

branchlines

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forestry
university of british columbia

dean's message



This issue of BranchLines is all about change. It seems trite to say that the speed of change is picking up, but it really does

seem to be the case, and the pace of change will only accelerate. The Faculty of Forestry continues to evolve to meet these changes, even within the very conservative regime of a major university. For example, we are pushing the boundaries of education in the courses that are taught in the Haida Gwaii – the courses are open to any student, they are highly experiential, and they are not just taught by UBC faculty members, with teaching faculty coming from many different universities. In fact, the new courses on reconciliation will be co-taught by academic and Indigenous instructors. At the opposite end of the spectrum, we continue to work on the development of electronic courses for the Asia-Pacific Forestry Education Coordination Mechanism (see www.forestry.ubc.ca/apfnet), and have recently published a textbook Sustainable Forest Management: From Concept to Practice (see <http://www.forestry.ubc.ca/sfmbook>) to support one of these. At the same time, I remain convinced that we need to utilize our existing facilities, especially our wonderful Research Forests, to the full.

Outside the Faculty, we are seeing a number of changes as our new President settles into his role and he begins to gather together his senior management team. A new strategy for the university is under development and tensions are already apparent between where we are comfortable being, where we would like to be and where we should be. Moving from the status quo to a new and better position involves change, taking risks and breaking new ground. This can be achieved by adaptation of our existing system, and is being helped by the recruitment of new faculty and staff members who will assist us move forward into new areas.

Our changing climate remains a deserving topic for research, and within the Faculty is being examined from many different angles, as demonstrated by the articles in this issue. Controversy will continue to surround not only the extent of future climate change, but also the best ways to adapt to the changes that have already occurred and to those, of largely unknown extent, that may occur in the future. Forestry has both advantages and disadvantages here. Forests represent a

valuable store of carbon and the management of this carbon is taking on increasing importance. However, to maintain these stores, the forest needs to survive. With increasing levels of disturbance by fire, insects and other pathogens, and changes occurring to the genetic composition of our forests, this survival can no longer be taken for granted.

The sound management of our forests requires the science, art and practice of forestry. We try and imbue these skills in our students but doing so requires expert faculty members and even the supply of these is changing. We are currently recruiting a number of new faculty, including in the field of forest operations. However, it is apparent that globally, there has been a major decline in the number of people qualified to teach operational forestry, and the problem is particularly evident in Canada. We seem to be in a serious spiral of decline: forestry companies are unwilling to invest in university-based forest operations research, which means that very few graduate students are being engaged in this area. The paucity of graduate students means that very few academics with an understanding of forest operations are emerging from the training system, resulting in some university forestry programs shifting away from this critical area. The end result is fewer opportunities for undergraduates to learn about forest operations, a reduction in the supply of graduates qualified to work in forest operations, and less research on topics such as the harvesting of timber on steeper slopes.

Change is occurring, and undoubtedly will be the topic of future editorials in this magazine. The Faculty of Forestry will be ready, I hope, to meet these changes.

A handwritten signature in black ink, which appears to read "John L. Innes". The signature is fluid and cursive.

John L Innes
Professor and Dean

forestrynews

Experiential learning at the Haida Heritage Centre



For a number of years, the Faculty of Forestry has been supporting the work of the Haida Gwaii Higher Education Society (HGHEs). The semesters offered by the HGHEs have featured in a previous issue of BranchLines, but with major changes to the program afoot, you may be interested to learn how it is evolving under the leadership of Dr Carlos Ormond, with the able assistance of the HGHEs team. We believe that the program is a unique opportunity for experiential learning for students, which is why we are so supportive of it.

Currently, 2 semesters are offered, both taught at the award winning Haida Heritage Centre at Kay Llnagaay in Skidegate, Haida Gwaii. Students take 5 courses per semester, and receive a total of 15 credits per semester from the Faculty of Forestry. While a significant number of our forestry students have taken a semester, the semesters are actually open to any student, and in any given year there are students from all over Canada, including the Haida Gwaii.

The semesters are arranged such that students work intensively on 1 of 4 courses at a time. This enables teaching faculty to be brought in from a variety of sources and allows students to focus on the subject matter at a deeper level. The fifth course is a discussion-based seminar and lasts the entire 14-week program. The Haida Gwaii Semester in

Natural Resource Science has courses on 'Applied Ecology of Coastal Terrestrial Ecosystems', 'Biophysical Dynamics of the Marine-Terrestrial Interface', 'Ecology and Management of Island Wildlife', 'Systems Thinking for Resource Management' and 'Ecosystem Based Management Seminar'. The second semester focuses on natural resource studies, and has courses on 'History and Politics of Resource Management', 'First Nations Governance and Natural Resource Management', 'Rainforest Ecology and Management' and 'Diversifying Resource-Dependent Communities', with a 'Case Studies in Haida Gwaii' seminar.

Some of the teaching faculty are from UBC, others from elsewhere, resulting in a variety of perspectives. However, all must work with the course outlines approved by UBC's Senate. A particularly interesting feature of the teaching is the participation of people from the local communities within Haida Gwaii. These include individuals from the federal, provincial, municipal and Haida governments, as well as a variety of other community members who add their broad perspectives to the complex issues examined in class.

The presence of about 20 students per semester throughout the fall and winter brings a significant economic boost to the communities, at a time

when traditionally there has been no tourism and very few visitors. The students all stay with local people as paying guests, and make use of a variety of facilities and opportunities. Being so embedded in the communities, their learning experience is extended: they hear firsthand from the people affected by the resource management decisions that they are learning about.

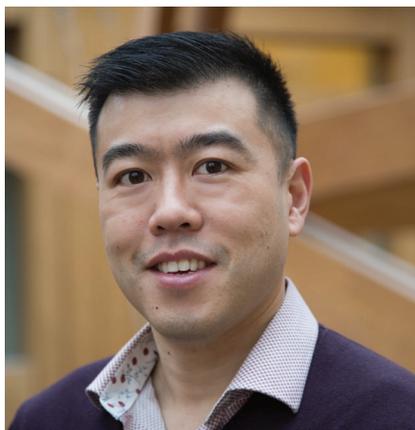
In September 2017, a new semester will be launched. The final details are still being worked out, but it is planned that the 5 courses will be delivered in Old Massett and Massett. The semester will cover the critically important subject of reconciliation, and the 5 UBC Senate-approved courses will be on 'First Nations and Canada (Re)writing History', 'Law and Governance: Indigenous and European Traditions', 'Perspectives on Reconciliation', 'Reconciliation and Resource Management' and 'Reconciliation and Communities'. Taking full advantage of the location, a unique aspect of each course is that they will be co-taught by an academic and an Indigenous instructor. Using the same model as the other semesters, students will be accommodated by local people, either in Old Massett or the adjacent village of Massett.

Towards the end of last year, the HGHEs started discussions with the Faculty of Forestry about a more formal link to the Faculty. These negotiations are well underway, and steps are being taken to integrate the HGHEs into the Faculty. A self-contained unit within the Faculty will be established that will operate much as the Research Forests do, with the operations base continuing in Haida Gwaii. Further developments to this unique partnership are underway and will, of course, be outlined in future editions of BranchLines.

New appointments



Dr Cole Burton has joined the Department of Forest Resources Management as Assistant Professor in Wildlife Ecology and Conservation. Cole's research is motivated by the challenge of human-wildlife coexistence on an increasingly crowded planet. He seeks to support evidence-based policy decisions through an understanding of wildlife responses to a changing environment. Cole specializes in studying terrestrial mammals using innovative monitoring methods, including camera "traps", and has a particular interest in the conservation of large carnivores prone to conflict with people. He has worked collaboratively with governments, industries, ENGOs, and academics in Canadian and international contexts. He has an MSc in Zoology from UBC and a PhD in Environmental Science from the University of California, Berkeley. Cole will be leading the Wildlife Coexistence Lab at UBC, and teaching courses in wildlife ecology, management and conservation. He can be reached at cole.burton@ubc.ca.



Jason Chiu has taken on the role of Managing Director of the Centre for Advanced Wood Processing (CAWP), effective January 1, 2017. Jason is a UBC alumnus graduating from the Wood Products Processing Program in 2000. He has been with the Department of Wood Science for 15 years, most recently as a technical specialist managing and implementing process improvement projects and providing 1-on-1 technical assistance to industrial designers and professionals. Jason has developed an extensive international network in the wood products industry and has a firm understanding of the needs of the industry and the Centre's daily operations. He will be overseeing the operations of CAWP's manufacturing facility as well as the Centre's professionals, technicians, and staff to ensure the operational goals and priorities are achieved. The managing director role was previously held by Iain McDonald. Jason can be reached at jason.chiu@ubc.ca.



Alison Krahn has joined the Faculty of Forestry as Coordinator of Aboriginal Initiatives. She is responsible for recruitment and retention of Aboriginal and Indigenous students, liaising with First Nations communities, and helping to develop curricula and outreach efforts. A teacher by training, Alison has an MA in Educational Studies from UBC, where she completed a community-based research project designed to enhance school learning for Indigenous students. Alison has extensive experience in experiential education, student support, curriculum development, and community and stakeholder engagement. She previously worked as an instructor and school-community liaison for Vancouver Community College, Tsawwassen First Nation, and the Vancouver School Board. Alison takes the place of Andrea Lyall, who has left this position late last year to concentrate on her graduate studies. Alison can be reached at alison.krahn@ubc.ca.

In memoriam

Professor Emeritus Dr Laszlo (Les) Paszner passed away on December 31, 2016. Les was a leader and innovator in the field of wood science. He had an expert understanding of the chemical utilization of wood and reconstituted wood products, and was recognized internationally for his contributions in these areas.

Les first came to UBC in 1957 as part of the group of students and professors from Sopron who fled Hungary during the Soviet occupation of 1956. He completed his BSF in 1958, his MF in 1960 and his PhD in 1964. In 1968 Les joined UBC Forestry as a faculty member, only 1 of 2 from the class of 141 Sopron Forestry graduates. He became an active member of the Department of Wood Science at UBC, teaching, patenting technologies and carrying out research in the field of wood chemistry. Les educated, trained and mentored many students, most of whom went on to meaningful careers in wood science. In 1999, he retired after 32 years of outstanding service.



Faculty members receive major funding for genomics research

Four UBC Forestry faculty members (along with partners from other universities and agencies) have received significant funding from Genome Canada's Large-Scale Applied Research Project (LSARP) awards. The LSARP awards support applied research projects focused on using genomic approaches to address challenges and opportunities of importance to Canada's natural resources and environmental sectors, including interactions between natural resources and the environment. Of the 13 projects funded in the past round of competitions, 4 projects involve UBC Forestry faculty members with total project funding of over \$30 million.



Forest technology building better bioproducts

Dr Joerg Bohlmann (UBC Forest and Conservation Sciences & Michael Smith Laboratories) is co-lead, with partners at Laval University, on the project, Spruce-Up. Spruce are the most reforested trees in Canada and also produce high quality wood and fibre. Climate change and unpredictable markets require innovative tools for tree breeding programs to deliver reliable spruce stock. Advanced spruce genomics for productive and resilient forests (Spruce-Up) is estimated to more than double the net economic output value of spruce forests, increasing the value of new trees and reducing losses due to environmental disturbances. Lead Genome Centre – British Columbia. Co-lead – Quebec. Total funding \$10.5 million.



Combatting invasive alien species

Dr Richard Hamelin (UBC Forest and Conservation Sciences) is co-lead, with partners from the Canadian Food Inspection Agency and Laval University, on a project to harness the power of biosurveillance. Their work involves decoding the genomes of some of the most threatening invasive species and developing a new suite of tools to rapidly and accurately detect these detrimental forest enemies and assess the risk they pose. This project will enable forest health professionals to identify the source of these threats and use a decision-support tool to predict the risk of an outbreak and weigh management and mitigation options. Lead Genome Centre – British Columbia. Co-lead - Quebec. Total funding \$8.6 million.



Planting tomorrow's trees today

Dr Sally Aitken (UBC Forest and Conservation Sciences) is leading a team with partners from the University of Calgary and Dr Richard Hamelin from UBC & Laval University, that will use genomics to test the ability of trees from different populations to resist heat, cold, drought and disease, and identify the genes and genetic variation involved in climate adaptation. The ultimate goal of the project is to develop better reforestation strategies for economically important tree species. Sally's team will use genomic tools along with climate modeling and seedling experiments to help better understand the adaptation of trees to both climate and diseases. Lead Genome Centre – British Columbia. Co-lead – Alberta and Quebec. Total funding \$5.9 million.



Faster growth times for trees will lead to better economic outputs

Dr Yousry El-Kassaby (UBC Forest and Conservation Sciences) is co-lead on a project that aims to shorten the time, by about 20 years, for tree-breeding cycles thus alleviating side effects from climate conditions and insects. Yousry and project partners at the University of Alberta will use genomic information in mathematical models to help identify specific genotypes that are resistant to insects and are drought tolerant at an early age. Their experiments will feed directly into the identification of naturally resilient trees and, ultimately, allow shortening of the time it takes to complete a typical tree breeding cycle of ~30-years to less than ~10-years. Lead Genome Centre – Alberta. Co-lead - British Columbia. Total funding \$5.7 million.

3-minute thesis results



On March 2nd, 11 Forestry students competed in this year's 3 Minute Thesis event. This fun competition helps graduate students to foster effective presentation and communication skills. Participants have just 3 minutes to explain the breadth and significance of their research project to a non-specialist audience. Our top 3 students have qualified to compete in the UBC-wide semi-finals.

First place – **Anna Smith**

Synopsis: Juvenile salmon do not have many morphological or physical

defense mechanisms, such as spines or poison, which makes them especially vulnerable to predation throughout their development. Instead, they rely heavily on detecting predator scents and chemical alarm cues released from injured fish. The smell of these alarm cues triggers a series of defensive behaviours that increase the likelihood of survival in the presence of a predator. Unfortunately, even at concentrations of parts per billion, certain contaminants, such as copper and possibly zinc, can interfere with

scent detection and render fish largely defenseless.

Anna, a master's student with Dr Scott Hinch, hopes to shed light on the harmful effects of low-level zinc contamination and determine its effects on the recognition of alarm cues and the initiation of anti-predator behaviours in juvenile Coho salmon. The probable disruption of these fishes' main system of defense could have massive impacts on juvenile Coho survival and should be of considerable concern to conservationists and policy makers. It is vital to understand the influence of sub-lethal levels of toxicants on stream systems and provide strong evidence to support the need for change in how acceptable levels of contaminants are determined.

Second place went to **Amanda Johnson** (doctoral student with Dr Scott Rennekar) for her talk titled "Goodbye garbage, hello hemicellulose".

Third place went to **Yuhao Bean Lu** (doctoral candidate with Dr Nicholas Coops) for his talk titled "Cities and satellites".

To view all 3 winning presentations on YouTube, visit www.forestry.ubc.ca/3mt

Paul Lawson receives award



Paul (left) accepting his award from ABCFP president Chris Stagg, RPF

Paul Lawson, director of UBC's Research Forests, has been awarded the Distinguished Forest Professional Award from the Association of BC Forest Professionals (ABCFP). Paul graduated with a BSF degree from UBC in 1977 and an MBA in 1990. After working in the forest industry and consulting throughout BC (including Quesnel, Gold River, Campbell River, Sandspit, Prince Rupert and Gibsons), Paul joined the Research Forest in 1999 as manager at the Malcolm Knapp Forest in Maple Ridge. He has been director of both Research Forests (Malcolm Knapp and Alex Fraser) since 2009. In this role, he helped to build a stable business and innovative forest management model in a highly visible urban interface. Paul has dedicated his career to elevating

the practice and profession of forestry in BC. He has made distinguished contributions as an educator, research supporter, and leader in demonstrating excellence in forest stewardship. His contributions include building a team that developed and implemented a restoration plan for Stanley Park in 2007, leading the redevelopment of Loon Lake Camp, and hosting DEMO 2016 at the Knapp Forest. Paul was presented with this award as a forest professional who has made significant contributions to the profession and study of forestry, ensuring BC's forests are managed to the highest environmental standards. The award was presented on February 23 in Prince George during a ceremony at the ABCFP's annual conference.

Congratulations Paul.

New graduate program approved



We are excited to announce that our Master of Geomatics for Environmental Management (MGEM) Program has been approved by the Province and our first cohort of students will start in August, 2017!

The need for this program reflects the overall growth in careers focussed on the environment, conservation and sustainability. Such “green-careers” require diverse skill sets, but among the most important are those relating to geomatics – the branch of science that deals with the collection, analysis, and interpretation of data relating to the earth’s surface. Whether planning renewable energy networks, designing urban greenspace corridors, implementing reduced-impact resource extraction strategies or targeting conservation priority areas: all require geomatics skills, for which demand continues to expand.

Our new 9-month course-based program provides an innovative and unique blend of geospatial skills and landscape ecology training, offering an interdisciplinary professional degree unlike any other in the world.

Our choice of program content reflects consultation with professionals from industry, government, consulting/private organizations and NGOs. The MGEM curriculum mixes theory and hands-on experience, including 1) an intensive landscape ecology course, 2) analytical and quantitative courses in GIS, remote sensing and image processing, spatial statistics, data analysis and programming, 3) a proof-of-concept project demonstrating how spatial analysis can be used to solve an environmental challenge, and 4) project management workshops and professional seminars.

Graduates will be able to handle large volumes of data, and seamlessly integrate spatial information in their daily work. Whether relating to local resource management concerns or global climate change assessments, MGEM graduates will be well equipped to tackle pressing environmental issues. We expect graduates will go on to work in numerous sectors, including industry, government, consulting/private, NGOs or academia.

We encourage applicants from a wide range of backgrounds - resource managers seeking new skills, computer scientists looking for new ways to apply existing skills, or recent graduates of undergraduate programs with some quantitative training – our program is designed for those with a passion for environmental management and an interest in emerging landscape ecology theories and geospatial technologies.

Applications for the August start date are due by March 30, 2017.

For further information visit <http://explore.forestry.ubc.ca/mgem/> or contact Dr Trevor Jones (program coordinator) at trevor.jones@ubc.ca.

MSFM program receives accreditation

We are proud to announce that the Society of American Foresters (SAF) has accredited our Master of Sustainable Forest Management (MSFM) program. The MSFM program is the first professional forestry program to be accredited by the SAF outside of the United States of America.

The SAF accreditation process was established 80 years ago to ensure that associate, undergraduate, and graduate forestry programs provide the highest standard of education possible. Accreditation focuses on the curriculum taught to students and uses strict criteria to rate the coursework. “The accreditation process is a voluntary process that’s in place to ensure quality so that a program incorporates and embraces continuous improvement into their program,” says Carol Redelsheimer, Director of Science and Education at SAF. The accreditation process includes peer review and feedback from current students and program graduates, along with the expertise of academics, educators, managers, and field practitioners, to identify the skills and knowledge needed by graduates as they begin their professional careers.

MSFM graduates are eligible to become Certified Foresters® with the SAF, and these credentials are highly valued by employers in the United States. This SAF accreditation complements the accreditation of the MSFM program by the Canadian Forestry Accreditation Board. A number of our graduates are now Registered Professional Foresters in BC, Alberta, and Ontario.

For further information on the MSFM program contact Deb DeLong RPF at deborah.delong@ubc.ca.

Loggers' Sports at UBC

By Marie-Eve Leclerc



Loggers' sports, something many people associate with the forestry industry, go back many decades. The sport was developed by tree fallers looking for ways to entertain themselves while based in a camp for weeks or even months at a time. Over the years, this form of entertainment has evolved into a competitive sport, and is practiced in countries such as Australia, New Zealand, parts of Europe, Canada and the United States. Loggers' sports are an important part of British Columbia's history. It is only natural that UBC's Faculty of Forestry would have a group of committed students competing at both the collegiate and professional level.

UBC Forestry students have been involved with loggers' sports for many decades. However, in the past 3 years, the club has been reinvigorated as a competitive team (the Thunderjacks) with the help of a handful of students and assistance from the Canadian Loggers' Sports Association. The team

has refurbished UBC's original loggers' sports field and has become actively involved in training. In the spring of 2015, the team participated in their first intercollegiate competition in Missoula, Montana, where they faced well-established teams from all over the States.

Following their first successful year, the club produced an enormous amount of momentum and were eager to start training in September. However, UBC Sports and Recreation had different ideas. The location of the field was rezoned for a new sports complex, a devastating blow for the club. Thankfully, Steve Mitchell, a professor from the Faculty recognized and appreciated the importance of keeping the club alive. He began talks with the UBC Farm to setup a new and permanent home. In March of 2016, the UBC Farm, Steve Mitchell, First Nation members and the Thunderjacks participated in a ceremonial blessing of the new site,

conducted by elders. The official setup process for the club's training grounds had begun.

In the interim, the team was not dispirited by the loss of their original field and had been practicing in the back corner of a construction site. In January of 2016, the club hosted their very first competition on a field outside of Forestry, welcoming 2 schools from the United States. The team also travelled to Moscow, Idaho to participate in another intercollegiate competition. Despite not having official training grounds, the club achieved successes above and beyond what was expected and placed in numerous events, proudly representing UBC.

This past year, has been a busy one for the club. With the help of many generous lumberjacks and lumberjills and countless person hours from club members, a new training ground was finally setup. This new facility at the UBC Farm includes a climbing pole and obstacle poles. The club hosted their second competition in January, with 43 competitors from 5 different schools. There was unparalleled excitement from both the crowd and competitors. The team hopes to participate in a competition in Edmonton at the end of March and in Missoula at the end of April.

The club has faced much adversity during its resurgence but has achieved a lot with very limited resources. Much of this success is due to the dedication and hard work from club members and the loggers' sports community. The club hopes to grow its membership to include students from all faculties at UBC.

For further information please contact Marie-Eve Leclerc (club president) at marie-eve.leclerc@forestry.ubc.ca or visit the UBC Logger Sports Facebook page.

Building blocks – Timber engineering education in China



Longest single span timber bridge in the world at 75.7 m Suzhou, China designed by Nanjing Technical University

Background

In early 2000, Canada identified the promotion of wood-frame housing as a key element of a market development program in the People's Republic of China. In April 2002, UBC joined a Canadian academic delegation to China to assess the educational activities in wood/timber engineering in Chinese post-secondary institutions and to evaluate collaboration opportunities that would enhance wood/timber engineering education in China.

Major findings were:

- Wood/timber engineering courses had been removed from major Chinese university curricula since the 1980s;
- There was little activity in timber/wood engineering research in China;
- Past teaching on wood/timber engineering was based on an outdated code (modeled after the 1950s USSR code);
- In comparison to concrete and steel design codes, the timber design code was inadequate for architects and engineers in the design of modern wood buildings.

In China, building construction projects require the stamp of a professional. It was apparent that the knowledge gap on structural use of wood for academia and design professionals needed to be bridged in order to kick start wood-based construction in China.

Actions

With support from Canada Wood Group, BC Forestry Innovation Investment and Natural Resources Canada, several actions were taken to address these findings. Tongji University has the highest ranked Civil Engineering program in China. Their graduates go on to become future specifiers, academics and decision makers. In 2003, UBC assisted Tongji in the set up of a formal credited course in "Modern Wood Engineering and Uses of Wood in Buildings". This new course was designed for senior undergraduate students and had 80 registrants in its first offering. The course was led by Dr Frank Lam from UBC's Department of Wood Science and was taught by 4 UBC professors.

Over the years this program has grown considerably. With enrolment now close to 400 students annually, this is perhaps the largest timber engineering course in the world. Currently,

this course is taught by 6 Tongji professors who have received training on timber engineering through exchange visits to UBC. One of these professors completed his PhD degree while at UBC. Today, UBC continues to support Tongji's program. Every March a professor from UBC travels to Tongji for a week to help with delivery of the course. This UBC involvement has also helped Tongji to raise its profile in international involvement. In 2012, this course was honoured by the Shanghai Municipal Education Commission as the "model university course taught in English".

Competing top-ranked civil engineering schools in China have aggressively sought UBC engagement with visiting scholars, R+D collaborations, lectures and seminars. Tsinghua University, ranked #1 in China, has a formal credited summer course on modern timber structures for the structural engineering students starting in 2017.

As well as structural engineering issues, education of architects on design with wood is also critical. UBC has been working with Southeast University in Nanjing for the past 5 years to deliver timber structure design studios. In 2017 the School of Architecture from Harbin Institute of Technology also joined this program.

In 2014, the Chinese Higher Education Civil Engineering Steering Committee formed a special subcommittee known as the "Timber Structures Education and Research Committee" (now under the auspices of Chinese Ministry of Education and Chinese Ministry of Housing and Urban-Rural Development) in recognition of ongoing activity in this field. This is a significant step in formally recognizing timber as a structural material in China.

Future

UBC Forestry hopes to create additional links and nodes in Chinese academic and government agencies in order to grow the discipline of timber engineering and architecture. By partnering with Chinese universities on research projects we hope that solution strategies from the West can be adapted to create "made-in-China" solutions for local conditions.

For further information, contact Dr Frank Lam at frank.lam@ubc.ca.

Indigenous agrobiodiversity and climate change

By Saori Ogura

Dawn is one of the most striking moments in the village. As the Milky Way — gwararakurumvi in the Shona language — recedes from a sky of deep navy blue, birds start to fly over the fields to espy millet and sorghum grains for breakfast. They know what to look for, and what's good for them. Suddenly, everything changes as the sun emerges from the horizon. This powerful energy, a source of life for plants, animals and people, shapes the landscape and confirms for me that I am in Zimbabwe. I lived in the Zimbabwean village of Mazvihwa from March to April 2016 while doing collaborative research with farmers on traditional plants.

Mazvihwa is located in south central Zimbabwe, a 3-hour drive from the second-largest city, Bulawayo. Although the landscapes were altered vastly during the colonial period (1890-1980), for the most part, Mazvihwa villagers were able to stay (paying special rents) on their land. In fact, the land was considered poor by White farmers, and was legally returned to Mazvihwa residents in the 1960s and 1970s. However, both ecosystems and agricultural practices have changed. In the rocky hills, lions no longer rest in caves. The huge trees that once survived in the region have been cut down. Previously,



people in Mazvihwa practiced intensive wetland cultivation in the valley bottoms and alluvial areas of major rivers. However, the 1976 Water Act and the 1975 Natural Resources (Protection) Regulations Act illegalized wetland use and farming within 30 metres of any stream or waterway. Some villages were forced to relocate from the riverside to dry land. Listening to the stories of former times, I imagined how the landscape looked 200 years ago.

As I climbed a rocky hill in Madzoke village, a remote village 2 hours walking distance from the nearest jeep road, a mountain rabbit darted past to hide in the shade of rocks. From the top of the hill I was able to see the whole village, an elliptical shape surrounded by rocky hills. A local friend pointed out 7 wetlands under rice, and bigger areas of dry fields where finger millet, bulrush millet, sorghum, cowpeas, ground nuts, round nuts, and maize were growing. While the local economy of Mazvihwa had become dependent on a maize monoculture, Madzoke is one of the villages that still cultivates varieties of traditional seeds. Although the variety of traditional grains has declined (compared to 30 years ago), grains fared better than the maize crop in the recent severe drought. My own small study was endorsed by a locally-driven NGO, the Muonde Trust, that had started to revitalize the traditional small grains as a hedge against drought and increasingly uncertain weather patterns.

The Muonde Trust (www.muonde.org), named after the indigenous fig tree, was founded on the friendships between community members of Mazvihwa and a British researcher, working together since the 1980s. The strengths of the NGO are that it is community-based and independent from large external funding. The Trust builds upon the community's own capacities, and envisions integrating traditional knowledge, indigenous innovation, quantitative research and new technologies. The Muonde Trust's work in response to the persistent drought is inspiring and encouraging. This work includes harvesting water through landscape design in the fields, re-introducing the traditional practices of rock walls, and encouraging local farmers to cultivate traditional crops. What's more, the Muonde Trust team are also great singers and

6 Rushambo



dancers, with representation from all genders and generations.

Much of my time in the villages of Mazvihwa was spent documenting the traditional crops and plants with hand-drawn illustrations. Drawing the plants helped me to discern the non-linear relationships between the people and the plants. Discovering scientific names and nutritional values is important, but so is learning the local names and how people perceive the life of the plants. I also conducted a drawing workshop in Mazvihwa aimed at rediscovering traditional landscapes and plants. Compared to photographs, drawing specifically captures what's important to the community.

In line with the vision of the Muonde Trust, my academic areas of interest are food security, traditional ecological knowledge (TEK), and climate change adaptation. I aim to develop sustainable solutions with Indigenous communities to mitigate economic risks and to adapt to environmental and climate change in multiple geographic areas. By studying traditional land use strategies and plant use, and co-creating a model that integrates TEK with modern technology, I hope to assist in improving resource self-sufficiency of Indigenous communities.

Previous experiences in India helped me to prepare for my Zimbabwe research and for my forthcoming PhD research at UBC under the supervision of Dr Janette Bulkan. In 2011-2012, I lived in Lepcha Indigenous villages of India's Sikkim Himalayas. Here, I examined traditional society's relationships with the natural environment, and how contact with the global economic system had triggered the loss of age-old (and quickly disappearing) Indigenous livelihood strategies. I used semi-structured key-informant interviews in Nepali, English and Lepcha languages, participatory observation, and focus group

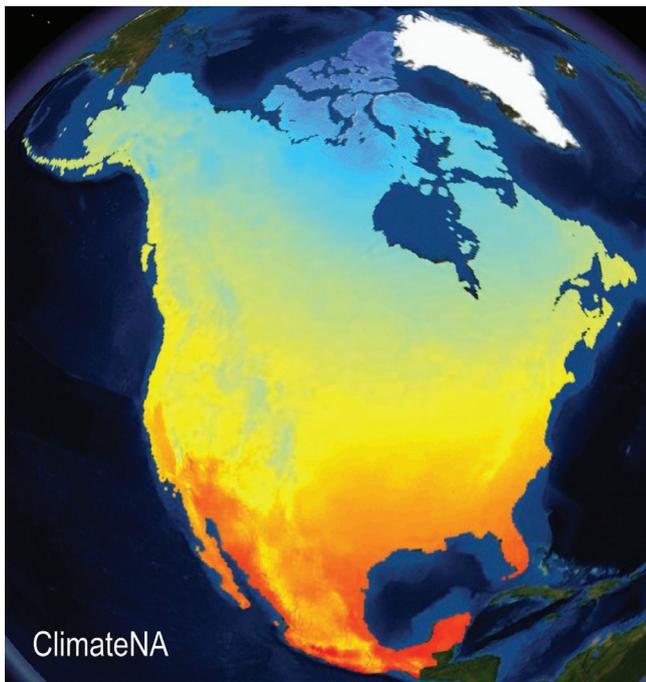
discussions to study land use change in the villages over the previous 100 years. Through this work, I gained an understanding of the issues resulting from dependence on a monocultural cash crop. The local economy had been devastated by a plant disease that decreased cash crop production in the early 2000s. Through my ethnobotany work, I found that varieties of traditional crops in this region were decreasing both in numbers and in areas cultivated. I became convinced that maintaining crop diversity is one of the key ways to mitigate the risk of loss to plant diseases and losses related to the fluctuations of global economic systems. A similar phenomenon was evident in Mazvihwa, Zimbabwe, where I came to understand how declining diversity is impacting not only the local economy, but also the health, culture and identity of local people.

My interdisciplinary studies at UBC will advance the work I began in my Master's thesis at UC Berkeley, in which I merged ethnobotany, ethnography and GIS methods to analyze land use changes. Using the skills I have gained, I will conduct my doctoral research in Zimbabwe, in collaboration with the Muonde Trust. This research will build on my earlier work on drought-tolerant traditional crops. Working with the Muonde Trust, I will develop strategies for revitalizing the traditional crops that can be reintegrated into local communities' food systems and the local economy. I also plan to include a research site in Polynesia, where I will use a traditional plant, such as breadfruit, to create a route map for transitioning from monocultural agricultural systems to agrobiodiversity systems. By isolating common traits in the outcomes from the 3 geographical areas, and developing a farming model that is widely transferable, I hope to contribute to global sustainable agriculture and food security.

For further information please contact Saori Ogura at saoriogura16@gmail.com or Dr Janette Bulkan at janette.bulkan@ubc.ca.



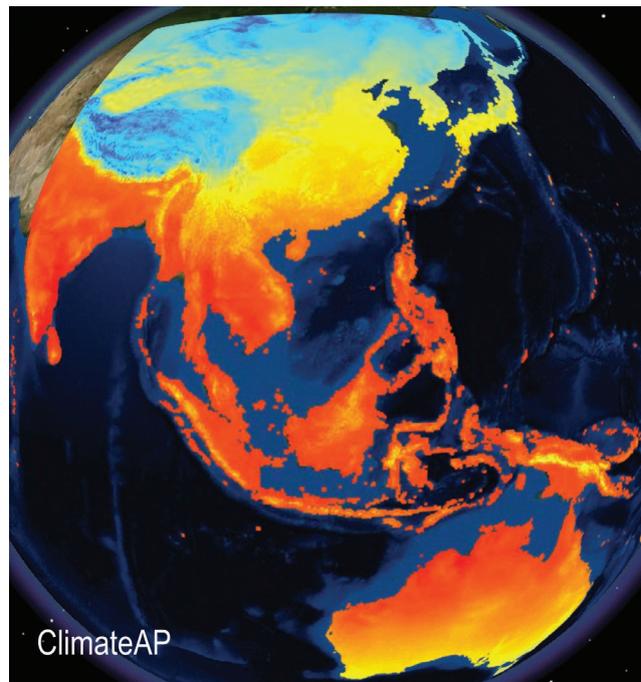
Cool tools for forest adaptation to a warming climate



Climate change is one of the more serious threats that we are facing on Earth. Seasons are shifting, temperatures are climbing and sea levels are rising around the world. People have never been so reliant on forests to mitigate climate change, and the COP21 in Paris last year put forests under a spotlight for this reason. However, forests and forest ecosystems themselves are also threatened by climate change. Scientists, policy makers and stakeholders are facing new challenges to ensure forests and forest ecosystems will be healthy, productive and effective in carbon sequestration under a rapidly changing climate. The following tools developed at the Centre for Forest Conservation Genetics at the Department of Forest and Conservation Sciences, are playing important roles in facilitating climate change research and developing adaptive forest management strategies at local and global scales to combat climate change.

Scale-free climate models

High-quality climate data are essential to conducting climate-related studies. Although a large volume of climate data have become available in recent years, these datasets are in grid format at various spatial resolutions. Extracting climate data for specific locations from large datasets is not a simple task and the climate data obtained are not location-specific. ClimateBC is a climate model that extracts and downscales gridded climate data to scale-free climate data for specific point locations. The tool also integrates paleo, historical and future climate data into a single package, and generates a large



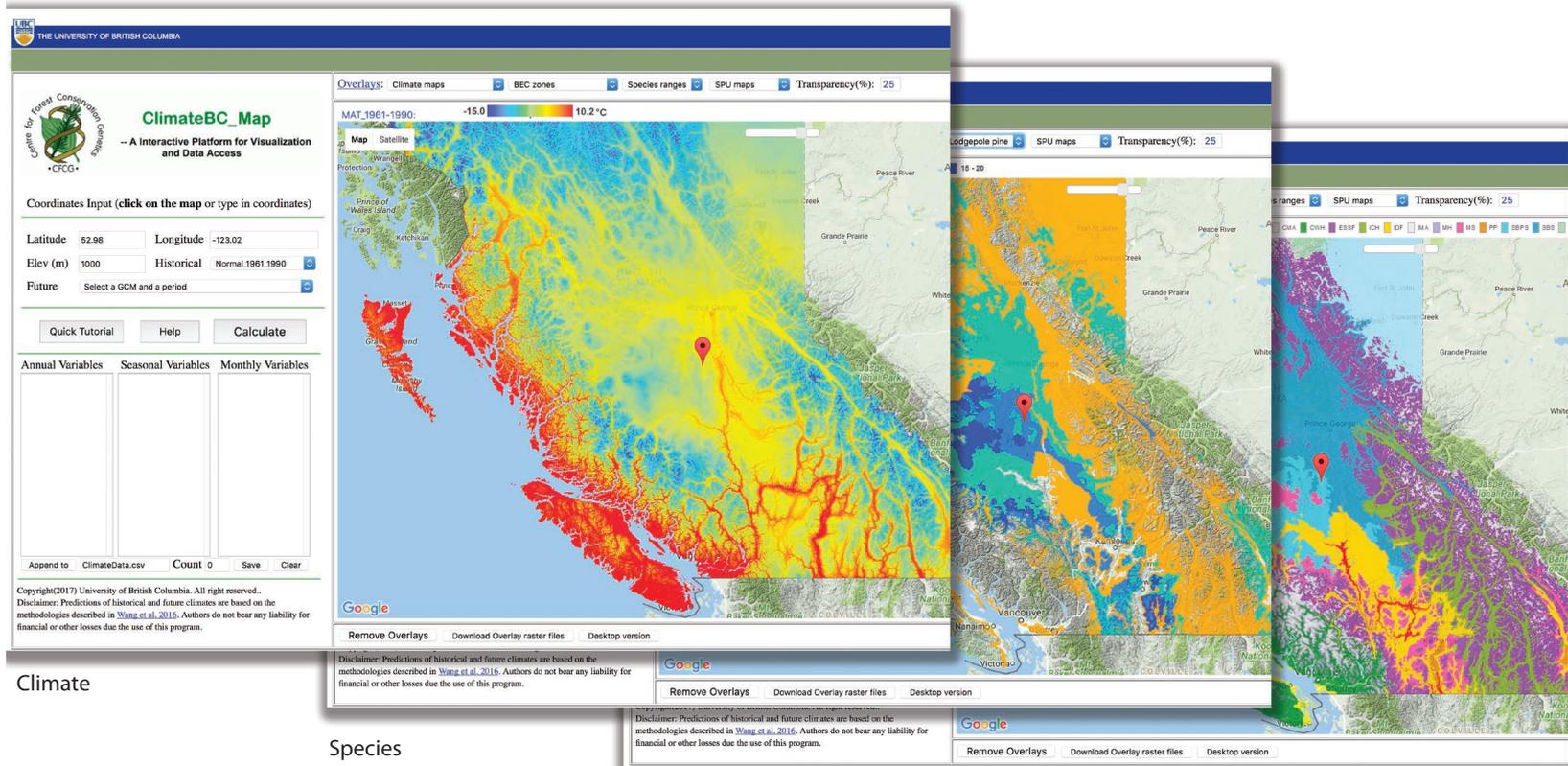
number of biologically relevant climate variables. ClimateBC also includes a time-series function that allows users to generate climate data for multiple years for historical or future time periods in a single run. It can save users a tremendous amount of time.

This climate model has now been expanded from BC to western North America (ClimateWNA) and entire North America (ClimateNA), as well as the Asia-Pacific (ClimateAP). These models have served as essential tools to generate location-specific or high-resolution spatial climate data for climate change related studies in forestry, hydrology, meteorology and other fields. They are available at <https://goo.gl/qV1r9A> for ClimateBC/WNA/NA and <https://goo.gl/2mr9gw> for ClimateAP.

High-accuracy climate niche models

Forest trees are genetically adapted to a range of climate conditions, referred to as their climate niche or bioclimatic envelope. Due to the long lifecycle and slow rate of migration of forest trees, a rapidly changing climate will likely result in a mismatch between the climate that trees are historically adapted to and the climate that trees will experience in the future. Such a mismatch may lead to maladaptation, which can compromise productivity and increase vulnerability of forest ecosystems. Climate niche models are required to tackle these problems.

We have developed climate niche models for the Biogeoclimatic Ecosystem Classification (BEC) system and projected their shifts under future climates. Since the BEC system



Climate

Species

Ecotypes

serves as a fundamental framework for forest resources management in BC, these projections have been used to develop stocking standards and regional forest adaptation plans by the BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO). We have also developed climate niche models for 42 native forest species in BC and projected their future distributions. These projections have been used by MFLNRO in developing the climate-based seed-transfer system.

Our climate niche models are highly accurate because they have gone through a series of optimization processes, which not only improved the accuracy of the predictions, but also showed their ability to predict the growth potential of forest tree species within their climate niches. In addition, future climate projections are based on the consensus of a large number of climate change scenarios.

Extending the BEC system

Ecosystem classification, such as the BEC system in BC, is effective for developing adaptive natural resource management strategies. However, such a system is not available elsewhere. In order to place BC ecosystems into the context of western North America, it is desirable to develop BEC-equivalent ecosystem classifications for Alberta and neighboring states in the USA. In collaboration with ecologists at the MFLNRO (for plot data collection and ecotype designation), we have developed a machine-learning based procedure that has successfully extended the BEC system into western North America. Our next step is to model and predict the extended BEC systems for future climates. This machine-learning approach has the potential to be of use in development of ecosystem classifications elsewhere.

Universal response functions

A climate niche model defines the range of suitable climate conditions at a species level. However, among-population variation in the adaptation and productivity of a species is substantial. Provenance trials have been used to develop

population geneecology functions and climate response functions to determine the variation among populations and their responses to climate. Due to the limited number of test sites and populations tested, such functions are often difficult to develop and have low accuracy. We have developed a methodology for generating anchor points that can reduce this limitation. We have improved the methodology further by integrating environmental (test site) and genetic (seed source) effects of climate into a single model, called the “universal response function” to predict the performance of a population from any seed source planted at any site. This new approach can make the best use of the provenance trials and improve the model accuracy. It can also allow the genetic and environmental effects to be quantified. This approach has recently been used by researchers working with lodgepole pine, Douglas-fir, white pine and black spruce.

Google-map based web platforms

In order to effectively deliver information to end users, we have developed a web-based platform that integrates ClimateBC, climate surfaces, biogeoclimatic ecosystem classifications and species distributions into the Google Maps framework. It allows users to visualize the spatial patterns of climate variables, ecosystems and species distributions in BC through an internet browser. It also allows users to download the spatial data to their own computers. Users can obtain all the climate variables for a location of interest simply by clicking at the location on the Google Map. This tool has attracted a large volume of visits (up to 2000 hits/day). The tool can be accessed at www.climatewna.com/ClimateBC_Map.aspx. Our next step is to extend this platform from BC to western North America, so that the maps for extended BEC system and complete species distributions can be overlaid on the Google Maps.

For further information contact Dr Tongli Wang, Department of Forest and Conservation Sciences, at tongli.wang@ubc.ca.

From forests-to-flight: Decarbonizing aviation



The International Panel on Climate Change has postulated that, if left unchecked, we will likely see a 3.7 to 4.8°C increase in the Earth's surface temperature by the end of the century. This temperature increase is likely to result in very disruptive and expensive events, such as rising sea-levels and extreme storms. Growing more trees, capturing CO₂ and finding alternative, renewable sources of energy are all ways to help mitigate this temperature rise. Although automobiles and other light transport vehicles have the potential to be powered by electricity derived from renewable sources such as wind and solar, some types of transport, such as long distance trucking, maritime and airplanes will need a more energy-dense biofuel.

Traditional biofuels such as ethanol and biodiesel cannot be used to power airplanes due to their low energy density and their tendency to freeze at low temperatures (-30°C or lower). In the short term, most commercial biojet fuels will likely come from oleochemical feedstocks, such as tallow, used cooking and palm oils. However, in the mid-to-long term, cellulosic feedstocks will likely supersede these lipids/fats as the main source of biojet fuel because they are not in direct competition with

food, are in large supply, and will likely be less expensive.

The Forest Products Biotechnology/Bioenergy (FPB/B) group at UBC has been fortunate to receive support from companies such as Boeing, Bombardier, Air Canada, West Jet and NORAM and from the funding agencies Green Aviation Research and Development Network, NSERC, International Energy Agency (IEA) and BiofuelNet to assess the potential of producing biojet fuel from forest residues. Working with NORAM, the FPB/B group is coordinating the efforts of a number of companies, researchers and partners to determine whether a biojet production facility could be commercialized in British Columbia using local forest residues.

Dr Susan van Dyk, coordinator for the project, is researching technologies and policies that will be required to get biojet fuels into the marketplace. As fossil-derived jet fuel is likely to be much cheaper to produce for quite some time into the future, effective policies will be required for all aspects of biojet fuel development, from encouraging production of feedstocks through to the production and use of the biojet fuel itself.

Two graduate students, Anna

Ringsred and Fraser Larock, are also working on this project. Anna Ringsred has been looking at the overall lifecycle analysis benefits of making and using biojet fuel, while Fraser has been assessing the adaptability of certification schemes to ensure the sustainability of the forest biomass feedstock.

Lifecycle analysis

Anna Ringsred, originally from the USA and a former member of the USA Olympic speed skating team (Sochi), has a BSc in Chemical Engineering from the University of Calgary. Her previous experience in the biofuel and energy industry attracted her to the FPB/B group and this project in particular. Anna has been looking into the greenhouse gas (GHG) reduction potential of the various technologies considered by the project. Anna's main research objectives are to determine which technologies and feedstocks offer the greatest GHG reductions and the GHG emission potential of a possible BC based commercial biojet facility.

In order to do this, Anna will be using Lifecycle Analysis (LCA) - a methodology used in many sectors to assess emissions and environmental impacts of a product or service. LCA models calculate the emissions generated over the entire lifecycle of a product, from

feedstock cultivation through production and final use of the product. LCA is commonly used by many of the world's industries, such as the ATHENA model used by the building industry. However, when it comes to biofuel legislation, such as the Renewable Fuel Standard in the USA or the Low Carbon Renewable Fuel Standard in British Columbia, lifecycle analysis is primarily employed by the government to determine the contribution that a potential biofuel has to reduce emissions and help the province reach its GHG reduction targets.

Though it depends on many parameters, Anna's work has found that biojet fuel made from sawmill residues has significant potential to reduce GHG emissions. Forest trimmings that are generally left on site to decompose or burn also show significant potential, especially in fire-prone areas. The GHG emissions from biojet fuel produced from these pathways are substantially lower than petroleum fuel, reducing emissions by up to 85%. This is much more than current biofuels such as corn ethanol, which generally only reduce automobile emissions by around 35%. However, it should be noted that emission values are very location dependent, as they incorporate the regions' cultivation practices, soil type, and electricity mix. Thus, it will be important to determine whether these same emission reductions can be expected for a facility utilizing BC feedstock.

Forest certification and biojet fuels

Fraser Larock, another FPB/B group graduate student, is working on the ATM/IEA biojet project. After graduating with his Forestry Operations degree from UBC, Fraser is using his forestry experience to help decarbonize the aviation sector by assessing whether current third-party forest certification practices can be adapted to help ensure the sustainability of the bioenergy and biofuels industries.

Many of the Scandinavian and Canadian forest based companies, including lumber and pulp and paper companies, use third-party certifications to verify sustainability of their forest management practices. Groups such as the Forest Stewardship Council, Canadian Standards Association and the Sustainable Forestry Initiative have arisen because buyers of forest products (Staples, Rona, newspapers, etc) can assure their customers that their products have been sustainably sourced and produced. In much the same way that auditing companies, such as PriceWaterHouseCoopers, ensure the financial sustainability of companies, third-party certification groups ensure the sustainability of forest-based businesses.

However, most of today's current certification schemes do not consider the potential benefit of utilizing some of the forest residues currently left to decompose or burn. This sustainably produced biomass can be used to

produce biochemicals, biomaterial and biofuels such as biojet fuel. Thus, one aspect of Fraser's research is assessing how current sustainable forest certification schemes might be adapted to include forest residues as a possible feedstock for future bioproducts such as biojet-fuel. Other groups, such as the Sustainable Biomass Partnership and the Roundtable on Sustainable Biomaterials, are also trying to ensure the sustainability of their products in the bioenergy area. BC is a major exporter of pellets (mostly sawmill residue) and the global wood pellet demand rose to approximately ~25 MT per year in 2014. European power companies such as Drax are expected to continue to drive the demand for increasing the amount of sustainably derived biomass to fuel their power stations. Fraser's work will consider the potential of modifying or adapting the certification schemes already in BC's forests and assessing the economic and logistical challenges of using the considerable amount of forest residues available in BC.

Rather than it being a flight-of-fancy, the biomass-to-biojet project offers one way of decarbonizing the aviation sector.

For more information, please contact Anna Ringsred (anna.ringsred@ubc.ca), Fraser Larock (fraserlarock@gmail.com), Susan van Dyk (svandyk100@gmail.com) or Jack Saddler (jack.saddler@ubc.ca).

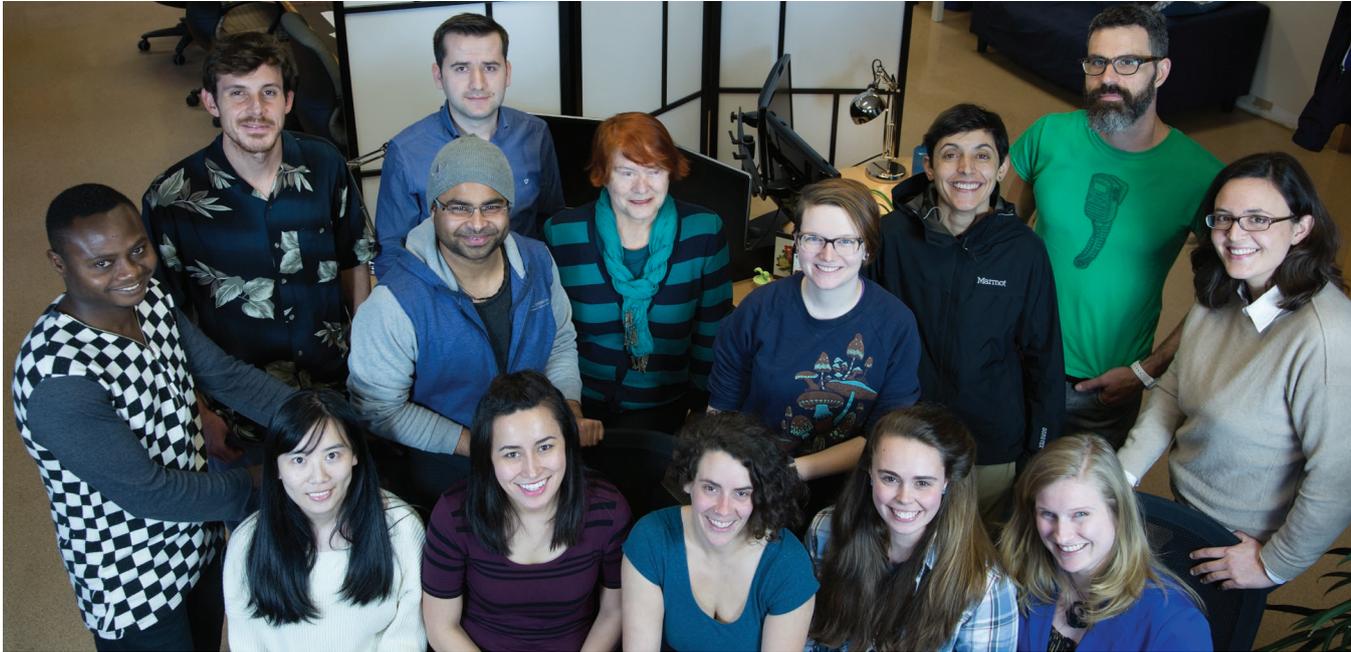


research lab profiles



FRESH

The Forest Resources and
Environmental Services Hub



The Forest Resources and Environmental Services Hub (FRESH) is housed in the Faculty of Forestry at the University of British Columbia and is led by Dr Verena C Griess from the Department of Forest Resources Management.

Members of the group are involved in the development, enhancement and application of highly sophisticated computer-based decision support systems (DSS) for forest management planning, including ecological, economic and social considerations. Computer-based decision support systems help with understanding outcomes of possible management approaches and allow modelling future development of indicators, such as area of old growth forest, habitat or timber production under uncertainty. To this end, work in the FRESH lab includes assessment of state-of-the-art inventory methods for use with DSS and the development of interfaces between data sources and forest management

planning software and tools. Activities in FRESH are not limited to lab work, but include hands on field trials aimed at researching best forest management practices.

Who works in FRESH?

Researchers in FRESH embrace complexity and diversity as one of their major strengths. They are contributing solutions to a variety of questions related to the use of forests for human well-being from local to national and regional to global levels. The group is comprised of graduate students, post-doctoral researchers, research associates and visiting scholars.

Oluwasina Akinlemibola (visiting research student) is working on the assessment of climate change impacts and their management and mitigation. The goal of his work is to assess successful practices applied in developed countries, such as Canada, for their applicability in developing countries.

Thais Lima Almeida (PhD student) is studying the spatial and temporal

patterns of land-use changes in a rural settlement of the Brazilian Amazon, focusing on understanding the impact and scope of selective logging activities. [@talmlima](#)

Kathleen Coupland (PhD student) is examining how changes in the forestry learning environment are impacting changes in forestry curricula and student learning. By enhancing the understanding of how urbanization impacts post-secondary forestry education she will develop approaches to account for these long-term changes in curricula.

Amber Hansen (MSc student) is working with the Tr'ondëk Hwëch'in, a First Nations community in the Yukon, on the development of a sustainable forest management plan for the communities' traditional territory with an emphasis on job creation and timber supply. The focus of her work is on the development of criteria and indicators suitable for best representing community goals and values in management plans.

Joris Jun (MSc student) holds a BSc in forest resources management from UBC. At FRESH she is researching Chinese consumers' perception of Canadian Aboriginal value-added wood products. She is also involved with the UBC branch of the APFNet (Asia-Pacific Network for sustainable forest management and rehabilitation).

Emina Krcmar (research associate) models decision processes under conflicting objectives and uncertainty. She has worked in quantitative decision-making, statistics and mathematics. At FRESH she is developing a DSS for the management and mitigation of Forest Invasive Alien Species (FIAS) under climate change in Canada.

Marie-Eve Leclerc (MSc student) is analysing the effects of various thinning intensities on natural regeneration and growth in mixed stands of birch and western redcedar. Her work is based on a long term trial in BC. Previously, Marie-Eve has worked on the development of a spatially explicit dataset for the evaluation of forest management alternatives in the Great Bear Rainforest. See also Marie-Eve's article on page 8.

Seraphine Munroe (MSc student) is a Dakelh and Sto:lo Aboriginal researching the efficacy of collaborative projects on Indigenous forest management planning and their implementation processes. Her work focuses on assessing the impact of various factors such as governance, traditional groups, and treaty on planning processes and outcomes.

Gregory Paradis (post-doctoral fellow) is designing models to evaluate and recommend potential climate change mitigation portfolios to reduce greenhouse gas emissions and increase sinks through forest management, forest conservation and the use of harvested wood.

João Gabriel Raphaelli (visiting research student) is assessing the initial development and performance of tree seedlings in various agroforestry systems, based on environmental properties as well as management in Brazil's Central Amazon region.

Enes Satir (MSc student) is working on the development of a spatially explicit forest database for Turkey. He will use this database, together with carbon budget modelling software, to assess the impact of various forest management approaches on the potential for carbon sequestration.

Devyani Singh (PhD candidate) is collaborating with NGOs, village communities, and forest officials in India, to study the impacts of improved cooking stoves on forests with the goal of providing solutions for the use of carbon credits for improved stoves. [@Kumari_Devyani](#)

Jillian Spies (MSc student) is collaborating with 4 First Nations communities in the Williams Lake area to develop key indicators for the inclusion of First Nations heritage values into forest management planning software at the landscape level. She is using software such as Woodstock and FPS Atlas.

Vivek Srivastava (PhD student) is developing current and future risk and distribution maps of Forest invasive Alien Species (FIAS) under climate change scenarios using spatial distribution models. His maps are integrated into a decision support system that assists decision makers on choosing economically viable mitigation strategies for FIAS.

Who funds the work of the FRESH group?

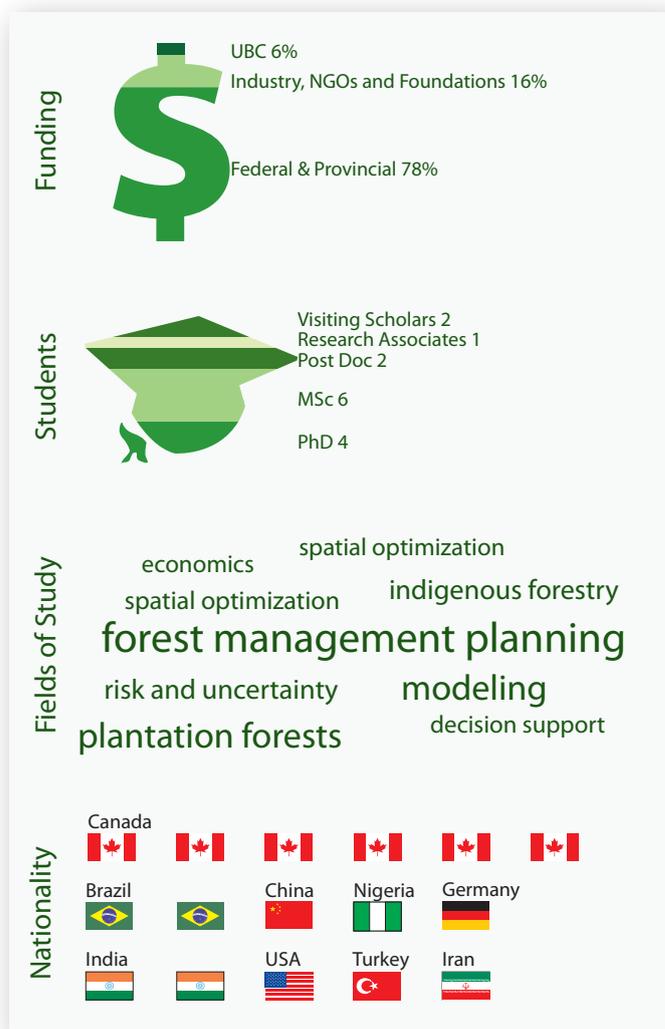
The work and research in FRESH is funded mainly from federal sources, including the Natural Sciences and Engineering Research Council of Canada, the Social Sciences and Humanities Research Council, Genome Canada's Large Scale Applied Research Projects component in Genomics and its Ethical, Environmental, Economic, Legal, and Social Aspects. Co-funding between Mitacs (a non-profit, national research organization) and industry partners, as well as internal UBC research funds, such as the Hampton fund are other sources of funding.

The outstanding scholarly work and high calibre of young talent in this lab are reflected in a high number of scholarships and awards, including fellowships from the International Tropical Timber Organization, the William John Splan Scholarship in Forestry, the Mary and David Macaree Fellowship, the Emerging Leaders in the Americas Scholarships, the J Harry G Smith Award in Forest Resources Management, the Native Indian Brotherhood Award, the Irving K Barber Award for Indigenous Research, as well as grants from the highly prestigious Public Scholars Initiative by UBC's Faculty of Graduate and Postdoctoral Studies.

How can you contact FRESH?

You can visit FRESH online at <http://fresh.forestry.ubc.ca/> or follow FRESH on twitter [@FRESH_UBC](#).

For further information about the FRESH group or their research, contact Dr Verena Griess at verena.griess@ubc.ca.



Assessing forest structure from above

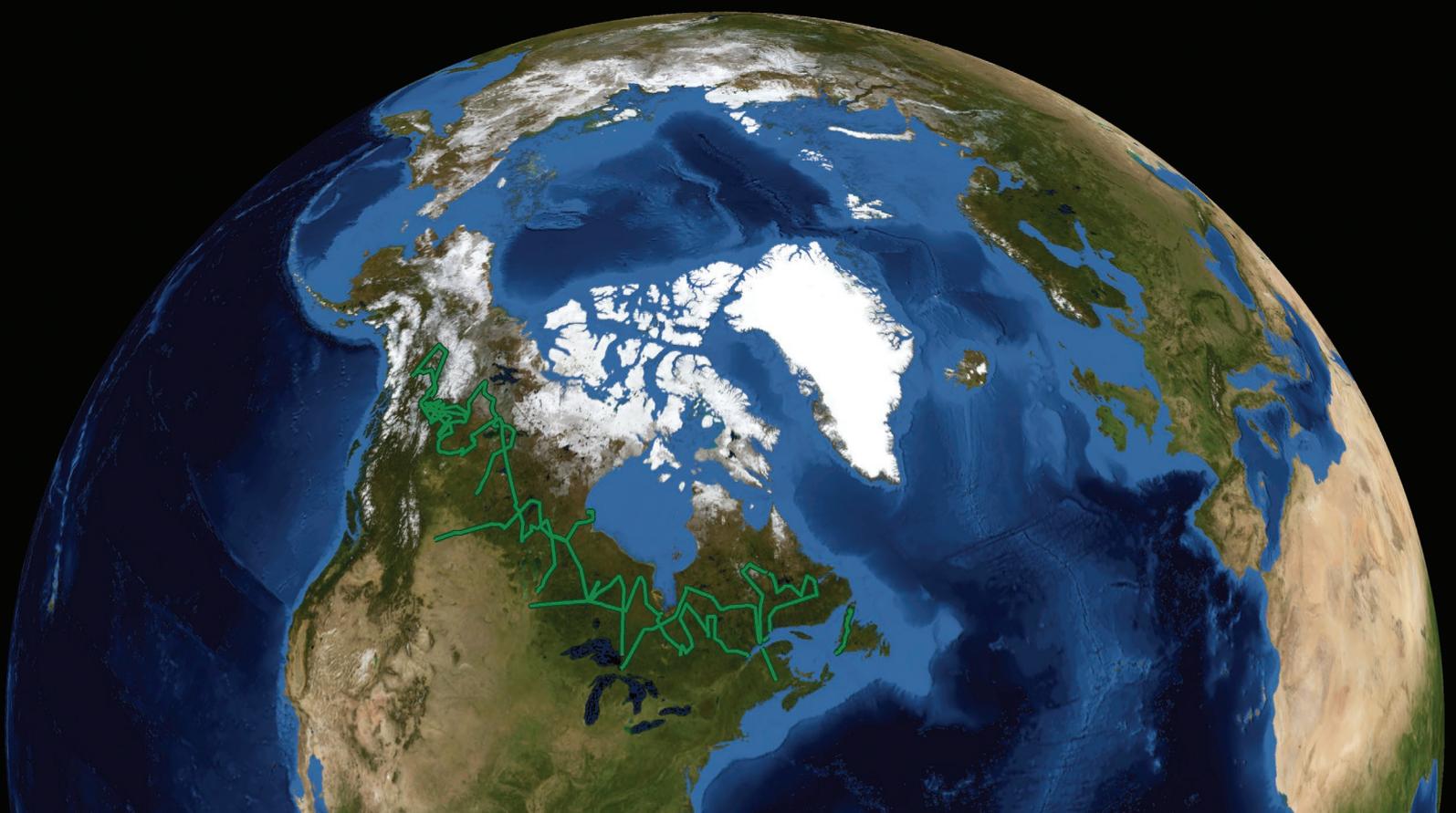
Forests play a critical role in the global carbon cycle by regulating exchanges of carbon between the atmosphere and the terrestrial biosphere. While carbon sequestration is a vital ecosystem service provided by forests, the future of forest carbon dynamics remains uncertain in the face of a changing climate. Specifically, changes in forest productivity, disturbance regimes, and continued land conversion are expected to alter rates of carbon sequestration and carbon storage in the world's forests. In order to understand potential feedbacks between forests and global climate, a better understanding of current carbon storage in the world's forests, and how carbon storage varies both spatially and temporally, is required. Due to the vast extent and remoteness of many of the world's forests, in particular Canada's northern boreal forests, quantifying the distribution of carbon storage in forests and how it is changing is difficult with field measurements alone.

In the past 2 decades, Light Detection and Ranging (LiDAR) has emerged as a remote sensing technology capable of measuring the 3-dimensional structure of forests, providing a potential means to measure and monitor forest structure and carbon storage over large forested areas. LiDAR systems, typically flown on airplanes, emit pulses of laser energy and record the timing of pulse returns to accurately locate objects in 3

dimensional space. By emitting millions of these laser pulses over forest canopies, LiDAR systems can provide a detailed look at the structure of forests from which information on canopy height, canopy density, and other 3 dimensional characteristics can be derived.

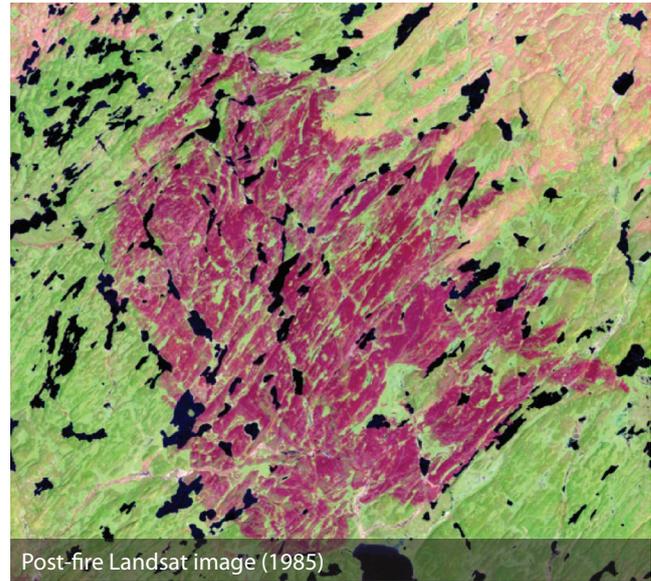
Recently, PhD graduate Douglas Bolton, along with supervisor Nicholas Coops, used LiDAR data to investigate how structure varies both spatially and temporally across Canada's northern boreal forests. Douglas used transects of LiDAR data collected by the Canadian Forest Service in 2010, which spanned 25,000 km from the Yukon in the west to Newfoundland in the east. This massive LiDAR dataset provides an unparalleled look at how structure varies spatially across Canada's northern boreal forests. As inventory data is scarce across Canada's northern boreal, these structural measurements from LiDAR are particularly important for informing on the state of Canada's northern forests.

While this LiDAR dataset offered a detailed look at the structure of boreal forests, it was limited to a single snapshot in time. Understanding how forest structure varies through time was not feasible with this dataset alone. To incorporate the dynamic nature of forests, Douglas used Landsat satellite imagery from 1984 to 2010 to identify the timing and location

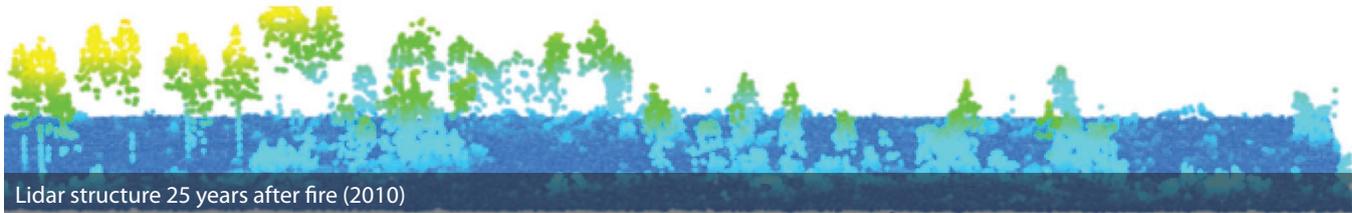




Pre-fire Landsat image (1984)



Post-fire Landsat image (1985)



Lidar structure 25 years after fire (2010)

Example of the detection of fire events, and the assessment of forest structure following these events. Using Landsat imagery, a fire is detected in 1985. With LiDAR data collected in 2010, structure and vegetation regrowth can be assessed 25 years following this fire

of fire events across the boreal, as fire is a key driver of forest structure and carbon dynamics in unmanaged boreal forests. Douglas detected fires by identifying large, discrete changes in the reflectance properties of forests in between consecutive Landsat images. By having multiple images in each year between 1984 and 2010, the precise timing of each fire could be determined. By combining this information on fire history with the LiDAR structural 'snapshot', Douglas was able to assess the impacts of fire on forest structure and investigate rates of forest regeneration following fire.

Through this data fusion approach, Douglas was able to demonstrate the slow growing nature of northern boreal forests, as tree cover remained sparse in many forest stands even after 25 years following fire. Additionally, Douglas was able to demonstrate the vast differences in forest regeneration that occur across the boreal, as more productive southern forests were able to regenerate and sequester carbon much faster than in the northern boreal, where long, harsh winters restrict growth to only several months in the summer. In addition to identifying regional differences in forest regeneration, Douglas also demonstrated that forest regeneration can vary locally across a landscape due to differences in pre-disturbance forest conditions. Specifically, stands that were more densely vegetated prior to burning, according to satellite imagery, showed faster growth and recovery compared to stands that were less densely vegetated prior to burning. This was an important finding, as this suggested that a satellite image prior to a disturbance event can help establish expectations for growth and carbon sequestration in the years following the disturbance.

Along with assessing vegetation regrowth, Douglas was able to detect the presence of standing dead wood and surviv-

ing trees in the immediate years after fire using LiDAR. These measurements of post-fire structure can provide important insights to land managers on how to emulate fires on their landbase through harvesting practices.

Across the Canadian boreal, roughly 60% of forests are unmanaged. Without sufficient field measurements, Canada's unmanaged boreal remains a source of uncertainty in both national and global efforts to characterize forest carbon budgets. Douglas' PhD research highlights the valuable role that LiDAR can play in reducing uncertainties in carbon budgets in these expansive forested areas, and demonstrates the ability of LiDAR to characterize both local and regional variability in forest structure. Additionally, Douglas's work introduces innovative approaches for assessing forest structure with remotely sensed data which can improve on-going and future efforts to monitor carbon storage in forests, both in Canada and internationally.

This research was conducted by Douglas Bolton (Post-Doctoral Research Fellow and former PhD student in the Department of Forest Resources Management), along with co-authors Dr Nicholas Coops (Forest Resources Management), and D Michael Wulder (Canadian Forest Service). The study was funded by the Canadian Space Agency, Government Related Initiatives Program, and the Canadian Forest Service in addition to an NSERC Discovery grant to Dr Nicholas Coops and a graduate scholarship to Douglas Bolton. The authors wish to thank Dr Chris Hopkinson for his survey planning and data collection efforts and Christopher Bater for his work in developing the LiDAR dataset used in this study. For more information on this research, please contact Douglas Bolton at douglas.bolton@ubc.ca or Dr Nicholas Coops at nicholas.coops@ubc.ca.

Pond ecosystems in the era of environmental changes



Small wetlands and ponds are unique ecosystems that provide essential ecosystem services such as habitat for species diversity, carbon sinks and nutrient storage. They also provide floodwater mitigation, water pollution control, food and income generation for local people, and grazing areas for livestock during the dry season. However, projected climatic changes are posing risks to these important ecosystems throughout the world. In Canada, and particularly British Columbia, reports have warned of changes in climate patterns in the coming decades. Summer months are expected to be hotter and drier and more rainfall is expected during fall and winter seasons. These anticipated climatic changes could severely impact wetlands by altering their physical, chemical, and biological components both independently and in concert with other anthropogenic stressors (eg urbanization and agricultural expansion). Examples of independent effects of climatic change on ponds include: changes in plant and animal phenology, composition, abundance, and diversity; increased salinity resulting from higher temperatures and evaporation rates; and loss of wetland areas during drought or flooding events due to sedimentation.

Detailed understanding of the effects of environmental changes on biodiversity, or specific ecosystem processes, at the pond level is limited. For example, it is not clear whether an increase in temperature, alone or in conjunction with a reduction in precipitation, will affect composition and diversity of pond organisms. What are the subsequent effects on important ecological processes such as primary production and leaf litter decomposition? How will sedimentation from flooding events and erosion influence these ecosystems and their biota? What is the magnitude of increase in a pond's salinity given the occurrence of warming and drought scenarios concentrating solutes in the water?

Dr Ahmed Siddig recently completed a post-doctoral fellowship with Dr John Richardson in the Department of Forest and Conservation Sciences at UBC. Ahmed joined Richardson's Stream and Riparian Ecology Research Lab through a fellowship from the German Academic Exchange Service. He developed an experimental study to predict and demonstrate the ecological responses of pond ecosystems to anticipated climate changes in British Columbia using a suite of experimental manipulations. Ahmed hypothesized that climatic changes

influence pond ecosystems and their associated biological communities through at least 2 pathways. Impacts may be from warming, drought or sedimentation effects. Impacts may also be mediated by pond salinization as a result of increased evaporation due to increased temperature and frequent drought events. Ahmed's experiments, using cattle drinking tanks as experimental units, simulated and applied 3 potential scenarios related to climate change. These treatments included: drying to mimic drought events; sedimentation to represent sediment accumulation from flooding; and water salinization to mimic increased evaporation.

Ahmed measured ecosystem-wide processes such as primary productivity and leaf litter decomposition as indicators of ecosystem health. He also estimated biomass, composition and abundance of invertebrates and zooplankton communities and measured the biomass of algae and phytoplankton. From preliminary results, he noticed that ecosystem productivity and decomposition rate were reduced by his treatments and likewise the biomass of algae and zooplankton. Further analyses will be carried out soon.

Ahmed's experiments will help to provide an understanding of the responses of wetland ecosystems to simulated drought, sedimentation and water salinization as potential scenarios for climate change. This study is interesting not only for its focus on these unique ecosystems, but also for its focus on important ecological questions about pond ecosystem health and dynamics under a changing climate. Eventually, he hopes that these findings will lead to a better understanding of these vital ecosystems and help to inform adaption and mitigation efforts.

For more information about this project please contact Dr Ahmed Siddig at asiddig@mail.ubc.ca or Dr John Richardson at john.richardson@ubc.ca.

development & alumni news

An enduring legacy supports forestry students



The Kapoor Sawmill at Barnet

A decision made 50 years ago, to honour someone born over 100 years ago, continues to make an enormous difference in the lives of Forestry students today. The Kapoor Singh Siddoo Foundation (KSSF) has supported 87 students through scholarships, and Emily Dorey and Victoria Diederichs are 2 of the happy recipients.

Emily is a student in the Natural Resources Conservation program. She is blunt about the difference the Kapoor Singh Siddoo Scholarship has meant for her. "I get to eat," she says. "That may sound extreme but right now my student loans, part-time job and savings barely cover my fixed expenses. Without the scholarship I would have had to take out additional loans in order to buy groceries. The scholarship also reminds me that working hard to achieve a high GPA can help me to be a more independent individual."

Victoria is in her third year of Forest Resources Management, working towards a career as a Professional Forester. She received the Kapoor Singh Siddoo Scholarship in Forest Ecology in 2016. "I am so grateful for the opportunities that I've been given not only to make the most of my education, but also to broaden my horizons in many

other aspects of my life," she says.

The story behind the Kapoor Singh Siddoo Foundation scholarships goes back 100 years to 1906, when Kapoor Singh Siddoo left his job and family in India and moved to San Francisco as part of the first wave of South Asian immigrants to North America.

Within a few short years of his arrival, immigration restrictions and widespread racism had narrowed his job prospects to 2 alternatives: farming in California or the lumber industry in British Columbia. Choosing the latter, Kapoor partnered with Mayo Singh to establish a lumber business, which endured despite the Great Depression, prejudice and discrimination.

Eventually Kapoor's wife Besant Kaur was able to join him in Canada, and over the next few years they had daughters Jagdis and Sarjit. Following the dissolution of his partnership with Mayo Singh, Kapoor sent for his brother Tara from India and started his own lumber business. With a forest near Sooke Lake on Vancouver Island and a sawmill in what is now Barnet Marine Park in Port Moody, the Kapoor Lumber Company grew and thrived.

In 1959 Kapoor retired at the age of 74, and he died 5 years later. In 1967

Besant, Jagdis and Sarjit established the Kapoor Singh Siddoo Foundation in his memory. The Foundation's donations are divided equally between India and Canada, reflecting his view that he was a citizen of both countries.

Carey Siddoo is the General Manager of the Kapoor Group of Companies, and a director of the Foundation. Tara Singh Siddoo is his grandfather, and Kapoor is his great-uncle. Dr Jagdis K Siddoo, her husband Donney, and Dr Chanda Siddoo-Atwal (Dr Sarjit Siddoo's daughter) are also directors of the Foundation.

"To this day funding from the family and revenue from Kapoor Lumber helps sustain the Foundation and its giving. We operate our forest sustainably, with an annual cut volume that will allow for continuous logging for the next 2 decades," Carey says.

The Foundation supports University scholarships including the UBC Faculty of Medicine, and to date has supported at least 34 students there. A new KSSF Endowment Fund was established in the Faculty of Medicine in 2012 and will be fully funded in the years to come, thereby enshrining Kapoor's legacy for the benefit for future medical students.

Carey is pleased to be one of the stewards of his great-uncle's legacy. "Kapoor came here looking for the North American dream, and it was completely fulfilled. Then he had the foresight and generosity to give back," he says.

Your gift to the Faculty of Forestry can have an enduring impact on the lives of students, decades into the future. To find out more about establishing a student award, please contact Sarah Doran-Coelho at 604.822.0898 or sarah.dorancoelho@ubc.ca.

Research Forest graduate internships: A win-win experience

By Gregory A Greene and Cathy Koot



Since 2011, the UBC Alex Fraser and Malcolm Knapp Research Forests have been able to host graduate internships, thanks to generous donor support. The intent of these internships is to foster reciprocal exchange of knowledge and skills. The Research Forests benefit by hiring students with expertise to complete specific projects. Students, in turn, gain valuable work experience in a dynamic and professional environment.

Greg Greene, a PhD candidate studying fire ecology, joined the team at the Alex Fraser Research Forest (AFRF) in 2016. Greg is a student with Dr Lori Daniels and a member of UBC's Tree-Ring Lab. To highlight this unique collaborative exchange, he and Cathy Koot, Research Coordinator at AFRF, elaborate on the benefits derived from the graduate internship from this past year.

From the intern (Greg Greene's) perspective:

The internship at AFRF has provided me with an invaluable learning experience. Coming from the science side of forestry, I had no practical experience with forest management – specifically with forest planning and operations. I applied for the graduate internship position to gain this practical experience, while fulfilling articling require-

ments as I pursue designation as a Registered Professional Forester. My career aspiration is to work for the BC Ecosystem Restoration program, where I will have the opportunity to integrate and implement the knowledge I have gained at AFRF with my knowledge of disturbance and forest ecology.

Since joining the AFRF team, I have had the opportunity to learn how to perform a number of forest planning and operations tasks, including timber cruising, cut block, skid trail, and road layout, tree regeneration surveys, planting quality assessments, Douglas-fir beetle surveys, and tree health assessments. As a graduate researcher and fire ecologist, I have also been able to contribute some of my knowledge to augment processes at AFRF. Specifically, I developed Fuel Hazard Assessment protocols to track changes in the quantity of surface fuels following different harvest methods. I have also used my knowledge of Geographic Information Systems (GIS) and Global Positioning Systems to help streamline data collection and field operations.

Now more than half-way through my 16-month internship, I am beginning to integrate what I have been learning about forest management with my knowledge of wildfire. For

example, I am working with Ken Day, AFRF Manager, to design skid trail patterns that can slow or stop the spread of fire through tree canopies, while simultaneously achieving wildlife and silviculture objectives.

From the Research Forest (Cathy Koot's) perspective:

The non-winter field season is a busy time with tree planting supervision, forest health surveys, and harvest and road layout. Despite the newness of these particular activities to Greg, the fact that he had lived and worked under field conditions elsewhere meant that he could adapt quickly. He supervised junior field staff and international volunteers with ease and kept everyone in a good mood to boot.

AFRF relies heavily on its GIS for tracking research projects and all aspects of forest management—most staff use it every day. After 2 decades of growth, the system was in need of reorganization. Greg came to AFRF with extensive GIS experience, not only from his research work, but also from prior employment. He rooted out redundancies and designed a vastly improved structure that will persist well into the future.

Moving forward:

Plans are afoot for heading back outdoors, once the GIS project is finished and the spring melt reveals harvesting debris requiring post-harvest fuel assessments. Both Greg and AFRF look forward to collaborating further on fuel management plans in the wildland-urban interface near Williams Lake, BC. This successful model of collaborative exchange between Forestry graduate students and the Research Forests is testimony to the value of visionary ideas from Faculty of Forestry supporters and donors.

Forestry alumnus honoured in Top Forty Under 40



Domenico Iannidinardo and his daughters

Domenico Iannidinardo (BSF 2001) is one of 13 UBC alumni to be named one of BC's Top Forty Under 40 for 2016 by Business in Vancouver magazine. He has accomplished much in the 16 years since graduating, and is excited and optimistic about forestry's future.

Domenico grew up in Duncan BC, where his interest in ecology developed early. "When I was a kid I sometimes saw forests I had played in being harvested and then reforested or turned into farms, and I thought to myself, 'How does that work?'" he says.

This interest led him to study biology at University of Victoria, then forestry at UBC. Each summer he took jobs logging, tree planting or harvest planning. "I learned the role and importance of taking a team approach to managing forest resources," he says.

After graduating from UBC, Domenico achieved concurrent registration as a Professional Forester (RPF), Engineer (PEng) and Biologist (RPBio), the first person in BC to do so. He went on to receive an MBA from Royal Roads University.

For several years Domenico worked part-time between UBC semesters

with Pacific Forest Products, Western Forest Products and TimberWest. After graduation he joined Western Forest Products. In 2005 he moved to TimberWest Forest Corporation and he was appointed Chief Forester and Vice President Sustainability in 2013. TimberWest is the largest privately-owned timberland company in western Canada, and in 2000 it became the first in Canada to certify its lands under the Sustainable Forestry Initiative.

"Companies have to understand the bigger role they play," he says. "As Chief Forester I meet with dozens of community groups because our land isn't just forest but also watershed and wildlife habitat. We work with diverse groups, organizations and First Nations to provide access to forests for research, recreation and cultural purposes."

As an example, TimberWest's landholdings include many salmon-bearing waterways, and as a result the company has a longstanding partnership with the Pacific Salmon Foundation (PSF). TimberWest has contributed over \$1 million to PSF since 2002, supporting vital research, watershed initiatives and conservation projects.

Domenico's role at TimberWest includes membership in the Canadian Council for Aboriginal Business (where the company was the first forest company member in BC) and the Marmot Recovery Foundation (where landowners provide the foundation with core funding and expertise).

He also serves as Chair of the Canadian Association of Forest Owners. "About 13 percent of Canada's working forest is in private hands, but it contributes almost 20 percent to the national timber supply," he says. "This association provides a united voice on national policy issues and regulations."

In addition, Domenico is President of the Association of Professional Biology, which represents 1000 biology professionals in western Canada.

In 2014 Domenico was recognized by Canadian Forest Industries as one of the Top 10 Under 40, and was named one of Business in Vancouver's Forty Under 40 in 2016.

Domenico is optimistic about forestry's future, particularly with respect to some recent and ongoing innovations. "Forestry has gone through a great deal of technological advancement, and I believe this will continue," he says. "Ecosystem services will continue to be important. Carbon is at the forefront, and there will be much more specific and tangible valuations of things such as water volumes, medicinal plants, and wildlife species. And I believe that Big Data will be deployed much more effectively in the future."

Domenico salutes UBC and the Faculty of Forestry for giving him the platform to integrate all his interests -- forestry, engineering, and biology -- in one degree program. "As an alumnus I'll keep giving back, and I encourage other alumni to do the same," he says.

Mark your calendars for the following Forestry alumni events



Upcoming 2017 Forestry reunions

The following UBC Forestry classes are organizing reunions. If you graduated in one of these years, or are affiliated with one of the classes, please contact us to confirm that we have your email address so that we can ensure you receive an invitation:

- Class of 2002 & 2003 15th Reunion in Vancouver, BC – July 15th, 2017.
- Class of 1997 20th Reunion, Vernon, BC - July 21st-23rd, 2017. For more information, contact Paul Rosher, Paul.rosher@tolko.com.
- Class of 1992 25th Reunion – Details to come.
- Class of 1982 35th Reunion in Summerland, BC – June 24th – 25th, 2017. For more information, contact Joanne Pickford at pickfordj@gmail.com.
- Class of 1967 50th Reunion at Loon Lake, Maple Ridge, BC – June 19th – 20th, 2017. For more information, contact Russ Clinton at aretrees@gmail.com.

For more information on these reunions contact the names above or Janna Kellett at janna.kellett@ubc.ca or 604.827.3082. If your class is not listed above and you would like to organize a reunion, please contact Janna to find out how she can help.

Upcoming Forestry events

- Master of Sustainable Forest Management 5 Year Celebration Dinner, Vancouver, BC – April 22nd, 2017.
- Loon Lake Alumni and Friends BBQ and Tour in Maple Ridge, BC – April 27th, 2017.

For more information and to RSVP for these events visit <http://getinvolved.forestry.ubc.ca/alumni/events/> or contact Janna Kellett at janna.kellett@ubc.ca or 604.827.3082.

You may be missing (out)!



If you are a UBC Forestry alumnus and are not receiving emails from the Faculty, we may be missing your email address. Without your email, you may be missing out on:

- Alumni event invitations
- Reunion invitations and information
- The monthly Forestry Alumni E-Newsletter with job postings and updates on our Faculty.

Simply email janna.kellett@ubc.ca with the subject "Here I am", your name, degree and graduation year. We will make sure you are signed up for UBC Forestry events and information.

Questions? Call Janna at 604.827.3082.

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