Brushing for future forests or free-growing requirements?: One to five year PROBE results

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INTRODUCTION

The legislation governing free-growing status sets out to ensure that plantations reverting from the licensee to the Crown are satisfactorily regenerated and are unlikely to require further significant interventions until maturity. The fundamental principle involved here is that "competition with plants, shrubs, or other trees" has a negative influence on survival and growth of young conifers, and has motivated extensive brushing of juvenile stands at substantial cost to the forest industry. This is expected to increase as more plantations approach the free-growing stage.

Although substantial money and effort has been expended for brushing treatments across the province, little has been spent on monitoring the effectiveness of these treatments. Furthermore, the underlying principle that native plant communities are indeed detrimental to conifer survival and growth has not been tested. One exception is the PROBE program (Protocol for Operational Brushing Evaluations, Simard [1993]) as applied in the Kamloops and Nelson Forest Regions.

MATERIALS AND METHODS

PROBE was designed to study the effects of vegetation management treatments on conifer survival and growth, and on the structure, diversity, and condition of the vegetation community. These effects are measured in operationally brushed clearcuts. Each PROBE installation consists of a treatment plot (treated operationally with the rest of the opening) and a control (area left untreated in the same opening) which have similar ecosystem characteristics. Each plot is about 0.8 ha in size. Thirty-six crop tree-centred subplots are established on a grid within each of the treatment and control plots. Within each subplot, crop tree size, condition, and degree of overtopping, as well as height and cover of the dominant species and vegetation groups are assessed before the brushing treatment. In four of these subplots, the cover and height class of all vascular plant species are also recorded. These measurements are repeated 1, 3, 5, and 10 years after treatment.

Sites that have the same biogeoclimatic zone, vegetation complex, conifer species, and similar brushing treatment are grouped together for analysis. A minimum of three replicates is required for analysis of variance and regression analysis. Results for fully replicated treatment cells are currently available for eight complexes.

Because PROBE monitors operational treatments, it includes more variable site and treatment conditions than normally occur in strictly controlled research studies. This is reflected in the results. There are

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several reasons why PROBE may not show significant brushing responses, when comparable, strictly controlled experiments do. For instance—

- Operational treatments are not always uniform, nor do they test "complete vegetation removal" treatments.
- PROBE monitors a wider range of site conditions and stand ages.
- Operationally brushed plantations include a wide range in vegetation density, whereas experiments are usually conducted on high-brush-density sites.

Each approach has advantages: PROBE provides a more accurate picture of operational brushing efficacy, whereas research experiments often investigate "potential" responses and the underlying mechanisms.

RESULTS AND DISCUSSION

Our 1–5 year results show that, on many sites deemed in need of operational brushing, conifers survived and grew as well in the untreated controls as they did in the brushing treatments. In some cases, this was because the brushing treatment had only a short-lived effect on vegetation (e.g., a single manual cutting treatment applied to the Fireweed Complex). At other sites, however, the lack of response was because seedlings were not experiencing deleterious competition (e.g., lodgepole pine in the Dry Alder complex). Survival was not improved by manual or chemical brushing in any of the complexes studied, and actually declined in the Mixed Hardwood-Shrub complex because of Armillaria root disease following manual cutting and girdling. In many cases, mortality was the result of factors other than interspecific competition, and in others, brushing did not reduce brush abundance below survival thresholds.

The effect of brushing on growth has been more variable than the effect on survival. It has improved height or diameter growth in one-half of the complexes studied, and had no effect in the others. In particular, we have found that:

- Brushing improved conifer growth in some Interior Cedar–Hemlock (ICH) complexes (Fern, Mixed Hardwood Shrub, Mixed Shrub) and in the Engelmann Spruce–Subalpine Fir (ESSF) Ericaceous Shrub complex. Our individual tree data indicate that: not all trees were suppressed by competition in these complexes; not all trees responded to brushing; and selective treatment of stressed trees would likely have achieved similar responses in average or top height growth.
- Brushing had no effect in any of the dry-belt complexes (Aspen, Dry Alder, Willow, Pinegrass) or in the high-elevation complexes that tend to occur on subhygric ESSF sites (Subalpine Herb, Wet Alder). Note that PROBE has only partial replication of Willow and Pinegrass, but our trends are corroborated by other published studies.
- A single manual cutting improved conifer growth in the ICH Mixed Hardwood-Shrub, Mixed Shrub, and Ericaceous Shrub complexes, but was ineffective in the remaining four complexes tested.
- Glyphosate, applied either as a spray or cut-stump treatment, improved conifer growth in the ESSF Fireweed complex, as well as the ICH Fern and Mixed Hardwood-Shrub complexes.
- A single sheep-grazing treatment had no effect on seedling growth in the ICH Mixed Shrub complex.

Brushing effects on plant communities depended on the brushing method applied. In general, a single manual cutting treatment had little effect on the herbaceous and low-elevation shrubby complexes, and reduced structural diversity only slightly in the Ericaceous Shrub complex. In contrast, manual cutting substantially altered structure of the broadleaf complexes. Glyphosate also changed community structure and diversity regardless of where it was applied. Sheep grazing altered the plant communities in the short term, including reductions in structural diversity and shifts in plant community composition.

In summary, our short-term results show that operational brushing makes biological sense in some complexes, but in many it is ineffective at improving survival or growth of conifers. Whether the observed short-term growth responses are sustained, affect rotation lengths, or affect stand yield or value, can only be determined with long-term monitoring. Although our results generally concur with the limited literature, conifer responses were sometimes lower than those measured in research experiments. This is attributed to the lower brush densities and greater variability in treatment efficacy, tree growth, site conditions, and stand ages normally encountered in operations. Our results suggest that brushing is frequently applied where it is unnecessary, and for some complexes, the single manual treatments commonly applied are ineffective. We feel that the free-growing standard overemphasizes the importance and severity of plant competition in several southern Interior vegetation complexes, and that free-growing legislation should be changed to give professional foresters more flexibility to prescribe brushing only where needed. Eliminating unnecessary brushing treatments would free-up dollars for better identification of deleterious competition, selective treatment of stressed trees only, and intensive management of the most valuable, problematic sites. This could be achieved by shifting the focus of the legislation away from "competing vegetation" and onto the health and performance of the crop trees.

REFERENCES

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