Research Forest

Alternative establishment prescription for control of spruce weevil damage: Five year growth and performance

Quick Sheet #7

March, 99

Research Project # 93-03

Introduction

Research project 93-03 was designed to test the effectiveness of an alternative planting prescription in reducing white pine weevil (*Pissodes strobi*) damage to young interior BC spruce plantations. Two mixed-species planting regimes, clumped and regular spacing, were established on two blocks within the ICHmk3 biogeoclimatic subzone, on the Gavin Lake block of the Research Forest. At the time of this report, the trees were not tall enough to be susceptible to weevil attack. This report summarises 5-year results of seedling growth and performance in each planting regime, measured from transects and NIVMA USSM vegetation monitoring plots, and provides initial growth information for future monitoring of weevil attack incidence in each planting regime.

Mixed species planting may be a useful management technique to control the severity of weevil attacks. Research by He and Alfaro (1997), Taylor et. al. (1996), and McLean (1994) demonstrated that mixed species planting modified spruce tree growth and the surrounding microclimate enough to reduce weevil habitat suitability. Planting faster growing seral species, like lodgepole pine, or permitting ingress of deciduous tree species, may decrease weevil attack frequency for the following reasons:

- The spruce will be overtopped by pine, reducing growth rates, and producing a smaller diameter leader with less brood space.
- Shaded spruce leaders will accumulate lower heat sums, retarding weevil development and permitting more predation.
- A mixture of species may reduce visual cues used by weevils for screening spruce leaders.
- Maintaining vegetation diversity and abundance may improve habitat, and therefore abundance, for weevil predators.

This project was established in 1993, at which time existing studies of weevil damage on the Research Forest involved stands that were established in 1985 and already had significant weevil damage. This project was introduced to study control methods initiated at the time of plantation establishment.

Study Sites/Methods

Two blocks (358 and 361) were established on the Gavin Lake Block of the Research Forest with similar site conditions and history. The blocks are rich moist ICHmk3 05 sites that are potentially very productive for conifer growth, but present

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72 South Seventh Avenue
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Phone 392-2207 Fax 398-5708

challenges due to sensitive soils and a high brush hazard. Both blocks were logged, burned and planted in the early 1970's, prior to the establishment of the Research Forest. A 1991 stocking survey determined that these areas were not sufficiently re-stocked and were dominated by willow, alder and cottonwood. From a timber standpoint the sites were considered non-productive, although abundant forage and cover made them very productive from a wildlife habitat perspective.

Aggressive site preparation was used to restore these areas for conifer production. Both blocks were site prepared in 1992 with a brush blade on a crawler tractor. All brush and tree species were removed and piled within the blocks. Site preparation resulted in removal of most of the humus layer and some soil compaction.

Treatment Background

Both blocks were planted with a mixture of PSB 313B 1+0 interior spruce and lodgepole pine in 1993. A detailed report of the planting and stand tending prescription may be found in Day (1995).

Two stand establishment prescriptions were implemented on each site:

1) **Regular** spacing - block planting with an even mixture of both species, at 1800 stems per hectare with a 2.5 meter target inter-tree spacing. Brushing of all competing vegetation within treatment area.
2) **Clumped** spacing - clump planting - 7-tree clumps at 300 clumps per hectare and 2100 stems per hectare. Each clump consisted of 4 lodgepole pine and 3 interior spruce. The pine was planted on the south side of the clumps to optimise shading. Clumps were spaced 5.7 meters apart and the target inter-tree spacing, within clumps, was 1.0 meter. Manual brushing was prescribed within clumps only. Deciduous trees and brush between clumps were retained to promote shading, biodiversity, and a deciduous commercial thinning opportunity.

Transects were established to monitor the growth and performance of 100 spruce trees, per treatment, on each block. NIVMA plots were established to monitor pine growth and vegetation response to each treatment.

The blocks were manually brushed in 1997.

Results and Discussion

Condition

Both blocks remained fully stocked and 72% of the spruce trees were in good or fair condition, five growing seasons after planting. There were no discernible differences in the overall vigour and condition of trees between the planting treatments. Comparing

condition between blocks, there was somewhat higher mortality by year 5 on block 361 (figure 1).

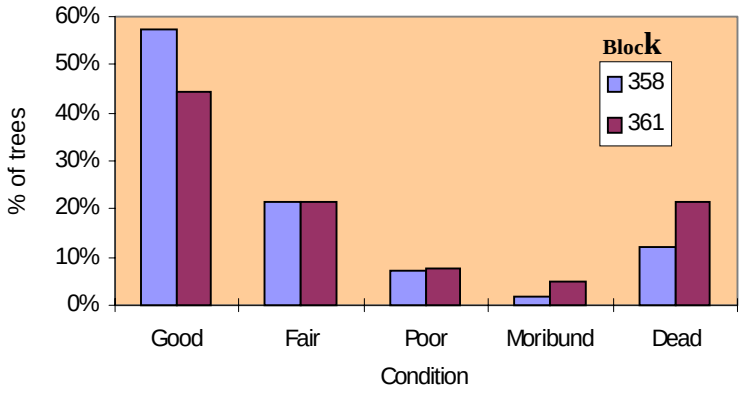

Figure 1) Five-year spruce tree condition assessment.

Twenty percent of the seedlings on site 358, and 25% on site 361, were chlorotic after the first growing season due to flooding which resulted from recently denuded and compacted wet soils.

By year 5, flooding and chlorosis were not a problem on either site, however, 5% of the trees on both sites had suffered leader and stem damage due to snow and vegetation press and animal damage.

After five growing seasons, 17 % of the sample trees had died and were culled from the sample for the purpose of reporting on growth.

Height

The spruce trees had not yet reached the height at which they become susceptible to weevil damage. As intended, the pine overtopped the spruce. Total mean height of pine surpassed total mean spruce height by year 3 in both treatments (figure 2). After five growing seasons pine was 30 to 50% taller than spruce.

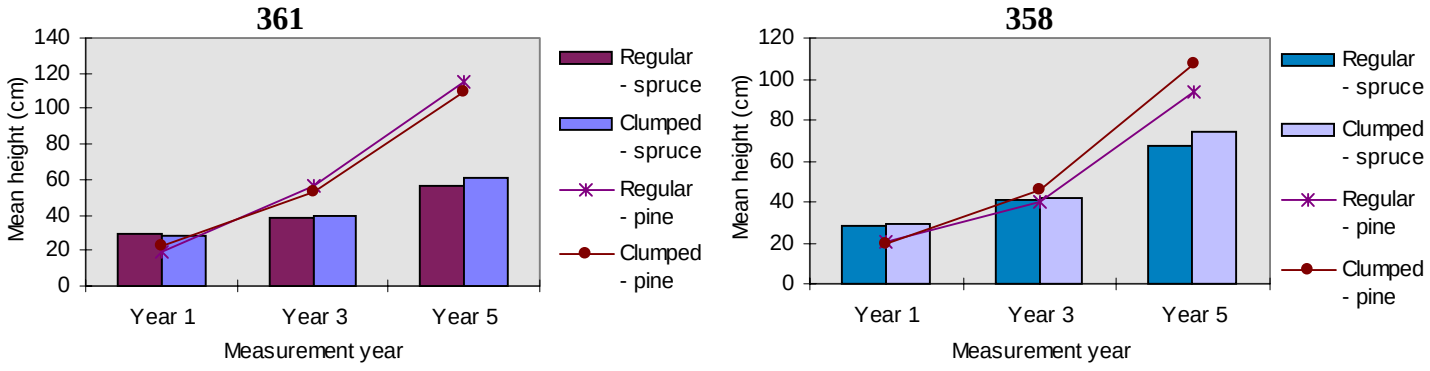

Figure 2) Five-year height growth of spruce and pine in regular and clumped plantings on two blocks - 361 and 358.

As shown in figure 3, there was an observed trend of greater spruce height growth in the clumped planting, when compared to the regular planting, however it was not found to be significant ($p<0.05$). Mean spruce height growth was found to be significantly greater in block 358 than in block 361.

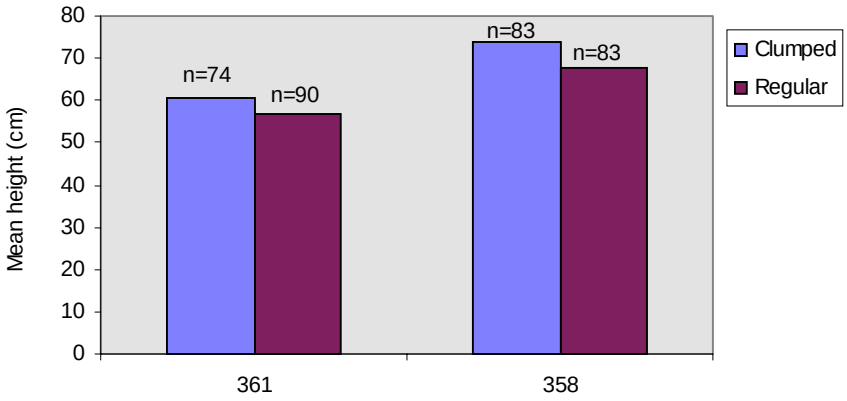

Figure 3) Mean height of spruce at year 5 by treatment and block.

Diameter

There was a significant difference ($p<0.05$) in mean diameter at year 5 between the clumped and regular planting treatments on block 358 -- the mean diameter of spruce trees in the clumped planting was 0.36 centimetres greater (figure 4). This trend was also present in block 361 but was not found to be significant.

In the clump planting, the trees on block 358 had significantly better diameter growth than those on block 361. In the regular planting, there was no difference in diameter growth between blocks.

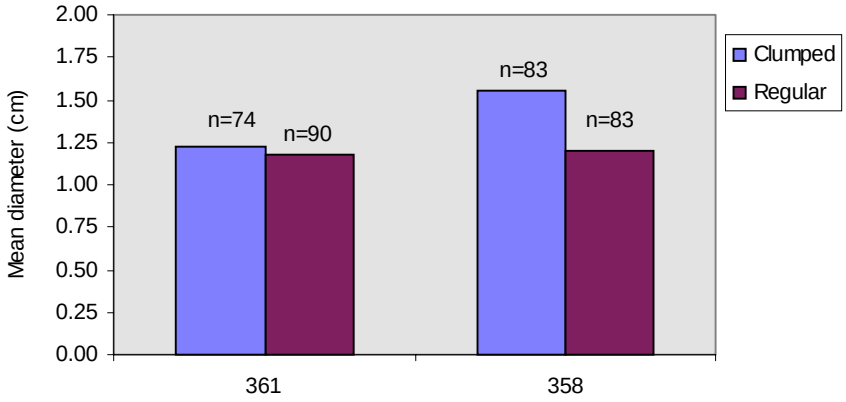

Figure 4) Mean diameter of spruce at year 5 by treatment and block.

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Conclusion

After five growing seasons, there is a trend towards better spruce height and diameter growth in the clump planting. This trend was not found to be significant for height, and was only significant on one replicate site, for diameter. It was surprising to find a greater mean stem diameter on trees in the clumped planting than those in the regular planting. It was anticipated that the denser vegetation in the clumped regime would result in a reduced spruce diameter increment. Significant site differences were observed between replicate blocks. Block 358 had better tree survival, height and diameter growth. It was too early in the trial to observe the effects of pine side shade influence on spruce growth and susceptibility to weevil attack.

Future Monitoring

Long term monitoring of the weevil damage in each of these planting regimes will be conducted until the trees grow beyond the height at which weevils are able to attack (10 – 15m). Tree growth and changes in vegetation will be tracked over time in permanent vegetation monitoring plots. Growth and yield will be monitored in each planting regime throughout the rotation. The demonstration value of this project will continue through the entire stand rotation and additional research opportunities include economic analyses of the two silvicultural regimes, comparisons of biodiversity, soil productivity, and stand health.

Authors

Jeffrey Hayward, MSc
Claire Trethewey, RPF, RPBio.

Funding

Forest Renewal BC
Forest Resource Development Agreement II
UBC/Alex Fraser Research Forest

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