Unreplicated 13-year responses of Douglas-fir and the *Aspen* complex to triclopyr treatment in the ICH zone

A summary of responses on PROBE site 126 (January 2008)

INTRODUCTION

This report describes 13-year trends in conifer and vegetation responses to triclopyr treatment of the *Aspen* complex, a common vegetation community on logged sites in the southern interior of British Columbia. Click here for a description of the *Aspen* complex.

The results presented here are based on one site only. The treatment was not replicated across sites to allow for analysis of variance (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 lack of replication. Nevertheless, the trends in conifer and vegetation responses to triclopyr treatment presented here can provide general information about the effectiveness of this treatment. It is important to understand that brushing outcomes on other sites may differ from the results presented here.

We also report baseline density and basal area results from permanent measurement plots (PMPs) that were established in the treatment and control plots on this site at a stand age of 19 years. These plots will allow us to monitor the effects of triclopyr treatment on stand development. Click here for a description of PMP methods.

SITE DESCRIPTION AND RESULTS

- The study area is described in Table 1.
- Triclopyr was applied as a basal bark treatment when Douglas-fir were 7 years old.
- 13-year responses to treatment are summarized in Table 2.

Table 1. Characteristics of the study site

Location	**Marl Creek**
BEC unit	ICHmw1/01
Elevation (m)	1240 m
Slope/aspect	25%/South
Soil texture	Silt clay loam
Logging history	Clearcut 1971
Site preparation	Wildfire 1971, Mechanical site prep 1986
Regeneration	Douglas-fir planted 1987
Brushing treatment	Basal bark triclopyr 1994

Table 2. A summary of Douglas-fir responses 13 years after treatment

Was there an improvement[1] in Douglas-fir performance after brushing?	
Survival	Yes
Vigour	Yes
Stem diameter[2]	Yes
Height	Yes
Leader length	Yes

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.

13 year Douglas-fir responses

Survival and vigour

- After 13 years, when Douglas-fir were 20 years old, survival was lower in the control (75%) than the treated area (94%). Mortality in the control was caused by vegetation competition (17%), animal damage (5%), and unknown abiotic factors (3%). In the treated area, mortality was attributed to vegetation competition (3%) and unknown factors (3%).

- 92% of the Douglas-fir seedlings that were originally planted in the treated area continued to have good or moderate vigour after 13 years, and only 3% were in poor condition. In the control, however, only 53% of the original planted Douglas-fir were in good or moderate condition, and 22% were poor. Thin foliage was more common in the control than the treatment (26% versus 3% of live trees, respectively), as was the incidence of forks and crooks (33 versus 18%).

Growth

- Thirteen years after triclopyr application, when Douglas-fir were 20 years old, diameter was almost twice as large in the treated area as the control (9.9 versus 5.2 cm, Figure 1a).

- Douglas-fir were 1.6 times taller in the triclopyr treatment than in the control after 13 years (550 versus 336 cm, Figure 1b). Leader growth averaged 56 cm/year in the treated area versus 32 cm/year in the control.

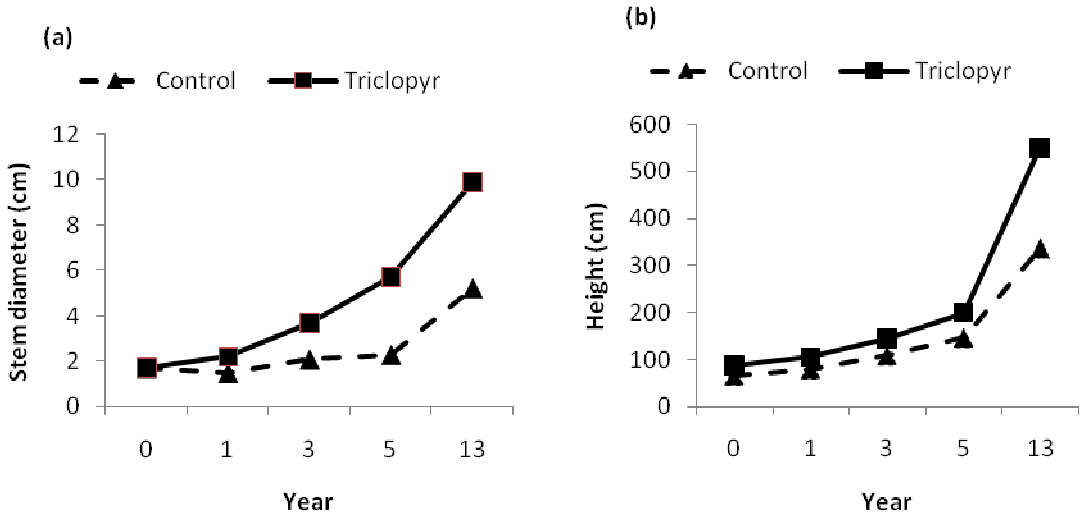

Figure 1. Douglas-fir (a) stem diameter and (b) total height in the control and treated area from pre-treatment (year 0) to 13 years after brushing.

Competitive status

- One year after treatment, 31% of Douglas-fir were free of vegetation in the treated area compared with 3% in the control. After 13 years, the proportion of stems that were free of vegetation had increased to 45% in the treatment, but remained at 3% in the control.
- After 13 years, vegetation was 1.2 times as tall as Douglas-fir in the treated area compared to 2.8 times as tall in the control (Figure 2).

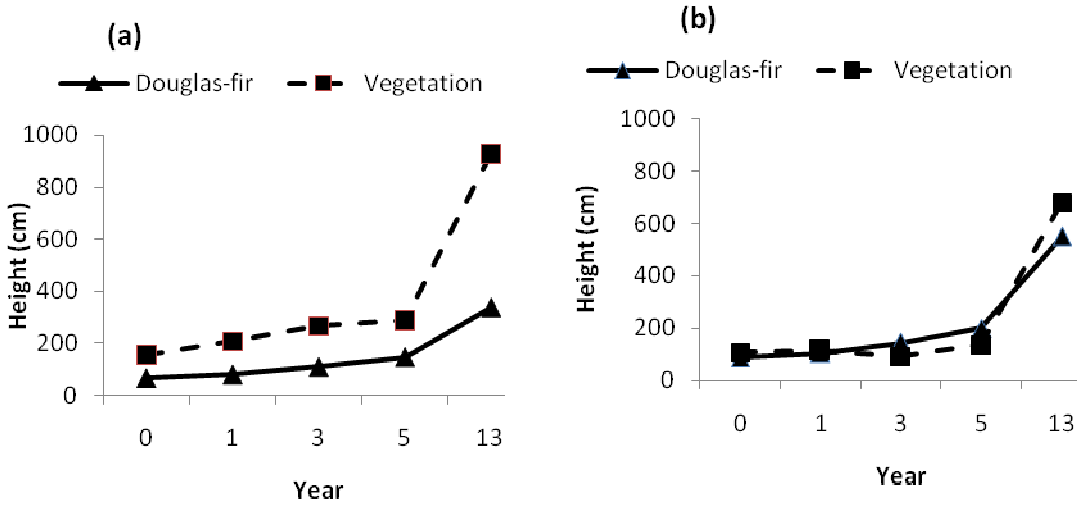

Figure 2. A comparison of the height of vegetation and Douglas-fir from pre-treatment (year 0) to 13 years after brushing, in (a) the control and (b) the triclopyr treatment.

VEGETATION RESPONSE

- Before treatment, the dominant non-crop species on the site were trembling aspen (10% cover; 220 cm tall), willow (14% cover; 130 cm tall), and alder (4% cover; 150 cm tall). Herbs were sparse (3% cover; 40 cm height).
- After 1 year, treatment with triclopyr had resulted in mortality of 44% of tagged aspen, 94% of tagged willow, and 57% of tagged alder. Cover of these species had been reduced to 4, 2, and 2%, respectively.
- The treatment was only moderately successful, having an ECW rating of 56% after 1 year (ECW is a measure of herbicide efficacy where 100% indicates all target plants have died).
- After 13 years, mortality of tagged aspen in the triclopyr treatment had increased to 72%, and cover of this species was less than half that of the control (13% versus 29%). In contrast, 36% of tagged aspen in the control were also dead by year 13, which was attributed mainly to heavy shade from larger overtopping aspen trees.
- By year 13, almost all (97%) of the tagged willow and alder in the treated area were dead. However, the majority of the tagged willow (67%) and alder (86%) in the control had also senesced and died.
- In year 13, total aspen density within 3.99 m neighbourhoods around target Douglas-fir was nearly twice as high in the control as the treated area (2883 versus 1653 stems/ha). Of those aspen, an average 2461 per ha were taller than Douglas-fir in the control, compared with an average 1053 per ha in the treated area.

STOCKING

- Throughout the 13 year study period, Douglas-fir was the most common conifer on this site. Natural regeneration was sparse (less than 200 stems/hectare) (Table 3).
- Thirteen years after treatment, when this stand was 20 years old, the treated plot had 1083 well-spaced and 678 free-growing stems/ha, which was slightly below the minimum of 700 free-growing stems/ha that is required. The control plot was far below the standard, having only 428 well-spaced and 22 free-growing stems/ha at age 20.

Table 3. Stocking in the treated area and control

Density per hectare	Pre-treatment		5 years post-treatment		13 yrs post-treatment	
	C	T	C	T	C	T
Total conifer stems	954	1306	989	1361	817	1528
Total Douglas-fir	828	1161	706	1200	522	1228
WS conifer stems	344	894	800	1089	572	1083
WS Douglas-fir	344	894	678	1033	433	1039
FG conifer stems	17	72	6	428	22	678
FG Douglas-fir	17	72	6	384	17	661

WS = well-spaced; FG = free-growing

STAND DEVELOPMENT IN PERMANENT MEASUREMENT PLOTS

- Twelve years after brushing with triclopyr, when the stand was 19 years-old, there were approximately equal densities of conifer and broadleaf stems in the treated plot (42% conifers and 58% broadleaves). In contrast, the stand in the control was heavily dominated by broadleaves (94% of total stem density, Figure 3).
- In the triclopyr treated plot, conifers comprised 57% of basal area and broadleaves comprised 43%. Control plots were heavily dominated by broadleaves, which comrpised 92% of total basal area (Figure 4).

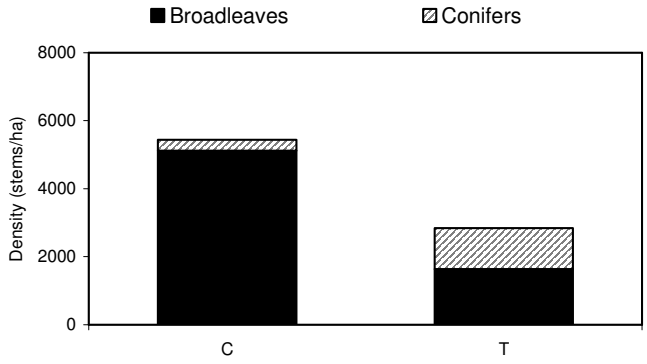

Figure 3. A comparison of conifer and broadleaf density in permanent measurement plots (PMPs).

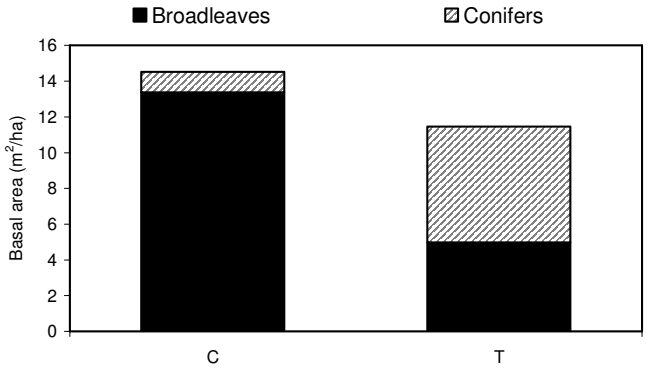

Figure 4. A comparison of conifer and broadleaf basal area in permanent measurement plots (PMPs).

PRELIMINARY MANAGEMENT INTERPRETATIONS

- The *Aspen* complex exhibited vigorous development on this ICHmw1 site, and the triclopyr brushing treatment clearly benefited the growth, survival, and condition of planted Douglas-fir. Without treatment, Douglas-fir were heavily overtopped and survival, growth and vigour were declining.
- On this site, planted Douglas-fir in the control are not expected to achieve free-growing without intervention. Without brushing, aspen is predicted to remain dominant throughout the juvenile phase.
- Even in the treated plot, free-growing status was not quite achieved at age 20 (678 free-growing stems) due to the presence of overtopping aspen at densities greater than that allowed by the free-growing guidelines. Nonetheless, Douglas-fir were performing very well in the treated plot,

suggesting that the presence of more than 1000 aspen stems/ha that were taller than crop Douglas-fir does not exceed the biological threshold for growth at that age.

- The triclopyr treatment was only moderately effective for reducing aspen presence on this site.
- Alder and willow were killed by triclopyr, but after 13 years, the majority of control alder and willow had also died as a result of natural senescence.
- We will continue to monitor stand development in the Permanent Measurement Plots on this site.
- Readers are reminded that information reported here is based on results from only one ICHmw1 site and that responses on individual sites may vary considerably, even within the same biogeoclimatic variant. Replicated PROBE results for another experiment suggest the *Aspen* complex is less competitive in other southern interior ecosystems. (Click here for a summary of 10 year responses of lodgepole pine and the *Aspen* complex to manual cutting in the IDF and MS zones).