Response of Lodgepole Pine Seedlings to Simulated Cattle Damage – Project 3.55

This Memo reports the results (to August 1990) of one of five related research projects carried out to study the effects of cattle grazing, forage seeding rate, basal scarring, and shoot damage on forest regeneration. Progress in the other projects is reported in the following FRDA Memos: the effects of aerial seeding on forage stand development (No. 184); the effects of forage seeding and cattle grazing on early establishment of lodgepole pine (No. 185); the impacts of grazing pressure, stocking rates, and forage seeding on lodgepole pine seedlings (No. 187); and beef production on seeded clearcuts in southern interior British Columbia (No. 188).

INTRODUCTION

Cattle may damage conifer seedlings by browsing, but damage more commonly occurs as basal scarring from trampling. There is, however, widespread disagreement and uncertainty about the effects of basal scarring on tree survival and growth. In principle, these wounds may cause mortality, reduce tree growth rates, and lengthen the time required to reach the free-growing stage. Nonetheless, few data are available which quantify the effects of basal scarring and leader damage on lodgepole pine (Pinus contorta).

The objective of this study is to clarify and describe the effects of basal scarring and leader damage on survival and growth of lodgepole pine. The information provided will enable range managers and foresters to assess the immediate and long-term impacts of livestock grazing on reforestation, including tree mortality, annual diameter and height increments, time required to reach the free-growing stage, and projected rotation ages.

STUDY AREA AND METHODS

The study site is located 50 km south west of Kamloops, B.C., in the Very Dry Cool Montane Spruce (MSxk) bioclimatic subzone at 1400 m elevation. Before logging, the forest overstory consisted of lodgepole pine and Engelmann spruce (Picea engelmannii) in approximately equal proportions. Pinegrass (Calamagrostis rubescens), heart-leaved arnica (Arnica cordifolia), and birch-leaved spirea (Spiraea betulifolia) characterized the understory.

The experiment was conducted on a 1.2-ha area within a 32-ha clearcut. The site was clearcut by Ainsworth (1987) Lumber Ltd., Savona, B.C., in November 1986 and the slash burned at the same time. In November 1987, the windrows were burned and the area drag-scarified using three shankfins at 2-m spacing behind a D-7 Caterpillar tractor. In May 1988, nursery-grown, 1-year-old lodgepole pine seedlings (1-0, PSB 211) were planted at a density of 1600 seedlings per hectare (2.7-m spacing). The experimental area was fenced with 4-m high pagewire fencing to exclude cattle and wild ungulates.

To simulate basal scarring by cattle trampling, 4.0-cm sections of bark were removed near the base of each of 10 seedlings at widths of 25, 50, and 75% of the tree seedling stem circumference. Ten untreated seedlings were also left as a control. Leader damage was simulated by removing the apical bud or by cutting off 50% of the existing terminal leader. The scarring and leader damage treatments were applied to 480 trees at two phenological growth stages and two tree ages. This memo reports results only for the trees that were planted and treated in 1988. Of these trees, 120 were treated during the stage of active growth (June 21, 1988) and a further 120 were treated after bud set (August 15, 1988). Tree seedling diameter, height and survival were measured in September 1999.

RESULTS AND DISCUSSION

Reductions in lodgepole pine diameter growth (22%) occurred only after seedlings were scarred to 75% of their stem diameter. When both leader damage and basal scarring were applied together, however, response to basal scarring was evident at all levels of scarring (Fig. 1). Removal of the terminal bud alone resulted in the same reduction of diameter.
growth as removal of 50% of the terminal. Trees damaged during active growth were affected less than those damaged after bud set (Table 1). Likely, trees scarred after bud set have less time to heal before winter, and consequently may suffer more over-wintering stress than trees scarred during active growth.

The greatest loss of lodgepole pine height growth (33%) occurred on trees scarred at 75%, although height growth was still reduced by 4% when trees were scarred to 25% of the stem circumference (Fig. 2). Removal of the terminal bud seems to be the most important factor in loss of height growth due to leader damage. Phenological growth stage at which damage treatments occurred was also an important factor in determining subsequent height growth (Fig. 3). Trees scarred after bud set may be more susceptible to snow press than those treated during the active growing period, because likely there is less time for stems to heal after bud set than during active growth. Indeed, by June 1989, 1 year after scarring, nearly 12% of the trees scarred after bud set had dead tops which resulted from stem breakage, compared to only 5% for those trees treated during active growth. Lodgepole pine mortality was unaffected by either basal scarring or leader damage, with survival averaging 97% in 1989.

<table>
<thead>
<tr>
<th>Damage treatment</th>
<th>Phenological growth stage</th>
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</thead>
<tbody>
<tr>
<td>% Scar</td>
<td>Leader treatment</td>
</tr>
<tr>
<td></td>
<td>Diameter (mm)</td>
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<tr>
<td>0</td>
<td>Control</td>
</tr>
<tr>
<td>50% Terminal</td>
<td>5.6</td>
</tr>
<tr>
<td>25</td>
<td>Control</td>
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<tr>
<td>75</td>
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</table>

CONCLUSIONS

- Basal scarring at 25 and 50% of stem circumference did not affect lodgepole pine diameter growth.
- Basal scarring at 75% of stem circumference reduced lodgepole pine diameters by 22% and heights by 33%.
- The combination of 50% terminal shoot removal and bud removal reduced diameter growth by 6%.
- Diameter and height growth was most affected when damage was applied after bud set.
- Lodgepole pine seedlings scarred after bud set appear to be susceptible to snow press.
- Lodgepole pine mortality was unaffected by basal scarring and leader damage.

These conclusions are based on the treatment of 1-year-old stock which has been monitored for only one growing season.

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FIGURE 3. Lodgepole pine height response to size of scar and two phenological growth stages.

FIGURE 2. Lodgepole pine height response to size of scar and leader treatment.