RESEARCH in Progress

Coalition for Advanced Wood Structures
a university, industry, government partnership

Characterization of Juvenile Wood in Western Softwood Species

There are approximately 303×10^9 net cubic feet of softwood growing stock in the western United States, excluding Alaska and the Great Plains. Of the 130 million acres of western timberland not reserved from timber harvest and meeting minimum production standards, 29 million acres are high-priority areas for fuel reduction (Fig. 1). Most trees in these areas are in diameter classes below 10-in. dbh (diameter at breast height); however, most of the biomass falls in larger diameter classes. Depending upon species, growth site, tree size, and tree age, the small-diameter trees may contain a high percentage of juvenile wood (also called core wood). Lumber from trees containing high percentages of juvenile wood is weaker and more prone to warp during drying than is lumber containing mostly mature wood. Juvenile wood can be a major impediment to efficient utilization of solid-sawn products cut from small-diameter trees.

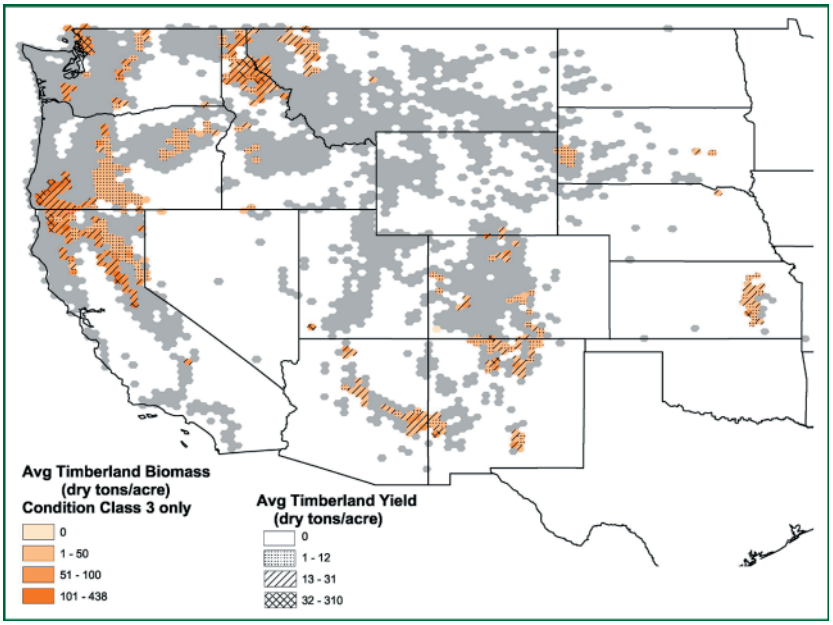

Figure 1. High-priority thinning opportunities (D. May, J. of Forestry, Feb. 2003).

Background

Extensive literature is available on the occurrence of juvenile wood in some western species, especially Douglas-fir. Much of the literature is based on variations in specific gravity with tree age (Fig. 2). Such information is insufficient for making practical assessments of wood quality for solid-sawn lumber products and structural wood-based composites. Modulus of elasticity (MOE) and tendency to warp during drying are the two most important indicators of wood quality for lumber to be used in light-frame construction. Specific gravity is one of the controlling factors for MOE, but it reveals little about how a board will react to drying. Microfibril angle, an indicator of orientation of the internal structure of the wood fiber, is another factor that controls MOE and is also a predictor of tendency to warp. However, microfibril angle is very tedious to measure and is hard to use directly as an indicator of juvenility (Fig.3). Only limited data are available on variation in MOE with tree age for many western softwoods and even less on variation in microfibril angle.

Objectives

The objectives of this study are to

- measure the variation in longitudinal shrinkage and MOE with tree age as alternatives for determination of the age of transition from juvenile wood to mature wood and
- establish relationships between specific gravity and anatomical characteristics with longitudinal shrinkage and MOE.

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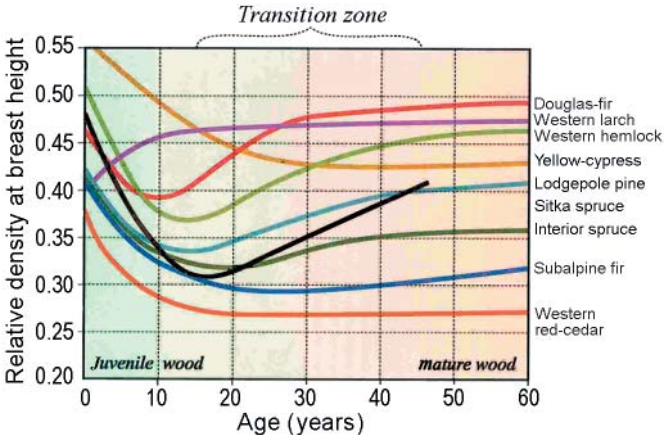

Figure 2. Juvenile wood in western softwood species (Forintek Canada Corp. 1994).

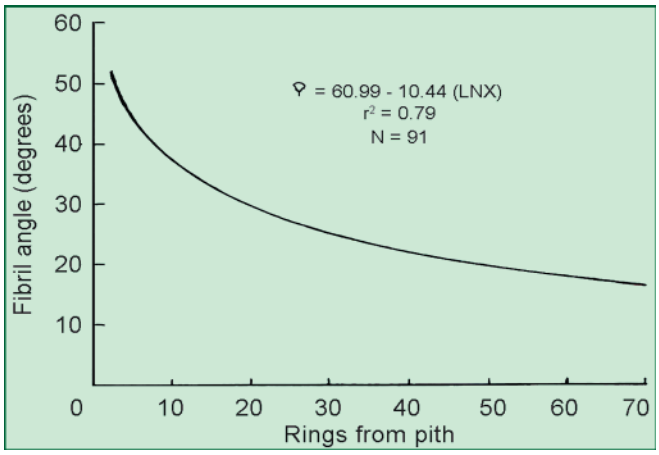

Figure 3. Variation in microfibril angle with tree age for young-growth ponderosa pine (Voorhies and Gorman 1982).

Approach

This study will initially focus on lodgepole pine and western larch, two important species of the Intermountain West. Lodgepole pine has the highest volume of small-diameter timber growing in overstocked stands in this region. Western larch was selected because the characterization of variation in specific gravity with tree age (Fig. 2) seems inconsistent with the general characterization of juvenile wood properties in softwoods. Other species may be added later if initial results prove valuable.

Samples for determination of properties will be obtained from throughout the growth range of these species in the United States. For specimens to be studied for MOE and longitudinal shrinkage, sampling will be limited to eight trees obtained from four locations. Length of growing season and mean annual precipitation will be used to help establish sampling sites. Specific gravity and anatomical characteristics will also be recorded for these specimens. Specimens will be obtained from additional locations for determination of specific gravity in the hopes of identifying variations in length of the juvenile wood period with geographic location.

Expected Outcomes

This research is expected to provide a better understanding of the fundamental factors controlling stiffness and shrinkage of wood from small-diameter trees. This understanding will allow us to better plan more applied studies on properties and utilization options for trees harvested from western forests to improve forest health and reduce fire hazards.

Timeline

Experimental work is scheduled to begin summer 2005. All the studies should be completed in approximately 3 years.

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