

spring/summer 2019

# IMPACT

MAGAZINE BY FPINNOVATIONS

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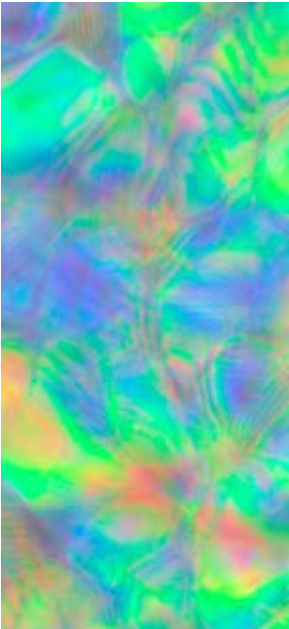
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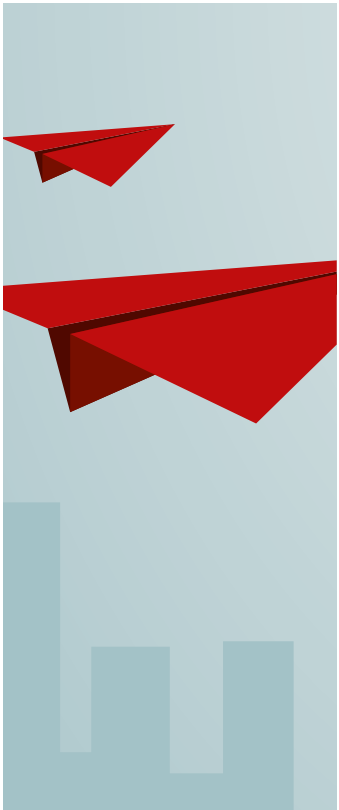
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# MESSAGE FROM STÉPHANE RENOU

***Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow.***

— William Pollard

Welcome to the spring/summer edition of Impact magazine.

So much has happened over the last year, and I couldn't be prouder of the team here at FPInnovations. We've been taking big leaps forward towards a re-centred FPInnovations whose focus is to support the growth, advancement, and competitiveness of the forest industry through innovative solutions delivered at speed.

Societal and economic circumstances are changing rapidly, and in response, we have adapted our value proposition to our stakeholders' needs. Our focus remains on:

- Creating an environment that fosters collaboration, co-creation, and the exploration of innovative ideas for the forest industry, within and outside of its current markets, and
- aligning our priorities with the forest-based industries across Canada to develop tangible solutions that directly address the forest industry's key needs and issues.

In the past few months, the Pulp, Paper, and Bioproducts membership model has undergone a major makeover to adapt to the new economic realities. We've also sat



down with our Forest Operations and Wood Products members to better understand how we can improve the membership model for them... Stay tuned, we'll have exciting news to share with you over the next few months!

## **What do these changes mean to you?**

It means a new intellectual property approach centered on the benefits for members and partners as well as more flexibility in the investment options to simplify and speed up interactions.

It means driving innovation together, openly and collectively. We are firm believers that our strength lies in our shared knowledge and expertise.

It means we'll be applying the new discoveries and technologies to your operations through impactful solutions delivered with speed and excellence.

It means initiatives and collaboration with new external and non-forestry markets that will allow us to speed up the development of our knowledge by becoming familiar with technologies that are novel to the forest industry.

It means that the solutions we collectively come up with will have a positive impact on our members, partners, the forest industry, Canada, and the world!

## **What the future holds**

Our strength is in our thirst for excellence, the talent of our team, and the deeply held passion for the work we do every day. It is what drives us to continue seeking out innovative solutions and embarking on new areas of growth.

Together, we have the power to deliver on new opportunities that can open doors to extraordinary innovations while supporting the Canadian economy and thinking of our planet's best interest.

*We've been taking big leaps forward towards a re-centred FPInnovations whose focus is to support the **growth, advancement, and competitiveness** of the forest industry through innovative solutions delivered at speed.*

Expectations are high for FPInnovations and they should be. We are committed to exceeding these expectations every day because we seek to deliver a better tomorrow.

I invite you to explore this edition of Impact magazine and read about our latest collaborations and innovations. This is our Impact.

Happy reading!

A handwritten signature in black ink, likely of Stéphane Renou.

Stéphane Renou  
President & CEO





# PAVING THE WAY FOR TRUCK PLATOONING IN CANADA

In November 2018, FPInnovations and its partners took truck platooning research to a new level. Their successful testing of a revolutionary technology earned a page in Canadian history as the first truck platooning test on Canadian public highways, and the first in Canada—and quite possibly in the world—in a forest environment.

forest operations





As a part of FPIInnovations' ongoing flagship initiative, Forestry 4.0., truck platooning is helping advance the Canadian forest sector by leveraging the agility and power of the fourth industrial revolution. Currently, the research and development focus of the platooning technology is twofold: First, improving fuel efficiency and decreasing tailpipe emissions. Second, reducing the number of drivers needed by transport companies and attracting the next generation of workers. The hope is to remediate the chronic shortage of skilled drivers that has plagued the industry for years and is showing no signs of abating.

### Emerging vehicle technology

The platooning technology was developed by Auburn University's Department of Mechanical Engineering, the research leader in autonomous vehicles and highway platooning. Trucks travelling in convoy are linked by a computer system that maintains the desired distance between the trucks, controlling acceleration and braking. A dedicated short-range radio communications protocol approved for communications at high speeds is used, as well as a multitude of integrated sensors in the vehicle for GPS, wheel speed, and engine torque.

Potentially improving driver safety, the system reacts quicker than a typical human driver and never becomes tired or distracted. The technology enables trucks to travel at distances much closer to one another as compared

with a driver in command. Consequently, aerodynamic drag for the following truck is reduced, decreasing fuel consumption by 5% to 10%.

### Highway vehicle platoon trial

FPIInnovations' PIT Group, in collaboration with Transport Canada, Auburn University, and Minimax Express Transportation, led Canada's first-ever on-road commercial vehicle platooning trial. Successfully tested on highways in the United States, where platooning is already legal in several states, testing had never been done in Canada. It was also the first time a platoon had driven in a combination of rain, ice, and snow. Travelling on approximately 1000 km of public highways around Quebec with regular vehicle traffic, the two heavy-duty transport trucks used during the trial decoupled at highway entrances and exits, and maintained a minimum distance of 20 m between them, allowing passenger vehicles to safely cut in between the trucks.

The team was thrilled with the trucks' performance during the trial. The automated braking and acceleration worked well in the changing road conditions and the system reacted properly to vehicle cut-ins. "This test is

another example of PIT Group's leadership in the testing and integration of new technologies," says Édouard Proust, a PIT Group engineer. "We're very pleased with the preliminary results and we're convinced they will lead to other breakthroughs in this field in the near future." With the success of the first highway platooning tests, PIT Group will continue testing the technology on highways as well as on forest roads.

### Introducing platooning on forest roads

FPIInnovations led a second trial to demonstrate the potential of the platooning technology on Canada's forest resource roads. A joint research project with Transport Canada, Auburn University, and Resolute Forest Products, this trial signalled the beginning of a transformation of log transportation on a scale not seen in decades.

The tests took place in Rivière-aux-Rats, Quebec and involved two platooned trucks hauling logging trailers on resource roads between a Resolute Forest Products logging site and the company's sawmill 75 km away. This was the first time a platooning system was tested under a thick forest canopy and on gravel roads. The trial is essential for determining the impact of harsh forest environment conditions with dust, switchbacks, steep slopes, sharp curves, and dense forests on the communications systems between the trucks.

"To the best of our knowledge, no other company has tested platooning in a forest environment," claims FPIInnovations lead forest engineering scientist, Francis Charette. "As a respected non-profit forestry research and development organization, FPIInnovations is ideally positioned to bring together specialized research organizations and commercial industries to further the common goal of introducing platooning on forest roads."

**"WE'RE VERY PLEASED  
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Thanks to these performance tests, the team gained clarity on how the platooning technology can be inclusive of forest operations by identifying, and now addressing, technology gaps in the data.

### Paving the way towards autonomous vehicles

Innovation is key to a competitive forest industry in global markets. FPInnovations initiated not only innovative technologies, but also innovative partnerships for the well-being of the sector's future. Transport Canada is a vital partner in these projects. Although testing the technology is permitted in certain provinces such as Quebec, platooning is still illegal on Canadian roads at this point. Following the feedback

from these preliminary tests, Transport Canada will be circulating a proposal for developing national safety guidelines for truck platooning trials. "We believe the testing we performed in conjunction with our Canadian partners

helped us move forward in validating the technology," says Auburn University professor of mechanical engineering and director of the GPS and Vehicle Dynamics Laboratory, David Bevy. "Specifically, it provided us with



Photo credit: Auburn University

a unique opportunity to test in conditions that were new to us and we're grateful for the assistance of Transport Canada and FPInnovations."

While the trials had drivers at the wheels of the trucks, the vision is to have one driver operating the platoon from

the lead truck. Autonomous vehicles are several years away from being a reality, but testing the technology in real-life conditions is a first step in the right direction. "We begin with acceleration and braking to pave the way towards autonomous trucks,"

notes Charette. FPInnovations will build upon the results of these trials and continue pioneering truck platooning research in the hopes of one day implementing the technology on Canadian highways and forest roads.

**TRUCKS TRAVELLING IN CONVOY ARE LINKED BY A COMPUTER SYSTEM THAT MAINTAINS THE DESIRED DISTANCE BETWEEN THE TRUCKS, CONTROLLING ACCELERATION AND BRAKING.**



## DEVELOPING, DESIGNING, AND IMPLEMENTING SOLUTIONS TO ADDRESS THE CHALLENGES OF THE ENTIRE VALUE CHAIN



Drawing on expertise acquired over the past 100 years, FPInnovations deploys solutions that make it possible to solve your most difficult operational challenges.

**Contact our experts today!**

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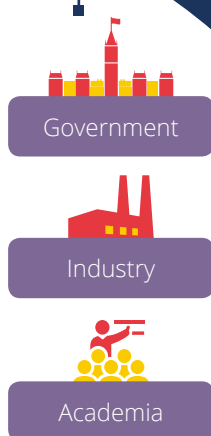
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# DIGITAL TWINS FOR FORESTS:

How can **virtual reality** improve forest operations' operational performance and land-based resource management?

3 AUDIENCES



80

students from the UBC Faculty of Forestry use **virtual reality** as a learning tool.

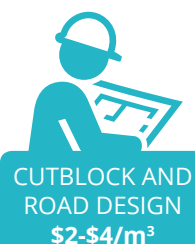


## TIMBEROps

A powerful visualization tool that combines spatial information and **big data** on one visual map

**VISUALIZE** individual trees, canopy heights, topography slope, and **tree species**

**INTERACTIVELY SURVEY** regions, **design cutblocks**, and roads



## TARGETED BENEFITS (\$/m<sup>3</sup>)



FPInnovations would like to acknowledge the financial support of the Province of British Columbia and the federal government.

## MANAGING WETLAND ROADS IN A CHANGING CLIMATE

In a fast-shifting climate, building roads across wetlands and using them in frozen conditions can no longer be relied upon, as this poses environmental and operational challenges. The Roads and Infrastructure group recently released four new YouTube videos that provide practical information on planning, constructing, and maintaining well-performing roads. Combined with *Resource Roads and Wetlands: A Guide for Planning, Construction and Maintenance*, which was published by FPInnovations and Ducks Unlimited in 2016, the six-minute videos help the industry meet wetland protection regulatory requirements and achieve sustainability components of forest certification standards. "They also provide practical training resources for staff who may not have time to read lengthy reports," says senior researcher Mark Partington.

You can download the English version of the guide, or order printed copies at [resourceroadswetlands.fpinnovations.ca](https://resourceroadswetlands.fpinnovations.ca).

### VIDEO QUICK TIPS

#### Planning Considerations

If a wetland must be crossed, make sure to consider its characteristics: see if surface or shallow subsurface water is present and whether the water flow is vertical, lateral, or a combination of both.



#### Geosynthetics

Improve the structural performance of resource roads and support the vehicles that use them with geosynthetic technologies: geotextiles, geogrids, and geocells.



#### Alternative Road Construction Materials

The availability and effectiveness of aggregate or on-site materials can highlight the need for alternative road construction materials: corduroy, temporary access mats, and lightweight fill can all be helpful.



#### Managing Surface and Shallow Subsurface Flows

To make provisions for water movement and drainage, consider using common techniques like culverts, corduroy, log bundles, and aggregate mattresses.



forest operations



# THE 411 ON THE FOREST CARBON SINK

**The scientific community is abuzz with talk about sinks—the kind you have to step outside and be with nature to see. Carbon sinks are components of the ecosystem that capture and store more carbon dioxide (CO<sub>2</sub>) from the atmosphere than they release.**

forest operations

Natural carbon sinks include oceans, trees, plants, and soil. Trees capture CO<sub>2</sub> in the atmosphere and convert it into carbon through photosynthesis. Stored carbon is environmentally neutral, which is just one reason why forests and forest products are our allies in combatting the effects of climate change and in achieving climate-change mitigation goals.

FPIInnovations is collaborating with a network of research scientists and government officials in the Working Group on Forests and Climate Change (WG FCC) to report on emissions and carbon stocks in land use. The group is modelling three options through which the forest industry can contribute to greenhouse gas (GHG) reduction: more intensive forest management, developing a market for bioenergy, and a combination of both.

“We have to move beyond conventional ways to reduce emissions,” says Patrick Lavoie, an FPIInnovations senior sustainability scientist and WG FCC leader. “Relying on reducing emissions from transportation, industry, and buildings is reaching for low-hanging fruit. Governments are now looking at drastically cutting emissions and it’s becoming clear that society needs to apply negative-emission technologies to get there, such as bioenergy with carbon capture and storage, and forest-based strategies geared towards products with long service lives.”

By 2030, Canada has committed to reducing its GHG emissions by 30% below 2005 levels. Lavoie says that

a forest-based bioeconomy can become a major player in meeting that target by replacing emissions-intensive products and energy, and moving towards renewable options. This strategy will also allow the forest industry to maximize revenue from every log that’s harvested.

Not all trees are created equally when it comes to CO<sub>2</sub> sequestration. Canada is well positioned with its swaths of boreal forests, which cover 35% of our land mass and make up nearly 10% of the world’s forests, to take the international lead in strategic forest planning to mitigate the effects of climate change. There is debate over whether the iconic towering rainforests covering much of the Southern Hemisphere absorb as much CO<sub>2</sub> as Canada’s boreal forests.

## **What does this mean for the forest industry?**

Lavoie and the WG FCC want to see the forest industry capitalize on Canada’s prodigious forests to increase CO<sub>2</sub> sequestration and to have carbon sequestration in forests and forest products recognized as a way to achieve GHG targets set for 2030 and 2050. “The industry is typically supportive of a more active role in climate change mitigation and governments are increasingly open to considering the forest sector’s contributions,” says Lavoie.

The forest carbon sink offers part of the solution to a man-made global crisis. By intensively managing wood stocks to augment the sequestration of CO<sub>2</sub>, the forest industry will ensure its economic viability while creating a sustainable industry that contributes to reducing GHG emissions.



# GETTING MORE FROM **FOREST** INVENTORY DATA

A partnership between FPInnovations and British Columbia-based Foresight Cleantech Accelerator Centre has produced a best-of-both-worlds technique of generating forest-inventory data, which is now being shared with FPInnovations members and the broader forest sector.

This research project started in 2016, when the two organizations collaborated for the first time, and challenged innovators to find better ways of obtaining reliable and affordable data about what tree species—and with what characteristics—are located within specific forest cutblocks.

The project is an example of an open-innovation approach, in which the best potential solutions to real-world industry challenges are sought from a broad network of innovators, and then fast-tracked towards development. The results are made widely available, rather than being treated as proprietary.

The selected proposal focused not on a revolutionary new technology, but rather on developing a more effective hybrid of two existing approaches, explains Peter Sigurdson, FPInnovations provincial leader for Saskatchewan and Manitoba.

The first is an area-based approach, which links ground-based sampling with LiDAR remote-sensing data on 20 × 20 m grids, to estimate metrics such as tree

diameters and volumes of timber per hectare. The second is an individual tree crown (ITC) approach, in which tree tops are segmented out from LiDAR remote-sensing data and categorized by height and other observable or predictable metrics.

Both have strengths and weaknesses. The area-based approach provides more statistically rigorous results, but a narrower range of insights. ITC yields more data on variables such as species, diameters, and potential log products, but is more prone to estimation errors.

The hybrid approach was applied to LiDAR data from forests spanning 70 000 ha on Vancouver Island and 50 000 ha in the B.C. Interior near Cranbrook. Among the refinements it entailed were diameter equations based on known relationships among tree species, tree heights, and stem densities.

When cross-checked against timber-cruising results on proposed harvest cutblocks, the hybrid approach delivered improved results on metrics including stems per hectare and tree diameter distribution.

The new approach comes with some added cost, Sigurdson acknowledges, but could deliver a richer data set and improve operational planning and returns. It may also contribute to more accurate calculations of sustainable harvest levels, better carbon modelling, and improved forest management overall.

The innovators behind this research were Object Raku Technology and Forsite Forest Management Specialists.



forest operations

## FPDAT II: FLEXIBILITY OF USE AND PRODUCTIVITY GAINS



FPInnovations introduces FPDat™ II, a tool designed to collect and analyze forestry machine performance and production data. We met with Martin Castonguay, Manager, Precision Forestry Group, to find out more about this new version.

### How has the original FPDat version been enhanced?

Compared to the original system, version II is a data acquisition module that shares information with a Windows tablet. This is a more compact and easy-to-install system.



### What needs do the changes address?

Mainly the need for additional flexibility. An optional high-precision GPS receiver and the possibility of working without a tablet mean a wider price range while better addressing needs for various equipment.

### How will these enhancements benefit the user?

FPDat II covers all needs which will simplify equipment purchases. This means a lower purchase price for many types of equipment that do not require a complete system like FPDat I.

### What is the impact of FPDat II on harvesting operations?

We noted productivity gains in the range of 5% to 15%, which could translate into additional annual revenue from \$50 000 to \$100 000 for one harvesting crew.





# IMPLEMENTING COMMERCIAL THINNING WITH CANFOR: SUPPORTING INDUSTRY NEEDS FOR FIBRE SUPPLY IN THE B.C. INTERIOR

As a result of the mountain pine beetle salvage over the last 20 years in the B.C. Interior, wood supply for lumber, pulp, and pellet plants is the biggest challenge that the forest industry faces. Alternative silvicultural systems, including treatments like commercial thinning in second-growth stands, can help provide another source of fibre. Once implemented, they can also mitigate the effects of mid-term fibre availability challenges, such as shift reductions and mill closures.

In the summer of 2017, FPInnovations approached Canfor about using commercial thinning as a tool to help abate its long-term timber supply challenges. Canfor agreed to participate in a one-day commercial thinning workshop that was held in the fall of 2017. Two FPInnovations research scientists, Philippe Meek and Ken Byrne, and two scientists from the Canadian Wood Fibre Centre (CWFC), presented the merits of commercial thinning in second-growth stands. Workshop participants included Canfor staff, representatives from the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development, licensee holders, indigenous communities,



and logging contractors. In early January 2018, Canfor asked FPInnovations for assistance in identifying stands that would be good potential candidates for commercial thinning. In March 2018, FPInnovations assisted Canfor staff in selecting its first set of cutblocks for thinning. “We reviewed several cutblocks on the ground with Canfor and their foresters, and ultimately selected a number of them,” says Byrne, Manager, Resource Management. “In August 2018, for one of the cutblocks, we helped Canfor implement operational strategies on how to get its contractor working effectively for commercial thinning.” Since then, the contractor has harvested a total of three cutblocks. In February 2019, he also made a presentation to over 400 professional foresters in northern B.C. at the Northern Silviculture Committee’s annual conference on his positive experience with commercial thinning.

The CWFC has helped FPInnovations promote the use of commercial thinning as a tool to help mitigate the mid-term fibre supply challenges. It has also worked with some licensee holders in regards to modelling the effect of commercial thinning on the allowable cut of some timber supply land bases. With the success

of this program, Canfor estimates that there are at least 1 million cubic metres of similar-type stands that are available for commercial thinning, and it intends to expand its program with this type of partial cutting. It’s a good example of how FPInnovations and the CWFC provided a successful outcome for the industry.

In addition to its collaboration with Canfor, FPInnovations did a similar type of scoping and implementation with West Fraser. “We’ve also acquired some new forest operations members in the B.C. Interior, including Carrier Lumber Ltd.,” Byrne notes. “One of their expressed interests is to go through a similar survey implementation

process with us. We now have a systematic approach for achieving successful outcomes when we engage with companies who are interested in commercial thinning.”

FPInnovations has already done a sort inventory of appropriate stands. Depending on the companies’ objectives in terms of piece sizes and harvest volumes, FPInnovations will develop selection and layout processes for them to implement. “We also assist them with on-the-ground operational guidance on how to give operators instructions and ensure that the results are supervised, so that they get what they initially planned out of the cutblock,” Byrne adds.





# ECO-FRIENDLY BUILDING INSULATION FROM THE FOREST

The renovation near Collingwood, Ontario added a 2-storey contemporary addition to a 150-year-old pioneer house.

Imagine a renewable, sustainable, and environmentally responsible insulation product—made from wood.

FPIInnovations, member-company 475 High Performance Building Supply, and the Canadian Wood Council partnered with the builders of three residential projects in 2018 that met Passive House standards to demonstrate the versatility of wood-fibre insulation panels. Contractors used the insulation panels for a renovation project near Collingwood, Ontario that added a two-storey contemporary addition to a 150-year-old pioneer log house, as well as for a Saskatoon, Saskatchewan co-housing project that consisted of a nine-unit townhouse development. The third project was a single-storey, prefabricated house in Gibsons, B.C. that met LEED Platinum standards.

FPIInnovations, 475 High Performance Building Supply, and the Canadian Wood Council collaborated on the wood-fibre insulation project to attract Canadian manufacturers, which would accelerate the product's adoption, and add a potential new revenue stream for FPIInnovations' forest operations, wood products, and pulp and paper members.

"Getting the homes built is a unique opportunity to demonstrate to the wood products and building industries that these panels can join existing insulation products in the market while benefiting the environment

and creating new jobs in the forest sector," says Jieying Wang, an FPIInnovations building scientist who's monitoring the product's performance.

***"WOOD-FIBRE INSULATION  
PANELS COULD BE AN  
EXCELLENT  
TRANSITION  
PRODUCT  
FOR MILLS."***

For the project, contractors used wood-fibre insulation panels imported from Europe to insulate exterior walls and roofs. The three partners believe the panels can be manufactured in Canada less expensively than in Europe, with R-values equivalent or close to those of some commonly used rigid foam panels.

"They're an effective envelope and higher value-added wood product. They also offer the Canadian forest sector another opportunity to incorporate wood in buildings, as well as add margin to some of the lower-value residuals from sawmilling, salvage, and solid-wood waste streams," says municipal technical manager of Wood WORKS! B.C. and the Canadian Wood Council, Peter Moonen. "The initial stage of the manufacturing process can be done using much of the same equipment used to make newspaper and pulp, and could be an excellent transition product for mills."

wood products

## Superior performance

FPIInnovations designed tests to determine the fire safety, stability, durability, and insulation values of the panels. Wood-fibre insulation demonstrates superior fire performance compared to polymer foam insulation and the panels also show superior moisture properties.

"Wood-fibre insulation offers a carbon-storing material that is also extremely durable. Manufacturing this insulation in North America will significantly decrease its cost while increasing its availability, which will help lead a transformation of the construction industry towards delivering high-performance low-carbon buildings," says western regional manager of 475 High Performance Building Supply, Lucas Johnson.

The panels are made of refined wood chips and shavings. The resulting fibre is dried, mixed with polyurethane adhesive and paraffin, sized to desired thickness, and cured. Wood-fibre insulation is considered to have

negative embodied carbon because the pressed-wood fibres trap and sequester carbon for the life of the building.

"Dry process wood-fibre insulation panels are the future of building insulation in Canada because we have the natural resources and industry to produce them economically," says former lead FPIInnovations scientist, Bob Knudson, who spearheaded the project and has recently retired.

The future of building insulation could already be here.

Wood-fibre insulation panels were attached to the exterior of 2 x 6 insulated load-bearing stud walls in the Radiance co-housing project in Saskatoon, Saskatchewan.



The interior of the Gibsons, B.C. home showing wood-finished walls and expansive windows.



# WOOD & WELL-BEING

Touted as the leading construction material for tomorrow's sustainable cities, wood is recognized as playing a key role in sustainable development and reducing the impacts of climate change. But that's not all. Mounting research now supports the health benefits that wood has on humans, even reducing stress responses in both the autonomic nervous and endocrine systems. These benefits have fostered a collaborative effort to incorporate wood into the structural and architectural design of buildings.

In 2017, six research and innovation centres, including FPInnovations, gathered to form the Woodrise International Alliance to position wood as the leading construction material. Joined by new members in 2018, the alliance prepared and launched the international roadmap on mid-rise and tall wood buildings. Today, FPInnovations and Institut Technologique FCBA are co-organizing *Woodrise 2019*—the second world congress on mid- and high-rise wood buildings in the fall of 2019 in Quebec City.

*Woodrise 2019* will provide solutions supporting the worldwide development of innovative wood building designs. International attendees will hear industry experts discuss topics such as seismic risk prevention in wood buildings, and the impact of wood on the quality of life and comfort. The trade show will showcase the latest products while the business-to-business, or B2B, meeting platform will provide an opportunity to network and develop strategic partnerships with leading industry professionals. The final two days of the congress will feature tours of recently constructed wood buildings and industrial facilities.

read  
more  
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## BRIDGING THE GAP BETWEEN OLD AND NEW: ONTARIO'S NEW WOOD BRIDGE RESOURCE ROAD



The Petawawa Research Forest, the oldest of its kind in Canada, influences forest policy, industry, and silvicultural and private forest management practices. Recently, a culvert system failure impacted the movement of forestry vehicles and research teams, while also disrupting water

flow and habitat. Collaborating with various partners and stakeholders, FPInnovations designed a modern, single-lane bridge constructed of engineered wood products (EWPs).

As an environmentally responsible and renewable resource with many other practical benefits, advanced EWPs were the chosen material for the Centennial Bridge. Lighter in weight than concrete or steel, timber significantly decreases transportation costs and seismic load during earthquakes. Prefabrication speeds up installation and also has positive financial, noise, health and safety, and environmental benefits.

The Centennial Bridge is an excellent example of the positive impact new EWPs have on the development of modern forest access bridges. It demonstrates that timber bridges can be compatible with Sustainable Forest Licence needs, while maintaining similar or more economical total installation costs than bridges constructed from steel.

## CANADIAN CLT HANDBOOK AN UPDATED VERSION SOON AVAILABLE

Cross-laminated timber, or CLT, has played a major role in sustainable construction of mass timber buildings in North America. The first edition of the Canadian *CLT Handbook*, published in 2011, helped expand the knowledge base required to design taller and larger buildings that are beyond the boundaries of the acceptable solutions in building codes.

Additional research performed since then, in addition to substantial regulatory changes, allowed for more wood to be used in the Canadian construction sector, highlighting the need for a revised version of the handbook.

FPInnovations is now pleased to announce the forthcoming publication of the 2019 Canadian *CLT Handbook*. All chapters have been revisited and a new chapter providing a design example of an 8-storey mass timber structure has been added to provide architects, designers, and builders with state-of-the-art information. The updated version will be available in the coming months—stay tuned to get your copy!





# INTRODUCTION TO WOODRISE 2019:



## AN INTERNATIONAL EVENT YOU DON'T WANT TO MISS!

This fall, from September 30 to October 4, Quebec City will host *Woodrise 2019*, the second world congress on mid- and high-rise wood buildings, with the theme of “Building our cities for future generations.” Wood construction stakeholders, decision makers, and professionals from around the globe will come together and share their expertise to position wood as a leading construction material for tomorrow's sustainable cities. After the huge success of the first *Woodrise* congress, held in 2017 in Bordeaux, France, FPInnovations and Institut Technologique FCBA (France) teamed up again to host this second edition in North America.

The event is expected to attract over 1000 attendees from over 20 countries, including official delegations and business professionals from Germany, France, Belgium, and Japan. So far, the represented countries include Austria, Brazil, Canada, China, Czech Republic, France, Germany, Italy, Japan, Netherlands, New Zealand, Norway, South Korea, Sweden, United Kingdom, and the United States.

Attendees will hear from more than 55 speakers from 17 countries on a wide range of topics. They will discuss the contribution of timber construction to the bioeconomy and carbon market, seismic risk prevention and fire safety in wood buildings, the impact of wood on quality of life and comfort, and emerging markets. The opening keynote speaker, Richard Woschitz, a world-renowned engineer from Austria, will discuss the new 24-storey wood-based building, HoHo, in Vienna. The closing address, delivered by architect Marie-France Stendahl from the Swedish firm White Malmö, will consider how the use of wood impacts the quality of life and comfort in cities built with this material.

*Woodrise 2019* is not a typical scientific conference—it's a technical and business event. Beyond the high-profile speakers, it offers many other advantages, including trade show exhibitions, a business-to-business (B2B) platform, technical workshops, and technical visits to various Quebec companies involved in wood manufacturing.

By participating in the trade show and B2B event, participants can showcase their newest products and connect with industry decision makers. The B2B platform provides a chance to meet potential partners and engage in discussions to assess the feasibility of sharing projects. All registered participants, including FPInnovations members and *Impact* readers, can get a B2B appointment on either October 1 or 2 and connect with companies from around the world.

The six technical workshops on October 2 will cover a wide range of topics: acoustic and vibration performance; prevention of seismic risk; fire safety; forest resources and wood products; the Asian construction market; and durable building enclosure design.

On October 3, the technical visits will offer tours that provide a first-hand look into wood manufacturing east of Quebec City and wood buildings in Quebec City and Montréal. On October 4, the tours will be in the Quebec City Area and will look into wood structure and systems manufacturing, as well as wood buildings. There will also be a technical and scientific tour of the FPInnovations and Université Laval research laboratory.

*“Woodrise 2019 will bring together **international experts in wood construction** and provide an exceptional platform for networking and discussing technological and commercial issues. FPInnovations is pleased to help bring such an event to Canada and demonstrate our commitment to **solutions that will shape the future** of our built environment with a view to sustainable development.”*

*Stéphane Renou, President and CEO, FPInnovations*

Register now at  
**woodrise2019.ca**



# FPINNOVATIONS' SAW TEMPERATURE SENSOR CUTS INTO THE MARKET

The recent innovation of a saw temperature sensor represents a huge advantage for sawmills by offering real-time feedback of saw performance data. Designed, prototyped, and tested by FPIInnovations' Advanced Wood Manufacturing group, the technology accurately measures the temperature of a circular saw blade during cutting to help predict saw performance issues.

## Sensor technology

The sensor technology monitors and controls varying sawing parameters key to performance. Measuring the difference in the saw rim and eye temperature directly affects saw stiffness and sawing performance. With this data, cooling capacity of the guide lubrication system can be quantified, helping mills determine the supply of water and oil to the guide system and whether too much heat generation or too little cooling is the cause of sawing issues.

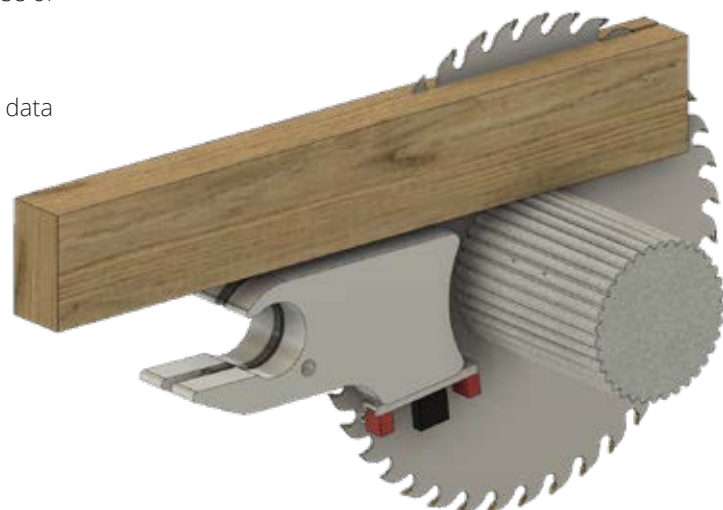
The sensor technology wirelessly transmits the data to a computer to display temperature changes over time. The sensors can be used continuously for day-to-day monitoring of saw temperature or installed when needed to troubleshoot a problem.

## Sawmill benefits

Trials in several mills confirmed that monitoring saw temperature provides valuable information to diagnose sawing and lubrication issues, significantly benefiting mills. Operating costs can be reduced and revenue can be increased by:

- Reducing oil usage by up to 40%
- Increasing mill speeds and production
- Improving chip quality
- Lowering maintenance costs from reduced oil and water flow
- Reducing unpredicted saw changes
- Improving the efficiency of the guide lubrication system

Now commercially available, the technology can be applied to both circular saws and bandsaws.



# NEXT-GENERATION PACKAGING

Let's face it, convenience is king. We're more likely to recycle and compost if we have curbside service and if we forget our reusable grocery bags at home, we can buy more at the checkout counter. But, the actual food we buy is typically wrapped or stored in plastic or polystyrene (PS) foam containers, be it fresh produce or fresh-food containers. FPIInnovations would like to change that.

The company is working on a far-reaching research project to make fibre-based packaging as accessible, reliable, and affordable as plastic and PS foam for food industries serving consumers, from grocery stores to fast-food restaurants. The idea is if it's convenient and cost-effective for industries to switch to fibre-based packaging, they will.

"We want to make a positive socio-economic and environmental impact on the single-use packaging industry," says Tingjie (Gary) Li, a technology and process development scientist. "We're looking at what we have already developed, such as lignin and cellulose filaments, and how we can increase their functionality to develop sustainable fibre-based packaging that meets the market requirements filled by single-use plastic products."

The Next-Generation Packaging project is a collaborative one involving the pulp and paper and bio-sourced products sectors. "We're focusing on a market pull

pulp, paper, and bioproducts

"WE WANT TO MAKE A POSITIVE SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACT ON THE SINGLE-USE PACKAGING INDUSTRY."

project, not a technology push project," says Ayse Alemdar-Thomson, a senior business intelligence scientist. "We've already identified commercial products on which to target our research and we're going to the marketplace, talking to converters, consumers, and brand owners to understand the competitive landscape and technical needs to come up with solutions benefiting the entire value chain."

Fibre-based solutions are currently more expensive than plastic-based ones mainly due to their higher weight per unit of performance. However, on an equivalent weight basis, fibre-based solutions are less expensive. Still, fibre-based solutions need more material than plastics to reach the same performance level. New cellulose materials like cellulose filaments and techniques like fibre foaming could remedy that issue.

The demand for responsible packaging comes from government policies as much as it does from consumers





## Pulp, Paper & Bioproducts Course

October 7–11, 2019

Montréal, Quebec, Canada

Looking to better understand pulp and paper manufacturing and get familiar with the emerging bioproducts industry? This is the course for you!

[ppbcourse.fpinnovations.ca](http://ppbcourse.fpinnovations.ca)

## Applied Tissue Course

November 5 & 6, 2019

Montréal, Quebec, Canada

Join this new course and gain a comprehensive and unique understanding of tissue properties and tissue manufacturing through presentations, hands-on demonstrations, and workshop style learning.

[tissuecourse.fpinnovations.ca](http://tissuecourse.fpinnovations.ca)

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more  
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and retailers themselves. The Business Intelligence team recently commissioned an online survey of 3000 North American consumers about their single-use purchasing habits. Fifty-two per cent of respondents said they refrain from buying products packaged with PS foam or plastic. Sixty-one per cent overall claimed to refrain from buying certain products that they consider to be environmentally unfriendly. This is in step with a growing number of major retailers that have added sustainability to their business strategies, such as an iconic American fast-food restaurant, which has stopped using PS foam, and an international discount retailer, which now charges a fee for plastic shopping bags in its Canadian stores.

### Packaging the future

FPIInnovations is focusing on three technology platforms to narrow the gap between plastic and fibre-based performance: stretchability, barrier properties, and the conversion process. Research demonstrates that a biomaterial-based coating can achieve a high level of water resistance, and a biomaterial film can be chemically modified to produce eco-friendly barriers for oil, grease, and oxygen. Each material has unique properties and the Next-Generation Packaging researchers are combining them to develop fibre-based solutions that are biodegradable and replace petroleum-based coatings.

As for the conversion process, the end-use application must be similar to the existing plastic packaging converting process. “We can’t develop new materials and then have packaging converters change their equipment,” says Li.

“We need to make these new materials compatible with existing equipment. Heat sealability is important for converters in the plastic bag-making process. The first thing they ask is if our material is heat sealable because they don’t want to change their existing process.”

Target products include formable packages, paper cups, plastic clam shells, and multi-material laminates such as potato-chip bags. The sustainability team is looking at the regulatory compliance and compostability side of the equation, while the business development team is lining up industry support.

“We’re identifying potential collaborators in our target markets with which to establish partnerships in our drive to move this project forward,” says Stephan Larivière, a business development manager.

The trend of retailers and consumers reducing their use of PS foam and plastic is well established. FPIInnovations is applying its substantial research capabilities to position its member companies to benefit from the growing movement.







# NEW STRUCTURE FOR PULP AND PAPER AND BIOPRODUCTS MEMBERS A RENEWED APPROACH TO MEET CURRENT NEEDS

The Canadian forest industry, and the pulp and paper sector in particular, have been undergoing major transformations in the past few years. Traditional products are giving way to new ones which, in turn, are opening up new markets. To reach its objectives, the industry must develop new processes and achieve the desired product properties at a competitive cost to customers that are not traditional to the pulp and paper industry.

To mobilize the industry and support its members by better positioning them in those new markets, FPInnovations has undertaken a vast consultation process with its Pulp and Paper and Bioproducts members to better understand the challenges they face, properly target their needs, and identify the changes required to its business model.

The organization is now moving forward and implementing a renewed collaborative structure that is better adapted to the new economic realities to meet and surpass the expectations of its industrial members.

Implementation of the new structure took effect in April 2019 for our Pulp and Paper and Bioproducts members. In parallel, a consultation process is now under way with the Forest Operations and Wood Products sectors to identify ways to improve our value delivery and best serve those sectors.



pulp, paper, and bioproducts

### INCREASED value for members through a better ADAPTED approach

Revision of membership fees to take into account the reality of the various segments of the pulp and paper and bioproducts markets  
Increased competitiveness through highly targeted programs

### FLEXIBLE investment options

Customized technology transfer programs that meet members' needs  
The ability for members to prioritize projects in the collaborative program that are important to them  
New **initiatives\*** program aimed at creating new markets that integrate players from non-forestry value chains to develop new products  
New discretionary fund in which members can use according to their individual priorities

### SIMPLIFIED intellectual property management

Adoption of intellectual property management principles that are in the members' interest and for their benefit  
Management to accelerate and simplify discussions related to the allocation of intellectual property

### IMPROVED consultation process

Publication of a summary document identifying key research priorities  
Improved monitoring of projects  
Faster feedback from stakeholders on research strategy and programs

#### \*Initiatives: a different approach to serve INDUSTRY

FPInnovations plans to implement large multi-year projects in the coming years, in which members will be able to participate on a discretionary basis, and which will also be accessible to external parties who can contribute knowledge and experience from other sectors. These initiatives aim to accelerate development, the creation of new markets, and the marketing of products and processes.



# MODERNIZING PORT HAWKESBURY PAPER'S TMP PLANT: IMPROVING ENERGY EFFICIENCY AND SAVING BIG

Built on several decades of fundamental and applied scientific research, FPInnovations' process knowledge is ideal for optimizing thermomechanical pulp (TMP) mills and their key unit operations, such as screening and cleaning. Fundamental research projects have resulted in a state-of-the-art pilot plant in Port Hawkesbury—a solid foundation for technology transfer.

Port Hawkesbury Paper took advantage of FPInnovations' expertise by using its recent TMP audits to help generate the design for a new energy-efficient process configuration. A series of "fractionation" screens incorporates 1.6 mm holes to selectively remove coarse, long fibres for further development in the high-consistency rejects refining system. A second series of screens utilize advanced technology and narrow slots (0.12 mm) to provide "barrier screening," preventing shives, or fibre bundles, from being accepted.



The advanced process configuration has permitted the decommissioning of several large pumps and opened the door for mainline refiner optimization. "We have completed quality performance audits for many years with FPInnovations and they have guided us on energy and quality projects," notes mill co-manager Bevan Lock. "Our next audit will confirm the project produced all promised results, including a \$1.5 million payback." An annual net energy savings of well over a million dollars, while maintaining or improving quality, demonstrates the value of modernization built on a solid foundation of science.



## INTERACTIVE LEARNING WITH FPINNOVATIONS

FPInnovations' most popular course, the Pulp, Paper, and Bioproducts Course, hit a record attendance in 2018. More than 25 speakers led presentations, discussions, hands-on workshops, and interactive laboratory demonstrations on the building blocks of the pulp and paper industry. The 2018 course also introduced Innovation Day, a platform for researchers to share prototypes of emerging bioproducts such as nanocellulose, lignin, and biofuel.

"The success of the course is based on the high interactivity students have with field experts for each topic covered," explains course director Xuejun Zou. The course will be offered once again in October 2019 at FPInnovations' Pointe-Claire office, providing students with valuable insights from lecturers and scientists with industry-specific knowledge and experience.

### New Applied Tissue Course in 2019

Starting in the fall of 2019, FPInnovations will also be offering an Applied Tissue Course designed to provide a comprehensive and unique understanding of tissue properties and tissue manufacturing. Through presentations, hands-on demonstrations, and workshop-style learning, the course will cover a range of topics featuring:

- Hands-on manufacturing experience on FPInnovations' pilot tissue machine
- Laboratory-based learning on testing tissue properties and improving tissue performance
- Tissue-making process, fibre physics, and tissue performance
- The role of pulp furnish in tissue-making and its impact on tissue properties

For those wishing to enhance their technical knowledge in pulp, paper, and bioproducts, and now tissue manufacturing, check out the calendar of events on our website.





## GROWING THE BIOECONOMY: ADVANCES IN DEVELOPING APPLICATIONS FOR NANOMATERIALS

With technical advances in the field of cellulose nanomaterials such as cellulose filaments (CFs) and cellulose nanocrystals (CNCs), the development of functional forest-based materials could lead to enhanced applications in multiple industries: intelligent packaging, cosmetics, paints and coatings, foods, and advanced electronic and photonic materials, among others.

Forest-based products have long capitalized on lignocellulosic biomass which yields fibres that are processed to meet many different requirements, such as superabsorbent hygiene products, ultrasoft tissue products, or ultralightweight coated paper. Now, new forest-based functional materials have the potential to compete with other materials, based not only on performance, but on the merits of being a CO<sub>2</sub>-neutral,

renewable, and recyclable resource. In addition to cost-effectiveness and product differentiation, the forest industry is considering new technologies to healthily grow and secure long-term, respectable return on investment.

The competitiveness of forest-based materials rests on linking product development with the concept of fibre engineering and selective design by using new technical tools to manipulate and restructure fibres, and their constituents, on as small a scale as possible, including the molecular scale, to add functionality.

Owing to their market potential, a variety of fibrillated cellulose products, including cellulose microfibrils (CMFs) and cellulose nanofibrils (CNFs), have been produced using low-consistency mechanical treatment procedures. However, high energy consumption is required for mechanical fibre delamination at low consistency. To reduce the total energy consumption, numerous chemical or enzymatic pretreatments have been used in conjunction with mechanical processing.

The CF production process, developed by FPIinnovations, has several key advantages compared to CMF and CNF production. CF can be produced at high consistency from all types of wood pulps, bleached or unbleached, without additional mechanical, chemical, or enzymatic

pretreatment. A much higher production rate can be achieved in either continuous multi-pass or batch mode owing to the higher operating consistency. Using commercially available equipment to produce mechanical pulps may reduce the capital cost for commercialization, and has the potential to revive pulp mills that are idle due to market decline in newsprint and other paper grades.

### THE DEVELOPMENT OF FUNCTIONAL FOREST-BASED MATERIALS COULD LEAD TO ENHANCED APPLICATIONS IN MULTIPLE INDUSTRIES.

In contrast, CNCs are produced by only chemical processes. Typically, a strong mineral acid such as sulphuric acid is reacted with bleached wood pulp under controlled conditions of acid-to-pulp ratio, temperature, and time to optimize CNC yield. Neutralization of the acidic sulphate groups introduced onto the CNC surfaces with sodium hydroxide, for example, improves the product's thermal stability. It also allows CNC aqueous suspensions to be spray-dried to provide a powder that is easily transportable and subsequently, redispersible in water or polar solvents.

Canada is well-positioned to lead the world in making serious contributions to devising an economically responsible, science-based agenda for the bioeconomy of the 21<sup>st</sup> century. The potential for creating cellulose nanomaterials with tailor-made functionalities and responsiveness is also remarkably exciting and promising. Significant work lies ahead: collaborative efforts between scientific and engineering disciplines and industrial expertise are essential for overcoming the challenges, and ensuring the development of methodologies for technological success and potential commercialization of the wide range of applications.



## SHINING A LIGHT ON **AWARDS AND RECOGNITION** AT FPINNOVATIONS!



**Erol Karacabeyli,  
Senior Researcher:**

Erol was awarded an ISO Certificate of Excellence for his excellent contribution to the ISO/TC 165 Timber Structures committee since 2010.



**Wei Ren,  
Researcher:**

Wei received the Energy, Recovery, and Recast Best Paper Award (Engineering Division) as well as the 2017 PEERS High Impact Paper Award for his paper "Use of Vent Stack Temperature as a Feedforward Variable for Dissolving Tank TTA Control."



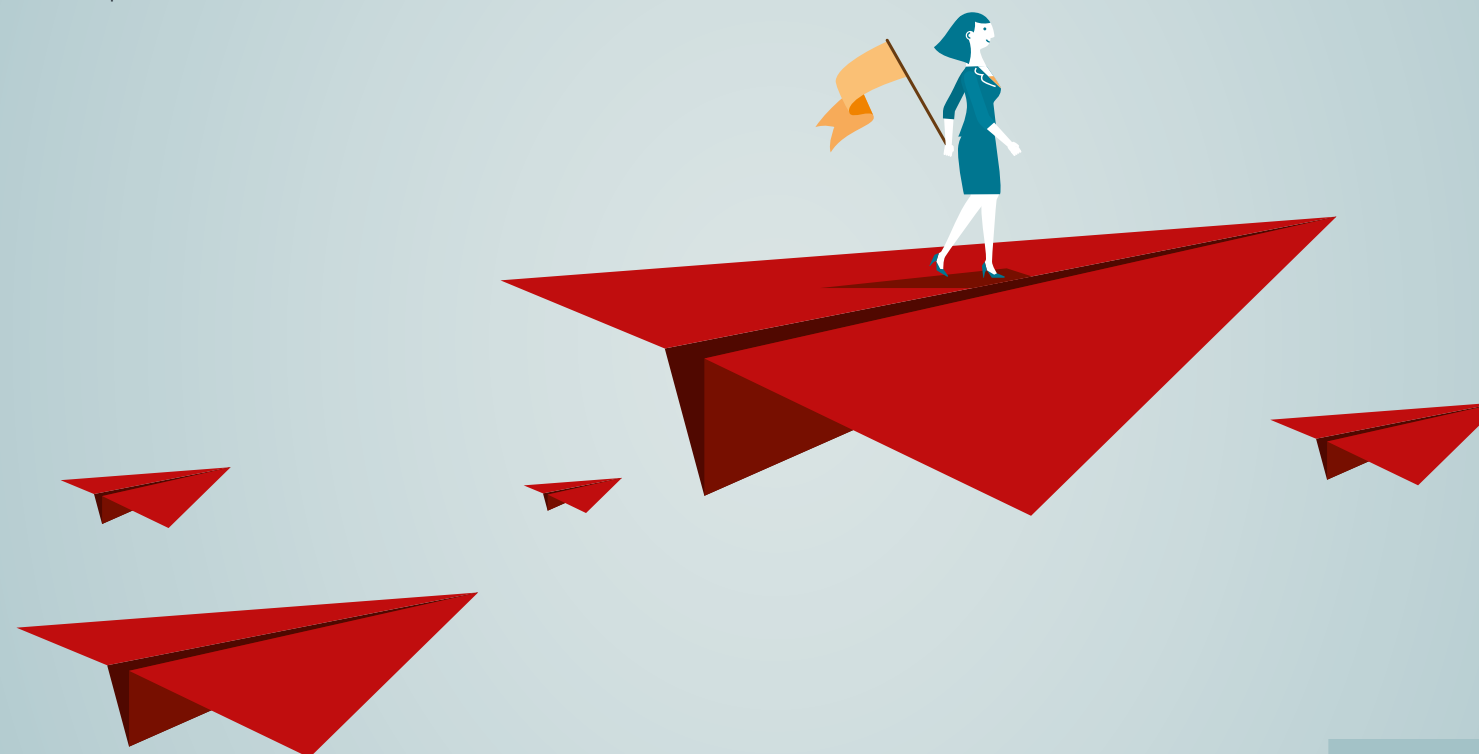
**Hooman Rezaei,  
Senior Scientist:**

A paper co-written by Hooman entitled "Sieving and Acid Washing as Pretreatment to Fast Pyrolysis of a High Ash Hog Fuel" has been accepted for publication in the *Energy & Fuels* journal published by the American Chemical Society. The paper is based on FPInnovations' open collaboration model with CanmetENERGY's Ottawa laboratory.



## SPOTLIGHT ON **WOMEN** IN **LEADERSHIP ROLES**

Women hold a variety of roles throughout the forest industry's many sectors and their contributions are numerous. Within the last several years, women have ascended to top management roles where their perspectives generate new ideas. FPInnovations interviewed two women in leadership roles in the forest industry to learn about their experiences and what motivates them.





# JOANE ST-ONGE

Joane St-Onge joined FPInnovations in 2018 as senior director of sustainable construction and director of the Quebec City laboratory, where she is responsible for carrying out research projects in an innovative environment to meet the needs of the industry. Joane is a civil engineer with over 25 years of experience, including more than 20 years in management in the engineering and construction fields.

## 1 What motivated you to join a company in the forest sector?

Wood has been part of my world since I was a child: one of my grandfathers worked in the forest industry, the other was a cabinetmaker, my father was a carpenter-cabinetmaker, my godfather taught cabinetmaking, and my uncle was a chemical engineer for a large paper mill. Wood has long been in our family's history. I grew up playing with hammers and hand saws, having fun in the sawdust among surface planers, buzz planers, and bandsaws. So the choice to join FPInnovations became a natural one for me, as it gave me the opportunity to combine my technical knowledge in engineering with my passion for wood.

## 2 How would you describe the working environment you discovered at FPInnovations?

It's an environment of innovation where scientists create value for the industry. All the knowledge gathered within one company represents an incredible potential for creation in a world that extends from the forest to the products made from this fantastic fibre. Working and developing in such an environment is highly motivating and stimulating.

## 3 How important is mentoring to you, and do you see yourself as a mentor?

A mentor makes all the difference. People have their own knowledge and expertise; when they open up to others and share their experiences, the whole team's knowledge is enriched. I expanded my skill sets because I was guided. Today, I enjoy sharing my wealth of experience.

## 4 Do women contribute a different approach to their work environment?

Absolutely. The approaches to challenges, business strategies, and relationship management are different and complementary. There's an unparalleled balance that's achieved in teams made up of men and women.

## 5 What opportunities does the forest industry offer women for the future?

There are great opportunities for women with this wind of innovation blowing through the industry. Whether it's the application of artificial intelligence, the development of new materials, or the development of best environmental practices, women are finding their place in our industry.

## 6 What advice can you give to women who want to take up a management position in an industry traditionally run by men?

Believe in yourself. Trust yourself. Persevere. Above all, the real development of your leadership depends on those abilities and the willingness to be true to yourself. That's the key, no matter where you work.



# IRENE PRETO

Irene Preto is pulp and paper company Mercer Celgar's energy manager and operations specialist. Based in Castlegar, B.C., Preto joined the company in 2012. She is a professional chemical engineer and Project Management Professional with management experience in both the government and private sectors.

## 1 Describe your role as operations specialist - capital projects.

I'm the operations lead on capital projects throughout the fibreline. It's my job to ensure that when operators start up the process, they're trained and have the tools and documentation they need.

## 2 Where did you start your career?

I started my career at Natural Resources Canada, working in bioenergy research and providing technical support to economic and policy groups. Seeing the innovative projects being proposed within the industry attracted me to working at a mill. I think it's important for women who support the industry from outside organizations to know that their experience would position them well to work at a mill.

## 3 How would you describe the work environment you encountered at Mercer Celgar?

I had some culture shock when I came to the mill from working in the federal public service. The equipment is super-sized, and the mill is male-dominated and fast-paced with a 24/7 operation. I also entered an environment of teamwork with a greater diversity of disciplines than I had ever seen.

## 4 Have you personally seen the forest industry change since you began working in the industry?

There's been a lot more discussion in the last year about the importance of diversity. This year, on March 8, Mercer International and Mercer Celgar celebrated International Women's Day for the first time. This and the commitment to continued recognition is very encouraging to me.

## 5 Do women bring different perspectives to the table?

Yes, and research shows that diverse teams make better decisions. Active listening and leading with emotional intelligence come very naturally to me and I think this is associated with how we raise girls in our society.

## 6 What advice do you have for women beginning their careers in the forest industry?

Think about being resilient, not perfect. This industry and its processes offer a career's worth of learning, so don't be discouraged if it feels overwhelming. You're not alone; leverage your network when you're taking on new challenges. I've met other talented women in the industry and technically benefited from participating in the PAPTAC alkaline pulping and bleaching communities.





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