branchlines

Volume 27#1 Spring 2016

Inside:

forestry
university of british columbia

dean'smessage

I have previously commented on the diversity of research interests within the Faculty. These cover all aspects of forests and their products and are increasingly extending beyond into other aspects of the landscape. We are not just restricted to rural landscapes, and more and more work is being done on urban landscapes, a trend that is likely to increase as our urban forestry program gathers strength. In this issue of Branchlines, it is very evident that the paths that our students take are equally diverse, and we are seeing our students entering a startling range of different types of employment.

In the past, it was fairly clear that anyone graduating from the Faculty of Forestry would likely end up working in the forest industry. Today it is very different, as such a wide variety of opportunities are available to our students. This is very apparent in this issue of Branchlines where a range of different career paths are described. It is particularly interesting to read about the cluster of graduates working for the City of Surrey – the presence of the group suggests that there will be many similar opportunities for our graduates in cities all across Canada and beyond.

This does not mean that we are no longer training new entrants for the more traditional aspects of the forest sector, and our Forest Resources Management and Wood Products Processing programs continue to grow, as does demand for graduates from these programs. With the end of the school year fast approaching, I am reminded that each year provides a fresh crop of graduates who will, over time, make their mark in the industry. However, today, our graduates have a greater choice in front of them than ever before, and they will not automatically apply for an entry-level position if it is not accompanied by a clear career path or some other form of incentive. It is up to the forest sector to ensure that they are not only employing the right people for the right positions, but that they also manage to retain them.

It was very gratifying to see British Columbia's Minister of Advanced Education, the Hon Andrew Wilkinson, tweeting about the Faculty of Forestry's co-op program. The importance of co-op cannot be over-stressed. It provides students with work experience that will enhance their employability and employers with an opportunity to introduce potential future employees to their workplace culture. Students get an opportunity to work in unfamiliar environments and, for some, this will be an opportunity to decide upon their career options. Consequently, the $1.3 million that the Government of British Columbia has recently allocated to supporting outreach to more co-op employers and increasing the awareness amongst students and employers of the benefits of co-op is very welcome.

We have just wrapped up our recent campaign, which was aimed at both raising funds and increasing alumni engagement. This does not mean that we can now sit back and relax. We particularly want to ensure that we can maintain, and even increase, our alumni engagement. We offer many opportunities for engagement and are always seeking out new ideas. If you feel that there is something that you think we should be doing, please do not hesitate to get in touch with me. Our fund-raising was also successful, and I am delighted that we have been able to complete the renovation of Loon Lake Research and Education Centre. We can now set our sights on several other ambitious projects that we have in mind. Don't forget that our alumni barbecue, held every year during spring camp, is a great opportunity to see what has been achieved in the research forest and at the Centre. For details of this event see page 21.

John L Innes
Professor and Dean

Salmon researchers reach out

Each year over the past decade Dr Scott Hinch and his Pacific Salmon Ecology and Conservation Lab (PSEC; see page 14) have hosted a workshop where students and postdoctoral fellows from PSEC and collaborating labs present research results to update collaborators, management agencies, First Nations, and key stakeholders on funded research programs and current science. The workshop provides an opportunity for feedback on results and to engage in a dialogue on future funding and research directions that could benefit salmonid management. What began 20 years ago as a modest gathering of researchers at UBC has grown into a hugely sought after event; this year seeing its largest turn out yet, with over 70 people attending from across North America.

Management of Pacific salmon fisheries is extremely complex and involves many players. As such, the PSEC lab is particularly collaborative with other universities and research groups such as Carleton University, University of Washington, University of Ottawa, Canada's Ocean Tracking Network, the US Geological Survey Science Center, ENGOs and consultants including InStream Fisheries Research, Kintama, Watershed Watch Salmon Society, Lower Fraser Fisheries Alliance, Seymour Salmonid Society, Pacific Salmon Commission, Pacific Salmon Foundation, government agencies including multiple branches of Fisheries and Oceans Canada (DFO), industry such as BC Hydro, First Nations including more than 11 bands, and commercial fishing groups including the Canadian Fishing Company (Canfisco) and the Area B Seiners Association. Almost every group was represented at the meeting this year in addition to several others, including Raincoast Conservation Foundation, David Suzuki Foundation, Fish First Consulting, LGL Consulting, and the Sportsfishing Institute of BC.

This workshop highlights how the PSEC lab is successfully reaching out beyond the university in order to extend science to others and facilitate the incorporation of scientific research results into management systems. Most recently, PSEC science is being utilized by The Canadian Science Advisory Secretariat, which is combining research produced by the PSEC lab into institutional guidelines that will direct management actions implemented by DFO. This is just one exciting example of how the PSEC lab is mobilizing scientific knowledge to directly influence real fisheries management decisions.

IUFRO Division 5 Conference – first time in Canada

The 2017 IUFRO (International Union of Forest Research Organizations) Division 5 Conference will be held in Vancouver, Canada from June 12- 16, 2017. The conference is organized jointly by IUFRO Division 5 (Forest Products), the Faculty of Forestry at UBC, FPInnovations, and the Society of Wood Science and Technology. In recognition of the pressing global need for the forest sector to be a leader in sustainability, diversification, and innovation, the theme of the conference is: Forest Sector Innovations for a Greener Future.

This theme will form a unifying basis for the week-long conference and will guide the agenda through a series of plenary sessions that will catalyze discussion on what the future forest products sector might look like. Each morning will feature 2 keynote presentations; one a research-based talk featuring a prominent academic, the other a more pragmatic, real-world talk featuring a prominent practitioner from industry, government, civil society, or an indigenous community. The plenary topics include:

Forest Sector Innovation: How can innovative forest sector based environmental and social approaches assure a greener future for our global society?

Innovations in Forest Products and Services: How will fibre and forests be used in the near and long term (focus on bioenergy, biomaterials, biofuels, biochemicals, carbon and non-timber forest products)?

Innovations in Wood Building and Design: What will the next generation's needs for shelter and buildings be and how will they be met?

Innovations in Forest Management, Policy and Markets: Will there be enough biomass and sustainable products to support the growing global population?

Innovations in Business Models and Management: What will the businesses of forestry look like in the near and long-term?

The conference will provide an excellent opportunity to network with fellow researchers and practitioners looking for novel and advanced solutions. We are expecting 500-600 participants from more than 50 countries. Please plan to join us!

For further information contact Jorma Neuvonen at jorma.neuvonen@ubc.ca or visit www.IUFROdiv5-2017.ca.

IUFRO
2017 Division 5
CONFERENCE

Developing links in south-east Asia

Following the Faculty's success in forming partnerships with a number of institutions in China and India, both Faculty members and students have benefitted from increased interactions. These are growing, and some important research cooperation has been developed. Increasing numbers of undergraduate and graduate students are coming to the Faculty of Forestry, and we are also seeing students and faculty members from here going to these countries. In view of the success of these interactions, we have started exploring links with a number of other areas in Asia. In February this year, Dean John Innes and Assistant Dean Guangyu Wang travelled through the region, meeting with representatives of the Faculty of Forestry of the National University of Laos, the Myanmar Forest Research Institute, and Universiti Putra Malaysia. This has already resulted in the development of research cooperation, funded by the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation.

Discussions were also held with the Danum Valley Field Centre in Sabah, Borneo. This is considered to be the leading rainforest research centre in the Old World Tropics, and is located on the edge of the Danum Valley Conservation Area, recognized as being one of the largest, most important, and best-protected areas of pristine lowland rainforest in southeast Asia – and also one of the field sites for a Faculty of Forestry research project on the impacts of climate change on tropical forests. The Centre provides a base for long-term research and has facilities for visiting faculty and students working on all aspects of tropical rainforests.

In March 2 faculty staff visited National Ilan University in China Taipei, Vietnam National University of Forestry and Bogor Agricultural University, developing cooperation agreements with each university. In each case, there was enthusiasm on both sides for further cooperation and exchange, and we expect to see this happening in the near future.

The Faculty has also assumed the role of chair for the Asia Pacific Forestry Education Coordination Mechanism, and an office for this has been established in the Forest Sciences Centre at UBC. The Mechanism is increasing forestry education cooperation in the region, and a number of projects are either already underway or will shortly be initiated.

Awards and recognition

Dr Suzanne Simard (Department of Forest and Conservation Sciences) has been awarded a new NSERC Strategic Project Grant. Suzanne is receiving $929,000 (the largest of UBC's 6 new grants in this category) for her research into reassessing current forest renewal practices in the context of climate change. Through this funding, Suzanne will be investigating novel combinations of logging and planting practices across British Columbia. She hopes that her work will aid in the development of strategies for helping forests remain healthy, vigorous and adaptive through climate change. Suzanne will partner with the BC Ministry of Forests, Lands and Natural Resource Operations and Brinkman Group for this research. See page 18 of this newsletter for further information on Suzanne and her research projects.

Congratulations Suzanne.

Congratulations to **Dr Shawn Mansfield** on winning a 2015 UBC Killam Research Prize (senior category). This peer-nominated prize recognizes outstanding research and scholarly contributions. Prize winners were selected by UBC's Faculty Research Award Committee, which spans arts and humanities, business, education, applied science, science and medicine. Shawn studies the biochemistry and genetics of plant cell wall development, with a major emphasis on cellulose and lignin biosynthesis. His laboratory employs a unique combination of plant cell wall biochemistry and functional genomics to elucidate the basic biology behind the spatial and temporal biosynthesis of the major plant cell wall biomacromolecules. Ultimately, his laboratory attempts to establish relationships between gene expression and phenotypic traits to better understand plant growth and development. Shawn will receive his award at a ceremony later this month.

Dr Maja Krzic (Faculty of Forestry and Faculty of Land and Food Systems) has received a 2016 3M National Teaching Fellowship. This award is the only pan-Canadian, cross-disciplinary recognition of educational leadership and excellence in university teaching. The Fellowship recognizes university teachers who have demonstrated leadership in enhancing post-secondary teaching excellence and superlative undergraduate teaching, sustained over several years. Maja is the second Forestry recipient of the 3M Teaching Fellowship and the first in the Faculty of Land and Food Systems. In the past 30 years, only 21 individuals from UBC have been granted this prestigious award

Congratulations, Maja.

Paul Pickell has been awarded the 2015 Best Doctoral Thesis Award for his thesis entitled "Characterization of boreal anthropogenic disturbance regimes from multi-scalar Earth observations". Paul was supervised by Dr Nicholas Coops in the Department of Forest Resources Management. Congratulations Paul.

Kenneth Cheng has received this year's Best Master's Thesis Award for his thesis on "Reducing the surface checking of deck boards exposed to natural weathering: Effects of wood species". Kenneth was supervised by Dr Phil Evans in the Department of Wood Science. Congratulations Kenneth.

Sheng Hao Xie (doctoral student in the Department of Wood Science) has been accepted into this year's IIASA's prestigious Young Scientists Summer Program. Sheng was one of 52 successful candidates from 347 international applicants. He will be working on improved modelling of harvested wood products. Well done Sheng.

It's about more than climate: UBC-IFSA at COP21

Beyond the suits and formal meetings, the 21st Conference of the Parties in Paris (COP21) was a great opportunity to meet our celebrities. But we are not talking about Hollywood celebrities (although some were present!). We are talking about the opportunity to meet, discuss with and ask questions of world-renowned scientists, political and environmental experts and leaders, as well as front-line defenders of Mother Earth. The knowledge and insights gained from these events and conversations were among the most valuable take-aways of this opportunity.

The International Forestry Students Association (IFSA) sent a delegation of 10 students from around the world to attend COP21, which brought together nearly 50,000 participants from government, industry, academia, NGOs, and civil society. In addition to COP21 and its 'Blue Zone' (open only to those with accreditation) and 'Green Zone' (open to the public), several other events were held in Paris to raise awareness of the many symptoms of global change, with climate change being highlighted among others. Delegates were also able to participate and present in the Global Landscapes Forum, the Youth in Landscapes Initiative and in the Resilience in a Time of Uncertainty: Indigenous Peoples and Climate Change.

Pertinent topics that impact *all* of us were discussed during COP21, such as the role of small holder farmers in maintaining viable food production systems that are resilient to the effects of global change. Issues related to the effects of extractive activities (such as hydraulic fracturing) as well as industrial meat production as major contributors to greenhouse gas emissions and disturbers of the social and ecological fabric are examples of topics discussed in the side events. The IFSA delegates documented their experiences in the IFSA blog at ifsacop21.wordpress.com.

The opportunity to attend COP21 as accredited observers provided delegates with a greater level of insight into the disparity in viewpoints between the government negotiators of the Paris Agreement. Of particular interest was the divide between countries concerning the target number for an acceptable increase in global temperatures. Coming into Paris, conversation was dominated by the need to limit global temperature rise to under 2 degrees Celsius above pre-industrial levels by the end of the century. Less attention was paid to the fact that many people and negotiators (led by the Small Island Developing States) urged for a more ambitious target of 1.5 degrees. This was an essential dividing issue that went almost entirely ignored in mainstream media before the negotiations began.

Now with an agreement in place, but its potential effectiveness under scrutiny, IFSA delegates hope to continue the conversations that began in Paris on the global pursuit for climate justice. In addition to delegates speaking on local television and radio shows, IFSA-UBC recently hosted a sharing circle to promote dialogue amongst UBC Forestry students. Some of the participants wanted to hear about potential contrasts between what was presented through the media and the delegates' own experiences and perspectives. Others wanted to learn more about Indigenous peoples' involvement, corporate intervention and influence on the events, and our own plans for future action.

In sum, Paris hosted events and discussions that allowed delegates to hear arguments, evidence and testimonies from a range of global stakeholders and rights-holders. Hearing the stories of people who have been displaced from their homes as unhealthy development and climate-related dispossession goes forward, allows those of us isolated from these realties to take a deeper look at how our own actions and lifestyles are impacting the planet and the people we rarely have the chance to meet.

Article authors, UBC Forestry students Andrea Vasquez and Jesse Way, attended COP21 as accredited observers on behalf of the UBC-IFSA. For further information Andrea can be reached at andrea.vasquez.ifsa@gmail.com and Jesse can be reached at jesseway.ifsa@gmail.com.

Co-op work as a garden educator

by Amy Ing
4th year student in the Natural Resources Conservation program

Placements

As a co-op student in the Faculty of Forestry, I have had the very rewarding experience of spending 2 work terms as a "garden educator", one in Vancouver and another in Pennsylvania. These work experiences have involved facilitating, organizing and teaching garden activities through school programs and summer camps. These 2 experiences have allowed me to make some comparisons in regard to garden sites, vegetation types, and in the different skills that I have gained. The employment opportunities have reinforced my interest in a career as a garden educator after I graduate with my degree from Forestry.

During my first work term as an Urban Agriculture Facilitator at the Society Promoting Environmental Conservation in Vancouver I was in charge of maintaining 7 urban school gardens as part of their School Gardens Program. This program commenced in 2008 and connects children to their food and local communities by applying their knowledge of agriculture to hands-on gardening activities in their outdoor garden classroom.

In my second work term I was a Gardening Specialist and Camp Counselor at Camp Chen-A-Wanda (CAW) in northeastern Pennsylvania, where I created their first garden program. My role was to provide expertise in the maintenance, supervision and running of this new activity for campers. I was trained by members of an environmental organization, Amir, on how to lead garden activities as outlined in the Amir Sourcebook which focuses on environmental and social justice.

Garden sites

My co-op placements exposed me to 2 very different garden sites by way of size, design and soil types. The SPEC school garden structures were already in place at the start of my employment and had been built as wooden raised beds to a size and design consistent with Vancouver School Board regulations. In contrast, the raised beds at CAW had been constructed according to the Amir Garden Manual.

Not surprisingly, the soil conditions were quite different between the SPEC sites in Vancouver and CAW sites in Pennsylvania, and this impacted the types of plants that could be grown. The soil at the CAW site was derived from glacial till creating a silty loam texture with large rock fragments. Poor drainage and shallow rooting depth caused by the rock fragments meant that this soil was best suited for summer squash, pumpkins, swiss chard, cabbage, and broccoli. The soil in the Vancouver school gardens was sandy, and with fewer rocks could support deeper root growth. These gardens were well suited to plants such as potatoes, tomatoes, carrots, marigolds, lettuce, beets and beans.

Skills gained

I gained valuable gardening skills through these 2 job experiences. At the school gardens in Vancouver I learned about companion planting, which is a method used to improve soil nutrient quality, disease and pest resistance, and to maximize space among plants. While at the camp garden in Pennsylvania I learned how to construct a garden from barren ground to a raised bed. In both school and camp environments, I was the "garden expert". In this role I was able to share the skills I had learned with children who had little or no previous gardening knowledge. These past 2 work terms have taught me gardening and teaching skills that will be valuable in continuing my passion as a garden educator working with children. Through these jobs I feel that I have had an opportunity to make a powerful impact on the environment while being an inspiration to children.

For further information on our co-op programs contact Tony Loring at tony.loring@ubc.ca.

Paying it forward through the Christmas Tree Farm

FUS Christmas Tree Farm Coordinator Angelika Kaufman inspects the crop

The UBC Forestry Undergraduate Society (FUS) Christmas Tree Farm was established at the South Campus Farm in the spring of 2006, in an area formerly used by the Faculty of Forestry to produce tree seedlings for reforestation. The Christmas Tree Farm was established for a number of reasons. The first was to provide a venue to demonstrate tree regeneration processes and challenges to undergraduate field classes. The second was to add an agro-forestry component to the Farm's production of vegetables and fruits. The third was to create an opportunity for student volunteerism, community engagement and fundraising. In its 10 years of operation, the Christmas Tree Farm has achieved all of these objectives.

The first batch of seedlings was donated by PRT Pelton Reforestation and included 100 noble fir and Nordmann fir. In 2010 a second batch of seedlings was donated by Tim Hale of CairnPark Nursery in Duncan. These 1-year old seedlings were planted in pots to produce live-trees for 'rental'. New batches of donated seedlings have been potted-up every 2 years, with potted trees transferred to the field when too large. The live-tree endeavor was inspired by the success of 2 Forestry alumni, Jeff Ferguson and Sean Macallister, who founded Evergrow live Christmas tree rentals. To explore the feasibility of growing and selling Christmas trees in the lower mainland, 2 undergraduate students completed directed studies projects. In addition to talking to Sean and Jeff, these students visited Art Loewen at Pine Meadows Christmas Tree Farm in Chilliwack and Randy Chiasson at TreeLine Nursery in Agassiz. Art grows sheared, cut, trees for the wholesale, retail and U-Cut markets. These experts shared the techniques and challenges of growing and marketing trees for the Christmas season, and this knowledge was incorporated into the Christmas Tree Farm's culture. One significant difference is that the UBC Farm uses organic production techniques, managing grass competition via mowing and mulching rather than herbicide spraying. This requires a roster of weekly volunteers during the spring and summer.

Leading up to the first Christmas tree sales event in 2013, undergrad student Miaorong Zhu worked on a project to examine marketing and pricing. The FUS established the elected position of Christmas Tree Farm Coordinator, which since Miaorong has been filled by Angelika Kaufman (2014) and Grace Carsky (2015). This year's coordinator is Marek Gorczyca. Through these sales events the FUS has raised over $4000 for charity. The majority of donations have gone to the Canadian Institute of Forestry's "Forests without Borders" charity which assists communities in developing countries establish community forests and nurseries. Many of the farm's first customers returned for the 2014 and 2015 sales events – they liked the idea of students paying it forward, and have often made donations on top of the price of the tree. Most customers come from the local UBC area and appreciate the opportunity to bring their families to the Farm to pick out a tree. Many also like the live tree rental option. Customers pay the full price to 'rent' a potted tree, and have the option of bringing back the tree for continued growth in January.

To broaden student engagement at the Farm and demonstrate how forestry integrates into rural land management, the Christmas Tree Farm and the former research plantations and young alder stands have been incorporated into a Farm Woodlot. This woodlot includes the arboretum established by Dr John Worrall. Students can gain experience with weeding, thinning and pruning operations in this woodlot. This spring an area will be cleared for a small Community Learning Space.

If you would like to find out more about the activities at the UBC Christmas Tree Farm, please contact Dr Steve Mitchell (Department of Forest and Conservation Sciences) at stephen.mitchell@ubc.ca..

Parametric design of timber shell structures

Increasingly complex architectural geometries present exciting new challenges and opportunities for the timber building industry. The design of these structures has been revolutionised in recent years by the development of "parametric design" software that allows intelligently designed architectural objects based on geometric relationships and rules. The 3-dimensional (3D) designs created within the software can be manipulated to scale (up or down) different virtual models, create similar repeating elements, and edit individual geometric parameters. Because the software builds models based on algorithmic relationships between components, it is far easier to include freeform elements and incorporate complex curves and angles in building designs. It is extremely challenging to then build those freeform designs using timber elements that are typically rectilinear in nature. Pioneering architects, engineers and timber fabricators have not been deterred by this challenge however, and in the past decade some stunning examples of freeform timber structures have appeared. The 8,000m^2 roof of the Centre Pompidou Metz, is one renowned example. The roof's 1,800 doubly-curved wooden glulam segments were "braided" together through computer-controlled (CNC) fabrication, and a geometry model provided the timber construction company with the computer-aided design (CAD) tools to detail and produce 18,000 linear metres of beams.

An interdisciplinary research project supported by Forestry Innovation Investment through the Wood First Program, and involving the Departments of Civil Engineering (Thomas Tannert, Associate Chair Wood Building Design and Construction), the UBC School of Architecture and Landscape Architecture (Annalisa Meyboom, Oliver Neumann) and the Centre for Advanced Wood Processing (Iain Macdonald, Managing Director) was completed this year, focusing on freeform timber design and fabrication. Alexandra Cheng, MASc student in Civil Engineering, used digitally-integrated models for the design and construction of solid timber structures using mass-timber panels. The result of this process was the design, fabrication, and assembly of a folded plate wall prototype and cross-laminated timber panels featuring double curvature. The research demonstrated how collaboration and integrated modeling enables the realization of the unique architectural versatility that mass timber products have to offer, and the efficacy that digital design and integrated models can bring to orthodox and unusual structures alike.

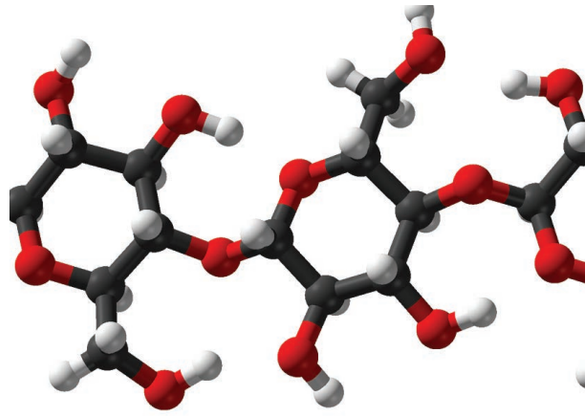
In November, CAWP held a 2-day workshop *"Designing and Fabricating Contemporary Timber Structures – Learning from Europe's Best"*. The workshop was led by Fabian Scheurer and Martin Antemann, arguably the world's foremost practitioners in computer aided design and prefabrication of timber elements for contemporary wood structures. Mr Scheurer is a founding partner of the firm Designtoproduction in Zurich, Switzerland, which generates sophisticated parametric computer aided design models used by fabricators to produce physical structures from wood. Mr Antemann is director of the Free Forms Department of Blumer-Lehmann in Gossau, Switzerland, which fabricates unique wood structures for clients around the globe. Their firms have worked in partnership on many high profile timber construction projects, several of them designed by renowned Japanese architect Shigeru Ban, including the Centre Pompidou.

The workshop brought together architects, designers, engineers, and manufacturers from around N America as well as graduate students from Architecture, Engineering and Wood Science. The workshop provided numerous examples of how to exploit the capabilities of modern design tools for modeling freeform-timber structures and how to connect these to engineering and manufacturing workflows. The event concluded with the creation of a demonstration freeform timber pavilion structure fabricated using CAWP's Hundegger Robot Drive CNC timber joinery machine (see photo). Perhaps most importantly, the workshop fostered understanding that considerations for detailing, assembly, and fabrication must be borne in mind at the design stage to plan for efficient, accurate and cost-effective manufacturing and assembly of freeform timber structures.

For further information, please contact Alex Cheng at aahcheng@gmail.com, Iain Macdonald at iain.macdonald@ubc.ca, or Thomas Tannert at thomas.tannert@ubc.ca.

Small things considered...

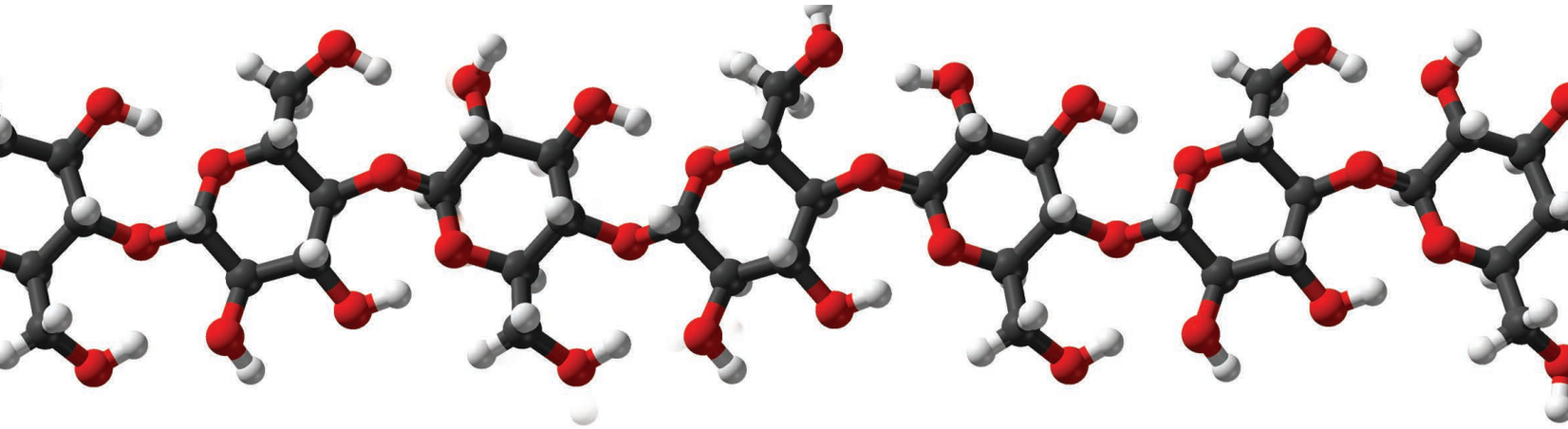
Plant cells magnified 400x



In Canada things are big – big country, big mountains, big forests, big prairies and big trees. The Canadian pulp and paper industry has been a big player in the global pulp and paper business. However, declines in newspaper demand over the past 2 decades, and competition from emerging countries in the southern hemisphere, have led to mill shutdowns across Canada. These closures have diminished the industry's contribution to GDP, while decimating communities that rely on these jobs. One solution to keep the industry healthy and Canada's economy diverse is to envision the modern paper mill as a "biorefinery" – a conversion facility that creates energy, chemicals, and materials sourced from trees. While many benefits from using renewable carbon from wood in this fashion are possible, the economics are not favourable when considering the competition from cheap oil. Another solution is conversion of trees into higher valued materials targeted towards new and growing markets such as the aerospace and automobile industries. To produce materials for these new markets, the Canadian pulp and paper industry is going small, extremely small.

As trees grow to be upwards of 30m in height, one has to wonder how each one is strong enough to support its own mass. The secret lies in the small-scale architecture of the cell walls within a tree. The skeleton of these cell walls is cellulose, a large chain-like molecule made up of sugar units linked end-over end. Cellulose is already well known as the material that makes up cotton and composes the bulk of the fibre from a pulp mill used to make paper. While sugar chains do not seem like a wise choice in the construction of large-scale structures, the cellulose molecules are arranged in bundles known as microfibrils. This arrangement allows cellulose chains to reinforce themselves resulting in microfibrils that are extremely strong. When mass is accounted for, these microfibril bundles are stronger than steel. Like threads in a rope, the microfibrils are tightly woven in the fibre structure. Deconstructing these fibres allows access to the bundles, which have been named nanocellulose and given the moniker of "wonder-material". Nanocellulose may sound like a term from a science fiction novel, however nano is a prefix that technically means one billionth of a unit of measure. To put this into perspective, we would have to split a hair nearly 50 thousand times before we have 1 nanometre! These deconstructed microfibril bundles are named nanocellulose because they have diameters of roughly 5 nanometres (nm).

When scientists first began investigating cellulose microfibril structure more than 50 years ago, they would cook paper-making fibre in strong acid over various periods of time. This resulted in the fragmentation of microfibrils into 5nm diameter rods that were a few hundred nanometers in length. Canadian scientists were amongst the first to investigate this phenomenon and were responsible for an important breakthrough. They discovered that the tiny particles would form liquid crystals — an important property found in high performance materials, such as spider silk and Kevlar. Fast-forward to today, and Canada has a flagship demonstration-scale nanocellulose production unit, developed between FPInnovations and Domtar. This facility has the ability to make 1 tonne of nanocellulose per day. Another nano-



cellulose pilot facility has been created in Alberta with a production scale of up to 100kg of material per week. These facilities support a strong contribution to nanocellulose investigation by Canadian researchers. Also, earlier NSERC support of the ArboroNano project provided global recognition of Canada's contribution to cutting edge science.

Other countries such as Finland, Sweden, and Japan have invested heavily in research and technology in order to isolate nanocellulose and make nanocellulosic materials. With the excitement around this material, the Canadian Embassy in Japan, in collaboration with the Alberta government and Japan's National Institute of Advanced Industrial Science and Technology, held a seminar on nanocellulose earlier this year. The seminar was held in conjunction with the Nano Tech 2016, International Nanotechnology Exhibition and Conference in Tokyo. Dr Scott Renneckar from UBC's Department of Wood Science (and Canada Research Chair in Advanced Renewable Materials) was invited to the Embassy to provide an overview on Canada's current role in nanocellulose research. Scott discussed Canada's efforts in basic research and investment in demonstration-scale facilities. He noted that Canada has specialized in making nanocellulose from pulp, resulting in nanocellulose materials commonly referred to either cellulose nanocrystals (CNC) or nanocrystalline cellulose (NCC). These materials have a potential use in high value applications such as cancer treatment and specialty films and coatings. In fact, films of CNC are highly colorful and iridescent and UBC's Dr Mark MacLachlan has been able to tune the colour of the films across the colour spectrum (Nature, 2010 468, 422 U246). Like the scale of a butterfly wing, the colour relates only to structural features arising from the ordering of the nanocrystals in the film. These materials could be used for applications from cosmetics to security papers. After the seminar Scott was able to learn more about Japan's efforts in the field of nanocellulose.

In contrast to nanocrystalline cellulose, Japan has focused on making nanocellulose where the length of the microfibril bundle is preserved such that the nanocellulose is 2 to 10 times longer. During the Embassy seminar, Professor Kondo provided an overview of his counter collision water jet method to shear pulp fibres into nanoscale particles. These materials are being used to reinforce plastic composites, enhancing the mechanical properties so that less plastic is needed overall. Scott also met with Professor Akira Isogai, inventor of a method to make nanocellulose with reduced energy input. This material has already found commercial success and is added into the ink of Signo Uni-ball pens as well as being used as a barrier material in adult diapers. Another Japanese researcher, Professor Yano, developed his own method to isolate nanocellulose. He spoke at the Nano Tech 2016 conference describing applications of nanocellulose for moulded car parts. Other nanocellulose research efforts in Japan were highlighted by a tour of the Forestry and Forest Products Research Institute's pilot nanoscale production facility and a meeting with Oji Holdings. Oji Paper has a technology to make perfectly smooth and transparent films from nanocellulose that could be used for flexible displays and batteries. The meeting demonstrated that nanocellulose is commercially feasible and products are being developed for new industries.

As a renewable carbon or "green" economy is being developed for high performance materials, new forest fibre is not necessarily needed to create this next generation material. Nanocellulose can be produced from recycled material as fibre properties are no longer a critical performance attribute. Also, sugar-rich paper mill waste can be used as a substrate to grow nanocellulose. Certain natural bacteria produce nanocellulose directly through a fermentation process. Recent results from the research groups of Drs Scott Renneckar and Jack Saddler at UBC were presented at the 251st ACS Annual Meeting in San Diego. Their work involving bacterial nanocellulose production from waste sugar sources highlights an alternative source to cleaner nanocellulose. Overall, university research across Canada, sponsored by NSERC, and further developed to pilot scale production by FPInnovations, has created a solid reputation for Canada as an important contributor to nanocellulose research. What seemed to be esoteric academic research into cellulose structure in the past century has now provided a path to developing innovative materials from the tiniest structures produced by some of the largest trees.

For further information contact Scott Renneckar at scott.renneckar@ubc.ca.

Soil productivity in the Fraser River delta

The Fraser River delta is regarded as one of the most significant areas for wildlife conservation in North America.. Its location along the Pacific Flyway, in addition to a mild year-round climate, makes this area an important stopover for many bird species migrating from northern breeding grounds to Southern wintering areas. Expansive marshes and tidal flats within the delta provide a plentiful food source and refuge for migrating birds. However, an additional habitat source is critical to the survival of wildlife: local farmland.

The delta's deep, fertile soils make the area one of the most productive agricultural areas in all of Canada. With 9,403 ha in the Agricultural Land Reserve, farmland within the Municipality of Delta boasts a diversity of agricultural sectors, including dairy, berry, greenhouse, grain and vegetable production. Unbeknownst to many, farms here provide an extensive amount of habitat for migratory birds, through crop residues left over after harvest, or by planting specific crops for wildlife and soil conservation. Although often overlooked in the context of the estuary, agricultural land provides a considerable amount of habitat in the Fraser River delta.

A local non-profit organization, the Delta Farmland and Wildlife Trust (DF&WT), assists farmers in providing on-farm habitat. DF&WT offers farmers stewardship programs which implement land management activities to conserve soil and provide habitat for wildlife. One of the Trust's programs, the "Grassland Set-aside Stewardship Program," assists farmers in planting a special mix of grasses and legumes in fields usually reserved for vegetable production. Fields sown with grass-legume mixes are then "set-aside" from production for up to four years, which allows for maturation into tall grass habitats. Small mammal populations gradually build with increasing grass cover, which provides hunting, roosting and nesting opportunities for raptors. Legumes such as clover provide habitat for local pollinators and other insects, which in turn becomes a food supply for aerial insectivores. At the close of the four-year period, the grass is tilled in, and fields resume vegetable production.

The wildlife conservation benefits of establishing grassland set-aside (GLSA) habitats are easily observed. However, GLSA fields are important for soil conservation and boosting productivity on local farms. DF&WT Program Coordinator (and UBC Natural Resource Conservation Program graduate) Christine Terpsma explains why a program of this nature is necessary in Delta. "Local vegetable producers typically include potatoes, peas, beans and corn in their rotations. These types of crops grow well; however, research has shown that continuous cropping can deplete soil nutrients over time and lead to soil structure degradation. Including grasses and legumes into vegetable rotations can help farmers improve soil structure and rebuild soil organic matter."

The GLSA Program has been utilized by farmers for over 20 years, but most of the research evaluating soil benefits took place in the mid 1990s to early 2000s. "Initial research has shown soil benefits from two years of GLSA treatment," remarks Christine. "To date, we have not evaluated the soil productivity benefits of enrolling a GLSA for the full four-year program period. Farmers needinformation regarding how quickly soil benefits accrue in GLSA fields, and how long they persist after incorporation."

To answer soil quality questions posed by local farmers, DF&WT launched a full evaluation of the GLSA Program in 2015. The five-year research project is conducted in partnership with Dr. Maja Krzic (Associate Professor, Faculty of Forestry/ Faculty of Land and Food Systems) and Dr. Sean Smukler (Assistant Professor and Junior Chair of Agriculture and Environment, Faculty of Land and Food Systems) and supported by federal-provincial contributions through the Investment Agriculture Foundation (IAF) of BC.

The evaluation is composed of two complementary studies. The first aims to evaluate the soil quality of 10 Delta fields prior to GLSA seeding (to provide baseline measurements) and will monitor GLSA and neighbouring vegetable fields during the four-year program period. This study is currently being carried out by MSc student Jason Lussier, supervised by Dr. Krzic. The following soil quality indicators are evaluated: structure, stability, compaction, and soil carbon storage.

Having grown up in Delta and previously worked with the farming community for several years, Jason feels a strong connection to this project. "The GLSA program is unique in that it provides growers with an opportunity to take degraded agricultural fields out of production for up to four years. Studies have shown that keeping fields in GLSA for a number of years can improve degraded soils. After speaking with farmers in the region, it appears that many have seen some of these benefits first hand. However, uncertainties persist surrounding the full understanding of benefits from GLSA to soil and the rate at which soil improvements occur. We hope that our study will bring some clarity to these uncertainties and provide farmers in Delta with useful information on how to best utilize the GLSA program."

The second study is conducted by MSc student (and UBC Natural Resource Conservation graduate) Khalil Walji, who is supervised by Dr. Smukler. Khalil's research aims to quantify the length and scope of benefits which persist in agricultural soils after GLSAs are returned to vegetable production. For his first field season in the summer of 2015, Khalil compared fields that were in GLSA for the previous three years to paired fields that did not have GLSAs. Soil samples were collected every other week to assess differences in nutrient availability between former GLSA fields and non-GLSA pairs. Crop samples were taken at the end of the harvest season to assess potential differences in crop yield and soil microbial populations as a result of GLSA management.

Khalil hopes his results have a real impact on how Delta farmers manage their crop rotations. "By evaluating nutrient availability and microbial populations over the growing season, we are hoping to show that incorporating a GLSA into a farmer's rotation can be beneficial for bothsoil health and crop yields," explains Khalil. "We know GLSAs accumulate organic matter over time as the grasses grow, and then all that grass becomes incorporated into the soil at cessation. This should result in a healthier microbial community and elevated availability of the nutrients that promote the growth of crops. Farmers have been increasingly curious as to how large these benefits are and how quickly they diminish once they reincorporate the GLSA grasses and legumes into their soil to start producing vegetables again."

These two studies will provide farmers with a comprehensive look at how the GLSA program affects soil productivity over time. "The GLSA program is the only one we know of in Canada that helps farmers establish rotational grass-legume mixes on vegetable fields," comments Christine. "The program is unique in its ability to provide habitat for a diversity of wildlife species, but also for its role in helping farmers in maintaining their valuable soil resources. Our research partnership with UBC is instrumental in providing the answers farmers need to continue to steward farmland to meet soil and wildlife conservation objectives."

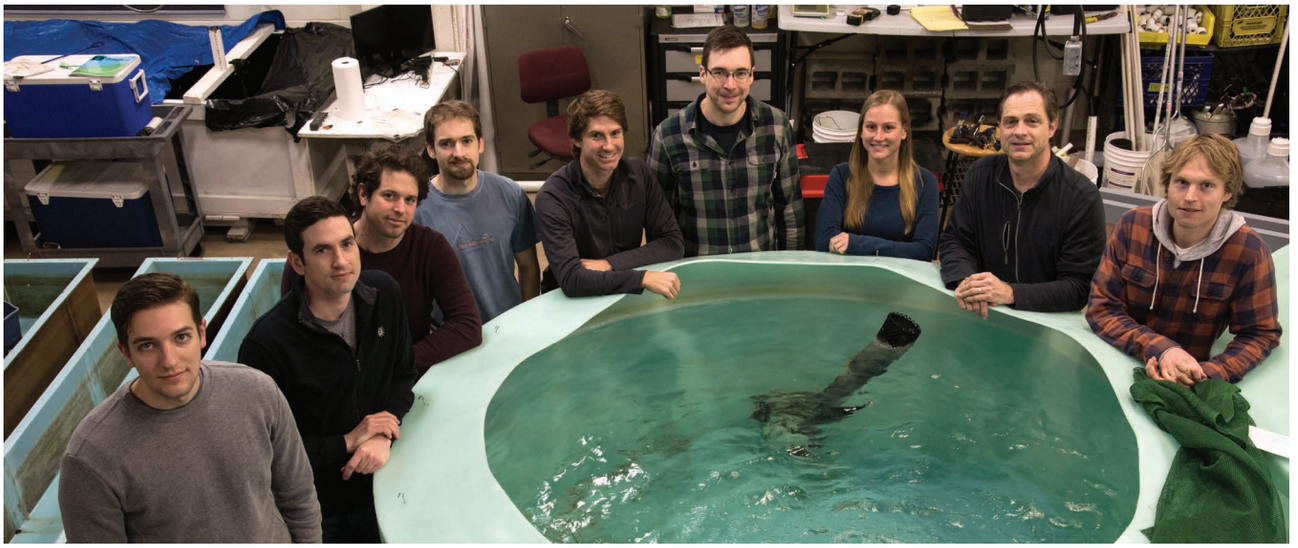
This project was funded in part by Agriculture and Agri-Food Canada and the BC Ministry of Agriculture through programs delivered by the Investment Agriculture Foundation of BC.

For further information contact Dr Maja Krzic (maja.krzic@ubc.ca), Dr Sean Smukler (sean.smukler@ubc.ca) or Christine Terpsma (christine@deltafarmland.ca).

All photos and cover photo by Adrian MacNair/Something Good Magazine.

research lab profiles

The Pacific Salmon Ecology and Conservation lab



The Pacific Salmon Ecology and Conservation (PSEC) laboratory is housed in the Department of Forest and Conservation Sciences at UBC's Faculty of Forestry. Members of the lab are committed to the study of salmonid ecology, behaviour and physiology, and to providing management systems with information needed for the conservation and sustainable use of fish resources. Pacific salmon are an ecologically, economically, and culturally important group of fish and research is focused on advancing understanding of the key challenges facing them across all life stages throughout freshwater and marine environments. PSEC lab members collaborate with fisheries scientists from other labs, marine research networks, ENGOs, government agencies, First Nations, and stakeholders to conduct influential and relevant research for fisheries management and conservation.

Dr Scott Hinch is the group's principal investigator. His research program focuses on the study of salmon migration survival, behaviour, energetics, physiology, habitat use, environmental cues, effects of fisheries and capture-release, passage in regulated rivers, and disease and pathogens. Scott is also director of the Faculty's undergraduate program in Natural Resources Conservation and contributes to 3 courses in aquatic ecosystems and fish conservation and management including a field school that many students cite as the most meaningful experience in their undergraduate education. Beyond UBC, Scott is affiliated with the American Fisheries Society where he was recently named 'Fellow of the Society' for his outstanding contributions in leadership, research, resource management and conservation, and public outreach.

Who works in the lab?

The lab is comprised of an accomplished group of postdoctoral fellows, graduate and undergraduate students. Andrew Lotto is the lab's Senior Research Technician and provides invaluable logistic support in the lab and field. Matt Casselman is the Project Coordinator for the lab's fish passage monitoring program in Lillooet, BC. Taylor Nettles is the lab's Research Technician involved in collaborative field and laboratory studies with the Fisheries and Oceans Canada (DFO) West Vancouver Laboratory.

Several research associates are also involved with the lab: Dr Mike Donaldson is reviewing the effectiveness of reflexes and behaviours that can be measured to help predict fish survival. Dr Erika Eliason, a research associate with the Ocean Tracking Network, is interested in how sockeye salmon respond to environmental stressors. Dr Eduardo Martins is a Liber Ero Fellow interested in how multiple effects experienced by sockeye salmon influence the dynamics of Fraser River populations. Dr Doug Braun is an honorary postdoctoral fellow examining adult salmon passage through fish ladders and in other regulated rivers.

What does the work entail?

The PSEC lab group works together with managers and stakeholders to create research with real management implications that can be used in a meaningful way. Research involves impressive laboratory experiments such as salmon migration simulation and behavioural choice studies, fishery simulation studies, and field studies involving both experimental fishing and real fisheries. Sophisticated techniques such as telemetry and tracking of both adult and juvenile salmon are often involved in field studies in combination with genomics, blood assays, and histopathology. Research also involves social science surveys with fisheries users, First Nations, stakeholders, and managers.

Experiments are carried out in the PSEC fisheries lab at UBC, as well as the Cultus Lake Salmon Research Laboratory in Chilliwack, BC - a partnership with DFO. Genomic research and physiological assays are conducted in collaboration with DFO at their Pacific Biological Station in Nanaimo, BC and West Vancouver Laboratory. Fieldwork occurs across BC including

multiple sites in the Fraser River, North Vancouver (Seymour Hatchery), Chilliwack (Chilliwack River), throughout the interior (Adams River, Gates Creek, and Seton River) and west-central (Chilko Lake) BC, Vancouver Island (Nitinat Hatchery and Quinsam Hatchery), and with commercial fisheries along the entire coast of the province. Fieldwork is also currently underway in the Xingu River in the Brazilian Amazon.

Research in the lab is shared through a number of conferences, most notably at an annual workshop with collaborators held at UBC (See page 3). The lab also produces an impressive number of peer-reviewed publications, with 14 papers published in 2015. The purpose of research produced by the lab extends beyond peer-reviewed journals and contributes to important fisheries management guidelines such as the Canadian Science Advisory Secretariat within the Department of Fisheries and Oceans (see page 3).

What is currently going on in the PSEC lab?

Current projects happening in the lab:

Dr Aimee Lee Houde (PDF) is examining how to improve survival of released hatchery juvenile Pacific salmon by developing genetic tools that measure seawater preparedness and other metrics of fish condition.

Art Bass (PhD student) and **Amy Teffer (PhD student)** are comparing mechanisms of disease and immune function across multiple salmon stocks by examining pathogen productivity and host responses within individuals over time.

Dr Lisiane Hahn (PDF) is examining how electromyogram telemetry transmitters can be used to describe swimming behaviour and movements of redtail catfish and spotted sorubim in the Amazon basin.

Nathan Furey (PhD student), **Steve Healy (MSc Student)** and **Christine Stevenson (MSc student)** are combining acoustic telemetry and genomic techniques to investigate how factors such as predation, pathogens, and landscape influence salmon smolt migration success from natal waters to the ocean.

Nolan Bett (PhD student) is focusing on the responses of Pacific salmon to olfactory cues and responses in olfactory gene expression during the spawning migration.

Katrina Cook (PhD student) is examining how differing marine capture scenarios influence recovery, pathogen development, and survival of Pacific salmon and how to effectively mobilize research to user groups.

Dr Matt Drenner (PDF) and **Collin Middleton (MSc student)** are examining how hydropower operations and environmental conditions influence Pacific salmon movements and survival in a regulated river system.

Vanessa Minke-Martin (MSc Student) is examining how physiological condition and migration water temperature affects the reproductive success of adult sockeye salmon.

Who funds the work in the PSEC lab?

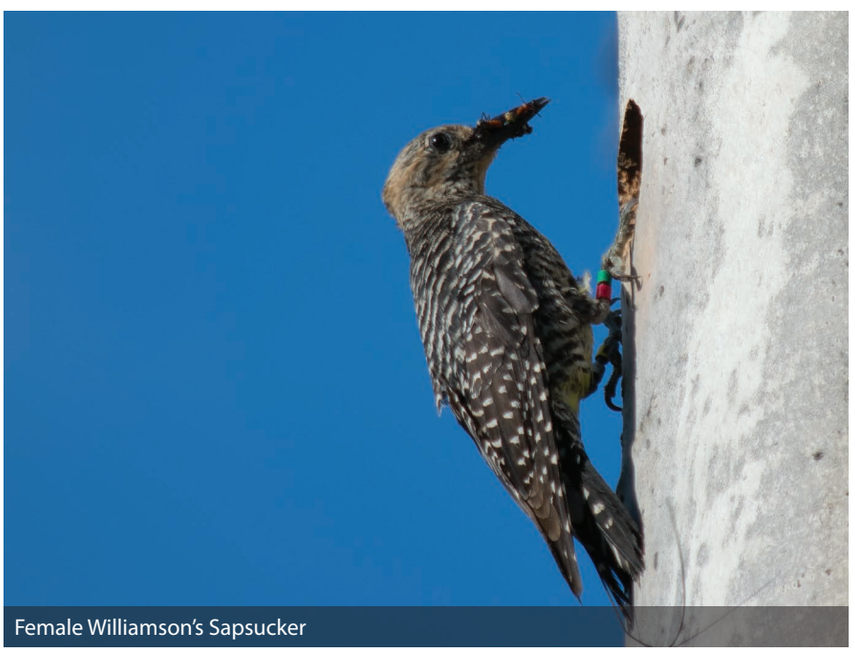
Research in the lab is funded through a variety of granting agencies including Natural Sciences and Engineering Council of Canada (NSERC) programs (Discovery, Strategic, Network), Mitacs, Canada's Ocean Tracking Network, and Canada Foundation for Innovation. Management agencies, user groups, ENGOs and First Nations also provide support including DFO, the Pacific Salmon Foundation, the Pacific Salmon Commission, BC Hydro, and St'át'imc Eco-Resources. Most students have major scholarship or fellowship support through NSERC or UBC, and the American Fisheries Society.

How can you contact the PSEC lab?

The Pacific Salmon Ecology and Conservation lab is a collaborative group of motivated individuals dedicated to providing research that will impact the conservation and management of fish and aquatic ecosystems. Learn more about the PSEC lab through their website at http://faculty.forestry.ubc.ca/hinch/Home.html or contact Dr Scott Hinch directly at scott.hinch@ubc.ca.

Habitat selection of the endangered Williamson's Sapsucker

Male Williamson's Sapsucker



Female Williamson's Sapsucker

Companies creating forest management plans for the montane forests of British Columbia's southern interior face a specific challenge in trying to protect the habitat of one of the least studied woodpeckers in North America. The Williamson's Sapsucker is listed as Endangered in Canada under the Species at Risk Act and is Red-Listed in British Columbia (BC), the highest protection levels for Canada and BC, respectively. Habitat loss, possibly due in part to tree harvesting, is considered the main threat to Williamson's Sapsuckers in Canada. Also, the Canadian populations of Williamson's Sapsucker cope with a naturally small and fragmented habitat, since they occur at the northernmost periphery of the distribution of the species. Their breeding range extends from southern BC to northern New Mexico. In Canada, they are found in 3 separate locations: the Okanagan-Boundary, the Princeton-Merritt and the East Kootenays, with estimated numbers of 303, 223 and 78 pairs, respectively. The Okanagan-Boundary and East Kootenay populations are in the Montane Spruce biogeoclimatic zone, while the Princeton-Merritt population is in the Interior Douglas-fir biogeoclimatic zone. They breed between late April and late July, but arrive in early March and leave in September. During the winter period, they can migrate south as far as central Mexico while remaining mostly in montane habitat. When the Williamson's Sapsucker was designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada in 2005, it was believed that its habitat would be completely lost from Canada by 2025. However, this situation has changed thanks to a joint effort by forestry companies, conservation experts and the provincial and federal governments to better understand the habitat requirements of the species.

Translating research into conservation

The success of forest management plans aimed at conserving imperilled species such as the Williamson's Sapsucker depends on our knowledge of the resources and conditions that they require to fulfill different aspects of their lives, such as reproduction (nesting), foraging and concealment (predator avoidance). Habitat selection studies investigate how animals select resources according to what is available to them, with the premise that they will orient their choices in order to maximize their fitness (lifetime reproductive success). More simply, habitat selection studies reveal their habitat requirements. Habitat requirements are then used to

inform the definition of the critical habitat, which in Canada is a legal protection for the habitat that is required by Species at Risk.

The Williamson's Sapsucker is exceptional among all woodpeckers because of its sexual dimorphism in plumage colour, the male being black and white with a bright red throat and yellow belly, while the female is brown with black and white streaks. Like any other sapsuckers, they drill holes in trees to create sap wells, from which they drink sap. The diet of the Williamson's Sapsucker differs from the other sapsuckers because of its dependence on ants while breeding, which composed 86% of the stomach content of sampled adults and 98% of arthropod mass in nestling fecal sacs. Breeding adult Williamson's Sapsuckers adjust their foraging techniques during breeding from 40% feeding on ants for their own maintenance to 75% of their time collecting ants while they are feeding nestlings. They mostly feed on wood ants and carpenter ants, which typically nest in dead wood. Williamson's Sapsuckers also feed on subcortical larvae by excavating in dead trees, although not as successfully as other woodpeckers. Williamson's Sapsuckers have developed morphological adaptations that favour foraging on sap and exposed insects, with a less extensible more flattened brush-tipped tongue that facilitates the retention of sap. They also exhibit opportunistic foraging behaviours such as fly catching and gleaning insects in the needles of conifers. They are primary cavity nesting birds, meaning that they excavate cavities in trees that they, or other animals, use for nesting.

What to protect

Very little is known about the habitat requirements of the Williamson's Sapsucker because it dwells in remote inaccessible terrain. Dr Kathy Martin and some of her students from UBC are part of the Species at Risk Recovery Team that studies the habitat selection of the Williamson's Sapsucker in order to inform forest management practices. Her group recently published an article on the habitat characteristics of Williamson's Sapsucker nesting territories. They found that the presence of nesting territories is primarily related to locations that include suitable nesting trees, such as large to very large (29-163 cm diameter at breast height, dbh) western larch and ponderosa pine, and large (22-54 cm dbh) trembling aspen. However, the study found that some characteristics of the nesting territories were not related to nesting requirements, but instead appeared related to foraging habitat, such as 80-119 years old Douglas-fir stands, large hybrid spruce, very large stumps and intermediate canopy closure. Overall, the study confirmed the importance of suitable nesting trees for territory establishment, however data were lacking to confirm the characteristics of the foraging habitat. One of the current objectives of the Species at Risk Act Recovery Strategy is to incorporate foraging habitat requirements into the definition of critical habitat of the Williamson's Sapsucker, to mitigate the effects of habitat loss on the already low population numbers in Canada.

Julien St-Amand, an MSc student (NSERC Industrial Postgraduate Scholarship partnered with Weyerhaeuser Company Limited) supervised by Dr Martin, is studying Williamson's Sapsucker foraging habitat selection. During the summers of 2014 and 2015, Julien used radio-telemetry to track Williamson's Sapsuckers, quantifying their foraging behaviour and their use of the habitat. Julien caught 29 Williamson's Sapsuckers using a combination of mist nets and dip nets, and affixed radio-transmitters to the birds for locating them throughout their territories. He collected 1412 visual observations, including 1134 foraging observations. The Williamson's Sapsuckers foraged 99% of the time on standing trees, of which 89% were alive, meaning that conservation efforts aimed at preserving foraging habitat should be focused on the retention of live standing trees. The size of the trees is the main predictor of selection for foraging with bigger and taller trees being preferred. Douglas-fir and hybrid spruce were the preferred live trees for foraging, while deciduous trees and lodgepole pine were avoided. Williamson's Sapsuckers foraged in forest stands containing a higher density of live trees and more coarse woody debris volume than generally available in forest stands.


Williamson's Sapsucker sap wells

Williamson's Sapsuckers are sensitive to the removal of habitat features that are required for nesting and foraging. However, they can persist in a managed landscape and, in fact, most of the known breeding territories in BC are in proximity to previously-logged patches (bird surveys are generally conducted along forestry roads). Habitat selection studies are the first step towards formulating evidence-based recommendations and regulations, which are indispensable tools to mitigate the effect of habitat loss on at-risk species such as the Williamson's Sapsucker. In this case, the information on habitat requirements will be incorporated into Best Management Practices and Wildlife Habitat Areas initiatives that are designed to meet the conservation objectives of the industry and federal and provincial governments. Habitat loss is the greatest threat to biodiversity in forest ecosystems, but the case of the Williamson's Sapsucker reminds us that it is possible to conserve biodiversity by preserving key habitat features that vulnerable species require for survival.

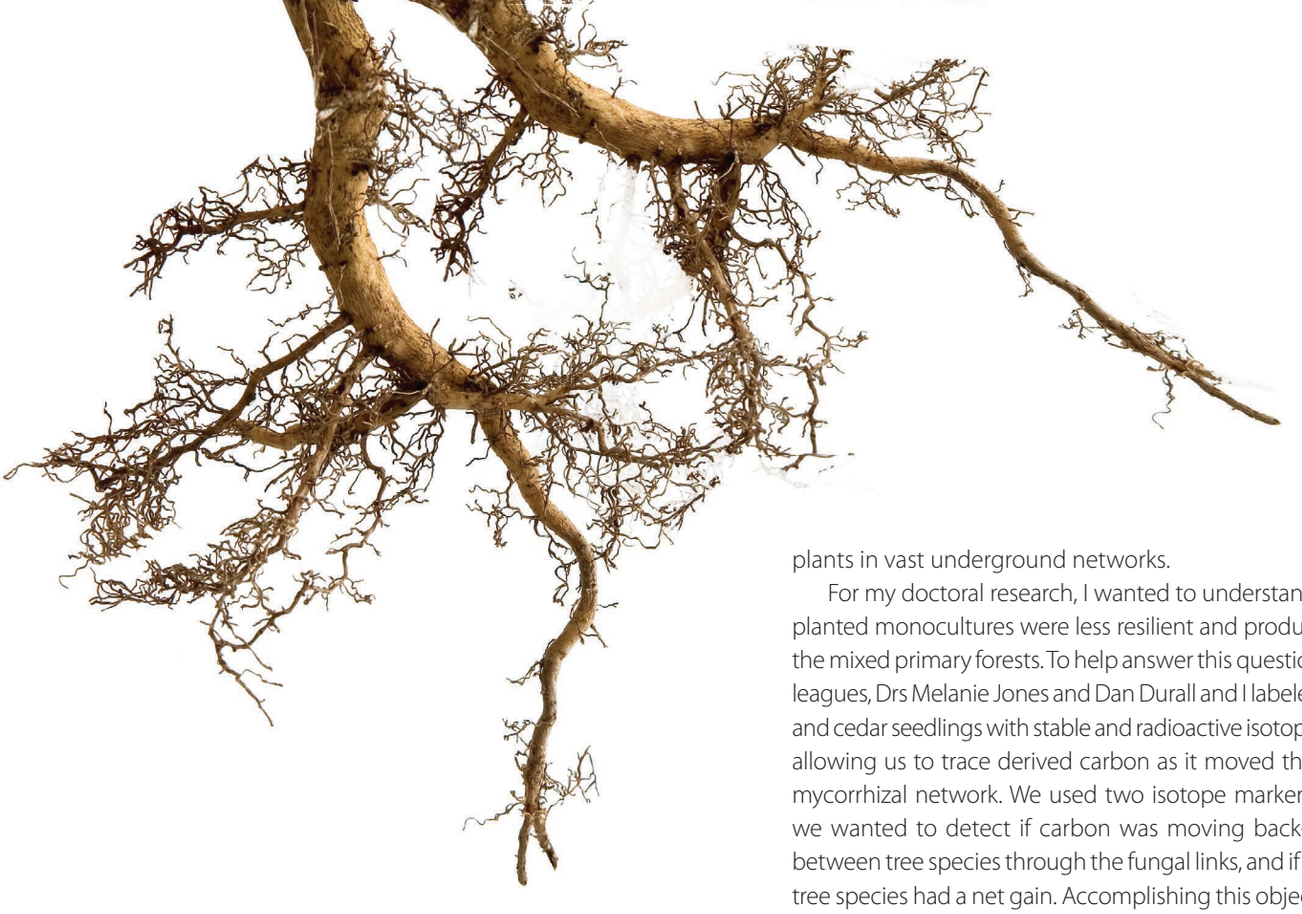
For further information contact Julien St-Amand at julien.st-amand@alumni.ubc.ca or Dr Kathy Martin at kathy.martin@ubc.ca.

Unseen Connections

In the spring of 2014, Dr Suzanne Simard (Department of Forest and Conservation Sciences) was contacted by Dr Marc Guttman, an emergency room physician, to contribute to his new book, We Discover. Dr Guttman wanted to reach out to people engaged in the pursuit of scientific discovery, and he had heard about Suzanne's work on mycorrhizal networks that link trees in forests. Suzanne joined a collection of other researchers, innovators and explorers in contributing personal stories of the development of their interests, research and discoveries. Below is a curated part of Suzanne's contribution.

"My kid-brother, Kelly, runs down the gangplank onto the logger's houseboat yelling "Jiggs fell in the outhouse!" We can hear Jiggs' muffled howls coming from the earthy pit. The howls are mostly in fright but also tinged with embarrassment, knowing his canine curiosity has finally landed him in the deepest possible s**t. "Tabernac!" Uncle Wilfred growls, as he strides up the path to the outhouse with a shovel. By this time, my whole family is peering down through the hole in the seat, calling to Jiggs that we will surely rescue him. Jiggs' beagle eyes, partly covered by toilet paper and drooping with remorse, stare back up at us. Uncle Jack, with half his fingers missing from chainsaws and axes, joins the rescue operation with a heavy mattock. He is laughing, as always. Rich smells drift up and we break into peels of laughter. The men quickly organize for the messy excavation. Soon remains just the men and I, them digging and me watching because I have a particular fascination with earthy detritus. I become entranced as the men dig down through the layers, starting with the dark forest floor, then the white then red then yellow mineral soil horizons underneath. The men curse. The fine roots have formed an impenetrable mat and the coarse ones are jutting at awkward angles deep in the soil. These roots provide Jiggs a foothold to rest from his struggles. The interwoven pallet of roots and soil also serve to anchor and connect the colorful mix of birch, hemlock and cedar trees. This diverse mixture inhabits the inland rainforests of BC's Monashee Mountains. Then, with a great deal of howling and cursing en français, the men liberate Jiggs from his earthy bind. Thus began my serendipitous journey of discovery about the unseen world of the forest.

The forest seems part of my blood and bones. My Dad would often take us up the mountain above the outhouse, following an old log flume deep into the forest. At the top of the flume, the ephemeral springs in the cedar swales would greet us with sweet aromas of wild ginger and skunk cabbage. There, Dad told of his own father and uncles who, in the 1940s, hoisted old-growth cedar logs into the flume with their pike poles, chokers, and horses. They were hand-fallers, selecting only a few to eke out a living. My Dad was a kid in those days, and his job was to stand on the log boom in Mabel Lake at the base of the flume. He waited for the logs to come barreling down the mountain, and when they pierced the water, they would disappear deep into the lake leaving an eerie silence. Where would they surface? Would they impale him from below? What took only seconds seemed like hours of torture. When they did emerge, it was as though a gun had been fired and the enormous logs shot



straight into the sky. Boom! My frightened Dad would then use his pike pole to train the bobbing cedar logs into the growing boom. The fear of this experience in my dad, along with the wonderful aroma of wild ginger root, are etched in his DNA, and then were copied into mine.

These early childhood experiences with my logging family in the forest-clad mountains of interior British Columbia eventually drew me to study forestry at UBC. After graduating in 1983, I worked as a silviculturist in the Lillooet Ranges for a logging company, Evans Forest Products. There, I sometimes worked alongside Grant Hadwin, forest road engineer, who was the eventual fugitive hewer of the famous Golden Spruce on Haida G'waii. He acted in protest against the provincial harvest. Like Grant, I was deeply conflicted by my part in the cutting of our old-growth forests. Back home, I watched my beloved Monashee forests cut up into uniform clearcuts, which eventually became so numerous that the old-growth forest was all but gone. These clearcuts were replanted with fast-growing lodgepole pine and Douglas-fir instead of the richly diverse, multi-successional native mixtures. Silviculture policy in the mid-1980's, in place to this very day, encouraged removal of my beloved birches to eliminate their competitive effects.

Through my graduate research, I learned that most of the forest is unseen. Underneath is an 'Otherworld', where creatures of life and death drive biogeochemical cycles. I joined scientists who were probing the soil with lenses, microscopes and later DNA markers and learned that the unseen Otherworld is teaming with communities of soil organisms of all sizes. We now know soil as a complex social system, where creatures of the soil foodweb eat each other, communicate, exchange resources, transmit warning signals, and even eavesdrop on each other. The mycorrhizal fungi in particular form tiny mycelial threads that penetrate the smallest soil pores, break down soil organic matter, take up nutrients and water, and connect plants in vast underground networks.

For my doctoral research, I wanted to understand why the planted monocultures were less resilient and productive than the mixed primary forests. To help answer this question, my colleagues, Drs Melanie Jones and Dan Durall and I labeled birch, fir and cedar seedlings with stable and radioactive isotope markers, allowing us to trace derived carbon as it moved through the mycorrhizal network. We used two isotope markers because we wanted to detect if carbon was moving back-and-forth between tree species through the fungal links, and if one of the tree species had a net gain. Accomplishing this objective deep in the wilderness was no small feat. The radioactive carbon had to be kept frozen in vials using liquid nitrogen, which involved driving back-and-forth daily from the bush to UBC Okanagan 300 kilometers away. To release the isotope as tagged carbon dioxide that the tree could then photosynthesize, we had to inject acid into the frozen radioactive base fixed inside bags covering the seedlings. Once the needle was plunged into the bag's septum, the acid was dripped into the frozen vial.

In performing this nerve-wracking feat, I wore a hazmat suit and goggles. I waddled from tree to tree, injecting acid and sweating profusely under the hot mid-summer sun. As I stumbled to the furthest set of trees, I suddenly heard snorting. I knew that sound. I looked up to see a mother bear and a cub walking toward me. I looked at them, then the syringe in my hand, and I thought – "OH NO!" I remembered – if its grizzly brown, hunker down; if it's black, fight back. In a frightful moment, I did neither. Instead, I ran, holding the syringe high in the air, shouting "GO AWAY!" The bears ran after me. I ran faster. They caught up to me. Just as the bears and I were approaching the work truck, Dan jumped onto the roof and I clamored up behind. Mama bear stood on her hind feet a few meters away and stretched her neck to see what sort of beast we were standing on. We shouted. We waved our arms. I warned her I had radioisotopes! She shrugged in amusement, somehow seeing my bluff that I had only acid in the syringe. After several moments, she sank back to her all-fours, gestured to her cub, and they both slipped silently into the woods."

Excerpt from: Simard, SW. 2015. Unseen Connections. In: Guttman, M. We Discover, available from www.WeDiscover.net.

Suzanne Simard and her colleagues published this research in Nature , showing that Douglas-fir and paper birch were intimately interconnected in a diverse mycorrhizal fungal network and communicated with each other in the language of carbon. Suzanne can be reached at suzanne.simard@ubc.ca.

development & alumninews

Historic campaign wraps-up

In 2008 UBC launched an ambitious campaign with the dual goals of raising $1.5BN and doubling the number of alumni engaged in the University over a 7 year period. The Faculty of Forestry's goal was to raise $22M and double alumni engagement. Today I am pleased to report that at the conclusion of the *start an evolution* campaign we have collectively exceeded both of these goals, at the University, and at the Faculty level.

At the outset of this campaign, I wrote that it is difficult to overestimate the importance of the world's forests but that this importance often goes unnoticed, and a major challenge for us is to help people realize the significance of forests and their products.

This campaign has taken us to a new level of alumni and community engagement in the life of the Faculty, and unprecedented levels of philanthropic support. You have helped make our aspirations a reality.

With your help, we have:

- Increased the number and variety of undergraduate and graduate scholarships, fellowships and bursaries, helping us attract and retain top-calibre students with a diverse range of backgrounds and passions.
- Provided more students with opportunities for internships and field work, giving them invaluable real-world experience before graduation.
- Expanded our research capacity by acquiring state-of-the-art equipment and partnering with other institutions worldwide, allowing us to create new knowledge that can be applied to multifaceted challenges.
- Completed the 12-year redevelopment of the Loon Lake Research and Education Centre, reviving and expanding its role in forestry education and community outreach for decades to come.
- Engaged more alumni in the life of the Faculty through doubling alumni involvement, establishing a tri-mentoring program and hosting alumni events throughout British Columbia.

Whether you supported the Faculty financially or with your time and expertise, your gift is very much appreciated.

Thanks to you, our capacity to be a magnet for excellent students, a nexus for interdisciplinary research, and a worldwide leader in forestry has been strengthened and enhanced. There are now opportunities open to our students, researchers and working professionals that would not exist without your help.

Thank you for your vision, your energy, and your eagerness to drive forward forestry education, research and community engagement with us. The momentum that you helped create through this campaign will continue to propel us to even greater accomplishments in the future.

John L Innes, Professor and Dean

2,863 engaged alumni

Raised $25.9 million from 1,190 generous donors

Completion of the Loon Lake Research and Education Centre redevelopment

29 scholarships, bursaries & awards, 2 research chairs

What's next?

As you have read in the message from Dean Innes on the previous page, with your support, the Faculty's *start an evolution* campaign has had a tremendous impact on creating opportunities for students, researchers and the community that would not otherwise exist. The work now is to maintain that margin of excellence and use the momentum created in the campaign to continue on this trajectory. The Faculty will continue to focus its efforts on:

- Enriching the student learning experience at both the undergraduate and graduate level.
- Building and expanding the Faculty's research capacity in current and emerging issues.
- Creating meaningful community engagement opportunities through partnerships and outreach activity.

We continue to need your support and involvement to meet these goals and ensure that British Columbia and Canada remains a global leader in forestry, natural resource conservation and wood products education and research – a goal from which we all collectively benefit.

To get involved please contact, Emma Tully, Assistant Dean, Development & Alumni Engagement, Tel: 604.822.8716 or by email at emma.tully@ubc.ca or visit getinvolved.forestry.ubc.ca.

Mark your calendars for the following forestry alumni events:

- **Class of '71 reunion** in Sidney, BC, July 12th – 14th, 2016
- **Loon Lake Alumni and Friends BBQ & Tour** at the Malcolm Knapp Research Forest, Maple Ridge, Thursday, April 28th, 2016
- **Class of '56 renunion** in Vancouver, Saturday, May 28th, 2016

For more details on these events, contact Janna Kellett at janna.kellett@ubc.ca or 604.827.3082.

Alumni in action – City of Surrey

Left to right. Eoin O'Neill, Neal Aven, Yalda Asadian, Owen Croy, Rob Landucci, Leah Zia, Mohammad Asadian, Nadia Chan

Recently we found a community of UBC Forestry alumni, including 2 siblings, working in the Parks Division at the City of Surrey, BC. We caught up with them to learn a little about their careers and experiences.

What is your role at the City of Surrey?

Owen Croy, BSF'87: I'm the Manager of Parks and my responsibilities include special events, the film office, long range planning for acquisition of new parks, overseeing the design of new parks, construction and the civic beautification office. I joined the City of Surrey in 1992 and very shortly after I became responsible for the city's street tree program and management of its natural forests. By 1994 I had moved into my current role. In 1996 I realized that the city needed a comprehensive urban management plan and with a small team we set about putting one together. We also created a complete urban forestry section which we launched in 2000, and that's when we started hiring UBC forestry graduates.

Neal Aven, BSc(Nat Res Cons)'00: I started with the City of Surrey in the Parks division in the spring of 1995 while I was in university. I started with repairing sports fields and then worked with the GIS database. I moved to full time when I graduated and since 2013 have been the Urban Forestry and Environmental Programs Manager. We maintain all public property trees and forests in the city and operate the Surrey Nature Centre. We are also responsible for environmental stewardship programs.

Nadia Chan, BSF'00: I'm the Natural Areas Coordinator and the quick version of what I do, with the Natural Areas team, is to manage the forested parkland that the city owns so that people can enjoy and recreate while protecting the ecological values. I started with the city around 2003 as a field crew member and moved into a technician role, then into my current position.

Leah Zia, BSc(Nat Res Cons)'05: I am going into my 10th year at the City of Surrey and I am the Community Services Coordinator. I take the messages the Urban Forestry and Environmental Programs want to distill and I put them into a format that is easily accessible to the public, such as signs, interpretive kiosks and brochures. I also help coordinate environmental events throughout the city, so my hands are in lots of different pots, which I enjoy.

Rob Landucci, BSc(Nat Res Cons)'01: I've been here almost 9 years and I moved from temporary labourer to Natural Areas Practitioner, and am now a Natural Areas Technician. My role is to help with the management of our natural area parkland in Surrey and follow the goals and objectives outlined in our Natural Areas Management plan. My main 3 areas are: tree risk assessment; wildlife program; and natural area restoration.

Yalda Asadian, BSc(Nat Res Cons)'08: I started out in the summer of my third year at university with SNAP, Surrey's Natural Areas Partnership . I was a volunteer coordinator for them and it was my first time being in Surrey. The following year I took the same job and the year after that they expanded the position for me so I was the Environmental Education Coordinator for SNAP. When I graduated I worked for BC Parks for an 8 month contract, and then came back to the City of Surrey as a relief program coordinator. I've been blessed with the opportunity to have a lot of varied roles and experiences here and in June of 2014 I became the Special Projects Manager for the Parks, Recreation and Culture Department.

Eoin O'Neill, BSc(Nat Res Cons)'09: My role is the Asset Management Analyst. It's definitely a mixture of many different aspects. I work for the Business Operations

and Support Services department and one of my primary responsibilities is to maintain the Parks GIS database. The other component of my job is working with our asset management program, which is called City Works. I think, in general, I'm seen as the IT guy for the office too, so if there are any common issues having to do with computers and technology, I'm the first person they come to.

Mohammad Asadian, BSc(Nat Res Cons)'15: I started out with SNAP and now I work for the Environmental Programs section, promoting environmental programs and green spaces. We represent the Nature Centre and our goal is to get families to go outdoors and appreciate nature through school programs, day camps, natural play areas and family drop in centers. We also have booths and tents in all city wide events to promote going outside and experiencing nature.

What do you enjoy most about your job?

Owen: The area I find most fulfilling is hiring excellent people that will carry out the work, and we have excellent people. The other is that I get to mentor junior managers and aspiring young leaders. We have a program called Management 101, where I serve as a lecturer. We also have an Emerging Leaders Program where we select 20 worthy individuals and put them into a program where they can develop their leadership skills and become the leaders of the future.

Neal: I love that we play a major role in greening the city, along with all of the benefits of trees and forests, from clean air to storm water management to the aesthetic side.

Nadia: I like connecting the community with forests and seeing people enjoy and use them.

Leah: It's phenomenal, being able to just drive people outside to play in Surrey's urban forests - whether it's in their backyard, learning about the tree planted outside their house, or walking a new trail in the park.

Rob: The part I enjoy the most is the natural area restoration, I also quite enjoy the forest health aspect of the tree risk assessment.

Yalda: The sky is the limit and I think our city is growing fast and it's diverse. So, if you have the right idea, you have the support of the city to run with it. Something else that is great is mentorship; we have amazing senior staff that are very supportive of our team. I'm part of the Emerging Leaders Program and I'm enjoying it. It's a lot of work, but it gives you a lot of tools to be a better leader right now and in the future.

Eoin: It's a good work environment where I think people really appreciate what you do for them. I also enjoy introducing people to new ways of doing things, whether it is technology or ways of organizing their work – I find that satisfying.

Mohammad: I love teaching and being with kids because that was my background before university, so it's cool to mix your passion with your education. I'm teaching what I was taught in Forestry and passing it down to the next generation, getting them interested in going outside and learning about nature.

Do you have advice for students or new alumni?

Owen: In urban forestry, we concern ourselves particularly with the interaction between people and trees. I like to quote a colleague, Paul Ries, who has had a full career practicing urban forestry and is now an instructor at Oregon State University. Paul says "Trees are easy to manage; it is managing the human dynamic associated with trees that is hard!" For those entering this field of practice, it is critical to understand how people's relationships to trees and forests are formed and nurtured, and how to turn that understanding into planning and implementing urban forest policies and practices.

Neil: In terms of urban forestry, a lot of municipalities are still building their programs so don't be deterred if you put your hat in the ring and you don't get a position. Keep at it and show your enthusiasm through other avenues, such as volunteering. You can gain valuable skills which will be applicable when you do find one of those full time roles. Just stick with it!

Nadia: Don't be scared to try a job that you don't think you're going to like, or take a job in the middle of nowhere. Give it a try for a season because you might surprise yourself and enjoy it. And if you don't like it, at least you know you really gave it a try. There are a lot of opportunities we don't know about and we won't find out about them unless we try. It's also worthwhile to try different aspects of forestry because during your career you will be able to understand what the other sides are doing and it makes you better at your job.

Leah: You can end up in so many different careers, so you really need to augment your education with work experience through the summer. Take advantage of lots of different types of work to find out where you want to end up. While I was at Forestry I did one co-op term with SNAP where we worked with habitat restoration and education, which was when I realized I had a passion for environmental education.

Rob: While you are at school, identify what you want to do and talk to professors to see if there are opportunities to work with them. At the end of my third year I got a job with Dr Peter Arcese doing song bird research, and I found that experience enjoyable and very beneficial.

Yalda: Don't expect the perfect job right away. Start basic, perhaps volunteering if you can, and set a precedent there and work up. If you love the job you do and if you love the place that you work, everything else falls into place.

Eoin: I took a lot of value out of the Forestry Co-op program, so I would highly recommend it. I didn't really know what kinds of job prospects there were out there for me, so even having a chance to look at the job board was helpful. I think it's always good to have that goal in mind throughout your education – eventually when this ends, you're going to have to find a job.

Mohammad: Make a lot of friends and enjoy your time at university because when you look back, you're going to realize it was one of the best times of your life. Also, enjoy the Forestry building because it's one of the quietest places to study.

To learn more about the City of Surrey's Parks Department and Urban Forestry Program, visit www.surrey.ca/culture-recreation/2015.aspx. For information on UBC's new undergraduate degree in Urban Forestry visit www.forestry.ubc.ca/ and click on the Urban Forestry link.

Reunions

Calling all members and affiliates of the Class of '86

The class of 1986 is in the early planning stages of a reunion and we want to ensure we have your contact information. If you are a member of the class and are not sure that we have your email address, please send it to janna.kellett@ubc.ca so we can keep you in the loop on all the reunion activities.

Forestry Class of '71 reunion

The Class of '71 is planning its ninth reunion to celebrate 45 years of survival since their graduation. The reunion is planned for July 12th to 14th 2016 in Sidney BC. As per the normal form, Tuesday evening will feature the arrival reception. Wednesday will feature golf at Royal Colwood, a hike through Goldstream Park or free time during the day, followed by a banquet. On Thursday an exploration of the Galloping Goose bike trails will be offered for those wishing to extend their stay an extra day. Most classmates have been contacted via email and future correspondence will follow at frequent intervals. Unfortunately our email list is not as complete as we would like. Ken Baker is chairing the reunion committee and can be reached at Ken_Baker@shaw.ca.

Electronic versus paper?

BranchLines is currently mailed to over 4,500 Forestry alumni, interested groups and individuals. We also upload an electronic version of each issue to our Faculty website **www.forestry.ubc.ca/branchlines/**.

If you would prefer to stop receiving paper copies we can notify you by email when electronic versions are available online. To change your subscription from paper to electronic notification please send your request to jamie.myers@ubc.ca.

Check out the revamped Alumni and Development websites

Since our program has been growing steadily, it was time to overhaul the Forestry Alumni and Development section of the Forestry website. We now have a new and more user and mobile friendly design to help you find the information you are looking for, for example how to organize a reunion, event details and how to get involved with the faculty. We have also added new sections, one example is the alumni profile section where you can read through the career paths of fellow Forestry alumni.

We hope you'll take a moment to check it out at **http://getinvolved.forestry.ubc.ca/** and let us know your thoughts and feedback through the survey tool on the site.

Newsletter production

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