branchlines

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Inside:

forestry
university of british columbia

dean'smessage

Attending a university as a student is costly in many different ways: the opportunity costs associated with a 4-year program, the tuition and other costs, and the break from home and family, to name just a few. Even so, some students consider the sole function of pursuing a degree is to get the qualification that will enable them to follow their chosen career. Forestry is no exception, since a degree is an important step on the way to becoming a professional forester or other professional. Yet students who focus solely on getting the degree miss out on the many opportunities that a university education provides.

The Faculty's co-op program has been mentioned in Branchlines on many occasions and is a great example of how additional expertise and experience can be gained while undertaking a degree. However, there are many more opportunities, and some of these are described in this issue of Branchlines. Congratulations go to the students who received awards for their work with the City of Vancouver: great examples of how academic work can have a strongly practical side. I should also recognize the MSFM students who took part in a tree-planting exercise in order to support a reforestation project in Madagascar started by MSFM alumna Stacey Boks.

The students who take our capstone course in sustainable forest management planning have an opportunity to work with communities while preparing their forest management plans. In recent years, we have focused on First Nations communities, most recently with the Northern Secwepemc te Qelmucw. These projects sometimes start from scratch, and sometimes build on relationships developed during earlier work. It is good to see that these undergraduate projects are being followed up by graduates working in forest planning. Continuing engagement of this nature is a vital part of building trusting relationships with First Nations communities.

The participation of students in the Global Environment Summer Academies is another example of the benefits that can be accrued while at university. Such events are huge networking opportunities for students, and enable them to establish partnerships that can last a lifetime. One person very involved with the Academies is Ana Elia Ramon Hidalgo – she recently received the Edward JC Hossie Leadership Award for her efforts not only with the Academies but for a range of other activities that have benefited our students.

Towards the end of this issue, we describe some recent acquisitions of art that have been donated to the Faculty of Forestry. Amongst all the high-tech laboratories of the Forest Sciences Centre, which contain some of the most sophisticated analytical equipment on the UBC campus, it is sometimes easy to forget that forestry is both a science and an art. This applies not only to traditional forestry, but also to areas such as wood products processing. For example, the care and thought that went into students' efforts to finish IKEA's Bekväm stools neatly illustrates the importance of design and craftsmanship in an area normally associated with the more scientific aspects of engineering. Including a range of artistic works throughout the Forest Sciences Centre is intended to provide inspiration for our students as well as enhancing the overall working environment of the building.

The Faculty is a centre for research on sustainability, and the work on biojet fuels being undertaken by Dr Jack Saddler's research team provides an example of how far we have moved on from traditional forestry research. I suspect that there are very few faculties that can claim to have a company such as Boeing as a partner, and they have been joined by a consortium of other companies that include Air Canada, West Jet and Bombardier. As explained in the article, using woody biomass as feedstock for biojet fuel will be a major step forward for the aviation industry.

John L Innes
Professor and Dean

forestrynews

New appointment

Dr Trevor Gareth Jones has been appointed as lecturer/coordinator for our new course-based Master of Geomatics for Environmental Management (MGEM) program. After completing his doctoral studies in forest ecosystem mapping at UBC in 2011 (supervised by Dr Nicholas Coops), Trevor went on to manage geospatial science and helped establish the Blue Forests project for the non-government organization Blue Ventures. He was also an affiliate faculty member at Portland State University (Environmental Science and Management) before joining our MGEM program on April 1st. The MGEM program (http://www.forestry.ubc.ca/mgem) is a 9-month degree designed for foresters, ecologists, conservation managers and other practitioners worldwide seeking to improve their understanding of geospatial theory, GIS and remote sensing methods, application and tools. Subject to the approval of the provincial government, the program has a planned start date of August, 2017 and will directly integrate these geomatics-focused tools for environmental management with landscape ecology concepts. Trevor can be reached at trevor.jones@ubc.ca.

Awards

Ana Elia Ramon Hidalgo, PhD candidate in the Faculty, has received an Edward JC Hossie Leadership Award for 2015-16 in the Community Servcie Leadershop category for demonstrating breadth of experience off-campus.

Ana Elia has a long and varied record of volunteering, community service and leadership activities. Some of these activities include co-organizing the first student-led CONFOR West conference, co-organizing a women´s day on the roles of women in forestry, mentoring and facilitating arts workshops at the Power of Hope youth camp to empower youth at risk, co-founding (and current secretary) of a non-governmental organization CEHDA, and co-organizing and facilitating the First Socio-Environmental Summer Academy in Latin America in the Dominican Republic (see article on page 18). Through Ana Elia's organizational and fundraising support CEHDA provides jobs to 5 staff in Ghana to improve the living conditions of families raising children who have lost their biological parents. In 2014 Ana Elia fundraised on her own over 1,000 Euros from supporters of CEHDA's campaign.

Ana Elia's PhD investigates the importance of social capital and social networks to conserve forests and empower rural communities in Ghana. She is currently co-directing a short film about socio-environmental justice in Guatemala.

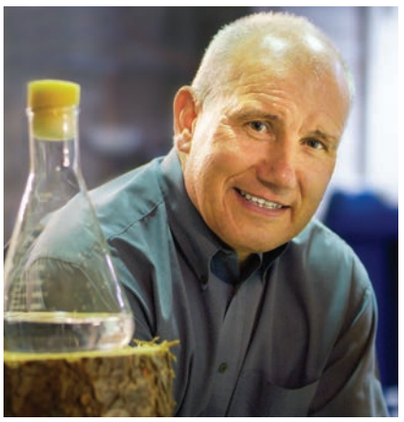
Ken Day (Manager of the Alex Fraser Research Forest) has been awarded the City of Williams Lake Certificate of Merit. Ken received this award for his 25 years of helping to place Williams Lake on the national and international stage. As manager of the Research Forest Ken has hosted hundreds of international delegates through tours, field trips and dialogue. He is widely recognized for his knowledge and integrity.

Awards *continued*

Nicholas Coops (Professor of Remote Sensing and Spatial/Data Modelling) has been awarded the 2015/16 Killam Teaching Prize for Forestry in recognition of his strong commitment to teaching and his abilities to interest and engage students both inside and outside of the classroom. The following citation highlights the justification for Nicholas to receive this award.

"Dr Coops has an incredibly engaging teaching style in the classroom. He uses a multimodal approach to learning, recognizing the different ways in which students learn, and has introduced innovative methods, such as a Pecha Kucha assignment, into his teaching. It is noteworthy that he has very high daily attendance in his classes although he provides all materials to students online and attendance is not required."

Chris Gaston (Honorary Associate Professor of Forest Products Marketing and Economics) and Wei-Yew Chang (Postdoctoral Fellow) have been awarded the Forestry Economics Prize of the journal "Forestry—International Journal of Forest Research"'. They received this award for their article "A trade flow analysis of the global softwood log market: implications of Russian log export tax reduction and New Zealand log production restriction ". The paper reflects their NSERC Strategic Research Network on Value Chain Optimization study.



Jack Saddler (Professor of Forest Products Biotechnology/Bioenergy) has been awarded the 2016 Linneborn Prize – an award established in 1994 for outstanding contributions to the development of energy from biomass. Although primarily a European award, Jack was selected for his work as a pioneer and innovator into why pretreatment, fractionation and enzyme hydrolysis have to be optimized to provide the front-end of a biorefinery. It was also noted that he has contributed to many policy-related issues through work with organizations such as the International Energy Agency.

Kathy Martin (Professor of Avian Ecology and Conservation) has been recognized by The Wildlife Society, Canadian Section, with the Ian McTaggart-Cowan Lifetime Achievement Award. This award recognizes individuals who have made outstanding contributions to the understanding, conservation, and/or management of wildlife in Canada over their career. It is only the second time the society has given out this award. Kathy will receive the award at their annual meeting in Newfoundland in July.

Congratulations to all our award winners!

Forestry students rewarded for their work at City Studio's Hubbub event

Students from 2 classes in Urban Forestry, Forestry, and Landscape Architecture won prizes for their posters at the City of Vancouver City Studio event on April 1st 2016. The event, known as 'Hubbub', is an interactive project showcase at City Hall that brings together City Studio students from several universities and courses, to share their projects, findings and recommendations with City staff, peers, and engaged community members. Over 25 projects were showcased at this year's spring semester event.

Students received awards for their projects in 2 urban forestry related courses:

- In the second-year course Urban Forestry and Wellbeing (taught by Sara Barron and Maria Stanborough), a group of the Faculty's first cohort of urban forestry students was awarded a prize for their project "Transforming the False Creek Flats area community through urban forestry design." The False Creek Flats area is currently lacking in greenspace and is disconnected from Vancouver's city fabric. The students envisioned design solutions for the site's human and natural systems, centered on a 're-wilding' meadow park. Their focus was on urban forestry's contribution to human health and well-being, based on lessons learned through their course. The group included Sarah Bishop, Mia Goodman, Alyx Hough, Jennifer Reid, and Eva Snyder.
- In the fourth-year course Landscape Planning for Sustainability (taught by Stephen Sheppard), 4 groups jointly won 2nd prize at the Hubbub event, for innovative projects on citizen engagement toolkits involving climate change and urban forestry at the neighbourhood block level (with input and data provided by Bill Stephen, City Urban Forester), and future visioning studies with climate change. One of these visioning studies, which developed a compelling public educational design for the proposed St George Rainway project in Vancouver, was also selected as a finalist in the LEWA competition and won 2nd place in the judging at the BC Society of Landscape Architecture conference on the same day! Students participating included: Vanessa Kuiper, Esther Li, Khadijah Benjamin, Sarah Eshpeter, Nan Zhou, Curtis Chance, Ashley Rose, Roya Bennett, Zack Wentz, Alexandra Somer, Tamara Bonnemaison , Huan Pan, Jieying (Jenny) Huang, Xuan (Joris) Jun, Sahar Badiei, and Dinara Yusufzyanova.

City Studio is a school that works with City Hall to unite students, staff and community in the co-creation of real projects that improve our city and enrich our neighbourhoods. Its projects produce experimental prototypes to advance the City's urban sustainability goals and give students the practical experience necessary to become future leaders. City Studio has been running for several years, and our new Bachelor of Urban Forestry program presents a unique opportunity for a suite of classes to contribute to City Studio. This is also the first time the Urban Forestry program has been represented at Hubbub, which is an important networking day for students. This year's projects generated a lot of interest from the City's Sustainability Group and the Park Board, and we look forward to further collaboration with the City.

Congratulations to the students, and a big thank you to their Teaching Assistants (Dinara Yusufzyanova and Emily Rugel) and UBC project reviewers Cindy Cheng, Alicia LaValle, and David Flanders: not bad for the first time out!

Photo: CityStudio Vancouver.

FRST 490/551/LARC 542 won second prize at at CityStudio's hubbub event

Bekväm step stool challenge: Work-integrated learning

Todays' students have a high expectation that what they learn in the class room will be relevant to their future careers. This expectation is challenging educators to develop a work-integrated learning environment within the constraints of timetables, class rooms and competing demands on students' time. This challenge is central to the Faculty's (BSc) degree in wood products processing which seeks to combine scientific education and technical training to produce graduates that can easily transition to management and technical positions within Canada's large wood products manufacturing industry. The degree program includes a diverse range of courses in several fields, including wood material science, mechanical, civil and industrial engineering, commerce, and information technology. It also contains a number of courses that are very specific to the wood manufacturing industry, including a fourth-year course on industrial wood finishing technology. This course is taught by Professor Philip Evans, Mr Jason Chiu, Mrs Diana Hastings and assisted this year by Mr Vinicius Lube, a graduate technical assistant.

The course in industrial wood finishing technology tries to meet the challenge of developing a work-integrated learning environment through various strategies including twinning the course with an industrial certificate on the same subject, thereby allowing students and industry learners to engage digitally and also in person; field trips to industry; and guest lectures by industry experts. These strategies are more fully described in a series of publications on training the next generation of knowledge based workers. This article describes another strategy that has been used to give students industry-specific skills in wood finishing, as well as encouraging deep learning of the subject matter. The strategy involves a practical exercise in which students are each given the most basic piece of furniture that IKEA makes – the Bekväm step stool. The students are then tasked to finish their pieces to a very high standard. We call this exercise the 'Bekväm Step Stool Challenge'. The Bekväm step stool is a small piece of flat-packed furniture made from European beech (*Fagus sylvatica* L) and retails for just under $20. It can be used as a step stool as its name suggests, but it has many other uses including plant stand, bed side table, small chair and child's table. The step stool is unfinished and hence it is an ideal object to use in our wood finishing class to demonstrate the complexities of wood finishing.

Wood finishing is an essential step in the manufacture of high value wood products including furniture, cabinets, flooring, wall panelling and a host of other products including wooden ships, windows, toys, and musical instruments, to name just a few. Finishing is important because it can represent up to 30% of the final cost of manufacturing some wood products, and it is the means by which very similar products, for example, the Bekväm step stool, can be differentiated.

This year's Bekväm step stool chal-

lenge is a perfect example of how finishing can add value to even the most basic piece of furniture, and it is also a tribute to the inventiveness and hard work of the students in this year's class. The photographs of the finished pieces show the variety of designs that students came up with, but the attractive appearance of the pieces belie all the hard and sometimes tedious, but very necessary work that was involved in finishing the stools. Students first had to sand every component of their piece to a smooth finish to remove defects such as torn grain, scratches and machining defects. Larger defects such as dents or gouges were removed by steaming or filling and excess glue around joints in the stools was scrapped off. The process of preparing the stool for finishing is a lesson in the importance of attention to detail, a skill that is much valued in today's workplace. Following surface preparation of the stool, students used a strong two-part bleach (sodium hydroxide and hydrogen peroxide) applied several times to remove the original colour of the European beech wood. This step is necessary because the colour of European beech varies from a deep red in old heartwood to a light tan. Without this preliminary bleaching step it's almost impossible to obtain uniformly coloured pieces during the next and most difficult stage of the finishing process, staining the wood with a semi-transparent stain. Staining is preferred to using paint because stain colours the wood, but allows the grain to show through (unlike paint). The uniform staining of wood during finishing is a significant challenge and is an area of tremendous interest to industry. The students were given individual and expert instruction on how to overcome this challenge by manipulating the chemistry of the stains and the process of spraying the stain. They then put theory into practice by finishing their piece. In this year's class several students chose to use masking techniques to create interesting colour combinations using the white colour of the bleached wood as well as 2 additional colours. In such cases avoiding bleeding of colour into adjacent areas was an additional challenge that students faced, and by and large overcame. In comparison to staining, the next stages of the finishing process: 1, Spray application of top coats (clear catalyzed lacquer) and; 2, Buffing pieces to a high gloss finish using buffing compounds that are very similar to the abrasive creams that are used to polish car bodies; are more straight-forward. The first step allowed students to achieve greater competency in the use of industrial wood finishing equipment and the last step added the finishing touches to their pieces.

This year's Bekväm Step Stool Challenge ended as all of them do with an open exhibition of the student's work which was well attended by all members of the Faculty as well as the cohort of industry learners who travelled to UBC from all over North America, as part of their certificate on industrial wood finishing. The UBC students doing our undergraduate course in wood finishing joined the certificate course at this stage to meet the industry learners and receive guest lectures from some of North America's leading experts in industrial wood finishing. These guest lectures were of particular interest to one of our students who was travelling to the UK for a co-op placement with Rolls Royce focussing on finishing the wood that is a distinctive feature of their cars. The lessons he learnt in finishing a $20 step stool should come in very handy at Rolls Royce!

For more information contact Professor Philip D Evans, BC Leadership Chair in Advanced Forest Products Manufacturing Technology (phil.evans@ubc), Iain Macdonald (Director of CAWP, iain.macdonald@ubc.ca), Jason Chiu (Instructor, jason.chiu@ubc.ca) or Diana Hastings (Instructor, diana.hastings@ubc.ca).

Why do we care about riparian zones?

Every stream and river has its riparian zone - the narrow fringe of forest directly adjacent to water. Riparian zones are one of the most diverse, dynamic and ecologically important portions of the landscapes. High diversity of riparian vegetation is maintained by recurrent flooding, which provides physical disturbance, suppresses species dominance and creates open patches for colonization. Together with floods, shallow groundwater tables in riparian zones provide moisture, which is beneficial for many plant species. Streams and rivers are also very effective media for seed dispersal therefore colonization of riparian areas is rapid. In many parts of the world riparian zones are considered hotspots for plant biodiversity.

Riparian zones are also important corridors for animal movement, and they provide shade and leaf litter inputs to streams securing a moderated habitat and a steady food supply to aquatic organisms. At the same time, riparian vegetation has an amazing ability to filter material carried by under- and over- ground water flow. Many nutrients and sediments can be picked up by riparian plants before entering the streams where they can become dangerous for aquatic organisms and human health. All of these riparian functions are increasingly important nowadays, where agriculture and urbanization produce excess nutrients, pollutants and sediments. Unfortunately, riparian zones are often compromised by land use management and they may lose biological diversity, filtration capacity and food source function. This in turn can transform streams and rivers into unhealthy systems, which are no longer able to support aquatic communities and provide us with clean water. And this is why we care!

For the past 8 years Lenka Kuglerová has studied various aspects of riparian processes and functions. Her PhD thesis focused on drivers of riparian vegetation in boreal Sweden, including hydrology, geomorphology, biogeochemistry and management practices, such as forestry. In northern Scandinavia small streams are the least protected during forest harvest and they often lack riparian buffers (unharvested forest around the water retained to protect stream integrity).Riparian buffers around larger streams are usually implemented with fixed widths of 5-15 m, which can be sufficient at some places but fail to protect streams at others. Riparian zones are not uniform in species diversity, functioning or ecosystem services across the landscape and the riparian buffer management should account for this heterogeneity. Lenka concludes from her research in Sweden that riparian buffers need to be of variable widths based on local riparian conditions, especially groundwater hydrology as this determines many other riparian functions.

Her postdoctoral research at UBC is centered on similar topics. Small streams (< 1-2 m wide) dominate the Canadian landscape and their length far exceeds that of large rivers. However, these small streams receive little protection during forest operations, agriculture or urbanization and are often severely disturbed and modified. Lenka's current research involves the effects of land use on small streams and the cumulative influence of this disturbance on downstream ecosystems (the larger rivers, where the small streams combine). Lenka and her colleagues from the Stream and Riparian Ecology Lab (led by Dr John Richardson) are looking at river systems across the Greater Toronto Area to answer questions about the consequences of small stream modification and loss. They are hoping to find certain thresholds which, if crossed, will be detrimental for the river system's health. For example, these thresholds might be the proportion of land converted to agriculture or the minimal width of retained riparian buffers. If these thresholds can be understood it will be possible to take precautions when managing the land. Lenka is heading to Toronto for her second summer field season where she and her team will be collecting data on riparian and aquatic communities, hydrology, water and soil chemistry and other freshwater processes. The team is hoping that their research will enhance the understanding of how to protect our entire freshwater systems, so that these systems can sustain us with clean water, fish and other ecological, aesthetic and social values.

For further information, Dr Lenka Kuglerová can be reached at lenka.kuglerova@gmail.com.

Forest planning with First Nation communities

Sustainable Forest Management Planning is one of the undergraduate capstone courses offered by UBC's Faculty of Forestry. The goal of the course is for our students to learn how to work with a client on the development of a forest management plan over the course of 1 term. Between January and May 2016 our students worked with the Stswecem'c Xgat'tem (Canoe/Dog Creek Band), the Xatśūll (Soda Creek Indian Band), the T'exelc (Williams Lake Indian Band) and the Tsq'escenemc (Canim Lake Indian Band). These 4 communities are part of the Northern Secwepemc te Qelmucw (the Northern Shuswap Tribal Council), who are in stage 4 of the BC Treaty Process negotiating an Agreement in Principle, the final step before the negotiations to finalize the treaty begin, and are in the process of gaining rights to about 5.6 million hectares of land that falls within their traditional territory. The sustainable management of the forests in the area under question is of great importance for the economic development of both the region and the communities.

Our students traveled to the Williams Lake region to meet with members and representatives of the communities to learn about the history of the land, traditional use and management of forest resources as well as other native heritage values. Objectives expressed by the community partners included ensuring long-term opportunities for hunting and fishing, or ensuring the availability of medicinal plants and berries. Back in Vancouver, students translated these values into objectives that can be represented by goals and indicators to incorporate them first into computer programs and ultimately into the forest management plan. The final plans displayed a selection of approaches to obtain the expressed goals and were presented to the communities in late April.

Using these plans and making the best out of the ideas developed during this collaborative period is a task that can easily extend over the runtime of a single term. However, we are in the ideal situation of having graduate students who can keep the partnership alive after the end of the course and ensure that we establish a long-term relationship between UBC's Faculty of Forestry and the communities.

One such master's student, Jillian Spies, will be taking the development of objectives and indicators based on native heritage values for the use in sustainable forest management planning to the next level. Jillian (a graduate student with Dr Verena Griess) will re-visit our partner communities to discuss the findings presented in the plans developed by our undergraduate students. Through meetings with community members she hopes to gain a deeper understanding of how well the plans reflect the anticipated goals. Relationship building and listening to the stories and knowledge that community members have to share will be cornerstones of this step of her work. As well as informal discussions, Jillian will enable a dialogue based on approaches from social sciences, such as semi-structured interviews and others. The results of these discussions will be used to adjust and enhance the existing forest management plans.

The overarching goal of Jillian's research is to develop an approach to planning that allows for the inclusion of First Nations native heritage values into forest management planning from a technical perspective, while also presenting ways that forestry can become an important pillar for the economic welfare of the community by creating jobs and opportunities in rural areas.

For further information, contact Jillian Spies at jillian.spies@forestry.ubc.ca or Dr Verena Griess at verena.griess@ubc.ca.

Photo: Jillian Spies

View of Fraser River on Stswecem'c Xgat'tem territory

Forest residues to biojet fuels: Challenges and opportunities

If the aviation sector was a country, it would be the 8th largest emitter of human-induced greenhouse gases in the world, equivalent to 2% of total human induced CO_2 emissions. In 2015 nearly 3.6 billion passengers were carried by airlines. This figure will keep increasing, meaning that emissions from aviation will keep going up. Thus, Canada and the world will not meet their climate targets of keeping global temperatures from rising less than 2°C (or 1.5°C) by 2050 unless something is done to slow down and drastically reduce emissions from aviation.

Reducing emissions

Many airlines, aircraft manufacturers and industry associations have committed to voluntary targets including reaching carbon neutrality by 2020 and achieving a 50% reduction in emissions by 2050. Initially, emissions will be slightly decreased through improving fuel efficiency (by 1.5% per year) via aircraft modifications, airport restructure and optimisation of navigation systems. However, these measures alone will not be sufficient and long term reduction of emissions will only be achieved if airlines start using renewable and sustainable aviation fuels, or biojet fuels (see figure). Biojet fuels can potentially reduce emissions by 60-80% compared with fossil jet fuel. Therefore, the use of biojet fuels in even modest percentages could have a significant impact on emissions from the aviation industry.

The global production and consumption of biojet fuels is still very limited. Basically, "a drop in the bucket". Most of the biojet fuel that is currently produced is made from oils and fats, such as vegetable, palm and used cooking oils or animal fats. However, many of these oils are derived from crops that can also be used for food or feed, raising issues of food-vs-fuels, sustainability and long-term supply. As the high costs of these oleochemical types of biojet fuel are associated with feedstock (rather than conversion costs) the use of feedstocks such as forest residues to make biojet fuel offers a potential solution. About one-third of Canadian forests are located in the west, most of this forest is third-party certified as being managed sustainably and British Columbia is home to an innovative forestry industry that is at the forefront of increased wood residue utilization. This is exemplified by the rapid establishment of cogeneration facilities, the BC pellet sector and the sector's increasing interest in producing novel products such as biojet fuels from residues.

Conversion technologies

Aviation fuels are high specification transportation fuels that have to be comparable around the world and which are able to withstand freezing. Biojet fuels have to be "drop-in" fuels, meaning that they have to be "functionally equivalent to petroleum jet fuels and completely compatible with existing infrastructure such as pipelines, pumps and aircraft". There are various Advanced biojet (in comparison to "conventional" biojet produced via the oleochemical route) conversion routes that could convert forest residues-to-biojet-fuel, including thermochemical routes, such as gasification and pyrolysis, and biochemical routes as exemplified by companies such as Gevo and Amyris. The biochemical conversion of softwoods to biojet has proven to be difficult plus the production of high-value intermediates, such as butanol and isoprenoids, along the way to making biojet fuel makes it unlikely that this will be the preferred commercial route to biojet in the-short-to-mid-term. Thus thermochemical conversion, via pyrolysis or HTL (hydrothermal liquefaction), is the most likely way of supplying the large volumes of biojet fuel that will be required in the medium to long-term.

UBC's work on biojet fuels

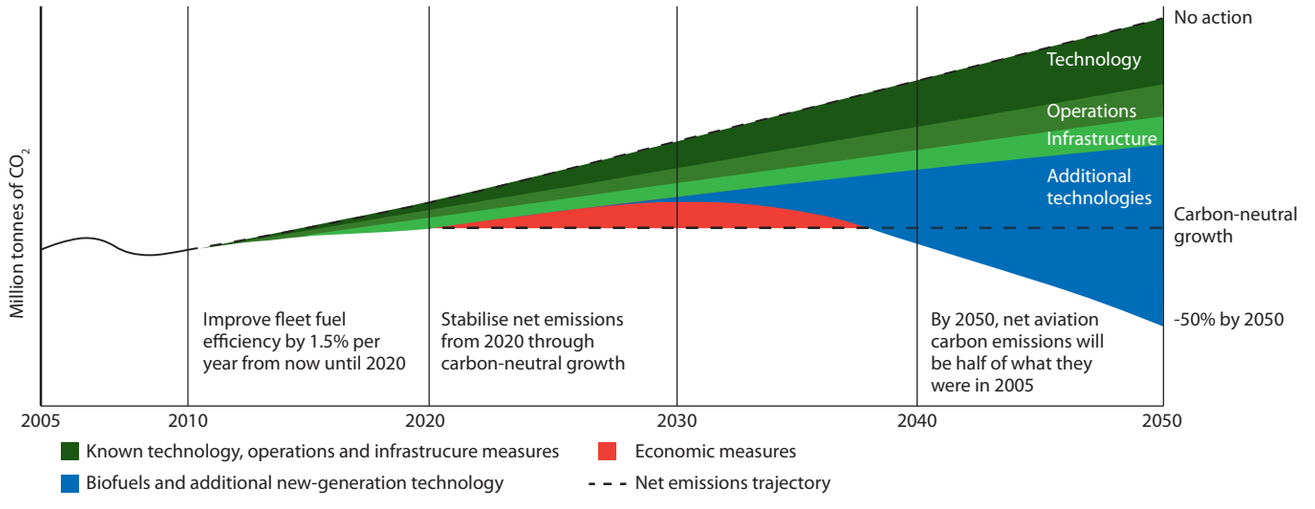
The Forest Products Biotechnology/Bioenergy (FPB/B) Group at UBC has been involved with the International Energy Agency (IEA) for several years with Jack Saddler (Department of Wood Science) acting as the Task or Co-Task leader of the IEA Bioenergy's Liquid Biofuels (Task 39, www.Task39.org) network.

A major report published by the Task provided a comprehensive analysis of conversion technologies and challenges involved in making hydrocarbons such as (drop in) fuels from biomass. On the basis of this highly cited report the FPB/B group was asked to contribute to a Transport Canada funded study on the feasibility of establishing a biojet supply chain in Canada over the short (2020) and longer-term (2025). The key conclusions of this report were that, in the short term, the supply chain for biojet will be based on oils and fats (the oleochemical route) while the longer-term supply chain will be based on lignocellulosic feedstocks such as forest residues. The IEA and Transport Canada reports caught the attention of Boeing who had been monitoring progress in the development of low carbon emitting fuels. Boeing approached the FPB/B group to assemble a team that would carry out "An assessment of the potential viability of producing biojet from woody biomass in Western Canada". With contributions from colleagues within the Department of Chemical and Biological Engineering including Prof Shahab Sokhansanj, Dr Mahmood Ebadian and Prof Xiaotao Bi the report showed that it could be possible to use current and potential forest residues to supply a significant amount of biojet fuel, but that there would be significant logistical challenges while the siting of the final production facilities will be impacted by various factors, such as the respective locations of the biomass, conversion facilities and airports. Boeing was encouraged enough by this work and supported a subsequent proposal that was submitted to the industry-led Network of Centres of Excellence (NCE) Green Aviation Research and Development Network. The resulting AMT Project (Assessment of likely Maturation Technologies for biojet production) was approved. As well as the FPB/B group the project will be co-led by NORAM (a local engineering company) and involve Air Canada, West Jet, NRCan's CanMet lab, US DoE's PNNL lab, skyNRG (a Dutch biojet supply chain company), Bombardier and Boeing. Dr Susan van Dyk, a postdoctoral fellow in the Department of Wood Science and member of the FPB/B group, will act as the project coordinator, complementing her ongoing activities as manager of the IEA Bioenergy Task 39 activities. Building on the earlier IEA/UBC work the project identified the pyrolysis/HTL route of forest residue to biojet fuel as the least problematic, with the upgrading of biocrude-to-biojet as a key step that has to be resolved. While the various biocrudes are being assessed for their ease of upgrading to biojet fuel by colleagues at CanMet and PNNL the UBC group will continue to monitor advances in technology development, assess the life cycle (LCA) benefits of the various routes to biojet fuel and how current forest certification schemes such as FSC, PEFC, etc., might be adapted to include the use of forest residues for biojet fuel production. However, in the same way that the right policies were key in the development of bioethanol/biodiesel use in Brazil, Canada the US and other countries, good policy will be also be essential if forest residues to biojet fuel is to be successful. This is the work being led by Susan van Dyk as part of the IEA and ATM projects

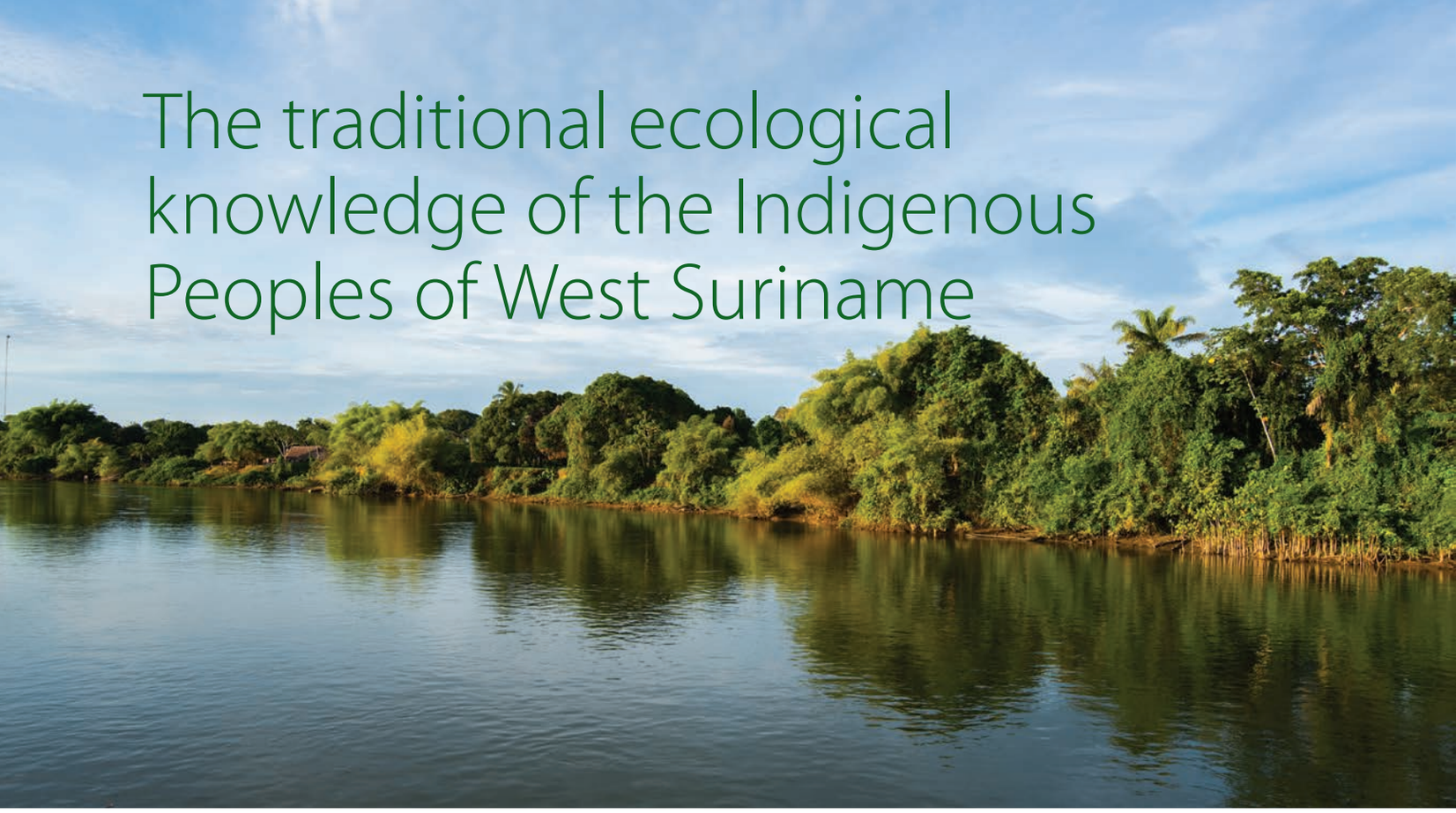
Main challenges

There are a number of barriers and challenges that influence biojet fuel production and use. These include, the maturity of the technology, the cost of biojet fuel production, low oil prices, lack of supply and demand, administrative hurdles in achieving certification and the fact that biojet fuel is still mostly delivered in small batches by truck to aircraft rather than being part of the regular downstream supply chain at an airport. However, the biggest challenge is the lack of the types of policies (such as mandates, credits, incentives, loan guarantees) that were instrumental in the development and commercialisation of bioethanol/biodiesel. Currently, the cost of producing biojet fuel is not competitive with fossil-derived jet fuel, with estimates ranging between 2-7 times higher than fossil-derived jet fuel. Given their generally low profit margins, airlines are not in a position to pay a premium for fuel. Thus, the right policies will play an important role in both bridging this price gap and facilitating the production and consumption of biojet fuels. Although the cost of biojet fuel is anticipated to become more competitive as the technologies mature, strong, ongoing policy support will be required if the aviation sector is to achieve the significant emission reductions it aspires to. British Columbia's already established biomass supply chain from forests that are third party certified is a major reason why groups such as Boeing think that biomass-to-biojet-fuel might be pioneered in Canada.

For further information contact Dr Susan van Dyk at jsvandyk@mail.ubc.ca or Dr Jack Saddler at jack.saddler@ubc.ca.



The traditional ecological knowledge of the Indigenous Peoples of West Suriname



The smallest country in South America, located on its northern Atlantic shore, is called Suriname and is inhabited by less than 600,000 people. It has a forest cover of 94.7% and is grouped under the High Forest Cover, Low Deforestation countries, which collectively contain about 18% of global tropical forests. Suriname's forests, together with those of French Guiana and Guyana, collectively are located on the geologically ancient Guiana Shield formation. This Shield is highly forested, contains a high biodiversity of which 40% is endemic to the region and is inhabited by many Indigenous and Tribal Peoples.

The interior forests of Suriname are inhabited by 4 self-identified Indigenous Peoples and 6 Tribal Peoples, who are all – to differing degrees – dependent on the forest and its resources including water, timber, wildlife and a great variety of Non-Timber Forest Product (NTFPs). NTFPs are defined as all vegetal and animal products derived from the forest, except for commercial timber harvesting. In Suriname, Indigenous Peoples make up about 4% of the total population and are formed by Amerindian communities, whose ancestors have occupied these lands for millennia. Maroon communities on the other hand are self-identified Tribal Peoples. Maroons are descendants of those African slaves who were brought to Suriname by the Dutch from the 17th century onward and who escaped into the hinterland where they created autonomous and enduring communities that negotiated and signed treaties with the Dutch colonial power.

Various indigenous communities inhabit West Suriname. The first Amerindian group were Arowak Amerindians who stopped living their nomadic life and founded Washabo in 1919, meaning 'let us get together' in Arowak language. Nowadays, Washabo has about 800 inhabitants and is neighbored by two other villages: Apoera (about 1150 people) and Section (about 300 people). While Washabo and Section are still inhabited by mainly Arowak Amerindians, Apoera contains a more diverse Amerindian population. In the 1970s Guyanese Amerindians, mainly people from the Warao tribe, moved to Apoera to work for natural resource extraction companies. Also, a small number of Carib Amerindians moved to West Suriname over the past decades. In 2002 a group of Trio Amerindians migrated from Suriname's southern region to live in Sandlanding (falls within the jurisdiction of Apoera) to get access to health and educational facilities. About 75 Trio Amerindians now inhabit this part of Suriname and still live in their traditional homes.

Most of the area's Indigenous Peoples are still (partly) dependent on hunting, fishing, gathering NTFPs and local agricultural practices for their subsistence. Therefore, their traditional customary lands are of vital importance to the local population. Their land tenure however is insecure since most of their customary lands are not legally protected for the local communities and are being overlaid by State-issued (timber) concessions.

The research project

Tim van den Boog is a master's student working with Dr Janette Bulkan in the Department of Forest Resources Management at UBC and in collaboration with Tinde van Andel from Naturalis Biodiversity Center in Leiden, the Netherlands. Tim completed undergraduate studies in Amsterdam (his home town) and then worked in a botanical garden in the Netherlands before pursuing his current graduate studies abroad. His research focuses on the Traditional Ecological Knowledge (TEK) of NTFPs held by Indigenous Peoples of West Suriname. The 3 objectives of his research are to: 1) identify

the most important NTFPs (both animals and vegetal ones) for subsistence and commercial purposes; 2) to document TEK on NTFPs held by the different Amerindian populations; and 3) to compare the data between the acculturated town of Apoera and the Trio Amerindians. The outcomes of this research could help to clarify how customary lands are being used and support their land claims.

On a daily basis Tim travelled with local guides into the forest in search of plants and trees that are customarily used for different purposes. For the vegetal NTFPs he made duplicate herbarium collections, one to be found in the National Herbarium of Suriname, the other at Naturalis in Leiden, the Netherlands. Tim also documented toponyms (place names derived from a topographical feature) and other ecosystem services using GPS during field trips. The main focus of Tim's research was on vegetal NTFPs as these serve many purposes and TEK is often lost as the younger generations tend to be less interested in such practices. Vegetal NTFPs are used as food sources, medicine, building materials and for spiritual purposes. The latter category contains plants used to aid hunting or to expel bad spirits, for example. Some of the NTFPs are used in their fresh state, others have to be stored or prepared in order to get the preferred outcome. In addition to forest walks, Tim convened focus group sessions with the local authorities, market vendors and hunters and gatherers. The entire research was done in accordance with the principle of Free, Prior and Informed Consent.

Results

The most important commercial animal NTFP is 'spari', better known as stingray. The tiger stingray (*Potamotrygon boesemani*) is endemic to the Corantyn River and is being sold for US$ 250 each to buyers from the city. The stingrays are then shipped to Asia and are sold to aquarium owners. For the community in Apoera, the most important vegetal NTFP is 'krapa siri' (*Carapa guianensis*), whose seeds are used to make crabwood oil. This is hard work: first, the crabwood seeds are collected from the forest floor, and then stored for about 2 weeks, after which they have to be boiled for a couple of hours. When red fungi start growing on them, the boiled seeds are ready to be cracked open, one by one, with a knife in order to remove the inner seed paste. Then, the paste is left to drain for a week, after which it has to be massaged 3 times a day; finally the oil will drip out over a period of 3 weeks.

For the Trios different vegetal NTFPs are important: the women of this tribe make jewelry from all kinds of plants and seeds, of which 'weteu' (*Ormasia* sp) is the most important one. The jewelry is the only thing they sell from the vegetal NTFPs they collect in the forest.

"On a daily basis Tim would go with local guides into the forest in search of plants and trees that are customarily used for different purposes."

Tim's research project represents a comprehensive catalogue of NTFPs and their uses within the customary lands of the Indigenous Peoples of West Suriname. In addition to the importance of capturing fast-disappearing TEK, the outcomes of this research are awaited by the local Indigenous communities who can use the results to advance Indigenous management of activities on their lands. The research will also be of interest to the wider scientific and national authorities who are collaborating with Indigenous Peoples and are interested in TEK and the ways in which ecosystem services are being utilised.

For more information on this project, please contact Tim van den Boog at timvdb@mail.ubc.ca or Dr Janette Bulkan at janette.bulkan@ubc.ca.

Basja Jang Djeneninpe, his wife and granddaughter of the Trio community in traditional clothing in front of their house

Post-disciplinary exchanges between students and communities

by Ana Elia R Hidalgo

Photo: Felipe Rodriguez Moreno

The Faculty of Forestry actively supports student initiatives to engage in interdisciplinary exchanges with students and communities outside Canada. Supporting such initiatives attracts international students to our faculty which further enriches the interdisciplinary research within our faculty on socio-environmental issues.

With the support of UBC Forestry, Gloria Borona a graduate student from Kenya was selected in 2015 from among hundreds of world-wide applicants as a finalist in the Global Environments Summer Academy (GESA) held in Europe for the past 5 years and organized by the Global Diversity Foundation through their Global Environments Network. GESA is a think tank designed for young socio-environmental leaders to deepen and expand their professional skills and visions in their academic or professional fields through intercultural exchanges utilizing a multiplicity of learning spaces. In prior years, 2 other UBC Forestry students also participated in GESA (Antonia Barreau MSc Forestry) and myself, Ana Elia R Hidalgo (PhD Candidate). Not only is UBC Forestry supporting the participation of their students in GESA but it has also sponsored the first Global Environments Network regional academy in the Dominican Republic, held November 13 to 22, 2015. Spearheaded by 6 GESA alumni – 2 of whom are UBC forestry students and alumni – the academy was entitled: the 1st Latin American Academy of Socio-Environmental Leadership (ALLSA). The aim of this regional academy was to bring together and train inspiring and dynamic environmental leaders from Latin America working with communities that face socio-environmental challenges. ALLSA's objectives were:

- To share methodologies and knowledge that encourage intercultural dialogue to catalyze meaningful learning;
- To strengthen motivation and competencies for leadership to facilitate socio-environmental change.
- To generate connective processes, creating and strengthening interpersonal networks that promote joint actions among participants following the event

Following a selection process from among over 100 applicants, 25 finalists from 12 Latin American countries who had exceptional socio-environmental leadership experience and motivation from the academic world, civil society, private sector and government were invited to join ALLSA. Partial tuition scholarships were provided to finalists facing financial constraints who would otherwise not be able to attend. With the support of UBC Forestry, Raquel Rivera Guallpa, an indigenous woman and leader from Ecuador was able to participate in ALLSA. This is how she describes her experience:

"I have no words to express what ALLSA has meant in my life (…). Living with ALLSA participants allowed me to exchange knowledge and experiences with people from different communities by creating a dialogue around a wide variety of topics related to leadership and our relationships with our co-habitants in this planet. (…) From ALLSA I take home a treasure of friendships, support, and strength to fly high and – without saying good bye – write a new future."

Key to the success of ALLSA was the diversity of participants represented in the group of finalists in terms of countries of origin, gender, personal and professional experiences, as well as indigenous and local perspectives. Another key to success were our mentors, experts both at regional and global levels

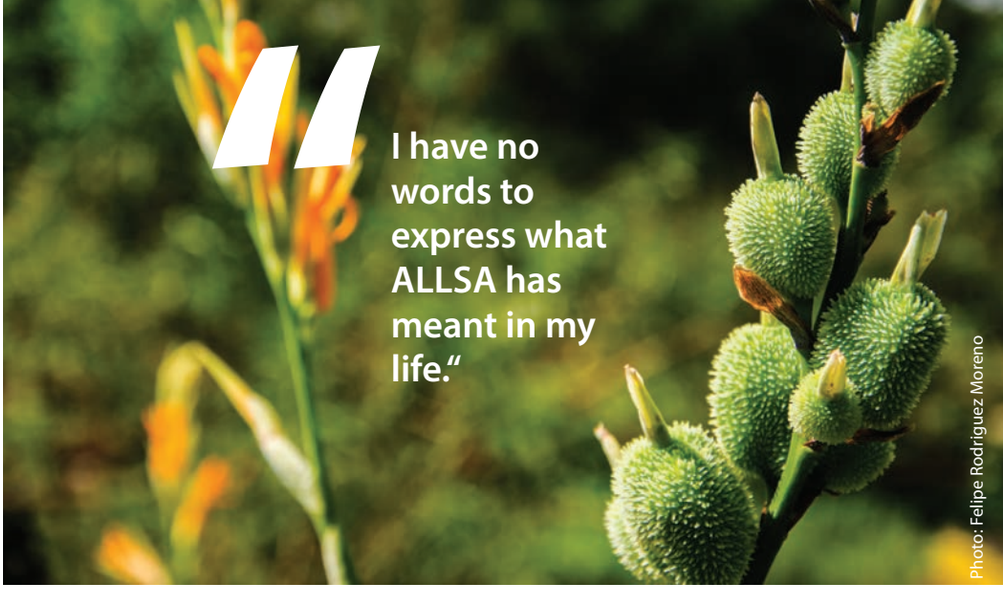


Photo: Felipe Rodriguez Moreno

who facilitated co-learning in different spaces through discussion circles, field trips, experiential workshops on eco-psychology, leadership, environmental ethics and indigenous epistemologies. The agenda was adaptive and allowed for participants to share their projects and ideas. For example, Daniela Biffi from Peru led one of our creative preludes and taught us how to play the Peruvian Food Chain Jenga, a fun methodology inspired from the Jenga tower game and marine ecosystem modelling that she invented to facilitate reflections and conversations around the connections that exist within a complex system. These learning methodologies surprised some and allowed others to learn at their outer edges, leaving no one indifferent. Antonio Sánchez from El Salvador related that, "[at ALLSA], I have been able to leave my comfort zone as never before. I've come to understand that the abysses between science, leadership and philosophy are not as deep as I had previously thought (…) I feel committed and strengthened." One of the ideas that generated reflections and conversations well into the night was our existence as a part of nature, in constant relationship with everything around us.

Manuela Fernández from Argentina reflecting on the ALLSA experience emphasized the need to listen actively and analyze deeply regional particularities in the face of our current socio-ecological challenges: "At ALLSA 2015 we explored a South American perspective of environmental ethics, its origins, its points of reference and its nuances. That allowed us to understand what it is that characterizes the region, to know which development models this environmental ethic is opposed to, as well as the objects, subjects, values and interests that it defends."

ALLSA shifted life's perceptions for some participants. Following ALLSA, Antonio Pulido from Mexico now aspires to "be part of a whole and not a whole split into parts; to make myself strong by recognizing that I am part of something larger and stop placing myself at the center in order to share equally with my habitat and co-inhabitants. ALLSA changed my perspective on life."

By the end of the program, participants outlined emerging ideas for future collaborations such as the development of a reforestation project in the Dominican Republic, the organization of the next ALLSA, and the compilation of oral traditions from the perspective of different cultures across Latin America that speak to human-nature relationships and show the diversity of ancestral biocultural wisdom.

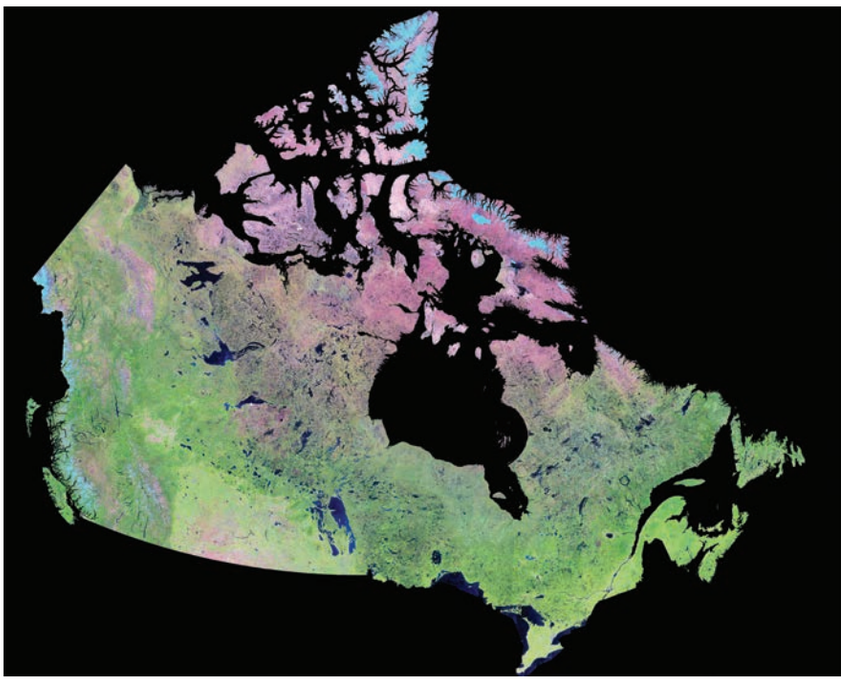
Photo: Felipe Rodriguez Moreno

Mariana Escobar from México related that, "After ALLSA I feel stronger, more creative and more conscious. ALLSA left me with a ton of concepts and ideas that I am still trying to assimilate, to integrate. But more importantly, ALLSA left me with the certainty that I need to reconnect with nature; that the study of the environment must be tied to ethics, and that my academic and professional life cannot be detached from my personal life."

ALLSA would not have been possible without the support of the Global Diversity Foundation, the Dominican Republic National Institute for the Education and Training of Teachers, the Faculty of Forestry at the University of British Columbia and the United Nations Institute for Training and Research. In addition, we want thank El Rancho Baiguate, El Sonido del Yaque and Angostura for welcoming us in their land and for so generously sharing their experiences with us. Finally, we are grateful for the support of ALLSA mentors Egleé Zent, Mirian Vilela, Ricardo Rozzi, Carlos del Campo, Gary Martin and Alberto Sánchez as well as all the participants for their willingness to learn together. Further information about ALLSA can be obtained by contacting the organization directly at allsa@globalenvironments.org

Ana Elia Ramon Hidalgo is a PhD candidate from Spain working under the supervision of Dr Rob Kozak (Forests and Communities in Transition project) in the Faculty of Forestry at UBC. She can be reached at anaeliaanaelia@yahoo.es.

Reconstructing the history of Canada's forest using Landsat data



Canada has recreated the recent history of its forest disturbance and related recovery using Landsat data; a history that would otherwise not be possible to recreate in a manner that is spatially explicit and at a spatial resolution of relevance for forest management. National governments need to produce information products with confidence to aid in national reporting, to inform policy, and to offer scientific insights.

Large nations such as Canada have previously relied on data from satellites such as MODIS (Moderate Resolution Imaging Spectroradiometer) and AVHRR (Advanced Very High Resolution Radiometer) for national forest characterizations. These valuable datasets and information outcomes allowed for map production and trend analysis of land dynamics, but were of a spatial resolution that was suboptimal for supporting management, reporting, and policy development.

With the 2008 opening of the US Geological Survey Landsat archive, Canada got the best of both worlds: national data coverage (~1 billion hectares) at a spatial resolution of 30 m. Having access to all Landsat in an analysis-ready form has allowed scientists from the Canadian Forest Service (Natural Resources Canada), and the Integrated Remote Sensing lab of the University of British Columbia, to produce large area, gap-free, surface reflectance science products.

Since 2013 postdoctoral research fellow Txomin Hermosilla has worked on the implementation of the Composite2Change (C2C) approach to generate annual gap-free image composite products representing 1984 to 2012, which enabled us to characterize change, land cover, and forest structure. The national time series of image composites offers a rich information source for both identifying and attributing forest changes. Thus, using the high performance computing and distributed data storage infrastructure provided by WestGrid we have parallel processed over 400 TB of data to ultimately produce about 25 TB of land change information products.

For a large nation such as Canada, with multiple jurisdictions responsible for forest stewardship, the ability to systematically produce nationally consistent information products is necessary to mitigate the different regional mapping protocols, forest inventory cycles, as well as differing definitions. The national change products relate a range of disturbances, chiefly wildfire and forest harvest. Wildfire can be variable year-on-year, with harvest levels relatively constant. The time series nature of the data allows for investigation of the return of vegetation following disturbance, with a positive vegetation response evident for almost all disturbed pixels.

Globally, other nations have similar information needs associated with terrestrial monitoring and will benefit from free and open access to the analysis-ready products of the Landsat archive, which continues to expand under the auspices of the Landsat Global Archive Consolidation initiative. And, the common use of Landsat data by the global community allows for an understanding of methods and outcomes across borders as well as the sharing of methods and lessons learned.

"The Landsat program is a global asset, allowing nations to consistently, systematically, and transparently characterize their terrestrial ecosystems," says Mike Wulder, a Canadian Forest Service scientist and member of the Landsat Science Team.

For further information, contact Dr Txomin Hermosilla (postdoctoral researcher in the Department of Forest Resources Management) at txomin.hermosilla@ubc.ca.

Project supported by the Canadian Space Agency. Project lead: Mike Wulder (CFS); rest of project team: Joanne White (CFS), Geordie Hobart (CFS), and Nicholas Coops (UBC).

From the mountains of BC to the mountains of Madagascar

Forests without Borders (FwB) is a registered charity founded by Ontario forester and former Canadian Institute of Forestry (CIF) President Fred Pinto, and adopted by the CIF. Forests without Borders works independently or with existing non-government organizations to deliver forest management skills, knowledge, tools and materials to rural communities in developing countries. FwB grew out of a desire by CIF members to apply their skills and knowledge to improve community well-being, restore degraded ecosystems, and promote sustainable forest management. There are FwB Chapters across Canada, including a BC Chapter led by Peter Ackhurst, RPF.

As a fundraiser for the BC FwB Chapter, a group of students and instructors from the UBC Faculty of Forestry's Master of Sustainable Forest Management (MSFM) program, together with a number of friends, planted 12,000 trees near Stave Lake, BC, under contract to British Columbia Timber Sales. The project, which took place over a weekend in early April, was initiated by MSFM Lecturer-Coordinator Deb DeLong and executed by Tom Kasperkiewicz and Patrick Ferguson – both graduates of this year's MSFM class with years of tree-planting experience. The project was generously supported by Tony Harrison of Zanzibar Holdings, Dirk Brinkman and John Lawrence of Brinkman and Associates, the Loon Lake Resort, and Chris Runnals of British Columbia Timber Sales. The proceeds, estimated at $6,000, will support a FwB project initiated by UBC alumna Stacey Boks (MSFM 2014), with the Mitsinjo Association Community Forest, near the community of Andasibe in Madagascar.

The villagers of Andasibe created the Mitsinjo Association in 1999, as a community-run conservation organization to integrate conservation in this highly biodiverse region with rural development. Their primary objective is to reforest with native species areas that have been degraded by mining, charcoal production and forest clearing for rice cultivation. Community members have the expertise to grow native trees and re-establish them, and have successfully reforested 400 hectares. However, their reforestation program has been limited by lack of funds to pay wages and purchase materials. In 2015, with funds from the BC Chapter of FwB, the Mitsinjo Association expanded their nursery and successfully grew and planted 15,000 seedlings of a dozen local rainforest species on 18 hectares. They also paid community members to cut competing vegetation after planting. The funds raised by the UBC students this year, will allow the Mitsinjo Association to further expand their program.

The impact of this effort on local biodiversity and human livelihoods is part of a research project funded by the program Ecosystem Services for Poverty Alleviation a global interdisciplinary research program funded by the United Kingdom's Department for International Development, the Natural Environment Research Council and the Economic and Social Research Council, as part of the UK's Living with Environmental Change partnership.

The planting group included Tom Kasperkiewicz, Pat Ferguson, Lauren Shinnimin, Alysha Van Delft, Mike Harrhy, Emma Dreiger (MSFM 2016), Nicole Bernardi (MIF 2016), Deb DeLong and Stephen Mitchell.

For further information, contact MSFM Coordinator Deb DeLong at deb.delong@ubc.ca or MSFM Director Dr Stephen Mitchell at stephen.mitchell@ubc.ca.

Predicting storm damage in partially-harvested boreal forests

In North America, 10,000 km^2 of old growth forest area is harvested every year, primarily in boreal ecosystems. These forests provide diverse habitats for wildlife and serve as important reserves of carbon. In Quebec, silviculturists have advocated use of partial harvesting systems in these forest types. These systems include strip selection (progressively thinning in strips), low intensity diameter-limit selection (cutting all trees greater than 14 cm diameter), and high intensity diameter-limit selection (cutting all trees greater than 9 cm diameter). In all 3 systems, harvest layout is designed to promote operational efficiency while minimizing damage to advanced regeneration. While these systems have been successfully implemented, the retained trees are vulnerable to wind damage.

The eastern Quebec boreal forest experiences both long duration wind storms associated with the passage of extensive, low pressure systems, and short duration, intense downbursts associated with convective systems. Process-based windthrow prediction models allow for the representation of harvesting pattern, windstorm intensity and storm duration. With funding from NSERC, Dr Jean-Claude Ruel (Laval University) and Dr Kenneth Anyomi joined with UBC's Dr Stephen Mitchell to adapt the ForestGALES_BC windthrow model for eastern boreal old growth stands. ForestGALES, is a hybrid-mechanistic windthrow prediction model originally developed by the UK Forestry Commission to predict the critical wind speed for complete failure of uniform, single species plantations. Earlier work by Drs Ken Byrne and Stephen Mitchell added information for British Columbia species, and introduced the capacity to represent damage propagation in mixed-species, partially-harvested stands.

To build the Quebec version of the model, crown form, stem shape and biomechanical data were added for balsam fir and black spruce from earlier studies by Dr Ruel's research group. Pre- and post-harvesting tree and stand data were obtained from a replicated silviculture system experiment in north-eastern Quebec. A simulation space made up of 500 cells, each 20x20 m, was created to represent the layout of the installations, and the characteristics of retained trees. Above-canopy winds of various speeds and durations were applied in order to test the initiation and propagation of damage within the simulated forest. Simulated outcomes were compared to observations of windthrow 6-7 years after partial harvesting at the experimental field sites.

Model predictions compared well with field observations. Over the range of peak wind speeds expected for the experimental site (20 to 90 km/h), simulated windthrow levels ranged from 7-32% which is comparable to the observed windthrow levels of 1-40 %. Simulated windthrow levels were lower in low intensity selection harvests than in higher intensity harvests where fewer trees were retained, and this is consistent with field observations. When the combined effects of wind speed and storm duration were investigated, wind duration was more important for wind speeds over 70 km/h. During long duration events, damage spreads through the stand until all vulnerable trees fail. In contrast, following short duration high speed wind events (such as downbursts associated with thunderstorms), patches of damage could be bordered by stand edges vulnerable to subsequent winds of similar magnitude.

The new ForestGALES_QC model allows investigation of a wide range of harvesting strategies, and storm types, and sets the stage for inclusion of wind disturbance in ecosystem succession models and other stand or landscape-level decision-support tools. We are presently working with the Ontario Ministry of Natural Resources to adapt ForestGALES_QC for boreal Ontario and integrate it with their wildfire risk and landscape-succession model, BFOLDS.

Dr Kenneth Anyomi is a post-doctoral researcher with the UBC Windthrow Research Group and can be reached at kenanyomi@gmail.com. Dr Stephen Mitchell can be reached at stephen.mitchell@ubc.ca.

$$Uh_{\text{over}} = \frac{1}{kD}\left[\frac{C_{\text{reg}}\text{SW}}{\rho\, Gd}\right]^{\frac{1}{2}}\left[\frac{1}{f_{\text{edge}}f_{\text{CW}}}\right]^{\frac{1}{2}}\ln\left(\frac{h-d}{z_0}\right)$$

Tree rings and insect outbreaks

Tree rings are a natural archive that can be used to retrospectively reconstruct climate-mediated disturbances such as insect outbreaks. As part of her postdoctoral research at UBC, Dr Estelle Arbellay has used a multi-proxy approach that includes measurements of the width, wood density, wood anatomy and wood chemistry of tree rings in order to improve reconstruction of past insect outbreaks. At the centre of her research are 3 widespread pests: (i) mountain pine beetle (*Dendroctonus ponderosae*), a cambium feeder that injures lodgepole pine, (ii) western spruce budworm (*Choristoneura occidentalis*), a defoliator that feeds on Douglas-fir, and (iii) larch bud moth (*Zeiraphera diniana*), a defoliator of European larch.

Estelle's first project involved mountain pine beetle (MPB) vs fire scars in lodgepole pine. A number of tree-ring studies have investigated beetle activity through the dating of scars caused by MPB gallery boring in the bark. However, frequent difficulties in conclusively separating MPB scars from fire scars have been a limiting factor in developing chronologies over large spatial and temporal scales. Through collaborations with UBC colleagues Alice Chang and Dr Shawn Mansfield, Estelle analyzed annual variations of wood properties in tree rings formed prior to and after injury. She tested the hypotheses that injury caused by either MPB or fire would elicit wood anomalies and that such wood anomalies would differ in type, magnitude, and/or duration between MPB and fire. Her main objective was to decipher an injury signal specific to MPB.

Results highlight MPB injury as more acute than fire injury and suggest methods to positively differentiate MPB scars from fire scars. This study can help to provide more precise tree-ring estimates of MPB outbreaks, needed by forest managers to guide ongoing ecological restoration of national parks and surrounding forests. Moreover, knowledge of MPB- and fire-scarred lodgepole pine wood properties is of great interest to the forest industry in dealing with the ever-increasing quantities of scarred timber that need to be integrated into solid wood products and commercialized successfully.

Estelle's second and third projects dealt with forest defoliation caused by western spruce budworm (WSB) and larch bud moth (LBM) in the Pacific Northwest and European Alps, respectively. Tree-ring studies have successfully used periods of growth suppression caused by WSB and LBM to assess forest defoliation over large spatial scales. However, a 1 to 4-year lag exists in tree ring response to defoliation. Together with fellow laboratory members Ingrid Jarvis and Raphaël Chavardès, Estelle analyzed annual variations of ring width for periods of growth suppression via image analysis. The team also analyzed annual variations of latewood width and blue intensity, ie the reflectance of blue light occurring in latewood, recognized as a proxy for latewood density. Their main objective was to improve the temporal accuracy of tree-ring reconstructions of forest defoliation.

Results demonstrate that latewood-related proxies help gain higher temporal resolution in tree-ring reconstructions and thereby more precise tree-ring estimates of forest defoliator outbreaks. High quality tree-ring data is essential for comparison with insect survey records and climate data in order to project the timing and frequency of future infestations, predict the potential expansion of populations beyond their historic ranges, and improve the reliability of forest management plans and timber supply projections.

In addition to guiding forest management, Estelle's research provides fundamental insights into the physiological response of coniferous trees to insect attack. This information is needed to counter recent severe outbreaks of cambium feeders and forest defoliators which are threatening forest resilience to global warming around the world.

Dr Estelle Arbellay is a postdoctoral researcher in the Tree-Ring Lab at UBC, led by Dr Lori Daniels, in the Department of Forest and Conservation Sciences. Estelle can be reached at arbellay@mail.ubc.ca.

development & alumninews

Mark your calendars for the following Forestry alumni events

- **Class of 1966 50th Reunion** at Sun Peaks, BC – September 7th – 8th, 2016
- **Alumni Reception at the DEMO International Conference 2016 & CIF/COFE AGM** in Vancouver, BC – Tuesday, September 20th, 2016
- **Alumni Booth at DEMO International 2016** in Maple Ridge, BC – September 22nd – 24th, 2016
- **Class of 1986 30th Reunion** at Harrison Hot Springs, BC – October 14th – 16th, 2016

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

Forestry Alumni and Friends Loon Lake BBQ and Tour 2016

On Thursday, April 28th, 2016 UBC Forestry alumni, friends, students, faculty and staff joined together for an afternoon in the woods at the Malcolm Knapp Research Forest (MKRF) in Maple Ridge. The day started with a tour of the research forest, which included a sneak peak of the 2016 DEMO exhibit site. Then guests cheered as two student teams went head-to-head in a tree pruning contest, after which they were quizzed by guests on their technique. The tour ended with a presentation on the Griffith trees, a historic part of the MKRF.

The tour was follwed by a reception in the newly renovated Pan Abode (old dining hall) and 4 student crews were each joined by an alumnus and squared off in a quiz about the history of Forestry in BC. It all came down to a tie-breaker question and the winner of the event was Crew 2 with Gerry Burch. The evening ended with a BBQ dinner in the new Bentley Family Hall and everyone joining in to celebrate Professor Emeritus Tony Kozak's 80th birthday. Photos of the event can be seen on the alumni website – getinvolved.forestry.ubc.ca/alumni/.

Thank you to those who joined us and we hope to see everyone next year!

Class of 1956 60th Reunion

Members of the class of 1956 and guests joined Dean Innes for a lunch on Saturday, May 28th to celebrate their 60th year since graduating from the Faculty of Forestry. The classmates reconnected and recounted stories from their days at UBC Forestry.

Congratulations to the class of 1956 and thank you for celebrating with us!

(Left to right) Paul Brett, Doug Rickson, John Kamimura, Peter Pearse, Ron Sawatzky, Stan Chester

Alumni in action

Often our alumni ask "What happened to my classmates after graduation?" while our students wonder "What can I do with my degree?" To answer these questions, this column features stories from our alumni highlighting the various career paths they followed.

Jeffrey Hayward, MSc (Forestry) '98

Where did you grow up?
I was born north of Boston and grew up in Amherst, Massachusetts. In 1980 our family moved to Eugene, Oregon. I immediately took to the outdoors, hiking as much as I could in the Cascade and Olympic mountains.

Why did you choose UBC Forestry?
A court injunction that closed logging from US federal lands in the Pacific Northwest in the 1990s really started my career rolling. I sought solutions that would drive environmentally and socially responsible forestry. By 1995 UBC had several faculty members focused on these issues. The prospect of studying forestry not far from my family and within a world-renowned and multi-disciplinary faculty was hard to pass up.

In what year did you graduate from UBC Forestry?
I defended my thesis in spring of 1998. I had started my graduate studies in 1995 and received a Master of Science in Forestry. The subject of my research was the assessment methods used by Forest Stewardship Council (FSC) certifiers in North America from the inception of the FSC up to 1997.

What was your first job after graduation?
I managed a number of short consultancies for 8 months, then joined the Rainforest Alliance in their forestry certification program as an intern. I had researched this extensively as a graduate student, so it was a logical place to start. I was immediately trained as a forest auditor, and within a few months was flying into the heart of the Bolivian Amazon to assess a forest concession.

What are you doing now and what led you there?
I'm currently Vice President, Landscapes and Livelihoods – the division leading our field work – at the Rainforest Alliance. I am also the global lead on climate and concentrate a lot of my energy on climate change adaptation, resilience and mitigation. The Rainforest Alliance is an international conservation organization based in New York that works with over 3,000 businesses, over 1.3 million farmers, in over 80 countries, and has certified over 38 million hectares of forest to FSC standards.

What is your fondest memory of your time at UBC?
I lived for a summer in Williams Lake and worked in the Alex Fraser Research Forest. I really enjoyed all the very practical and real-world forestry concerns embodied in a small university forest. I also did a few stints as a teaching assistant with the fall camp, and I really loved helping students on plant identification.

If you weren't working where you are now what profession would you most like to try?
I'd still be trying to solve a global problem. If not forests and climate change, I'd probably be at a think tank working on urban sustainability issues.

What is the toughest business or professional decision you've had to make?
In 2002, I had to oversee a process to revoke the FSC certificates of Perum Perhutani, the Indonesian parastatal teak plantation company. This meant that the majority of the teak garden furniture industry, which had become very supportive of certification, would need to both phase out their teak certified product lines and identify new sources of supply within a very narrow time frame. There was a lot of hostility and open threats to me and the Rainforest Alliance. It was a hard time. But it also demonstrated that certifiers will revoke certificates.

Do you have any advice for students currently in Forestry or recent graduates?
Get practical experience in the area of forestry that really calls to you, even if it's not necessarily the most lucrative opportunity. Also, find one thing in your position that you can be the expert or specialist in, even while maintaining an ability to be a well-rounded generalist, so you emerge as the go-to person in your company for something.

Bringing art to the Faculty

A love of forests and an appreciation for the cycles of nature are behind the creation of artworks by Lori-ann Latremouile and Pnina Granirer recently donated to the Faculty and on display in the atrium of the Forest Sciences Centre.

Lori-ann Latremouile is Vancouver born-and-raised, and describes her artwork as "biophilic", using EO Wilson's term for the innate love of living things. Since the age of 3 she walked in the UBC Endowment Lands (now Pacific Spirit Park) and has brought those early experiences in nature to her art.

"In my work the figures and the landscape become one, sometimes fitting together in a way that is encoded by nature," she says. "It speaks to how we need to be completely integrated with our environment, not separating and commodifying it."

Lori-ann's painting *Healing the Stream* (below) was donated to the Faculty by Carol Robertson. Carol has donated several artworks to UBC, and this is her second donation to the Faculty.

"Lori-ann is one of the most original artists I have seen. She has a unique way of incorporating all the different elements into her artwork," Carol says. "I have long been a fan of her work and I am honoured to donate these works of art to the Forestry building which was in part built with funds donated by my grandfather HR McMillan."

In *Healing the Stream* fish skeletons swim through and around human and animal figures, becoming alive and whole again. "I wanted to show how Nature is forgiving," Lori-ann says. "As humans, we need hope that we can do it; we can heal the planet."

Pnina Granirer was born in Romania and has lived in Vancouver since the 1960s. Her work has been exhibited widely in Canada and abroad in both solo and group shows. Her husband is Professor Emeritus of Mathematics Ed Granirer, through whom Pnina developed a relationship with UBC. She taught art in the Faculty Women's Club and in Continuing Education.

Pnina recently donated the diptych *Lumber* and the mixed-media piece *Beach* (above) to the Faculty. Pnina's friend Dr Eve Rotem has donated Pnina's diptych *Forest Ghosts* as well.

All 3 works feature Pnina's signature textures and layers. They invite contemplation and careful inspection, as the details add complexity and meaning to the works. In *Lumber*, for example, a collaged measuring tape from IKEA stretches across the width of the tall cedar in the painting to symbolize the commercial value we attach to trees.

"These pieces are part of a West Coast series that I created in the late 1980s and early 1990s. I love to be in forests, surrounded by trees. I feel like these works (*Lumber* and *Beach*) naturally belong in the Forest Sciences Centre," Pnina says.

Beach is part of an extensive body of work inspired by the stones of the Gulf Islands and the sense of eternity they convey. Most of the works in this series were exhibited at the Two Rivers Gallery in Prince George under the title Whisper of Stones. They are now in the permanent collections of the gallery.

Art donation is just one more way to support the Faculty of Forestry and enhance the learning environment for our students. For more information, please contact Emma Tully at 604.822.8716 or emma.tully@ubc.ca.

Belief in equity behind longstanding scholarship

Back in the early 1990s, Clark Binkley was Dean of the Faculty of Forestry at UBC. As such, he was frequently invited to give talks throughout Canada and the US; talks for which he was offered speaking fees. "I just felt awkward accepting the fees," he says, "so I decided to have them go back to UBC in some way, and what better way than to support students?" Clark established a scholarship in 1996 and has added to the endowment since then. The scholarship has supported the education of over 20 Forestry students to date.

Clark credits his parents for the whole idea. "Both my parents were dedicated to education: Dad taught biochemistry at Emory University and Mom was a high school teacher. I grew up in Georgia, and we were deeply involved in the civil rights movement," he says. " I understood from a young age that equal access to education is critical to equal economic opportunity."

Clark is currently the Chief Investment Officer and Managing Director of GreenWood Resources Inc, a Portland, OR, based timberland investment and management company that specializes in acquiring, developing and managing plantation assets. He holds degrees from Harvard and Yale University, and was a faculty member at Yale before joining UBC as Dean.

On his move from east coast to west, Clark says, "UBC has one of the best – if not the best – forestry programs in the world. Great forestry programs need to be located in a place that cares about forests, and within a university that is strong in all the disciplines that support forestry, like economics, geography, engineering and ecology. UBC is one of the few places in the world with these unique ingredients."

The **Emily and Francis Binkley Scholarship**, named after Clark's parents, is awarded to an undergraduate student each year. Preference is given to First Nations students, then to female students in any UBC Forestry program.

"I wanted the award to support students who are underrepresented in the Faculty," Clark says. "The profession of forestry works best when it fully reflects the society in which it works."

Clark finds the experience of being a donor "very fulfilling". "I get letters from the students who receive the award, and they tell me what a difference this has meant to them. Some of them have been the first in their family to go to university. Being able to help them is immensely satisfying to me."

Jemina Coutu, a First Nations student in the Forest Resources Management program, was the 2015 recipient of the scholarship. She says the award has allowed her to concentrate on her schoolwork without financial worries, and to accept a lower-paying summer job that allows her to gain more valuable experience with community or aboriginal forestry.

"Forestry, as I am coming to appreciate, is incredibly diverse, touching on environmental, social and economic issues that all excite me. I am looking forward to my future in this field," she says.

> **"I get letters from the students who receive the award, and they tell me what a difference this has meant to them ... Being able to help them is immensely satisfying to me."**

The Faculty of Forestry is grateful to Dr Clark Binkley and all other donors who help enrich students' lives through scholarships and bursaries. To find out more about establishing a student award, please contact Emma Tully at 604.822.8716 or emma.tully@ubc.ca.

In memory of Dr David Barrett

The Faculty is saddened by the loss of our colleague and friend Professor Emeritus David Barrett. David passed away on April 5, 2016, after a valiant fight against cancer. David graduated from the UBC Faculty of Forestry in 1965, and went on to complete his PhD in Wood Science at the University of California, Berkeley, before returning to Vancouver in 1971 to begin his wood science career in the Western Forest Products Lab.

David joined the Faculty in 1984 as the Head of the Harvesting and Wood Science Department. During his 15 years as Head he played a major role in developing the Wood Products Processing undergraduate program and in establishing the Centre for Advanced Wood Processing, Canada's national centre for education, training and technical assistance for the wood products manufacturing industry.

In recognition of his tremendous contributions to research and education in wood mechanics and timber engineering the Faculty is working with David's family, colleagues and friends to establish a scholarship fund in his memory. To find out more or to contribute please visit http://memorial.supporting.ubc.ca/david-barrett/ or contact Emma Tully at 604.822.8716 or emma.tully@ubc.ca.

Electronic versus paper?

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