Effect of Timing of Manual Treatment on Red Alder Regrowth and Conifer Response – Project 2.12

INTRODUCTION

Red alder (Alnus rubra Bong.) is a common deciduous tree species found throughout coastal British Columbia. It is most abundant in the CDF and CWH zones. Because of its rapid juvenile height growth and ability to form dense stands, red alder can dominate recently logged sites, resulting in reduced conifer growth rates and survival.

Several herbicides are effective for controlling red alder, but non-chemical treatment is often favoured in forest plantations near population centres or close to important water bodies. One such treatment alternative is manual cutting with chain saws or circular brush saws.

A study began in 1989 investigating the sprouting habits of red alder after cutting. The objectives of the trial, established in a 5-year-old conifer and red alder stand near Powell River, were:

1. to examine the effects of five cutting periods (between June 7 and September 1) on the resprouting of red alder; and
2. to determine the effect of alder removal on subsequent conifer growth and condition.

This memo summarizes the growth response shown by both red alder and conifers for the 7-year period following manual cutting.

SITE HISTORY

The trial was established at the head of Okeover Inlet, about 15 km northwest of Powell River, B.C. The site was within the Wetter CDF Biogeoclimatic Subzone at an elevation 80–120 m above sea level. An immature stand of Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) which occupied the site was logged between 1976 and 1978. To control the spread of laminated root rot (Phellinus weirii) to the Douglas-fir, a Caterpillar tractor extracted and piled stumps on 14.2 ha of the site.

The podzolic soils of this site exhibited a very dry moisture regime. The nutrient regime was poor to medium, due to low organic matter content, and the soil texture was coarse.

The site was spring-planted in 1979 with a mixture of Douglas-fir and grand fir (Abies grandis (Dougl. ex D. Don)). The disturbed mineral soil proved ideal for alder regeneration, and rapid early height growth allowed it to overtop the conifer plantation. In November and December of that year, some alder was cut with chain saws. By 1983, alder untreated since establishment had a density of 4440 stems per hectare (sph), averaged 4.4 m in height, and continued to overtop the slower growing conifers. Alder cut in the winter of 1979 had a higher density (51 600 sph), reflecting vigorous resprouting.

METHODS

Six treatments (Table 1) were applied to both the area manually treated in the winter of 1979 (previously brushed) and the area where alder was left untreated (not previously brushed). Treatment plots were 25 x 45 m in size. Workers were instructed to cut alder low to the ground and level, to maximize alder mortality.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Treatment period (1983)</th>
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<tbody>
<tr>
<td>Cut 1</td>
<td>June 7–8</td>
</tr>
<tr>
<td>Cut 2</td>
<td>July 5–7</td>
</tr>
<tr>
<td>Cut 3</td>
<td>July 16–21</td>
</tr>
<tr>
<td>Cut 4</td>
<td>Aug. 2–4</td>
</tr>
<tr>
<td>Cut 5</td>
<td>Aug. 30–Sept. 1</td>
</tr>
<tr>
<td>Control</td>
<td>Untreated</td>
</tr>
</tbody>
</table>

After the alder was cut, stump height, diameter, and angle of cut were measured on 50 alder stumps in each plot. Measurements of resprouting alder included number of new sprouts and height of tallest sprout. Conifer measurements included total height, stem diameter, and condition on 50 saplings in each plot. Overtopping of conifers by red alder was assessed according to a three-class scale including “free-growing” (alder below the height of the conifers top whorl), “threatened” (surrounding vegetation reaching height but not overtopping the conifers top whorl), and “overtopped” (conifer top whorl overtopped by surrounding vegetation). Sampled red alder and conifers were re-measured one, two, three, five, and seven growing seasons after treatment.

RESULTS

Plots manually cut in the winter of 1979 are referred to as "previously brushed." Plots referred to as "not previously brushed" were not treated until this trial.

Red alder

Alder cut later in the growing season had significantly higher mortality for the 2-year period immediately after treatment, than did alder cut earlier. Substantial red alder mortality occurred during the 3rd year after treatment in all plots. Alder showed symptoms of severe moisture stress (drooping foliage and branches) and of the disease Melanconium spp.
Seven growing seasons after cutting, alder mortality did not differ significantly between cutting periods or between alder previously brushed and not previously brushed (Figure 1a). Alder mortality increased in the years since treatment, and now ranges between 58 and 91%. Seventh-year alder density remained lower in plots not previously brushed, ranging between 900 (untreated control) to 3500 sph (Figure 1b). By comparison, the plots previously brushed had densities ranging between 6500 and 9000 sph.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of sprouts</th>
<th>Ht. (cm)</th>
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</thead>
<tbody>
<tr>
<td>Previously brushed</td>
<td></td>
<td>Not previously brushed</td>
</tr>
<tr>
<td>June 7–8</td>
<td>3.5</td>
<td>607</td>
</tr>
<tr>
<td>July 5–7</td>
<td>2.4</td>
<td>556</td>
</tr>
<tr>
<td>July 19–21</td>
<td>3.5</td>
<td>609</td>
</tr>
<tr>
<td>Aug. 2–4</td>
<td>4.1</td>
<td>603</td>
</tr>
<tr>
<td>Aug. 30–Sept. 1</td>
<td>3.3</td>
<td>559</td>
</tr>
<tr>
<td>Control</td>
<td>1.0</td>
<td>744</td>
</tr>
</tbody>
</table>

TABLE 2. Mean number of alder sprouts and height by prior brushing status and treatment

Red alder height growth in the control plots averaged 0.6 m/year since establishment and 7.5 m in total height (Table 2). Number of sprouts on surviving alder stumps has declined in each subsequent assessment period, eliminating the differences between treatments.

Conifers

Seventh-year total Douglas-fir height and stem diameter growth were significantly less in the control than in the manually treated plots, but not different between previously brushed and not previously brushed conditions (Figure 2). Percentage of Douglas-fir classified as overtopped by red alder increased in the treated plots as the resprouting alder outgrew conifers in height (Figure 3). Survival was 87.5% in the control plots and 97.4% in the treated plots.

FIGURE 1. Seventh-year red alder (a) mortality and (b) density by treatment and prior brushing condition.

FIGURE 2. Douglas-fir (a) height and (b) stem diameter by treatment and time.
Height and stem diameter growth of grand fir was slower than that of Douglas-fir (Figure 4). Grand fir appears to be less sensitive than Douglas-fir to alder competition. Percentage of grand fir classified as free-growing has declined over the past two growing seasons (Figure 3). Grand fir survival remained high in both the treated plots (92.3%) and the controls (95.8%).

The effect on conifer growth of removing red alder overstory was substantial in the longer term. Douglas-fir and grand fir saplings overtopped since trial establishment exhibited height growth two to three growing seasons behind saplings that remained free-growing since treatment (Figure 5). Similar differences were found with conifer stem diameter. Maximum growth of grand fir occurred when 60–80% of saplings were overtopped, indicating not only a greater shade tolerance than Douglas-fir, but also some shade preference (Figure 6). Douglas-fir demonstrated shade intolerance because stem diameter increased when overtopped by a low number of alder.

**DISCUSSION**

Manual cutting can be a successful method for controlling alder on sites where other treatments, such as herbicides, are not appropriate. Before any alder control method is implemented, however, estimation of acceptable (or preferred) post-treatment alder density should be made. Site moisture and nutrient status, conifer shade tolerance, and alder's nitrogen-fixing abilities should be considered in defining target levels of alder control.

Miller and Murray (1977) suggest that red alder densities of 50–100 sfi are adequate for maintaining site nitrogen capital without substantially reducing conifer growth. Such low alder densities were not reached in any manual treatment at Okeover, at least in the short term.

Trials in the Vancouver Forest Region, and research elsewhere (Harrington 1983; Hoyer and Belz 1984; Debell and Turpin 1989) resulted in the following recommended treatments to maximize alder mortality and minimize number of resprouts and height growth:

1. **Cut alder when it is 5 years of age or greater.** Resprouting vigour of red alder decreases with age. Avoid cutting alder prior to year 5 since vigorous resprouting may exacerbate the alder problem. Alder mortality rates of 97% have been achieved when the stems are cut at 6-years of age. In dense alder stands, a second treatment may be necessary but should be delayed until the resprouting alder gets older.

2. **Cut late in the growing season, before leaf fall.** At lower elevations in the Vancouver Forest Region, this translates into late August to mid-September.

3. **Create a level cut, with low stump (< 20 cm) and remove all live branches.** Stump heights less than 20 cm were easily achieved in these treatments carried out with chainsaws.
CONCLUSIONS

In summary, the following factors should be considered when decisions about alder management to enhance conifer growth are made on drier ecosystems typical of Okanagan Inlet:

- Red alder height and crown development are less vigorous on sites that have moisture deficits during the summer and consequently less competitive to conifers than on moister sites.
- Grand fir displays shade-requiring characteristics. Douglas-fir shows moderate shade tolerance, although best growth occurs in open-growing conditions on this ecosystem.
- Nitrogen fixation may have a positive effect on site nitrogen status and over the long term improve conifer productivity. Some alder (50–100 g per plant) should be retained on sites that demonstrate nitrogen deficiency.

FOR FURTHER INFORMATION


For more information on this project, contact:

Brian D'Anjou or Frank Pendle
Forest Sciences Section
Vancouver Forest Region
4595 Canada Way
Burnaby, B.C. V5G 4L9
(604) 660-7531