Natural Regeneration 10 Years after Partial Cutting in a Dry-belt Interior Douglas-fir Stand

The Issue

We often assume that partially cut stands will regenerate naturally, but patterns and amounts of natural ingress are hard to predict. Dry-belt Douglas-fir stands of British Columbia’s southern interior have been partially cut for decades, but there is still very little reliable information on regeneration rates and the effects of different amounts of residual stocking. A greater understanding of the regeneration response to partial cutting will help silviculturalists anticipate what contribution natural ingress might make to future stocking, and assist with the ongoing development of stocking guidelines for partially cut stands.

Study Methods

A partial cutting experiment in dry-belt Douglas-fir was established in 1993–1994, about 6 km north of Westwold in the Okanagan-Shuswap Forest District, to test the growth and yield response of a previously unmanaged stand to a range of single-tree selection harvest treatments (Johnstone 2000). We revisited this experiment 10 growing seasons after treatment, to assess the amount and quality of Douglas-fir regeneration. The study is located at elevation 1100 m, on a level to gently sloping site, with a northwest exposure and site series predominantly Douglas-fir – Feathermoss (04) of the IDFdk2 biogeoclimatic subzone (Lloyd et al. 1990). The pre-treatment stocking ranged from 32 to 40 m²ha⁻¹ in an uneven-aged Douglas-fir (Pseudotsuga menziesii var. glauca (Bessin) Franco) stand, with minor components of lodgepole pine (Pinus contorta Dougl. var. latifolia Engelm.), hybrid white spruce (Picea glauca x engelmannii), trembling aspen (Populus tremuloides Michx.), and paper birch (Betula papyrifera Marsh.).

Before treatment, the site was divided into three blocks based on differences in stem density and species mix. One replication of six treatments, based on a factorial combination of three levels of residual basal area (15, 20, and 25 m²ha⁻¹) (Figures 1–3), and two target diameter distributions, was applied in each block. Within each block, the treatments and an untreated control were randomly assigned to 0.25-ha square plots (Figure 4). In all of the treatments, only trees between 7.5 and 52.49 cm diameter at breast height (dbh) were treated, and the goal for maximum residual tree size was 50 cm dbh. Harvesting by
hand-felling and horse-yarding was carried out in the fall of 1993, and afterwards, dense thickets of trees under 7.5 cm diameter were thinned out (Johnstone 2000).

To sample the understorey, four 50-\(\text{m}^2\) circular sample plots were randomly located within each treatment and control plot, and all ingress 2 years and older, plus advanced regeneration up to 7.49 cm dbh, were tallied by species, age, and quality (good, medium, and poor). Height was measured on trees over 10 cm tall, and diameter was recorded if the tree was taller than 1.3 m.

**Results**

The target diameter distribution treatments were found to have no demonstrable effect on regeneration, based on covariance analysis. Therefore, the two replications of each residual basal area level within each block of treatments were combined to provide mean values for the block in further analysis. Average values across all of the blocks are presented in Table 1 to summarize the results of the survey.
Key Findings

- Analysis of variance indicated no statistically significant differences in seedling number, quality, or height among the treatments ($p \leq 0.05$). Seedling counts within each treatment level were highly variable within and across the blocks.
- Fewer than 10% of Douglas-fir recruits have reached 30 cm height, a result of mortality in the older age cohorts and slow height growth.
- At this site, most of the seedlings belong to age cohorts associated with significant recruitment years 1996 and 2000.

Implications

- There appears to be sufficient numbers and quality of Douglas-fir regeneration to restock the site, but the seedlings are relatively small and irregularly distributed. Stocking survey methods for partially cut stands are currently being redesigned to account for this.
- A wide variety of regeneration results can be expected within these levels of residual stocking. Regeneration is influenced by many factors other than those controlled in this study. The future measurement of additional site or tree variables in this experiment could elucidate significant factors.

The understory sample plots established for this project will be revisited in future years to follow mortality and development of the regeneration.

This brief note is intended for rapid communication of the key findings of this project. For further information, contact:

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Literature Cited


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