Site preparation treatments can have a dramatic effect on seedling survival and growth. Some treatments, such as broadcast burning are intended to make planting easier and to improve seedling growing conditions. However, different conifer species respond in different ways. In addition, accurate data on how site preparation changes changes seedling microenvironments and its effects on seedlings physiology are lacking.

FRDA Project 3.25 was initiated to examine (1) howburning and vegetation control modify seedling environments in the IChA1 (ICHdW) subzone of the Nelson Forest Region; and (2) the effect of these changes on the physiology and growth of four species (interior Douglas-fir, western larch, lodgepole pine, and Engelmann spruce). The study focuses on the effects of plant competition on seedling survival and growth and on the response of seedlings to the altered environment.

David Crampton, now a research ecologist in the Prince George Forest Region, is undertaking the study, with the help of Dr. Denis Lavender, UBC Professor of Silviculture, and Chris Thompson, Research Silviculturist for the Nelson Forest Region. In 1986, an experimental site was established near Radish Creek, 25 km east of Nelson, on a southern exposed slope of about 20%, at an elevation of 1050 m. Portions of the area had been broadcast burned in 1985. The duff layer had been reduced from approximately 9 cm to approximately 6 cm by the burn. The four conifer species were planted in plots where the shrub and herb vegetation had either been 100% manually removed or left untouched. Three of the plots were established in the broadcast burned area; one control plot was established in an untreated part of the cutblock.

Environmental, physiological and morphological data were collected during 1986 and 1987.

RESULTS:

Vegetation cover increased by the end of the third growing season from 3 to 30% on unburned plots and to 42% on burned plots. The species composition also changed. Birch (Betula papyrifera), snowberry (Symphoricarpos albus), thimbleberry (Rubus parviflorus), and spirea (Spirea betulifolia) dominated the unburned area. Red-stem ceanothus (Ceanothus sanguineus), thimbleberry, fireweed (Epilobium angustifolium), and thistles (Cirsium spp.) were most prevalent on the burned plots.

Treatment Effects

1. The soil surface temperatures reached 70°C in 1986 and 1987 on the burned plots where the vegetation had been removed. Seedling damage was not observed even at these high temperatures. Maximum surface soil temperatures were lower and declined rapidly as vegetation cover increased in all the plots where vegetation was not removed.

2. With the exception of very small patches of thimbleberry, light levels at 20 cm were never less than 45% of full sunlight during the first 2 years.

3. Soil water at 10 cm was limiting on all the burned microsites from late August through to September in 1986 and 1987. Soil moisture was never limiting on the unburned plots; the intact organic layer retained soil moisture and reduced evaporative soil moisture losses.

4. Soil temperature at seedling rooting depth (10 cm) was 3 to 4°C higher on the plots where vegetation had been removed, regardless of treatment. On all sites the soil temperatures at rooting depth exceeded 15°C for most of the growing season.

Seedling Response

1. There were no significant differences in total height between treatments for any species during the first three growing seasons (Figure 1a).

2. Total biomass (dry weight of shoot and root) after two years indicated a significant response by some of the species (Figure 1c).
   - all species responded positively to vegetation removal;
   - burning plus vegetation removal resulted in the greatest productivity;
   - the best short term growth performance was from western larch and lodgepole pine that are promptly planted on burned sites with the vegetation removed;
   - Douglas-fir and spruce showed relatively little growth response to the treatments.
CONCLUSIONS

1. Light was probably not a limiting factor for spruce and Douglas-fir. Current research indicates that all of the species tested reach their maximum photosynthesis at lower light levels than were recorded in this project.

2. Burning promoted establishment and growth of non-crop vegetation which resulted in increased competition. This resulted in poorer seedling growth in the burned plots compared to the unburned areas.

3. Competition from non-crop species reduced the growth in all crop species.

4. The combination of burning plus vegetation removal resulted in the highest productivity for all species. This response is due to the combination of increased soil temperature, available light, soil moisture and nutrients.

5. Burning plus vegetation control resulted in the best initial growth of larch and lodgepole pine. Spruce and Douglas-fir may be successfully established by planting immediately after harvest without burning or vegetation control treatments. Longer term results are needed to confirm these responses.

6. Seedling height alone is a poor indicator of growth response to various burn intensities and vegetation management treatments. Diameter should be considered as an alternative operational measure of seedling response.

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