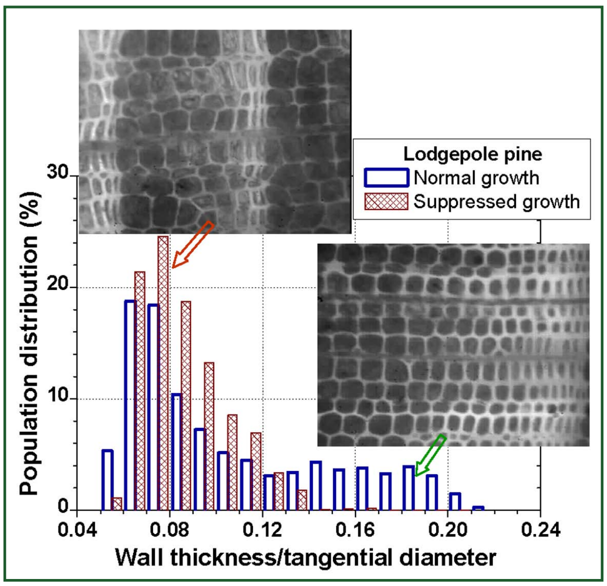
Research in Progress

Forest Products Laboratory

Forest Thinnings for Integrated Commercial Production of Lumber and Paper

Tree overcrowding on U.S. National Forests is a major contributor to the incidence and extent of catastrophic wildfires. Although controlled burning is not an option for many forest lands near communities, selective forest thinning can reduce fuel loading and the risks associated with catastrophic wildfires. High-value and large-volume uses for forest thinnings, such as the production of lumber, poles, and posts, can offset the expense of thinning and benefit local communities. However, many thinned trees are in small-diameter classes (6 inches or less), which produce low lumber yields. Using these materials for biofuel is another option, but potential economic returns are low. An alternative use of thinned trees that can provide higher value and use large volumes is paper production. Ironically, quality wood chips for papermaking are in short supply in the western United States. Therefore, a significant volume of small-diameter thinning materials could be diverted to paper mills, with the saw-log material going to lumber mills. This is a new supply paradigm for forest products in the Intermountain West, where industry economics were historically driven by larger diameter saw logs, with tree tops and saw mill residuals going to the paper industry. Success with this new approach would provide an opportunity to integrate production of lumber and paper in the West, minimize taxpayer expense for fuels reduction projects, satisfy management needs of the Forest Service, and provide raw material for the forest products industry.



Effect of tree growth conditions on wood tracheid geometry. Normal growth produced a bimodal distribution with clear distinction between earlywood (thin wall) and latewood (thick wall), while suppressed growth produced a uniform (narrow) distribution with little distinction between earlywood and latewood. Photographs were taken from wood core samples.

Background

Forest thinning materials from managed plantations are characterized by high juvenile wood content. Low strength of fibers from juvenile wood is a concern for paper production. Thinning materials from unmanaged timber stands on U.S. National Forests include many older trees that have small diameters as a result of decades of suppressed growth. Although juvenile wood content of these older trees is low, the perception that forest thinning materials are inferior for pulp production has persisted in the industry. This reduces the value of the materials and negatively impacts the economics of fuels treatment. Our laboratory studies show that small-diameter, suppressed-growth trees show less distinction between earlywood and latewood in terms of wood density and tracheid wall structure (see figure) and have a higher fraction of mature wood. These factors should produce superior thermomechanical (TMP) pulp properties.

Objectives

The objectives of this research are (1) to dispel the notion that material from thinning is inferior to conventional wood chips through laboratory experiments, commercial demonstration, and educational outreach and (2) to encourage collaboration between industry and the Forest Service to solve a problem of significant national interest.

Approach

Laboratory studies focused on understanding anatomical properties of suppressed-growth trees and their potential effect on thermomechanical pulping, and the mill trial study is to demonstrate the quality of forest thinning materials in commercial pulp and lumber production. A small fuel hazard reduction site was selected and inventoried for species distribution, stem densities, and available log sizes. Trees were harvested by the saw mill according to a Forest Service prescription. Logs were segregated into saw and non-saw small-diameter logs (less than 4.1 inches) and non-saw defect logs. Then saw logs were processed through the saw mill's automated system, which is designed to maximize recovery of lumber while converting all trim into "residual" chips. The non-saw logs were debarked and chipped. All chips were shipped to the pulp mill. Chips from the fuel hazard reduction site were blended with the mill's normal chips for the commercial trials. Chips were sampled and analyzed offline. Mill production performance was evaluated using data from the mill's automated data recording system. No noticeable change in pulp quality was observed in trials using data from mill online measurements. Less refining energy was required in the whole log chip trial runs. Newsprint produced from the pulps met market specifications. Lumber produced also met mill specification. Visual inspection was conducted at the lumber mill trials. Detailed analysis is ongoing.

Expected Outcomes

Research has demonstrated that materials from hazardous fuel reduction are satisfactory for the small-diameter lumber mill and good quality material for thermomechanical pulp production. Integrating lumber and pulp production around small-diameter logs can maximize the commercial value and reduce the cost of forest thinning. Furthermore, it can provide an immediate and practical solution to the fuel loading problem on National Forests.

Timeline

Preliminary laboratory results demonstrated the suitability of small-diameter logs for pulp production. A 70-acre site on the Colville National Forest near Usk, Washington, was selected. Short mill trails were conducted in February and March 2006. Two separate trials were conducted at the TMP mill, and we are currently working on detailed analysis of data from these trials. With success in the short-run trials, we are working to secure a large site to conduct a long-period trial by spring 2007.

Cooperators

USDA Forest Service, Forest Products Laboratory

USDA Forest Service, Pacific Northwest Research Station

USDA Forest Service, Colville National Forest

University of Idaho

Ponderay Valley Fiber, Inc.

Ponderay Newsprint Company

Contact Information

Junyong Zhu, PhD
USDA Forest Service
Forest Products Laboratory
Madison, Wisconsin
(608) 231–9520, jzhu@fs.fed.us