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CWFC Facts 003

Canadian Wood Fibre Centre Fibre Facts

Improving Fibre Quality Through Silviculture

As the Canadian forest products industry shifts toward intensive forest management and value-added manufacturing, resource managers and policy makers are taking an increasing interest in the influence of silvicultural practices on wood fibre quality and attributes. The Canadian Wood Fibre Centre of Natural Resources Canada and FPInnovations – Forintek Division are currently studying the effects of mechanized commercial thinning operations on wood and lumber properties in a natural jack pine stands.

Jack pine (*Pinus banksiana* Lamb.) is one of the widest-ranging tree species across Canada and thus has great economic and ecological importance. Accurate estimates of solid wood properties from intensively managed stands of jack pine are essential to enable Canadian wood products to compete successfully in the global marketplace.

Edwin Swift of the Canadian Wood Fibre Centre of Natural Resources Canada and Isabelle Duchesne of FPInnovations – Forintek Division are studying the effects of mechanized commercial thinning operations on wood and lumber properties in natural jack pine stands. The selected stand was established after a fire in the 1930s in Tracadie, New Brunswick. In 1976, an operational commercial thinning was done, removing 50% of basal area (tree spacing 2.7 m x 2.7 m) and leaving trail spacing of approximately 20 m. The prescription was similar to today's mechanized commercial thinning operations. The same stands were measured and assessed in 2007, 31 years after treatment.

In order to determine the effects on wood fibre attributes, five stems per diameter-at-breast-height (dbh) class were sampled in the control and thinned areas (12 dbh classes in total). The stems were processed into 3-m logs, which were sawn at a local mill in Belledune. The lumber produced was then transported to FPInnovations – Forintek in Quebec City for analysis. The lumber was kiln dried to a moisture content of 15% and tested in static bending for stiffness and strength.

Keeping in mind concerns that commercial thinning degrades wood quality by enlarging the juvenile wood core, increasing branch diameter, and decreasing stem straightness, the objective of this study was to examine: the initial effect on stand structure; the long-term potential effects on growth response and stand dynamics; the effect on wood-quality traits; the resulting lumber conversion; and the impact on lumber mechanical properties from a commercially thinned, mid-aged, mature jack pine stand.

Stand structure—The resulting diameter distribution for the number of stems and volume per stem produces a favorable stand structure in the thinned area with greater potential harvest and product value.

Growth response and stand dynamics—Trees in the thinned area had 2.5 times greater volume than those in the control. Thinning recovered some additional volume that would have been lost to mortality, as the total volume on the site 70 years after stand establishment was similar in both the control and the thinned blocks.

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Wood-quality traits—There was no significant difference in wood density between the control and the thinned stand.

Lumber conversion—Results show that commercial thinning had a positive effect on lumber volume recovery, with an increased proportion of large, 38 x 140 mm (2 X 6 in.) lumber, in turn providing better sawmill productivity and “baskets of products” (current and future diversity of potential forest products) due to flexibility allowed by larger log sizes. The logs in the thinned stand produced 3% more select structural grades.

Mechanical properties — Lumber bending stiffness (Modulus of Elasticity; MOE) and lumber bending strength (Modulus of Rupture; MOR) are positively correlated with wood density and negatively correlated with ring width and knot size. Faster growth rates have a negative impact on lumber MOE and MOR. Therefore, the bending properties and wood density of the lumber produced from the largest tree-diameter classes (32 and 34 cm dbh) grown in the thinned area were lower than that of the smaller dbh class trees studied, (whether coming from the control or the thinned area). Also, there was more lumber downgrade because of large knots (branches) on stems in the thinned area, whereas the control area had more lumber downgrade because of wane (small logs).

Based on this study, in which the dominant fast-growing trees had the lowest MOE and MOR properties, thinning operations should include removal of trees in the larger dbh classes, along with the more traditional removal of smaller diameter, suppressed trees and damaged trees. This prescription



has the added benefit of making commercial thinning more economically feasible. The resulting stand, comprising fewer dominant trees and more codominant trees, will be best able to respond to the thinning treatment, and at the same time, maintain the desired fibre attributes.

As forest management and production practices shift from simple volume production to a value-added, wood-manufacturing economy, the long-term effects of intensified silvicultural management on tree growth and concurrent changes in wood properties of conifers in Canada are increasingly important and will remain a priority for the Canadian Wood Fibre Centre.

References

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