branchlines

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Inside:

forestry
university of british columbia

dean'smessage

Several articles in this issue of Branchlines feature the international work undertaken within the Faculty of Forestry. To us, this is a natural extension of what we do here in British Columbia and in the west of Canada. Others however have questioned this engagement. So why do we consider that it is so important?

Samuel Adeyanju provides some very convincing reasons in his article on advancing education in Africa. Samuel is a Mastercard Foundation scholar, a program that has brought 22 young scholars from a number of African countries to the Faculty of Forestry. We can use our expertise to impart skills to people from all over the world that they will then use to further the aims of forestry, conservation, poverty alleviation, food security and other issues in their home countries. At the same time, they are enriching British Columbian students with their experiences and different world views. It is truly a win-win situation and we are grateful to the Mastercard Foundation for making it happen.

The symposium organized by Future Forestry Leaders in conjunction with the 76th session of the UNECE Committee on Forests and the Forest Industry provided another example of taking a more international viewpoint. Over 30 students from across North America converged on Vancouver in November to share their knowledge and experiences. They were given the opportunity to take part in the main discussions, and did so with distinction. As one senior delegate put it: "Students brought a much-needed energy and perspective to the meeting". It seems that many international meetings would benefit from fresh perspectives.

Knowledge sharing also took place in the Urban Forestry Design Challenge, with students from UBC's urban forestry program teaming up with students from the urban forestry major at the University of Wisconsin – Stevens Point to develop a plan to improve an area of urban forest in the city of Surrey, British Columbia. The students clearly benefited from each other, with the UBC students being stronger in design and planning questions and the Wisconsin students being stronger in urban forest assessment and management. We have of course noted this, and one of the new faculty members starting with us in 2019 will help us fill this gap.

Our cover picture is of an orangutan and our centre-fold story is about the work done by one of our newer recruits, Jacqueline Sunderland-Groves. Jacqueline has joined the Wildlife Coexistence Lab, which focuses on solving wildlife – human conflicts. Orangutans are suffering from habitat loss brought about by a variety of pressures, with conversion of forest to palm oil plantations being particularly important. Making palm oil production more sustainable is a goal of many organizations, including the industry itself, but it is a complex and difficult issue with many different players, including large numbers of relatively impoverished smallholders who rely on palms as their main source of income. The lab is now working with the Borneo Orangutan Survival Foundation to expand our knowledge of the ecology of orangutans and to monitor the long-term success of their program to re-introduce orphaned orangutans to the wild. At the same time, others in the Faculty are working on ways to make palm oil production more sustainable.

While we place a lot of emphasis on the importance of our students gaining an international perspective, we are not forgetting the many different needs associated with our domestic situation. We continue to work with many communities throughout British Columbia, such as the project with St'át'imc Government Services on the effects of changing snowpack and habitats on wildlife habitat. Such projects are involving both graduate and undergraduate students, adding to the experiential learning that undergraduates receive in the Faculty while contributing to the long-term welfare of the communities.

Not all our international links are welcome. Increased contacts between countries, and particularly increased trade, means increased risks of invasive pathogens. The BioSurveillance of Alien Forest Enemies (BioSAFE) project is trying to identify invasive species as early as possible, and the article on Phytophthora indicates some of the work that is involved. Invasive pathogens are believed to be one of the most significant threats that we face, and the havoc created by the emerald ash borer in eastern Canada shows why. We need to ensure that we can deal with these pathogens if and when they arrive in Canada.

As a final word, I would like to congratulate and sincerely thank Dr Sue Watts, who is stepping down after almost 30 years as editor of Branchlines. This is probably the longest-running newsletter of any UBC faculty and we continue to have no shortage of stories to tell. Here's to the next 30 years!

John L Innes
Professor and Dean

forestrynews

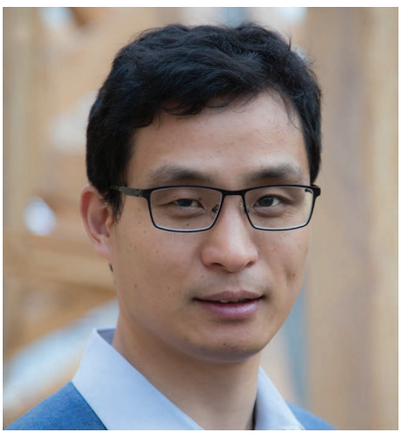
New appointments

Dr Emily Rubidge has joined the department of Forest and Conservation Sciences as an honorary assistant professor in marine conservation. Emily is a research scientist with Fisheries and Oceans Canada where she leads the Seascape Ecology and Conservation research group based out of the Institute of Ocean Sciences.

Emily holds an MSc in Zoology from UBC and a PhD in landscape genetics from the University of California, Berkeley. Her research is centred on understanding species' responses to global change and the effectiveness of conservation measures. Current projects in her lab include mapping marine species diversity, MPA network design and evaluation, and developing tools and strategies for marine biodiversity monitoring. As an honorary faculty member at UBC Emily will supervise graduate students, and serve on graduate committees. Emily can be reached at emily.rubidge@ubc.ca.

Dr Feng Jiang (a recently hired assistant professor in the department of Wood Science) has been appointed as a Canada Research Chair (Tier 2) in Sustainable Functional Biomaterials. Jiang's research focuses on developing high value-added functional materials from forest biomass using sophisticated chemistry and nano technologies.

Jiang's group is working on the development of functional wood-based nanomaterials with adjustable optical, electrical, catalytic, and mechanical properties – with the ultimate aim of replacing petroleum-based materials. The novel materials that Feng is developing in his lab will also help to reduce our carbon footprint and create a more sustainable society. You can read about his research in a previous issue of Branchlines (Vol 29#3 Fall 2018) or contact him at feng.jiang@ubc.ca.



Awards and recognitions

Dr Scott Hinch (department of Forest and Conservation Sciences) has been honored with the 2018 Mitacs Award for Exceptional Leadership – Professor. Scott earned this award in recognition of his ground-breaking work to protect, conserve, and rebuild declining Pacific wild salmon populations. The award ceremony was held in Ottawa, Ontario, on November 27.

Dr Maja Krzic (department of Forest and Conservation Sciences and Faculty of Land and Food Systems) has received an Award for Excellence in Open Education from BCcampus. Maja received this award in recognition of her leadership that has been instrumental in transforming provincial, national, and international post-secondary soil science education.

Dr Sarah Gergel (department of Forest and Conservation Sciences) has been elected as a Fellow of the American Association for the Advancement of Science. Sarah is being honored by the Association for "greatly improving our understanding of the implications of human activities and landscape change on ecological processes and ecosystem services at the land-water interface". Sarah has been appointed to the Geology and Geography section of the Association.

Dr Dominik Roeser (department of Forest Resources Management) has been named as a senior associate with FPInnovations. Dominik was a senior director at FPInnovations before joining UBC Forestry earlier this year. The signing of this collaborative partnership will strengthen the links between UBC Forestry and FPInovations and will create new opportunities for sharing knowledge, resources, and best practices that will benefit students, FPInnovations' members, and the forest industry.

International Urban Forestry Congress 2018

INTERNATIONAL
URBAN FORESTRY
CONGRESS 2018

Diverse In Nature

In early October, more than 750 researchers and practitioners from 30 countries came to Vancouver for the inaugural International Urban Forestry Congress (IUFC). The attendance made IUFC 2018 possibly the largest international conference on urban forestry ever held. IUFC 2018 was the result of a unique partnership between Tree Canada's Canadian Urban Forest Conference, the Pacific Northwest Chapter of the International Society of Arboriculture's Annual Training Conference, and the international Urban Tree Diversity Conference. The Faculty of Forestry, was one of the lead organizers, and several members of the Faculty's urban forestry team held key positions in the various conference committees.

Combining these 3 conferences, the Congress provided a forum for practising arborists and urban foresters, green space planners, and designers, policy makers, researchers and educators to share their unique insights into arboriculture and urban forestry. The IUFC had as its theme 'The Urban Forest – Diverse in Nature', and conference sessions and field trips focused on aspects of urban forests and tree species diversity, the many ways in which urban residents value and use urban forests, as well as the need for a range of innovative planning and management practices.

The Faculty was represented among the keynote speakers by Dr Suzanne Simard (department of Forest and Conservation Sciences), who delivered a thought-provoking presentation on how her work on forest ecology and interactions between trees (especially below ground) can inform urban forestry. The more than 100 presenters included many UBC faculty members, postdoctoral researchers, and graduate students. The event also provided a great learning and networking opportunity for the Faculty's undergraduate students, many of whom volunteered for conference organization tasks.

For more information visit www.iufcvancouver2018.com.

Field day for Aboriginal youth

On October 17, the Faculty's Indigenous Initiatives program hosted a field day for Aboriginal youth at the Malcolm Knapp Research Forest. The field day was designed to give Aboriginal high school students the opportunity to learn about forestry-related work and research, as well as the different degree programs offered by the Faculty of Forestry. UBC staff and students were on hand to answer questions that participants had about studying at UBC. Aboriginal students in grades 10-12 travelled from Abbotsford, Coquitlam, Delta, and Vancouver school districts to take part.

The day opened with a welcome from Katzie First Nation member Mavis Pierre. Students then took part in 3 activities designed and led by the Research Forest's Wild and Immersive program staff. These activities were designed to educate students about ecological knowledge and technical milling skills. The first activity was an art and papermaking station, where students made paper by hand to see the use of recycled paper products. They then included local plant species to provide some plant ID opportunities. The second rotation was a tour of the Gallant Enterprise Mill operations, where students learned about the custom wood products being made from the different types of trees growing in the Research Forest. The last activity was a tour of the Marion Lake fire pond, and a presentation on fire ecology by doctoral candidate, Kelsey Copes-Gerbitz, who explained her research on implementing proactive strategies for dealing with wildfire.

The Faculty's Indigenous Initiatives program would like to extend thanks to all of the people who made this day possible, including the Wild & Immersive program staff, Loon Lake staff, UBC student volunteers, Ionut Aron (Research Forest staff), Clayton Arnott (Gallant Mill staff), and to Canfor for providing funds for the event.

For further information on the Indigenous Initiatives program, contact the program manager, Alison Krahn, at alison.krahn@ubc.ca.

A crash-course in soil science

By Akshit Puri and Kiran Preet Padda

The Faculty of Forestry's Master of Sustainable Forest Management (MSFM) program trains future forestry professionals to apply their knowledge and skills to the challenges of contemporary forest land management. Since soils are an integral part of forest ecosystems, it is important for future professionals to have a solid understanding of the interactions between vegetation and soils. Appropriately, incoming MSFM students are offered a crash-course in soils, prior to the start of their coursework; this reminds them of the key concepts of soil science. The course involves both classroom-based and field-based activities. Since the start of the MSFM program 6 years ago, this course has been delivered by graduate students in the Soil Science program at UBC. This year we were given the opportunity to teach the course.

In the classroom-based component, we covered topics of soil formation, reminding students of the factors and processes responsible for soil formation, and how soils are classified according to the Canadian system of soil classification. This was followed by an exercise on hand-texturing with the objective of training the students how to use their hands as a "tool" to determine soil texture – which is one of the most important soil properties for understanding soil behaviour and management. In this exercise, students "calibrated" their fingers by determining the texture of known soil samples and familiarized themselves with a 'Soil Texturing Key'. The students then worked in groups to identify the texture of "mystery" soil samples.

On the following day we led the students on a field trip to the forest area at the UBC Farm's Centre for Sustainable Food Systems. The goal of this field component was to allow students to practice soil description and identification skills of relevance to forest management. The activities included:

- A brief description of the site history and how soils had formed in the area.
- Group work on identifying soil horizons, describing their respective depths, colour, structure, and texture. This involved the hand-texturing exercise again.
- An exercise in conducting a quick, field determination of the soil pH .
- An exercise on classifying the observed soil into a soil order as per the Canadian system of soil classification.

This soil science crash-course is well-aligned with the objective of the MSFM program in helping graduates to "know how to design and implement site and landscape level plans that integrate the environmental, social and economic components of sustainability." Deborah DeLong, MSFM program coordinator, adds "MSFM students need to learn about forest soils because they are an integral part of the forest ecosystem and an understanding of soil development processes is essential in managing forests in a sustainable way." A current student in the MSFM program, Ben Ozols-Mongeau, who attended this year's course also comments "Being out in the forest, learning about soils right in the first week of classes sets the stage for the program ahead." We hope that the soils training provided during this course will help students not just during their required courses but also in their future careers as forestry professionals.

Akshit Puri and Kiran Preet Padda are PhD candidates in the UBC Soil Science graduate program. For further information, contact the crash-course organizer, Dr Maja Krzic (department of Forest and Conservation Sciences and department of Soil Science – Faculty of Land and Food Systems) at maja.krzic@ubc.ca.

Advancing education in Africa

By Samuel Adeyanju

Local and international partnerships will be critical to achieving Sustainable Development Goal 4, which is quality education for all. The Mastercard Foundation is one of the world's largest foundations working to advance education in Africa. In 2012, the Foundation launched its Scholars Program, a $500 million global education initiative to educate 15,000 talented, yet economically disadvantaged, students from developing countries – particularly from sub-Saharan Africa. Implemented through 24 partner universities and non-governmental organizations in Africa, North and Central America, the Middle East, and Europe, the program provides financial, social, and academic support for scholars to pursue secondary, undergraduate or masters education at partner institutions.

The University of British Columbia joined the Mastercard Foundation Scholars Program in 2013. Through a $25 million grant, UBC will provide 163 young scholars from Africa with access to quality and relevant university education at UBC over a 10-year period. The Mastercard Foundation Scholars Program (MCFSP) at UBC began with 5 undergraduate students in 2013 and has since grown to welcome students from 18 different sub-Saharan African countries over the past 5 years. As of 2018, MCFSP at UBC has graduated 36 scholars (15 undergraduate, 21 graduate) and currently has 87 scholars (65 undergraduate, 22 graduate) in approximately 60 different degree programs across 8 faculties.

The Faculty of Forestry has enrolled 22 scholars from 6 different African countries since it welcomed its first students in 2014. Ten of these scholars have since graduated. Currently, we have 8 MCF graduate students and 3 undergraduate students in the Faculty. Our Forestry programs are very popular with MCFSP applicants but there are only a limited number of scholarships available each year. I was one of 9 MCF Graduate Scholars to arrive at UBC in 2017 and one of the 3 to be accepted into Forestry. I am also most fortunate to be the first MCF student to be admitted into a thesis-based masters program in Forestry.

I grew up in Akure, a city in South-Western Nigeria. My aspiration was to become a medical doctor as the society I grew up in attached prestige to professional degrees such as medicine and engineering, thereby relegating other disciplines to an inferior status. Today, I look back with gratitude that I decided to study forestry and have come to realize the importance of forests and forestry to the sustainability of planet Earth. My resolve to be resilient and focused in the face of unfavourable financial conditions earned me a distinction at the end of my undergraduate program – which I believe contributed greatly to the success of my MCF application in 2017.

Being a beneficiary of the MCFSP at UBC has provided many opportunities for me to re-discover myself, expand my horizons and develop the skills needed to achieve my dreams. Here at UBC, I am involved with a number of university/student led associations such as the International Forestry Students Association, Student Sustainability Council, and UBC Graduate Student Ambassadors. I have also participated in conferences in Germany and Rwanda. This past summer, I joined 325 MCF Scholars from 41 countries at the annual Baobab Summit in Rwanda. The photo below was taken during the Summit where I was shading the Nigerian flag on a creative art board. During this 3-day forum, I interacted with other young Africans making positive impacts in their communities in Africa. My major takeaway from the summit is this: *The solution to most of the challenges that Africa faces as a continent can be found within its borders if only we collaborate and put value on our home-grown innovations.* I believe that being a beneficiary of the Mastercard Foundation Scholarship Program here at UBC's Faculty of Forestry will help me to achieve my goal of contributing to sustainable development in my community and the African continent.

Architects of a sustainable future

This past November, UBC's Faculty of Forestry supported the 4th Future Forestry Leaders (FFL) event – this year held in conjunction with the 76th session of the UNECE Committee on Forests and the Forest Industry (COFFI 2018). Representing forest-based researchers and policy makers from Western and Eastern Europe, the Russian Federation, the United States of America, and Canada, this was the first time that this UN body had met in North America. The theme of their meetings, held at the Vancouver Convention Centre, was "Building the Future with Forests".

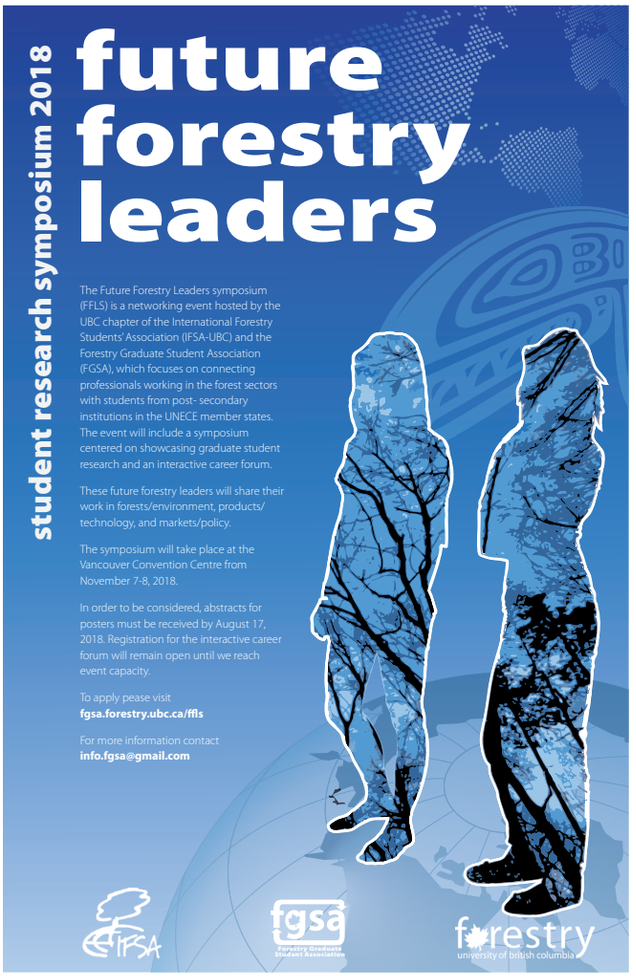
As another first, COFFI organizers were determined to put significant effort into including the "voice of the youth" throughout their discussions.

Paola Deda, Chief of the UNECE/FAO Forestry and Timber Section, explained the motivation to engage students at this high-level event with the following statement: "There is an inevitable need to support the next generation of forest leaders. Not only did we want to provide an opportunity for young people to learn from experts about the circular economy, wood construction and the role of sustainable forest management, but we really wanted to have their voices heard so that their perspectives are taken into account by policy-makers around the UNECE region."

Future Forest Leaders proved to be an ideal mechanism for student engagement, providing over 30 students from across North America with the opportunity to visit Vancouver, showcase their forestry-related research, and network with experts from international organizations, government, industry, and academia.

The event started with a poster competition highlighting scientific contributions to the COFFI 2018 theme of "Building the Future with Forests". Twenty-two students were invited to present and the top 3 posters were chosen by FFL Faculty Chair Dr Chris Gaston (UBC department of Wood Science) and Dr Ivan Eastin (University of Michigan). First place was awarded to Olivia Jacobs from the University of Washington and her collaborators for their poster, "Global warming mitigating potential of forests and forest products". Second and third place prizes went to Sepideh Nourian and Kristina Kshatriya, both from UBC's Faculty of Forestry. Roughly a dozen of the graduate student presenters will be invited to write individual articles for publication in a forthcoming 2019 special issue of The Forestry Chronicle.

In addition to the poster competition, Future Forest Leaders participants met with a diverse panel of international experts for an Interactive Career Forum on the role of "future leaders in the transition to a circular economy". Led by FFL graduate student co-organizers Meike Siegner (representing the International Forestry Students Association) and Emily Murphy (representing the Forestry Graduate Students Association), participants and experts moved between themed tables for focussed dialogues on opportunities and skills that will allow the next generation of leaders to shape a sustainable forest sector.



Maureen Whelan, Manager of International Affairs with Natural Resources Canada, summarized: "Having student involvement was a key element of the success of COFFI 2018. Students brought a much-needed energy and perspective to the meeting. It is crucial to integrate the views of tomorrow's leaders in today's discussions. Having student involvement also gives them (students) a view of international processes and provides an opportunity to understand how policy is developed and implemented."

For more information about this event, please visit fffls2018.forestry.ubc.ca or contact FFL Faculty Chair Chris Gaston at chris.gaston@ubc.ca.

Building relationships with community research partners

This past year, the Faculty of Forestry's Indigenous Initiatives program partnered with the Student Engagement Office to pilot a mentorship program designed to assist undergraduate students in working with Indigenous communities. The goal of the program is to expose undergraduates to a way of conducting research with Indigenous communities that involves more than simple data collection. Eight of the Faculty's graduate students and post-doctoral researchers signed up to mentor 12 undergraduate students. MSc student Zoltan Mityok was one of the graduate students who volunteered to serve as a mentor. With financial support from the Indigenous Initiatives office, Zoltan was able to take 2 mentees into the field for a week in July as he worked on his research project with the St'át'imc Government Services

Zoltan's project is a partnership with the Faculty's Integrated Remote Sensing Studio and the St'át'imc Government Services' (SGS) Environment Team based in Lillooet, BC. The project involves looking at ways to better understand snow dynamics and wildlife habitat requirements for species important to the St'át'imc, including grizzly bears and mule deer. St'át'imc Government Services are concerned that a changing climate may be affecting snowpack, resulting in altered fire regimes and impacts to wildlife within and beyond St'át'imc territory. The outcomes of Zoltan's project will be used by SGS to help inform future winter range management plans for mule deer – a species that continues to be provisionally and culturally important for the St'át'imc.

At the start of the project, St'át'imc members guided Zoltan on several tours of the area enabling him to become familiar with the land. He was also exposed to a range of different thoughts and ideas during the project as he attended conferences, ceremonies, presentations and informal meetings with community members. Zoltan later commented that forming connections and familiarizing oneself with the land and people of the St'át'imc territory was the only way that his research could have remained focused, helpful, and effective for the people concerned with its outcomes. Zoltan was able to share the value of collaborative research with his mentees, helping them to better understand the context of First Nations' history and issues as well as community concerns and objectives.

Zoltan's mentees, David Fluharty, a recent graduate from the Faculty, and Chris Colton, a fourth year Natural Resources Conservation student, were able to see a great deal of the St'át'imc territory as they toured and worked with SGS staff. Darwyn John (wildlife and land assistant with SGS) led tours of the area to demonstrate traditional foods, culturally important sites, historical landmarks, and the diverse habitats and environments within and around the St'át'imc territory. St'át'imc Government Services staff organized a helicopter ride to field sites and a visit to local legend and activist Hubert Jim's home.

Zoltan could not have been more pleased with the outcomes of the mentorship program. The pilot project gave his mentees an opportunity for firsthand experience in the area of collaborative environmental research, and exposed them to opportunities for new relationships and new ideas. The project also helped Chris and David learn about a First Nations community that is active in, and supportive of, working with students to answer questions that are important to people concerned about wildlife health and a changing climate.

For further information about this mentorship program, contact Alison Krahn (program manager for Indigenous Initiatives in the Faculty of Forestry) at alison.krahn@ubc.ca.

Chasing roots

By Maria Continentino

Ectomycorrhizal fungi colonizing a spruce root harvested from the Mount Polley field trial

Roughly 90 percent of the world's plant species form mycorrhizae. These structures, in which root and fungal tissue combine, are advantageous to both the fungus, as it receives food in the form of sugars (products of photosynthesis), and to the plant, as it benefits from numerous services in return. Mycorrhizal associations enhance water and nutrient uptake, protect plants against root pathogens, and link individual plants of the same or different species in networks through which resources can be passed. The success of plant establishment and survival can be greatly enhanced by the presence of mycorrhizae.

As an undergraduate research assistant working with UBC Forestry's Belowground Ecosystem Group this past summer, I was able to learn more about mycorrhizae and their importance to the reclamation of ecosystems after human-caused disturbances such as mining. Reclamation methods for mine sites have most often been focused on soil nutrient amendments and vegetation species selection – with little importance given to soil biota such as mycorrhizal fungi. Typically, soil salvaged and stockpiled prior to mining is used later on in the process of reclamation. However, this soil has often degraded during storage and may not be of sufficient quality for restoration needs. Consequently, non-soil materials, such as overburden and tailings, are often used as growing media. To promote recolonization of the soil food web in these degraded and non-soil materials, seedlings inoculated with soil transferred from local undisturbed ecosystems can provide a source of soil biota that is locally adapted and can improve seedling establishment.

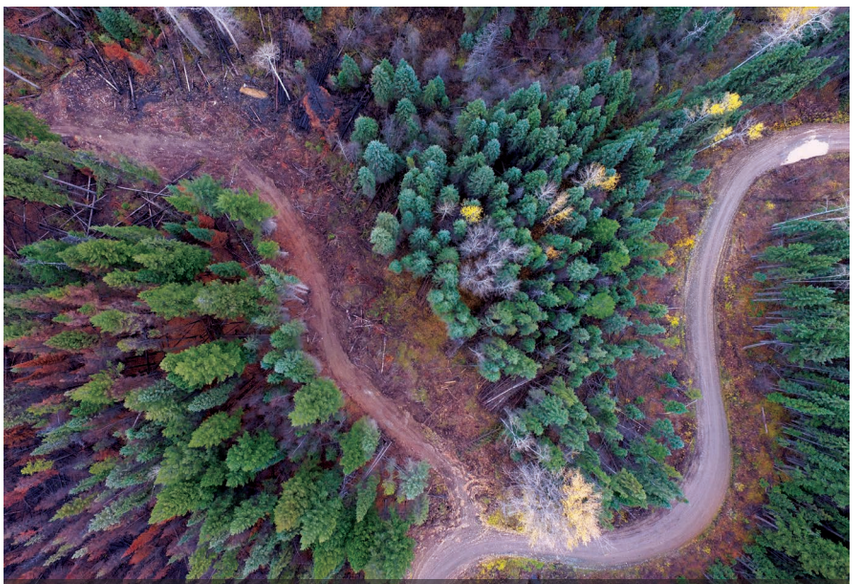
My summer was spent at the Mount Polley Mine, a copper and gold mine near Williams Lake, BC and the site of severe disturbance following a tailings dam failure in 2014. My work involved assisting PhD candidate Katie McMahen with her study of soil transplants at the site. Katie's project involved a study of forest soil transplants mixed into the seedling planting hole, site preparation (mounding), and seedling proximity to undisturbed forest (ie, potential for soil biota ingress and mycorrhizal network formation). I helped Katie with destructive harvesting of 3-year old spruce (*Picea engelmannii x glauca*) seedlings to determine whether these reclamation techniques had improved seedling establishment and growth. In short, destructive harvesting meant carefully digging up 220 spruce seedling root systems, and often times chasing meter-long root runners across a research plot full of stinging nettles. I never thought I would be so happy to see the end of a tap-root. The resilience of these young roots was quite impressive – having sometimes penetrated through hard dry soil, travelled through fallen logs and continued their growth under heavy rocks.

Back in the laboratory, it was interesting to observe (under the microscope) the different structural features formed by ectomycorrhizal fungi that had colonized spruce roots. They wrapped around the surface of the root cells to give the root tip a swollen appearance. In some cases, fungi had also formed ropelike structures known as rhizomorphs for transport of water and nutrients over long distances.

While this study is not yet completed, we hope that Katie's research will contribute to the development of reclamation techniques for the mining industry and other resource extraction sectors, improving reclamation outcomes.

Maria Continentino is a recent graduate from the BSc Natural Resources Conservation program. She is a recipient of the Work Learn International Undergraduate Research Award, which support students interested in research as a career. For more information contact Maria at eduardacontinentino@gmail.com or Katie McMahen at katiemcmahen@gmail.com.

Rehabilitating the legacies of wildfire suppression



A fire guard (left) prior to rehabilitation, 2017/10/23

Following weeks of summer drought, a dry lightning storm on July 7, 2017 ignited 7 wildfires at the Gavin Lake Block of the Alex Fraser Research Forest (AFRF). The proximity of homes, other infrastructure, and timber values in the vicinity prompted a suppression response led by the BC Wildfire Service that included the rapid creation of 55 km of fire guards.

Machine-made fire guards are 20-metre wide linear swaths where fuel is removed and mineral soil is exposed. Trees are cut, and stumps and forest floor are pushed aside into berms. Ideally, the cut trees are skidded out allowing for salvage of the timber. In many cases, however, the fires at AFRF caught up to the guards under construction and burnt past them before they could be completed. The pattern of fire guards that resulted from the responses to rapidly changing fire behaviour was a network of roads that traversed growing forest of various ages, steep slopes, and more than 80 creek crossings.

As soon as the ash cooled, the process of fire guard rehabilitation began. Forest staff undertook mapping, inventorying unsalvaged timber, and identifying specific restoration activities for each feature. Heavy equipment contractors constructed water-bars or cross-ditches to reduce erosion on the steepest sections. Road surfaces were decompacted and berms of stumps and topsoil were pulled back in select locations to allow natural vegetation to reestablish. The berms act as barriers to wildlife movement, so establishing regular, periodic breaks along them was a priority. Rehabilitation work continued through 2018. On sections susceptible to erosion and invasive plants, a perennial grass was hand-seeded to temporarily occupy the growing space. Slower growing native plants are expected to out-compete these grasses in the long-term but these sections will require ongoing monitoring for invasive species.

Wet soil conditions during spring were conducive to planting willow, red osier dogwood, and black cottonwood cuttings along streambanks. Such cuttings will grow roots readily, stabilizing riparian soils and reestablishing vegetatiion cover. Damaged streambanks were recontoured and in some cases, the channels reconstructed using boulders and embedded logs during the previous autumn.

Bioengineering with cuttings is labour-intensive but very effective. The planting materials were collected from shrub swamps in March. Each stem was hand-trimmed, bundled, and stored under a snowbank until the thaw. The fortitude and endurance of young Research Forest interns was greatly appreciated during the planting phase that required use of an iron rod to pound a deep hole, a piece of stem cutting to be pounded into the hole, and then trimming to leave two-thirds below ground. These steps were repeated hundreds of times.

It is fortunate that lumber markets have been strong since the fires. Local mills have been accepting logs with a certain amount of char and the Research Forest has been able to sell much of its burnt timber. This demand for logs has facilitated salvage efforts to collect and process logs left behind on fire guards. Additionally, 13 km are being upgraded into permanent roads to provide new access and continue providing fire guard function.

It is also fortunate that 2018 is a spectacular mast year for all tree species. The seed beds along the restored fire guards and in the burnt areas themselves are in perfect condition to receive seeds that are falling this autumn. While some of the guards have been planted to conifers, the majority will rely on natural regeneration.

Researchers and students are invited to seize this unique opportunity to study rehabilitation in action.

For further information, contact Cathy Koot (biologist and research coordinator at the Alex Fraser Research Forest) at cathy.koot@ubc.ca.

The battle of trees and Phytophthora

In the picture to the right, dark veins are growing out of an infection point of an otherwise healthy leaf of big leaf maple. This is the early stage of infection by Phytophthora, a plant pathogen. In those dark veins and surrounding tissue, a battle is taking place. The Phytophthora pathogen first attempts to colonize host tissue by secreting hundreds of different molecules to evade host defences; later, it will feed on the nutrients released once the host cells are dead. Luckily, the trees have ways to resist such attacks. They can create cellular environments that are unfavourable for the pathogen, detect and inactivate pathogen molecules before they can act, and trigger localized cell death to prevent pathogen spread. The process is multifaceted, dynamic, and involves the interaction between genes in the host and the pathogen. As part of the BioSurveillance of Alien Forest Enemies (BioSAFE) project, Kelly Hrywkiw (a PhD candidate working with Dr Richard Hamelin in the department of Forest and Conservation Sciences) is unraveling these mechanisms in trees, so that new tools can be developed to prevent and mitigate the impact of invasive pathogens.

Phytophthora (from the Greek: plant destroyer) is a group of microscopic organisms known as oomycetes – commonly referred to as water moulds. They are considered to be among the deadliest of plant pathogens and have caused devastating repercussions worldwide, with a predicted global impact upwards of $6B annually. On the surface, they resemble filamentous fungi, but they are more closely related to diatoms and seaweeds. This complicates their control, as they lack many traditional fungicide targets. Phytophthora can attack not only almost every agricultural crop but also hundreds of woody shrub and tree species found in forests. One big worry is that new Phytophthora species seem to be appearing at an accelerating rate due to an increase in plant trade globalization. In particular, the nursery trade of ornamental plants has been instrumental in the spread of many harmful and previously unknown Phytophthora species. Better detection and identification of these Phytophthora is part of the solution to prevent and contain these introductions.

One challenge is to predict which Phytophthora has the potential to create large-scale tree mortality. Sudden oak death is caused by *Phytophthora ramorum*, an aggressive pathogen that attacks over 130 different plant species and can invade both foliar and woody tissues – resulting in a large-scale reduction of forest biodiversity. By contrast, its close relative *Phytophthora foliorum* only causes minor foliar lesions on rhododendron. Clearly, forest Phytophthora do not share one standard mode of attack or pathogenicity profile. By understanding the underlying mechanisms that cause these differences we hope to have the ability to predict which species are detrimental, a pre-requisite to understanding which Phytophthora we should focus on for management.


Photo: Berni van der Meerby

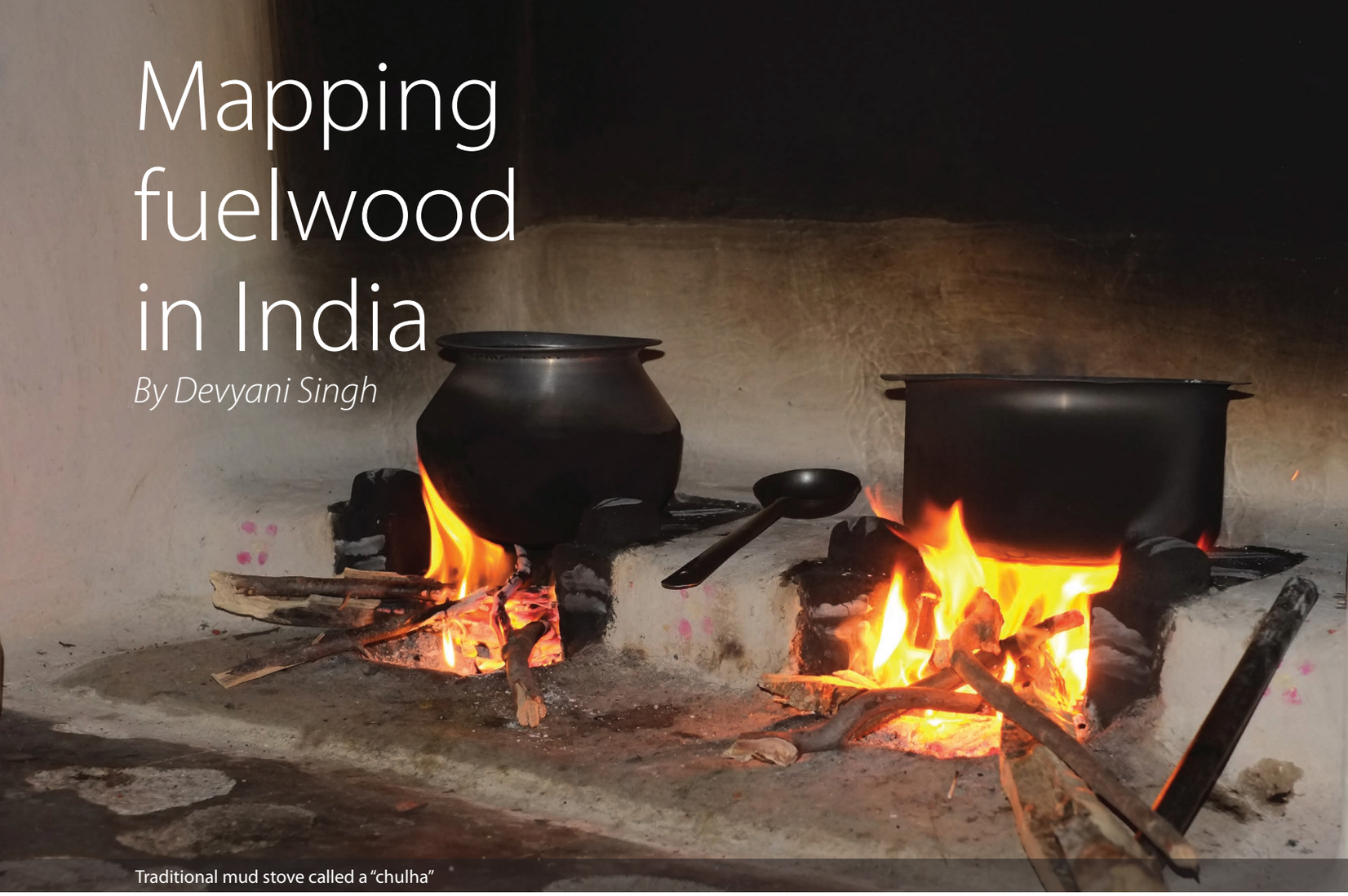
Another big question is, which trees and shrubs are susceptible to Phytophthora? In the forests of California and Oregon, *Phytophthora ramorum* has substantial negative impacts on live oak, tanoak, California bay laurel, and rhododendron. However, some species such as red alder, commonly found near infected tanoak trees, remain entirely unharmed. By identifying the molecular drivers of host susceptibility and resistance this information can be used to create more resistant cultivars.

By studying the infection of 10 BC tree species with 8 Phytophthora species, Kelly is beginning to shed light on these questions. As part of the BioSAFE project, genomics is used to identify which genes are expressed ("turned on") when a Phytophthora attacks a tree, and in parallel, which tree genes are expressed in response to a pathogenic Phytophthora attack. Kelly anticipates that the identification of these genes will help predict the outcome of the battle of trees and Phytophthora. This information will be used to develop new biosurveillance tools to identify potentially harmful forest Phytophthora, and create more resilient tree species – helping protect our forests so that they may continue to grow and flourish.

For further information, contact Kelly Hrywkiw at khrywkiw@gmail.com or Dr Richard Hamelin at richard.hamelin@ubc.ca.

Mapping fuelwood in India

By Devyani Singh



Traditional mud stove called a "chulha"

Let us go on a journey to the interior Indian Himalayas. After a 17 hour plane ride to Delhi, we take a 4 hour train ride to Chandigarh. From here we take a 10 hour, bumpy and dusty taxi journey to the mountain city of Kullu, situated on the Beas River in Himachal Pradesh. Exhausted and jet lagged, we rise early in the morning to meet with the field staff and the founder of the community-based organization Jagriti, who has been working on social and economic issues with women in the 172 villages of the region. Next we are loaded into a rickety old jeep (one wonders if it has any suspension at all), and take another bumpy ride through riverbeds and along unpaved roads. By the time we arrive at the village, I feel I might have lost a few bones. At the village, we are taken to the central courtyard where all of the elders, and a few other village people, have gathered to meet with us. After introducing ourselves and explaining our research project, we are invited to a villager's house for some chai. Our host starts a fire in her semi-circular mud stove, called a chulha. She begins to prepare the chai as I start to question her about her fuelwood collection habits. It has been barely 5 minutes but the room is already filled with smoke, and I am unable to stand it anymore. I have to leave and get a breath of fresh air, while the woman continues to make chai. This type of smoky situation is not isolated. Globally, 2.6 billion individuals use traditional systems to meet their daily cooking needs. The use of these traditional cooking technologies has many negative consequences on health, climate change, and the forests. Inhalation of smoke, for example, kills 2.6 - 3.3 million people every year; emissions of black carbon and other greenhouse gases contribute to climate change; and unsustainable extraction of wood from the forests contributes to degradation and deforestation.

Woodfuels (such as charcoal and fuelwood) provide 9% of global primary energy and constitute over 50% of all roundwood harvested globally. In some countries, woodfuel extraction can be over 90% of all harvest. Global woodfuel trade in 2016 generated about US $800 million, and accounted for about 35% of forest income (8% of household income). It is also estimated that there will still be about 2.7 billion individuals dependent on these fuels by 2030. Clearly, there is a need for sustainable management of these resources, and a transition to cleaner fuels. The seriousness of these negative impacts depends on the local forest resources and the fuel collecting habits of the population (where they go, what they collect, and how much they use). In Kullu, a region with over 35% forest cover, these impacts might not be easily visible. However, in regions such as southern India, where we also work, the district has only 0.17% forest cover and these impacts are significant. Although researchers have studied woodfuel consumption quite extensively, there are far fewer studies related to the location of extraction, the distances traveled for collection, time required for collection,

or exact locations within the forests where this extraction is happening. Often a simple buffer around the village of fixed diameter is used to estimate the area where fuelwood is extracted. More spatially accurate data is essential if we want to instate forest programs and community forestry to alleviate negative impacts.

Finding solutions to these problems is what we do. The "we" in this context is Dr Hisham Zerriffi from UBC's department of Forest Resources Management and myself, PhD candidate Devyani Singh. For the past 5 years we have been working in remote villages in the Indian Himalayas and the Deccan Plateau where, as well as collecting other data, we have tracked households' woodfuel collection trips to the forest using GPS loggers. We also measured the details of the woodfuel they were using on a daily basis (by total weight and by species). Interviews, surveys, and focus groups involved hours of conversations with the households and drinking a million cups of chai (full of sugar and milk). Issues faced by the households are similar. Most households are concerned about increasing distance and time required for collection and limited access to improved cooking technologies. At the same time, given their intimate reliance on their local resources, they have a deep understanding of the issues of fuelwood extraction, labour requirements, and the impacts on forests. Households have seen a decline in forest resources and are worried about future sustainable sources of cooking fuels. However, they also indicate that fuelwood extraction is their only option in the absence of better and affordable alternatives.

Once our field work was completed it was time for analysis (what every graduate student lives for!). While analysis of some data, such as total wood weight and species, was relatively simple using statistical tools, we were unsure what to do with the data collected from our GPS loggers. Dr Valerie Lemay (department of Forest Resources Management) came to the rescue by explaining the use of GPS tracks to estimate animal home ranges in wildlife biology. The idea clicked, and we decided to create 'home ranges' for fuelwood collection. Since wildlife biology already has accepted and tested tools for creation of home ranges using GPS track data, we used one of their methods and created what we have termed Resource Collection Polygons (RCPs). Unlike the simple circular buffers used before, our RCPs show that collection is directional and not equally dispersed around the villages. In fact, collection is centered along roads, farms and the local forests and varies from village to village and from region to region depending on local resources, topography, and socio-demographics of the households.

These RCPs not only help us gain a better understanding of the impacts of cooking with wood, they could become helpful in designing and implementing clean cooking programs. A move to cleaner fuels can have positive impacts, not just on climate and forests, but also on society where women can have more time to work, do other household tasks that take up their day or just to socialize and relax while girls can have more time to attend school or study. These social benefits and the health benefits of clean cooking have led a number of governments, including the Indian government, to promote cleaner options. However, while some are successful in getting households to adopt cleaner fuels, they are not always as successful in getting households to use them consistently. The use of these RCPs can help in understanding the micro-scale dynamics of household fuel collection and how they might influence household decisions on transitioning to new fuels. A next step for us is to explore how this data can also be merged into existing fuelwood extraction models being used globally.

The Resource Collection Polygon approach need not be limited to woodfuels. RCPs could also be used to understand the spatial pattern of collection of other local resources, such as water, medicinal herbs or other forest products. There are already others thinking of using our methodology to understand water collection and we look forward to seeing this tool being further developed and refined.

For further information on this project contact Devyani Singh at devyani@mail.ubc.ca or Dr Hisham Zerriffi at hisham.zerriffi@ubc.ca. To read more about the work of the Energy Resources, Development and Environment Lab, visit https://erdelab.forestry.ubc.ca

Project village in the Indian Himalayas of Kullu valley, Himachal Pradesh, India

Orangutan reintroduction: Measuring success

By Jacqueline Sunderland-Groves

Reintroduction of a species within its historic range can play an important role in the conservation of endangered species. Since the 1960s, efforts to reintroduce ex-captive orangutans have become a growing practice. In Indonesia and Malaysia, significant forest loss due to mechanical logging and the establishment of oil palm and pulp and paper plantations, coupled with the impacts of hunting, has led to a predicted loss of more than 82% of the Bornean orangutan population in just 75 years. The Sumatran orangutans have fared no better and, combining all species across their range, only around 72,000 orangutans continue to survive in the wild. As a slow-reproducing species, no level of loss is sustainable and each new loss brings the species closer to peril. An additional consequence of these human development activities is the overwhelming number of orphaned or displaced orangutans cared for in rescue centres. Without a reintroduction strategy the only future for these unfortunate individuals would be life in a cage.

Prior to joining UBC, I worked as part of a dedicated team rescuing, rehabilitating and reintroducing critically endangered Bornean orangutans in the Central and East Kalimantan regions of Indonesia. I have been involved in the reintroduction of over 380 illegally captured wild-born orangutans – individuals who had either been orphaned through hunting, captured for the illegal pet trade or displaced through habitat loss. After completing a lengthy rehabilitation process, orangutans who successfully master all the skills they need to survive in the wild can be returned to the forest. Thanks to novel radio tracking technologies, field teams are able to track these orangutans after release and record data related to their adaptation back to life in the forest. This radio tracking technology has been instrumental in helping us to calculate reintroduction success rates and has provided a wealth of data related to their adaptation, which would not otherwise have been available. This includes the importance of life history prior to rescue, the time spent in captivity and the early forest learning opportunities before reintroduction. However, although the 1-year reintroduction success rates are amongst the highest recorded for Borneo, radio transmitter batteries eventually expire, orangutans move out of range and data become harder to record on all but the most habituated individuals.

As conservation biologists we strive to ensure that our actions have lasting, positive impacts towards reaching global conservation goals, and adequately gauging our success is critical to evaluating and refining our methods and practices. The most important factors to determine in this reintroduction program are survival and long-term viability. Now, as a

research scientist working with UBC's Wildlife Coexistence (WildCo) Lab in the Faculty of Forestry, we are teaming up with the Borneo Orangutan Survival Foundation in Indonesia to expand on current knowledge and investigate long-term reintroduction success rates. This is important to inform pre- and post-release practices to maximize future success, but it will also improve our understanding of current orangutan distribution, and therefore allow us to identify additional carrying capacity in the forest areas supporting these new orangutan populations. This is critical given that the aim is to reintroduce viable populations, which for orangutans means populations of 250 individuals or more. Sharing UBC WildCo's extensive knowledge and expertise, which spans a multitude of countries and species from caribou in Canada to leopards in Sri Lanka, our pilot study will use camera traps to help detect wildlife activity over long periods without a researcher needing to be physically present. We will use spatial capture-recapture methods combined with standard methods such as nest counts, to investigate orangutan population density. And, since most reintroduced orangutan individuals are facially recognizable, the camera trap surveys will allow us to identify the longer-term reintroduction success of specific individuals and follow their life histories – potentially for many years to come. The added bonus of camera traps is, of course, that they are completely unbiased and capture all wildlife species in their range; data which is crucial in highlighting the biological importance of these pristine rainforests for their long-term protection.

Measuring the success of conservation efforts is key in conservation science and allows conservation managers to plan future actions for maximum impact, and for these newly established orangutan populations, it is critical for their long-term viability.

Jacqueline Sunderland Groves can be reached at jacqui.sunderland-groves@ubc.ca. The Wildlife Coexistence Lab at UBC is researching a number of wildlife species to investigate how human development impacts their distribution and abundance, and how human-wildlife conflict can be alleviated. Find out more about their research on page 20 of this newsletter or visit wildlife.forestry.ubc.ca.

The future of spring

By Elizabeth Wolkovich

It was a beautiful spring day in Vienna in 2012. I was running to catch a tram to the ZAMG, Austria's Central Institute for Meteorology and Geodynamics. At the time, meteorological institutes still seemed a far stretch from my PhD training in ecology, but they would become an ever more integral part of my research in the coming years as my focus turned to plant phenology. This area is now also the central focus of my research group – the Temporal Ecology Lab which moved with me in January 2018 to UBC's department of Forest and Conservation Sciences, where I am an associate professor.

For plants, phenology generally includes the vibrant and visible seasonal cycle – budburst, leafout, flowering, fruiting, leaf coloring and leaf drop – as well as events equally critical but less visible, such as the start and break of dormancy in the fall and winter.

Phenology has a long history of study, especially in Europe where records of winegrape harvest dates stretch back into the 13th century and where Linneaus, who formalized how we name species, was a great observer of phenology. Plant phenology is often strongly linked to climate, which underlies Europe's history of phenological gardens. Many of these 'gardens' – clones of several plant species often located at a research institute – were planted to help test the once newfangled technology of thermometers.

This history of phenology as an indicator of climate is part of why I was racing after a tram in Zurich towards a meteorological institute 6 years ago: most of the long-term data on phenology – decades upon decades of observations of plant leafing or flowering or fruiting – comes from Europe. The other part of the reason relates to why those records matter so much now: climate change.

Six years ago in Zurich I reported that current estimates of global average temperatures had risen an estimated 0.8 °C since the 1970s. That number is now close to 1.0 °C and the changes are far more radical in northern latitudes: in much of Canada increases are closer to 2-3 °C.

While thermometers tell part of the story, phenology remains a very tangible indicator of this warming. Indeed, it is the most reported biological impact of climate change, with rising evidence that most plants, birds and other organisms are shifting earlier with warming. Winegrape harvests in France are 2 weeks earlier than before the onset of anthropogenic climate change, oak trees across central Europe leaf out 1 to 3 weeks earlier.

Europe has compiled an incredible database of over a million phenological observations of plant phenology, with data back to the 1300s, and this shows that trends across plant species are strikingly consistent. Yet the records, as rich as they are across space and time, are surprisingly species-poor. Altogether they offer data on fewer than 200 species and most of the data come from only a couple dozen species. Further, the data are focused strongly on crop species, meaning many of the well-represented species are cereals or fruit trees. Despite this, the European data underlie many global estimates of how climate change alters plant phenology. My training in community ecology, a field focused on understanding why

we have so many species and what determines which are found where, and with which other species, made me especially interested in whether findings based on such species-poor data were robust, and how applicable they might be to plant communities in other locations, such as North America.

Over the past decade I have worked to compile long-term phenological records from across North America, and discovered that not all species are shifting so dramatically and not all are shifting earlier. Across 1,500 wild species, average advances in leafout and flowering times are similar to estimates from Europe: 4-6 days per degree of warming, but behind those averages are diverse responses. Some species are delaying flowering with warming, while others do not appear to change much. Understanding and explaining this diversity of responses is the current aim of my lab's research.

Early progress using the large database of records yielded a suite of answers as to what underlies some of the species diversity of responses. Early-active species from many habitats were the most sensitive, which explains why average estimates of 4-6 days per degree of warming can coexist with estimates that cherry blossoms and other spring species have advanced 3 weeks or more in recent decades. Invasive and exotic species also appeared to advance their phenology more with warming, and follow-up analyses suggested that many species that advance with warming also perform better with warming (that is, they grow more each season or produce more seeds).

Analyses also started to uncover that species that did not appear to change much over time, as temperatures have risen, may actually be very sensitive to warming, but in opposing ways. This occurs because most temperate species use a complex mix of cues to time leafout and flowering each spring. In addition to advancing phenological events due to warmer temperatures, they also advance events due to lengthening daylength and they respond to winter chilling (the accumulation of cold temperatures when plants are dormant). Plants generally advance events such as leafout with greater chilling, but if chilling declines, as it has been in some areas with warming, then plants may actually delay leafout. Our results suggested that plants that had not changed over time actually appeared to be responding to warmer springs and warmer winters in contrasting ways – leading to little overall change now but the potential for noticeable changes as warming continues.

This project started my interest in the role of winter chilling in determining spring leafout timing across species, and understanding how it will shift with climate change. Over the past 5 years my lab has conducted research in forests out east and found a high diversity of chilling responses across species. We are now compiling additional data to better characterize these species in other ways (eg, growth rate, tissue types etc) to try to understand what may determine plant responses to chilling.

My lab is now expanding this research to the forests of British Columbia. This summer we visited 5 different sites to set up a latitudinal transect of research locations to study roughly 20 major tree and shrub species. We're excited to see if the patterns match what we have seen out east or present new dynamics. It's especially exciting to be working in west coast forests as they include many deciduous species for which we have few phenological records, but which will be critical to forest and carbon dynamics in the future. Unlocking the basic physiology that drives their leafout will certainly be the focus of my lab's work for years to come. And I am excited to add these species to our growing global understanding of how climate change is reshaping our seasons.

For more information please visit temporalecology.org. or contact Dr Elizabeth Wolkovich at e.wolkovich@ubc.ca.,

Prioritizing timely recovery of endangered species

By Tara Martin

Photo: Petr Kobik

Recovery of endangered species is failing. In their latest Living Planet Report, the World Wildlife Fund (WWF) reported that populations of mammals, birds, reptiles, and fishes around the world have declined on average by 60% between 1970 and 2014. Canada is no exception. Of the over 600 federally listed Species at Risk (214 of which are in British Columbia), over 80% have continued to decline or show no change since listing. There are many reasons for this failure, not least that pressures on biodiversity continue to outpace protection and limited resources hamper recovery efforts. But there is also evidence that we are not spending the resources we do have most effectively.

This biodiversity loss crisis was the motivation for my team to develop a tool called Priority Threat Management to inform timely investment decisions in species at risk recovery. Priority threat management provides a rational way out of a trap that is hampering species recovery. Often, we are investing in species with the lowest likelihood of recovery at the highest cost. By default, many other species are getting neglected. In theory this shouldn't happen. Canada's Species at Risk Act tasks Environment and Climate Change Canada, and Fisheries and Oceans Canada, with leading efforts to safeguard and recover these species. But with insufficient resources being allocated to their recovery, agencies face tough decisions. If our goal is to address the biodiversity extinction crisis by saving as many species as possible, then our current way of investing in Species at Risk is not achieving its objective.

Priority Threat Management prioritizes investment in actions to recover endangered species based on their benefit to species recovery, their feasibility and their economic cost. To determine the best actions to take to recover as many species as possible, we multiply the benefits of each possible action with the feasibility of that action being taken. The result is then divided by the cost of implementing the action, to yield a cost effectiveness score for the action.

The approach is similar to a cost-benefit analysis, but instead of a monetary benefit, we are calculating the benefit of a particular management action in achieving species recovery. Actions that benefit more species tend to score higher. But sometimes the most beneficial actions of all are the least realizable. For example, if all cats were kept indoors, the benefits to songbirds, small mammals, amphibians, and reptiles, would be extremely high, but the achievability of such an action is also extremely low. Only by doing the math is it clear which actions are most cost effective.

With this tool, we can calculate the return on investment of recovering multiple endangered species across a region, province or country. We can answer questions such as – How much does it cost to recover all endangered species in Canada? What management strategies will save the most species per investment? How many species can be recovered for a given budget? And


Photo: Alex Harris

finally, which species are unlikely to be recovered irrespective of budget? In some cases, we may have lost the opportunity to recover a species, simply because we have left it too late and no amount of effort will bring the species back.

The development of Priority Threat Management has been a collaborative effort over the past 8 years, originally developed with my former team at CSIRO in Australia. Through its application across 1/3 of the Australian continent, along with several case studies here in Canada, we have been able to demonstrate the return on investment for species conservation and in each case produce a prospectus for investment in species recovery.

Lack of funding is clearly an important factor in contributing to failed recovery efforts. A key output of our approach is identifying the funding gap between what is currently being invested in species recovery efforts and how much additional funding is needed to do the best job possible. Without this knowledge, there is little chance of leveraging the additional resources required.

The Priority Threat Management process relies on empirical data gathered from the literature and generated from models, along with a structured approach to elicit knowledge from experts. Together these data are used to generate reliable estimates that can be fed into the equations. Experts include indigenous knowledge holders, and university, government, NGO, and industry scientists.

For species recovery to be successful, implementation of actions need to occur in a timely manner. This often means making decisions under uncertainty. Tackling this uncertainty is an appealing feature of our method. For example, experts are often uncertain about how a species might respond to a particular action. Our calculations incorporate a range of estimates including both the best- and worst-case outcomes that might result from any action. By assessing the sensitivity of the priority actions to this range of values, we are able to identify when a lack of knowledge is genuinely worth worrying about. In the context of endangered species recovery, the only uncertainties that really matter are those that would change our decision from taking one action to another.

In the first application in Canada, published in the journal *Conservation Letters* earlier this year, we show what can be achieved with different levels of investment in the South of the Divide, Saskatchewan, a 1.4M ha region of mixed prairie grassland. Of the 15 species at risk in the study, only 2 – the eastern yellow-bellied racer (a snake) and the Mormon metalmark (a butterfly) – have a better than 50 per cent chance of recovering with no additional action. For an investment of $1.4M a year, 2 additional species, the black-tailed prairie dog and the long-billed curlew, are secured. At $4.8M a year, the number jumps to 9, and so on. The best case scenario is a $126M investment spread over 20 years that funds 5 recovery strategies and has a good chance of recovering 13 of the 15 species.

Even then, the burrowing owl and the black-footed ferret have a low chance of reaching self-sustaining populations in the South of the Divide. In the case of the burrowing owl, the challenge is that it is a migratory species that faces additional threats outside of Canada. The analysis makes it clear that any amount of money spent within the South of the Divide is unlikely to save it, even while other species benefit. The best hope for the burrowing owl in Canada will require agreements with other jurisdictions that span the owl's range, including in the United States and Mexico.

We have 4 other Priority Threat Management assessments under way across Canada including 1 in UBC's backyard – the Fraser River Estuary examining the management actions required to save 102 species at risk of extinction. We are now in discussions with Environment and Climate Change Canada, Fisheries and Oceans as well as WWF Canada about how to apply the approach more broadly across the country.

Dr Tara Martin is a professor of conservation decision science in UBC's department of Forest and Conservation Sciences. You can find out more about her group's work in the Conservation Decisions Lab by visiting www.taramartin.org or by contacting Tara at tara.martin@ubc.ca.

research lab profiles

WildCo: Wildlife Coexistence Lab

Wild animals hold a special place in human cultures around the world. Iconic species, such as caribou, moose, wolf, and grizzly bear, are woven into the cultural identity of many Canadians, including Indigenous peoples. And many other "charismatic megafauna" – like lions, tigers, and elephants, inspire international awe and intrigue. Beyond such cultural values, wild mammals generate significant economic revenues for governments and local communities from activities such as tourism and hunting. And they play critical roles in functioning ecosystems through processes such as predation, herbivory, seed dispersal, and nutrient transfer. Yet many wildlife remain undervalued in traditional approaches to resource management and economic development. Growing human demands for food, fibre, and energy have led to widespread declines in many wildlife species. For instance, the 2018 Living Planet Index documents an average decline in abundance of 60% since 1970 across more than 16,000 populations of 4,000 vertebrate species. Closer to home, more than 1,800 wildlife species have been classified as at risk by the Government of British Columbia's Conservation Data Centre. In the modern era of the Anthropocene, we face a crossroads in the challenge of sharing the planet with wildlife.

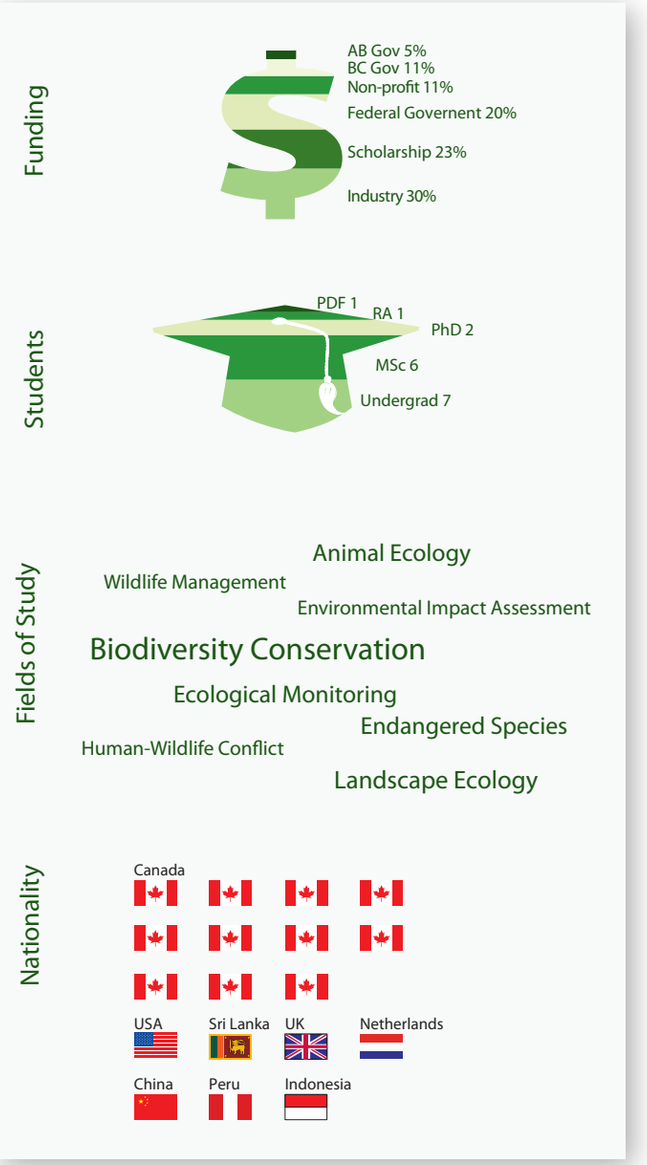
The Wildlife Coexistence Lab (WildCo for short) in the department of Forest Resources Management strives to conduct science to support wildlife conservation and management on a crowded planet. Navigating trade-offs between wildlife conservation and human activities – such as resource extraction, urban expansion, and wildland recreation – requires an understanding of the ways animal populations respond to changing environments, and to the management actions designed to sustain them. Research in the WildCo lab is focused on human-wildlife coexistence across multiple species and spatial scales, with a particular emphasis on large-bodied terrestrial mammals. The research is grounded in ecological principles and quantitative rigour, while incorporating interdisciplinary perspectives that are a critical part of conservation science. Coexistence is defined broadly, from balancing industrial development with habitat protection in remote landscapes, to mitigating conflicts with backyard bears and other animals active at the urban-wildland interface. The lab seeks to develop innovative methods to inform evidence-based decision making, including the use of remote camera networks to monitor animal distribution and abundance, and the application of advanced statistical

models to assess wildlife community responses to the cumulative effects of interacting stressors.

WildCo is led by **Dr Cole Burton** @cole_burton, who joined UBC in 2017 and holds the Canada Research Chair in Terrestrial Mammal Conservation. Cole has pursued a lifelong passion for studying wildlife through diverse positions in academia, government, industry and non-profits. He aims to work collaboratively with wildlife managers, conservation practitioners, and policy makers, and has been involved in a range of wildlife research around the world – from western Canada to West Africa. Cole completed an MSc in zoology at UBC and a PhD in environmental science, policy and management at the University of California, Berkeley. He teaches wildlife ecology and management in the Faculty of Forestry's undergraduate program, and is developing a graduate course in advanced topics in wildlife science.

WildCo is home to a motivated group of wildlife scientists pursuing research projects across the planet. Several members of the lab are conducting research related to the challenge of conserving woodland caribou in western Canada – this threatened species is affected by industrial land use, climate change, and the complex dynamics of interacting predators and prey. **Dr Joanna Burgar** (Post-Doctoral Researcher, @joburgar) is using camera trap data and Bayesian statistical models to generate new estimates of population density for caribou and other large mammals in northern Alberta's oil sands region. She is using these estimates to improve understanding of how different anthropogenic and natural disturbances affect mammal communities within the changing boreal forests. **Erin Tattersall** (MSc Student, @erin_tatt) is also researching large mammals in Alberta's northern boreal forests, using camera traps to assess the effects of habitat restoration on caribou and other interacting species. **Caroline Seip** (MSc Student, @Caroline_Seip) is working with the Government of Alberta to understand how management activities focused on caribou recovery affect the broader mammalian community in west-central Alberta.

Other key WildCo research themes include the conservation of endangered species, mitigation of human-carnivore conflict, and effects of land use decisions on wildlife communities. **Jacqui Sunderland-Groves** (Research Scientist, @JLSGroves) researches great ape ecology, conservation, and reintroduction, with a particular focus on critically endangered orangutans in Indonesia (see article on page 14). **Cheng Chen** (PhD Student, @CHEN_Cheng_) is synthesizing a global dataset of camera trap surveys to test for general patterns in the effects of human disturbances – the human "footprint" – on the structure and function of mammal communities. **Cindy Hurtado** (PhD Student, @CindyM_Hurtado) is testing different types of habitat suitability models for pumas and other carnivores, with a goal of improving the design of wildlife corridors within the fragmented forests of Ecuador and Peru. **Francis Aurich** (MSc Student, @FrancisAurich) also conducts research in Peru, seeking to determine whether threatened Andean bears are negatively impacted by cattle grazing in protected areas. Cattle husbandry is likewise a theme investigated by **Aisha Uduman** (MSc Student, @aisha_uduman),



whose research addresses the ecological and social dimensions of leopard-livestock conflict in Sri Lanka. She is combining surveys of attitudes and practices in livestock-rearing communities with GIS and remote camera data to identify drivers of observed conflict. In British Columbia, **Joanna Klees van Bommel** (MSc Student, @JoannaKvB) is mapping interactions between people and black bears on southern Vancouver Island, using camera traps and reports by local residents. Her research aims to identify hotspots of conflict that could be targeted by managers to reduce negative outcomes for both bears and residents. And **Alexia Constantinou** (MSc Student, co-advised by Dr Suzanne Simard) is using camera and live traps to understand how large and small mammals respond to different forest harvesting strategies at 3 sites spanning a climate gradient from the southern to northern interior of BC. These graduate student projects are being supported and complemented by a number of undergraduate students involved in WildCo research.

You can follow us on twitter (#WildCo) or find us at wildlife.forestry.ubc.ca. Cole Burton can be reached at cole.burton@ubc.ca.

In 2014, UBC launched a new Bachelor of Urban Forestry (BUF) program to meet the call for more natural resource management professionals specialised in working in urban areas. Enrolment in the program has increased steadily, and now stands at close to 200 students from Canada, China, the US, and other countries.

Applied and problem-based learning is a key component of the BUF, and opportunities are sought to enhance student learning outside of the curriculum. In August 2018, 8 students from both the BUF and the urban forestry major at the University of Wisconsin – Stevens Point (one of the oldest urban forestry programs in the world) participated in the inaugural Urban Forestry Design Challenge, a student competition aimed at putting urban forestry knowledge and skills into practice. Similar to UBC, experiential learning is a foundation of the Wisconsin program. Thus, the complementary strengths of each program were foundational to solving 'real-world' problems through problem-based solutions at the project site.

Structure of the Design Challenge

The 1-week Challenge at the end of August was a team competition, with students working in groups of 4 (2 members from each school). Faculty members and graduate students served as mentors. The task was to prepare an innovative plan for improving an actual urban forest site (Redwood Park) in the City of Surrey, British Columbia. Student teams had to first assess the current urban forest, its use and management, as well as its context. Next, they were asked to develop a vision and plan for improving the area. They were also asked to consider future monitoring of progress, as well as innovative ways of communicating their plans.

At the end of the week each group presented their final product to a panel and to their fellow students. The panel evaluated the 4 projects for content and originality of the proposal; applicability of the proposal; as well as presentation and communication effectiveness. The winning group members each received a certificate and a prize of $1,000.

Project site

The 32-hectare Redwood Park in southeast Surrey provides various recreational opportunities for local residents. In 1893, Peter and David Brown were gifted the land with the intention of utilizing the rich soils as agricultural land. However, the brothers, who had a keen interest in trees and nature, established a forest of a large number of exotic as well as native tree species. The forest was donated to the City of Surrey after the passing of the brothers. The park as is stands today is mostly forested, but it also includes meadows and other open areas. It has an extensive infrastructure of paths and other recreational facilities, including a tree house.

Redwood Park seems to fulfil the current needs of its users, but it is also facing several future issues and challenges. The


One of the student teams at work in Surrey's Redwood Park

'fairy-forest' is a popular area in the park that draws families with young children to visit and leave behind their interpretation of a fairy house. Originally, the fairy-forest was meant to be an area of subtle mystery that would encourage children to expand their imagination. Unfortunately, the area has become a bit of a 'dumping ground' of often brightly coloured fairy houses expanding in all directions (including upwards into the trees). Even though this has resulted in a fascinating place, issues have emerged in terms of soil erosion, degradation of vegetation, aesthetics, and heightened tree-risk potential. Other local issues include rapid urbanization and densification around the park, with an estimated 11,000 additional residents anticipated in the coming years. This will increase recreational pressure and also potentially change the role of the park. There are also challenges related to an ageing tree population and the need to manage invasive species.

Team work and projects

The Design Challenge started with an ice breaker on opening night, followed by a session at UBC's Faculty of Forestry. Professors from both schools gave inspirational lectures and introduced the challenge. Student teams quickly got to know each other by participating in an exercise about the urban forest on campus. The teams and their mentors then moved to Surrey, where field work started with an introduction by Surrey's head of urban forestry, Rob Landucci. Teams were given about 72 hours to analyze the current state of the park, and then develop a vision and plan for improvement.

Each team approached the challenge differently. Some teams spent more time in the park, while others retreated indoors to analyze documents and maps. The 'fairy forest' was an important concern for all groups, although the mission for the teams was to address the overall challenges faced by the managers of Redwood Park.

The final projects, presented at Surrey City Hall, were all of such high quality that the jury had a difficult job selecting a winning team. Many of the teams focussed on specific challenges of the park at the site level, but it proved challenging for teams to develop a cohesive overall plan for the area. The park currently functions very well and is appreciated by park users, making it difficult for the teams to see opportunities for improvement. On the other hand, rapid urbanization around the area will increase pressures on the park and possibly change its use.

The winning team combined hands-on proposals with a stronger overall concept for the park, focusing on a zoning of qualities and activities. They also integrated a tree inventory of the central part of the park. Collectively, the teams produced an interesting array of ideas that could benefit the City of Surrey and future land management at Redwood Park.

Lessons learned and perspective

The first Urban Forestry Design Challenge was a great success. Students from UBC worked well with their peers from another university, and proved themselves capable of analyzing a real-life urban forestry problem. The respective strengths of the 2 urban forestry programs became evident, with the Wisconsin students demonstrating more skills related to urban forest assessment and management, and the UBC students showing greater strength in design and planning questions.

Some important lessons were learned for future editions of the Challenge (such as the need for more joint field trips and activities). A second Challenge is being planned for Wisconsin, continuing on the success of bringing students together to learn and share their knowledge through practical ideas set to solve a real management problem.

The Urban Forestry Design Challenge 2018 was made possible by the financial support of Bartlett Tree Experts, Parkland, the City of Surrey, the University of Wisconsin – Stevens Point, and UBC's Faculty of Forestry. We gratefully acknowledge this support and the contribution it made to student learning in urban forestry. *For further information contact the authors Dr Cecil Konijnendijk (professor of urban forestry) at cecil.konijnendijk@ubc.ca or Dr Richard Hauer (professor of urban forestry at UWSP) at richard.hauere@uwsp.edu.*

The 'fairy forest' in Redwood Park is an illustration of park user engagement but poses challenges to managers

development & alumninews

Foundation gift supports wildfire research

The **Intact Foundation** will support valuable research into wildfire prevention and management, and climate change adaptation in British Columbia with a gift of $250,000 over 3 years.

Led by **Dr Lori Daniels**, the research project is in collaboration with the St'uxwtéws (Bonaparte) Band and the Rocky Mountain Trench Ecosystem Restoration Society.

The wildfires of 2017 burned a record-breaking 1.2 million hectares of BC forest, only to be exceeded in 2018 when 1.35 million hectares burned. Combined, the 2017-18 fire suppression costs exceeded $1 billion and the indirect costs on human health and well-being, community sustainability, and forest resources will be in the billions.

Two key factors in uncontrollable wildfires are prolonged periods of hot, dry, and windy weather and over-abundant forest fuels. This research project digs into these factors to determine how best to increase forest resilience to climate change, and to help BC communities reduce their vulnerability to fire.

"Our vision for this project is to develop science-based strategies for proactive fire management and post-fire recovery that take climate change into account," Lori Daniels says. "I'm looking forward to working with our partners, especially the St'uxwtéws band members, and of course our forestry students, to conduct this research in the field."

The research project has 3 key components: fire suppression effects on forest density, post-fire recovery of forests, and integration of indigenous knowledge, and science to guide adaptation.

To better understand the origin of very dense forests (up to 22,000 trees per hectare) that are about a century old, researchers are reconstructing forest histories by analyzing tree rings. The outcomes will provide much-needed guidelines for reducing forest density to mitigate hazardous fuel loads while improving carbon storage.

Typically, after a fire, dead trees are salvaged and new seedlings are planted, sometimes at high density. However, evidence from 2017 and 2018 fires suggests that climate change is calling these strategies into question. Debris from past logging and overly dense forests contributed to the mega-fires of 2017, in particular the Elephant Hill fire that burned 135 homes and almost half of the St'uxwtéws traditional territory.

Researchers, including UBC students and St'uxwtéws research interns, will measure burned and unburned areas, with and without salvage logging. The goal is to document the regrowth of trees and plants in burned areas and measure the impacts of salvage logging on forest recovery.

The results will contribute to fire-behaviour models that can forecast the risk of re-burning over the short and long terms.

Working closely with St'uxwtéws band members, researchers will explore natural forest regeneration and cultivation of culturally important plants. They will pilot the effectiveness of natural gardens as buffers in the space between forests and communities. And they will develop educational workshops for children to help them learn more about preparing for wildfires using science and indigenous ecological knowledge.

The Intact Foundation comments, "The 2017 and 2018 wildfires have entrenched the fact that adapting to climate change impacts is more important than ever. Dr Daniels' work in providing post-fire recovery strategies to BC's new Wildfire Resiliency initiative is paramount in ensuring that community resilience is a top priority."

The Intact Foundation is the charitable arm of Intact Financial Corporation, the largest provider of property and casualty insurance in Canada. Since 2004 the Intact Foundation has donated over $31 million in charitable funding to over 1400 organizations across Canada.

The Faculty is deeply grateful to the Intact Foundation for their generous contribution to this research project that will ultimately make a difference in communities all over British Columbia.

If your company is thinking about ways to enhance student learning or research at UBC, please be in touch. Contact Emma Tully at 604.822.8716 or emma.tully@ubc.ca.

New scholarship for Indigenous graduate students

Masters student **Seraphine Munroe** is the first recipient of a new student award for indigenous graduate students. **TimberWest Forest Corporation**, partnering with the Faculty, has created an endowment that will generate scholarships in perpetuity through interest revenue.

Seraphine is focusing her research on forest resource management, specifically the impacts of tenure rights granted since 2010 on BC First Nations. "I want to better understand these policies and how they are working on the ground in communities," she says. She is part of the Forest Resources and Environmental Services (FRESH) Hub in the Faculty of Forestry.

Seraphine was born in Prince George and raised around Fort St James. A member of the Dakelh and Sto:lo First Nations, she is also part of the Maiyoo Keyoh Society.

"My siblings and I grew up around the bush in our traditional territory, with lots of time at the cabin with my grandparents," she says. "When I was 8 years old my grandmother asked my father for help to stop the logging in our territory. I think I became an activist right then."

From age 8 to 20, when Seraphine wasn't in school, she was doing research and advocating for her family group's claim over their traditional territory (keyoh). "We wrote publications documenting our historical occupation of the land. We developed forest management plans. And we did blockades," she says. "It's been a long process but we are getting there."

The influence of her family's history led Seraphine to study anthropology, geography, history, and archaeology at Thompson Rivers University, where she received a BA in 2014. She then attended Archaeological Field School at the University of Northern British Columbia.

After a couple of years working as a professional archaeologist, Seraphine began looking for a way to be more influential in the forest management process. "I got in touch with Forestry at UBC to see what more I could do with a Masters degree to help mediate the rights of First Nations," she said.

Seraphine is examining the efficacy of collaborative forest management plans and their implementation processes. "Right now I'm interviewing Indigenous forest managers and provincial government staff involved in Indigenous affairs and forest management. The next stage is to analyze all the data for thematic content," she says.

"This scholarship gives me a huge sense of relief. In addition to studying, I am working part-time, and my younger brother, who is in high school, is living with me right now. The financial aspect of it is really helpful," she says. "It's also great to have affirmation of my work. This support is going to help me get across the finish line."

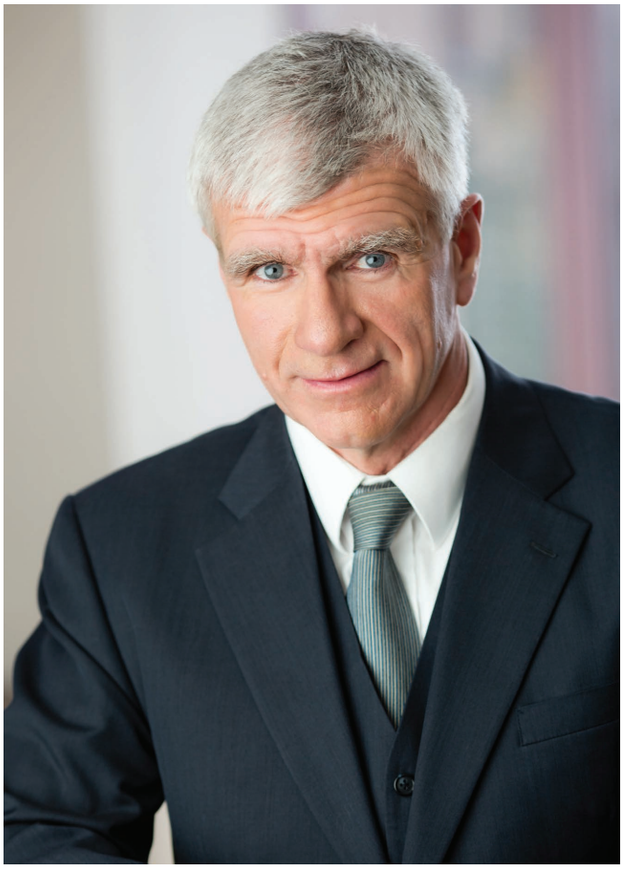
Seraphine acknowledges the efforts of forestry companies like TimberWest. "If forestry companies can help advance the education of Indigenous students it shows they are making advances toward reconciliation," she says.

Domenico Iannidinardo (BSF 2001) is the Chief Forester and Vice President Sustainability at TimberWest, and was instrumental in creating this award. "The future of forestry includes remarkable students like Seraphine. I've seen the forest industry adapt and lead on important stewardship matters since my time at UBC, including those that will define our generation, such as climate change and indigenous reconciliation. Congratulations to Seraphine; I am excited to know that she will be dedicated to the big issues of modern forestry."

The Faculty is matching TimberWest's gift dollar-for-dollar, creating an endowment valued at $100,000.

If you or your company is interested in supporting graduate or undergraduate students, please get in touch. The Faculty has a limited budget of matching funds for those interested in establishing endowed awards. Please contact Emma Tully, emma.tully@ubc.ca phone 604.822.8716.

From logging to lawyering: A clearcut path for this alumnus



Faculty of Forestry alumnus **Garry Mancell**, BSF 1974, has successfully combined his studies and experience in forestry and the law to create a successful career over several decades.

Garry joined Davis & Company in 1988 as an associate, and became a partner in 1992. "It was good timing," he says. "Davis was setting up practice groups, and they had a number of forestry clients. I had a network in various forest industries, and people began contacting me almost immediately." (Davis merged with DLA Piper in 2015.)

Garry's clients include timber developers, contractors, tenure holders, First Nations, trade associations, and contractors. His work focuses on timber and business acquisitions, joint ventures, fibre supply agreements, regulatory compliance and service agreements.

Born and raised in Vancouver, Garry was exposed to the forest industry early, spending time in the shingle mill where his father was a foreman. When it came time to apply to university, UBC seemed a logical choice.

"When I went to UBC you had to do 1 year of general sciences before entering many other faculties," he says. "I was thinking about medicine, but it turns out I don't deal very well with the sight of blood. I chose forestry because of my dad, and it was the best choice I could have made."

In 1974 Garry graduated at the top of his class with a BSF in Forest Engineering. That same year he met a student named Ann who was in the Faculty of Education, and they began a relationship that led to marriage in 1980 and eventually to a daughter and 2 sons.

After graduation, Garry went to work on a BC Forest Products logging crew. He then moved to a forest engineering position, working along the coast of British Columbia. In 1976 he received his RPF designation.

When Garry felt the itch to go back to school, he left work and spent a year travelling and thinking about his future. On the advice of his brother, he applied to law school at UBC and University of Victoria. Accepted at both, he chose Victoria because "the school was new, interesting and exciting," he says.

As a mature student, Garry initially had difficulty fitting in with his younger colleagues, many of whom had limited work experience and very different undergraduate backgrounds. "I was going to leave after 2 weeks," he says. "Ann convinced me to persist, and eventually things got smoother."

After being called to the bar in 1982 and a brief stint in civil and criminal litigation, he joined Crown Forest Industries as in-house counsel. When Crown merged with BC Forest Products the resulting company had more lawyers than it needed and Garry was laid off. "It was a bit traumatic at the time because I had a young family, but it compelled me to get out and knock on doors," he says. That's when he joined Davis.

In 1989 Garry began teaching a course in Forest Law at the UBC Faculty of Law (now the Allard School of Law) and is today the longest-serving adjunct professor in the faculty. He also is a regular guest lecturer in the Faculty of Forestry

Garry is also a member of Coquitlam Search and Rescue, a volunteer position he has held for the past 20 years. SAR members train for hundreds of hours each year so they are prepared for any possible rescue situation.

"I have noticed in my practice that foresters are particularly well-equipped to deal with land use conflict issues," Garry says. "Our profession is the first that really had to grapple with multiple stakeholders in the context of a publicly owned resource. This is a real asset in helping not only forest industries but mining companies, First Nations, environmental management organizations, and many others."

Alumni reunions

Seventeen UBC Forestry alumni from the **class of '65** gathered at the Quaaout Lodge on Little Shushwap Lake, September 11-12, 2018. Everyone enjoyed Quaaout's beautiful setting, fine food, and hospitality. A spirited bocce tournament on the spacious grounds at the lodge was followed by a buffet banquet overlooking picturesque Little Shushwap Lake. The strong camaraderie formed by the class was once again invigorated and piqued enthusiasm for gathering again in 2020 to celebrate their 55th.

The **class of '68** reunion exceeded the expectations of everyone who attended. Held in Penticton BC, it was a 3-day affair with a Happy Hour Friday event followed by many hours of chatting late into the evening. Saturday included a wine tour and a dinner in a small restaurant. The evening inluded a skit like the old days. On Sunday the group gathered for breakfast at the Hooded Merganser.

Thirteen of the original class of 32 students were able to attend, coming from as far away as Australia.

Upcoming alumni events

Alumni Social at the 2019 ABCFP Conference – Kamloops

Whether you are attending the 2019 Association of British Columbia Forest Professionals Conference or live in the Kamloops area, join us for an Alumni Social hosted by the UBC Faculty of Forestry. Spend the hour with fellow alumni, catching up with friends and meeting new people. This event is in partnership with the ABCFP, however you do not need to be registered for the conference to attend the social.

Thursday, February 7th, 2019
5:30pm – 6:30pm
Salon A&B
Coast Kamloops Hotel and Conference Centre
1250 Rogers Way, Kamloops, BC
Register at https://getinvolved.forestry.ubc.ca/alumni/events/
or contact Michelle Lindsay at michelle.lindsay@ubc.ca or 604.827.0297

Alumni & Friends Loon Lake BBQ & Research Forest Tour – Save the date

Please join us for a Sunday afternoon in the forest to learn more about the research and teaching taking place at the MKRF and to mingle with this year's Field School students over a BBQ dinner at the Loon Lake Centre. Family and guests are welcome. Invitations and further details to follow in the new year.

Sunday, April 28, 2019
Malcolm Knapp Research Forest
Maple Ridge

Looking back and moving forward

Back in 1989, Dr Bob Kennedy (dean from 1983 to 1990) suggested that the Faculty should have a regular newsletter. I was asked to design and produce the first edition. What started as a 6-page 1-colour tri-fold has evolved considerably over the years. Our most substantial change was initiated 8 years ago by dean John Innes who visualized, and committed to, the full-colour 28-page newsletter that you see now. Over the years, Branchlines has become a central communication tool for the Faculty – linking alumni, researchers, educators, and members of the public with the exciting and broad-ranging work of our students and staff. Today the newsletter is mailed to over to 5,000 individuals and organizations around the world. It is also read by countless individuals on line. Over my almost 30 years at the helm, I have been responsible for producing 94 issues and editing over 500 research articles. Every issue has been an exciting learning experience for me. I have always been passionate about communicating research, and my Branchlines editorial role has served me well. Although this is my ultimate issue as editor, I will be continuing my "passion for communicating" through mentoring and teaching of communication skills to graduate students here in the Faculty. Thank you for your feedback and encouragement over the years. You can still reach me anytime at sue.watts@ubc.ca. Moving forward, there will be an announcement about our new editor in the next issue of BranchLines.

Sue Watts, Editor

Branchlines cover designs 1990-2010

Newsletter production

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

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