University Research Forests Extension Note Series

Quicksheet #23

Performance of Ponderosa Pine and Western Larch Planted North of Natural Ranges

Research Project 05-03

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Key Words:

climate change

ponderosa pine

western larch

Introduction

As human-induced climate change progresses, it is predicted that the climatic conditions of the Cariboo region of British Columbia will become significantly hotter and drier. The pace of change will likely outstrip the ability of vegetation to move by natural distribution so it is thus likely that people will have to plant tree species outside of current ranges to ensure sufficient stocking for future forestry operations. This study incorporates the methodical movement of western larch (*Larix occidentalis* Nutt.) (Lw) and ponderosa pine (*Pinus ponderosa* P. Laws. exC. Laws.) (Py) northwards out of their ranges and to compare their growth among various biogeoclimatic units in the Cariboo region.

Study Sites and Methods

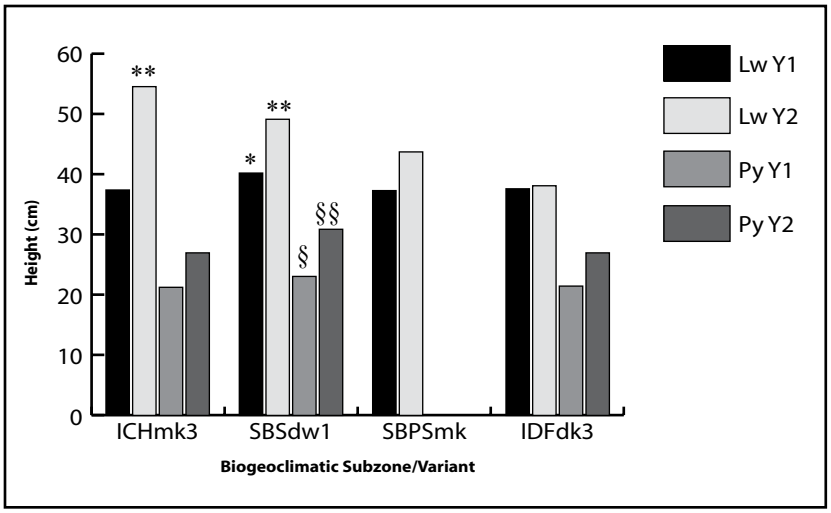
The study sites are in the Gavin Lake Block of the Alex Fraser Research Forest as well as near 100 Mile House and 70 Mile House. Treatments are: Sub-Boreal Spruce dry warm biogeoclimatic subzone in the Horsefly variant (SBSdw1), the transition zone from the Interior Cedar-Hemlock moist cool biogeoclimatic 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), where harvesting had recently occurred. 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 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 at ground-level were measured and tree condition assessed following the second growing season. Year 1 height and condition were interpolated as well. Statistical interpretations used one-way analyses of variance with 95% confidence intervals.

Results

Pine survival and condition in general following both growing season was better than that of larch. Eighty-nine to 98% of the pine ranked as good or fair in Y1, while 74-90% of the larch fell into those categories. Following Y2, percentages dropped to 78-89% for the pine and 45-67% for the larch in these categories. Correspondingly, pine had fewer dead and missing (2-7 % Y1 and 2-14 % Y2), while larch had 10-20 % Y1 and 14-34 % Y2. Mortality occurred most often in the ICHmk3-SBSdw1 transition (20% Lw, 7% Py) in Y1 and in Y2 (34% Lw, 14% Py). Growing season frost damage occurred on the larch in all biogeoclimatic units but especially in the IDFdk3. The larch also received greater animal damage. Snowshoe hares and voles nipped leaders and chewed bark on many, especially in the ICHmk3-SBSdw1 and SBSdw1, and less so in the SBPSmk.

Mean tree heights and diameters after two growing seasons are graphed in Figures 1 and 2.

Larch: After Y1, tree heights in the SBSdw1 were significantly greater than in the other treatments (α=0.05, p=0.025). After Y2, however, those growing in the ICHmk3-SBSdw1 transition were significantly taller than those in the other sites, including the SBSdw1, while those in the SBSdw1 continued to be statistically different than those in the SBPSmk and IDFdk3 sites (α=0.05, p=0.000). At the end of the second growing season, larch in the ICHmk3-SBSdw1 had a significantly greater mean diameter at ground-level than those in the SBSdw1, SBPSmk and IDFdk3 (α=0.05, p<0.000). No statistical differences were detected between the other treatment combinations.



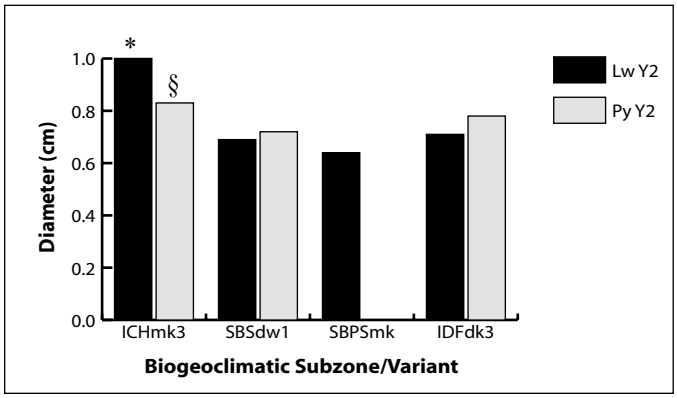
* Lw Y1: SBS significantly different than ICH, SBPS and IDF (α=0.05, p=0.025)

** Lw Y2: ICH significantly different than SBS, SBPS and IDF; plus SBS significantly different than SBPS and IDF (α=0.05, p<0.000)

§ Py Y1: SBS is significantly different than ICH and IDF (α=0.05, p=0.002)

§§ Py Y2: SBS is significantly different than ICH and IDF (α=0.05, p<0.000)

Figure 1: Mean heights (Y1, Y2) for western larch (Lw) and ponderosa pine (Py) planted in different biogeoclimatic subzones/ variants



* Lw Y2: ICH significantly different than SBS, SBPS and IDF (α=0.05, p<0.000)

§ Py Y2: ICH significantly different than SBS (α=0.05, p= 0.024)

Figure 2: Mean Y2 ground-level diameters for western larch (Lw) and ponderosa pine (Py) planted in different biogeoclimatic subzones/variants

Pine: The tallest trees were found in the SBSdw1 site in Y1 and Y2 respectively (α=0.05, p=0.002; α=0.05, p<0.000). These trees, however, had the smallest mean diameter (0.72 cm) as compared to those in the ICHmk3-SBSdw1 treatment where it was significantly greater (0.83 cm). No other statistical differences were detected.

Conclusions

For the populations of western larch and ponderosa pine represented by the two seed lots planted in these particular sites, it appears that the greatest volume increment is occurring in the ICHmk3-SBSdw1 transition zone and SBSdw1. Trees at these sites had the most animal damage though, especially the larch. Both larch and pine growing in the SBSdw1 may be exhibiting significant height growth as a response to light competition with brush. Growing-season frost damage occurred on larch in all treatments, particularly at the IDFdk3 site where more than a third of the sample trees were set back. Larch growing in the SBPSmk maintained the best condition after Y2 (67% good or fair), while pine fared well in the SBSdw1 and IDFdk3 (89% and 86 % good or fair respectively). Pine survival and condition in general following both growing season was better than that of larch. *The full technical report is available at http://www.forestry.ubc.ca/resfor/afrf/Reports_Index.htm*.