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THE EDGE

Putting Wood First in B.C.

In 2009, a process of intense consultation with the forest sector on the future direction of B.C. forestry culminated in a number of policy decisions that continue to resonate today. Collectively, these decisions were to put "wood first" in B.C. as a means of driving innovation, building demand, and supporting a stronger, more vibrant and sustainable forest industry.

The rationale for this direction was straightforward—all British Columbians benefit from a strong forestry sector. After all, forestry touches more communities than any other primary industry in B.C., employs almost 60,000 people and provides the largest share of jobs in the manufacturing sector, and directly supports more than 6,400 local businesses.

In terms of total sales, the forest sector generates well over $11 billion annually, making it one of the largest contributors to the B.C. economy.

Since the Wood First program was introduced by the B.C. government five years ago, the use of wood in building construction has grown rapidly, particularly in the multi-family residential market and in institutional and recreational buildings.

The venues constructed for the 2010 Olympic Winter and Paralympic Games showcased the potential for wood in the non-residential sector in dramatic fashion, with facilities such as the Olympic speedskating oval and the Vancouver Convention Centre serving as central legacies of the Games.

And more than 150 mid-rise construction projects are now either completed or under development across the province, up from zero five years ago. These five and six storey wood-frame projects are directly attributable to changes to the provincial building code in 2009 that allowed for taller wood-frame buildings. B.C. was the first province in Canada to make this change. Quebec has since implemented changes to allow for taller wood-frame buildings. Revisions are underway in Ontario, and the national code is expected to follow suit in 2015.

Local governments and public agencies across the province are leading by example in using more wood in new building and capital projects. Reflecting the province's desire to advance a culture of wood use and innovation, dozens of projects featuring wood have been completed spanning all areas of government construction—education, health care, the justice system, transportation, housing, services for seniors, and recreational and community facilities.

B.C. is now looking at building even taller with wood to further showcase the province's expertise in wood design and construction and wood products manufacturing. When completed, the iconic, 29.3-metre tall Wood Innovation Design Centre, now under construction in Prince George, will be the tallest contemporary wood building in North America. Its design reflects an international movement, led by architects and engineers in B.C., to capitalize on advances in wood products and building technologies to build larger, taller structures with wood.

These new approaches to building with wood must be tested to confirm that they meet building code and other requirements. Wood First continues funding research to assist building code and other technical specialists in these reviews.

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Supporting the market for advanced wood building is an expanding base of manufacturing capacity in B.C. for new products, like cross-laminated timber, and a broadening of the skills to design and build with wood. More than 3,000 architects, engineers, designers, builders and regulatory officials have taken training programs delivered through Wood First. On a project-specific basis, technical experts have provided technical support to more than 133 projects, directly resulting in $130 million in incremental wood use in building projects in B.C.

The result is enhanced production and design capacity that is establishing B.C. as a global leader in wood products and wood-based building systems. Developers, architects and builders from other countries now regularly contact their B.C. peers for advice, project management, and consulting support.

Today B.C. is not just exporting wood products, it is exporting expertise.

The wood sector today is supported more than ever by industry and the public. Nine out of 10 British Columbians say wood-product manufacturing is important to the provincial economy and job growth. Some 53 communities across B.C. have adopted their own resolutions, bylaws or policies to encourage wood use in municipally-financed construction.

To build on this broad support and the gains of the first five years of Wood First, the B.C. government is investing another $2.14 million this year to further advance the use of wood in British Columbia. Funding is being provided to industry trade associations and research institutions with experience in wood products marketing, training, wood products development and research. The focus of efforts is on expanding the use of wood in non-residential construction, strengthening manufacturing capabilities, and positioning B.C. as a global leader in wood design technologies.

The funds are being distributed through Forestry Innovation Investment, B.C.'s market-development agency for wood products.

More information is available at the Wood First website (www.woodfirstbc.ca). A five-year report on Wood First is also available from the website.

FPInnovations leverages aerial LiDAR for resource road safety inspections

By Matt Kurowski, MSc, EIT

Researcher - Resource Roads

Has increased traffic on your resource roads created unsafe conditions? Do you need help prioritizing where to make road upgrades? If you have aerial LiDAR, FPInnovations can now use it to reduce the cost of our road safety inspection (RSI) service.

The new approach leverages aerial LiDAR to analyze stopping sight distance (SSD)—the distance along a road that a driver requires to stop a vehicle safely after seeing an obstacle ahead. When the line-of-sight to a potential obstacle is blocked at a location on the road, the result is an SSD hazard (SSDH). On a resource road, vegetation or surrounding terrain can create SSDHs at horizontal curves (i.e. tight turns), and the road itself can create SSDHs at the crests of vertical curves (i.e. hill summits).

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FPInnovations' Resource Roads Group first started investigating ways to systematically identify SSDHs in 2007 using vehicle-mounted mobile mapping systems equipped with LiDAR. This research led to the establishment of our RSI service in 2008. To date, we have delivered RSIs at 12 locations totalling over 1000 kilometres.

Our established RSI approach involves going into the field with a contractor who operates a vehicle equipped with GPS, cameras, and LiDAR scanners. Back in the office, the vehicle's GPS measurements inform our calculations of road curve radii, while the imagery and our field observations allow us to measure road and pullout widths, georeference signs, and view bridge decks and guardrails. The mobile LiDAR, along with vehicle GPS points, become the input for an automated SSDH calculation model. A final report highlights prominent safety issues and is a decision support tool for prioritizing road upgrades.

Recently, we evaluated whether aerial LiDAR datasets could consistently identify the same SSDHs as found with mobile LiDAR. Before we could do any testing, we first needed to develop a new automated SSD calculation model, since our existing model runs inside specialized mobile LiDAR software and cannot use aerial LiDAR for this.

To test the new model, we found two previously completed RSI sites that also had aerial LiDAR coverage. The density of the aerial LiDAR at one site was 12 hits/m2 and 1.2 hits/m2 at the other. At each site, we ran the new SSD calculation model on a test section and compared results to the model that uses mobile LiDAR. The new model successfully located all prominent SSDHs—even when using the lower density LiDAR dataset.

The implications of this evaluation are substantial RSI cost savings if aerial LiDAR is available in your area; FPInnovations can locate SSDHs without any field work, and can complete the RSI by collecting georeferenced imagery and making field observations to inform the remainder of our analysis. We anticipate that this approach to an RSI will aggressively cut costs since it sidesteps the expenses of collecting and processing mobile LiDAR. At the same time, our established RSI service that relies on mobile LiDAR remains valuable—especially if, i) aerial LiDAR does not exist in the region, ii) aerial LiDAR exists but is dated and would not identify current vegetation-caused SSDHs, or iii) collecting mobile LiDAR would also eliminate detailed ground surveys needed for road alignment improvements.

Aerial LiDAR has many cost-effective forestry applications such as planning new roads using a derived terrain model, mapping streams and wet areas, and statistically correlating forest plots with LiDAR to produce enhanced forest inventory predictors such as volume and stem size for your entire tenure. Now, another benefit from purchasing aerial LiDAR is the opportunity to utilize FPInnovations' new lower cost RSI approach. Although there is a capital expense to aerial LiDAR, the accumulating suite of applications and resulting benefits paints a foreseeable future where forestry companies without it will be at a significant competitive disadvantage.

For further information about employing LiDAR in road safety inspection (RSI) service, please contact Matt Kurowski, Researcher, Resource Roads, FPInnovations, Matt.Kurowski@fpinnovations.ca, 604-222-5727.

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WOLF invests in four new equipment simulators

By Tony Kryzanowski

Alberta's Woodland Operations Learning Foundation (WOLF) has more than doubled the size of its equipment simulator collection by purchasing four new Simlog equipment simulators. It can now offer students many more opportunities to experience what it feels like to operate a larger variety of logging equipment and equipment used in forest products manufacturing facilities.

In addition to using the simulators within its own educational programming, WOLF welcomes inquiries from any organization interested in gaining access to the simulators for their own programs, says David Blackmore, WOLF Executive Director.

The simulators are intended primarily to help students enrolled in the Alberta Distance Learning Centre (ADLC) Career and Technology Studies (CTS) program accumulate more time as they practice operating harvesting, processing, forwarding, road construction, and equipment used in the mill and woodyards.

In addition to the CTS curriculum offered through ADLC, the simulators will also be made available to other WOLF education partners, such as the Northern Lakes College, and to individual school systems that contract WOLF directly to provide educational resources and services. As part of this investment in simulation technology, WOLF is also upgrading the computer and personal computer joysticks for a simulator that travels with the Alberta Forest Products Association (AFPA) Work Wild program. It makes contact with thousands of students in schools across Alberta every year.

The simulators allow students to experience operating a harvester processor, bulldozer, excavator, forwarder and for the first time through WOLF—a forklift. They complement two ORYX simulators already in WOLF's collection, which allow students to experience the operation of a feller buncher and harvester processor.

"For the most part, the students are completely involved with the simulators and they can't believe that an hour has passed," says Bevan Davidson, WOLF simulator training instructor. The instructor sets out specific tasks that students must accomplish while in the operator's chair.

Davidson says both students and instructors find the simulator's records management software particularly helpful because they can acquire and evaluate performance at the end of each session and track progress. This is an important feature because a major part of the simulation experience for students is to evaluate if they have the psycho-motor skills needed to operate forestry-related equipment efficiently and safely. This is of great benefit for making career choices.

The new Simlog simulators are much more portable, requiring only about 20 minutes to set up, with additional functionality, such as being able to control equipment attachment heads with greater accuracy and in more realistic ways, such as lining up the log butts on a log deck. Most of the Simlog simulators are table-top arrangements, but one features an actual operator's chair.

Simlog is a Canadian company founded 15 years ago with its roots in providing forestry-related simulators to forestry schools in Quebec. Today, it supplies generic equipment simulators to customers around the world.

From WOLF's perspective, having the ability to tap into simulation technology using today's most powerful computer

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hardware obviously offers students the experience of operating forestry equipment at a fraction of the cost vs. sitting in the chair of an actual piece of equipment.

Blackmore says one reason why WOLF opted to expand its collection with Simlog's simulators was the affordability factor. The company's approach is to use powerful, off-the-shelf personal computers (PCs), such as those typically purchased by gamers.

"The cost effectiveness occurs in two ways," says Paul Freedman, Simlog President and founder. "Firstly, we let people use off-the-shelf Windows-based PCs, and secondly, we provide industrial strength, but multi-purpose simulator controls with USB connectors that can be plugged right into your off-the-shelf computer. The same joystick can be used with all kinds of simulation software."

He says the combination of using the most current, high performance PC's and Simlog's simulation software enhances the overall experience for students.

"What we are building today has much better graphics and much better simulation physics to simulate equipment in a much more lifelike way," says Freedman. "Because it is more lifelike, the training value goes up. The more you can make the simulated world like the real world, the more the students can learn at the simulator and when they graduate to the real world, the better prepared they are."

For more information about WOLF, and its resource-related curriculum and services, see the website, https://www.w-o-l-f.ca.

Near-infrared chemical composition tool among initiatives supporting pulp and paper sector at AITF

By Tony Kryzanowski

It's all about operating more efficiently and finding new market niches for Alberta's pulp and paper producers as they face challenges resulting from competition for market share and decreased demand for paper products from the so-called digital workplace.

Alberta Innovates Technology Futures (AITF) is a well-equipped, well-staffed research organization based in Edmonton that is ready, willing and able to partner with the pulp and paper industry to meet these challenges.

Dr. Benji Ahvazi, AITF's Forestry Program Lead, has a research specialization in lignin and cellulosic material. Along with other colleagues from AITF and FPInnovations, he visited Alberta's seven pulp and paper mills last fall to identify their biggest research needs. This tour is now helping to drive AITF's pulp and paper research agenda. AITF also does contract work for pulp and paper producers as well as lignin users situated outside the province.

Ahvazi notes some promising and potentially game-changing research projects at AITF that have recently started, and will build momentum over the next few years.

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One challenge industry faces is the impact of mixing different feedstock in the pulping process; at present, pulp mills experience fibre loss because each feedstock typically reacts differently under specific mixing and cooking conditions.

What AITF has developed under the direction of researcher Keith Lau and in co-operation with FPInnovations is an online, non-destructive, near infrared imaging tool that will allow pulp mills to immediately determine the chemical composition of their wood species mix. This will allow them to build calibration models and achieve maximum yield from their feedstock while reducing their chemical consumption. Previously, it could take weeks to determine this.

“We have spent more than $500,000 to build the aspen near infrared calibration model,” say Lau. “The next step is to transfer this model to a conventional scale near infrared instrument.”

AITF is also partnering with University of Alberta researchers investigating faster growing hybridized wood fibre feedstock that can grow in this environment to compete with wood species currently grown in such places as Brazil. AITF has both the chemical and mechanical pulping research facilities as well as its near infrared technology to evaluate these species for their potential use for producing pulp and paper products more competitively. There is also the potential to blend wood fibres with agriculture fibres, which AITF can do.

Furthermore, AITF is developing a bleaching tower system and expects it to be operational next year. It uses pure oxygen to remove up to 55 per cent of the lignin in pulping fibres, bleaching the fibres so that they can be used in paper, toweling, and tissue. This system is unique in North America because few other organizations have the ability to bleach fibres this way at the demonstration scale.

“Companies taking advantage of this system will be able to reduce the use of environmentally harmful chemicals, allowing them to offer greener products and demonstrate their commitment to environmental sustainability,” says Ahvazi.

He says that an added benefit to the bleaching tower system is that it can be connected to AITF’s chemical and mechanical pulping pilot plants, which will allow companies to efficiently and cost effectively chop and treat fibre, wash, dry and sort it, and remove the lignin in one continuous process.

Speaking of lignin, another promising area under development at AITF is the use of lignin in the production of carbon fibres, which have a variety of potential commercial uses.

AITF is equipped with both chemical and mechanical pulping pilot facilities, with the mechanical pulping research lab capable of reducing, washing, and preparing both forestry and agro biomass.

“Our chemical pulping batch digester is unique because it resembles what goes on in pulp and paper mills in the real world,” says Ahvazi. “We can use it to remove sugars and perform chemical pulping with and without additives to make or enhance the yield of pulp. We can also test and evaluate the conditions our mills are using, without them having to shut down their facilities.”

Complementing both these facilities is a humidity-controlled laboratory capable of evaluating various aspects of both pulp and paper products against industry standards.

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For more information about AITF's research program, facilities, and support for the pulp and paper sector, contact Dr. Benji Ahvazi at (780) 450-5488 or behzad.ahvazi@albertainnovates.ca

CWFC investigates innovation stand enhancement/regeneration systems to rehabilitate beetle-impacted stands

By Tony Kryzanowski

In an effort to control the spread of the mountain pine beetle, Alberta forest companies have agreed to give priority to harvesting merchantable stands within their Forest Management Areas (FMAs) infected by the beetle, but there are a number of infected sites with unmerchantable timber being left behind.

One concern is that by not harvesting and replanting these stands, and given the number of hectares of these types of forest blocks in the beetle-infected forest, industry could experience a mid-term softwood timber supply shortage due to the mortality of the lodgepole pine in these stands.

With support from the Forest Resource Improvement Association of Alberta (FRIAA) Mountain Pine Beetle Rehabilitation Program, the Canadian Wood Fibre Centre (CWFC) has partnered with forest company Canadian Forest Products Ltd., Spectrum Resources and University of Alberta researchers on an operational trial aimed at investigating the most economical ways to recover value and rehabilitate beetle-affected lodgepole pine mixed stands. These are stands with small diameter mixed wood with over 50 per cent mortality. The specific test site consists of seven forest blocks totaling 450 hectares north of Grande Prairie.

The goals of the operational trial are to establish vigorous stands of lodgepole pine and lodgepole pine/white spruce softwood mix, reduce the present and future stand risk of wild fire and beetle attack, as well as develop and test management options for non-commercial beetle-infected stands.

"We're going into these stands with the goal of salvaging as much as we can," says Tim Keddy, CWFC Wood Fibre Development Specialist. "There's a minimum 50 per cent lodgepole pine mortality in the stands, but there are live green stems in there as well. We're looking at harvesting whatever we can either for biomass or other potential products, and the proceeds from the sale of those products will be returned to the operational trial to contribute to the costs of the operations needed to rehabilitate the stands."

He adds that there may be thousands of hectares of these types of sites in the beetle-infected forests and this operational trial is "to see how much it costs and if it is feasible to economically bring these sites back into production."

CWFC has assessed the stands and has designed a harvesting pattern that is flexible and can be implemented using a variety of harvesting systems. Using parallel, designated, five metre wide access trails, established at 20-metre centres, the harvester will be able to reach and harvest the targeted stems.

"The idea is to use a tree length or cut-to-length system to reach in and harvest the product that we need and the volume that we need, picking and choosing as we go," says Keddy. "The designated skid trails also give us access for the site prep and planting to start to establish the next crop."

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The harvested stems are forwarded to a landing where they will be processed, sorted, and then trucked to purchaser locations. These are sites that have been infected repeatedly, so sorts will include green lodgepole pine and infected pine at various stages of infection, from green fibre with pitch tubes to red stage pine and to grey stage pine.

“We want to get the beetle off the site so that everything that is green and non-merchantable has a chance to survive,” says Keddy.

The goal is also to recover as much value as possible from the sale of the wood fibre to pay for the harvesting and rehabilitation operations as part of the project’s goal of evaluating the cost effectiveness of taking this treatment approach. The productivity of each machine will be monitored, as well as the volume of wood fibre recovered, and the income derived from the sale of the wood fibre.

Once established, there is also potential for additional research components studying such questions as the impact of this site treatment on fire risk vs. leaving the site as is, different silviculture treatments, and investigating strategies to decrease the potential for future MPB attacks.

For more information about this project, contact Tim Keddy at (780) 435-7212 or tim.keddy@NRCan-RNCan.gc.ca or CWFC Regional Coordinator and Program Manager Derek Sidders at (780) 435-7355 or derek.sidders @NRCan-RNCan.gc.ca

Lucrative extract market opens for forest industry with AI Bio support for Radient Technologies

By Tony Kryzanowski

The door is now open for forest companies to potentially tap woody biomass and residuals such as leaves and bark for their high value extracts with the launch of the Radient Technologies commercial production plant in Edmonton.

The company says its “transformative technology” involves novel uses of microwaves to more economically extract valuable ingredients from such natural materials as bark, leaves, wood fibre, crops, fungi, and micro-algae.

There is the opportunity to extract ingredients from commonly harvested wood species, wood waste, undergrowth species generally ignored by the forest industry, or to grow new wood species specifically for their extract value. A good example of a high value extract derived from a well-known, existing wood species is the cancer fighting drug, Taxol, which comes from the bark of the western or Pacific yew.

“There are probably a number of potential value-added ingredients that are currently not exploited—particularly in many of the forest industry’s waste products,” says Denis Taschuk, Radient Technologies president and chief executive officer. “One thing for certain: if these actives have been identified but not commercially exploited, the reason is probably that it has been too expensive to do so. We provide an opportunity to potentially extract these ingredients economically.”

Taschuk adds that Radient’s presence in Alberta is extremely important for helping to grow the provincial economy because it provides a commercial-scale world class infrastructure to capture extra value from various forms of biomass, including wood fibre and residuals.

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"One of the economic spinoffs could be collaboration with the Alberta government on specialty biomasses," he says. "So Alberta growers who want higher value crops now have a way to take the ingredients derived from these crops to market."

Radient Technologies has invested $23 million to develop its technology and build its commercial-scale production facility, which includes a $1.2 million contribution from Alberta Innovates Bio Solutions (AI Bio) through its Advanced Materials and Chemicals Program. The program focused on supporting companies that were close to having a new product or process ready for market.

"One of the important criteria to qualify for the program was the potential to use Alberta-based biomass materials, whether from agriculture or forestry," says Steve Price, AI Bio Executive Director for Advancing the Bio Economy. "Radient Technologies scored high during our review process."

Price adds that AI Bio may either extend or expand the program, given its success.

Taschuk says the timing of the financial support from AI Bio was particularly appreciated.

"When AI Bio stepped forward, it came in to help bridge our financing. They played a significant role because that support was big enough to tip the scales forward for a number of investors and other funding agencies," he says.

Extracts are used in a wide variety of products including foods, beverages, cosmetics, pharmaceuticals, and health supplements. Initially, Radient Technologies will focus its marketing efforts in these areas. For example, one product they will extract is antioxidants from flax. Some extracts are sold for as much as $10,000 per kilogram. The company's production facility and industrial scale extractor located at 4305 - 101 Street Northwest in Edmonton can continuously extract from up to 200 kilograms of biomass per hour and is the only one of its kind in the world.

The science of extracting ingredients from plant materials is well established. Radient's technology is much faster and more economical than traditional extraction methods using solvents, it's more environmentally friendly, and it's much more versatile. Dr. Steven Splinter, Radient Technologies founder and chief technology officer, says that the microwave extraction method being used by the company is the biggest change in extraction process technology for the industry in many years.

In addition to its application to extract valuable ingredients from various forms of biomass, he says that longer term, there is an opportunity to apply the company's microwave technology within the forest industry's processing systems.

"Clearly, there are some opportunities for using our technology in this way," he says.

The microwave extraction technology used by Radient Technologies was invented by Environment Canada scientist, Dr. Jocelyn Paré. The company purchased the patents and has been working toward ramping up production to a commercial scale. That goal has now been achieved.

For more information about the AI Bio Advanced Materials and Chemicals Program, contact Steve Price at (780) 427-2567 or steve.price@albertainnovates.ca. For more information about Radient Technologies, contact Denis Taschuk at (780) 465-1381 or dtaschuk@radientinc.com, or Dr. Steven Splinter at (604) 970-1685 or ssplinter@radientinc.com.