UBC Forestry

branchlines

Volume 30#3 Fall 2019

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dean's message

A number of faculty members will soon be joining the 25th World Congress of the International Union of Forest Research Organizations (IUFRO), being held in Curitiba, Brazil. The Congress will address how forest researchers can help solve some of the grand challenges of our time. These are often referred to as 'wicked problems', a topic addressed in a forthcoming book by William Nikolakis and myself where we suggest that many of the problems currently facing forestry could be resolved by more effective governance.

As has recently been shown in the debate about the importance of forest fires in the Amazon, it is critical to have the relevant scientific facts: only these can provide the basis for finding solutions. The facts always interact with policy, itself affected by a multitude of factors including societal, economic, environmental, and political. The massive exchange of information that occurs at the IUFRO World Congress is an important step in moving towards planetary solutions for some of the global challenges that we face. The research programs and initiatives conducted at our Faculty help to address these; some of the most recent ones are highlighted in this issue.

Much has been said about the circular bioeconomy. It is going to be a challenge for us all to place more emphasis on sustainability. As students in our forthcoming undergraduate program, Forest Bioeconomy, Science and Technology (BEST) will learn, forests will play an important part in the future. Our BEST students will find out about the many different ways that wood can be used, and how the different products will all play a role in creating a cleaner future for our planet.

Some might argue that the bioeconomy is still a long way off, but the evidence suggests otherwise. In Europe and elsewhere, very significant investments are being made in biorefining, and the list of products coming from mills is impressive. For example, the new biorefinery being built by Boreal Bioref Ltd. in northern Finland will produce long-fibre bleached and unbleached pulp, dissolved pulp, microcrystalline cellulose, C5 and C6 sugars, biogas, pine oil, turpentine, and granulated soil improvement substances. On top of all that, it will produce twice as much electricity as it needs and obtain 80% of its fibre from the forests in the area. British Columbia, and indeed Canada, has nothing as ambitious as this at this time but important advances are being made by the Advanced Renewable Materials Lab on the uses of lignin and by our Faculty on ensuring the sustainability of the biomass supply chain.

While the use of wood is critical for the development of a global bioeconomy, it needs to be done with care. Good forest management practices can help guide this, as can conservation. We need to ensure that countries have adequate governance systems in place so that forests are not exploited inappropriately, an all too common problem. While the use of wood in furniture, for example, should be encouraged, it should not be at the cost of the depletion of precious woods in countries such as Madagascar.

A central tenet of the IUFRO World Congress is global collaboration, and this is also one of the Faculty's characteristics. This issue of *Branchlines* contains several examples that demonstrate this from the community-focused REACH Program, a climate resilience tool for Vancouverites, to universities at opposite ends of the globe working together to provide novel, immersive, multimedia approaches to help their students better understand tropical ecosystems.

When addressing our shared global challenges, deliberate attempts to be more inclusive, collaborative, and innovative will help us generate the best, most creative solutions together. Just as importantly, it will ensure that these solutions are put into practice.

John L Innes
Professor and Dean

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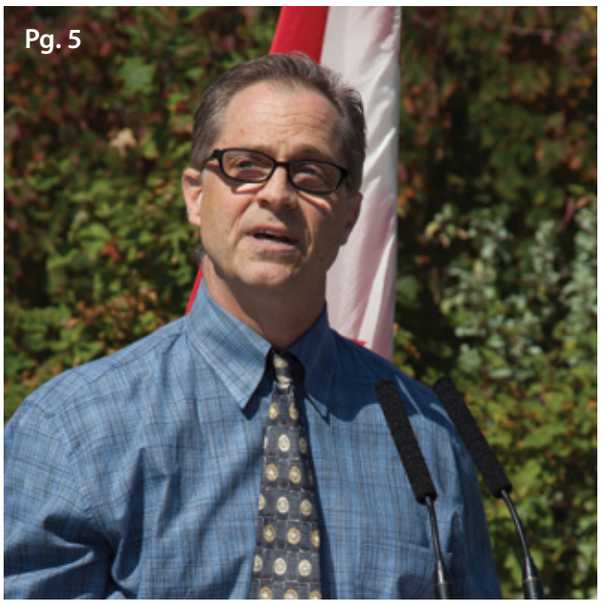

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Editor: Susan Gagnon, susan.gagnon@ubc.ca
Designer: Jamie Myers, jamie.myers@ubc.ca

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Questions concerning **branch**lines or requests for mailing list updates, deletions or additions should be directed to jamie.myers@ubc.ca.

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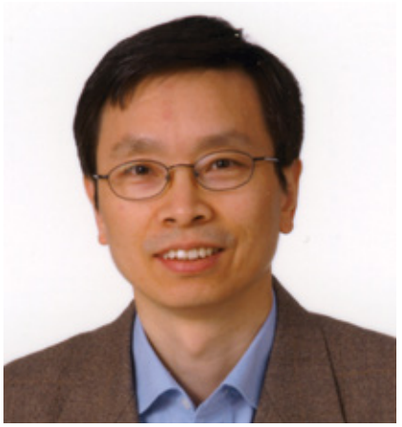
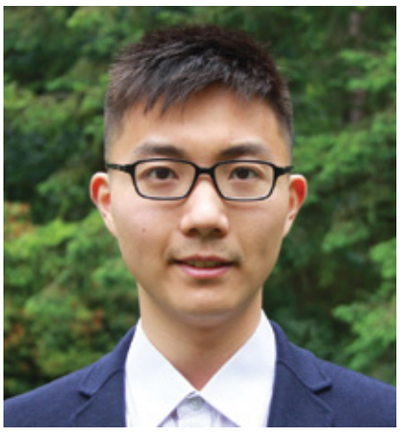
THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Forestry

NEW APPOINTMENTS



Dr Chunping Dai has joined the Department of Wood Science as an associate professor of Bamboo Utilization Technology and Engineered Wood Products. He has a PhD in wood science from the University of British Columbia. Prior to joining UBC, he was a principal scientist in Forintek/FPInnovations where he worked for 25 years, providing technical services to the Canadian forest products industry, especially in the area of engineered wood products. During that time, he was also a long-time adjunct professor with UBC and several forestry universities in China where he studied and taught wood and bamboo composites. *He can be contacted at chunping.dai@ubc.ca.*

Marie Labitté has joined the Faculty's Development and Alumni Engagement team in the role of Development Officer. Marie was previously with Canopy, a not-for-profit promoting forest conservation and sustainable forestry practices. She has a deep commitment and passion for forest ecosystems and has been working to advance the work of Canopy, most recently in the role of Senior Development Officer. Marie is originally from Normandy, France and has been living in Canada since 2012. *She can be reached at marie.labitte@ubc.ca.*



David (Ziyan) Zhong has joined the Faculty's Asian Strategy Unit as Research & Partnership Development Coordinator. He holds a Bachelor of Science in Forestry and a Master of Sustainable Forest Management degree from the University of British Columbia. David is a Registered Professional Forester and comes to us from Skeena Sawmills where he worked as a Forestry Supervisor. In his current role and with a background in forestry operations, he will be assisting with the process of aiding the transfer of students from partner universities in the Asia-Pacific region to UBC. *He can be contacted at ziyan.zhong@ubc.ca.*

Steph Troughton has joined the Faculty's Communications team in the role of Senior Communications Manager. Steph was previously with Laura Ballance Media Group (LBMG) where she worked as a senior account manager for one of the busiest public relations and advertising firms in the Lower Mainland. Prior to her time with LBMG, she worked as an independent communications advisor for a diverse roster of clients including those representing the forest sector. Steph was also part of the communications team at FPInnovations for numerous years. *She can be reached at stephanie.troughton@ubc.ca.*

forestry**news**

AWARDS AND RECOGNITION

FACULTY AWARDED $1.6 MILLION IN FUNDING FOR WILD SALMON CONSERVATION AND HABITAT RESTORATION PROJECT

The Faculty of Forestry's forest and conservation sciences professor Scott Hinch was recently awarded $1.6 million in government funding over five years for his team's work in wild salmon conservation and habitat restoration.

During an official press conference hosted this summer by the Government of Canada and Province of BC and held at the Forest Sciences Centre, his project was one of five local awards funded to Lower Mainland groups under the umbrella of the British Columbia Salmon Restoration and Innovation Fund (BCSRIF) for a total local investment of $2.7 million. Overall, the BCSRIF will provide an investment of up to $142.85 million over five years to support the province's fish and seafood sector, and to ensure the sustainability of wild Pacific salmon and other BC fish stocks. This fall, there will be another call for project proposals.

Jonathan Wilkinson, Minister of Fisheries, Oceans and the Canadian Coast Guard, and faculty dean John Innes were among those congratulating Scott for his many outstanding achievements involving salmon research, salmon being a key species in BC forest ecosystems. One of these is winning the 2018 MITACS Prize for Exceptional Leadership, which is awarded to select professors considered to be instrumental in advancing innovation.

In their most recent project, Scott and his research group, The Pacific Salmon Ecology and Conservation Lab, focus on improving the sustainability of capture and release marine recreational salmon fisheries.

During the press conference, Hinch said, "It's imperative for management decisions to be informed by the best possible science and this project uses cutting-edge, individual salmon based tracking and genomic technologies."

Scott also said his lab's latest project will include developing recommendations and guidelines for improving catch and release practices as well as providing guidance to fisheries for dealing with climate change challenges such as warming temperatures.

CONGRATULATIONS TO DR LORI DANIELS, CIF SCIENTIFIC ACHIEVEMENT AWARD RECIPIENT

Dr Lori D Daniels (Department of Forest and Conservation Sciences) has been honored with the Canadian Institute of Forestry/Institut forestier du Canada (CIF – IFC) 2019 Canadian Forestry Scientific Achievement Award.

The award recognizes Lori's outstanding work as a fire science researcher and her reputation as a widely recognized figure in the interpretation of wildfire. In 2017, Lori co-authored the publication *Megafires in British Columbia – Urgent need to adapt and improve resilience to wildfire*. That same year, the group of authors wrote to the provincial government imploring the government to consider a recommended four-prong approach to improving communities' wildfire resilience. Their recommendations included: improving fuel reduction treatments; integrating wildland-urban interface zoning and pro-active landscape planning; enhancing forest restoration and management practices; and increasing research funding for informing adaptive wildfire management practices.

The official award ceremony will take place in Pembroke, Ontario in October.

UBC AND FACULTY FEATURED IN BOOK SHOWCASING BC'S INNOVATIVE WOOD BUILDINGS

UBC's leadership in innovative wood use is prominently featured in Naturally Wood, a new book produced by Forestry Innovation Investment, the Government of British Columbia's market development agency for forest products. The 160-page collection highlights BC's sustainable forest management and innovative product development, while showcasing BC's rich wood building culture.

Of the 65 projects featured, eight are from UBC, demonstrating the university's ongoing leadership in incorporating innovative uses of mass timber in academic, industrial, and residential buildings throughout its campuses.

Featured buildings include the Forest Sciences Centre. When completed in 1998, it was one of the first UBC buildings to incorporate mass timber elements. Housing the Faculty of Forestry, it reflects both BC's world-renowned wood architecture and the pioneering research and technologies stemming from our Faculty.

The Faculty is also represented in the publication's list of expert contributors with Dean Innes featured in an article on the importance of increasing Indigenous traditional knowledge in forestry education as an integral aspect of sustainability and effective resource management. Dean Innes notes, "Our goal is to create a centre of excellence in traditional use and management".

Globally recognized as one of the top institutions in forestry-related research and education, the Faculty looks forward to continuing to lead the advancement of the health and wellbeing of our planet's forested ecosystems and all who interact with them.

To learn more about UBC's innovative wood buildings and to read the article featuring Dean Innes, download your free copy by visiting naturallywood.com.

A DEGREE THAT COMBATS CLIMATE CHANGE

The Faculty of Forestry is committed to tackling the grand challenges of our time, as articulated in the new UBC Faculty of Forestry Strategic Plan 2019-2029. One such challenge, combatting climate change, is being addressed through the introduction of a new undergraduate degree, the Forest Bioeconomy Science and Technology (BEST) program.

The first of its kind in Canada, this program aims to provide graduates with the interdisciplinary skill-set required to imagine and implement a viable manufacturing sector focused on sustainable bioproducts, including those originating from forests. These efforts are being complemented by ongoing research conducted within our faculty as discussed in "The Bioeconomy in BC Forests" article in this edition of Branchlines.

BEST is set to launch in September 2020, with applications due early in the New Year. Students currently enrolled in the Faculty of Forestry will also be eligible to transfer into the second-year of the program.

For more information on BEST and the opportunities that this degree can lead to, please contact Dr Scott Renneckar at scott.renneckar@ubc.ca.

THE HAIDA GWAII INSTITUTE

LEARNING TOGETHER AT THE EDGE OF THE WORLD

The Haida Gwaii Institute (HGI) is a community-based education and research post-secondary institution that develops and delivers transformative education inspired by Haida Gwaii. A remote island archipelago off of Canada's northwest coast, Haida Gwaii is the ancestral, traditional and unceded territory of the Haida Nation, and is known to some as the edge of the world.

HGI offers students immersive, experiential learning opportunities in rural, resource-dependent communities in transition. Here, the Haida Nation, island communities, and provincial and federal governments are working together through complex, joint-management models towards reconciliation and sustainability.

When the organization took form a decade ago, Elders from HlG̱aagilda X̱aayda Kil Naay Skidegate Haida Immersion Program were asked to find a term in the Haida language that was fitting for the work that they set out to do in education. Their response was **Sk̲'aadG̲a G̲ud ad is** which translates to, "Learning Together".

Sk̲'aadG̲a G̲ud ad is embodies the shared vision for a cross-cultural and community-based approach to higher education. The institute aims to provide both western and Indigenous lenses on issues explored in class, and to learn from leading academics as well as people with direct, lived experience who are experts in their own right. Facilitating this rich collaboration supports a meaningful learning exchange and the opportunity for students to develop a deep and broad perspective.

HGI is governed jointly by the University of British Columbia's Faculty of Forestry and the Haida Gwaii Higher Education Society, which is made up of a diverse board of directors ranging from forestry professionals, doctors, hereditary chiefs, and other local communtiy members committed to the idea of learning together and to transformative education inspired by Haida Gwaii.

Embracing a place-based approach, HGI sees the social and ecological systems of Haida Gwaii as vibrant natural classrooms engaging students by grounding high-level course content in living, local case studies.

As issues around the globe become increasingly complex, HGI's range of programs help position students at the leading edge, preparing them to be future leaders and decision-makers. Current programming includes undergraduate semesters, executive education and professional development courses, research opportunities, public lectures and workshops, and more.

Applications are now being accepted for several programs, including:

- Semester in Natural Resource Studies; January to April 2020
- Semester in Marine Conservation; January to April 2020
- Summer Session in Plants, People and Place; May and June 2020
- Semester in Natural Resource Science; September to December 2020

In addition, a call for applications will be opening soon for professional development and executive education programming which cover topics such as Aboriginal Law in Canada, Indigenization, and innovation.

For more information, or to apply, visit hginsitute.ca.

MEDIA SNAPSHOT

Here's a few excerpts taken straight from some of the stories coming out of the Faculty of Forestry. Visit the *Faculty in the News* section of our website to read more.

Conservationists call for lasting ban on trade in Malagasy precious timber

Published in *Mongabay News*, May 3, 2019
Dr John L Innes

For over a decade Madagascar has wrestled with a thorny question: What to do with stockpiles of illegal precious timber in government custody? A new analysis contends that selling off the confiscated timber would fuel rather than curb illegal felling and trade of endangered tree species. What needs to be done, according to a paper published recently in *Biological Conservation*, is to offer the hardwood species the highest level of protection under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) rather than sign off on a government plan to legally sell it.

To read the paper published in Biological Conservation, visit sciencedirect.com/science/article/pii/S0006320719304276

Using data to assess cooking gas adoption and its impact in India

Published in *Science Daily*, July, 2019
Dr Hisham Zerriffi and PhD student Abhishek Kar

Clean cooking energy transitions are extremely challenging to achieve, but they offer enormous potential health, environmental, and societal benefits. A study conducted by our Faculty's researchers provides new insights about a program based in India that aims to solve what is considered to be one of the most difficult developmental challenges of the 21st century – smoky kitchens. In their study published in *Nature Energy*, researchers endeavored to understand how the launch of the program has altered both the adoption and use of LPG. They employed an LPG sales dataset from one district of a southern state of India (Koppal district in Karnataka state) to carry out their analysis.

To read the paper published in Nature Energy, visit nature.com/articles/s41560-019-0429-8

Big, old B.C. trees produce mutations over time that could improve success: UBC

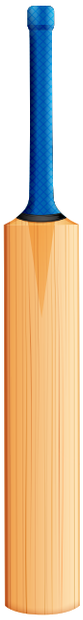
Published in *National Post,* July 11, 2019
Dr Sally Aitken

Researchers collected DNA from the tops of some of Canada's tallest trees to search for mutations that could provide evidence of how the ancient forest giants evolve to survive. It involved ascending 20 Sitka spruce trees on Vancouver Island, averaging 80 metres tall and ranging in age from 220 years to 500 years old, to reveal that the old-growth trees developed mutations to their genetic code as they grow and age. Prof. Sally Aitken, associate dean in the Faculty of Forestry at the University of British Columbia, said they wanted to know whether mutations that occur during growth, as opposed to those during reproduction, could add up to substantial changes for the trees. The results of the research appeared in the June edition of Evolution Letters.

To read the letter published in Evolution Letters, visit onlinelibrary.wiley.com/doi/full/10.1002/evl3.121

Cricket for all: UBC researchers use algorithms to produce affordable cricket bat

Published in CBC online news, July 13, 2019
Dr Phil Evans



As New Zealand and England battle it out in the 2019 Cricket World Cup final in London, an attempt to transform a crucial aspect of the sport has begun thousands of miles away at the University of British Columbia. UBC forestry professor Phil Evans is leading a project that uses an algorithm to design a cricket bat that's cheaper to produce but just as powerful as the one used by professional cricketers.

To read the article, visit cbc.ca/news/canada/british-columbia/ubc-researcher-affordable-cricket-bat-algorithm-1.5210911

Indigenous-managed lands have the greatest biodiversity, says UBC-led study

Published in the *Georgia Straight*, July 31, 2019
Dr Peter Arcese and former UBC PhD student Richard Schuster

As human activities such as deforestation, overfishing, and emitting greenhouse gases continue to devastate the planet, the forecast is bleak for its species. More than one million types of plants and animals worldwide are currently facing extinction: a number that is between 1,000 and 10,000 times greater than the natural rate. A new UBC-led study suggests that Indigenous-managed lands may play a critical role in helping species survive. Researchers sampled land and species data from three of the world's biggest countries – Canada, Australia, and Brazil. The study was the first to compare biodiversity and land management on such a broad geographic scale.

To read the paper published in Environmental Science & Policy, visit sciencedirect.com/science/article/pii/S1462901119301042

Dr Suzanne Simard pioneers work on tree communication

Published in *BC Local News*, August 3, 2019
Dr Suzanne Simard

I became familiar with Dr Suzanne Simard's work through a TED talk where she described her work at the University of British Columbia, which is centered on understanding the vital relationships between plants, microbes, soils, carbon, nutrients and, in particular, how fungus reacts with tree roots. A mycorrhizal (fungus) network is a series of below-ground mutualistic connections via fungal hyphae (fine roots) and root systems of a plant community. The role of mycorrhizal association are wide-reaching, including resource acquisition and sharing, as well as acting as signaling pathways, potentially for individual (genetic) recognition between individual plants. Simard described how she determined the exchange of gases like CO_2 and other nutrients using radioactive isotopes and a Geiger counter. Some of her graduate students have gone on to show kin recognition/selection in interior Douglas fir and the role mycorrhizal networks play in that interaction.

To view Dr Simard's TED Summit Talks video, how trees talk to each other, visit ted.com/talks/suzanne_simard_how_trees_talk_to_each_other?language=en

COMMUNITY FORESTRY IN CLAYOQUOT SOUND

Gillian Miller

My Master's of International Forestry (MIF) summer internship with the Clayoquot Biosphere Trust served as an opportunity to explore how their community forestry model is helping support their many community initiatives and partners including:

- Clayquot Sound Biosphere Reserve Region
- Barkley Community Forest
- District of Ucluelet
- Toquaht Nation

By engaging with various stakeholders, I gained an understanding of the numerous ecosystem services provided throughout the Barkley Community Forest and surrounding region. Through these meetings, I was also able to understand how the community forest is enabling the Toquaht Nation, a Nuu-chah-nulth First Nation, to regain decision-making capabilities over their traditional, ancestral territories while also providing a source of funding for long-standing regional projects of both the District of Ucluelet, and the Toquaht Nation.

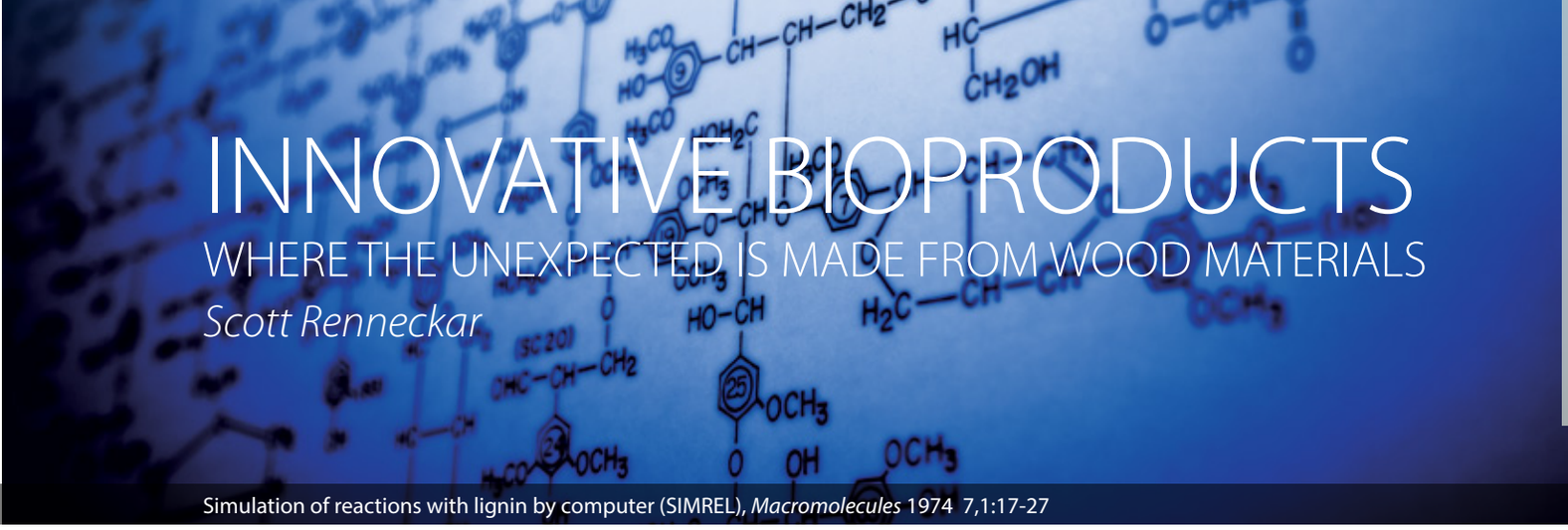
The Barkley Community Forest is an example of how a well-managed community forest can provide support locally, with profits generated from the forest staying within the region. This is unlike forestry operations of the past where a company would sometimes come in and leave with not just the timber, but all the profits and additional benefits.

In addition to providing local economic advantages, this community forest model also benefits the forest and surrounding ecosystems. Many of the community members involved have multigenerational ties to the land – and in the case of the Nuu-chah-nulth First Nations, these ties go back many thousands of years. These community members want to have a successful enterprise not only for today's communities, but also to ensure the regenerative nature of these ecosystems to support future generations, consistent with the traditional approach of the First Nations of the area.

The Barkley Community Forest case study demonstrates how community forestry can be used as a tool for implementing sustainable forest management, demonstrating the valuable contributions made by local knowledge and expertise. This community forest model has the potential to support local initiatives and small-to-medium forest enterprises through the use of small grants and microfinance opportunities for local community members whose ideas and vision match the larger goals and mission of sustainable forest management.

A key aspect of my internship was proposing an investment model that, if approved by the Barkley Community Forest Corporation, would structure the financial returns of harvesting to be shared with future generations. The model proposes that the Barkley Community Forest Corporation would set aside a percentage of their profits each year to be added to the Clayoquot Biosphere Trust's endowment fund, held in its own special sub-fund. It would only be used to support the community forest, including grants and microfinance capital associated with the advancement of the corporation's vision and mission. Each year, half of the compound interest would be reinvested into the principal to continue accumulating interest while the other half could be used to support current initiatives. Through reinvestment, future stakeholders in the community forest will have the opportunity to decide the best uses of these funds when the time comes.

I would like to thank all the communities in the Clayoquot Sound Biosphere Reserve Region, particularly the Toquaht Nation, Clayoquot Biosphere Trust, West Coast NEST, Barkley Community Forest, District of Ucluelet, and all other partners in the Clayoquot Sound Biosphere Reserve area for their time and support during my internship.



INNOVATIVE BIOPRODUCTS

WHERE THE UNEXPECTED IS MADE FROM WOOD MATERIALS

Scott Renneckar

Simulation of reactions with lignin by computer (SIMREL), *Macromolecules* 1974 7,1:17-27

forestry**research**

Trees are imposing plants, dwarfing all other vegetation. One might wonder just how they can grow to sizes taller than buildings? The key is that each of the trillions of microscopic cells found within trees contain a secondary lignified cell-wall. This structure means there is a rope-like fibre assembly for each basic unit of the tree that becomes embedded with a super glue-like compound called lignin. For a tree, lignin is analogous to the cement that coats metal rebar in a concrete wall.

While useful for the tree to grow tall enough to capture more sunlight than its neighbours, the encrusting material is removed during the pulping process to ensure products have desired characteristics such as tissue paper being soft and white. When lignin is removed, it is often burned as fuel during the paper-making process with only a small portion diverted from the furnace to create new bioproducts, as the complexity of lignin makes it an almost intractable substance.

Researchers and industry have long recognized its unique potential for many commercial applications ranging from engineered plastics to biobased chemicals. However, two key challenges must be addressed to advance the broader market application of lignin. First is the ability to recover lignin in amounts suitable for commercial applications. The second is the question, what can industry make from this biobased material?

Progress is now being made in making more lignin available. Recently, two Canadian forest products companies invested in infrastructure to recover lignin in amounts suitable for commercial applications. It is also an area of focus for UBC researchers Shawn Mansfield, Department of Wood Science, and Lindsay Eltis, Department of Microbiology and Immunology, who together with industry, are analyzing and fractionating lignin from several BC pulp mills to develop ways to increase the amount commercially available. The aim of the project is to find biological routes for conversion into high value chemicals that could be used to make materials like nylon.

Research is also currently underway to explore additional applications for lignin. By building on decades of previous work, we know of uses for lignin and the areas to improve upon when considering market realities and scientific advancement. To this end, I have picked up where my former co-advisor Wolfgang Glasser, Emeritus Professor, Virginia Tech, USA, left off in converting lignin into useful materials.

My Advanced Renewable Materials team at UBC has developed a new method to treat lignin so it can be processed with other bioplastics. Through a new infrastructure grant to our Bioproducts Institute, we are creating injection molded biodegradable plastic parts derived from lignin to replace fossil-derived plastics. Along a similar path, we have also created a straightforward method to react plant-based oils with lignin in order to create hydrophobic coatings to repel water off wood surfaces that can be used in the protection of wood products.

Other members of the Advanced Renewable Materials team took previous research on carbon structures and made foam-like, all-carbon materials. In one case, the spongy materials were ultralight weight and flexible and were able to soak-up polluting solvents or oil preferentially from water. Another case, involving research into high-surface area carbon materials, resulted in a patent and a collaborative research development grant to make super-capacitor materials serving as energy storage devices.

In addition to batteries, plastics, coatings, and sponges, our group also created a new catalyst to break apart lignin into small aromatic compounds. The main product isolated was the highly valuable compound vanillin, the essence of vanilla.

With renewed interest in sustainable materials and energy, lignin can play a central role in ushering in a new era, where the unexpected is made from wood materials.

Dr Scott Renneckar is an associate professor in the Department of Wood Science and is also the Canada Research Chair in Advanced Renewable Materials. He can be reached at scott.renneckar@ubc.ca.

ACHIEVING A GLOBALLY-FOCUSED BIOECONOMY IMPLEMENTATION PLAN

Gary Bull

Earlier this spring, UBC's Faculty of Forestry hosted the International Bioeconomy Forum (IBF) – 2nd Plenary Session, co-chaired by Canada and the European Commission. The session drew together delegates from nations around the globe to review and finalize implementation plans on how the bioeconomy can be used to achieve global objectives such as the United Nations Sustainable Development Goals.

The bioeconomy is an area of intense focus for many of us at the Faculty, reflected in the opportunity to host this significant conference. Broadly defined, the bioeconomy refers to the production and conversion of renewable biological resources into value-added products, such as food, feed, bio-based products, and bioenergy. Our work at the Faculty involves looking at ways that the bioeconomy can be used to achieve practical environmental solutions that address current sustainability challenges, particularly in the rural communities of British Columbia.

Our work ranges from preparing our students for opportunities in the emerging and innovative field of the bioeconomy to spearheading the research supporting multi-stakeholder and First Nations collaborations. Our Bachelor of Science in Forest Bioeconomy Sciences and Technology (BEST), also mentioned on page 6 of this edition of *Branchlines*, received approval from the Province of British Columbia and is set to begin in the autumn of 2020. It is the first ever program of its kind in Canada.

One of the largest employers in the province, the forest industry is a traditional cornerstone of the economy and has shaped our culture and way of life. However, the industry is undergoing a period of significant change due to challenges such as: lack of economically available fibre; continued pressure for improved conservation measures especially with the increase of natural disturbance patterns across the landscape; changes in First Nations rights and title to the land; dramatic changes in engineering, information and communication; forest biotechnologies; and the ongoing challenge to find ways to address climate change effectively. Our interest in the bioeconomy is undoubtedly fueled, at least in part, by the massive transition the industry is currently experiencing.

The types of goods and services produced by the bio-

> “The broad aim is to provide carbon-friendly energy sources, help fulfill Canada’s commitment to the Paris Agreement, and to create new economic employment opportunities in many rural areas of Canada.”

economy are generally classified as: bio-based chemicals, biocomposites, biofuels, next generation wood products, and bioenergy. I am currently focused on the bioenergy sector and its growth and development as a substitute for fossil fuel-based energy. My colleagues, particularly in the Department of Wood Science, are focusing on the other potential uses of biomass.

Wood pellets and chips, as a source of bioenergy, are an important topic around our bioeconomy tables. We have held meetings in communities throughout the province with forest companies, government, First Nations, and local stakeholders to look for ways that a sustainable biomass program could provide positive economic, environmental, and social impacts under the circumstances of massive change. Specifically, our discussions are centred on how BC’s traditional forest products industry could augment their operations to increase the production of energy from biomass.

To ensure that there are proper procedures in place to demonstrate the sustainability of biomass use for the various government regulators, the Sustainable Biomass Program (SBP), a third-party certification program, has been developed. The SBP assists in catalyzing many of these discussions, thereby helping us work through some of the practical and conceptual hurdles that we face. If we are to produce wood pellets and chips from forest and manufacturing residues, how do we ensure the sustainability of the entire supply chain? How do we ensure that the forests where they originate are being sustainably managed?

Through our many discussions, my colleagues and I are looking at an entirely new governance model for certification that complies with international requirements described by organizations such as the International Social and Environmental Accreditation and Labeling Alliance, the global membership association for credible sustainability standards. We are very concerned that issues such as GHG accounting systems and biodiversity are appropriately addressed. Another concern is that all key members of civil society are fully engaged in assessing the environmental, economic, social, and cultural implications of the increased use of biomass as an alternative to fossil fuels. The broad aims are to provide carbon-friendly energy sources, help fulfill Canada’s commitment to the Paris Agreement, and create new economic employment opportunities in many rural areas of Canada.

Applied research that supports the growth of the bioeconomy is the way of the future if we can find practical solutions that can be adopted by industry, governments, First Nations and NGOs.

Dr Gary Bull is a professor and the Department head of Forest Resources Management. He can be reached at gary.bull@ubc.ca.

CAN MADAGASCAR'S RARE ROSEWOODS BE PROTECTED?

John Innes

In Canada, logging is generally well-regulated and while there are examples of illegal activities, they are mostly considered to involve only a small amount of the overall harvest. This is not the situation elsewhere, and in some countries, a significant proportion of the wood harvested from forests is illegal. This can happen through various mechanisms. Protected species may be harvested, or logs harvested from protected areas, such as national parks. Logs may be harvested without paying stumpage or other duties, or exported despite the existence of export bans. Such activities become easier when done in countries with poor governance and high levels of corruption.

Globally, a major target for illegal logging is rosewood, a wood that has been widely used for furniture because of its beauty and fragrance. According to the UN Office on Drugs and Crime, rosewood accounted for 35% of the value of all global wildlife and forest product-related seizures between 2005 and 2014. Over-exploitation of rosewood has led to its protection under the Convention on International Trade in Endangered Species (CITES), with Brazilian rosewood (from the tree *Dahlbergia nigra*) being placed on Appendix I since 1992, with a ban on all international trade in the species. In 2013, Siamese rosewood *(Dahlbergia cochinchinesis*) was added to CITES Appendix II, which allows international trade but requires export permits. The same year, all Madagascar species of rosewood were added to Appendix II, and in 2016, all remaining species of *Dahlbergia* (there about 300) were added to Appendix II.

Since the 1980s, rosewood in Madagascar has been targeted by illegal loggers, aided by a mix of weak governance, poor law enforcement, unclear forest regulations, and widespread corruption in the forest sector. There is mounting evidence that some of the true rosewoods (*Dahlbergia* spp.) found in Madagascar are becoming increasingly rare, and that they are being illegally logged in national parks and reserves. We believe that halting the logging would

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Rosewood being transported in Madagascar (pictured above and below)

involve regulating the international trade in rosewood, but this is difficult because rosewood is a trade name that is used for many different species. Many of the rarest belong to the *Dahlbergia* genus, but others include Bolivian rosewood (*Machaerium scleroxylon*), West African rosewood (*Pterocarpus erinaceus*), and New Guinea rosewood, also known as Burmese rosewood (*Pterocarpus indicus*). As might be expected, these vary in their rarity and consequently in their need for protection.

Large stockpiles of rosewood now exist in Madagascar and elsewhere. In 2011, the stockpiles in Madagascar were estimated to contain 300,000 logs, a total of 500,000 tonnes. The government began confiscating these in 2011 and in 2013 it agreed to an 'action plan' that included assessing standing stocks of rosewood, inventorying existing stockpiles, and enforcing an embargo on the export and international trade in rosewood. Efforts to meet the promises of the action plan have either never materialized or been conducted in a haphazard and fragmented fashion. The government has also proposed compensating traffickers whose illegally-felled rosewood was confiscated, a move strongly opposed by many CITES Parties. In the past, the government has allowed traffickers to buy back confiscated logs, effectively converting them from illegal to legal.

A group of scientists, including myself, is suggesting that a possible solution to the illegal logging of rosewood in Madagascar is to raise its level of protection under CITES, elevating it to Appendix I status. However, challenges exist. CITES works with individual species, but the taxonomy of *Dahlbergia* is complex and uncertain, and the wood cannot be reliably identified to a species level, especially where this is needed such as at points of exit or entry.

There are probably about 65 species of *Dahlbergia* in Madagascar, but only 48 have been formally described and named. To enable exports under Appendix II, the government has to be able to issue a "non-detrimental finding" – a statement that a proposed action will not be detrimental to the survival of a species, nor reduce its role in the ecosystem. Given the lack of knowledge about the individual species and their distributions within Madagascar and the near-extinction of some species, this seems unlikely. Having the resource managed sustainably by local communities is another option, but we believe that this is impractical in the current situation in Madagascar.

Listing Madagascar rosewoods under Appendix II of CITES has failed to stop their illegal logging. In fact, since the listing, stockpiles of rosewood have increased in volume. Madagascar has suggested that this could be resolved by selling the stockpiles and allowing their export, a move that is encouraging further logging. Under such circumstances, the transfer of all *Dahlbergia* species in Madagascar to Appendix I seems to be the only viable way to ensure their future survival.

If this is successful, the next step would be to determine what to do with the remaining stockpiles of rosewood, and it is one we are looking into. This is a difficult problem; one also faced by those trying to control the trade in elephant ivory and rhinoceros horn. Options include destroying the stockpiles, allowing their export, and allowing within-country processing and sales, all of which have their relative advantages and disadvantages. It is the subject of our ongoing research on Madagascar rosewoods.

Dr John Innes is a professor and dean at the Faculty of Forestry. He may be contacted at john.innes@ubc.ca. *This article is based on a multi-authored paper recommending the uplisting of Madagascar rosewood and ebony that is being circulated in time for the 18th meeting of the Conference of the Parties of the Convention on International Trade in Endangered Species.*

SCALING UP SOCIAL MOBILIZATION ON CLIMATE CHANGE IN LOCAL NEIGHBOURHOODS

Deepti Mathew Iype

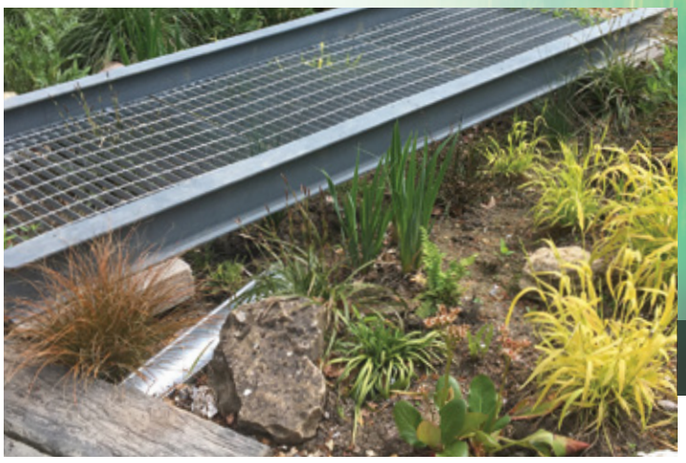
Sandy Riechekn (left), Weciong Fu, Wendy Hanna, Doris Sun develop a vulnerability mapping of their Vancouver neighbourhood during a Coolkit Workshop

Imagine a neighbourhood where residents and youth are empowered as agents of change leading climate-proofing on their block, developing climate-friendly solutions such as tree planting, rain-gardens, local food and energy conservation – all while having fun, building neighbourliness, and improving resilience.

The Collaborative for Advanced Landscape Planning (CALP) at UBC's Faculty of Forestry is partnering with a cluster of leading researchers and multiple stakeholders to make this vision a reality. This fall is the Vancouver launch of our REACH Program (also known as Resilience through Education, Action & Capacity-building in the 'Hood). This program will provide a roadmap for rolling out local climate action across our cities through a community-led approach, backed by systematic collaboration between those cities, various groups – including the school board, NGOs, park board, academic institutions, thought leaders, community centres, faith groups, youth and volunteers – and trained student interns from UBC's Urban Forestry program.

The enormity of climate change is overwhelming, and citizens and communities are unsure what they can do to mitigate or adapt to climate threats. Cities and countries around the world, including Canada, have declared a Climate Emergency in 2019. A recent report from the Intergovernmental Panel on Climate Change (IPCC) states we have until 2030 – less than 11 years – to massively reduce greenhouse gas emissions. Social innovations around climate awareness and behaviour change are essential in meeting these targets.

Research shows that collective action that is: local, visible, and fun, involves peer-pressure, includes training, and has government support can reach the under-engaged, transform attitudes, change behaviour, and deliver rapid solutions. Successful precedents in Canada and beyond such as Cool Block and Green Bloc have improved neighbourliness



Rain gardens channel rain into a shallow planted depression to allow the water to soak into soil. Featured rain garden by wendyallendesigns.co.uk

and social cohesion by connecting neighbours and inspiring discussions on the things they care about such as heatwaves, cooling, floods, increasing greenspace, and health.

We used these programs as our inspiration. However, there is rarely a one-stop shop that includes everything needed to address all the areas of interest for communities. The Citizen's Coolkit on Climate Change and Urban Forestry, co-developed by CALP, aims to bridge the gap by providing people with a package of fun and engaging tools and activities for building climate resilience in different ways, such as urban greening, gardening, low-carbon transportation, and energy retrofits.

Using tools like the Coolkit, the REACH Program will build climate engagement and scale up citizen-led initiatives across multiple residential blocks each year over this crucial next decade. To achieve success, we are committed to encouraging bottom-up ideas that can be implemented by local citizens in coordination with local government policy. We will also work with communities and help them build visible and practical on-the-ground climate solutions to inspire further action through activities ranging from tree-planting for cooling to active transportation promotion.

REACH will involve people in the following ways:

- Build capacity of local residents as neighbourhood champions
- Train high school teachers to be able to teach climate change with confidence
- Engage high school students as climate ambassadors
- Implement visible community projects led by youth
- Foster the community-school connection through a joint delivery of programs
- Prepare UBC students to be youth mentors

Our REACH Program launch begins this fall in Vancouver through community activities, professional development days for teachers, and practitioner workshops. All of us at CALP would like to thank our many partners who are helping make this exciting initiative happen including the Vancouver School Board, Vancouver Park Board, City of Surrey, and Evergreen BC.

We continue to seek additional financial partners and contributions to support the initial roll-out and impact monitoring – and we encourage all interested parties to get involved in this exciting project that will soon become a model for other communities.

"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has" – Margaret Mead

Deepti Mathew Iype MSc is a social innovation lead and research scientist at the Collaborative for Advanced Landscape Planning at the Faculty of Forestry. She can be reached at deepti.mathewiype@ubc.ca. For more on the Citizen's Coolkit visit calp.forestry.ubc.ca/home/urban-forestry-toolkit/

A PROBLEM-BASED, MULTI-MEDIA APPROACH TO STUDENT LEARNING IN SOUTH AFRICA

Khalil Walji

Exploring the need for physical soil preparation to enhance site productivity

Recent changes in the forest sector have led to new expectations of graduate competencies upon entering the job market. Young professionals are increasingly required to manage large-scale, complex problems and operate in a cross-sectoral fashion. Additionally, the job market has expanded to international and intercontinental scales, providing more opportunity for job mobility, and bringing some unique challenges. Hence, it is important that students obtain core knowledge reflective of current global issues.

An example of an initiative to integrate an international forestry case to benefit students at the University of British Columbia is a project funded by the UBC's Teaching Learning Enhancement Fund (TLEF). This focuses on the development of a problem-based learning (PBL) case study about sustainable forest and soil management on *Pinus radiata* plantations and the mosaic forest landscape located in the Western Cape of South Africa. The case study enables students to experience first-hand the trade-offs that land managers face between production and sustainability. Student learning is enhanced by incorporation of multi-media material. The case study will be integrated into the Sustainable Soil Management courses offered by Dr Maja Krzic at UBC and the forest soils course at Stellenbosch University, South Africa.

The project is being undertaken by a multi-disciplinary project team, comprising content and media experts, including: Dr Maja Krzic, Faculty of Forestry / Faculty of Land and Food Systems; Saeed Dyanatkar and Michael Sider, Emerging Media Lab; and Chris Crowley, Centre for Teaching, Learning and Technology as well as international members: Prof Ben Du Toit, Stellenbosch University, South Africa and Khalil Walji, United Nations – Food and Agriculture Organization-(UN-FAO).

To begin our collaboration, this May I traveled to the town of Knysna, located

The Knysna-tsitsikamma forest complex, a part of the Southern Afrotemperate forest type

Silviculture forestry in the tropics

Aerial view of the Harkerville plateau

in the Western Cape province of South Africa, an area known for its remaining pockets of Indigenous forests and productive plantation forests. We spent several days in the landscape, capturing footage of Prof Du Toit describing the local forest ecosystems, soil management practices, and their impacts on soil quality. Commercial plantations in South Africa cover nearly 1.2 million hectares, 99% of which are exotic species from the genera *Pinus*, *Eucalyptus*, and *Acacia*. These plantations are recognized as highly productive on a worldwide scale, owing to favourable climate and soil conditions combined with innovative forest management.

Using 360-degree photo imagery and drone footage, we captured elements of these forest plantations to provide students with a unique background perspective of the ecosystems. The immersive, PBL case study focuses on specific silvicultural treatments, (pitting, mounding, bedding), and how they impact soil physical and chemical properties and, in turn, tree growth. Prof Du Toit's descriptions, gathered in real-life settings, will help students to understand better the issues in those tropical forest ecosystems. Additionally, the multimedia resource integrates and offers opportunities for students to explore site history, geology, climate, vegetation, and topography, as well as various elements of the regional foresters' decision-making process, including site preparation for tree growth, costs, effects of fire on soils, and balancing the risk of erosion with sustainable forest and soil management.

The PBL case and its supporting multimedia material will enrich learning, provide engagement with learning material, and allow students to gain an international perspective, while also reflecting on how these specific contexts equate or differ from the forests of British Columbia.

Khalil Walji is the Project Coordinator for the TLEF funded project – Pinus Radiata Forests of South Africa and is a former MSc student with UBC's Integrated Studies of Land and Food Systems program. He can be reached at KhalilWalji@gmail.com

LOOKING TOWARDS THE NEXT GENERATION OF WOOD-BASED TALL BUILDINGS

Cristiano Loss

A system-level hybrid combination, showing an innovative CLT-steel composite floor component

When it comes to advancing wood use in the built environment and leveraging a sustainable forest sector as a source for new value-added building materials, Canada is a global leader – and British Columbia its key showcase.

In fact, the University of British Columbia is internationally recognized as a key part of BC's success story. It leads by example, from the C.K. Choi Building for the Institute of Asian Research built in 1996 to Brock Commons, the world's tallest modern wood building when completed in 2017. UBC is also a preeminent research institute and educator, and through the Faculty of Forestry's Wood Science Program has contributed significantly to the development of innovative products, building systems, and skilled professionals.

Since joining the Faculty in January, I have been focused on establishing a research cluster for developing high-performance, wood-based systems and structures, examining optimum performance-based design procedures for the next generation of mid-and high-rise buildings, and expanding the boundaries of conventional wood processing. In April, the Natural Sciences and Engineering Research Council of Canada awarded my lab with a Discovery Grant and Discovery Launch Supplement in recognition of the value of this proposed research and to stimulate more BC innovation.

So, how has BC become a global leader in advancing structural wood use in non-traditional segments such as multi-family, commercial, and industrial applications? Understanding the key achievements helps contextualize and advance the next phase of research that my lab will undertake.

Historically, BC, through its Wood First Program, proactively encouraged industry, researchers, and design professionals to explore innovation in wood building systems, technologies, and mass timber building products, helping transform the local and international built environment. This helped the modernization and augmentation of the province's stringent building codes to reflect the capability of wood products. In fact, BC was the first province in Canada to adopt building code changes in 2009, permitting six-storey wood frame residential buildings. In March of this year, BC announced that it would be raising the height limit for wood buildings to 12 storeys, a year ahead of the National Building Code implementation, setting yet another benchmark that will likely create a cascading effect on a global scale.

Observing the BC experience, jurisdictions around the world – particularly in the United States and China – have changed or are in the process of updating their building codes. BC's advances are fueled by a better understanding of new possibilities in building with wood and wood's proven ability to perform well for a wide range of conditions including fire, seismic, and wind. This is thanks to innovations and progress related to products, connec-

tions, and related design approaches, including the introduction of hybrid structural concepts; prefabricated and automated fabrication; and on-site assembly enhancements helped by easy and efficient processes.

However, there is still an acute need for research to develop novel and efficient multi-performance, optimized, structurally-resilient uses for wood. This will maximize its benefits as a cost-efficient, carbon-neutral material for multi-storey and high-rise buildings.

In North America's mid-rise building market, mass-timber solutions, primarily those using Cross-Laminated-Timber, are prevalent. For high-rise buildings, modern wood-based assemblies consist of hybrids which combine wood with concrete, steel, or other structural materials. This provides engineers with more options to meet performance-based code compliance, and also helps satisfy strict fire, earthquake, acoustic, and vibration serviceability building requirements.

Currently, materials and connection technologies used in hybrid load-resisting assemblies can vary considerably, resulting in difficulties with collecting information to use in design guidance and code implementation, or to reliably and accurately assess construction time and costs. This points to the need for fundamental research on performance-based design methods for hybrid structures, and to also account for the inclusion of technologies and proper devices to perform damage limitation under seismic loads and control sway of buildings under wind loads.

At UBC, I have created a tall wood research program that will address these research needs by focusing on solutions to achieve quick assembly and large-scale production of structural components. Shapes, dimensions, and arrangements of elements will be defined to meet performance objectives at the system and structural level, as well as transportation and assembly requirements on-site and during the manufacturing process.

Another critical advance requiring research is the development of new wood-based products that are lighter in weight and reduce the use of raw materials. Innovative connection solutions, an integral part of the hybridization process, will be developed to make the most of the material-stress transfer among elements, help with quick on-site assembly, and provide rational structural performance to the entire structure.

We will also research stretching the boundaries of conventional wood processing, explicitly referring to computer numerical control machining manufacturing technologies and robots, adopting a highly automated fabrication process that enables large-scale production. The knowledge transfer is expected to help Canadian manufacturers, companies, and the design community be competitive in the related construction industry. We look forward to applying the Natural Sciences and Engineering Research Council of Canada's grants to dig deeper into these challenges, and find innovative solutions to meet them.

Dr Cristiano Loss is an assistant professor in Timber Engineering and also serves as Associate Chair in the Wood Building Design and Construction cluster, a branch of the UBC Department of Wood Science. He can be reached at cristiano.loss@ubc.ca.

Hybrid bolted glued connectors undergoing push-out shear test

FORESTRY FIELD SCHOOL FUND HELPS REDUCE FINANCIAL PRESSURE

Thanks to the support of alumni, foundations, corporate and other donors, this year five students were able to attend Field School with less financial stress and worry. But these five represent only a tiny percentage of students who attend – many of whom are in financial need.

Field School is an important milestone in a student's forestry education. After three years of classroom courses in basic sciences, ecology, silviculture, hydrology, and much more, Field School moves the learning environment to the forest.

However, students must pay for their transportation, accommodation, meals and gear at Field School, an amount that can be an obstacle to participation. Thanks to the Forestry Field School Fund, this year that obstacle was cleared for five undergraduate students:

"*When I looked at enrolling in the Field School course, the high expense of the course fees and outdoor equipment was very much a worry for me. These fees would cost more than a month's living expenses for one person.*" – Xin Yang , 3rd year

"*Last semester I was even working full time while taking full-time courses! Being the recipient of such a generous donation not only helps alleviate some of my financial burden, but it also motivates me to keep working hard while continually seizing amazing opportunities.*" – Bailey Williams, 4th year

"*Field school gave me the opportunity to tie my textbook education with 'real world' applications. I was able to apply my education out in the field and gain hands-on experience.*" – Blake Connell, 4th year

"*This funding is not only helping me financially, but also gives me the encouragement to study hard and work hard. Through this hands-on field school experience, I have learned about the complexity of natural conservation issues and the limitations of my knowledge.*" – Tian Yang Liu, 4th year

"*I would add that getting to know and bonding with my peers and instructors throughout the course contributed to a sense of belonging at UBC that I hadn't really experienced before.*" – Corbin Manson, 4th year

Employers also notice the difference in students who have attended Field School. Mauro Calabrese, RPF and past-president of ABCPF, says, "Getting hands-on field camp experience helps forestry graduates contribute right away when they come to work in the forest industry, because they already have field skills that are assets to future employers."

Paul Lawson, Director, UBC Research Forests, says that about 400 students attend Field School at either the Malcolm Knapp or Alex Fraser Research Forest each year. "For a lot of students, these are required courses," he says. "Students are paying for the UBC credit, as for any other course, then they have to pay the field school fee for accommodation, meals and transportation. On top of that, many students don't have the right kind of boots and rain gear, so that's an additional expense."

This past year the Faculty received many more compelling applications to the Field School Fund than it could support. Please help us build this fund so more students can benefit. A donation to the Forestry Field School Fund, in any amount, can help a student in financial need gain practical, hands-on learning without the stress and worry of affordability.

For more information please contact Emma Tully at 604.822.8716 or emma.tully@ubc.ca, or visit support.ubc.ca/projects/forestry-field-school/.

SCIENTIST, DIRECTOR, CEO:

HOW DAVID BRAND (PhD'85) TURNED ADVERSITY INTO OPPORTUNITY

David Brand's career in forestry has been underpinned by a continuous desire for self-improvement and greater achievement. Since starting out in forestry 40 years ago, David has experienced the growth and recession cycles of the industry, but has adapted, grown and even risked his career at times as he has sought to re-invent himself in an ever-changing world.

David grew up in Toronto, and received a BSc.F. from University of Toronto in 1978. With itchy feet he hitchhiked to British Columbia and got a job with the BC Forest Service in Campbell River, and then shifted to work for Weldwood Coast Forestry in 1980. Laid off in the recession of 1982, he went back to school at UBC. "I didn't have stellar grades at U of T," he says, "and so I was only accepted at UBC as a provisional Master's degree candidate, but I worked hard, and ultimately was able to complete a PhD. in under three years."

David's research put him on track to be a forest scientist. His thesis studied quantifiable factors that could help government assess whether a harvested forest on public land had been successfully regenerated. After completing his PhD, David moved back to Ontario to work for the federal government first at the Petawawa National Forestry Institute, and then in Ottawa. He ultimately rose to the position of Director General of Science and Sustainable Development in 1995.

"It was an exciting time to be working at the national level," he says. "In addition to implementing the Canadian and International Model Forest Networks as part of Canada's Green Plan of 1991, I was working in one of the world's largest forest research organizations at a time when sustainable forest management was becoming the central objective." David also worked on international negotiations on forests and was the technical chair of the Montreal Process for the conservation and sustainable management of temperate and boreal forests.

In late 1995, the largest manager of commercial forests in New South Wales, Australia, approached David with the opportunity to become their Executive General Manager. "My wife Marion, our two sons and I decided to take a risk and make a three-year commitment to work in Australia," he says. David stayed with State Forests for 18 months longer than that, helping the organization become more forward-looking, establishing a 20-year plan for sustainable management of native forests and undertaking some of the world's first carbon offset transactions.

David's next leap was into a more business-oriented position as a Director with Hancock Natural Resource Group in 2000. Still based in Sydney, David designed and managed investment program integrating forestry and carbon offsets for the firm.

In 2005, David left Hancock to establish his own investment management firm, New Forests. "We manage about 1 million hectares of land and forests valued at almost $6 billion, including plantation forests, timber processing and international timber sales to Asia," he says. "We offer our investors funds that focus on conservation forestry, climate change mitigation, and sustainable timber plantations. We are now the largest forestry investment manager in Australia, and we are also involved in the United States, New Zealand and Southeast Asia. Needless to say, I travel a lot."

David's advice to today's forestry students is to look for opportunities in moments of disruption. "I got laid off from my job in the 1982 recession, so I went back to school. During the 1993-94 recession there were lots of cutbacks in government and my salary was frozen for three years, so I started looking for opportunities elsewhere, and that led to Australia. The 2008 financial crisis was really hard on us at New Forests, so we adapted the way we did business and moved up to be a full funds management business."

He adds that students should be prepared to adapt, take risks, and re-skill during their careers. "I think right now is the most extraordinary time to be starting a career in forestry. The challenges of climate change, biodiversity conservation, and watershed management are really exciting," he says. "Forestry produces sustainable and renewable materials that store carbon during their lifetime of use and that is going to be increasingly in demand. The world keeps changing and sometimes you have to re-invent yourself, and that can feel uncomfortable, but it's worth the risk."

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Join us on the Vancouver campus on Saturday, September 14th for an exciting day of family fun! Start your day at the Alumni & Friends Festival before taking advantage of complimentary admission to UBC attractions. Then, return to Thunderbird Stadium to enjoy the Alumni Game Experience at the Homecoming Football Game. Find out more at - **alumni.ubc.ca/event/alumni-day-homecoming-2019/**

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Faculty of Forestry
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