Retrospective studies of soil conditions and forest productivity on rehabilitated landings: Interior of British Columbia

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INTRODUCTION

In British Columbia, forest soil rehabilitation aims to restore productivity to roads and landings that are no longer needed, and to areas that have suffered unavoidable or accidental damage. Soil rehabilitation is often an important component of management strategies to maintain or enhance timber supply in the working forest. Restoring productivity to degraded soils also enhances other environmental values, which contribute to successful ecosystem or watershed restoration.

Soil rehabilitation research was initiated in British Columbia over two decades ago (Vyse and Mitchell 1977), and numerous contributions since that time have been reviewed by Bulmer (1998) and Sanborn et al. (1999). Despite significant progress in the past, and new information expected in the future, more information is required to guide current operational projects. In particular, information is needed on the long-term effectiveness of soil rehabilitation efforts, and the extent to which operational rehabilitation projects can contribute to the timber supply.

We examined tree growth and soil conditions on sites that were rehabilitated in 1991 in the Interior Cedar–Hemlock (ICH) biogeoclimatic zone. The objectives were:

- to document at least 5-year growth of lodgepole pine on rehabilitated landings, and compare it to growth on sites that were simply harvested; and
- to document soil conditions affecting site productivity on the rehabilitated areas.

MATERIALS AND METHODS

We sampled 98 landings and areas in the adjacent plantations in three forest districts. The landings were tilled with a winged subsoiler in the early 1990s as part of operational rehabilitation programs. To evaluate forest productivity and soil conditions on the landings and adjacent areas, we:

- located randomly three 0.005-ha plots on each landing, and three in the adjacent plantation;
- measured height and all increments of lodgepole pine within the plots (maximum five trees per plot in plantations), and recorded the abundance of all tree species in three age groups;
- measured soil temperature, moisture, forest floor depth, and probe penetration depth;

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- evaluated soil texture, total C, total N, mineralizable (available) N, bulk density, and pH; and
- collected foliage samples and analyzed them for nutrient content.

RESULTS AND DISCUSSION

Figure 1 shows that 63–95% of the time (in the Boundary and Kispiox forest districts, respectively), the plots we sampled on landings had greater than 1000 stems per hectare. The average stocking level (all lodgepole pine trees greater than 15 cm tall) was approximately 1450 stems per hectare. These results indicate that planting pine on landings, which were tilled with a winged subsoiler, has led to successful establishment of a new forest most of the time.

In the Boundary Forest District (Figure 2), trees growing on rehabilitated landings were growing as well or better than trees in the adjacent plantations. In the northwestern forest districts (Figures 3, 4), tree heights were generally lower for the rehabilitated landings, in comparison to the adjacent plantations.

Trees growing in the plantations in the Kispiox and Kalum forest districts were growing at similar rates, but the trees on rehabilitated landings in the Kalum Forest District were much larger. Factors that may explain the apparent difference in rehabilitation success include:

- seedlings planted in Kalum Forest District were bigger, and from copper-coated styroblocks;
- fertilizer was used in the Kalum Forest District to assist the establishment of seeded cover crops; and
- subsoiling in the Kispiox Forest District was less effective.

Trees were growing more slowly in the plantations in the Boundary Forest District than in the other districts. Trees on landings in the Boundary Forest District also tended to be younger than those in the other districts, which reflects fill-planting associated with some initial establishment problems. Many more naturally established trees occurred on the landings in the Boundary Forest District.

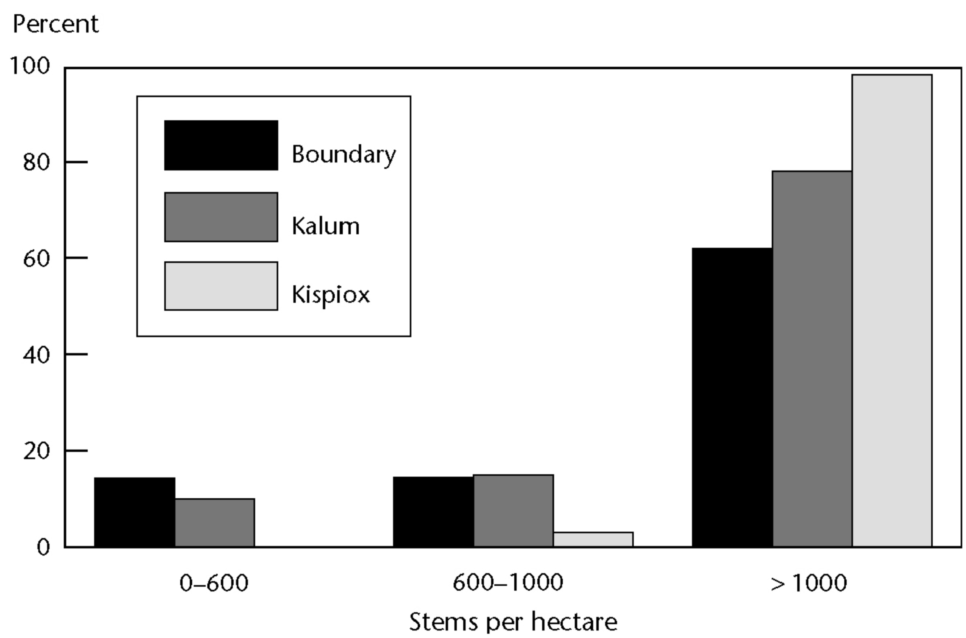

FIGURE 1 *Stocking rates for landings in three districts.*

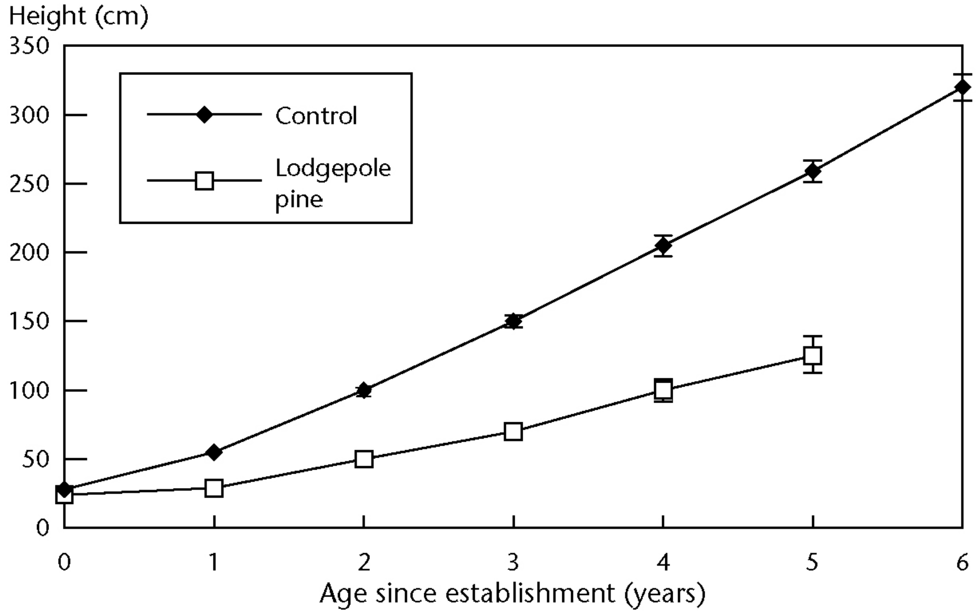

FIGURE 2 *Lodgepole pine growth on landings and plantations in Kispiox District (*n *= 32).*

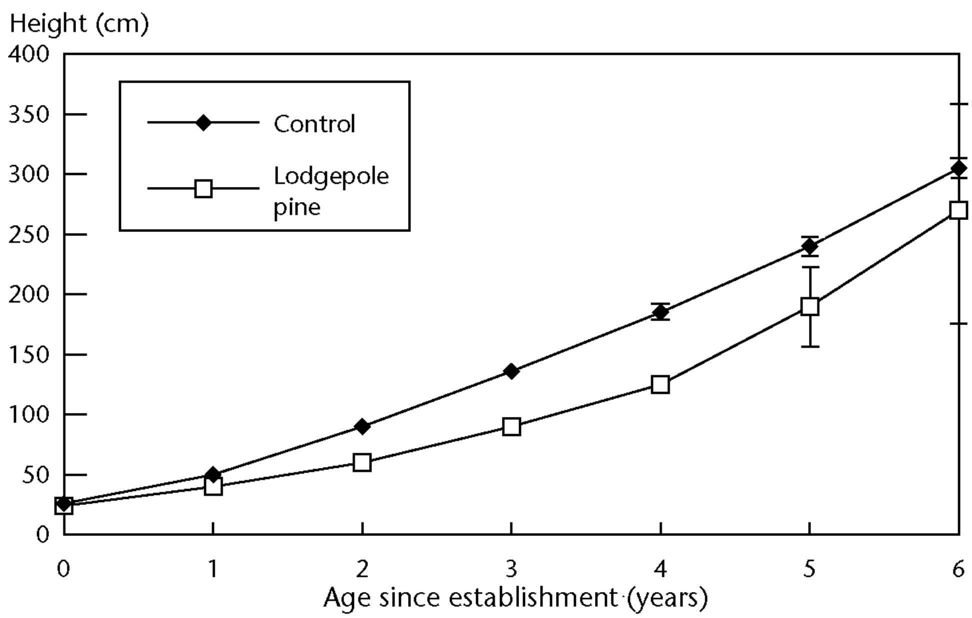

FIGURE 3 *Lodgepole pine growth on landings and plantations in Kalum District (*n *= 25).*

In all three districts, landings were warmer and drier than plantation sites. For all districts, average soil bulk density was below growth-limiting values for both landings and plantations. Landings tended to have less C and mineralizable N in all districts, but the differences were smaller for the Kalum Forest District. For the Kispiox Forest District, mineralizable N values on landings were substantially lower than the values for plantation sites. Differences in C and nutrients likely reflect the absence of topsoil on the rehabilitated landings.

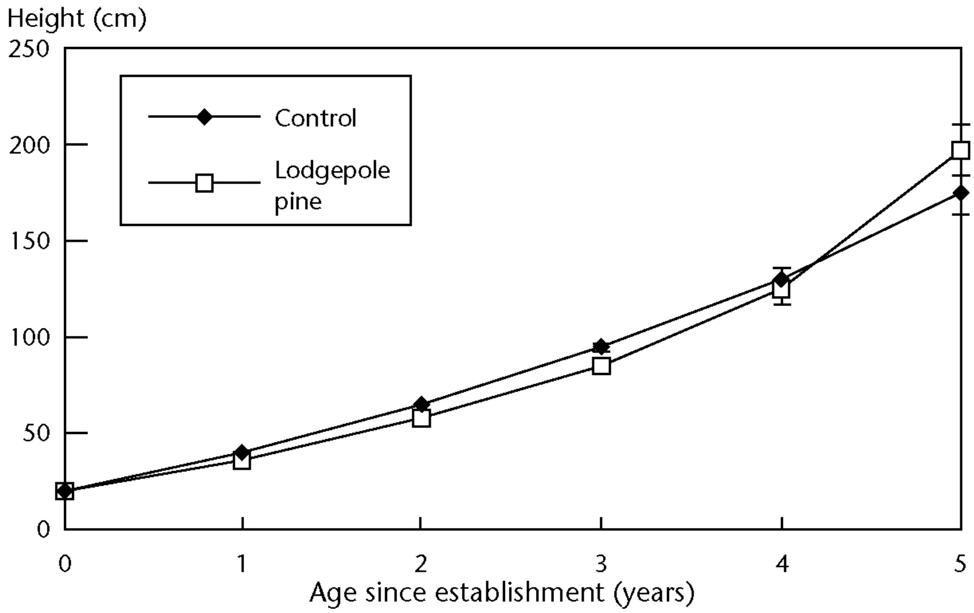

FIGURE 4 *Lodgepole pine growth on landings and plantations in Boundary District (n = 41).*

Foliar nutrient concentrations, determined for a subset of 10 landings and plantations in each district, were generally adequate for most nutrients (Ballard and Carter 1984).

SUMMARY

- Early indications are that, even without spreading topsoil, rehabilitating these landings has resulted in good stocking.
- Observed productivity suggests that a commercial tree crop will likely result.
- Modern rehabilitation techniques with topsoil spreading would likely result in even better growth than we have found in our study.

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