Success Stories from Canadian Forests

Stories about people working together to innovatively solve problems in the forest sector

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As Canada marks the sesquicentennial anniversary of Canadian Confederation, we are proud to release the third installation of *Success Stories from Canadian Forests*. This compilation of stories based on innovative thinking and peer-to-peer collaboration are brought to you through the collaborative efforts of the Canadian Institute of Forestry, the Canadian Wood Fibre Centre, FPInnovations, and many other partners and contributors.

Throughout this magazine, we celebrate the role of Canada’s forest sector as a global leader in sustainability by highlighting just a few of the many accomplishments that Canadian forest practitioners have achieved in recent years.

Through the application and implementation of better science and new technology, forest practitioners are involved in important work that is improving both forestry and society. Often, these grassroots initiatives and achievements are not shared, and as a result do not receive the appropriate attention to acknowledge this great work. It is for this reason that we have taken the opportunity to highlight a number of forestry success stories.

We hope that you enjoy reading these short accounts of real successes! We encourage you to share these stories with others and to take pride in the wonderful work that Canadian forest practitioners have achieved over the last 150 years, and their continued dedication to sustainability!

Thank you to the following CIF-IFC staff for their contributions in writing and preparing many of the stories within:

- Natasha Machado, CIF-IFC Extension Forester
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With regards,

Dana Collins  
Executive Director,

*Canadian Institute of Forestry - Institut Forestier du Canada*
Innovation might as well be their middle names. With over 70 years of combined experience, Derek Sidders and Tim Keddy are leaders in coming up with new and innovative ways that assist landowners with their reforestation/afforestation efforts across Canada. They are well versed in the field of forest practices innovation including: partial harvest systems, short rotation woody crops, mountain pine beetle rehabilitation, silviculture practices development, boreal plains mixedwood management systems, and countless other areas.

Working out of the Canadian Forest Service (CFS) office in Edmonton, both Tim and Derek are part of the Canadian Wood Fibre Centre (CWFC), a branch of the CFS that focuses on providing sustainable fibre solutions for forest sector innovation. Not that they are in the office much, they prefer to be out in the field, where all the magic happens. Derek, a Regional Coordinator and Program Manager and Tim, a Wood Fibre Development Specialist, recently established a new group, Silviculture and Bioenergy Solutions. This group focuses on using silviculture techniques to grow more wood that can supply forest product and bioenergy demands. The group works closely with CFS scientists, as well as researchers, forest managers and practitioners affiliated with the numerous universities, governments and industry. These partnerships are key for successful application and adoption of silviculture research by landowners and managers. They are also the first to admit that they can’t do it alone, “Our team also includes Brent
Joss who is a geospatial analyst, developing digital information and valuation systems, and Wendy Mills, who is our nursery grower, and has the ability to grow the right trees for the right application,” explains Derek.

Derek worked in Ontario for several years before joining the CFS, focusing on operations. Tim’s background is in silviculture operations, and forest management planning and delivery in the Maritimes, North West Territories (NWT) and the Prairies. With this experience they have created partnerships in forestry that are focused on scalable usable tools and techniques to meet operational needs of both government and industry. Looking at the challenges of reforestation, Derek and Tim learned quickly that it was important to develop and adapt tools to improve microsite conditions, manage vegetation, and reduce issues with planting stock establishment.

By using developed forest and agriculture techniques, Tim and Derek didn’t have to reinvent the wheel. It also allowed them to get a head start on testing new tools and techniques that could be applied to the forest sector. For example, take the Meri-crusher, one of the innovations that they have brought successfully to the Canadian forest market.

The Meri-crusher, which seems aptly named, is a horizontal bed mixer (it virtually ‘crushes’ anything in the bed) creating a perfect planting spot while limiting competition and enhancing the growing environment. As a diverse application machine, it can be mounted on common prime movers such as an excavator, skid-steer loader or a tractor. Dave Cheyne, Management Forester with Al-Pac Woodlands, adds, “When it comes to the promotion of forest practices and associated tools for reforestation in the boreal forest, Derek and Tim are second-to-none in their zeal, knowledge and conveyance of said products to practitioners throughout the Prairies.”

The Meri-crusher is commercially available. It works similar to a rototiller consisting of high strength, bullet-shaped, carbon-tipped teeth on a horizontal drum that spins at 500 to 700 rpm. The Meri-crusher can operate on forest sites with roots, stones and different surface densities. It mixes litter, humic, and upper mineral soil layers on undisturbed or disturbed forest sites, creating horizontal micro-sites on moderate to well drained sites for softwood or hardwood regeneration.

Tim and Derek strongly believe that people need to see any new tools or techniques before adopting. It is therefore no surprise that they are nothing short of masters in organizing field tours, creating guidebooks, and more recently creating virtual field tours to complement their repertoire. Steeped in a background working with Regional Reforestation Technical Committees (RRTC), which allowed
industry and provinces to recommend to CFS where research needs were in reforestation, Tim and Derek took questions from industry and developed answers. They organized annual bus tours in the western half of Canada, and created an acceptance for applying silviculture techniques and more recently afforestation techniques. They are experts when it comes to knowledge exchange and extension activities: show and tell is second nature to them. If they are in charge of a field tour, it will not simply be a site visit. There will be guidebooks, hand-outs, posters, established trails with fixed or temporary signage in the field, and plenty of time to discuss the presented techniques or tools. Victor Liefers, Professor and past Chair Department of Renewable Resources, agrees, “They understand forestry operations and machines and have a relentless can-do attitude to get things done that end users want. Their field tours are always well-subscribed and successful. In short, I really like working with Derek and Tim.”

In recent years a lot of their effort focused on high-yield afforestation, concentrated biomass and mixed afforestation plantation development, known as short rotation woody crop systems (SRWC). Between 2003 and 2009, they developed protocols to successfully establish sites of hybrid poplar which have been applied to sites all across Canada. The systems were initially developed to address carbon sequestration, biomass for bioproduct development and expansion of the Canadian woody fibre resource through afforestation.

Thanks to some ‘out of the box’ thinking, which is pretty common for the Bioenergy and Silviculture Solutions team, the short rotation work has led to a collaborative project between the CWFC and fertilizer giant Agrium. Like many fertilizer producers, Agrium has a surplus of phosphogypsum, a by-product of the phosphate fertilizer manufacturing process. Rather than contouring the waste, covering the piles, and
seeding them to grass, the team decided to establish a short rotation woody crops system on the piles. After one growing season, the outcomes look very promising. The trees survived the first winter and have shown excellent growth during the first growing season. A successful forest should establish in three to five years. This project might be the first in the world where trees are planted on a rehabilitated phosphogypsum site.

Another area that has recently been addressed is the Mountain Pine Beetle impact on immature stands of lodgepole pine in north central Alberta. Innovative harvesting applications and reforestation systems were developed and demonstrated on over 300 hectares in partnership with Canadian Forest Products Inc. and the University of Alberta. The intention of this work is to recover value, reduce risk to wildfire and continued insect attack, and rehabilitate affected stands.

All in all, it’s no surprise that their work is so successfully being adopted in many different places across the country. Derek and Tim are proof that if you listen to your end-users and add some innovative thinking to the mix, you have a very successful formula in your hands. And even though they have many years of practice under their belts, they have no intention of leaving the forestry world anytime soon.

Phosphogypsum is an industrial by-product created during phosphorous fertilizer production. It is created during the production of phosphoric acid, the main component of phosphorous fertilizer, when phosphate rock is mixed with sulphuric acid.
Turning Tree Bark into ‘Green Glue’

When we think of products derived from tree bark, we often think of birch bark canoes, black ash baskets, cedar mulch or most often the pop from uncorking a bottle of wine. Yet there are millions of tonnes of tree bark residues building up as waste piles near sawmills. The quest for commercialization to use tree bark at a broad scale has proven difficult.

That is until now. Where others saw waste, Dr. Ning Yan saw an opportunity.

Dr. Yan, a professor from the Faculty of Forestry and the Department of Chemical Engineering and Applied Chemistry at the University of Toronto, has spent the better part of a decade thinking about how to better utilize tree bark. Along with the Bark Biorefinery Project team, she is transforming tree bark, a forest industry waste stream, into a green alternative for petroleum-based glues and adhesive. With this innovative, eco-friendly product, capable

Within Canada’s forest sector, bark constitutes one of the largest waste streams. Close to 17 million cubic metres of bark can be found in chip piles.
of playing a role in climate change mitigation, we’d say she’s barking up the right tree!

“When you consider the basic anatomy of a tree, the bark is the first line of defence. Bark has naturally occurring chemicals with antifungal or antioxidant properties, which ultimately protect the tree,” said Dr. Yan. “I just thought there must be an opportunity to make use of the chemical properties of bark, and transform this traditional waste stream into a good product with added value.”

Passionate about the potential of tree bark, Dr. Yan now leads the Bark Biorefinery project. The project focuses on utilizing bark, a residue from forest mills, to develop eco-friendly products with a large market potential. In the simplest terms, various products have been developed through an extraction technique, which removes the chemical compounds from bark, and converts it into adhesives, foams, epoxies, and other industrial materials. One of the most promising products for industrial application is the development of a bark-based adhesive that can be used as a replacement or alternative to conventional glues.

The Bark Biorefinery project is a large-scale collaborative partnership between academic institutions, the public sector and the forest, chemical and automotive industries. The University of Toronto and Lakehead University, received funding from the Ontario Ministry of Research and Innovation, which is matched by private sector and institutional partners. The research outcome will promote the conversion of bark into green value-added products, while enhancing Ontario’s forestry sector and replacing petroleum-based materials.

For the most part, commonly used glues and adhesives for building materials, such as plywood, particleboard, and oriented strand board are derived from fossil fuels—a carbon intensive material and
greenhouse gas emitter. While these traditional glues have served an important role in developing more durable wood products that have allowed for revisions to building codes that accommodate more wood structures, the long-term sustainability of any petrochemical-based product comes into question.

“We’ve seen a lot work focussed on the sustainability of using more wood as a building material, but we haven’t seen as much work on green alternatives for manufacturing materials, like glues and epoxies. We’re creating a product that will make wood products even greener.”

In addition to the environmental benefits of this ‘green glue’, it has also demonstrated performance advantages, and in certain cases, outperforms traditional glues. In collaboration with industry partners, researchers at The Bark Biorefinery performed a pilot extraction to test both adhesives. Martin Feng, principal scientist in the wood products division at FPIInnovations, discussed the results.

“We found that bark-based adhesives could replace up to 20% of the petrochemical-based adhesives using current processing practices. This is all while being cheaper and greener. When tested, bark-based adhesives performed similarly to traditional non-renewable adhesives.”

Researchers at the Bark Biorefinery further collaborated with FPIInnovations to perform an economic analysis looking at the feasibility of producing this adhesive with an extraction plant beside a pulp mill, and if the bark of certain species performed better.
“Our analysis showed that softwood species tend to be better for creating the bark-based adhesive. We are sure there may be species in other countries with unique characteristics suitable for creating glues, but we wanted to focus on typical residues that can be collected from Canadian mills,” explains Dr. Yan.

While the results are positive from the environmental, economic, and performance perspective, large-scale commercialization remains to be a sticky situation. Without a stable source of bark extractives, it is difficult for a company to produce the adhesive, but without the demand for the extractives from a company, it is difficult for a mill to invest in such a facility. This challenge is all compounded by the precarious nature of petroleum prices. With recent drops in the price of oil, the cost of non-renewable adhesives remains relatively low.

For now, the research team at Bark Biorefinery hope to create partnerships between mills and adhesive producers to promote the commercialization of this bark-based adhesive.

“We’ve had some challenges with getting some of these bio-based materials to the marketplace, especially since the drop in oil—there’s been a little less incentive to change,” says Dr. Yan. “But if you think in the long run, the future has to be green. Green chemicals will be the way of the future!”
Fostering Future Forest Leaders

The Prince of Wales Forest Leadership Award

Students pursuing studies in forestry and natural resources management generally have dreams of making a difference—ensuring healthy, thriving, working forests can be used and appreciated without compromising the needs of future generations. The Prince of Wales Forest Leadership Award is about making those dreams a reality, one step at a time.

Geraint Richards, Head Forester for the Duchy of Cornwall, has been instrumental in creating and developing this prestigious Award program. Geraint came to Canada in 2010 to give the keynote address at the Canadian Institute of Forestry’s (CIF) National Conference in Jasper, Alberta. Through an informal ‘think-tank’, Geraint and several CIF members, including Michel Vallee, Mark Kube and John Pineau, engaged in discussions on the many similarities between the forest sectors in Canada and the United Kingdom (UK). They discussed the challenge of increasing youth engagement and recruitment in forestry. With an aging work force and a talented pool of young people eager to gain work experience, all realized the potential to build a unique Award program. With the CIF leading the charge, this opportunity was envisioned to foster the personal and professional growth of future forest leaders in Canada and the UK.

Inaugurated in 2014, The Prince of Wales Forest Leadership Award recognizes students and recent graduates from natural resource management and forestry programs who have a passion for the environment. Award recipients take part in an international work exchange program where two Canadian and two United Kingdom recipients gain summer work experience in the forestry sector in their host country.
It is expected that by 2020, 40,000 new workers will be required to fill a demand in Canada’s forest sector. This Award program is providing young professionals with a leg up as they enter the forest sector.

Award recipients learn valuable, transferable skills, and gain a range of interdisciplinary forestry and natural resource sector experience in policy, planning and fieldwork. When Nicholas Hill, a 2016 Award recipient from the UK, was asked about his work experience in Canada, he explained, “My work was split between City of Ottawa Forestry and the Algonquin Forestry Authority (AFA) in Ontario. In Ottawa, I explored urban forestry in regards to the emerald ash borer where one of my projects was to develop a regeneration survey method for woodlots, which was really interesting. With the AFA, I had a great experience working with the whole company from attending board and silviculture meetings, to learning about tree marking and GIS, to learning about how to geo-reference aerial photographs. It’s been absolutely thrilling to work in a far more complete and balanced ecosystem here in Canada, and it’s amazing to see all of the wildlife and diversity here.”

Nicholas Hill, 2016 UK Prince of Wales Forest Leadership Award Recipient with Mark Burleton, Manager of Grounds and Greenhouses for the National Capital Commission, visiting one of the oldest Red Oaks at Rideau Hall; a gift planted by His Royal Highness Prince Arthur in 1906.

While the scale of forestry is much smaller in the UK, the potential for developing relevant skills outside of the classroom is great. Sarah Townson, a 2016 Award recipient from Canada, gained new skills through hands-on experience in the UK. “It’s one thing to learn about forestry in the classroom and another to learn about it in person. Working for Lockhart Garratt in the UK, I researched and contributed to long-term land use management, which was an amazing experience.”
In addition to fostering personal growth and professional development for students and recent graduates, this Award program is also igniting their passion to seek careers in the forestry sector. As a testament to the success of the program, some students, like David Johnes have decided to stay for further employment opportunities in their host country. “The places we get to work here in Canada are pretty incredible. We get to use helicopters, boats and trucks, and do things I never would have imagined back in the UK. I’ve been to very remote locations that most people would never see, and that’s pretty cool. I’ve made a great group of friends in Port McNeill and I’ve gained new experiences that I wouldn’t have had access to before. I’ve even worked in Bella Bella, in the heart of the Great Bear Rainforest!”

Host employers also benefit from working with the Award recipients, resulting in a successful two-way knowledge exchange. This additional by-product of the program is a positive development that further strengthens the experience of both the participating companies and students.

“Hosting students from the UK through this program has opened our eyes to the type of training that is happening elsewhere,” explains Jonathon Lok, managing partner of Strategic Natural Resource Consultants in British Columbia. “Students like David Johnes have really set the model for us. I have learned that new forestry professionals don’t have to come from a Canadian institute to be a great role model, and we have learned so much from the visiting students that we have worked with.”

Similarly, Jeff Leavey, General Manager of the AFA explains why it was important to get involved with this Award program, “It’s exciting to see somebody from somewhere else with such a passion for forestry. We share similarities and differences between the UK and Canada, and for me on a personal level, it was very gratifying to teach someone new about what we do here at the AFA. As a Crown Agency, it’s very important for us to demonstrate and advocate for sustainable forest management. This Award program presented an opportunity for us to get an
international focus on what we do, and to share it with young people. These students became our ambassadors for spreading the word about forestry practices here in Ontario.”

Award recipients have even provided employers with valuable new management approaches. “I really enjoyed working with Nicholas Hill and hearing his different perspectives based on his experiences in the UK. He gave us some good ideas of how to approach regeneration monitoring and we all learned a great deal from him,” says Nancy Young, City of Ottawa Forester.

As for any employers who might be interested in hosting students, “you won’t be disappointed,” says Jonathon Lok. “The Award recipients I’ve worked with have been top caliber people who learn quickly. We’ve been fortunate in opening our doors, and we’ve gained so much from this!”

The Award program has been well received and has plans to grow and expand internationally. Steps are currently being carried out to expand the program to Australia and New Zealand. “My hope is that we create an ever-growing group of people who are passionate about sustainable forest management and that these people can be the future leaders and executives of our forestry organizations. I’ve got a vision to make this program go as far as we can make it go!” says Geraint Richards.

As core components of the CIF mission, the Award builds and supports young professionals and future forest leaders by providing them with all of the resources required for success. In an increasingly competitive workplace, gaining international recognition as an exceptional student and young professional is an incredible way to begin a career in the forestry profession. 

Award winners receive a bursary of $12 000 CAD and are provided with valuable international forestry work experience. This prestigious Award is endorsed by His Royal Highness the Prince of Wales and delivered in partnership with the Canadian Institute of Forestry (CIF-IFC), the Institute of Chartered Foresters (ICF), the Duchy of Cornwall, and sponsored by TD Bank.

“It’s been an amazing experience to see how forestry is carried out in Canada.” says David Johnes, 2015 UK Prince of Wales Award Recipient working for Strategic Natural Resource Consultants on Vancouver Island, BC.
Pushing Boundaries,
Growing Innovation

Tall Wood Buildings

The University of British Columbia (UBC) is reaching new heights with Brock Commons, the tallest contemporary wood-hybrid building on the planet! Recent technological developments in engineered wood products coupled with changes to building codes are inspiring designers and builders to reach new boundaries. The newly built eighteen-storey (53m) student residence at UBC’s Vancouver campus uses mass timber products from BC harvested wood.

Brock Commons is set to open in September 2017, and will serve as a residence for over 400 students. This building comes at a critical time for UBC, which has been faced with an on-campus housing shortage crisis for several years. “When I saw the plans for this project I was intrigued at the challenge to design a tall wood structure that could be built on a reasonable budget,” says Russell Acton, Principal Architect, Acton Ostry Architects Inc. “This project presents a building solution that is both marketable and competitive; something that can make a genuine change in the industry.”

The structure uses locally sourced sustainable materials that have a much smaller carbon footprint compared to traditional concrete and steel. Brock Commons is comprised of a concrete podium, two concrete cores, and seventeen storeys of mass timber topped with a prefabricated steel beam and metal deck roof.

Glulam (glued-laminated timber) is a timber product made by gluing together pieces of lumber under controlled conditions. Pound for pound, it can be stronger than steel. Glulam is commonly used for structural columns and beams, and comprises a major structural component of Brock Commons. PHOTO CREDIT: naturallywood.com, photographer: KK Law Natural Resource Consultants on Vancouver Island, BC.

Constructed as a hybrid structural system, Brock Commons is comprised of a one storey concrete podium, two concrete cores, and seventeen storeys of mass timber topped with a prefabricated steel beam and metal deck roof.
PUSHING BOUNDARIES

Wood-built structures store carbon and require less energy to heat and cool than traditional materials, making them a sustainable option for construction companies, architects, developers and occupants. Brock Commons is expected to achieve up to 25% energy savings compared to a traditional concrete and steel building of the same size.

Engineered wood products have created a renaissance in tall wood construction by providing alternative solutions. One of these products is cross-laminated timber (CLT), which is made of layers of timber glued together using hydraulic or vacuum presses. CLT is strong enough to support large structures, but much lighter than other commonly used materials like concrete. “Wood is by nature very resilient and flexible, its strength to weight ratio is comparable if not better than other building materials, “says John Metras. “When it comes to CLT, the structure can be pre-assembled and put together very efficiently and quickly on site in a clean and quiet manner, with less truck traffic to the site and less waste to manage as compared to traditional construction projects.”

WOOD IS GOOD!

By using wood, the impact is a reduction of 2,432 metric tonnes of carbon dioxide compared to other construction materials. Manufacturing wood products requires less fossil fuel energy, creating less greenhouse gas emissions compared to concrete and steel, which are highly energy intensive materials to produce.

The CLT that was used for Brock Commons was harvested in BC and fabricated in Penticton, BC at Structurlam Products LP. CLT panels are also very forgiving in terms of the quality of wood required to construct them. “The inner area of CLT can be made with lower grade materials, it is a product that can be made out of beetle killed pine trees for instance, as well as other underutilized tree species,” says Erol Karacabeyli, Principal Scientist with Advanced Building Systems at FPInnovations, and Adjunct Professor at the Department of Civil Engineering at UBC. Using locally sourced wood products for this state of the art structure is a win-win scenario for the forest and construction industries.

One of the biggest achievements of Brock Commons is that it follows a repeatable system, similar to a flat slab concrete system. “The parts for this building were pre-fabricated, so you can kind of imagine it like large scale Lego, “says Robert Jackson, Project Engineer, Fast + Epp. “We designed a system that could click together very quickly, and be built very quickly. This project shows that mass timber solutions are a feasible, strong, and cost competitive alternative.”
The pre-fabricated nature not only made it a quick build, but made it a highly accurate one as well. “The precision was amazing, we had an accuracy within 2mm, which made it much easier for installing the mechanical and electrical systems. There is a real aspect of certainty about the precision, and I appreciate that as a designer and architect,” says Russell Acton.

John Metras agrees, “It was surprising to see how well it fit together. Watching that last CLT panel fly into place 6 weeks earlier than expected was amazing. Being able to stand on the top floor and look down the utility conduit openings and see the bottom clearly from the top, with no interruptions or mis-alignment was pretty neat.”

One of the most interesting aspects about modern mass timber products is their expected resistance to fire and seismic performance. Well-designed mass timber structures behave in a significantly different manner in fire conditions compared to light wood frame structures. Thick solid panels, like those used in Brock Commons are slow to burn, charring on the outside at a predictable rate while protecting the structural wood underneath. The strict fire protection methods that were put into place for this project make it safer in terms of life safety, compared to those constructed out of steel and concrete. “Wood is about 1/5 the weight of concrete,” says Erol Karacabeyli. “The demand on a wood building is a lot less than that of a concrete one in terms of seismic performance.” With Vancouver nestled in a seismic hazard zone, building structures that perform well during seismic events makes a lot of sense.

Aside from providing much needed living spaces on campus, the building will also serve as a “living laboratory” where students can research and monitor various aspects of it’s structural design through sensors that have been imbedded throughout. “This new addition has a lot of civil engineering students really excited as many of our professors are using it as an example in teaching,” says Erica Mason, President of the UBC Civil Engineering Club. “We have too many concrete buildings on campus, it’s exciting to explore new...
potentials in sustainable design. Having the tallest wood building in the world being built right here on our campus is really cool.”

With the largest Faculty of Forestry in Canada conveniently located only minutes away, the new campus addition has captured the interest of forestry students as well. “I think this project highlights the forest industry in a positive way. There are a lot of misconceptions about the industry and hopefully this will help showcase that the industry is sustainable and has great practices,” says Riley Fisher, UBC Forestry student and CIF Vancouver Section student liaison. “The biggest hurdle is education. If you start with people who are eager to learn, you can have the biggest impact.”

A 13-storey residential building in Québec is currently the number one contender for the tallest modern all wood condominium structure in North America. Called Origine, and being built by Québec based Nordic Structures, a 10-minute drive from Old Québec City, this building is expected to be 41m tall

The current National Building Code of Canada restricts the widespread use of wood in buildings greater than four storeys. Despite this, ongoing research and development in tall wood structures is taking hold, helping to strengthen the argument that building with wood is a good thing. “Using wood as a principal material is more in alignment with goals regarding climate change as we carry on into the future. Hopefully, the attributes of mass wood will be better recognized as time passes,” says Russell Acton. Projects like Brock Commons help keep Canada’s forest sector competitive while showcasing the benefits of sustainable wood design. 🌲

Brock Commons was funded by Natural Resources Canada, the Province of BC, the Binational Softwood Lumber Council and FPInnovations. The total cost of this project was $51.5 million. PHOTO CREDIT: naturallywood.com, photographer: KK Law

Tall wood buildings are those greater than 10 storeys. The Technical Guide for the Design and Construction of Tall Wood Buildings in Canada was developed in partnership with over 80 experts. It provides design and construction teams with the concepts and background needed when designing beyond the height and area limits currently prescribed by the National Building Code of Canada.
In 1995, Don Ruzicka was looking for a different way to farm his land. When he and his family moved to the farm in 1983, he had viewed the trees as obstacles blocking his equipment. Over time, he began to recognize them as integral parts of his agro-ecosystem. As he put it, “After learning through a course how ecosystems function, we had a whole new perspective. It changed the way that we farm but most of all, how we came to view the land and everything on it.”

For nearly 30 years, Don had partnered with the Prairie Farm Rehabilitation Administration (PFRA), a former branch of Agriculture and Agri-Food Canada to rebuild the ecosystem on his farm. Through this stewardship work, Don planted shelterbelts, wildlife habitat plantings and in 2011, tried a new concept called an eco-buffer.

Eco-buffers are planted communities of perennial species designed to provide specific ecosystem services. They can be established in “nothing” areas, or underperforming and degraded areas on a farm that are not contributing to its successful operation. These areas include fence lines, ditches, wet areas, steep slopes, or patches of marginal soil.

“These areas are bursting with potential, and under the right conditions can deliver ecosystems services for you. Some examples of these services include livestock shelter, crop pollination, pest suppression, and nutrient cycling,” explains Luke Wonneck, a Technician with the Agroforestry and Woodlot Extension Society (AWES) in Edmonton, Alberta.

Large-scale agriculture and the introduction of precision farming have increased agricultural field sizes to facilitate larger equipment and higher yields. This change has decreased habitats within and adjacent to fields, such as naturally occurring hedgerows, woodlots, and wetlands.

Traditional windbreaks or shelterbelts are usually single species rows of trees and shrubs. They provide...
Planted shelterbelts, natural hedgerows, and herbaceous fencerows are three common types of woody field boundaries found across Canada’s agricultural landscape.

well-documented services, such as livestock and farmyard shelter, as well as soil conservation and snow trapping. Eco-buffers offer an enhanced agro-forestry alternative for farmers looking to restore or increase biodiversity on their farm.

“Eco-buffers tend to be planted with greater diversity and density than traditional shelterbelts. The design attempts to mimic patterns found in a natural forest—for example, long-lived “climax” trees, fast-growing “nurse” trees, and shrubs of different sizes are arranged to create a layered canopy. If done well, the result is a dynamic, evolving structure that requires next to no weed control after the first couple of years, while potentially providing a number of additional functions,” says Luke.

The functions provided depend upon the site’s characteristics and the management goals of the landowner. For instance, if a landowner has pollinator-benefiting crops such as alfalfa, sunflower, canola or clover, they might wish to design an eco-buffer to provide habitat for wild pollinators like bees, flies, wasps, moths, butterflies, beetles and hummingbirds. This would involve the inclusion of native woody and herbaceous species with different flower colours, shapes, heights, and blooming periods. Species would be arranged to maximize sun exposure, and clumped together in small groups to facilitate their pollination.

Habitat loss, pesticide use and disease have been linked to declines in native pollinators both in Canada and globally. Eco-buffers are a way of re-integrating pollinator habitat into agricultural landscapes, conserving biodiversity, while providing valuable pollination services for adjacent cropland. Studies in Canada, USA, and the UK, have shown that the yield increases resulting from enhanced pollination services can more than make up for the losses that arise from taking land out of production to provide habitat.
“Each tree, shrub and herbaceous species play an important role in a well-designed eco-buffer. For example, Manitoba maple planted on the windward side provides wind protection for other wind-sensitive species such as white spruce,” explains Luke. “Meanwhile, white spruce are effective at reducing pesticide drift, and can be sited to provide protection for pollinators and pest suppressing insects.”

Eco-buffers evolved out of a century of researching shelterbelts/windbreaks at the PFRA Shelterbelt Centre in Indian Head, Saskatchewan. In the late 1990s and early 2000s, researchers at the Centre began looking for ways to reduce the long-term maintenance requirements of shelterbelts drawing upon high-density hedgerow designs being successfully implemented in Europe and the USA. When funding for the PFRA ended in 2013, organizations such as AWES continued conducting eco-buffer research.

“Don’s eco-buffer at Ruzicka Sunrise Farm was the first eco-buffer in Canada explicitly designed to provide habitat for pollinators, birds and pest-suppressing insects,” explains Luke. “Gary Bank, a former PFRA employee and member on the Board of Directors of AWES, assisted with its design.” Since then, AWES has partnered with various organizations and set up demonstration sites.

AWES designed and planted three eco-buffer demonstration sites last year including, the Edmonton Corn Maze, Gambling Lake, and at the Crop Diversification Centre North. The eco-buffer at the Edmonton Corn Maze was designed to provide similar ecosystem services as Don’s, in addition to absorbing/filtering nutrients and sediments. When asked if the Edmonton site has generated public interest Luke responds, “There is lots of interest in it—we gave a tour this July to over 120 attendees.”

The Gambling Lake eco-buffer with the Nature Conservancy of Canada is already getting volunteers involved in monitoring efforts. Bumblebee boxes were built and shrubs were planted this past year during a volunteer event to measure changes in bumblebee abundance in the area.

The eco-buffer at the Crop Diversification Centre North, a Government of Alberta Research Centre, was planted to provide fruit and nuts among other...
services. Larger species like trembling aspen and bur oak were planted on the northwest side to trap snow in the winter, while nitrogen fixing species were planted near food-producing species to enhance their productivity. Alberta’s Minister of Agriculture visited the site this August.

Although it is still early for the newly established eco-buffers to start providing ecosystems services, Don’s eco-buffer is already showing signs of progress. It has added important pollinator, bird and mammal habitat to his farm without long-term maintenance and weed control.

“So far, we’ve planted 65 acres of our farm with around 100,000 trees and shrubs, building its resilience,” explains Don. “As these plantings developed, the biodiversity of birds also increased.” Bird surveys conducted since 2004 have so far documented 93 species.

Luke agrees with Don. “By creating and enhancing natural habitat through eco-buffers and similar plantings, Don has been able to connect existing wooded areas and riparian zones. This has created corridors for wildlife to pollinate and disperse seed, increasing the habitat’s resilience. Not only that, it’s increased the farm’s resilience by providing ecosystem services and alternative potential sources of income. For example, if Don wanted, he could harvest wood and a variety of non-timber forest products such as fruit and mushrooms.”

Don frequently opens up his farm for public tours, letting people see first-hand the remarkable results of his change in perspective towards trees over the past 30+ years. Through the continued dedication of farmers like him and organizations like AWES, eco-buffers are becoming an increasingly popular way of restoring or enhancing underused/marginal areas on a farm to create more diverse, profitable and sustainable farmlands.
Bottom of the 7th inning. Two outs. Runners on the corners. Pitch count one and one.

The Toronto Blue Jays were tied with the Texas Rangers at 3-3. It was game five of the 2015 American League Division Series. Win or go home. The crowd was already roaring, the Blue Jays trying to cap off a comeback from a crazy inning.

The crowd went nervously silent. All eyes were on Jose Bautista as the pitcher delivered the pitch.

With a mighty swing of the bat a crisp distinctive crack echoed through the stadium. Bautista launched the ball far into the Rogers Centre bleachers. What followed, was the infamous bat flip which sent Canadian baseball fans into a frenzy. Nobody really knows what happened to the bat, but we do know that it was made of hard maple.

All of the household names of the present Toronto Blue Jays have used a maple bat one time or another. In fact, over 75 percent of bats sold to Major League players are now made from maple. This was not the case 20 years ago. It was only when Sam Holman introduced the maple bat to Joe Carter in 1997 that maple became a well-known source for bats in Major League Baseball (MLB).
It all started in the garage of Sam’s Ottawa home in 1996 after meeting with a friend who was also a MLB scout. “They told me that ash bats were breaking too often and asked if I had any solutions,” recalled Sam. After diligent research of wood species and physical properties, Sam decided maple was the answer. Not just any maple, but specifically rock maple which is commonly known as sugar maple. “Only rock maple with a straight grain and minimal flaws can withstand the forces created when bat meets ball.”

After receiving great reviews from the local minor league team on the first few maple bats he crafted, Sam traveled to Toronto and presented the new alternative to Blue Jays stars Joe Carter, Ed Sprague, and Carlos Delgado. The bat hit their sweet spot and the popularity of maple bats has grown steadily ever since. From there, Sam Bat—The Original Maple Bat Corporation was born. Sam Holman’s maple bats revolutionized a century-long industry that traditionally utilized white ash.

To this day, the company could not be prouder that a tree long recognized as a national symbol of Canada is being used to make bats for some of the top players around the world. “It’s absolutely a source of great pride,” says the Arlene Anderson, the company’s President. “For maple, being such a prominent tree species in Canada, to become a standard in baseball and the bat industry is something that we feel honored about.”

In addition to successfully introducing maple bats, Sam Bat remains one of the finest bat-makers in baseball. Sam Bat sells to all 30 teams in the MLB, a number of minor league teams, and professional teams all over the world. Countless MLB star players have used Sam Bat exclusively or at certain times in their career. Big names such as Miguel Cabrera, Barry Bonds, Giancarlo Stanton, and Bryce Harper are all part of the roster.

Once the demand for maple bats exceeded the capacity of Sam’s garage, production moved to larger facilities. After multiple relocations through the years, The Original Maple Bat Corporation found a home in Carleton Place, Ontario where I met up with Sam and Arlene.

Entering the facility, I was greeted by Arlene who I could tell right off the bat was passionate about what the company produces. In his signature overalls, Sam stood up from his desk and offered me a firm handshake. These were the people who shook the traditions of baseball.

Even after 20 years, the company is as dedicated as ever to ensure that they produce the very best bats available. Each piece of cut lumber or also known as a billet, undergoes rigorous grading, testing,
weighing, and processing. It’s expensive, time consuming, and requires master expertise gained over the years, but “If you want quality, you have to invest in it,” explains Sam.

Aside from the best quality maple and expert craftsmanship, the company credits a great part of their success to customization and personalization. “We work closely with the athletes to ensure we deliver what they are looking for,” says Arlene. “Barry Bonds told us that he continued to use our bats because Sam was the first person to give him exactly what he wanted in a bat.”

Sam still maintains a good relationship with many of the players including the all-time home run leader himself. “Barry personally made me breakfast once, and knows that I like my eggs sunny-side-up,” chuckles Sam.

With the increase of environmental issues including climate change and invasive pests such as the Asian Long-horned Beetle and Emerald Ash Borer there are concerns about the future of wood sourcing. “We have noticed changes in when we are receiving the wood,” says Arlene. “If the weather does not allow you to get onto roads, you can’t get into the forest.”

Preventive measures are also taken to avoid wood shortages. “We have a good inventory, with a multiple month supply in case our sources are compromised,” said Arlene. The wood sources, however, are a corporate secret. The company also continues to experiment with different species of wood and have branched out to using ash, yellow birch, and beech for their bats.

In the meantime, bats made from rock maple will continue to be some of the most desired bats for professional baseball players. In this year’s World Series, MLB players from both Cleveland and Chicago including Jason Kipnis, Jose Ramirez and Dexter Fowler were seen wielding a Sam Bat. As long as pitches are thrown on the baseball diamond, maple wood will be there to hit it out of the park. 🏆
Every bat is made from a billet, which undergoes a rigorous grading, testing, weighing, and assessment process. Senior staff then determine the best orientation for the billet. Each bat specification is catalogued into a “bat library.”

**Canadian Maples**
There are ten native maple species in Canada, but only the rock maple can be used for baseball bats. The rock maple is also known as hard maple, sugar maple, or by its scientific name Acer saccharum.

**Ash Bats vs. Maple Bats**
Ash bats were once the most commonly used in baseball. They are generally softer and more flexible compared to maple bats. However, due to their ring-porous structure, ash bats easily flake between their annual rings after continuous impact. Rock maple bats are much harder, and less flexible creating stiffer contact with the ball. As a diffuse-porous wood, maples are more uniform in composition and do not flake.

**Slope-of-Grain and Structural Strength**
Slope-of-grain is the angle in which a piece of wood is cut respectively to the longitudinal axis of the tree and wood fiber formation. A piece of wood will have optimal strength when it is cut in alignment with the axis of the tree and wood fibers. Ink dot tests are conducted to determine the slope-of-grain, which is an important component in the grading process for bats.

**MLB Highlights Set with a Sam Bat**
- **Triple Crown Winner** - Miguel Cabrera (2012)
- **Most home runs in a single season** (73) - Barry Bonds (2001)
- **Most homeruns in a season** (54) - Jose Bautista (2010)
- 12 MVPs
- 4 Rookies of the Year
Willows and Poplars
Alternatives to Traditional Municipal Wastewater Treatment and Opportunities for Bioenergy Production

The cost of upgrading lagoon-based wastewater treatment systems to meet new, stringent wastewater discharge standards can be an expensive financial undertaking for rural communities. Many smaller communities in Alberta and the Prairies operate these systems that do not have secondary treatment. There are also municipalities with advanced wastewater treatment systems looking for innovative and economic ways to use digested biosolids.

For the past 10 years, Martin Blank and Richard Krygier from The Canadian Wood Fibre Centre (CWFC) have researched the use of willows and poplars to use nutrients, otherwise discharged from lagoon-based treatment facilities and to produce bioenergy. Research is growing in favour of the humble willow, which is becoming a cost effective and innovative way of utilizing treated wastewater and biosolids.

“Our research and demonstration program started in 2006 when we established the first wastewater irrigated willow plantation in western Canada, in Whitecourt, Alberta” says Martin, a Wood Fibre Production Technologist with the CWFC, Natural Resources Canada. “My colleague, Richard received funding from the Canadian Biomass Innovation Network and support from Whitecourt Town Council.”

The initial goal of the Whitecourt site and associated research program involved applying treated wastewater and biosolids. “We wanted to know if we could increase woody biomass production by applying wastewater or biosolids on short rotation woody crops like willow and hybrid poplar, without causing any adverse environmental impacts,” explains Martin.
Municipalities and industries quickly became interested in the Whitecourt research site. With funding from Alberta Innovates BioSolutions, four additional sites were established across central Alberta by 2011. Of the five project locations, four are irrigated using wastewater, and one was applied with biosolids.

**What makes willows the ideal species for biomass production and utilization of treated wastewater?** Part of the answer is that willows grow extremely fast; utilizing nutrients and moisture provided by wastewater. A two-year-old willow can reach a height of 15 feet and will regrow vigorously through coppicing after harvest. A willow stand harvested on a three-year rotation can remain viable for up to 24 years on the same root system. Above ground biomass production can increase by 30% with irrigation.

Camrose County, Alberta, is one of the research sites where willows are irrigated using lagoon-treated wastewater. The County was looking for a way to augment their lagoon treatment system while lowering operating costs through bioenergy production.

“We wanted a source of energy that would reduce our environmental footprint. Working with the CWFC and the woodlot management association, we determined that willows were the best species for our needs,” says Paul King, Chief Administrative Officer, Camrose County.

“The willow stand is four hectares in size,” explains Paul. “The project started back in 2010 and is harvested on a three-year rotation. The first harvest took place in 2013 and will be harvested again this winter.”

Camrose County replaced their natural gas boilers with a biomass heating system and the willows heat their municipal building. “The initial costs were quite reasonable, and the willows are very low maintenance for the County,” says Paul.

This approach provides a cost-effective alternative for rural municipalities, like Camrose County, to meet new, stricter standards for the discharge of treated wastewater. The willows also produce a steady fibre supply for bioenergy production and are considered a carbon-neutral energy solution.

Since studying the use of willows to augment existing wastewater treatment, Martin and Richard’s research has branched out to focus on
different crops, methods of irrigation, and soil types. Over 20 organizations from forest industry, to private companies, academia and other levels of government are now involved.

SYLVIS Environmental Services is one of those companies. Since 2013, SYLVIS has worked with the City of Calgary to implement the Demonstration Program for the beneficial use of digested biosolids: with the broad goal of improving marginal agricultural land through amendment with biosolids, and conversion from traditional agricultural crops to willow biomass production. “The goal of the project is to improve marginal agricultural land by applying biosolids, and establishing a productive fallow system with a willow biomass crop,” explains Shawn Northwood, Project Manager.

Located northeast of Calgary, the 405 hectare willow sites are the largest contiguous plantation of willows in North America. Each year the willows add organic matter through leaf litter and fine root mass, incrementally improving the soil while providing a harvested product every three years. Since 2014, 2.3 million willows have been planted annually for a total of 6.9 million willows.

“In the harvesting process, the equipment is matched to the scale of the site. A forage harvester is the primary piece of equipment used in the harvest and is fitted with a specialized header to cut and chip the willows. The ideal time for harvesting occurs in the winter months when the willows are dormant and there is minimal snow.”

Environmental conditions such as severe droughts and hailstorms can affect the soils and make it hard on first year trees. “The challenge is to get them started and give them the first three years to establish the root system. After getting through the second year, they become very resilient and can survive almost anything,” explains Martin Labelle.

Every year, SYLVIS conducts annual site tours for Counties, residents, and government agencies, which in 2016 included support from Martin Blank to engage with the broader biomass production, harvest and use industry. “We see the willow biomass as having a variety of uses, including: as a feedstock for composting, for erosion protection, as animal bedding, or for energy production,” says Shawn.

Martin Labelle agrees, “Woody biomass is a smart solution to utilize treated wastewater and reduce energy costs. We are seeing a push towards alternatives to costly infrastructure upgrades and using willows to help achieve new discharge standards costs a fraction of upgrading current lagoon-based wastewater treatment infrastructure.”
Using short rotation woody crops for the treatment of wastewater is already a well-established practice in Europe. CWFC research is showing this system is also suitable for use in North America.

A forage harvester with a header for willows. PHOTO CREDIT: Craig Evans/FPInnovations

An informal group, known as the Alberta Rural Organic Waste to Resources Network (AROWRN), was formed in 2012, to advance willow and poplar research and technology. Martin Blank, Richard, Shawn and Martin Labelle are all part of AROWRN. The network includes stakeholders from various sectors including municipal government, industry, consulting companies including SYLVIS and Bionera, and College and University professors.

“Dr. Bruce Rutley and the team at the Grande Prairie Regional College (GPRC) Research & Innovation have been instrumental in helping us form AROWRN,” explains Martin.

Public outreach and education is an important part of creating awareness of this research within the sector. “We use a combination of knowledge transfer tools such as field days, workshops and our website to promote this technology,” explains Dr. Bruce Rutley, Director, GPRC Research & Innovation.

AROWRN is also providing support to municipal governments. Huy Nguyen, a graduate student at the University of Alberta built a computer-based decision-making, cost-analysis tool for municipal governments interested in establishing a woody crop plantation with willows or poplars.

When asked where he sees the potential for these systems in the future, Dr. Rutley explains, “We are at a point where within two to five years, this technology could be widely implemented. The research and data suggests that it’s a viable, cost-effective solution for municipalities.”

Martin Blank agrees that this technology can help meet future energy needs, “Over the years, our research is showing that in addition to reducing the amount of treated effluent discharged into rivers, it can contribute to community and industry diversification, and provide new income streams.”

Moving forward, the future applications of this research continues to expand beyond plantations into higher value end uses in pharmaceuticals, biochar, and biofuels. The future remains bright for willows and other woody crops in offering reliable and renewable energy solutions.
The dense canopies of trees make it a delight to stroll through the woods during a hot summer day. Not only is the understory shaded from the scorching sun, but it also feels like the trees are thriving and the forest is in good shape, right?

Not always.

Forest fires consume everything in the surrounding landscape, damage trees and wildlife habitats leaving the area completely barren. Therefore, fire must be put out and avoided at all costs, right?

Not quite.

Initiated in 1997, The Rocky Mountain Trench Ecosystem Restoration Program has been using prescribed fires, mimicking the natural disturbances of the Rocky Mountain trench ecosystem, and systemized tree removal operations to return the landscape to a healthy, open forest grassland habitat. The Trench Restoration Program is the first of its
kind in British Columbia and has since become the model for similar projects in the province.

Historically, the southern region of the Rocky Mountain Trench was low-elevation grasslands, and open forests. Due to lightning strikes and the activities of First Nations people, the ecosystem had adapted over thousands of years to low intensity fire regimes, and was considered ‘fire maintained’. This unique habitat, shaped by disturbances, allowed for wildlife such as elk, deer, and bighorn sheep to thrive. These regular, low intensity fires also prevented forest “fuel” from accumulating, thereby reducing the occurrence of large-scale crown fires. However, the history of fire suppression practices altered the fire regime with unintended consequences for the Trench ecosystem.

Starting in the 1890s, fire suppression became a prevalent practice. The fire activities of First Nations were restricted through the establishment of Indian Reserves, and long-term fire cycles were disrupted. The open landscape shifted through many decades of fire suppression. Open grasslands became treed grasslands; treed grasslands became open forests; and open forests became closed forests, states the 2013 Blueprint Report for the Restoration Program.

“There wasn’t really an ‘Ah-Ha’ moment where people realized it was an issue,” explains Ian Adams, Communications and Outreach for the Restoration Program. “It was an ongoing process that led to many problems.”
By the 1970s, local ranchers and hunters started to notice that foraging sources for domestic livestock were diminishing and competing with wildlife, which led to escalating conflicts between local stakeholders. As grasslands were reduced, habitats were disappearing, forest fuels continued to build up, and forest health declined with an increased proneness to diseases and pests.

Around the 1990s, the multiple stakeholders and resource users realized that the issue could only be addressed together.

“People just got tired of fighting,” says Dan Murphy, Coordinator for The Rocky Mountain Trench Natural Resource Society who was one of the founding partners of the program. “They began to understand that working towards a common goal brought much broader benefits for everyone.”

They agreed that in order to revitalize the area, the landscape would need to be restored to its previous state of grasslands and open forests. And this is how the Rocky Mountain Trench Ecosystem Restoration Program was formed.

Integrating a variety of stakeholders and agencies, the Restoration Program is implemented through the work of the Steering Committee and the Operations Committee. The Steering Committee is responsible for the strategic planning of restoration efforts and the coordination of the public including stakeholders, funders, residents, and partners. The Operations Committee then uses the strategic plans as guidelines for on-the-ground planning and execution.

“The program really functions like a big cooperative organization,” says Dan.

Tree densities are first reduced through the use of harvesting, hand slashing, and mastication (a land clearing method that uses machinery to cut, grind, and clear sites). Local forest companies, First Nations, the provincial government, and others carry out these stand-tending or ecosystem restoration treatments. Employment programs and numerous agencies have provided funding for manpower to implement hand-slashing operations.

“It’s really a collaborative effort where everyone has a part to play,” explains Ian. “For example, the forest companies harvest trees which help achieve the restoration target, while also supporting the local forest industry.”

Prescribed fires are implemented through the collective effort of various groups such as the BC Wildfire Service, local fire departments, and local districts. “The public is especially sensitive when fire is involved, and therefore we need to exercise extra caution,” says Ian. “The Wildfire Service has been exceptional,” adds Dan. “The program would be a major challenge without the help and cooperation from them.”

Through 20 years of restoration efforts, the Rocky Mountain Trench Ecosystem Restoration Program has seen success and improvement to the landscape. There are more abundant natural forage and habitats for wildlife and domestic livestock. Noticeable increases in shrubs have been observed. Risks of severe fires have been reduced through the use of prescribed fires. “We are happy to see these improvements, but by no means is it done,” says Ian. “It’s a continuous process that we try to keep working on.”

The program has had its share of setbacks and challenges. “In recent years, we have seen an increase in invasive species. We initially saw a decline, but they are becoming a real problem,” expresses Ian. Other factors such as climate change and weather conditions are making it harder to plan for and implement prescribed fires.
Overall, the restoration program is a great success story of not just returning a landscape to its pre-existing form, but also the collective effort of many. “The collaboration between so many different groups of people with diverse backgrounds is a big reason behind the success of the program,” remarks Ian. “While every ecosystem and landscape is different, the frameworks and the collaboration of people in the program, can certainly be a reference model for other similar ‘Fire maintained Landscapes’.”

**Forest Fires and Fuel**
Biomass including twigs, branches, slash piles, vegetation, logs, etc. become fuel that contribute to forest fires. Different types of forest fires are classified by the main source of fuel consumption. For example, surface fires typically burn ground vegetation such as leaves, debris, grass and shrubs.

**Landscape of the Rocky Mountain Trench Restoration Area**
The program mainly operates on crown land in the southern region of the Rocky Mountain Trench. This region is a linear valley historically made up of grasslands and open forests. Grasslands included vegetation such as bunchgrass, fescues, sedges, shrubs, and forbs. In this landscape, douglas firs are replacing once dominant fire resistant species such as Ponderosa pines and western larches. The climate is generally warm and dry with a mean annual precipitation of around 500mm.

**Fire Maintained Landscape**
Roughly 250,000 hectares of Crown land are identified as fire-maintained ecosystem in the Rocky Mountain Trench. For management purposes, they are separated into four components: shrublands, open range, open forest, and managed forest.
The Vancouver Island Marmot

Partnership Key to Recovery Success

Stopped by the radio at 4:30 am, after two hours of bumps and jolts, the motley band of biologists tried their best to answer questions about their work on the CB between slurps of coffee. Ahead some piece of heavy equipment laboured in the darkness. A few minutes later, the road clear, their pickup bumped upward again. Now past the active work areas, the road got rougher and narrower, at times so overgrown that it disappeared completely. Once the road ended, the crew hiked up the remaining mountain in the pre-dawn light. Close to the tree line they heard several shrill whistles, like those of a thrush, but not quite. It was a hopeful sign their journey to find one of the world’s rarest mammals would be rewarded.

The team’s destination was Haley Lake Ecological Reserve, an idyllic sub-alpine meadow in south central Vancouver Island. The wildflower filled slopes of the area surrounding Haley Lake were set aside specifically to protect habitat for the Vancouver Island Marmot. “This mountainous region, known as Nanaimo Lakes, is home to the largest and healthiest group of colonies remaining on the planet,” explains Adam Taylor, Executive Director of the Marmot Recovery Foundation.
“Many of the colonies are on property owned by TimberWest and Island Timberlands, who play an active role in the Recovery Program.”

The reserve was originally created in 1987, through a donation of 93 hectares by MacMillan Bloedel, and then expanded in 1991 through the donation of an additional 27 hectares by Fletcher Challenge. Island Timberlands and TimberWest have since acquired the forestry operations of those companies.

Few, aside from forestry workers and alpine enthusiasts, ever come in contact with the elusive mammal. As the only burrowing animals in the Vancouver Island’s alpine and sub-alpine, their burrows are important habitat features for other species. “Amphibians like the Western Toad, reptiles, and alpine pollinators make regular use of their burrows. Similarly, grouse use the excavated soil for dust bathing and grit,” says Adam. “Another reason why their recovery is so important.”

Its secluded habitat is both a blessing and a curse explains Adam, “The remote habitat has buffered them from direct contact with the growing population on Vancouver Island. Yet at the same time it also delayed recognition of their steep decline in the 1990s. It was not until 1997, when many colonies were already lost, that a rescue effort was launched.”

This effort was driven by a partnership between the provincial government, private landowners, and the Toronto Zoo, along with a newly created non-profit to lead on-the-ground efforts, the Marmot Recovery Foundation.

“With the wild population crashing, a team of government, private sector, and non-profit affiliated biologists, identified captive breeding as the best available solution.

“A captive breeding program ensures that regardless of what happened to the incredibly fragile wild population, the marmot would not go completely extinct. However, the goal has always been to support their recovery in the natural habitat by releasing offspring from the captive group,” says Adam.
“When I began, I imagined that working with an array of stakeholders, balancing the different needs and expectations, would be extremely challenging,” says Cheyney Jackson, the Marmot Recovery Foundation’s Field Coordinator. “But what I’ve found is that the different perspectives and resources have been complementary. I believe our Recovery Program is stronger for it.”

Bill Waugh, Island Timberlands Chief Forester, shares Cheyney’s view of the partnership. “We manage our lands to maintain critical habitat,” says Bill. “We’ve learned a great deal through our participation in the Recovery Program, and we feel like we’ve played a part in creating a model that can help other species-at-risk on private lands.”

Through the Landowner Partners Fund, the three landowners—Island Timberlands, TimberWest, and the Province of B.C.—make a financial contribution to the Recovery Program, and the Foundation leverages these funds with donations from the public. “I believe all Canadians have an interest in ensuring that one of Canada’s unique species has a place in our future,” explains Adam. “When the Foundation approaches donors, we get a lot of questions about whether we receive support from the stakeholders—that is the government and private landowners. We’re able to assure donors that they are committed, which goes a long way to getting buy-in for our work.”

The landowners’ support goes beyond money. Working with the Foundation and other stakeholders, they play an important role in stewarding colonies and minimizing impact. They also share expertise, whether in emerging technologies, site access or safety, and help provide key contacts. That has meant donating drone time so the Foundation’s field crew can explore new ideas on effective monitoring methodologies, clearing access roads, reviewing safety plans and providing guidance. “The Foundation is a small organization, and having the support of experts from Island Timberlands and TimberWest has made us more efficient, safer, and more innovative,” says Adam.

Forest workers have also been critical eyes and ears in areas where wandering animals sometimes get into trouble. “Crews have been great about reporting if they find marmots outside one of the colonies,” explains Cheyney. “It’s helped us save a number of them over the years.” This is a species where every individual counts, and some of those rescued animals have gone on to play important parts in the recovery.

With marmots released every year since 2004, completely extirpated populations are now re-established, increasing in numbers from 30 to nearly 200 today. Combined with efforts to conserve and improve habitat, their range has expanded in the Nanaimo Lakes area, and progress has been made towards the program’s ultimate goal.

Marmot Skylar sunbathes in typical sub-alpine habitat preferred by marmots. PHOTO CREDIT: by Mike Lester
The Vancouver Island Marmot is still critically endangered, but the population is doing better than many thought possible 20 years ago. The colony at Haley Lake has blossomed into small colonies on many of the surrounding hills: Butler, Heather, and the aptly named Marmot Mountain.

That trip up to Haley Lake didn’t turn out as hoped. The team didn’t see a single marmot. They heard them and detected them on with radio telemetry, but frustratingly they hid from view the entire day. The forestry workers took the opportunity to rib the biologists on their failure.

It’s okay—they will be there next time.

One of the ways the rodents cope with this intense cycle is by breeding less often. The typical female Vancouver Island Marmot breeds only once every two years, producing a litter of three or four pups.

Thank you to Adam Taylor, Executive Director of the Marmot Recovery Foundation, for telling this story.

The marmots preferred habitat is open alpine and sub-alpine meadows where there is abundant foliage for browsing, and tree cover is swept away by avalanche activity in the winter.

As herbivores, they feed on a wide range of foliage for the five months of the year they are awake.

They enter hibernation in autumn and are one of the few animals that hibernate for longer than they are awake. In the spring, they emerge from their burrows having lost a third or more of their body mass.

Thank you to Adam Taylor, Executive Director of the Marmot Recovery Foundation, for telling this story.
It’s not often a prominent figure in the forest sector calls your team’s research a ‘Game-changer’. To quote James Irving, Co-Chief Executive Officer of J.D. Irving, Ltd., “An example, CFS, the Canadian Forest Service, one of your federal government organizations, has been a good partner in modelling applications of LiDAR. If you’re not familiar with LiDAR, it’s the latest technology. It’s like an MRI that gives you topography and geography, and it’s a great measurement tool. It’s a game-changer.”

Before you read any further, we have to say it is not just our research, but a whole lot of other people who have contributed to the program.

So how did we get to this point where a rather simple technology, invented to provide accurate and instant altitude feedback to pilots, can greatly improve the way the forest sector manages Canada’s immense forest resource?

You have to start back at the beginning. Sustainable forest management of Canada’s vast forest has always needed a cost effective method to provide up-to-date information on what is where and how to access it. This challenge was originally attempted with boots on the ground measuring trees and sketching timber maps with pencil and paper. Then air photos gave an eye-in-the-sky view for more precise surveys and the ability to cover larger areas. Later, satellite sensors provided additional data and better refresh rates. But none of these methods could enumerate 100% of the forest and produce a meaningful, statistically sound forest inventory on a forester’s desktop.

At the Canadian Wood Fibre Centre’s (CWFC) June 2009 workshop, a team of forest inventory experts from around the country touted the ‘ideal inventory system’ as being:

*Fully automated, digital, multispectral, providing tree, stand, and forest-level detail with high quantitative and spatial accuracy and precision, updated on a near continuous basis, available on the desktop—all achieved without the use of contractors, for $1.00/ha or less.*

I contacted Doug Pitt, Research Scientist, at the CWFC in Sault Ste. Marie, Ontario, to provide an
update on how the research community is advancing towards the ideal inventory.

Before Doug started answering my questions he made sure I knew there were a lot of partners and collaborators involved in these achievements.

“When I say ‘we’ I mean a collective we. A lot of partners have been involved in this research including the CFS, universities, forest industry, service providers, and the provinces.”

Almost eight years since that June 2009 workshop, how close are we to the ideal inventory?

“Spatial, 3-D point clouds generated from light detection and ranging (LiDAR) and digital aerial photography (DAP) have indeed reshaped and revolutionized ‘enhanced forest inventory’ (EFI) today, bringing us within reach of our 2009 ideal. Resolutions in excess of one remotely sensed measurement per square metre are certainly attainable within the target price point and costs continue to decrease.”
With proper calibration data (an up-front, overhead cost), such point clouds are providing forest managers with accurate estimates of average tree size (stem diameter, height, and volume), tree size distribution, and growing stock (density, basal area, merchantable volume) at spatial resolutions as fine as 400 m², across entire forest estates. Such inventory data are unprecedented and serve strategic, tactical, and operational needs simultaneously. Tools such as Lim Geomatics’ AFRIDS (Advanced Forest Resource Inventory Decision Support) system allow these enhanced inventories to be readily accessed by planners and operational folks alike, on something as simple as a tablet in the field, to instantly query volumes and tree size distributions for areas of interest. The spatial accuracy of the LiDAR-derived digital terrain model (DTM) is truly a dream-come-true to operational folks with the job of accessing and moving timber in an environmentally sound manner.

What’s all that mean?

“All combined it means the savings associated with making smarter decisions, more efficient equipment and product allocations, and reduced road construction and harvest-block design costs, EFI investment gives Canadian forestry a strong competitive advantage.”

I asked Doug how much EFI has been done in Canada.

“We are tallying about 33 million ha with millions more to come. Several provinces are well on their way to wall-to-wall LiDAR and EFI.”

What about price?

“With large areas being collected the price is hovering around $1/ha, we are very close to the ideal price point. Right now we recommend flying LiDAR for the initial inventory then using DAP to regularly update the data.”

Doug gives us a pretty good grade on meeting most of the criteria set out, but what does the future hold?

“We’re not finished yet. By 2019, I envision that we will be operationally classifying species from the 3-D point clouds of LiDAR and DAP. Current research is showing 98% accuracy in the conifer-hardwood split and more than 75% accuracy across individual species. The segmentation of point clouds into individual trees, a necessary step in the species classification process, also places us within striking distance of predicting individual tree diameters, stem, and, potentially, product volumes as well.”
Effort is also being brought to bear on the problem of spatially forecasting these EFIs, with promising early results. Current research with the LiDAR-derived DTM is showing that its accurate spatial detail provides information about landform, slope, aspect, elevation and moisture regime – all attributes that may enhance species predictions, but also enable us to predict and map eco sites. It seems that identifying seasonal operability windows, where to invest silviculturally, and how to maximize environmental integrity are all increasingly within operational reach. Moreover, it’s not just foresters that have taken notice of EFI - researchers in other disciplines are currently evaluating 3-D point clouds for wildlife habitat assessment, determining riparian zone integrity, and quantifying ecological indicators. Stay tuned, the future is exciting!

I dragged out a forest inventory map from the province and some LiDAR flown over the same area. Comparing Stand 25-1, a corner of some land I am familiar with, I am jealous of the power future foresters will have to make really good decisions. The terrain really pops out at you from the LiDAR. The EFI will provide almost individual tree data to make better decisions. But then, I used to enjoy walking the forest blocks vetting strategic level forest inventory maps. There was nothing quite like a good wander in the woods, returning only when my wet feet became too cold to trudge anymore. Future foresters will hopefully get to make excuses to their bosses and walk their forests. But they won’t be vetting inventory data like we used to, they’ll be spot-checking individual trees.

1 February 25, 2015, House of Commons Standing Committee on Natural Resources.

Field Coordinator Cheyney Jackson monitors the marmot colony at Haley Lake Ecological Reserve. PHOTO CREDIT: by Adam Taylor