Environmental Effects on Relative Wood Density in Lodgepole Pine and Strategies for Improved Growth and Density Breeds

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Interior lodgepole pine (*Pinus contorta* Dougl. ex. Loud. var *latifolia*) is the most heavily planted tree species in British Columbia, Canada. The lodgepole pine breeding program is in its second generation of progeny testing which incorporates two breeds: (A) height growth improvement and (B) height growth and relative density improvement. An 'environmental map' free of genetic effects, was considered important to develop strategic deployment approaches for materials coming from the A or B breeding groups. To achieve this, environmental variation in wood relative density in lodgepole pine was examined by sampling from a 33 year-old provenance test planted at 60 test sites across the range of the species in British Columbia, using a set of six standard provenances.

Transfer curves (regression models with relative density as the dependent variable, and site climate variables as independent variables) were generated for each of the six standard provenances. Each regression equation was used to predict relative density at 370,000 grid points covering British Columbia. The predicted relative density values were converted to principal components and mapped using ArcView. Climate change scenarios were used to generate climate data for 2055, which was also used as input for the model.

Maximum temperatures in the summer months, and summer heat to moisture index accounted for most of the variation in relative density, with R2 ranging from 0.74 to 0.84. These relationships were mapped with Geographic Information Systems, which showed significant patterns of relative density variation across the province, but were geographically related to decreasing density with increasing elevation and increased density in areas of higher precipitation. This environmental map did not present any obvious approaches of how to currently utilize the two breeds with respect to deploying low or higher relative density individuals, however, considering one of many possible future climate change scenarios, relative density may be adversely affected across the entire planting range so that the higher density breed may become more important than previously considered.