

Project Statement

BC Coastal Forest Sector Development Initiative

Program	Resource Characteristics
Project Title	Characterization of Hem-Fir Wood Attributes in Terms of End-Product Potential
Project Number	R.01
Project Leader	Gerry Middleton
Project Team	FPIinnovations: Dave Munro, Tony Sauder, Paul Bicho BCMoFR Research Branch: Jim Goudie, Mario Di Lucca
Start Date	April 1, 2008
Completion Date	March 2011

Rationale:

Western hemlock and amabilis fir (hem-fir) constitute the greatest proportion of the forest inventory in coastal BC, but are the least valued commercial species in the region in terms of product markets. An improved understanding of hem-fir wood quality attributes related to geography, site index and age class will help industry identify the highest-value utilization opportunities, and provide technical data needed to support marketing efforts and new investment in processing technology and product development, and provide decision support with respect to economic rotation age and stand management practices.

Key Objectives:

Characterize second-growth hem-fir stands and trees in terms of wood product attributes to identify market value and to provide technical data for market support, product development and stand management decisions.

- Determine stem characteristics and basic wood properties of 50 – 60 year old hem-fir and 90-year-old amabilis fir.
- Conduct tree and log quality and wood attributes studies to determine product potential.
- Measure stem attributes of 20, 40, 60 and 90 year-old amabilis fir to provide data needed to calibrate the stand management decision support model TASS for amabilis fir.

Project Methodology:

1. Old Growth

A review of existing information revealed that current log grade rules for old-growth hem-fir are robust and sufficient information is available on lumber grade yields by log grade to render comprehensive conversion studies unnecessary. This information has been passed to the conversion team.

Some information is available on regional variation in log grade distributions (timber quality), but extensive sampling and a large quantity of data would be needed for reliable inferences. This information should be available through a regional breakdown of log grade distributions routinely reported in

summary form by the BC Ministry of Forests and Range Revenue Branch. Using this information to code regions by resource value and product potential is proposed under Project R.06 and will not be duplicated here.

2. Second-growth

A review was made of existing second-growth hem-bal wood quality and product attribute information. Data from a previous 90-year-old-hemlock study were assessed for average quality attributes to 60 years of age. Second-growth stands were surveyed for suitable sampling locations. Advice and contributions were sought from MoFR and industry foresters with respect to choice of age, site, location and sampling. A proven Task Force holistic approach will be followed for the characterization of second-growth hem-fir. Product potential will be determined by species, tree age class, site index and stand spacing. The following tasks will be completed over three years:

- a. **Stand and Tree Growth Simulation**
Sampling will include the obtaining stem and branch data required for further development of tree and stand growth models for western hemlock, and for incorporating amabilis fir into these models (TASS).
- b. **Internal Scanning (CT Imaging) and Sawing Simulation**
Tree stems (long logs) will be brought to FPInnovations, Forintek Division and then cut to 5m lengths for CT imaging. The complete stem images will provide a stem bank for testing log-grading assumptions with respect to knots and other external quality indicators. Sawmill simulation software (Optitek) capable of considering internal defects will be used to compare yields and values generated by cutting products for alternative markets and product specifications..
- c. **Basic Wood Properties**
Following CT imaging, the 5m logs will be cut into stem segments to determine basic wood properties by stem location (density, compression wood, spiral grain, heartwood/sapwood proportions, MOE and MOR of small clears) to provide baseline technical data to assess product potential and to provide marketing support.
- d. **Pulping Properties and Composites**
Stem segments will be selected to use as material to test veneer yields and Laminated Veneer Lumber (LVL) potential, and. properties and yields of kraft and TMP pulps.
- e. **Treatability**
Sub samples of lumber will be selected by juvenile wood content and tested for treatability. The preservative formulations tested will include copper-amine-based preservatives currently in use (one solution and one solution/emulsion) as well as emerging and developmental formulations such as a carbon-based micro-emulsion formulation and a micronized copper formulation. This represents a range of formulations with different penetration characteristics.
- f. **Machining Properties**
Additional lumber samples will be selected by stand and juvenile wood proportion, and tested for machining (planing, sanding, shaping, boring and mortising) and fastener (nail and screw) withdrawal properties.

Project Milestones:

Activities	Planned 1/3 Completion Date
Tree selection, crown and branch measurements (TASS requirements) and destructive sampling (4 locations x 5 trees, 13 cookies per tree).	June 30, 2008
Tree selection, quality cruise, increment cores (2 locations, 48 trees). Tree felling, limbing and bucking (Hand faller). Skidding sample trees to roadside. Trucking samples to Forintek. CT imaging 12 trees X 2 species X 2 locations = 48 trees. Assuming about 4 logs per tree = 200 5 m logs. Measuring and bucking long logs. Image analysis.	June 30 to September 30, 2008 March 31, 2009
Measurements of tree stem basic wood properties: spiral grain, compression wood, stain, pith-to-bark wood density (x-ray densitometry), tests of strength properties of small clears and data analysis. Pulping properties 60-year-old hem-fir.	March 31, 2009
Suitability for veneer based composites products.	March 31, 2009
Preliminary tests of alternative new and emerging formulations for wood preservation.	June 30, 2008

Key Deliverables:

- Technical wood attributes for 60-year old hem-fir trees.
- Solid wood, composite, and pulp product value and performance attributes for 60-year old hem-fir.
- Stem images for testing internal defect sawing simulation program *Optitek*.
- Tree stem growth and wood attributes for amabilis by 20 year age cohorts and rotation age product value data for stand management decision support model TASS.
- Assessment of new options for treatability.

Expected Long-term Outcomes:

- A sustainable coastal forest industry based on greater utilization of hem-fir and an orderly shift from reliance on old-growth hem-fir to second-growth.
- Decision support to guide present day stand management expenditures for an economically sustainable coastal forest industry.

Potential Impact:

This project will determine the marginal economic harvesting age for second-growth hem-fir in terms of product values, identify wood attributes that can lead to innovative products, and quantify the impacts of alternative stand management options for hem-bal.

Collaboration:

Industry, BC MoFR. Research and Forest Practices Branches, the Canadian Wood Fibre Centre and UBC personnel with expertise in past Task Force projects have agreed to serve as scientific advisors on the second-growth study. MoFR research branch staff will assist with defining sampling requirements to ensure data meets their specific needs. An industry consultant will assist with identifying suitable sampling locations and assist field work. Contractors will be used for industrial operations including tree felling, limbing, bucking, skidding and trucking.