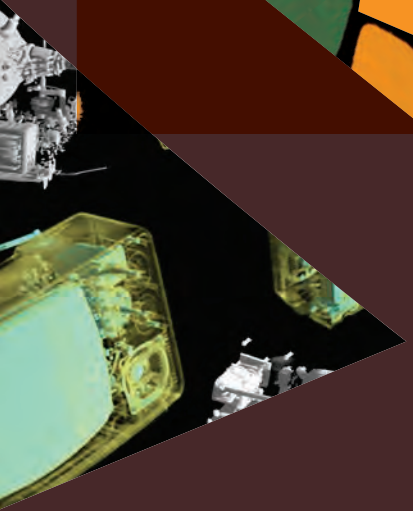
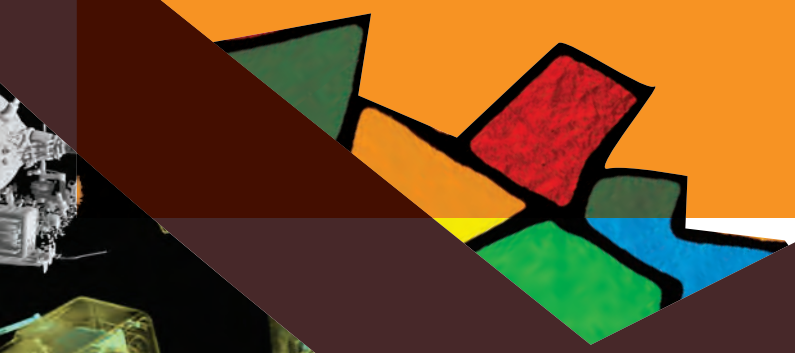
Delivering on
our commitments

Knowledge.
Innovation.
Results.

REVIEW OF ACTIVITIES | 2011-2012





2012

FPInnovations

Towards an innovation hub for Canada's forest sector

A MESSAGE FROM ALAN POTTER, EXECUTIVE VICE-PRESIDENT

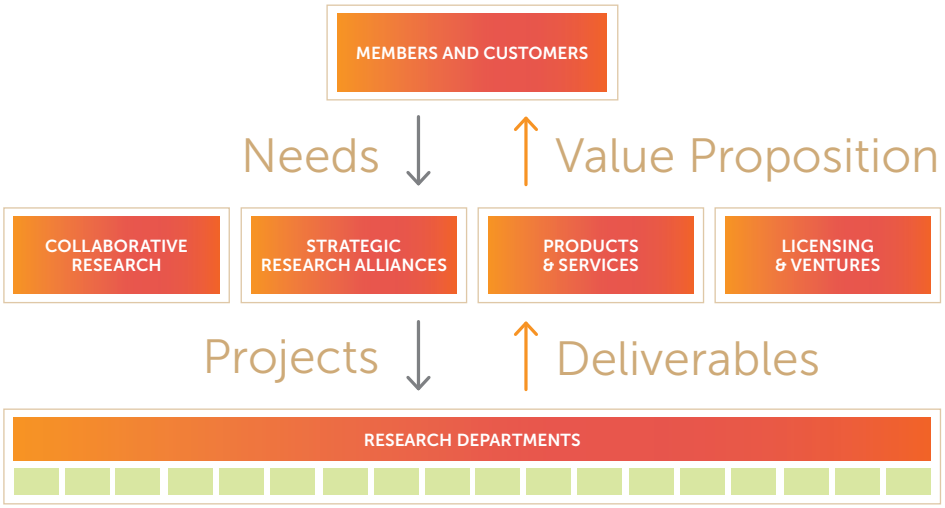
FPInnovations is more than a research partner. It's a research partner you can trust to generate return on your investment.

Alan Potter
Executive Vice-president

Collaboration with our industry members and government partners in research, development and demonstration has made FPInnovations a world leader in forest sector innovation. This year the collaboration has resulted in distinctions for groundbreaking research, recognition as a centre of expertise and a global reputation for leadership.

This *2011-2012 Review of Activities* describes some highlights of our work that aims to help build and sustain a strong, prosperous and globally competitive forest sector. Our team has continued to make strides in research in areas fundamental to our success, such as developing state-of-the-art technologies, bringing tools to market, carrying out pilot projects and demonstrations, and forging new partnerships. Such efforts prove once again that our combined efforts are making the forest sector stronger every day.

FPInnovations' business model



Research Vice-presidents

JEAN HAMEL
PULP, PAPER & BIOPRODUCTS

PETER LISTER
FOREST OPERATIONS
& WOOD PRODUCTS

GEORGE BRUEMMER
RESOURCE ASSESSMENT

Business Development Vice-president

HERVÉ DESCHÊNES

We are proud of our many accomplishments this year, made possible through truly collaborative relationships with our members, our federal and provincial funding partners, First Nations communities, universities, and the industry at large. Among the accomplishments you will read about in this Review is one we are very proud of: the January 2012 opening of CelluForce's nanocrystalline cellulose (NCC) demonstration plant in Windsor, Québec. It is the first such plant in the world. This initiative is a testament to what we can do when we work together and have the will to succeed.

We are proud of our many accomplishments this year, made possible through truly collaborative relationships with our members, our federal and provincial funding partners, First Nations communities, universities, and the industry at large.

While much has been accomplished this year, and as we maintain our strength in forest R&D, we must also continue to reach for the future and deliver what will be needed in years to come. Such a future is quickly becoming the present. New and novel applications for forest products are in demand. Sectors such as chemicals and energy are beginning to use our solutions to leverage their business needs. A market-focused approach to designing and developing new tools and technologies has begun to transform Canada's forest industry.

This year, FPInnovations took a giant leap into the future with a new market-focused business model — one that will better position us to serve members, clients and partners. The intended outcome is to secure new market opportunities and a stronger place for Canada on the world stage.

On February 6, 2012, a new organization structure was unveiled to our 550 employees across Canada. The essence of the change lies in aligning our Research Program with members' interests to ensure a market focus, synergy among partners and a competitive advantage for members. We have also made Business Development a VP responsibility. Our value proposition remains rooted in collaborative research, yet our leadership role enables us to take on new challenges to meet the sector's transformation goals.

To this end, we will offer a broader range of innovative solutions to members and to a growing roster of new clients who will use our products and services; form new research alliances with our public and private partners; and we will position ourselves for more licensing and commercialization opportunities. Through such changes, we hope to be able to achieve new revenue streams and reinvest in the collaborative research program.

The new model places greater focus on a business development function that will draw new revenue to our R&D departments. Business Development is made up of three streams: Strategic Research Alliances; Products and Services; and Licensing and Ventures. Each of these streams presents new revenue opportunities. Our R&D departments will continue to be the heart of the organization — they will now work on the R&D program as well as assisting the Business Development team. We expect this will result in greater synergy among teams and contribute in a meaningful way to the evolving demands of our members, partners and clients.

While the forest sector is bound to change, we steadfastly retain our focus on innovation and share both the risks and benefits associated with R&D. As other sectors and industries, such as those in chemicals, energy and pharmaceuticals, come to see what we have to offer, our new business model will better position us to share with our members and funding partners an exciting future for our sector.

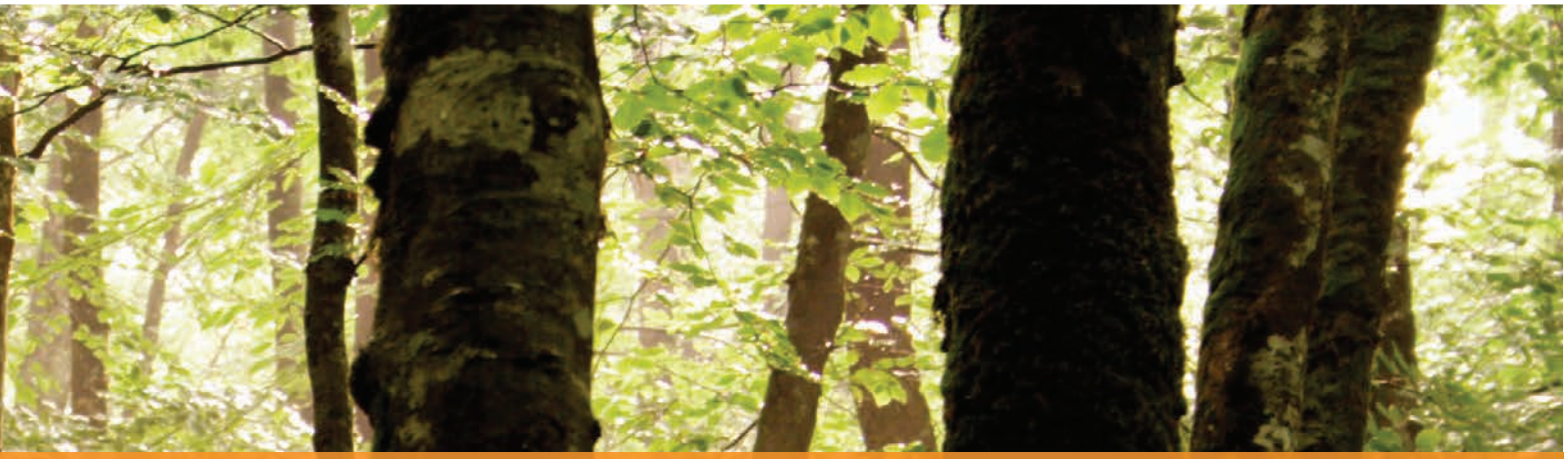
Alan Potter
Executive Vice-President

An overview of our projects in 2011-2012

Eleven research programs.

One focus: to innovate and deliver results.

FPInnovations understands the importance of always protecting its members' interests and, therefore, ensures that any mention of an industry member by name was done with the explicit consent of each company, both prior to writing this publication's articles and after they were completed.



RESOURCE ASSESSMENT

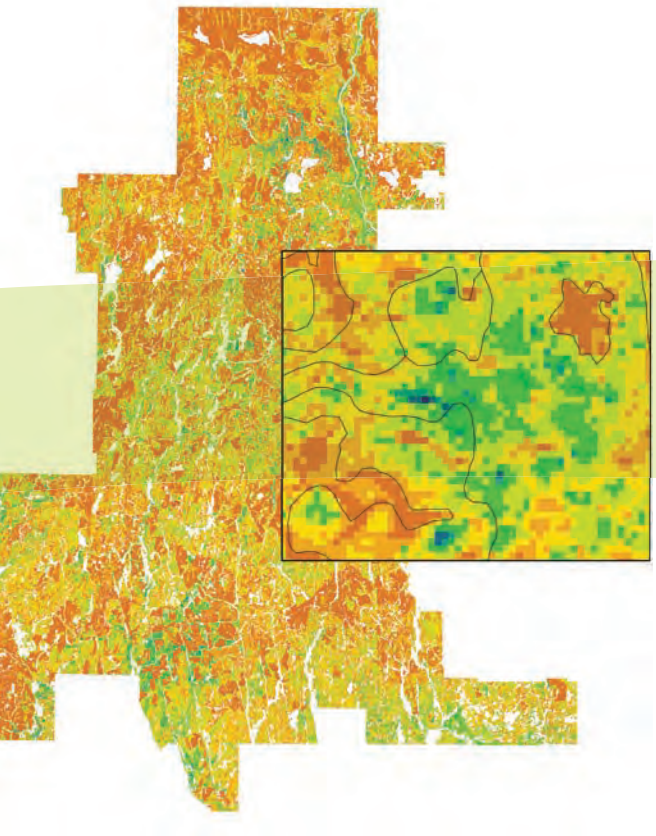
Fibre inventory enhances mill operations in Newfoundland

In Atlantic Canada, the forest industry represents approximately $2.6 billion in real GDP and over 25,000 primary jobs; However, global competition has been threatening this economic base with new pulp and paper competitors from developing countries having lower fibre and labour costs coupled with modern pulping and papermaking technologies.

FPInnovations has been collaborating with university, government, and industry partners on a three-year, $2.5 million Forest Industry Competitive Advantage project to develop an enhanced forest inventory system (EFIS), which will help optimize the value chain from resource to market. The EFIS integrates state-of-the-art ground-based, airborne, and spaceborne imagery analysis to measure detailed forest structural characteristics with models for predicting fibre attributes and value at the tree, stand, and landscape levels. Directly integrated within existing operational inventory, the EFIS generates strategic-level information quickly and at broad spatial scales, contributing to better forest management planning.

Piloted at the Kruger paper mill in Corner Brook, Newfoundland, information generated from the EFIS has led to better controlled incoming fibre variability and an estimated savings of $175,000 annually for each one percent substitution of high density balsam fir in place of black spruce. The mill is also better equipped to meet client demands for products with specific quality characteristics, such as strength. In addition, the EFIS's ability to generate accurate and reliable digital elevation models for road planning will result in road system optimization and further cost savings.

Partners in this joint university, government, and industry partnership include: Natural Resources Canada, (Canadian Forest Service, Canadian Wood Fibre Centre), Newfoundland and Labrador Department of Natural Resources, Corner Brook Pulp and Paper Limited, FPInnovations, Atlantic Canada Opportunities Agency, Sir Wilfred Grenfell College, and the University of Sherbrooke.



Fort McPherson project creates economic benefits for Aboriginal community

Collaboration between FPInnovations and Fort McPherson, a First Nations community of 800 people in the Mackenzie Delta, Northwest Territories, has resulted in a business model aimed at community engagement and establishment of a small local forest industry.

The community started collaborating with FPInnovations in 2006 on private forest management practices and portable sawmill training. Four workshops were held in the region to address topics such as manual harvesting, sawmill operations, mill maintenance, business planning, and marketing. Community training led to the purchase of more modern and efficient equipment and the identification of local champions to foster the development of a business model. Another FPInnovations' initiative, the Northern Bioenergy Conference (held in Whitehorse in 2010), triggered additional interest in pursuing a bioenergy facility to offset energy costs in the community. As a result, FPInnovations recently carried out two studies for the community.

FPInnovations' support and participation at community stakeholder meetings led to the creation of a model, which includes the implementation of a merchandizing strategy and a sawmill yard, with the use of sawmill residues for the proposed bioenergy facility. The cost-benefit assessment of the model is favourable, potentially creating up to 11 local jobs, reducing energy costs, and, at the same time, producing timbers and lumber for local and regional markets. The model identifies funding support from all three levels of government, and identifies a role for FPInnovations in supervising implementation of the model.

Implementation will result in the creation of a local small-scale forest industry for the community with the opportunity for further expansion, energy savings through low-cost feedstock for the community heating facility, the successful manufacture of local products, and a model for other First Nations' communities.

Johnny Kay, project co-manager and participant of the FPInnovations portable sawmill training in Fort McPherson, NWT, running the Tetlit Gwich'in owned Woodmizer LT40.

FOREST OPERATIONS

Innovative Road Safety Inspections (RSI) service implemented regionally

Collecting road geometry data using vehicle-mounted mobile mapping technology.

Canada's millions of kilometres of resource roads are not always engineered to ensure optimal road-user safety. Risk factors include road design and maintenance, posted speed limits, and lack of radio communication. In response to a 2008 request from the BC government and its partners, financial support from the Natural Resources Canada's Short-term Competitiveness Initiative enabled FPInnovations to design and develop a Road Safety Inspections (RSI) service.

The objective of this project was to develop a systematic method with advanced road-scanning systems and software. This has allowed road owners to prioritize upgrades and implement traffic control measures. The project has leveraged investments from partners such as Tolko Industries, WorkSafeBC, BC Forest Safety Council, and the BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO). Collaboration with these partners in full-scale operational trials has reduced surveying costs, as well as time and post-processing costs, by more than 50 percent.

Following an initial road safety assessment from FPInnovations, the BC MFLNRO proceeded with recommended upgrades to a forest resource road near Clearwater. Regular road users found that the improved right-of-way and line-of-sight provided enhanced safety as it allowed for drier surfaces, visibility of wildlife and oncoming vehicles at greater distances, improved night driving, and safer locations to park and unload equipment.

Recent results show that the RSI will provide for independent, methodical, proactive and standardized resource road analysis. FPInnovations is now well positioned to provide clients, across Canada, with low-cost high-precision data, as well as detailed assessment reports with upgraded recommendations and priorities. This will be of particular interest to Canadian industries that are increasingly looking for opportunities in the North.

NCCruise software improves log value

A stand valuation model created by FPInnovations is helping Canadian forest products companies increase their efficiency and their bottom lines by allowing them to describe and maximize the value of their timber resources more accurately.

Developed as part of the British Columbia Coastal Initiative, and with funding support from NRCan, NCCruise can quickly analyze different scenarios to reflect changing market conditions. It can predict wood volume distribution by species and log sort for each proposed harvest site, using standard inventory data (timber cruising), with the ability to compile volumes for old-growth stands and those that have been attacked and killed by the mountain pine beetle. Originally developed for second-growth hemlock stands in coastal British Columbia, the most recent version can now be applied to all species in the province's coastal and interior regions.

A large coastal company has described NCCruise as vital to their decision-making. The firm has estimated that using NCCruise improves their log value by one percent, which translates into $2 million per year. Another company operating on private land has used the model in pilot tests, and plans to implement NCCruise as the standard cruise compiler. In addition, NCCruise was also used on individual trees to test the accuracy of its taper equations.

FPInterface – Centrepiece of the MRNF new Forestry Plan

FPInnovations is now assisting Québec's Ministry of Natural Resources and Wildlife (MRNF) by supplying it with FPInterface™ software. This forest operations planning software will significantly contribute to the efficient implementation of the Ministry's new Forestry Plan on April 1, 2013. The Plan is dedicated to the sustained ecosystem management of Québec's forest heritage.

Through the Transformative Technologies Program, the federal government has provided FPInnovations with the operating funds required to support the development of FPInterface. The Québec government is currently the biggest client, fostering implementation of the software, its development and creation of relevant companion tools adapted to the MRNF's needs. Indeed, over the past year, 75 licenses were acquired by the Ministry and distributed across its 17 administrative regions in Québec.

This initiative has stimulated the development of FPInterface-linked activities, such as the creation of optimization models, Ministry staff-training contracts and technical support. The MRNF can now objectively plan, manage and maximize the development of public forest lands using tools that assist in selecting harvesting lots to be opened to bids or placed under warranty and in allocating wood stands to producers.

At the same time, several forest companies, including Chantiers Chibougamau, Kruger and Tembec, have already acquired the software. Thanks to a better-planned harvest, savings of $0.25 to $0.50 /m^3. harvested can be generated. A number of universities (Laval, Moncton, Lakehead) use academic licenses in their forestry engineering and management programs. FPInterface is going to constitute one of the key tools in forestry management in Québec, while promoting open communication between the MRNF and forest companies.

Evaluating airtanker drop effectiveness in standing timber in the Northwest Territories

Airtankers are an effective, but expensive, firefighting resource used by fire management agencies to help control the number of large, costly wildfires. With aging fleets and changing roles for airtankers, forest management agencies need to make new investments. Having an objective evaluation of an airtanker's fireline effectiveness can assist in the selection process.

FPInnovations was contracted by the Government of the Northwest Territories' (GNWT) Department of Environment and Natural Resources to assist them with evaluating the drop effectiveness of two amphibious Air Tractor AT-802Fs in standing timber as compared to the Bombardier Canadair CL-215. Because the AT-802F is a smaller aircraft, questions have been raised regarding its canopy penetration capabilities.

Evaluating drops in standing timber—in this case, a boreal mixedwood closed canopy—presents numerous challenges for data collection and analysis, such as precision of grid layout, efficient and accurate collection of drop media, canopy saturation and canopy destruction. FPInnovations researchers and GNWT staff worked together to use the cup-and-grid method in standing timber to gather information on the canopy penetration of airtanker drops. Ground evaluations and video footage were also gathered. When all the data were evaluated, the project team found no operationally significant differences in canopy penetration or coverage level areas between a salvo drop from a CL-215 and consecutive drops from two amphibious AT-802Fs. The results of the study, which include observations and recommendations by the team, will allow forest management agencies to make more informed decisions, thereby saving time, money and Canada's valuable forest resources.

WILDFIRE OPERATIONS

PRIMARY WOOD PRODUCTS MANUFACTURING

Increased sawmill efficiencies through advances in testing and verification

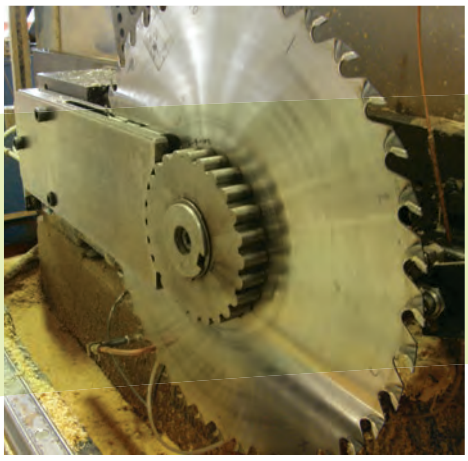
Advances in sawmill testing and verification, through tools and programs developed by FPInnovations, offer new efficiencies in sawmills across Canada.

LOG ROTATION VERIFICATION SYSTEM CUTS LOSSES FOR SAWMILLS

Log rotation inaccuracies result in huge financial losses each year, which can be minimized, at low cost and effort, by making adjustments after accurately measuring rotation errors.

This year, FPInnovations demonstrated sawmill value recovery improvements of one to two percent by analyzing log breakdown stages. Since most log turners appeared to be operating well, sawmills thought they were more precise than they actually were. However, after investigation, adjustments were made and sawmills witnessed improved accuracy and annual benefits of $150,000 to $500,000 per mill.

FPInnovations' Log Rotation Verification System collects information from several sequential log breakdown processes, linking decision-making and information systems together for analysis and control. The newest system, developed with funding support from NRCan under the Transformative Technologies Program, has been applied successfully in the BC Coastal Initiative, adding over $1 million a year to a sawmill's bottom line. Wider implementation and inclusion of more systems are planned.



TESTING PROGRAM RESULTS IN ENHANCED SAWING SPEED AND ACCURACY

The complexity of saw blade dynamics being similar to jet engines limits the ability of sawmills to make improvements, rendering saw speed a continuing barrier to productivity and efficiency improvements.

FPInnovations, with financial support from NRCan under the Transformative Technologies Program, has been improving sawing speed and accuracy through the application of decades of research and the development of a unique testing program. Scientists have been conducting sawing tests under simulated mill conditions in the laboratory in order to recommend best practices and determine opportunities for mills to increase production, while helping ensure accuracy. A better way of testing for accuracy will help reduce the risks for mills that would otherwise have to predict the best settings and improvise if the results are not as expected.

The program has resulted in speed gains in the range of 10 to 30 percent on two machine centres at one BC coastal sawmill, facilitating improvements in productivity and efficiency. As well, production has been increased at Western Forest Products by reducing downtime caused by unscheduled saw changes, while Québec-based Boisaco has reduced downtime by one percent and made recovery improvements. Work has been continuing at other BC interior and coastal mills, and the program will ultimately benefit most sawmills across Canada.

Product diversity and OSB mill versatility through measuring fines

A project was completed this year that involved mechanical changes at Tolko Industries' Meadow Lake Saskatchewan plant to enable production of both OSB and laminated strand lumber (LSL) products on a single manufacturing line.

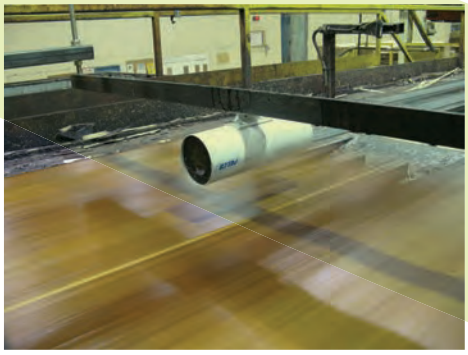
The collapse of the American housing market in recent years had a devastating impact on producers of oriented strandboard (OSB). As a result, many OSB plants closed or cut production, taking a heavy toll on forest-dependent communities.

Industry has wanted for some time to transform commodity OSB plants into facilities capable of greater product diversity. However, a critical factor in plant diversification is the ability to manage fines—small strands and wood particles generated during production that affect the strength and characteristics of the final product.

This project is the culmination of a four-year initiative involving FPInnovations' research and technology development under NRCan's Short-term Competitiveness Initiative. Under NRCan's Transformative Technologies Pilot-Scale Demonstration Program, Tolko was selected for the mill demonstration project, which included installation of two FPInnovations FPFMS™ (patent pending) fines-monitoring imaging systems to continuously measure the amount of fines generated. Mechanical changes to the forming line included: two new parallel-orientation core formers that can be quickly interchanged with the cross-orientation core formers to produce both OSB and LSL products on a single production line; and changes to the core and face formers to better control the placement of fines in the strand mats. In June 2011, Tolko launched T-Grade, a new re-engineered OSB flooring product for the residential market, the first product introduction since they adopted the new process.

The project marks the first time that an existing OSB plant has demonstrated the ability to quickly convert its production line from manufacturing commodity-grade OSB to other engineered wood products, such as LSL. The low investment of $3.2 million—a fraction of the $200 million plus to build a new plant—was shared by Tolko and the federal government, with the Province of Saskatchewan providing additional funding for plant assessment.

The project and the technologies it employs could open new markets for OSB producers that will benefit industry and forestry-dependent communities.



New scanner technology reduces mill usage of adhesives

With funding support from NRCan's Short-term Competitiveness Initiative, FPInnovations carried out research to optimize the manufacturing processes for plywood and laminated veneer lumber (LVL)—both staples of the construction industry. While adhesive usage accounts for a high proportion of total manufacturing costs, the application technology presents deficiencies that can result in up to 20 percent overuse of adhesives.

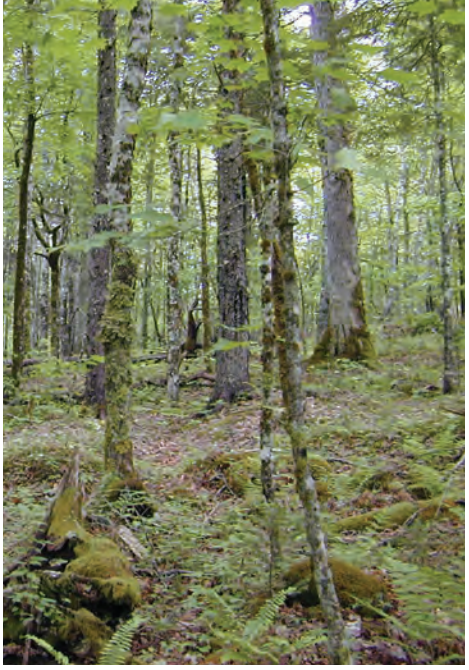
FPInnovations developed a novel camera-based scanning system specifically designed to continuously monitor adhesive application levels and uniformity on all veneer sheets directly on the production line.

Long-term testing successfully demonstrated the system's ability to detect poor adhesive application that would otherwise go unnoticed and lead to problems such as panel blistering and glue "dry-out." Continuous feedback from the scanner allows mills to fine-tune their glue application process, resulting in improved panel properties, reduced glue usage and increased product recovery. The improvement of adhesive application uniformity is estimated to save mills up to 10 percent on adhesive consumption.

The cost for implementing this technology in a mill is estimated at $150,000, with a six-month payback. Estimated savings correspond to more than $250,000 per mill with a combined value for all Canadian mills of over $2 million.

Work continues on enhancing the system to enable mills to optimize their strategies for press operations. Most recently, FPInnovations has developed near-infrared scanning for monitoring of adhesive resin curing during panel hot pressing.

This system will help the industry lower its environmental footprint by allowing mills to use less adhesive, while delivering a more consistent, stronger and safer product for housing construction.



Hardwood research initiative introduces 17 projects

Hardwood forests represent a significant volume of Eastern Canada's industrial activities. Primary and secondary wood product manufacturing industries produce high-value manufactured goods and are significant job generators. However, the past ten years have been challenging.

With financial support from NRCan, the Ontario, Québec, New Brunswick and Nova Scotia governments, and industrial and research partners (FOR@C, École Polytechnique, VCO Network), FPInnovations has been able to focus on a hardwood research initiative. This initiative was designed to research short- and medium-term solutions for transforming this industrial sector into a client-focused industry. The initiative has resulted in 17 projects covering areas ranging from harvesting to second- and third-level hardwood forest transformation products.

FPInnovations has developed and tested the 1-2-3 Method created for coniferous forests, and applied it to hardwood forest selection cutting, with similar and positive results. The 1-2-3 Method does not require tree marking by a specialist, and the harvesting machine operator selects the trees to cut by following directives prepared by the supervisor. This processing is intended for moderate planning when the minimal conditions for traditional processing are not met. During the experiment, the integration of this approach was found to be very profitable, and generated lumber, supervision, and planning savings of up to $\$1.50/m^3$ or between $100,000 and $350,000 per year, depending on the size of the mill.

This initiative has enabled the exploration of innovative methods for mills that create second- and third-stage transformation wood products. The potential benefits could reach between $62 and $356/Mfbm of produced components, depending on the sector of activity. In the case of an enterprise owning both a sawmill and secondary wood transformation mill, the benefits are immediate. However, the sawmill must continue to invest in sorting or sawing technologies, such as the addition of an automated vision system equipped with laser and colour cameras.

Although this new approach requires changes to the company's business model, the results for one logging company are very promising.

SECONDARY WOOD PRODUCTS MANUFACTURING

ADVANCED BUILDING SYSTEMS

Renaissance in wood construction — past meets future

A century ago, it was not uncommon for eight-storey heavy timber post-and-beam construction to be designed and built for non-residential applications. However, due to difficulties in obtaining large timber members, code changes have favoured steel and concrete construction. Alternative solutions that involve advanced engineered wood products offer an opportunity for the industry to recapture a greater share of the market, particularly in the areas of non-residential and high-rise multi-family buildings.

FPInnovations' Renaissance in Wood Construction project is creating new opportunities for innovative wood products to be used as alternatives to (or in concert with) concrete and steel. Further support is given by developing and implementing design tools with architects and engineers, and promoting science-based technical information to building code officials.

The alternative solutions are being developed in the formats most likely to achieve faster building code and market acceptance: light platform-frame wood construction up to six storeys; heavy timber frame construction up to 10 storeys; new products such as cross-laminated timber (CLT) or massive wood panels up to 10 storeys; and hybrid construction that combines wood with steel or concrete in non-residential and high-rise multi-family building structures. As a result of good structural performance in testing of HBV hybrid laminated strand lumber (LSL)-concrete floors at FPInnovations, this alternative approach is being used in the Earth Sciences Building under construction at the University of British Columbia.

FPInnovations is playing a major role in the implementation of CLT in North America, and two members, Structurlam and Nordic, have already started commercial production. With the help of FPInnovations' CLT Handbook, and support from NRCan and the provinces of BC and Québec, Canada's design and construction community have started designing CLT buildings under the alternate solutions within building codes. A partnership among FPInnovations, the US Forest Products Laboratory, the American Wood Council and US WoodWorks was formed for the development of a US Edition of the CLT Handbook for release in December 2012.

Technical specifications approved for light-wood trusses in China

Technical Specification for Light-Wood Trusses is a Standard that supports Canadian marketing initiatives in the area of wood trusses in China, particularly for metal-plate-connected wood trusses used in new concrete or masonry buildings, or as a retrofit for existing flat roof systems currently using concrete. The Standard was approved by China's Ministry of Housing and Urban-Rural Development this year and will take effect in August 2012.

Because of wood's high strength per light weight, and effective prefabrication techniques, light-wood trusses provide new possibilities when penetrating markets for wood applications in construction. The technical specifications will facilitate broader acceptance of these applications, thereby increasing export opportunities for Canadian forest companies.

In collaboration with MiTek Australia, FPInnovations scientists provided critical technical support for the development of the Standard.

The project, which was initiated by the Chinese government, is jointly funded by British Columbia's Forestry Innovation Investment and NRCan's Canada Wood Export Program.

1 Standing and facing up, from right to left: Angela Dale, Stavros Avramidis (professor at UBC), Erica Son (UBC student), Brian Zak (Canada Wood), another male student from UBC, and Aaron Coelho (hidden behind him is Ciprian Lazaresku; UBC).

2 Angela Dale and Aaron Coelho.

3 Aaron Coelho.

Pest risk reduced through alternative phytosanitary treatment

As an exporter of forest products, Canada recognizes the serious global issue associated with cross-border transportation of forest-damaging pests, along with the ecological and economic impacts. It is critical that Canadian companies assure foreign markets that their products are pest-free to reduce the risk of having trading partners curtail imports to prevent bio-invasion.

Researchers at FPInnovations, with funding support from NRCan, have been helping the industry and regulators develop pest-detection tools, more options for sanitation treatments, and reasonable approval procedures for innovative tools and treatments based on credible science. FPInnovations' competency in this area is helping the industry maintain existing markets and create access to new ones.

This year, FPInnovations research helped Canada achieve a long-term goal of opening the door for the international community to consider innovative detection tools and treatments. Work included participation at international phytosanitary forums, such as the International Forestry Quarantine Research Group (IFQRG) (around research into economically and environmentally sound alternatives for treating wood to eliminate pests), and with the University of British Columbia in a project funded by Genome Canada to more effectively detect known and unknown pathogens based on genomes.

Ensuring that phytosanitary treatments are effective in thwarting the export of pests allows Canada to maintain its trading partnership with sensitive markets, such as the CDN $32.8 million Australian and CDN $61.4 million Korean softwood lumber markets. Developing alternative phytosanitary treatments, especially to replace methyl bromide, which is already banned for some uses, helps keep Canada's $2.4 billion off-shore (non-US) softwood lumber export market open and meet its Montréal Protocol obligation to phase out the use of ozone-depleting substances.

New methodology benchmarks NBSK for performance

MARKET PULP

To help industry target the growing tissue and towel markets, FPInnovations, in collaboration with industry partners, undertook a project to identify the difference in the performance attributes of northern bleached softwood kraft (NBSK) required for tissue and towel products, as compared with printing and writing grades.

A new methodology to benchmark NBSK fibre properties for tissue and towel grades using low-basis weight and low-density handsheets is under development and will include benchmarking for tissue-making potential. FPInnovations' unique evaluation capacity and expertise will contribute by conducting pilot tissue machine trials and by developing strategies for pulp quality improvement for tissue-making. This initiative will support market pulp manufacturers in optimizing pulp quality, reducing the production costs of their pulp products and strengthening their position in the growing tissue and towel markets.

PAPER, PACKAGING AND CONSUMER PRODUCTS

Strengthening technical support for NBSK

With the declining market for printing and writing grades, the demand for northern bleached softwood kraft (NBSK) has been challenged. In the current marketplace, simply supplying a high-quality product is no longer enough. Strong technical support for customers is becoming essential for maintaining key relationships and developing new business. Faced with these challenges, as well as the need to diversify the applications and markets for NBSK, a member company turned to FPInnovations for technical support and advice.

With significant knowledge and expertise in fibre morphology and characterization, papermaking and product performance, FPInnovations is able to offer a customized approach to support its market pulp members. A customized training program for technical and sales personnel was developed and delivered. With FPInnovations' fast and cost-effective testing services, supplemented by a model available to members that describes refining response, they were able to evaluate and assess NBSK performance, highlighting its features and advantages, and underscoring the unique advantage that Canadian fibres possess.

Additionally, FPInnovations supported the company's staff on customer visits to help the mill optimize its NBSK usage and performance, and, in turn, improve pressroom runnability. As a result of these activities, the company was able to tap into FPInnovations unique capabilities and tools, significantly increase customer understanding of the benefits of their NBSK, develop stronger customer relationships, and expand into new markets. This initiative is an ideal example of technology transfer delivering value to FPInnovations members.

PapTune technology helps mill reduce kraft pulp usage and save money

When a paper mill in BC began experiencing unacceptably high web break rates in a pressroom, mill operators added kraft pulp to the thermomechanical pulp-based furnish to increase the strength of the paper. This, however, led to a significant cost increase. Hoping to diagnose the root cause of the high web break rate, the mill turned to FPInnovations for help under the BC Coastal Initiative and NRCan's Short-term Competitiveness Initiative.

Using PapTune technology—software developed by FPInnovations that calculates paper strength uniformity in a unique way—FPInnovations analysed the pressroom web break statistics and paper strength data received from the mill, and performed a comparison with competitors' paper. FPInnovations determined that the mill's paper had sufficient strength and strength uniformity, and the high web break rate was related more to the pressroom operation. Analysis of the paper samples, collected along the cross-machine direction of the paper machine, showed lower strength uniformity in front-side rolls, which explained the higher number of web breaks observed in the pressroom.

Based on these findings, FPInnovations made recommendations to reduce kraft content, which saved the mill $2.5 million annually—based on a $500,000 saving for each one percent reduction in kraft content. As well, the use of PapTune to review their processes enabled the mill and pressroom to implement more efficient operations.

Nina Deng and Ilya Vadeiko, scientists.

BIOREFINERY AND ENERGY

Removal of methanol from pulp mill condensates generates new product opportunities

Kraft pulp mills have the potential to generate about 10 kilograms of bio-methanol per tonne of pulp from their digester and evaporator condensates. In most mills, the methanol is steam-stripped from the condensates along with other volatile compounds, such as terpenes and sulphur compounds, and burned in boilers or dedicated incinerators. Kraft pulp mills also purchase methanol for use as a reducing agent in the manufacture of bleach. A variety of options for recovering this methanol exist, among them a novel technology designed and developed by FPInnovations in which the methanol extracted can be used in a range of applications, such as replacing purchased methanol in the mill's chlorine dioxide plant.

With FPInnovations' assistance, Alberta-Pacific Forest Industries received funding through NRCan's Investments in Forest Industry Transformation Program to build a methanol recovery and purification plant—the first of its kind in the world. It is estimated that the plant, which will open in July 2012, will produce about 16 tonnes per day of pure methanol, of which 20 percent will be used in the mill's chlorine dioxide generator. The rest will be sold to other kraft pulp mills, windshield liquid manufacturers, biodiesel plants and phenol formaldehyde manufacturers, thereby creating a new revenue stream for the mill.

By helping Canadian kraft pulp mills become more cost effective and reduce their environmental footprint, FPInnovations is contributing to making Canada's forest sector more economically competitive and environmentally sustainable.

Lignin — green alternative to petroleum-based substances

FPInnovations' Bio-economy Technology Centre in Thunder Bay, Ontario is a world-class facility designed to serve as a pilot plant for demonstration of new forest-based biomaterials. The Centre is currently being used to develop value-added lignin-based products.

Lignin is one of the most abundant organic polymers on earth, and the only compound with aromatic properties that can be extracted from biomass. It is a residual substance from the chemical pulping process and is a key component for developing commercially viable fossil fuel alternatives. The potential market for lignin-based products is enormous; lignin can be used as a green alternative to many petroleum-derived substances, such as fuels, resins, rubber additives, thermoplastic blends and pharmaceuticals.

At the core of the initiative is the Centre's demonstration facility, which ties directly into the black liquor stream of Resolute Forest Product's Thunder Bay kraft pulp mills and is the first of its kind in North America. Up to 100 kg/day of lignin can be produced, serving R&D laboratories across Canada that are developing novel uses for wood products.

This initiative brings together governments, research and private organizations to support the Canadian forest industry in better integrating the emerging bio-economy, and will bring home-grown technologies and products to the forefront of international markets. Funding partners for the Centre are the provincial Centre for Research and Innovation in the Bio-economy (CRIBE), Natural Resources Canada, FPInnovations and Resolute Forest Products. NORAM, which built the pilot facility, will be contributing to the plant's operation. Six positions will have been created by June 2012.

Credit: courtesy of Pulp and Paper Canada.

BIOMATERIALS

World's first nanocrystalline cellulose demonstration plant opens

On January 26, 2012, the world's first Nanocrystalline Cellulose (NCC) demonstration plant officially opened at the Domtar pulp and paper mill site in Windsor, Québec. The plant is operated by CelluForce, a joint venture between Domtar and FPInnovations.

The plant's opening followed Environment Canada's regulatory approval for the manufacture and use in Canada of NCC, which is a renewable and recyclable nanomaterial that can be extracted from wood through an FPInnovations-patented process. NCC is abundant and has unique characteristics that make it suitable for applications such as security papers, packaging, coatings, cosmetics, paints and construction products. NCC has the potential to significantly improve product strength, durability and toughness, and reduces damage caused by wear and abrasion.

Collaboration with universities and industry partners enabled FPInnovations to develop the technology that led to the production of NCC. Work was carried out by FPInnovations and industry partner Domtar Inc., with support from both the Government of Canada (Pulp and Paper Green Transformation Program and Transformative Technologies Pilot-Scale Demonstration Program) and the Government of Québec.

The plant's inauguration was attended by the Honourable Joe Oliver, Minister of Natural Resources Canada (NRCan); Alain Paquet, Québec's Minister for Finance, John D. Williams, President and CEO of Domtar; and Pierre Lapointe, FPInnovations' President and CEO.

Ribbon-cutting ceremony of the CelluForce NCC plant. CelluForce is a Domtar-FPInnovations joint venture. From left to right: Alain Paquet, Québec's Minister for Finance; Joe Cunningham, Manager, Forest Innovation, Natural Resources Canada, Canadian Forest Service; John D. Williams, President and CEO, Domtar ; and Pierre Lapointe, President and CEO, FPInnovations.

Innovative high-yield pulp (HYP) technology helps industry

In this era of electronic information, the paper industry has faced multiple challenges and sees the need for major change. The demand for newspaper and printing grade goods is decreasing, while that for wrapping and sanitary goods continues to increase, leading the industry toward a conversion process focused on areas of growth.

In 2000, FPInnovations built a unique and multi-function pilot paper and tissue machine that can transform paper pulp into different products, such as printing grade newspaper, cardboard, wrap, tissue and towel. FPInnovations members, along with pulp and paper companies in Europe, Asia and the Americas, chemical product companies, and equipment manufacturers routinely use the services of this machine to test new products, enabling them to experiment without high-risk trials on a full production line in a mill.

With financial support from Québec's Ministry of Natural Resources and Wildlife (Ministère des Ressources naturelles et de la Faune (MRNF)), FPInnovations researchers and industrial partners recently succeeded in creating an innovative high-yield pulp that can provide significant economic savings and have a lower environmental impact.

By using the pilot paper machine, companies have conducted numerous tests to obtain tissue paper conforming to quality standards that apply to the industry. In doing so, they were able to make sure that the required hygienic properties of softness, strength, bulk and absorption level were met.

FPInnovations is a key partner in the high-yield paper pulp industry state-of-the-art technology and equipment.

PIT goes municipal

PIT

In September 2011, Shawinigan, Québec, became the first municipality in Canada to join the membership of FPInnovations' Performance Innovation Transport (PIT) municipal program. Shawinigan's participation was followed this year by nine other municipalities.

By joining PIT, municipalities will be better equipped to achieve energy efficiency objectives, while benefiting from the unique expertise of FPInnovations' team of experienced engineers and technicians.

PIT brings together researchers, managers of vehicle fleets, technology providers and government agencies to improve every phase of a transportation system. PIT aims to increase fuel efficiency and reduce fuel costs — a serious and growing concern among transport companies and organizations with fleets of vehicles—through research, guidance, training, best practices and logistical support.

PIT seeks to support municipal vehicle fleet managers with the implementation of high-performance energy efficiency measures and plans, and give them the tools and training to "green" their fleets.

PIT has been enormously successful over the course of its four-year history, demonstrating that management measures that support innovative technologies can make a significant difference in energy efficiency and driving down fuel costs.

PIT's municipal partners are Beaconsfield, Dollard-des-Ormeaux, Pierrefonds, Pointe-Claire, Ville de Saguenay, Saint-Jean-sur-Richelieu, Ville de Shawinigan, Sherbrooke, Victoriaville, and Rivière-du-Loup.

Vital research points to link between wood and human health

ENVIRONMENT AND SUSTAINABILITY

A study carried out by the University of British Columbia (UBC) and FPInnovations points to an important link between wood and stress in humans.

The body's sympathetic nervous system (SNS) is partially responsible for physiological stress responses in humans. In the study, the presence of visible wood surfaces in a room lowered SNS activation among those of the study's participants who were subjected to wood-decorated versus non-wood-decorated rooms.

The study's 119 subjects—students at UBC—were assigned to either a wood-filled or non-wood-filled room in the form of an office with identical furnishings, but were not informed that the effects of the materials in the room were being studied. Heart rate (EKG) and skin conductivity (GSR) were continually monitored.

Stress, as measured by SNS activation, was lower in the room with wood surfaces in all three periods of the study (baseline, test and recovery). These results show that the presence of wood in a built indoor environment reduces SNS activation.

The impacts of the study are far-reaching, indicating that one way to reduce stress in building occupants is to use wood surfaces. The study also establishes wood as a tool in the pursuit of evidence-based design, which is a growing field that seeks to promote health and optimize outcomes based on scientifically credible evidence.

Follow-up research under NRCan's Transformative Technologies Program is under way using a variety of wood species, colours and characteristics.

New wood products for profile decking and sound abatement fencing poised to regain market share

Using hemlock and Pacific Silver (Amabilis) fir, FPInnovations designed and developed two dynamic and competitively priced wood products—profile decking and sound abatement fencing—with smaller environmental footprints than their non-wood counterparts (wood-plastic composites and cement). The commercial mix of these species, Hem-fir, grows naturally in BC's coastal forest region and is an underutilized forest resource.

To reduce traffic noise in residential areas, FPInnovations used Hem-fir to develop a natural, lightweight, sustainable and lower-cost option to the thousands of kilometres of concrete sound abatement fencing currently erected each year along North American highways. Sound abatement fencing using Hem-fir is more cost-effective to install, aesthetically appealing and effective in reducing unwanted noise.

FPInnovations submitted specifications to the BC government, which has added wood to the Recognized Products List as a product that can be used for sound abatement fencing. In December 2011, a 460-metre section of sound abatement fencing in Burnaby was completed, and a second demonstration project along Highway 1 is under construction.

Decking is an approximately $5 billion/year market, for which wood has lost a 30 percent share to wood-plastic composites (WPCs), even though they are up to five times the price of conventional wood decking. Profile decking made with Pacific Silver (Amabilis) fir is a unique product that allows customization to create a designer look, and comes in at less than half the price of the top-quality plastic lumber alternative. Profile decking is poised to take back some of the market share currently enjoyed by plastic lumber decking.

Both products were developed with funding from the BC Ministry of Forests, Lands and Natural Resource Operations and NRCan's Canadian Forest Service.

Predicting and mitigating the effects of mill effluent on fish reproduction

Since 1992, pulp and paper mills discharging effluent in Canada must conduct regulatory Environmental Effects Monitoring (EEM) studies every three years (Fisheries Act 1992). The EEM studies include comparisons of benthic invertebrates and adult fish living in reference and effluent-exposed zones. To date, the first three cycles have shown that, on a national basis, mill effluents can have an impact on fish reproduction.

To study and identify solutions for this finding, FPInnovations formed a collaborative alliance with Canadian universities (Guelph, PEI, and Wilfrid Laurier) and Environment Canada scientists. The first step was to select the best test for laboratory study of the effects of effluents on fish reproduction. The test developed by FPInnovations has the advantage of being fast and allows for testing multiple effluents at the same time. The test was employed at two mills and led to the identification of potential causes (e.g., liquor losses and biological treatment upsets) and solutions (e.g., process control and optimizing secondary treatment).

The project was expanded to test 20 mills across Canada. The results are helping to establish benchmarks and best management practices so that mills will be able to ensure that their effluents no longer cause impacts on fish reproduction in the environment.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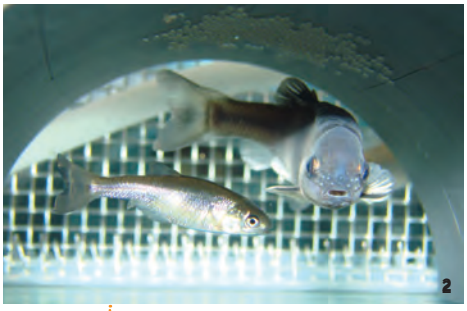
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1 Laboratory set up for assessing the reproduction of fish exposed to mill effluents.

2 Male (right) and female (left) fathead minnow used in fish reproduction tests.

Environmental assessment of nanocrystalline cellulose results in regulatory approval

This year, FPInnovations completed all required environmental and health testing on Nanocrystalline Cellulose (NCC), demonstrating that this organic nanomaterial is non-toxic to mammals and, once released into the environment, is virtually benign. It was also this year that NCC was added to Canada's Domestic Substances List (DSL), the first nanomaterial to ever be included.

The inauguration of the CelluForce plant in Windsor, Québec in January 2012 coincided with Environment Canada's regulatory approval for the manufacture and use of more than 10 tonnes per year of NCC in Canada. This approval paved the way for the plant to begin production. The increased production is critical for meeting the demands of customers who want to exploit the novel properties of NCC in their products. The plant is expected to meet a production target of 1,000 kilograms (one tonne) of NCC per day in 2012.

The next phase in NCC research is to develop its use in non-water-based applications, such as plastic composites. For this to occur, NCC must first be altered or "compatibilized" in order to allow for effective mixing into the plastics. Since Environment Canada considers compatibilized NCC to be a new substance, additional environmental and health testing will be needed before this next generation of NCC is approved for use in Canada.

Pierre Lapointe, President and Chief Executive Officer of FPInnovations; Alain Paquet, Québec's Minister for Finance; the Honorable Joe Oliver, Minister of Natural Resources Canada; John D. Williams, President and Chief Executive Officer of Domtar; and Jean Moreau, President and CEO of CelluForce.

FIBRE — building synergies among university R&D networks and FPInnovations

Forest Innovation by Research and Education—FIBRE—is an organization established in October 2011 to build synergies among eight university networks funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) and Networks of Centres of Excellence (NCE) that are part of the NSERC Forest Sector R&D Initiative. As partners of FPInnovations, these university networks have become key players within the forest sector innovation system that is helping transform the Canadian forestry sector. Their role in the training of highly qualified professionals is crucial at a time when the sector faces major workforce challenges.

Of the eight Networks under FIBRE, seven are NSERC Strategic Networks: ForValueNet and Value Chain Optimization (both led by Laval University); Bioconversion (led by University of Guelph and UBC); LignoWorks (led by UBC); Green Fibre (led by McGill University); Sentinel Bioactive Paper (led by McMaster University); and NEWBuildS (led by University of New Brunswick). The eighth network, ArboraNano—the Canadian Forest NanoProducts Network—is a business-led centre of excellence.

FIBRE's mandate comes from a partnership comprised of FPInnovations, NRCan, NSERC and the Forest Products Association of Canada (FPAC). To complement funding provided to each Network, additional funding was approved by NSERC in March 2012 to support joint activities under the auspices of FIBRE, such as workshops, student training and international collaborations. FPInnovations plays an active role in each Network, not only as a member of the Boards of Directors and various committees, but also at the scientific level on key university research projects.

The Networks are now able to participate in FPInnovations advisory processes. Increasingly, the NSERC Forest Sector R&D Initiative is being recognized, both in Canada and around the world, as a unique sector-specific innovation system.

FIBRE

Focus on First Nations relations

Technical and business development support to First Nations communities continues to be a priority in FPInnovations' efforts to build a viable and sustainable forest sector across the country and improve the technical/business capacity of these communities.

BC FIRST NATIONS FOREST SECTOR TECHNICAL SUPPORT PROGRAM

March 31, 2012 was the pre-set date to measure the success of the BC First Nations Technical Support Program against performance criteria established at the start of this two-year project. Results have proven to exceed all expectations. Since October 2010:

- 51 First Nations communities have been engaged (target of 40);
- 20 businesses have been created, maintained, or expanded (target of 15);
- more than $1.3 million in new capital investment in manufacturing capacity has been identified (target of $350,000); and
- at least 40 jobs have been created or maintained (target of 25).

The Wealth from Forests website—designed several years ago by FPInnovations for the program—was updated this year and featured on the FPInnovations website, providing First Nations communities looking for assistance with online access to the program. As well, 19 case studies and three best practices (forest sector opportunity analysis; sawmill production and net profit calculator; and creation of "circles of wealth") were drafted. Program specialists provided technical services during more than 40 site visits, and worked on technical assessments and other site-specific projects as specified in 26 Letters of Understanding developed in collaboration with First Nations.

The number of "multi-community" activities grew substantially this fiscal year, with 26 new projects initiated in all regions of the province, with representation from the Northern and Southern Interior, Central Coast, North Coast, Haida Gwaii, and Vancouver Island.

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SASKATCHEWAN KNOWLEDGE TRANSFER PROGRAM — FIRST NATIONS COMPONENT

As part of a project funded by the Saskatchewan government and Western Economic Diversification Canada, FPInnovations carried out a series of activities designed to help Aboriginal people and communities in Saskatchewan improve entrepreneurial skills critical for success in the marketplace.

The project brought information related to developing strong business skills, knowledge of markets and marketing, product design and innovation, and process improvement through adoption of new technology. Sharing of this information was carried out on an individual basis as well as through various workshops, seminars, and presentations throughout the province.

As well, a number of pre-feasibility studies were completed with First Nations businesses, with the goal of providing technical assistance when investigating business opportunities and implementing new practices.

SIGNING OF COOPERATION AGREEMENTS WITH FIRST NATIONS IN QUÉBEC AND LABRADOR

Initial cooperation agreements were signed on January 17, 2012 by FPInnovations, the First Nations of Québec and Labrador Economic Development Commission, and Forêt modèle du Lac-Saint-Jean. The agreements are aimed at encouraging development of forest businesses in Aboriginal communities, which are home to a growing number of small- and medium-sized businesses in the sector.

Signing of the agreements is an important step in the acquisition and sharing of technical knowledge in the fields of forest operations, silviculture, transportation, primary and secondary transformation, and bioenergy.

At the signing event, which took place at the Native Museum of Mashteuiatsh, FPInnovations' President and CEO, Pierre Lapointe, emphasized the importance of the agreements, and how innovation plays a pivotal role in developing the local and regional forest sector and creating new businesses and jobs.

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