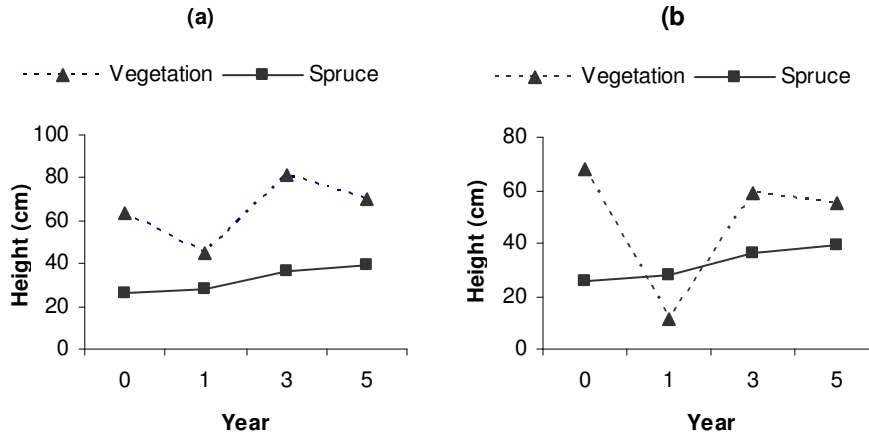


Figure 3. A comparison of height of vegetation and spruce in the (a) control and (b) treatment from pre-treatment (year 0) to 5 years after grazing at Caribou Mountain.

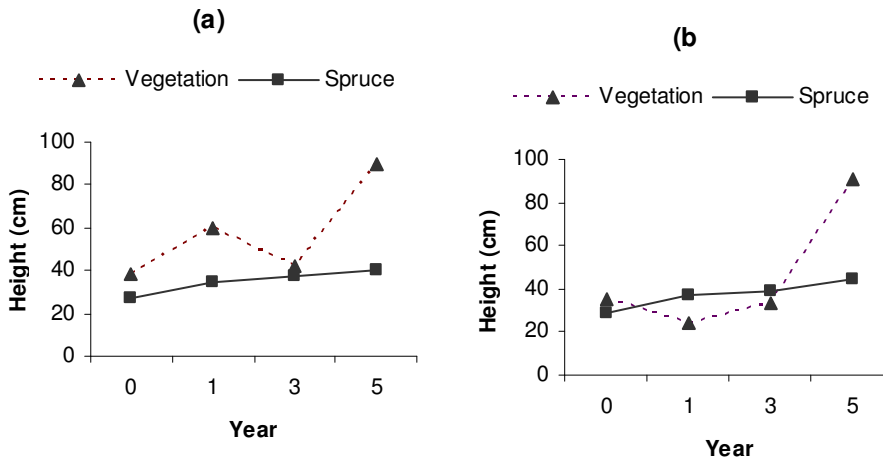


Figure 4. A comparison of height of vegetation and spruce in the (a) control and (b) treatment from pre-treatment (year 0) to 5 years after grazing at Camp Creek.

Conifer stocking

- Both sites were well-stocked at the time of brushing. On both sites, spruce and subalpine fir were the only tree species.
- Five years after the brushing, stocking was below the minimum allowable density of 700 well-spaced stems/ha in both the treatment and control at Caribou Mountain. The density of spruce, which were mostly of planted origin, declined over time. In contrast, the density of naturally regenerated subalpine fir increased, presumably as small seedlings grew above the minimum tally size.

- Stocking density declined slightly over time in the control at Camp Creek, but the minimum density requirement was still achieved 5 years after grazing. At this site, the density of subalpine fir increased over time in both the treatment and control, while spruce density increased in the grazing treatment but decreased in the control.
- Five years after brushing, spruce were still too young to be assessed for free-growing.

VEGETATION RESPONSE

- The dominant plant species on our study sites were fireweed (*Epilobium angustifolium*) and Sitka valerian (*Valeriana sitchensis*).
- Similar trends in vegetation responses to grazing were observed at the two sites.

Vegetation cover

- At both sites, total vegetation cover and herb cover were reduced only in the first year after grazing.
- Fireweed cover was reduced for 5 years at both sites.
- Sitka valerian cover was reduced for 5 years at Camp Creek and only one year at Caribou Mountain.
- Shrub cover was not affected by the grazing treatments.

Vegetation height

- Vegetation height was reduced more than cover.
- At both sites, herb height was reduced for 3 years. Height was reduced by 78% (33 cm at Caribou Mountain and 45 cm at Camp Creek) one year after grazing.
- Fireweed and Sitka valerian height were reduced one year after grazing but had nearly recovered 2 years later.
- Shrub height had increased slightly in the grazing treatments after 5 years.

PRELIMINARY MANAGEMENT IMPLICATIONS

- Cattle trampling can lead to serious damage and mortality of young seedlings, as was seen at Caribou Mountain. On the other hand, the complete lack of trampling damage by sheep at Camp Creek is evidence that grazing can be carried out with a minimum of damage, even when there are enough livestock on the site to greatly reduce vegetation cover and height.
- Grazing has the potential to reduce vegetation press, but the effects are unpredictable. At Caribou Mountain, nearly one-third of control spruce were damaged by vegetation press after 5 years, compared with virtually none in the treatment. At Camp Creek, vegetation in both the treatment and control had recovered enough by year three to damage seedlings.
- Seedling height growth was slow at both sites throughout the 5-year measurement period and was not improved by the grazing treatments. This suggests that environmental or other factors were more limiting than vegetation competition.
- Readers are reminded that information reported here is based on results from only two sites and responses on individual sites may vary considerably.