



Making Better Business Decisions Using Enhanced Forest Inventories

ONE FORESTRY CHALLENGE HAS LONG been accepted as unsolvable: placing an accurate, detailed and defensible forest inventory on our foresters' desktops in a cost effective manner. The Canadian Wood Fibre Centre (CWFC) Enhanced Forest Inventory program is demonstrating we are at the cusp of tackling this challenge.

This national research and development program is undertaking pilot studies at the management unit scale. We will demonstrate that we can deliver statistically accurate information on traditional inventory parameters such as species, canopy height and stocking. We will do this while also providing spatially explicit estimates of tactical and operational parameters such as diameter, basal area, biomass and volumes.

Site, stand and tree attributes are known to drive wood growth characteristics. We are researching correlating detailed information from all three to supplement the inventory with operational insight into wood fibre characteristics such as wood density, microfibril angle (MFA), and fibre length. For example, in Alberta lodgepole pine stands we are using a statistical approach to determine MFA from LiDAR (Light Detection and Ranging System) data. MFA relates to wood stiffness and drying characteristics which are important lumber traits. Knowing wood fibre characteristics prior to the wood being harvested opens new avenues for integrated planning between the mill and the woodlands that feed a mill.

The CWFC Enhanced Forest Inventory program uses LiDAR data. LiDAR systems use an aircraft mounted laser to provide an accurate 3D model of forest canopies, sub-canopy vegetation and terrain. At a large management unit scale, data acquisition for LiDAR at 1 hit/m² is expected to cost less than \$1.00/ha.

The advantage of LiDAR technology is its ability to provide a complete enumeration rather than scaling up a traditional sampling of a small portion of the forest. As a result, measures

of precision can be calculated for any portion of the forested landbase at will. Within stand variability and distribution of estimates are provided with statistical certainty as compared to traditional inventories that provide only a single average to represent the stand condition.

Processed LiDAR data looks like a three dimensional cloud of points and statistical modeling can be combined with species information derived from other sources. This combining with sources such as Individual Tree Crown Classification (ITC) analysis or softcopy photo interpretation of multi-spectral optical imagery, results in a suite of enhanced inventory metrics including stand vertical structure, DBH distribution, basal area and density. These enhanced metrics complement existing inventory attributes.

LiDAR also provides extremely accurate terrain mapping for optimizing road location, cut block layout and wet area mapping. The Wet Areas Mapping Initiative in Alberta has imported a tool developed at the University of New Brunswick and is in use by JD Irving. The LiDAR data recently acquired by the AB government has made it possible to begin mapping ephemeral streams and wet areas that otherwise would go unnoticed under the normal vegetation cover. This means fewer surprises when planning roads and cutblocks.

By combining the above outputs with spatial planning tools like Patchworks© (wood supply modeling) or FPInterface (optimization), resource managers can make better informed tactical and strategic decisions on their management units. The enhanced inventory can aid planning decisions (resulting in cost savings and increased value) to deliver the right wood, at the right time, to the right mill.

There are also other benefits to having more accurate information. Allocation blocks and harvest schedules can be engineered to meet mill requirements. An efficient road layout can be planned. Planning for mill expansion or equipment changes can be

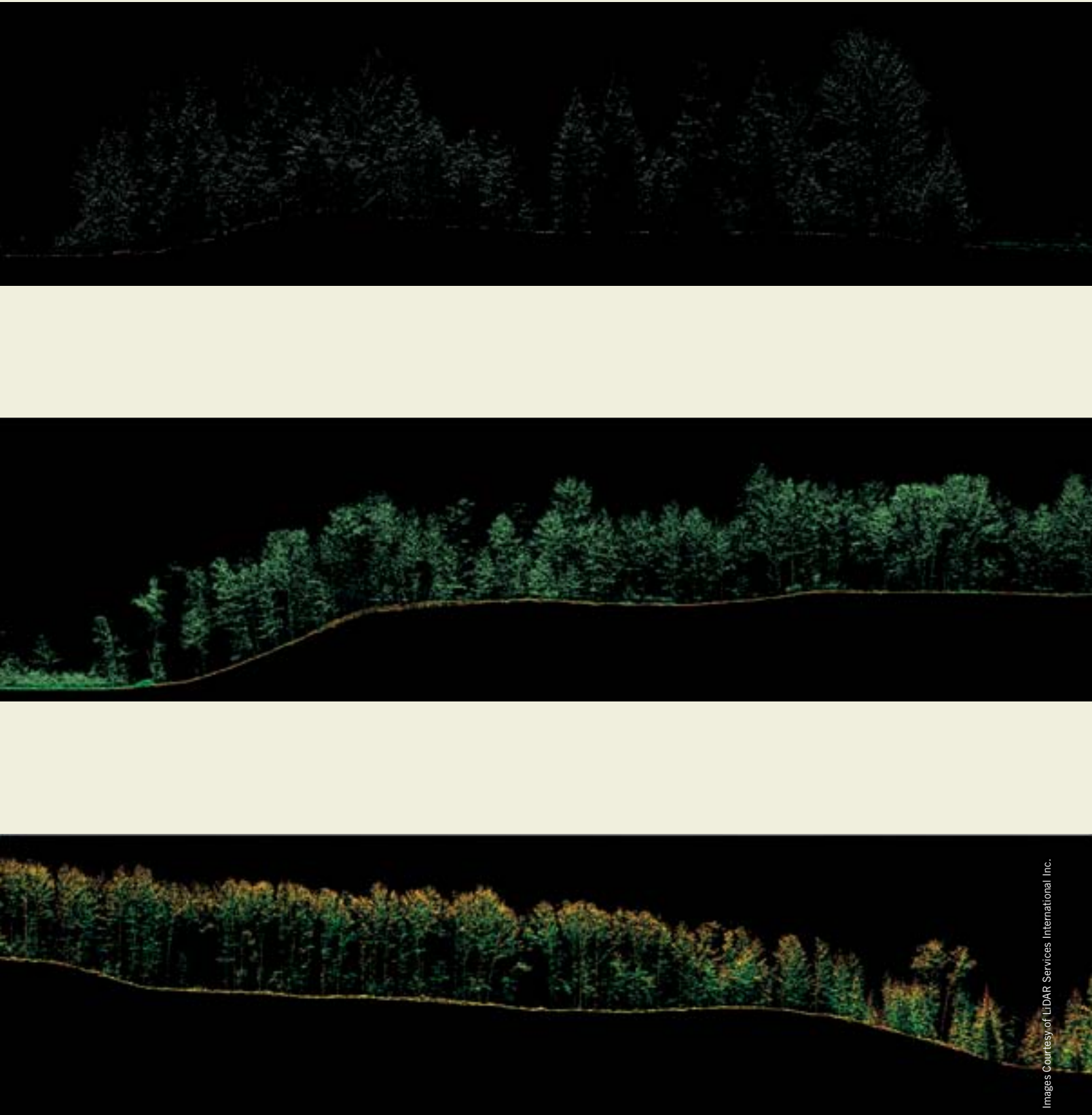
made with confidence about future wood supply characteristics. Predicting wood fibre properties and relating these to the mill's processing parameters and end-product properties will lead to better business decisions.

The future should bring reduced costs and more efficient data handling as more forest companies and contractors gain experience with the data. Regular re-flights are envisioned to track changes and calculate growth. The Canadian Wood Fibre Centre Enhanced Forest Inventory program is national in scope and is dependent upon partnerships with industry to fully deliver the right product and accelerate its development. We have tested at the management unit scale in northern Ontario and expect those lessons to be applied as we work in other areas of the country. In BC we expect to make advances in lodgepole pine country but a coastal based company has been acquiring LiDAR for their holdings so perhaps both areas will advance quickly. With sufficient resources and partners it might only be a few years before LiDAR and Enhanced Forest Inventory is a desktop tool for every forester. 🌲

To find out more about these important developments check our website (<http://cfs.nrcan.gc.ca/subsite/cwfc/programoverview>) or contact:

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Images Courtesy of LiDAR Services International Inc.

Three vegetation profiles from LiDAR.