Characterization of Juvenile Wood in Lodgepole Pine in the Intermountain West

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Potential high-priority fuel reduction thinning needs on timberland in the western United States
• Most trees in high priority treatment areas are in diameter classes below 25 cm (10 inches) dbh.

• Thinning at risk stands is often imperative to reduce fire risk, even for stands that are eventually to be subjected to controlled burns.

• The costs of fuel reduction treatments often exceeds the value of the material removed, finding higher value uses for the thinnings is a major focus of Forest Service Research.
Some advantages of using logs in the round form instead of sawing them into lumber include:

• Less susceptible to warp during drying
• Lower processing cost
• Load-carrying capacity two to four times that of largest rectangular member that can be sawn from a log
• Potential for higher economic value
Park pavilion, Townsend, Montana

Rattlesnake Creek bridge, Missoula, Montana

Six-inch-diameter lodgepole pine used in 5,000 ft² library in Darby, Montana.
Our research is intended to improve the utilization of small diameter roundwood for use as structural members by:

• evaluating the physical and mechanical properties of small diameter logs

• determining the effect of doweling on strength

• developing grading systems to establish allowable design values

• improving structural connections
Effect of doweling on strength properties of structural roundwood

- Modulus of Elasticity, GPa
  - Ponderosa Pine
    - Dowelled
    - Tapered
  - Douglas-fir
    - Dowelled
    - Tapered

- Modulus of Rupture, GPa
  - Ponderosa Pine
    - Uniform
    - Tapered
  - Douglas-fir
    - Uniform
    - Tapered
Juvenile wood in western species (Jozsa and Middleton 1994)
The objective of this study was to measure longitudinal shrinkage and microfibril angle to estimate the juvenile wood-mature wood transition in lodgepole pine across a wide range of geographic locations in the western U.S.
Four sites selected for sampling

1) dry site, intermediate growing season,
2) wet site, short growing season,
3) mid-range precipitation, intermediate growing season, and
4) mid-range precipitation, long growing season.
Methodology
Longitudinal shrinkage results

- **Dry site, intermediate growing season**
  - Helena
  - Mid-range precipitation, intermediate growing season

- **Wet site, short growing season**
  - Panhandle
  - Mid-range precipitation, long growing season

- **Mid-range precipitation, intermediate growing season**
  - Payette
  - Kootenai

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Microfibril angle results

Helena
- dry site, intermediate growing season

Panhandle
- wet site, short growing season

Payette
- mid-range precipitation, intermediate growing season

Kootenai
- mid-range precipitation, long growing season
Relationship between longitudinal shrinkage and microfibril angle for all measurements
Segmented regression to determine to predict juvenile transition period
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<th>National Forest</th>
<th>Longitudinal shrinkage</th>
<th>Microfibril angle</th>
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Conclusions

• A good correlation was found between longitudinal shrinkage and microfibril angle. Either method could be used to determine the juvenile wood transition in lodgepole pine.

• Significant differences in the juvenile wood transition period were found between the four sites.

• These results are useful for establishing parameters meaningful to the characterization of juvenile wood in the western conifers when utilized as solid-sawn products and structural composites.
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