

Responses of hybrid spruce and the *Mixed Shrub* complex to manual cutting and grazing: A summary of 5 year PROBE results

About the *Mixed Shrub* complex

This community is typically a lush mixture of shrubs and herbs. It includes many of the same species as the *Fireweed* and *Fern* complexes, but is dominated by shrubs rather than herbs. In the southern interior, it is common on medium to wet sites in the ICH zone, as well as on sites that are transitional to the ESSF zone. Where abundant, the *Mixed Shrub* complex reduces light to understory conifers, and also causes physical damage through snow- and vegetation-press. ([Full complex description](#))

Results

This section summarizes results from two fully replicated PROBE experiments ([Full Methods description](#)):

1. Five year responses of 0-3 year-old¹ hybrid spruce and vegetation to manual cutting of the *Mixed Shrub* complex in the ICH and ESSF zones. Study sites were mesic to subhygric, gently sloping (5-20%), with variable aspect. Total vegetation cover averaged 81% at the time of treatment.
2. Five year responses of 1-2 year-old hybrid spruce and vegetation to grazing of the *Mixed Shrub* complex in the ICH and ESSF zones. Study sites were mesic to subhygric, gently to steeply sloping (15-50%), with north to northwesterly aspect. Total vegetation cover averaged 89% at the time of treatment.

Table 1. A summary of 5 year hybrid spruce responses

Was there a significant ^a improvement in conifer performance?	Manual cutting	Grazing
Survival	No	No
Basal stem diameter	Yes	No
Stem diameter increment	No	No
Height	No	No
Leader length	No	No
Height:diameter ratio	No	No

^a Differences are significant where $p \leq 0.05$ according to ANOVA.

¹ Seedling age refers to age since planting, so that “0 years-old” means seedlings were newly planted.

Spruce responses 5 years after brushing

- **Survival** - Hybrid spruce survival was not significantly improved by either manual cutting or grazing treatments, and was declining in the treatments and controls of both experiments as a result of vegetation competition. Five years after treatment, survival of 5-8 year-old spruce in the manual cutting experiment averaged 73%, while survival of 6-7 year-old spruce in the grazing experiment averaged 69%.
- **Vigour** - Hybrid spruce vigour was declining similarly in controls and treatments of the two experiments (Figure 1). The proportion of poor vigour seedlings in the manual cutting experiments suggests survival may decline further in both the treatment and control.
- **Stem diameter** - Hybrid spruce stem diameter increased as a result of the manual cutting treatment, but not the grazing treatment (Figure 2). This is probably because manual cutting reduced shrub cover for at least 3 years, whereas grazing effects had disappeared within a single growing season.
- **Height** - Neither manual cutting nor grazing resulted in significant increases in the height of hybrid spruce relative to individual controls. Height generally takes longer to respond to brushing treatments than stem diameter, however, and as of year 5, there was a trend of increasing height in the manual cutting treatment relative to its control ($p=0.0873$) (Figure 3). Spruce in the manual cutting treatment were as tall as surrounding vegetation by the time they were 9-12 years-old, 1 year in advance of spruce in the untreated control. In contrast, spruce in the grazing experiment had not grown above the height of surrounding vegetation by the time they were 11-12 year-old, regardless of brushing.
- **Height:diameter ratio** - Five years after treatments, there were no differences in height:diameter ratio as a result of either the manual cutting or grazing treatments.



Figure 1. A comparison of hybrid spruce survival and vigour in controls (C) and treatments (T) 5 years after manual cutting and grazing treatments.

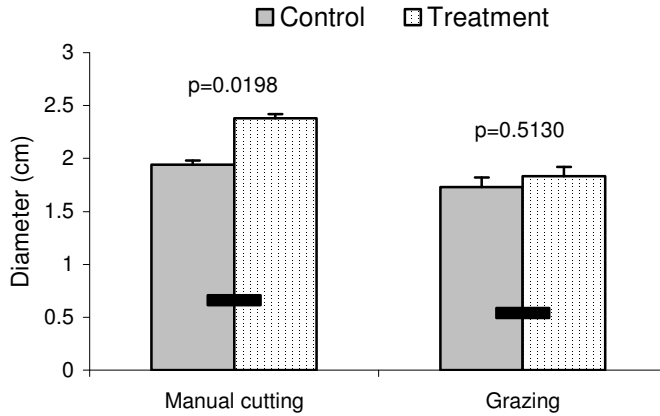


Figure 2. A comparison of hybrid spruce basal stem diameter in controls and treatments 5 years after manual cutting and grazing treatments. Horizontal bands represent spruce diameter at the time of treatment. Error bars represent 1 standard error.

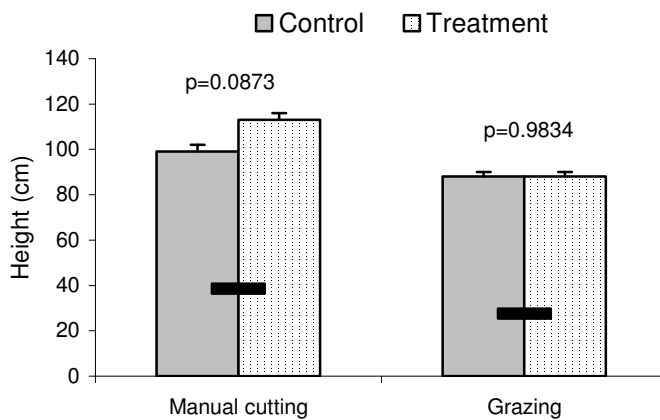


Figure 3. A comparison of hybrid spruce height in controls and treatments 5 years after manual cutting and grazing treatments. Horizontal bands represent spruce diameter at the time of treatment. Error bars represent 1 standard error.

Vegetation responses

Table 2. Duration of vegetation responses

Years of significant vegetation reduction	Manual cutting	Grazing
All vegetation cover	None	None
All vegetation height	None	>1 and <3 years
Shrub cover	>3 years ^b	None
Shrub height	None	None

a Differences are significant where $p \leq 0.05$ according to ANOVA.

b 5th year vegetation results are unavailable for the manual cutting treatment.

Manual cutting - A single manual cutting treatment significantly reduced shrub cover for more than 3 years, although the actual magnitude of the reduction was relatively small (approximately 10%). Manual cutting had no effect on vegetation height, but spruce in the manual cutting treatment grew above the vegetation canopy 1 year sooner than in the control. There were no significant treatment effects on herb height and cover during the 5 years following manual cutting. Richness and diversity of vascular plant species were not affected by the treatment.

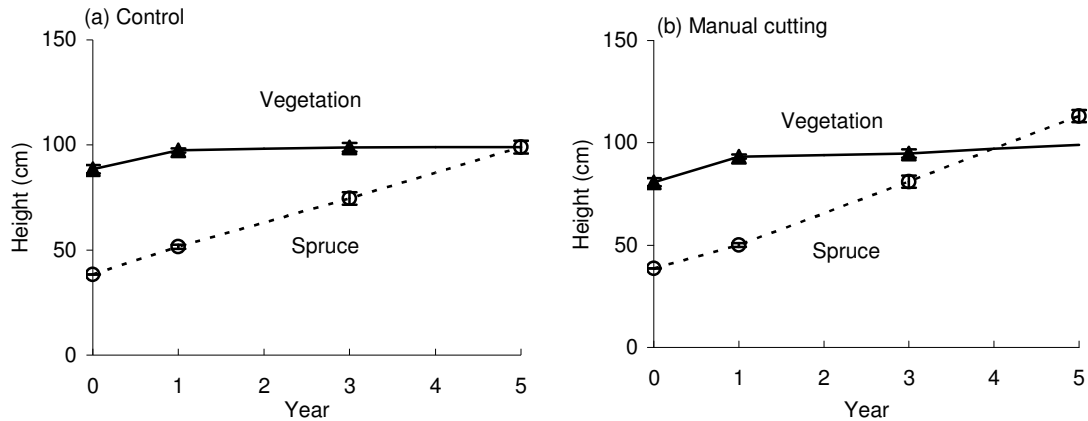


Figure 4. A comparison of average hybrid spruce and vegetation height profiles in (a) the control and (b) the manual cutting treatment. (5th year vegetation heights were extrapolated from previous years)

Grazing significantly reduced overall vegetation height for 1 year after treatment, but the effect had disappeared by year 3. There were no other significant treatment effects on vegetation height and cover during the 5 year measurement period. Spruce had not grown above vegetation by the time they were 11-12 years-old, regardless of the grazing treatment. There were no significant treatment effects on the richness or diversity of vascular plant species.

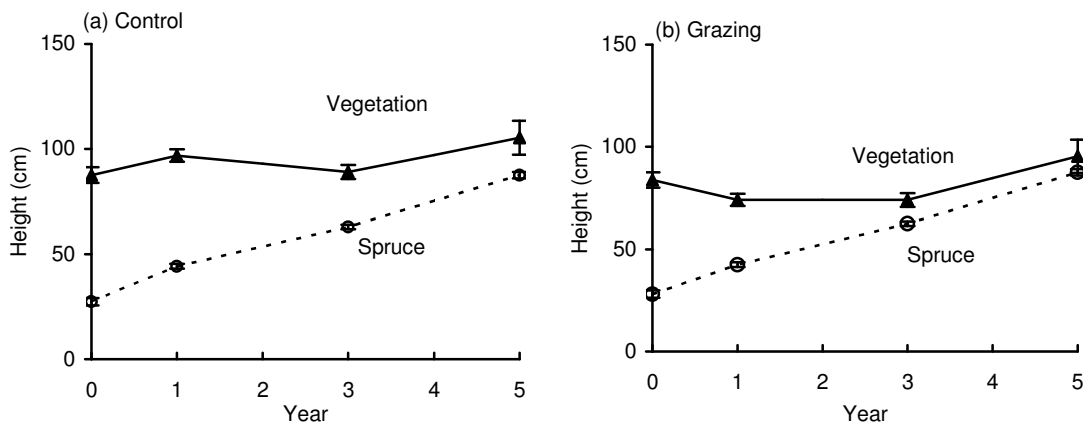


Figure 5. A comparison of average hybrid spruce and vegetation height profiles in (a) the control and (b) the grazing treatment.

Management interpretations

Survival - Our fifth year results indicate that on mesic-subhygric ICH and ESSF sites, competition from the *Mixed Shrub* complex is severe enough to reduce hybrid spruce survival below 70%. Single manual cutting and grazing treatments do not reduce vegetation abundance adequately to significantly improve survival, which suggests that more severe and longer lasting treatments may be appropriate for this community. Our PROBE results suggest there was a trend of increasing survival following a single manual cutting treatment (78% in the treatment versus 67% in the control), but not following a single grazing treatment (68% in the treatment versus 69% in the control).

Conifer growth - Competition from the *Mixed Shrub* complex is intense enough to reduce hybrid spruce growth, and a single manual cutting treatment may reduce shrub cover enough to result in small, but significant increases in diameter growth. There were no significant increases in seedling height within 5 years of manual cutting, but height commonly takes longer to respond to treatment than diameter. Manual cutting allowed spruce seedlings to grow as tall as vegetation 1 year sooner than those in the untreated control. A single grazing treatment did not reduce vegetation abundance, and had no effect on conifer seedling growth. Spruce in the grazing experiment had not grown through the vegetation canopy by the time they were 6-8 years-old.

Treatment efficacy – Our study suggests that manual cutting may result in a small, but significant reduction in shrub cover that persists for at least 3 years, and that this is adequate to slightly improve spruce stem diameter growth. However, responses were very small in our study. Boateng and Comeau (1997) suggest at least two manual cutting treatments or foliar glyphosate are necessary to adequately control this community.

Richness and diversity - Our results suggest that manual cutting and grazing treatments do not affect vascular plant species richness or species diversity (according to the Shannon-Weaver diversity index). Full results are described in [LMH 48 \(Simard et al. 2001\)](#).

References

Boateng, J.O., and P.G. Comeau. 1997. Operational summary for vegetation management: Mixed Shrub Complex. For. Prac. Br., B.C. Min. For., Victoria, B.C.

Simard, S.W., J.L. Heineman, W.J. Mather, D.L. Sachs, and A. Vyse. 2001. Effects of operational brushing on conifers and plant communities in the southern interior of British Columbia: Results from PROBE 1991-2000. Res. Br., Min. For., Victoria, B.C. Land Manage. Handb. No. 48.

Prepared March 2005
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