

Quicksheet #25

a place of mind



Five-year Performance of Ponderosa Pine and Western Larch Planted North of Natural Ranges

Research Project 05-03

Dec. 2009, 2014

Support for this project provided by West Fraser Mills Ltd., 100 Mile Lumber and Williams Lake Divisions through the Forest Investment Account Land Base Investment Program.

Introduction

This study incorporates the methodical movement of western larch (*Larix occidentalis*)¹ and ponderosa pine (*Pinus ponderosa*)² northwards out of their ranges and compares their growth among various biogeoclimatic units in the Cariboo region. This note summarizes growth performance after five growing seasons.

Study Sites and Methods

The study sites are in the Gavin Lake Block of the Alex Fraser Research Forest as well as near 100 Mile House and 70 Mile House. Treatments are: Sub-Boreal Spruce dry warm biogeoclimatic subzone in the Horsefly variant (SBSdw1), the transition zone from the Interior Cedar-Hemlock moist cool biogeoclimatic subzone (Horsefly variant) to the SBSdw1 (ICHmk3-SBSdw1), Interior Douglas-fir dry cool biogeoclimatic subzone, Fraser variant (IDFdk3) and Sub-boreal Pine Spruce moist cool biogeoclimatic subzone (SBPSmk) (Lw only). Sites had been planted within two years of clear cutting. Using a completely randomized design, treatment unit locations and species allocations were randomly assigned and replicated three times (except in the IDFdk3 where there were two Lw plots and four Py plots). Assessment plots with 11.28 m radii (0.04 ha) containing an average of 43 trees each were nested within the 15.1 m radius (0.072 ha) treatment plots. The same seed lots and stock types were used in all treatment plots and were planted in May 2005. Tree height and root collar diameter were measured and tree condition assessed following the second growing season (see Quicksheet #233 for Year 1 and 2 results). Sample trees that were dead, missing, or mechanically damaged (e.g. by cattle) were culled from the data for assessing growth, but were included in the summaries of seedling condition. Statistical interpretations used one-way analyses of variance with 95% confidence intervals ($\alpha = 0.05$). The Fisher least significant difference method was also to control for Type 1 statistical error (MiniTab 15 Statistical Software).

Key Words:

assisted migration

ponderosa pine

western larch

Results

Ponderosa Pine

Pine condition in the SBSdw1 and ICHmk3 transition ranked as good (75% and 61% of the original plantings respectively) while only 35% made this rank in the IDFdk3. Forks or crooks occurred in 35% of the IDFdk3 pine and several more will develop this form as a result of leader damage in Year 5. Growing season frost is suspected to be the cause as the site is gently rolling such that cold air has little opportunity to mix and there is almost no vegetation

1 Lw Seed Lot #60748 Lw 1-0 PSB 313B seedlings, elevation 950 m, source Kalamalka Research Station orchard, Vernon, B.C.

2 Py Seed Lot #45260 Py 1-0 PSB 410A seedlings, elevation 900 m, source SW of Kamloops, B.C.

3 Koot, C. 2007. Performance of ponderosa pine and western larch planted north of natural ranges. Quicksheet #23. UBC/Alex Fraser Research Forest.

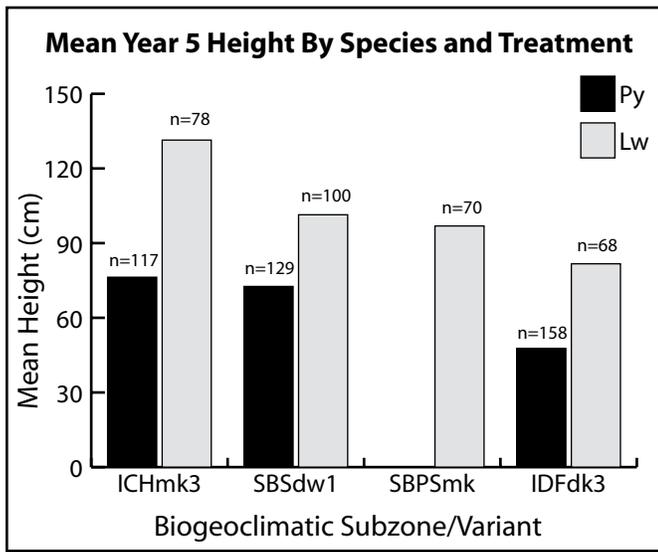


Figure 1: Mean Year 5 heights for ponderosa pine (Py) and western larch (Lw) planted in different biogeoclimatic subzones/variants

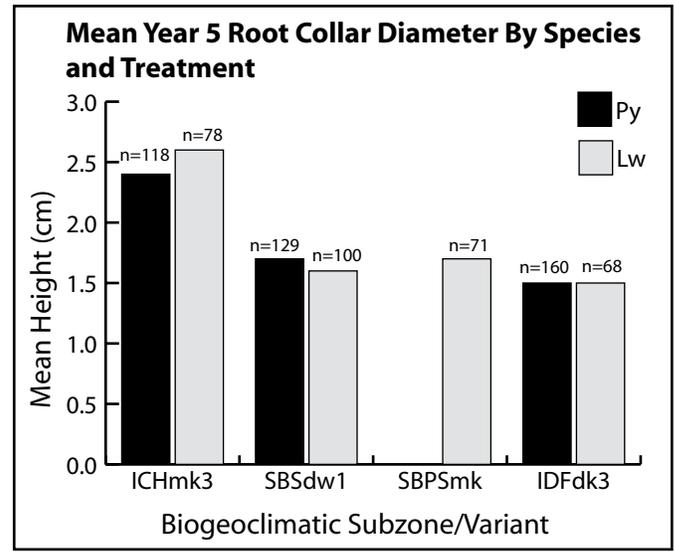


Figure 2: Mean Year 5 root collar diameters for ponderosa pine (Py) and western larch (Lw) planted in different biogeoclimatic subzones/variants

of sufficient size to provide shelter to the saplings⁴. Ponderosa pine and western larch both have moderate frost tolerance⁵. Mortality since time of planting was least in the SBSdw1 and IDFdk3 (8% and 9% , respectively) and greatest in the ICHmk3 transition (18%).

Mean heights of ICHmk3 transition (76.2 cm) and SBSdw1 pine (72.6 cm) were not significantly different, however, both were significantly greater than the mean height in the IDFdk3 pine (47.7 cm) ($p < 0.0001$) (Figure 1). Significant differences ($p < 0.0001$) among mean root collar diameters occurred in all sites: ICHmk3 transition (2.4 cm), SBSdw1 pine (1.6 cm), and IDFdk3 (1.5 cm) (Figure 2).

Western Larch

Tree conditions did not vary widely across biogeoclimatic units for larch. Percentages for combined rankings of "good" and "fair" ranged from 71% in SBSdw1, 67% in both IDFdk3 and SBPSmk to 50% in the ICHmk3 transition. The latter site experienced the highest mortality (43% - up from 34% following Year 2) while the other sites had from 21-25% mortality since time of planting (up from 14-20% after Year 2). Forking and crooks occurred in all treatments ranging from 26% in SBSdw1 to 40% in SBPSmk.

Despite survivorship being lowest in the ICHmk3 transition, the larch that are still growing exhibited significantly greater mean height (131.4 cm) and mean root collar diameter (2.7 cm) than all other treatments ($p < 0.0001$) (Figures 1 and 2). Mean heights of larch in the SBSdw1 and SBPSmk were similar at 101.3 cm and 96.9 cm respectively but significantly larger than that for the IDFdk3 (81.7 cm) ($p < 0.0001$) (Figure 1). Mean root collar diameters were similar for larch in the SBSdw1 (1.6 cm) and SBPSmk (1.7 cm) and IDFdk3 (1.5 cm) (Figure 2).

Conclusions

The greatest volume increment for the populations of western larch and ponderosa pine represented by the two seed lots planted in these particular sites continues to occur in the ICHmk3-SBSdw1 transition zone (Figure 3a). Mortality, however, is highest there especially for larch where almost half the population has been lost in five years. Though twice as great as in

4 Stathers, B. and O. Steen. 1990. Identification and management of summer frost-prone sites in the Cariboo Forest Region. FRDA Report 157.

5 <http://www.for.gov.bc.ca/hfp/silviculture/Compendium/index.htm> (accessed Dec. 10, 2009)

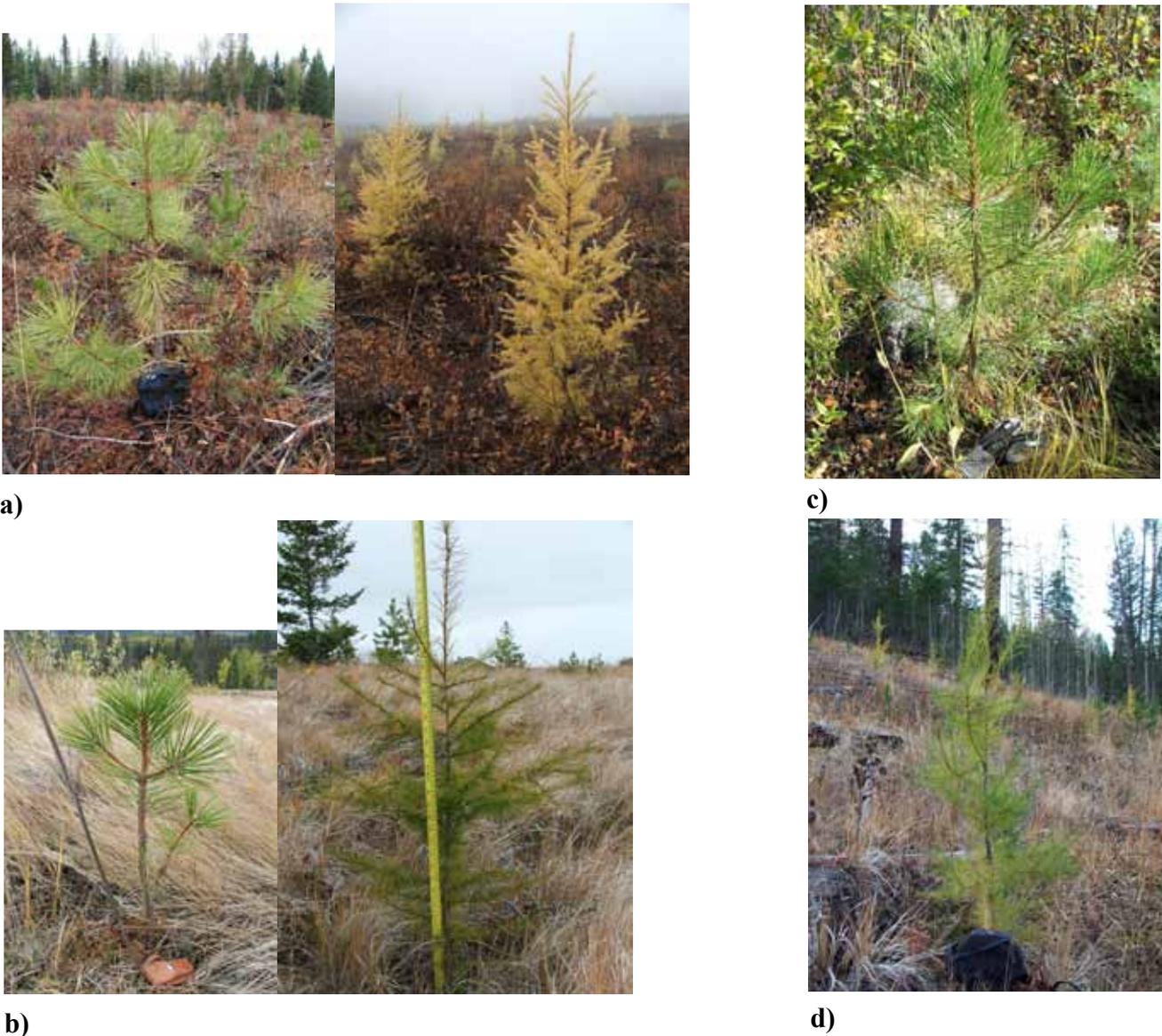


Figure 3: a) Py (camera bag for scale) and Lw in ICHmk3-SBSdw1 transition; b) Py with fork (knife case for scale) and vigorous Lw (measuring tape showing 100 cm height) in IDFdk3; c) Py (glove for scale) in SBSdw1; d) Lw with fork (camera bag for scale) in SBPSmk.

the SBSdw1 and IDFdk3, pine mortality in the ICHmk3 transition is considerably less than that for larch at 18%.

The poorest growth performance for both pine and larch occurred in the IDFdk3. Growing season frost was noted as having set growth back in more than a third of sample larch following Year 2 and is suspected as being the causal factor in the frequent forking and crooks observed in the pine up to and including Year 5 (Figure 3b). The larch there, however, experienced little mortality since Year 2 and those still growing are exhibiting generally good vigour (Figure 3b).

The plots in the SBSdw1 showed the next best growth increment following those in the ICHmk3 transition and had 92% survival among the pine and 75% among the larch with both species exhibiting the highest occurrence of "good" condition ranking scores (Figure 3c). The SBPSmk site for larch proved similar to SBSdw1 for height and root collar diameter but had the highest incidence of forks and crooks for that species (40%) (Figure 3d). Growing season frost is also suspected as being a contributor to form flaws there.

Tree tag replacement is recommended in 2011 and continued monitoring at Year 10 (2014).

Acknowledgements

Regina Kurschat and Cathy Koot collected the data and C. Koot conducted analyses.