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Canadian Forest Service

CANADIAN WOOD FIBRE CENTRE

Fibre Facts nº 24

New CT scan imaging increases lumber value recovery and sawmill efficiency

Photo by I. Duchesne

Canada's forest industry continues to adapt in the face of a changing world. From challenges related to climate change such as increasing fires, drought, and insect outbreaks, to a greater importance being placed on protecting forested lands for other values like habitat and cultural importance, forest professionals must manage many factors to remain competitive in the global market. There is a continuous need to develop new approaches to sustainably extract the maximum value from every tree harvested on the landscape.

Canada

The results of a pioneer study in New Brunswick indicate that X-ray computed tomography (CT) scanning of internal log characteristics, combined with sawing optimization (Figure 1), increases lumber value of processed trees and improves sawmilling efficiency.

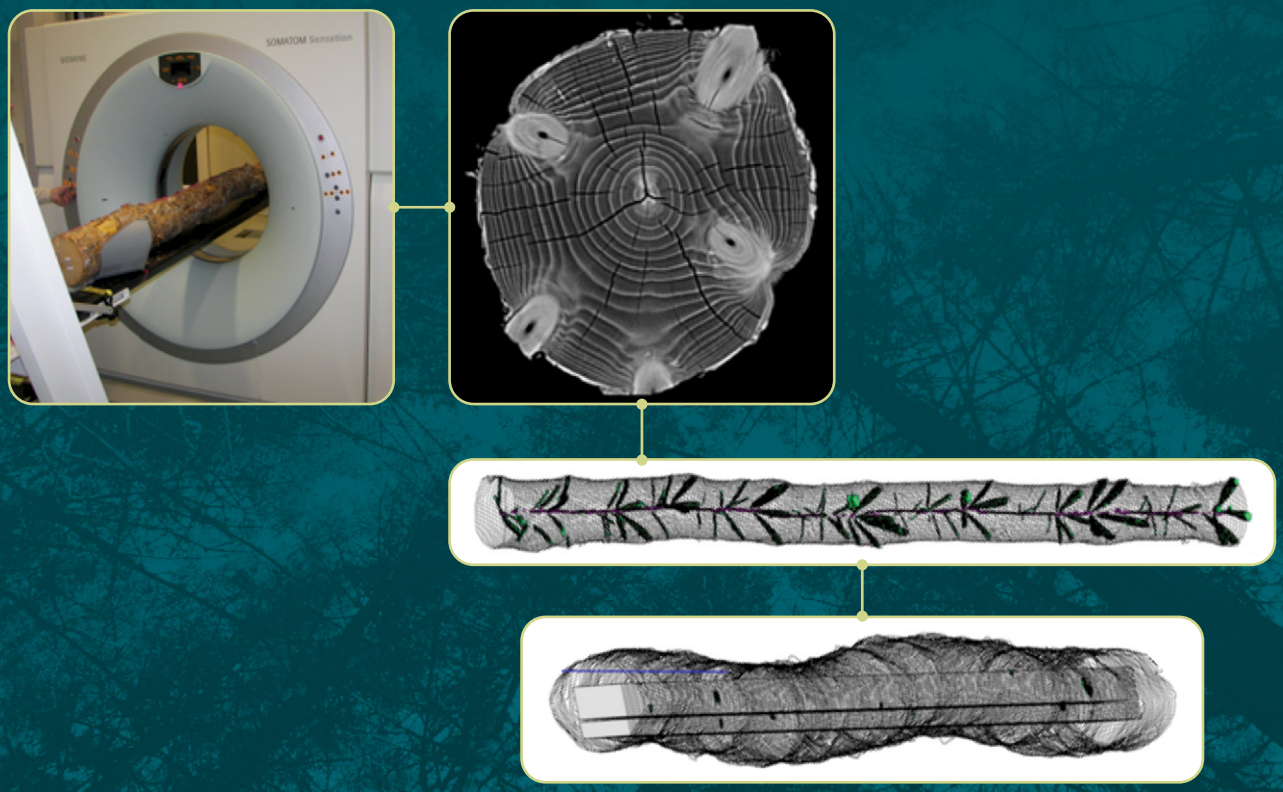

Figure 1: Diagram outlining data collection process. Logs were X-ray CT scanned and knots were extracted from the CT images using the CT2Opti software. The Optitek sawing simulation software simulated the optimal log sawing pattern that maximized lumber value considering the distribution of internal knots. (Photo credit: Denis Belley)

Canadian softwood sawmills are currently equipped with laser scanner technologies that can provide a precise external three dimensional log shape. Unfortunately, the majority of Canadian sawmills lack equipment to gain information on the internal characteristics of logs, which could also provide information on product quality. As a result, sawmills are limited to maximizing volume production during log primary breakdown rather than the highest possible quality.

In this study, researchers investigated whether additional knowledge of knot size and position before log processing could affect lumber volume, value, and grade recoveries of softwoods. Specifically, researchers tested whether log rotation, combined with knowledge of internal knottiness through X-ray CT Scan imaging, increased the gross value of lumber and volume yields for two commercially important softwood species.

A total of 31 white spruce and 22 jack pine trees were harvested from a spacing experiment established in 1977 near Woodstock, New Brunswick (Figure 2). Three different sawing optimization strategies (traditional or baseline (sweep up), shape optimized, and knot optimized) were tested. The latter two applied different rotational angles to maximize lumber volume and value, and the production of good-quality grades of lumber (No. 2 and better). The curve-sawing simulation, economic estimation, and lumber grading were done using the Optitek sawing simulation software (FPInnovations). In Optitek, optimization processes are based on a price list of lumber products of various sizes and lengths that were determined by the researchers. The National Lumber Grades Authority (NLGA) rules were used to grade lumber in the study.

Figure 2: Selecting trees for measuring and sawing in the spacing trial. (Photo credit: Denis Belley)

Results

The baseline scenario that positioned the log's maximum sweep in the vertical axis before sawing (without considering internal knots) provided the least benefit in terms of lumber value and volume recovery, and the number of high quality pieces.

Relative to the baseline scenario, knot-optimized strategy provided increased:

- lumber value by 23% in jack pine and 15% in white spruce (Figure 3),
- lumber volume by 19% in jack pine and 13% in white spruce (Figure 4), and
- number of high-quality lumber pieces (No. 2 and better) by 38% for jack pine and 15% for white spruce (Figure 5).

Using sawmill production capacity of 300,000 m^3 per year, when differences in revenues were simulated among the three sawing strategies, knot optimized provided an additional income of 3.7% for jack pine and 1.5% for white spruce compared to baseline.

Management Implications

Using CT scanning technology to determine internal knot distribution offers good opportunities to implement new sawing optimization strategies and maximize forest resource utilization (i.e., increase lumber volume, lumber quality, and lumber value). The sawing optimization strategies proposed within this work, as well as the substantial gains obtained when simultaneously considering external and internal log attributes before sawing, provide baseline information for further development and potential investments. By increasing the maximum extraction value from every tree, the forest sector will be able to remain competitive in the global market in the face of reduced national fibre supply.

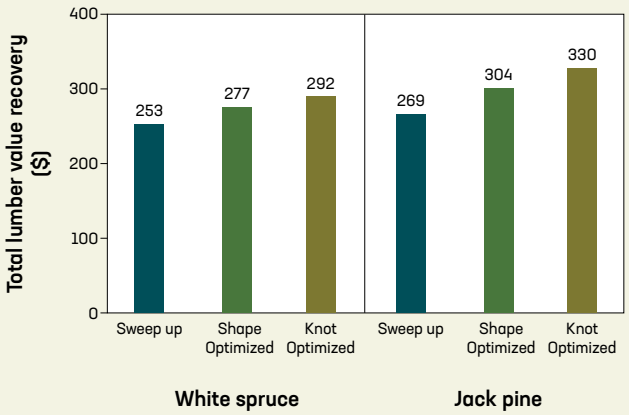

Figure 3: Total lumber value recovery (in CDN $) based on sawing strategy for white spruce and jack pine. Amounts are total value of all trees per species for each strategy.

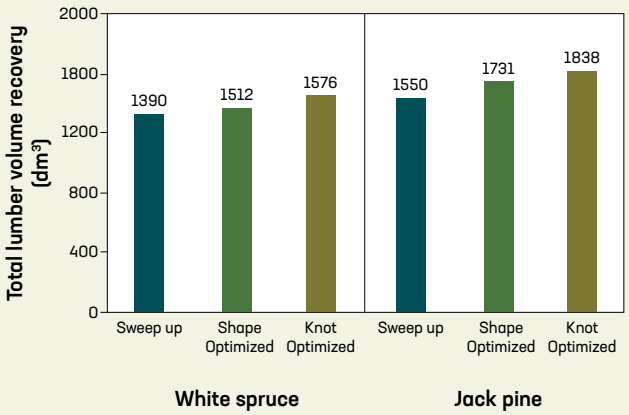

Figure 4: Total lumber volume recovery based on sawing strategy. Amounts are total volume (in cubic decimetres) of all trees per species for each strategy.

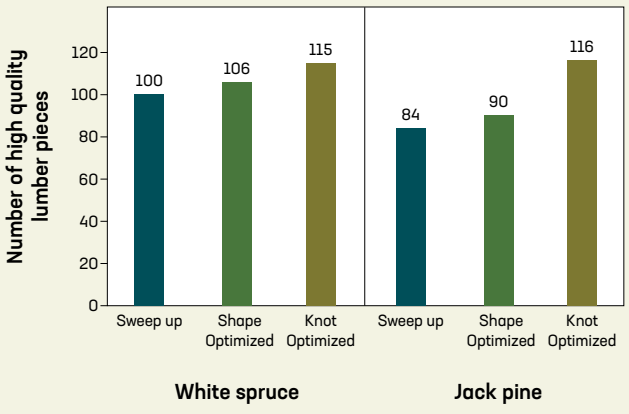

Figure 5: Total number of high quality lumber pieces (No. 2 and better) based on sawing strategy for white spruce and jack pine. Amounts are totals from all trees per species for each strategy.

Photo by Isabelle Duchesne

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FPInnovations

For more information (reference):

Belley D., Duchesne, I., Vallerand, S., Barrette, J., and Beaudoin, M. 2019. Computed tomography (CT) scanning of internal log attributes prior to sawing increases lumber value in white spruce (*Picea glauca*) and jack pine (*Pinus banksiana*). Canadian Journal of Forest Research (49:1516-1524).

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