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dean'smessage

As usual, this issue of Branchlines contains some fascinating details about the research that is being undertaken in the Faculty of Forestry. However, there is also another item that is worthy of comment: the 10 new appointments featured in the forestry news section. The new additions to the Faculty include a staff member, 2 lecturers and 7 professors. While some of these positions represent turnover within the Faculty, others are new positions and reflect its continued growth. The changes are by no means over, and there will be both significant turnover and continued growth in the coming years. Ensuring that we maintain the right balance between traditional activities and new areas of investigation, between the very different areas of research within the Faculty, and between provincial, national and international priorities, will be challenging. It requires considerable strategic thinking: in developing new undergraduate programs, for example, we need to think about the likely needs of employers at the time the students graduate. It can take 2 to 3 years to develop a new program, and then 4 years for students to pass through the program. Who can say with confidence what the global forest sector will be like 6 or 7 years from now? Added to this challenge is the difficulty of designing programs that will meet the needs of employers that don't currently exist: change in the sector is so rapid that this problem is inevitable.

Towards the end of this issue, an article featuring the work of Ricardo Pelai emphasizes the importance of thinking carefully about the future. The article raises many fascinating issues, but the central tenet is the importance of understanding how people will react to "novel interventions". Essentially, this is about doing something that may be outside the experience of the people that may be affected, and understanding how they might react to these changes. This is an area of huge importance, particularly in areas that are traditionally rather conservative, such as forestry and conservation. There is massive inertia in the system, whether it be within the university, in industry, in government or amongst the public at large. Yet the world is changing rapidly and old and established ideas and methods are being challenged and, in some cases, overturned. Universities should be at the forefront in this area, but we have often failed to understand the resistance to change, even within the university. In addition, an averseness to risk may make any major innovation, particularly what is now known as a disruptive innovation, difficult. In some cases, this is dealt with through 'change management', but to do this successfully, we need to have a clear idea of the direction that we are headed, and the potential barriers and pitfalls that lie ahead. The conversation between Alice and the Cheshire Cat springs to mind.

As I have pointed out in previous editorials, the forest sector (broadly defined) in British Columbia faces many challenges. Listing the challenges sounds too much like a litany of disasters but, without being trite, every challenge represents an opportunity. We need to step back from the day-to-day management crises and think more carefully about where we are headed in the long-term. Doing so results in a different viewpoint, one that is not ruled by quarterly statements or annual targets. UBC has been developing a new strategic plan that looks to the next 10 years, and the Faculty will be revising its own plans to take into account the new directions outlined in the UBC plan. However, such documents are intended as guides, and it is very possible that we will need to adjust our course in response to local and global developments. With such major changes occurring in the composition of the Faculty of Forestry over the same time period, we are well-positioned to both adapt to and create change. A key to success will be in ensuring that we can convince everyone to join us on this journey.

John L Innes
Professor and Dean

forestrynews

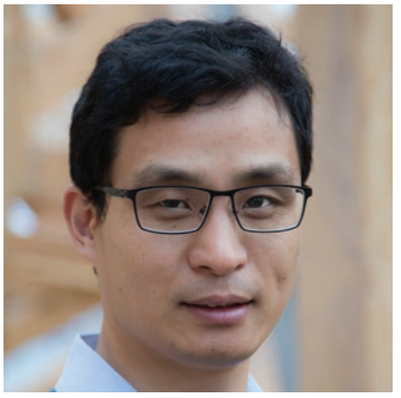
Nazlyn Pirani has joined the Faculty of Forestry as our new coop coordinator. Nazlyn previously worked with UBC Go Global, where she held the role of Global Seminars Advisor for the past 2 and a half years. She brings along a wealth of experience in working with students, youth, faculty, employers and the community in various capacities and across cultures. Nazlyn has lived and worked in 9 countries and believes that experiential learning provides the best complement to academics, student development and success, while ultimately leading to the development of active global citizens. She can be reached at nazlyn.pirani@ubc.ca.

Dr Dominik Roeser has joined the department of Forest Resources Management as an associate professor in forest operations. He holds a PhD in forest engineering from the University of Eastern Finland. Most recently, Dominik worked as senior director for FPInnovations, managing a multidisciplinary team focused on improving the competitiveness of the forest sector and developing solutions to reduce the impact of wildfires. He has more than 17 years of experience in forest operations and his research has focused on biomass supply systems to support the emerging bioeconomy in Europe and Canada. Dominik believes that forest operations can support all aspects of sustainable forest management and is excited about the opportunity to work on innovative approaches with faculty members, the forest industry and other stakeholders. He can be reached at dominik.roeser@ubc.ca.

Dr Andrés Varhola has joined the department of Forest Resources Management as a lecturer responsible for developing and teaching courses relating to hydrology, biometrics and forest management. Andrés is a forest engineer from Universidad Austral de Chile, with a PhD in Forestry from UBC. He has worked extensively inthe Ecuadorian forest industry as a silviculture head with leading roles in ISO certification and fire protection, supervising around 60 workers. More recently, Andrés has been teaching several forestry and earth sciences courses at UBC and Simon Fraser University – from Introduction to Biogeography to Advanced Remote Sensing and Sustainable Forest Management, among many others. Andrés is keen to develop cutting-edge teaching materials and methods adapted to our modern educational environment. He can be reached at andres.varhola@ubc.ca.

Holger Griess has joined the department of Forest Resources Management as a lecturer in forest operations and management. Holger received his education as a Forester in Germany at the Technische Universität München (TUM). He has worked as a researcher for the department of Forest Operations at TUM and for the Bavarian State Forest Institute. Prior to joining UBC, Holger worked for a consulting company in the lower mainland which specializes in forestry and natural resources. He believes that that the key to understanding forestry is a broad education in combination with an eagerness to improve using cutting edge developments. Holger is excited about the opportunity to teach undergraduate forestry students at UBC and to train them as leading professionals with a strong background in sustainable forestry. He can be reached at holger.griess@ubc.ca.

Dr Elizabeth Wolkovich has joined the department of Forest and Conservation Sciences as an associate professor in global change ecology. Elizabeth returns to UBC after 4 years as an assistant professor of Organismic and Evolutionary Biology at Harvard University. Elizabeth holds a PhD in ecology from Dartmouth, and has spent several years as a National Science Foundation Postdoctoral Fellow at University of California, San Diego. Her research interests focus on understanding and predicting the consequences of climate change for plant communities through the lens of phenology. Elizabeth is excited to continue addressing her research questions in her new role here at UBC. She will also be teaching courses in global change ecology and statistical methods. She can be reached at e.wolkovich@ubc.ca.



Dr Feng Jiang has joined the department of Wood Science as an assistant professor in advanced carbohydrate chemistry and sustainable functional biomaterials. Feng received his PhD in macromolecular science and engineering from Virginia Tech, and has been working on renewable cellulosic nanomaterials at the University of California Davis and the University of Maryland College Park. His research group here at UBC will focus on converting naturally abundant biomass into advanced functional materials complying with green chemistry practices. Targeted applications of materials developed in his lab will be used in environmental remediation, biomedicine, structure and building, as well as energy storage and harvesting. Feng will teach a course on carbohydrate chemistry and biomaterials at the undergraduate level. He can be reached at feng.jiang@ubc.ca.

Dr Intu Boedhihartono has joined the department of Forest and Conservation Sciences as an associate professor in tropical landscapes and livelihoods. Intu has a multidisciplinary background (anthropology, fine arts, cinematography and natural sciences) and has a doctorate in ethnology & visual anthropology from the University of Paris 7, France. Intu has worked for the United Nations Environment Program and the International Union for the Conservation of Nature in Switzerland. She joins UBC after spending 8 years running a master's program in development practice at James Cook University in northern Australia. Intu's research has sought to enable forest dependent people, coastal communities and indigenous groups to achieve a balance between conservation and social, cultural and economic development. Intu will be teaching in the Master of International Forestry program. She can be reached at agni.boedhihartono@ubc.ca.

Dr Jonathan Davies has joined UBC as an associate professor of ecology. He is appointed jointly between the department of Forest and Conservation Sciences and the department of Botany. Jonathan was most recently an associate professor in the department of Biology at McGill University in Montreal, Quebec. His research lies at the interface between ecology and evolution, making use of the information within phylogenetic trees to bridge between them. The integration of phylogenetic approaches in ecology has been transformative, and has given rise to new subdisciplines in biodiversity science, invasion biology, infectious disease research and community ecology. In his research, Jonathan addresses questions on the distribution of biodiversity and the challenges posed to its conservation. He can be reached at j.davies@ubc.ca.

Dr Terry Sunderland has joined the department of Forest and Conservation Sciences as a professor in tropical forestry and food security. He was previously a principal scientist at the Centre for International Forestry Research, Indonesia, where he worked on forests and food security, biodiversity conservation and integrated landscape management. Prior to this, he was based in West Africa working on conservation and livelihood-focused initiatives. Terry has a Master's degree in forestry from the University of Oxford and a PhD from the University of London. Having both a field practitioner and academic background gives him a wide perspective on conservation, livelihoods and issues related to sustainable landscape management. Terry is an active blogger, Twitter user and engages regularly with the media on disseminating research for policy influence and outreach. He can be reached at terry.sunderland@ubc.ca.

Dr Jeff Sayer has joined the department of Forest and Conservation Sciences as a professor of tropical forest conservation. Jeff is an ecologist who has worked at the interface of research and conservation practice in many tropical countries and for many different organizations. Jeff's approach to conservation and sustainable management has been very much influenced by working in areas where poverty is prevalent and where solutions to forest conservation and management problems have to align with the needs to improve the livelihoods of local people. Jeff was the founding director of the Center for International Forestry Research in in Indonesia. At UBC Jeff is contributing to the Masters of International Forestry program and conducting research on forest landscape conservation in Indonesia and Central Africa. He can be reached at jeffrey.sayer@ubc.ca.

Forestry students create content on UBC Wiki

Two years ago the Centre for Teaching, Learning and Technology (CTLT) developed UBC Wiki, a platform for student-created content, part of UBC's goal to train and inspire the next generation of global leaders. UBC Wiki pages facilitate the 'student as synthesizer of knowledge' that is freely shared with the global community.

With support from Will Engle and his team at CTLT, Janette Bulkan, assistant professor in the department of Forest Resources Management, worked with students in 3 courses – 2 undergraduate and 1 graduate – to create over 140 UBC Wiki pages on a range of forest and conservation topics. Only media elements under a Creative Commons License can be used in a Wiki page, so students learn about Intellectual Property Rights issues in a direct way. In addition students surveyed by CTLT listed increasing confidence in their own intellectual prowess, learning how to conduct research and working collaboratively among the benefits they gained while creating their pages, some now listed on their CVs.

A counter at the bottom of each Wiki page keeps track of the number of page views. Traffic to many of the UBC Wiki pages is impressive. The Wiki page on Illegal logging imports in India by Stephanie Lee, Master of International Forestry graduate (2017), has been viewed > 4,000 times. That page was the first item listed in a recent Google search of key words, 'illegal logging' and 'India'.

A page on the Flathead Valley – a Forest of the Ktunaxa Peoples of Canada and the Kootenai Peoples of the United States by TransforM student, Braydi Rice, led a researcher with shared interests to reach out to Braydi so as to continue the conversation.

So far, 29 of the UBC Wiki pages are the work of group collaborations; with the rest produced by individual students. Their topics are situated in 48 countries. Twenty-three pages are devoted to Canadian issues and 12 to Chinese, issues. Other pages focus on examples of collaborative management involving Indigenous Peoples or local communities.

You can listen to 4 students from the most recent 'Foundations of Conservation' course talk about their experiences while creating a Wiki page by following this link: https://ctlt.ubc.ca/2018/03/26/open-dialogues-using-wiki-pages-to-advance-student-created-knowledge/. *For more information about this project please contact janette.bulkan@ubc.ca.*

Trust and networks:

Experiencing my own research findings

By Ana Elia Ramón Hidalgo

Reconciling the conservation of natural resources with rural community empowerment is a much-needed endeavour, but remains a global challenge. Conservation and the well-being of rural communities have been seen as opposing goals in the so-called "development literature" for some time now. Clearly, these are not the only challenges we face as humans when learning how to thrive as societies while at the same time having a healthy relationship with our environment and with each other. Yet, in a world every day more attuned to the connections between conservation and rural empowerment and their relevance, the need to understand socio-ecological systems has gained attention in research and in practice. My research experience showed these 2 goals are not necessarily at odds, yet their relationships are complex. One way to navigate such complexity is to investigate how local social networks enable/disable the compatibility of these goals.

Community approaches to natural resources management (CBNRM), like community ecotourism, are one way in which international institutions are trying to reconcile the goals of conservation and rural empowerment. In particular, the role of trust and networks in the formation of strong CBNRM institutions is a line of research that has borne fruit. Trust and social connection are the basis for any functional relationship between people. They allow for the exchange of support, information, products or services. Today these concepts are associated with the term social capital. While employed in recent years to investigate policy and management improvements in CBNRM, social capital has become a popular buzzword to mean "anything social". Treating communities as homogenous entities creates further confusion when examining the role of social capital and devising appropriate local community practices. In this context, the aim of my doctoral dissertation was to investigate social capital as it relates to a diverse set of empowerment outcomes and equity impacts in 2 community-based ecotourism projects in Ghana's Volta Region. Knowing how these pieces work together helps us find better ways to manage natural resources for, and with, empowered communities. My hypothesis is that when people working in ecotourism are connected and trust each other, ecotourism projects thrive and may offer more benefits to people and the nature on which the ecotourism depends. Seems logical, right? Well, let me share some of the key insights this research uncovered:

Generally, people with more social capital (ie, more trusting and having a denser network of people to discuss tourism matters with) reported more empowerment from the ecotourism projects. However, socio-cultural norms seem to shape people's ability to both access social capital and be empowered by it. For example, women and people from the non-local ethnicities seemed less able to access ecotourism-related networks and benefit from ecotourism because of a set of explicit and implicit socio-cultural norms around who, where and when people may participate in tourism decisions. So, practitioners would be well advised to understand socio-cultural contexts and account for community and individuals' predispositions towards trust, reciprocity, and cooperation – as well as their accessibility and diversity of discussion ties – when assisting and assessing the empowerment potential of CBE projects.

My research also showed that understanding the structure of the discussion networks of formal and informal community leaders along with their perceptions of ecotourism, can help practitioners to locate areas of a network needing attention to improve ecotourism practices and outcomes. For example, these kinds of analyses may reveal the need to build ties among certain leaders, or encourage

information exchange between leaders with different knowledge bases.

Besides these key insights, the research process was very relevant to my understanding of what it means to do good community research. This study transformed me as a researcher and shaped the way some community members and local leaders reimagined the role of research in their lands. A recurring wondering through my PhD has been how one can be a good guest when doing research in foreign lands. In 2013, I lived for a few months in the 2 communities of study, both surrounded by some of the last remaining pockets of tropical Ghanaian rain forest. I was excited to support them with this study in the conservation of their forest while diversifying their livelihoods through ecotourism. In previous visits, I had approached the local leaders and followed the necessary protocols to ask for permission to do research on their ecotourism projects. In addition, upon my arrival to the communities and during 2 full weeks, I visited each household and introduced myself and my research purpose. Soon after I was invited to visit my neighbours' farms, graveyards, and the surrounding forests. Later, I also attended funerals, traditional ceremonies and community meetings. I helped fetch water and sand from the river during the women's communal labour days and was shown, among other things, how to cook palm oil and make palm wine. I clearly wasn't as helpful or efficient as local women but everyone seemed to be welcoming my willingness to watch, learn and respectfully contribute. Through these experiences and efforts we co-created a trusting environment and important social ties that enabled the communities to openly share their opinions about ecotourism and its challenges and in turn made this process much more meaningful, useful and engaging.

When I last visited them for the implementation of my knowledge mobilization plan, both communities were surprised at my return. I was partly surprised by their surprise. Residents told me that previous researchers and visitors would promise to come back but rarely did. These were not uncommon stories, but may only be part of the whole story. There may be good reasons for not returning. Yet, from what I heard, never had anyone returned to share insights from the research done in their lands. My knowledge mobilization plan aimed to do exactly that, and as a consequence enabled important community discussions on research results and its implications. It also provided the opportunity for local formal and informal leaders, men, women, locals and non-local residents to share ecotourism concerns and broader concerns. Additionally, discussions were held regarding possible amendments to their research approval protocols requiring researchers to share results in the communities.

My approach was in no way "perfect", but the research seems to have had an unexpected impact on many. In retrospect I now see that the ideas, stories and testimonies shared during my research wouldn't have showed up in such detail (or not at all) if it weren't for the willingness and efforts from everyone involved to build trusting relationships. I have since reflected a great deal and read more about the responsibilities and implications of community-based research generally, and specifically in Ghana. While some of my thoughts are still evolving, what I can see clearly is that we, as researchers, need to strengthen our capacity to be good guests and allies when doing research in foreign lands. While rigour and critical thinking are necessary pieces for highly achieved research, this can't be done at the expense of poor relationships. Research and researchers create many ripple effects and we should ask that we approach CBNRM research with great respect and consideration. This should include a persevering willingness to learn from both research results and the process. Social networks and social capital matters. Not only did I show that in my research analyses and results, but I also worked hard to bring that same understanding into the research process itself.

Chiefs from a traditional area in the Volta Region entering ceremonial grounds

Learning how to prepare the Jollof rice spice mix

Dr Ana Elia Ramón Hidalgo completed her PhD in the fall of 2017 with the support of a SHHRC IDG grant, UBC Forestry, PSI initiative and the FACT lab. She is currently a sessional lecturer in the department of Forest Resources Management at UBC. She can be reached at anaelia@mail.ubc.ca.

Working with the Namibia Nature Foundation

By Sarah Sra

Sarah Sra at Deadvlei in Sossussvlei

From a young age, I knew that the natural environment and wildlife sparked a passion within me that has become a central part of who I am today. Being lucky enough to come from a family that shares similar interests, some of my earliest memories include playing in the forests and rivers near my childhood home and trips to India where I was overwhelmed at the sight of magnificent jungles home to elephants, tigers and a whole new world of amazing creatures. After high school, I completed my bachelor's degree in human geography with environmental specialty at Simon Fraser University. It was during this time that I first travelled to Kenya and spent some time living with the maasai tribe, learning about their culture, way of life, and how they interact with the natural environment. After I completed my bachelors degree, I spent time working at Khama Rhino Sanctuary in Botswana, gaining valuable field experience while learning about complex conservation issues in Southern Africa. I had the opportunity to work with the rhinos hands on, participating in their daily care as well as educating the public on the importance of species conservation. I also had the opportunity to travel to Rwanda and Uganda where I was able to track gorillas and chimpanzees and learn about various endangered species, the benefits of eco-tourism and how humans impact the natural environment. I was convinced that this was the field in which I wanted to build my career, and in order to enhance my knowledge and open myself up to new opportunities, I decided to look into different programs to obtain my masters degree.

There are many reasons why I chose the Mater of International Forestry (MIF) program at UBC. I felt that the aim of the program overall aligned perfectly with my own goals and interests. I was able to learn about various international issues surrounding the natural environment while simultaneously gaining practical skills and knowledge needed to build my career. One of the things that I enjoyed most about the program was being able to learn from many different Forestry faculty members, all with diverse backgrounds. I couldn't wait to get into the field and start working and I feel as though the program truly prepared me to enter into the international workforce and gave me the necessary tools to

navigate through real world issues. The thought of having the opportunity to travel again for a mandatory internship to complete the degree was always very exciting to me, and since forestry is a multidisciplinary field, I found myself lost in countless ideas of where I might end up.

Namibia is a country that I have been fascinated with for years, and I was able to secure my internship with the Namibia Nature Foundation. The natural landscape here is stunning, with massive sand dunes that meet the ocean, some of the oldest deserts in the world and lush forests and rivers in the northern Zambezi region. Just over 40% of land is protected in the country and as of 2013 there were 79 registered communal conservancies that give rights over wildlife and natural resources to local people. This has resulted in an increased elephant population as well as expanding free-roaming lion and rhino populations. I have been able to witness first-hand the benefits of community based natural resource management through Namibia's unique but highly effective approach to conservation. I have learned how this approach empowers local communities, diversifies livelihood options, creates new business opportunities, restores species diversity, mitigates human-wildlife conflicts and combats wildlife crimes and poaching.

I have been busy balancing both office work and field work to gain as much working experience as I can during my internship. When I arrived in July 2017, one of my first tasks was to assist with a frame survey targeting fishermen along the Kwando River up north in the Zambezi region. We conducted interviews to understand local livelihoods and why the fisheries were collapsing, and I also filmed and produced a short documentary of the process. We researched how many people were fishing, what kind of gear they were using, how many fish they caught and what types of illegal activities they witnessed in the area. The result from the research has led to the establishment of fish protection areas and hiring fish guards with the participation of local communities. In the office, I found myself busy with various tasks including data entry, producing illustrations, putting together species composition lists, background research for various projects and organizing trips to the field.

One of the highlights of my internship has been participating in a game count in Khardom National Park, an area abundant with wildlife along the Botswana border, with the Ministry of Environment and Tourism. I spent 3 days camping with 2 colleagues very deep in the forest, taking shifts throughout the day and night counting each animal that came to our water hole, and In the first few hours alone we encountered over 300 elephants. I was also able to attend and volunteer at the Pathways 2018: Human Dimensions conference through my internship, which was my first time attending an international conference. I attended many fascinating talks by scholars from all over the world on topics surrounding the interactions and challenges between humans and wildlife. One of the most interesting talks I heard was about using livestock guard dogs to mitigate losses of livestock from predators in southern Africa, and how effective this had been in helping rural farmers deal with human-wildlife conflicts.


A young boy and his "mukolo" (canoe) by the Kwando River in the Zambezi Region of Namibia

Currently, I am assisting on a project to develop an integrated forest and wildlife management plan for the Zambezi State Forest and have been completing background research, becoming familiar with local legislation and learning about the factors contributing towards the degradation of the forest. I am currently in Katima Mulilo, a small town in the far north east, and have been making visits to the forest to complete some ground-truthing. I have observed the impacts of anthropogenic fires, human encroachment, illegal logging operations, and had the opportunity to engage in some stakeholder consultations. Although at some points working in a foreign country can prove to be challenging and daunting, what I have learned from my internship has been invaluable. The Namibia Nature Foundation has provided me with many opportunities to continue to learn and excel in a field that I am so passionate about, and has provided me with endless support along the way. I had originally planned to stay in Namibia for 6 months, however I still find myself here 8 months later as busy as ever working on diverse and exciting projects. I am looking forward to taking all of the valuable skills and knowledge that I have acquired during my time here in Namibia and applying it to future work and projects, wherever in the world they may be.

Sarah Sra (a recent MIF graduate) can be reached at sarah.sra11@gmail.com. Further information on the Faculty of Forestry's MIF program can be found at www.forestry.ubc.ca.

Tree species vulnerabilities in a changing climate

Major changes are occurring in the forests of western North America. The summer of 2017's record breaking wild fires have been associated with our warmer and drier summers. Previously, the mountain pine beetle outbreak killed huge areas of lodgepole pine forest in British Columbia and in the western United States. Climate change is partly to blame, and now the occurrence of such extreme events has been described as our "new normal".

Changes in climate and other disturbance events influence forest composition and the types of trees that are distributed across the landscape. While such disturbances can put stress on tree species, they can also create a potential for range expansions to areas that are more climatically suitable. Tracking shifts in tree species distributions will allow us to better recognize how forests are responding to climate change and will also help us to understand how we can help build species resilience in the future.

Amanda Mathys has recently completed her doctoral studies under the supervision Dr Nicholas Coops in the department of Forest Resources Management at UBC. Her research involved mapping current and future tree species distributions under changing climate conditions. Amanda was interested in identifying which species were the most vulnerable to climate shifts and which regions were expected to experience the least forest changes.

To accomplish this, Amanda used the process-based model 3-PG (Physiological Principles Predicting Growth) to determine the extent to which environmental limitations are affecting forest growth. The model calculates photosynthesis and growth responses to climate and produces outputs that are useful to both forest ecologists and managers. The model is simple to use and freely available at http://3pg.forestry.ubc.ca/.

The 3-PG model is driven by climate data and detailed soil information that provides information on the amount of soil water and fertility accessible to the trees. Such soil properties are rarely used in species distribution models despite their importance in influencing tree growth and distributions. Amanda used detailed maps of soil water availability and soil fertility, developed by combining information from satellite imagery and tree physiology, and showed that the predicted distribution of most of the tree species can vary greatly depending on the amount of available water within the soils.

To determine where tree species are likely to occur, Amanda combined the environmental limitations derived from 3-PG with an extensive dataset of tree species occurrences obtained from numerous sources across western North America. This dataset amounted to a total of 43,404 field survey plots. Amanda ranked the relative importance of the environmental limitations on species growth to infer the presence or absence of a species across the region. She assessed shifts in tree species distributions associated with climate change by first determining their historic distribution from 1950 to 1975. She then compared these baseline ranges to where a species is likely to occur under present climate conditions, as well as in the future, to assess the vulnerability of tree species to a changing climate.

Amanda found variations in responses among different tree species as well as across the diverse ecoregions of western North America. The greatest vulnerability to future climate change (from 2075 to 2100) was predicted to occur within North American deserts, particularly within the Thompson-Okanagan Plateau of British Colombia, where the current tree species in these regions experienced high stress. In contrast, the least change was predicted to occur along the west coast forests, extending from the coast of British Columbia to Washington and Oregon. Amanda found that the tree species located in subalpine forests were the most vulnerable to climate shifts. As species within these regions become more and more stressed, there may well be an invasion of tree species that are better adapted to novel climate

Climate change is already affecting the current composition of forest ecosystems. Tracking the distribution of tree seedlings reflects if and how species are beginning to respond to changes in their environment."

conditions, given that conditions are optimal for their establishment.

Climate change is already affecting the current composition of forest ecosystems. Tracking the distribution of tree seedlings reflects if and how species are beginning to respond to changes in their environment. Amanda used the large regeneration dataset RESULTS (Reporting Silviculture Updates and Land Status Tracking System), provided by the BC Ministry of Forests, Lands, Natural Resource Operations & Rural Development (BCMoFLNO&RD), to assess the extent that predicted tree species shifts agreed with the early establishment of tree seedlings under current climate conditions. She found good agreement between areas predicted to be suitable for tree species range expansion and the recorded distribution of tree seedlings. Habitats favourable for lodgepole pine experienced the largest relative increase in summer drought, posing stresses on the tree species. In contrast, areas dominated by western larch experienced the least limitations and this species was projected to expand northward in BC. Seed sourcing requirements have been changed to allow small amounts of western larch to be planted outside its natural range in BC. The idea is to assist tree species migrations by planting those species and populations that are preadapted to future climates. The outcomes from this study will contribute to existing assisted migration efforts by identifying areas that are climatically suitable for tree species range expansion and for planting of species that are resilient to climate shifts. The modeled tree species distribution and vulnerability maps from this research are publicly available at www.databasin.org. Given the vast area that has opened up following the wild fires of 2017, now is the time to be proactive when considering which species to replant in a changing climate.

This research was carried out by Dr Amanda Mathys (recent doctoral graduate and now a research consultant with the Center for International Forestry Research in Indonesia), Dr Nicholas Coops (department of Forest Resources Management) and Dr Richard Waring (Oregon State University). Project funding was provided by the NASA Biodiversity and Ecological Forecasting program, an NSERC Discovery Grant and an NSERC CGS and TerreWEB Scholarship. Numerous researchers contributed to this project, including Dr Todd Schroeder (USFS) and Dr Andreas Hamann (University of Alberta) who provided the tree species plot data in western Canada and the United States. Dan Turner, Matt LeRoy and Caroline Wood (BCMoFLNO&RD) provided access to the RESULTS database in BC. For further information, please contact Dr Amanda Mathys at amathys@alumni.ubc.ca or Dr Nicholas Coops at nicholas.coops@ubc.ca.

What happens to surface fuels after forest wildfires?

Forest wildfires have immediate effects on forest carbon stocks due to carbon consumption during the fire. However, they also result in post-fire transfers from live to dead carbon pools and from standing to downed carbon pools. Carbon from dead pools is eventually released into the atmosphere. Thus, forest wildfires initiate changes in carbon stocks that may continue for decades. It has been shown that post-fire carbon emissions can greatly exceed carbon emissions due to combustion during the fire. Yet, we lack detailed understanding on what exactly happens in the different carbon pools after forest wildfires. Many existing studies are restricted to case studies of individual fires. Other existing studies are based on chronosequences (sites that share similar attributes and only differ in the time since fire). These case study and chronosequence approaches tend to focus on a set of limited conditions—for example on ponderosa pine stands or high severity wildfires.

Surface fuels contain downed dead wood in different size classes that are commonly referred to as either twig, branch, large branch or log fuels as well as litter (freshly fallen non-woody material) and duff (partially decomposed biomass). Surface fuels receive a lot of attention in fire management because this fuel layer is often used to predict fire behaviour. Therefore, understanding post-fire dynamics of surface fuels is important to make decisions about post-fire fuel management, for example to avoid re-burns of areas previously affected by wildfires.

Taking advantage of repeated post-fire measurements on 191 California inventory plots from 49 fires, Dr Bianca Eskelson (assistant professor of forest biometrics in UBC's department of Forest Resources Management) estimated surface fuel dynamics up to 9 years post-fire across 3 fire severity classes in dry conifer and hardwood stands in California, USA. Depending on the fuel type, post-fire surface fuel dynamics differ substantially among fire severity classes—low, moderate, and high—as well as between forest types. In the first 9 years post-fire, duff biomass did not change significantly regardless of forest type and fire severity. Litter, twig and branch fuel loadings peaked 6 years after the fire in dry conifer stands but increase at a constant rate over the first 9 years post-fire in hardwood stands. Large branch and log fuels increased at a constant rate for both forest types with varying rates by fire severity.

Bianca's research focuses on quantifying disturbance effects and post-disturbance dynamics. This study, performed in collaboration with Dr Vicente Monleon from the US Forest Service, provides unparalleled insights into surface fuel dynamics after wildfire. The data used in this study are a sample across the entire state of California, which therefore covers the variability in forest wildfire characteristics and forest stands in the state. The wildfire and forest stand conditions represented in this sample are representative of what occurs on the landscape. Thus, the estimated trends from this study can be generalized to all wildfires in the region that burned with low, moderate, or high severity in hardwood or dry conifer stands. Regional inventory data—like the data used in this study—collected with a spatially balanced design and re-measurement cycles, provide opportunities to analyze post-disturbance dynamics as demonstrated. As many natural disturbances are expected to increase in frequency, severity, and duration, it is more important than ever to invest into regional inventories with re-measurements that will allow us to understand forest ecosystem responses after natural disturbances.

For further information, contact Dr Bianca Eskelson at bianca.eskelson@ubc.ca or or see her publication (Eskelson & Monleon) in the International Journal of Wildland Fire, February issue. Funding for this research was provided by the US Forest Service Pacific Northwest Research.

Clearing up water quality


Photo: Alex Yeung

Gillian Fuss cleaning and taking care of one of her turbidity sensors in (literally) Van Horne Creek, near Shawnigan Lake, BC

Canada is in the special position of having over 9% of the world's fresh water. However, managing that water isn't always straightforward. Surface water sources (lakes, rivers and streams) are where many Canadians get their drinking water from. Poor water quality in these areas can be caused by many things. For drinking water, the main concerns are pollutants (such as nitrogen), aesthetics (how appealing water looks to the drinker) and viruses/bacteria. Often, these are caused by an increase in the number of particles in the water column. Aquatic ecosystems have similar concerns, for example unclear water can decrease photosynthesis, which can have cascading ecosystem impacts. Aquatic animals (such as fish, frogs or invertebrates) are also affected by water clarity, as reduced visibility can impact the animals' ability to find food or mates. Additionally, high particle levels can interfere with the breathing apparatuses of many aquatic organisms, potentially causing suffocation.

Generally, particles in the water column are increased by runoff, which is water that flows over land and picks up surface particles. This can include inert materials, organic matter (including viruses or feces), and pollutants, all of which reduce water clarity and increase particle concentrations. All of these sources can be influenced by geology or landscape surface, as well as human activities. For example, forestry can dramatically disturb soil, increasing the amount of material picked up by water runoff. By comparison, urban areas typically involve runoff over roads, and so may have hydrocarbons or other pollutants as well as other materials. As cities grow larger in Canada, these concerns continue to grow. Furthermore, high levels of particles can interfere with effective water treatment, either by disrupting the disinfection process, or by simply having too high loads of particles to treat. Therefore, it is important to understand how water quality is being impacted by the many activities on the landscape in order to effectively manage it.

As part of the Richardson lab in the department of Forest and Conservation Sciences, and working closely with environmental professionals from Aqua-Tex Scientific Ltd, Gillian Fuss analyzed water quality in headwater streams for her recent master's research. Headwater streams are small streams at the top of drainage networks that receive very little legislative protection, but can influence the rest of the network. Her focus was understanding turbidity: a measure of water clarity, which can be used to estimate the number of particles in the water. Turbidity has become one of the most common ways to assess water quality in North America.

Gillian's research involved 2 field sites. The first was in the Malcolm Knapp Research Forest, where she analyzed turbidity in 3 streams with historical forestry, but no present land use modifications. Her second site was the Shawnigan Watershed, which had a range of land-use modifications, including agriculture, industry and residential areas. Her work showed that turbidity frequently went above the water quality standards from small events, even in catchments without land use modifications. This suggested that the current standards may be too strict for these areas, and difficult for water managers to maintain. For the catchments with land use, she found a significant correlation between industrial land use (in the case of Shawnigan contaminated soil processing sites) and tributary turbidity. This suggested that areas with small streams, even where riparian buffers are enforced, are still at risk for degradation. Finally, she found that land use impacts could be very high in one area, and less pronounced in another, suggesting that water quality issues may go unnoticed in areas of limited monitoring. Overall, her research has pointed to critical gaps in the current legislation and methods towards water quality monitoring in the Pacific Northwest.

For further information, contact Gillian Fuss at gillianefuss@gmail.com or Dr John Richardson at john.richardson@ubc.ca.

Commercial thinning: A way to mitigate BC's midterm timber supply shortage

The recent mountain pine beetle *(Dendroctonus ponderosae*) (MPB) epidemic in BC has killed large volumes of pine, detrimentally affecting forest health and economics. Much of the standing dead timber was harvested before it was no longer merchantable or lost to fire. The Annual Allowable Cut (AAC) was increased in affected areas in order to allow licensees access to available timber. Additionally, licensees were required to include specific ratios of beetle killed pine in their overall volumes harvested.

The forest industry in BC requires continuous availability of mature and harvestable timber. Because profit margins are comparatively low, the industry is sensitive to changes in supply. To help provide a continuous flow, long-term sustained yields (LTSY) are calculated to inform AAC determinations. In an ideal situation, every year the same amount of timber would be available for harvest, very much like in a 'normal forest'. Now that most of the available beetle-killed timber has been salvaged, or is no longer suitable for commercial use, the AAC will have to be lowered to pre-MPB levels. This could be a challenge for companies that have adjusted to the larger available volumes. An additional challenge is that the use of large amounts of beetle killed timber has included the harvest of stands that would – under normal circumstances – have been left to grow and would have contributed to current and future timber supply. Overall, the MPB epidemic has caused what we now call a "midterm timber supply shortage", or a gap in age class distribution. This imminent shortage was identified in mid- to long-term supply studies, such as those carried out to determine AAC, or those required for the development of a sustainable forest management plan.

Researchers at FRESH (the Forest Resources and Environmental Services Hub, led by Dr Verena Griess) are working with the Canadian Wood Fibre Centre on possible solutions to this issue by focusing on the use of commercial thinnings. In commercial thinnings, a forest stand is thinned by harvesting a predetermined amount of the total standing timber before the stand reaches maturity. This allows an additional and earlier, but smaller, revenue generation from stands when compared to a clearcut only approach. The remaining stand continues to grow until it reaches maturity when a final harvest is scheduled. Such 2-pass systems allow for both short and long term economic returns and are widely used in Europe and other countries. However, they require an in-depth understanding of the natural processes and dependencies in a forest ecosystem and are associated with a number of challenges around economic feasibility.

To understand whether or not commercial thinnings are a possible option in helping to mitigate timber supply shortage in the province, we developed a timber supply model for Bulkley TSA (Timber Supply Area) in northwestern BC. Bulkley was selected as a typical interior TSA heavily impacted by the MPB epidemic. Forecasts and analyses for Bulkley TSA reveal that there is a lack of timber in the age cohort ranging from 60 to 79 years. If timber is scheduled for harvest at 70 to 130 years of age, a shortage in available timber is expected, starting 10-20 years from now.

We developed 6 heuristic modelling scenarios for Bulkley TSA combining different minimum stand volumes for a stand to be eligible for thinning at different distances from existing roads. All scenarios required a relatively stable harvest flow not fluctuating by more than ±10% per decade. Additionally each scenario was required to ensure the maintenance of a non-declining growing stock in the last 100 years of the 250 year planning horizon. The overall goal of all 6 scenarios was to maximise timber harvest.

Clearcuts were prioritized over commercial thinning, which was only carried out if clearcuts did not yield the required timber volumes per period. Stands were commercially thinned 20 years before reaching rotation age, and 40% of the timber was extracted from each stand on the first pass. For reasons of economic feasibility, stands needed to contain at least 100m^3/ha of timber in order to be eligible for thinning.

The basecase scenario (Scenario 1) represented the status quo and allowed forecasting current management plans in place. Stands are harvested when they reach a minimum volume of 150m^3/ha using clearcuts only. The first alternative scenario, Scenario 2, allowed clearcutting in stands that have reached a minimum volume of 150m^3/ha and commercial thinnings are allowed in stands that are located within 300m of an existing road. This limitation is lifted in Scenario 3 where clearcutting was allowed in stands of 150m^3/ha or more and commercial thinnings occured throughout the harvestable landbase. For

scenarios 4-6, instead of a minimum volume, the CMAI (culmination of mean annual increment) was chosen to select stands to be harvested in each period. CMAI is the point in time in a forest stand's life at which volume increments are just about to decrease. For Scenario 4, clearcutting at CMAI and no commercial thinnings were scheduled. In Scenario 5, clearcutting was scheduled at CMAI and commercial thinning occured within 300m of roads. Scenario 6 scheduled clearcuts at CMAI, and allowed commercial thinning throughout the harvestable landbase.

Our results show that Scenarios 5 and 6, which allowed commercial thinning and clearcutting at CMAI, are the most promising scenarios for the mitigation of midterm timber supply shortage in the case study area. Results indicated that timber harvest volumes would, over the planning horizon of 250 years, fall within +/-2.1% of harvest levels of the basecase scenario, and the timber supply shortage would be dramatically shortened or entirely eliminated. Overall, the resulting age class distributions would be more uniform and would allow for a balanced LTSY.

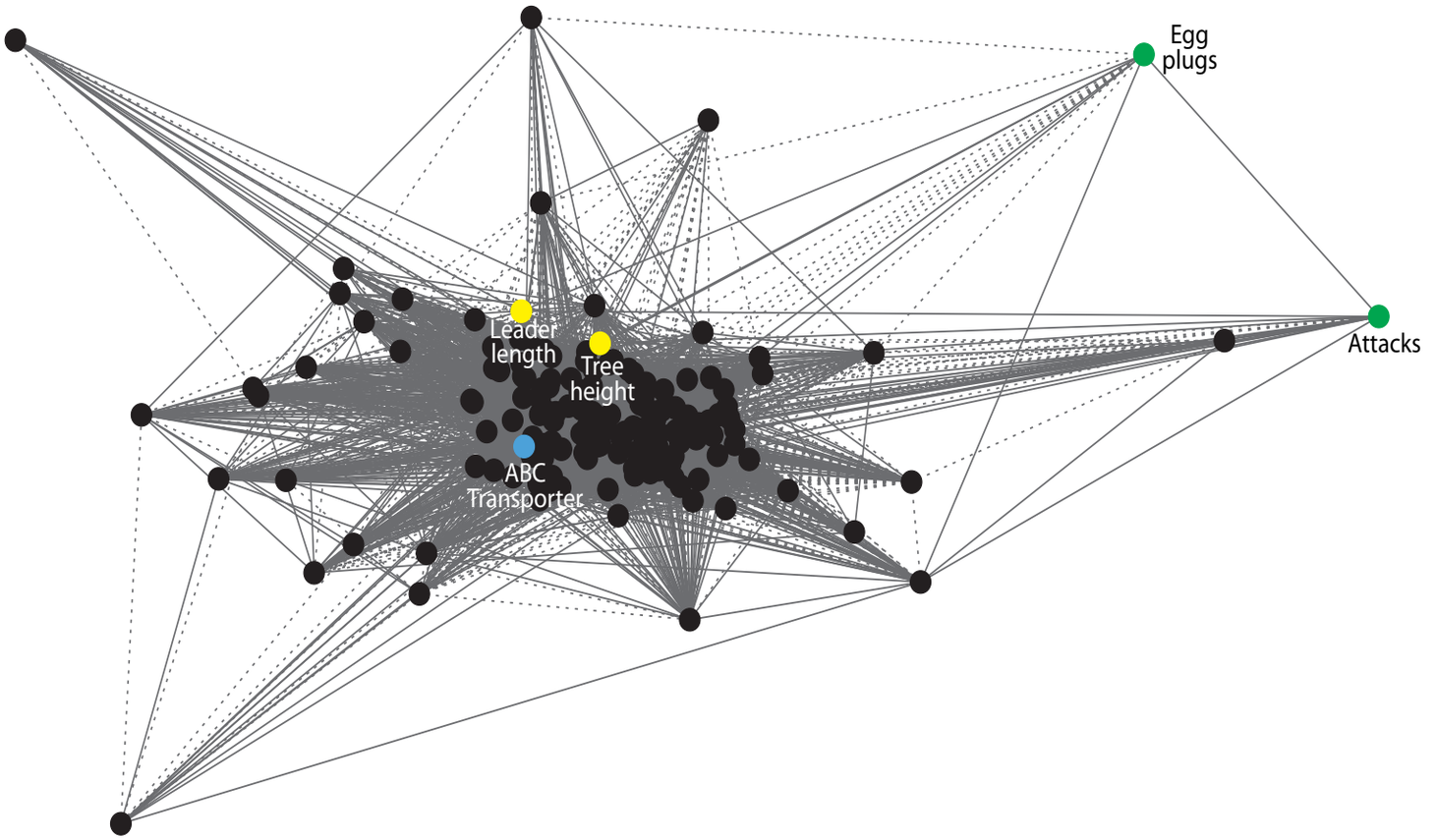
These positive results led us to explore additional alternatives such as flipping harvest prioritization to increase commercial thinning activities, and using clearcuts only to complete the volumes required to meet harvest flow requirements (LTSY). For Scenario 5, this approach led to higher timber volumes harvested over the planning horizon, and a similar age class distribution to when clearcutting was prioritized. This finding suggests that using commercial thinnings can result in higher overall timber volumes available for commercial use.

Finally, we used an alternative software product to re-model Scenarios 5 and 6. This product included an optimizer, allowing prioritization between commercial thinning and clearcutting, given that the maximisation of timber harvest was the set goal. This alternative software simulated lower amounts of timber available for harvest in Scenarios 5 and 6, and led to the creation of a more uniform age class distribution. As before, these findings hint at the potential for commercial thinning in mitigating midterm timber supply shortage.

While our initial findings indicate that commercial thinnings should be considered in the development of policies and approaches to mitigate timber supply shortage, additional questions need to be answered before robust recommendations can be made. These unknowns include the effects of differences in assortments stemming from commercial thinning operations, the costs of building and maintaining additional infrastructure such as roads, the economic impacts of a change in required machinery, or the effect of thinning on the actual growth in forest stands. Ultimately, the question of how forest policies can ensure that licensees benefit from their silvicultural investments needs to be answered before forestry in this province will be able to benefit from more sophisticated harvest approaches such as 2-pass systems.

For more information, please contact Dr Verena Griess at verena.griess@ubc.ca, or research assistant Jillian Spies at jgspies@mail.ubc.ca, or visit our webpage at http://fresh.forestry.ubc.ca/projects/.

Inferring gene networks for growth and defence in spruce



Networks are becoming a paradigm for understanding biological systems. The type of network can range from molecular signaling pathways among genes, to neural networks in the brain, or to interacting species in a food web (social networks). Genomics makes the study of gene signaling networks possible. In particular, the "transcriptome" or set of transcripts generated by all genes in the genome (prior to conversion to proteins) can be precisely examined for its level of expression, and such gene expression values could be analyzed in the same way as any other quantitative phenotype. As part of the Genome Canada "Treenomix" and "Conifer Forest Health" projects, Dr Kermit Ritland, in the department of Forest and Conservation Sciences, has been applying network tools to identify critical genes involved in host tree resistance to insect pests in Canadian tree improvement programs.

Kermit and coworkers from Genome Canada projects have developed an innovative approach to dissect gene networks underlying the relations between growth and defence traits in white spruce. In traditional gene network analysis, the proximity of genes is gauged by their co-expression, which is measured by the ordinary correlation coefficient (Pearson coefficient, or total correlation coefficients). To extend this analysis, the group used partial correlation analysis to help identify spurious external sources of variation that confound the direct association (total correlation) between pairs of genes. Their aim was to identify "core" or master genes that reside in the core of a network, and thus have a greater influence on other genes. Such genes have different properties. For example, other researchers have shown that highly connected genes within the core of the co-expression network in flushing buds of *Populus tremula* (European aspen) have experienced stronger natural selection than those in the network periphery, and hence are of more importance in adaptation and growth. Kermit and his team expect that by identifying such core genes, they can increase the effectiveness of tree improvement programs.

The pathogen problem in spruce

The white pine weevil (*Pissodes strobi*) is a major pest of white spruce in British Columbia The weevil occurs throughout Canada, but is a problem only in BC and also, interestingly, on Norway spruce (but not white spruce) in Quebec. The insect larvae feed on

White pine weevil

younger spruce trees (5-25 year old) during the spring, consuming the phloem of the apical leader (previous year's growth), and destroying its vascular system. As a result, the leader becomes girdled and dies. Recurrent weevil attacks substantially reduce lumber quality due to the severity of stem deformations and growth losses. For several years, the UBC Genome Project has been studying the white pine weevil in collaboration with the Canadian Forest Service (Dr Rene Alfaro, entomologist emeritus) and the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (Dr Barry Jaquish, spruce tree breeder at Kalamalka Research Station, Vernon, BC). The stakes are not small: among conifers, spruce is the most significant forest resource in Canada, with 14.2 billion tons of above ground biomass and c. 400 million seedlings planted annually.

Reconstructing gene regulatory networks

To infer networks, Kermit's group analyzed transcriptomics data obtained from terminal shoot bark tissue. One example of an inferred network is shown in the figure. Note the network also includes growth traits (green dots) and defence traits (yellow dots), as they are quantitative traits just like gene transcripts; their location is arbitrary but they must be present in the network of transcripts (otherwise the network would not be involved with growth or defence). The blue dot is a "core gene", in this case a drug resistance gene (ABC transporter). Identification of such key genes for growth and defence is the critical inference of our analysis.

Functional genomics involving growth and defence

Functional genomics seeks to understand the relationship between genes and traits (gene function). On a genome-wide scale, it might uncover so-called "master regulons", which are genes that underlie a massive extent of trait variation, which can affect both other genes and multiple traits (pleiotropy). Quantitative genetics approaches that correlate trait variation to genotype have been quite successful in uncovering the presence of such functional pleiotropy in forest trees. Importantly, functional genomics can uncover not only trait interrelations, but also potential tradeoffs in life-history evolution of forest trees. Also knowledge about such tradeoffs is important in understanding tree ecosystem functioning and host tree-environment interactions. Tradeoffs in life-history evolution also have direct implications on biodiversity and conservation. With regards to coevolved host defences and herbivores, tradeoffs between life-history traits involve the hierarchical allocation of resources to biochemical pathways for growth on one side versus defences on the other side. Because the underlying genetic interactions are possibly manifold, genomic investigations can disentangle this myriad of interactions and demonstrate evolutionary tradeoffs between growth and defence.

Understanding the molecular basis of forest tree growth and development is crucial for the selection of stress resilient trees with enhanced biomass productivity. In particular, knowledge about trait interrelations can help predict the response to selection for a valued trait, or a set of traits. When traits are genetically correlated (share the same genetic variants), they are constrained to evolve independently, and generally do not reach the global optimum as predicted by Fisher's fundamental theorem of natural selection. In addition, the interactions between the various resistance genes that determine overall resistance are complex, and network analysis captures that complexity.

Network analyses and causal inferences

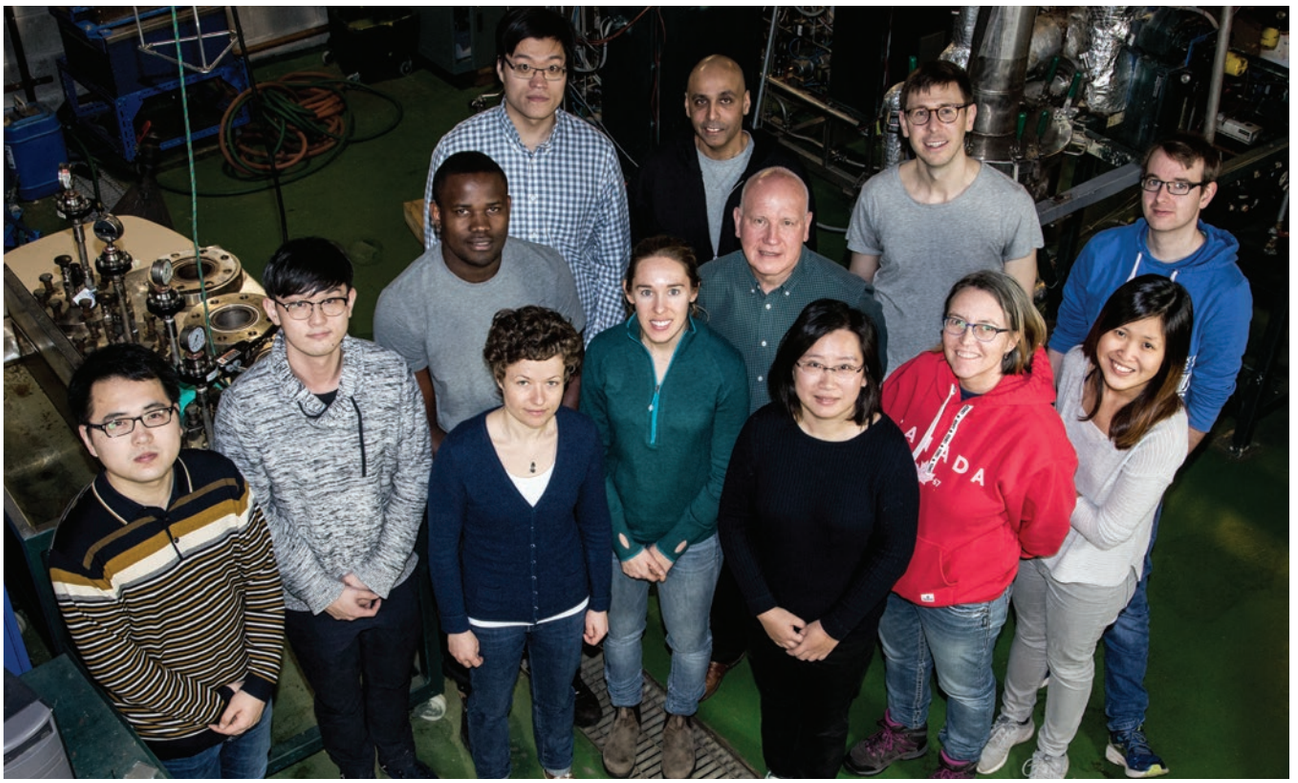
The "network" representation of biological relationships is relatively new in biology. It seems natural for disciplines such as spatial ecology, where individuals interact across spatial dimensions. In these cases, sharing of environments can be a basis for a network correlation coefficient. Network analysis is also applied in neurobiology where data on electrical brain impulses are analyzed for association among networks of neurons to understand the functioning of the brain. With regards to our own approach, an application of partial correlation analysis is to infer direct influences upon stocks traded in a stock market. For example, in the New York Stock Exchange, partial correlation analysis has revealed that stocks belonging to the investment services subsector were the most influential stocks influencing the correlation profile of the entire market. In fact, the inference of causation in these networks is essential to the full understanding of their properties.

Network analyses have emerged as a powerful tool to untangle complex intertwined relationships between variables and ultimately aid in the identification of core genes. Targeted selection of these core genes will help us meet the dual objectives of breeding for resistance and growth in our vast stands of spruce.

For further information on these research projects, contact Dr Ilga Porth (former post doctoral fellow with Kermit Ritland and now a faculty member at L'Institut de biologie intégrative et des systèmes, Université Laval) at ilga.porth@sbf.ulaval.ca, or Dr Kermit Ritland (Forest and Conservation Sciences) at kermit.ritland@ubc.ca.

research lab profiles

Forest Products Biotechnology/Bioenergy Group



The Forest Products Biotechnology/ BioEnergy (FPB/B) group, led by Dr Jack Saddler, has trained over 100 graduate students, post-docs and research associates over the past 20+ years. Many of these graduates are in senior positions in academic, industry and government positions around the world, most still involved in some aspect of "greening the global economy". Reflecting this focus, prior to COP 21, Dr Jack Saddler was on sabbatical in Paris, in the renewable energy division of IEA, helping set the targets for how bioenergy and biofuels could contribute to decarbonizing the global economy.

As well as being multinational, the FPB/Group is multidisciplinary. The students have come with backgrounds in disciplines such as forestry, forest products, microbiology, biochemistry, chemical engineering, business, law, pulp and paper. The current focus of the group can be broadly categorized as "developing a forest based biorefinery approach to decarbonizing the economy". Projects undertaken have ranged from how forest certification schemes (such as the Forest Stewardship Council and Sustainable Forestry Initiative) might be adapted to ensure the overall sustainability of the bioproducts/biofuels derived from forest resides, through to the possibility of repurposing a newsprint mill as the front-end of a biorefinery (with the help of enzymes). The group has pioneered processes such as using steam pretreatment and enzymes to selectively break down carbohydrates to sugars (that can be fermented to products such as ethanol). These same enzymes, or components of the enzymes, can also be used to selectively modify high value materials, such as nanofibrillated cellulose or dissolving pulps, to enhance their properties.

The group has been a key player in several national networks, including co-leading the NSERC-Strategic Bioconversion Network (with Dr Hung Lee at Guelph), active roles in the BioFuelNet Centres of Excellence and the Forest Innovation by Research and Education Network. The group plays a key role in the International Energy Agency Bioenergy Task 39 network on Liquid Biofuels (www.Task39.org) which has increasingly emphasized policy and techno-economic aspects, as well as the overall sustainability of these "greener technologies" using tools such as LCA. A major focus of the group's ongoing work, sponsored by companies such as Boeing, Air Canada and WestJet, is drop-in biofuels that have been defined by Task 39 as "functionally identical to petroleum fuels and fully compatible with existing petrochemical infrastructure".

As might be imagined, to cover the depth and breadth of the projects described above requires the hard work and creativity of a multi-talented team of dedicated individuals.

Who works in the FPB/B Group?

Ms Gladys Tecson (Group Manager) deals with personnel issues, manages finances, interfaces with international groups such as the IEA and liaises with financial units within and outside of UBC.

Dr Richard Chandra (Senior Research Associate) is helping to elucidate our better understanding of biomass recalcitrance. He is also applying the selectivity of enzymes to areas such as dissolving pulp and nanofibrillated cellulose.

Dr Susan van Dyk (Research Associate) is the Coordinator of IEA Task 39 (Liquid biofuels) (http://Task39.org), leads the groups policy work on tasks such as the ATM biojet project.

Dr Vera Novy (PDF) is putting wood-decaying fungi under the microscope to learn from nature's own approach how to efficiently break down plant materials for use of the component sugars.

Dr Fredrik Nielsen (PDF) is developing resource efficient process technologies to address the need for efficient pretreatment methods for softwoods and allow newsprint facilities to reposition themselves as biorefineries.

Dr Ran Bi (PDF) is working on chemical and enzyme fibre modification by chemically/biochemically introducing functional groups on to cellulose to make it more hydrophobic.

Dr Mahmood Ebadian (PDF) is working on supply chain aspects of the forest residues-to-biojet project. He is also involved in the IEA Bioenergy Task 39 activities.

Dr Masatsugu Takada (PDF) is assessing the role that lignin plays in restricting enzymatic deconstruction of biomass through both a more fundamental, mechanistic approach as well as a more applied approach.

Na (Joanna) Zhong (PhD student) is assessing the benefits of integrating sulphite treatments prior, during and after steam pretreatment to enhance the effectiveness of the enzymatic hydrolysis and fermentation of the biomass derived sugars.

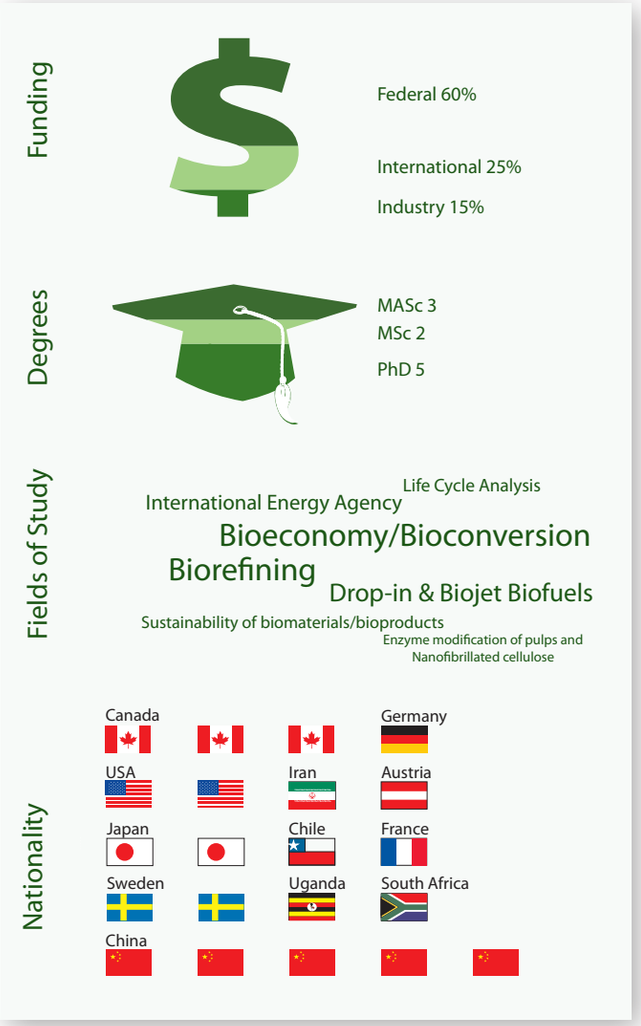
Timo van der Zwan (PhD student) is completing research on the influence of cellulolytic enzymes on biomass slurry rheology and the impact this enzyme action has on bioconversion processes.

Kevin Aïssa (PhD student) is studying the roles of various carbohydrate structures in lignocellulosic substrate during enzymatic hydrolysis. He also hopes to develop new ways to "activate" cellulose surfaces as a way of developing renewable biomaterials.

Jianping Su (PhD student) is assessing the technical, economic and environmental potential to co-process lipids (oils and fats) and bio-oils (from forest residues) in oil refineries for drop-in biofuel production.

Jie (Adam) Wu (PhD student) is adapting pulping techniques, particularly mechanical pulping that produces newspaper, to a pre-treatment method for use in future biorefinery processes.

Drake Mboowa (MSc student) is studying cellulase enzymes over a wide range of cellulosic and lignocellulosic materials with the goal of developing a method that can better predict how well these enzyme mixtures breakdown these materials to fermentable sugars.



Anna Ringsred (MASc student) is using Lifecycle Analysis to calculate the sustainability of biofuels from cultivation of the feedstock through to production and combustion of the biofuel. Her work focuses primarily on biojet fuels.

Daniela Vargas Figueroa (MASc student) is studying the potential of using a variety of novel fungal and bacterial accessory enzymes to enhance the bioconversion process and improve the efficiency of biomass deconstruction.

Rou Yi (Joey) Yeap (MASc student) is using a combination of enzymes and chemicals to increase the hydrophobicity of cellulose.

Fraser LaRoche (MSc Student) has completed research on how the use of forest residues under current BC forest management standards does not fulfill some sustainability requirements defined by trade policies.

Yanliang Song (visiting scholar) is looking at the pretreatment and deconstruction of lignocellulose and its influence on cellulose accessibility and lignin structure.

Alex Sigg (visiting MSc student) is from the Technical University of Munich, Germany. Alex is looking at heterogenous enzyme catalysis and hopes to provide insights into enzymatic hydrolysis of lignocellulosic substrates from a kinetic view point.

How can you contact the FPB/B Group?

You can visit the FPB/B web page at www.bioenergy.ubc.ca or contact Dr Jack Saddler at jack.saddler@ubc.ca.

Thinking socially about novel interventions in resource management

Photo by Government of BC

Assisted migration adaptation trial in BC

We live in a world that is rapidly changing. Global environmental change has altered long-term climatic conditions, contributed to biodiversity loss, and affected the productivity of forests. Many of these impacts are unprecedented and irreversible. As a result, species populations might not be able to adapt to these rapid changes. Conventional interventions in forestry and conservation such as reforestation with native species, or the creation of protected areas respectively may not be sufficient to conserve species of interest, and/or to maintain productive forests. Thus, some scholars, practitioners, and policy-makers have called for novel interventions. Examples include i) assisted migration of trees - the deliberate translocation of tree species and genetic material outside of native ranges to areas where they are expected to grow healthily given climate change, and ii) the re-introduction of species to places from which they were extirpated in historical times for conservation.

Humans have historically made use of interventions to alter their environment and shape their surroundings. However, what is unprecedented today is the scale and the speed at which technology-driven, human-caused change is taking place. Tools such as genetic engineering, genomics, and more recently gene drive technologies have facilitated the use of novel interventions in resource management. As a result, more provocative and potentially disruptive interventions have emerged, including the use of genetic engineering to modify trees with desirable traits, or using genetic engineering to bring back once-extinct species (proxy species). Numerous potential benefits of novel interventions are documented; however, implementation is controversial and continues to face technical, biophysical and societal challenges.

Ricardo Pelai has had the opportunity to explore these issues over the past 3 years through a number of initiatives and roles within the Faculty of Forestry and UBC more broadly. As an undergraduate and now graduate research assistant in the Social-Ecological Systems Research Group, Ricardo has worked on projects relating to societal aspects of novel interventions in resource management (PI Dr

Shannon Hagerman). His undergraduate thesis (supervised by Dr Hagerman) explored the scientific literature's narratives of novel genetic technologies in forestry and agriculture. As part of a group effort for a class project at the UBC Institute for Resources, Environment and Sustainability, Ricardo's group investigated the degree to which social considerations were included in a Parks Canada project to re-introduce bison into Banff National Park. Ricardo is currently a Master's student in Forestry. Through his MSc degree (co-supervised by Drs Hagerman and Kozak), he is setting out to explore the governance dimensions of genomics-based assisted migration in the BC forest sector (more details below).

After providing some brief context about the controversy novel interventions have generated, 3 main reflections arising from these projects are offered. Namely, the complexities of novel interventions governance, the value of social sciences insights, and more broadly, the sector-specific effect with respect to novel interventions.

Controversy surrounding novel interventions

Novel interventions have called into question the long-standing assumption that local is best, and that ecosystems are (or ought to be) stable. Heated debates in academic and practitioner circles have also surfaced questioning what the relationship of humans and the environment should be, and to what extent humans should intervene in, or control nature. A plethora of additional concerns has been raised regarding potential technical and socio-economic risks.

Numerous novel interventions have already generated a formidable public opposition. In the eyes of the public, novel interventions are often perceived as too risky. However, public perceptions of risk are far from being 'irrational.' It is crucial to keep in mind that perceptions of risk are socially constructed, subjective, and historically situated. There is indeed a well-studied logic behind people's perceptions of risk, which may be affected by previous experiences with hardships, legacies of mistrust, knowledge and awareness, and demographics (eg gender). An attempt to simply 'educate' the public to fill a real (or perceived) knowledge gap merely offers a unidimensional way of understanding societal concerns at best, and a tokenistic response to global environmental change at worst.

Drawing by Frits Ahlefeldt

Technology assisted migration of endangered species

Unanswered governance dilemmas

In addition to the numerous technical, biophysical, and public opposition challenges, there are perhaps even more acute challenges related to governance. If novel interventions are deemed necessary to help species and ecosystems adapt to global environmental change, then our institutional mandates, legal and regulatory mechanisms (eg laws), and governance processes (eg public deliberation) will inevitably have to adapt as well. Yet, science and technology, as well as the novel interventions they enable, seem to evolve asymmetrically with policy and institutions. Novel interventions in forestry and conservation are perplexing from a governance standpoint: on the one hand, there is a consensus in the academic literature that governance mechanisms should be in place before novel interventions are widely implemented. Yet, developing actionable mechanisms in the absence of something substantive to regulate is not easy to achieve. This was evident when distilling recommendations from the scientific literature on how to move forward with novel interventions, as most governance-related recommendations tend to be based on general principles that are too vague to be actionable.

Importance of social sciences insights

Novel interventions in resource management will likely increase in the next few decades. With perceptions of risk being inevitable, and uncertainty pervasive, the implications of novel interventions for society necessitate careful examination and empirically based research. Yet, insights from the social sciences and humanities are under-represented relative to natural sciences insights in novel interventions research. This under-representation seems to be more prominent in forestry. This is problematic because novel interventions necessitate a deep and nuanced understanding of the cultural norms and governance dimensions of where and when they take place. Without these dimensions, policy alternatives will likely be unsuccessful in the long term.

Moving forward: genomics-based assisted migration in BC forestry

Drawing from lessons on risk perceptions and governance of novel interventions, we can anticipate that the potential implementation of genomics-based assisted migration in BC will be influenced not only by our understanding of technical/biophysical aspects, but also by our understanding of institutional dimensions (including their historical context), and human behaviour. Moving forward, Ricardo's master's thesis will focus on assisted migration in the BC forest sector. His work is part of a larger interdisciplinary Genome Canada project investigating the potential for the use of genomics for climate change adaptation in BC forests. Ricardo aims to identify and examine the roles of institutional (eg policy instruments, decision-making processes) and human behavioural (eg perceived risks) factors as they relate to the potential adoption of genomics-based assisted migration. He will be interviewing decision-makers in the BC forest sector for this project, which is expected to inform assisted migration policy in BC.

For further information contact Ricardo Pelai at ricardo.pelai@alumni.ubc.ca or Dr Shannon Hagerman at shannon.hagerman@ubc.ca.

development & alumni news

Gift of shares creates bursary for undergraduate students


Jack Newman, BSF '62 and Tori Lahoda at the Forestry Recognition Evening

Third-year Forest Resources Management student Tori Lahoda is the inaugural recipient of the **J F Newman BSF 1962 Forestry Bursary**, established in 2017 by Jack Newman.

"When I found out I received the bursary, I almost fell down. This was a huge game-changer for me," she says. "This year has by far been the hardest of my program. I have student loans but they aren't enough to live on. It was such a relief to receive this support."

Jack Newman received a BSF from UBC in 1962, and after graduation went to work for MacMillan Bloedel in Port Alberni. Following 2 years there he relocated to the Cariboo to work for Weldwood, and spent the next 35 years in a variety of roles with the company.

"I actually felt like I was in school during my entire career," he says. "When I was with MacMillan Bloedel I was a supervisory trainee in a large sawmill cutting 5 different species of wood. When I started with Western Plywood (later acquired by Weldwood) I was involved in lumber operations. Then I learned to manage their plywood operations."

As area manager of Weldwood's Cariboo operations, Jack managed the construction and operation of a plywood plant in Williams Lake as well as sawmills and plywood plants in 100 Mile House and Quesnel. "I lived in Quesnel and it was a lot of driving on highway 97," he says.

> **"When I found out I received the bursary, I almost fell down. This was a huge game-changer for me"**

Bursary recipient Tori is also familiar with the Cariboo, being born and raised in Kamloops. She was attending Thompson Rivers University and studying natural resources when she decided that her program wasn't giving her the focus on forestry she wanted. "I came to UBC in second year, and I love it," she says. "My profs are really diligent in their teaching and are always welcoming if you have questions."

Tori confesses to being one of those questioning students. "I asked so many questions in field school last fall that one of the instructors offered me a summer job." That instructor was Chris Gruenwald RPF, owner of Cascadia Environmental, an Abbotsford-based company providing operational services for forest tenure management.

During his career Jack Newman remained connected with UBC Forestry, notably in running the 10-year reunion for his class for the past 5 decades. He also served on the research committee of Forintek (now FP Innovations) for 10 years. Now retired for 20 years, after 35 years with Weldwood, he enjoys sports, his garden, travelling and spending time with his wife, 2 grown children and 4 grandchildren.

Jack had long considered the idea of giving back to students at UBC. "A long time ago I bought stock in CPR, and over the decades it had returned quite a bit on the investment. So I decided to give those shares to UBC Forestry. I thought a lot about which discipline to focus the bursary on. Even though my career was in forest products, I decided it would be for a student in forest resources management. We need the trees first, and we are still not managing them well enough."

Tori is grateful to Jack, and to others who support students in UBC Forestry. "When someone is willing to give up some of their income to take weight off your shoulders, it's such a gift," she says.

A gift of shares or life insurance can be the foundation for student support that endures for generations. For more information, please contact Emma Tully at 604.822.8716 or emma.tully@ubc.ca.

Alumni profile

Janna Kumi (MSc '84)

As a forestry professional turned artist, and someone who went through a life-changing medical event, Janna Kumi remains fascinated by both past experiences and future opportunities.

Janna was born in the Netherlands and immigrated with her parents to Montreal in 1953. In the late 60s she began university studies in art, but lasted only 1 year. Switching gears, she moved to Germany to study forestry. Degree completed, she returned to Canada but not to Quebec. "My parents had moved to Calgary. I had learned German in order to study in Munich, and French was always tough for me to speak fluently," she says. "Frankly, I wanted to speak English again."

One long bus trip later, Janna found herself in downtown Vancouver in mid-March, "surrounded by everything in bloom. I thought I had found nirvana, and decided to stay."

Janna took a job at UBC Forestry working for Professor Emeritus Hamish Kimmins, translating documents from German to English. Prof Kimmins encouraged Janna to pursue graduate studies, and in 1984 she received an MSc in silviculture.

"I started working in 1981, which unfortunately was right at the beginning of a recession in the BC economy," she says. "I was hired and laid off by MacMillan Bloedel within 6 months. Fortunately I was re-hired later on, and spent 13 years working with MB."

Janna championed sustainability issues within the company and in the wider forest sector. She was one of the first to propose ideas for certifying sustainable forest management and chain-of-custody practices. "I said we should have an MB sticker that tells the consumer that we are held to a higher standard and lets the consumer know that the forests are sustainably managed," she says. "A few years later sustainability certification became a very big deal."

Janna was appointed Assistant Deputy Minister in the BC Ministry of Forests in 1994, where she was responsible for implementing the Forest Practices Code. "It really changed the way we do forestry," she says. "I think BC met the challenge."

In 2005, Janna experienced a major stroke. "It came out of the blue, and left me paralyzed on my right side and unable to speak," she says. "I was lying there in hospital and thinking, 'What is my life going to be like now?'. As I recovered in hospital my overriding goal became to regain the use of my right hand, so I could return to work but also so I could begin making art again."

Janna returned to work full-time within 6 months. At the same time she dove back into art. She received a Certificate in Fine Art Techniques from Emily Carr in 2009, then returned to UBC to pursue a BFA: at first part-time, then full-time when she retired. She graduated in 2015.

Today Janna's art takes the form of paintings, drawings and collage work. She uses acrylic ink stains on raw canvas, colour pencil drawings on paper, and hand-coloured mulberry paper for collages "My inspiration is almost always a tree, even if it doesn't end up looking like a tree," she says. Her paintings reference biological processes like gas exchange, decay, weathering, and communication tree-to-tree.

Janna's work was on display in March 2018 at The Hatch Gallery in the Nest on campus. This summer she has a show at VanDusen Botanical Garden in Vancouver. And after that, "I'm going to work on composition in a more abstract way," she says. "I am also working on a collaborative piece with Adele Arseneau, who is an Aboriginal artist and carver.

Decades after launching her forestry career, Janna is still learning from the trees.

The class of '67 hosted their 50th reunion on Monday June 19, 2017 at Loon Lake. The 13 grads and 11 spouses started at mid day with lunch at the Koerner Dining Hall then headed off on a tour of the Malcom Knapp Research Forest. Dinner and overnight accommodation at the Loon Lake Lodge was excellent. The party carried on around the fireplace but being more subdued than 50 years ago, barely lasted until Tuesday. However the stories have become better with time.

Electronic versus paper?

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