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Inside:

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dean'smessage

The maintenance of biodiversity should be at the forefront of sustainable forest management, yet it is surprising how often the conservation of an endangered species creates a conflict with forest harvesting. Whether it is Spotted Owls and Marbled Murrelets in the Pacific Northwest, Red-cockaded Woodpeckers in the US Southeast, Leadbeater's Possums and Orange-bellied Parrots in Australia or Noguchi's Woodpeckers in Japan, the loss of mature forest, and particularly old growth forest, is considered to be a contributing factor to the decline of the species. In one case, the Ivory-billed Woodpecker, logging of its habitat (along with hunting for specimens) was the major cause of its likely extinction.

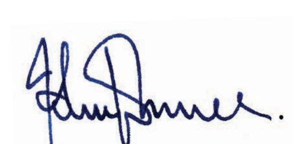
Frequently, when a species is recognized as being at risk, assumptions are made about its habitat requirements. However, a lack of reliable field data sometimes means that these assumptions are incorrect. Consequently, it is important to ensure that we know which species are at risk, which are likely to become at risk, and why. Unfortunately, most forest products companies are extremely reluctant to undertake research in this area, relying instead on government and other research. Yet governments are also remiss, and the funding being devoted to research into issues such as habitat requirements has shrunk dramatically. This leaves a space that is frequently filled by conservation advocates, some of which are sufficiently large to be able to do the necessary research. Others rely on emotive issues to generate support. As recent actions by the federal government in Canada in relation to the conservation of caribou have demonstrated, a lack of reliable research can lead to the potential exclusion of forest harvesting from some areas. This exclusion may or may not be justified: the data simply aren't there to demonstrate one way or another.

This creates a problem for policy makers. If the precautionary principle is applied to the species believed to be at risk, then the decision may be to protect the habitat that is believed to be critical for the species, even if the research is not there to support the decision. However, if there are uncertainties over the science, those in favour of harvesting can argue that it is more important to create economic opportunities for people living in the area. However, the science to show the true extent of these benefits is also often missing.

The work by Kathy Martin reported in this issue of Branchlines provides some important baseline data that indicates the abundance of cavity-nesting bird species around the world. At least 1,878 bird species (ie 18% of all bird species) rely to a greater or lesser extent on tree cavities. It is well-known that the older the tree, the more likely it is to have cavities. Where there are no tree cavities, some species, such as Australia's Rainbow Lorikeet, adapt by nesting in burrows in the ground. Most cavity nesters however are reliant on the availability of cavities. In some places where there is a lack of mature trees, such as young plantations, nest-boxes have been used successfully to provide opportunities for cavity nesters. However, in areas where large trees are being selectively removed, the loss of potential breeding cavities can have significant effects not only on the birds dependent on cavities, but also a range of other organisms that also use them. For example, in Australia, a wide range of marsupials use tree hollows, and some, such as the Leadbeater's Possum, have been classed as critically endangered by both the International Union for the Conservation of Nature and the Australian Government. This has led to calls to halt the logging of native eucalypt forests in much of the state of Victoria.

The research surrounding the use of tree cavities is problematic. Not only are the cavities often relatively inaccessible, but their occupants may be nocturnal, making observation difficult. Fortunately, modern technologies are making it easier: endoscopes can be used to see inside cavities, and increasingly sophisticated camera traps provide information about nocturnal species. However, cavities still have to be located, which can be challenging in a tall tree.

Kathy Martin's research has repeatedly demonstrated the importance of cavities for the maintenance of one aspect of biodiversity. More such research is needed to quantify the importance of other habitat features. Research done by Fred Bunnell (now an emeritus professor in the Faculty) and his colleagues in the 1990s and 2000s pointed the way forward, but has not been continued at the scale necessary to answer important questions about the maintenance of biodiversity. Given that this is a fundamental tenet of sustainable forest management, the lack of active research is disappointing.



John L Innes
Professor and Dean

forestrynews

New appointments

Five new faculty members will be joining the department of Forest and Conservation Sciences effective January 1, 2018.

Intu Boedhihartono will be joining the department as an associate professor of tropical landscapes and livelihoods. Intu comes to us from James Cook University in Cairns, Australia where she is currently a senior lecturer in tropical landscapes and livelihoods as well as director for the Master of Development Practice program.

Jonathan Davies will be joining the department as an associate professor of ecology. Jonathan is currently an associate professor in the department of Biology at McGill University in Montreal, Quebec. He will hold a joint appointment between the department of Botany and the department of Forest and Conservation Sciences at UBC.

Jeffrey Sayer will be joining the department as a professor of global forestry. Jeffrey was the founding Director General of the Centre for International Forestry in Indonesia and is currently a professor at James Cook University in Cairns, Australia.

Terry Sunderland will be joining the department as a professor of tropical forestry and food security. Terry is currently Senior/Principal Scientist at the Centre for International Forestry in Indonesia.

Elizabeth Wolkovich will be joining the department as an associate professor in the area of community ecology. Elizabeth is currently an assistant professor in the area of organismic and evolutionary biology at Harvard University.

We also will be welcoming one new faculty member to the department of Wood Science, effective January 1, 2018.

Feng Jiang will be joining the department of Wood Science as an assistant professor in the area of glycoscience and advanced carbohydrate chemistry. Feng is currently a postdoctoral researcher at the University of Maryland's department of Materials Science and Engineering, College Park, Maryland, USA.

Michelle Lindsay has joined the Faculty as our new Manager of Alumni Engagement. Michelle has a wealth of experience in alumni and community relations, event management, operations and communications. Most recently she was the Alumni Relations Manager, Athletics and Recreations, UBC. Michelle has a BCom in Entrepreneurial Management from Royal Roads University and is from Vancouver. Michelle can be reached at michelle.lindsay@ubc.ca. Welcome Michelle.

We are pleased to announce that **Stephanie Ewen** will take over the role of Manager at our Alex Fraser Research Forest following Ken Day's retirement in early 2018 (see article on page 4). Stephanie has a BSF degree from UBC and an MSc (specializing in growth and yield) from Laval University. She has worked for us previously as Planner and Assistant Manager at the Alex Fraser Research Forest and more recently she has been a forest consultant with the Infinity Pacific Group. Welcome Stephanie.

Forestry/Asia partnership expanded

The 25th of September 2017 saw another milestone in collaboration between the Asia Pacific Network for Sustainable Forest Management and Rehabilitation and UBC's Faculty of Forestry. Building on an already strong partnership and leveraging UBC's excellent international networks, the 2 organizations will expand their cooperation through North and South America (Brazil, Peru, Chile, Argentina and Mexico). This partnership will be based in the Asia Forest Research Centre at the Faculty of Forestry at UBC. For further information contact Dr Guangyu Wang (Director of the Asia Forest Research Centre at UBC) at guangyu.wang@ubc.ca.

Ken Day to retire

By Paul Lawson

The December sun carries little warmth at Gavin Lake, but it does bite through the crisp cold mornings and make them brilliant. Wool pants, felt-lined boots and balaclava - the crunch of cold snow underfoot goes along with the breath-clouds that freeze in mid-air. These are the sights and sounds of forestry in the Cariboo. Ken Day has been donning his woollies for over 30 years as Manager of UBC's Alex Fraser Research Forest and heading out to find just the right spot for that research project, cutblock or tour stop. He's been monitoring the hosts of bark beetles, defoliators, root rots and pathogens that annually threaten this forest. He's fought the fires that almost devoured his home town and his livelihood last summer as a capstone to his career. Now he's out there in the winter, salvaging the lost forest that was scorched by the fires which erupted across the central interior last July.

Never say die…

Through all of this turmoil, Ken has retained his sense of long term. "The forest will recover" he says stoically, "just like it has before, over and over". It's like one person's career is a 3 minute video in the life of a forest, and we are just here for such a short time from nature's point of view. "Passing on what I have learned is my main focus", he says and Ken has been very good at that. 30 years of Fall Field School at Gavin Lake have given more than a generation of young foresters a glimpse of what it means to manage a forest in the central interior. "Keeping your finger on the pulse of the forest", is what it's all about. Observing the evidence of forest pests, from beetle frass to fungal fruiting bodies is the work of a detective. Teaching others how to do it is a calling unto itself.

In the beginning

Dr Don Munro, retired Professor and Director of the UBC Research Forests hired Ken into the job of Manager at Williams Lake in 1987. At that time, the Research Forest was only 2 squares on a map. The 9,800 hectare forest had just been dedicated, and hopes were high for its success. "Several people from the local community in Williams Lake volunteered their time and lobbied the Provincial Government and the local timber companies to get the forest started", he recalls. "We had big dreams that it could become a centre for excellence of forest management in the interior". History has proven those dreams to be realized. "We saw in Ken a young forester with tremendous energy and dedication" says Don. "He did not disappoint".

Ken's impact went far beyond those 2 squares that became the Knife Creek and Gavin Lake blocks of the Research Forest. His dedication to the cause of forest management brought him together with like-minded people from all over the interior of BC. He helped lay the groundwork for the study and demonstration of silviculture systems, mule deer habitat management, interface fire hazard reduction and proactive forest health management. When Community Forestry came into being in the late 1990s, Ken became involved and toured BC helping people set up their own managed forests, developing research extension and management planning tools. He saw the potential for the City of Williams Lake and the Williams Lake Indian Band to jointly own a Community Forest, and he worked tirelessly to make that happen. Today that forest is a going concern, standing on its own thanks in part to Ken's efforts.

Ken is the first to admit that he has not worked alone. "I've worked with some fantastic staff and had great support from the Faculty of Forestry" he recalls. "The team atmosphere has been incredible, and we owe our success to the many folks who have helped us along the way".

Ken plans to travel, spend time with his very supportive wife of 38 years, Karen, and open a boutique consulting business after he hangs up his wool pants next March.

He will be succeeded by Stephanie Ewen, (see page 3) who joins the Research Forest staff on January 22. Her felt lined boots will soon be crunching the same footprints in the snow.

Paul Lawson is director of UBC Resarch Forests. He can be reached at paul.lawson@ubc.ca.

Cumulative Effects

Working together to manage resources

By Candy Lo

The province of British Columbia is a hub to many natural resource sectors such as forestry, mining and oil and gas. While these sectors provide substantial social and economic benefits, they also cause inevitable environmental impacts. Although there are many policies, laws and regulations around natural resource management, they are typically focused on sector specific effects, unless the projects are large enough to require formal environmental assessments. The lack of thorough inter-sector considerations may allow accumulation of unintended consequences to our environment, as well as our social and economic values – leading to Cumulative Effects. Cumulative Effects are changes to the environmental, social and economic values (eg water quality, cultural, economic wellbeing and biodiversity) caused by the combined effect of past, present and potential future human activities and natural processes.

I have always been fascinated by the beauty of nature and the animals that live in our many ecosystems. My passion for natural resources management and conservation eventually led me to enrol in the Natural Resources Conservation program in the Faculty of Forestry. With many possible career paths available to me, I joined the Co-op Program, which is uniquely positioned to connect me with employers in the forestry sector, NGOs, government and in research.

After completing co-op work terms with an NGO and in research, I worked as an engagement coordinator at the Fort St John office of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development for my fourth co-op work term. What attracted me to this position was the opportunity to experience the policy side of natural resources management and to observe how government responds to the voices of various stakeholders, including Indigenous communities concerning development projects.

The BC government is currently in the implementation phase of the Cumulative Effects Framework, which guides and supports the management of Cumulative Effects (CE) in natural resource decision-making by identifying the important values to residents, Indigenous communities and stakeholders while outlining current policies and guidelines concerning those values. Part of my role was to research existing Best Management Practices for 3 pre-identified CE values – grizzly bears, aquatic ecosystems and old growth forests – for which the Cumulative Effects Assessment protocols have received interim approval. Cumulative Effects Assessment is the process that compares the current conditions and trends of each value to existing management objectives and science-based benchmarks. Essentially, the Cumulative Effects Framework allows the province to move away from single-sector and project-focused decision-making to area-based and value-focused governance.

One issue the province encountered when attempting to develop a province-wide, standardized assessment is that each region varies in climate, geography and species composition. Regions also differ in their industrial, social and cultural structure. This diversity has led to many distinct regional initiatives launched by various ministries. In the Northeast, the Forest Practices Board did the Kiskatinaw River Watershed cumulative effects assessment case study while the Ministry of Environment and the Ministry of Energy, Mines & Petroleum Resources is undertaking the Murray River cumulative effects project to address selenium concentration and its relation to coal mining.

Regional Strategic Environmental Assessment (RSEA) is another initiative driven by the urgency to address Cumulative Effects. RSEA is a collaboration between Treaty 8 Indigenous communities and the BC government through a written agreement. The purpose of RSEA is to undertake a regional assessment and form recommendations in response to the effects of natural resource activities on the rights of participating Indigenous communities.

We are at an interesting time as we begin to understand the importance of Cumulative Effects and its relationship with natural resource decision-making and environmental stewardship. I am glad that I have had the opportunity to take part in this process. This exposure has confirmed my interest in natural resource management, given its complexity and constant challenges. Although the management processes are in the early stages of development, I believe that we are well on our way to developing holistic strategies that allow for economic and social benefits from our natural resource sectors while ensuring the long term sustainability of our shared environment.

For more information on our co-op programs, contact Tony Loring (Co-op Coordinator) at tony.loring@ubc.ca.

Opening Doors

An interview with artist Arlene Ness
by Taylor Wale

Arlene Ness with her limited edition Opening Doors panel "We-gyet and the Swans", installed at the new Emily Carr University of Art + Design Campus. The original will reside at the entrance to the Dean's office in UBC's Faculty of Forestry

In a celebration of technology, sustainable forest use, and traditional Gitxsan-style carving, artist Arlene Ness has carved a piece that will now hold space and open doors for Indigenous students in the Faculty of Forestry at UBC. As a part of the Aboriginal "Opening Doors" project, created by UBC's Chris Gaston and Emily Carr University of Art + Design's Brenda Crabtree, 10 Indigenous artists from the BC Coast and Yukon carved original door panels representing both their traditional and unique styles. The project brought together the forces of UBC's Centre for Advanced Wood Processing, FPInnovations, Emily Carr University of Art + Design and the Freda Diesing School of Northwest Coast Art in Terrace, BC. This initiative creates the opportunity for artists to utilize scanning and CNC router technologies to further produce "limited edition" replicas of their original panels. The original carving of Arlene's door will now live in the Faculty of Forestry, while its replica is being displayed at Emily Carr University of Art + Design's new campus in Vancouver.

Arlene Ness, a Gitxsan carver from the community of Gitanmaax near Hazelton, BC, is embracing this transition of working with new technology and helping create capacity for her own community. Arlene works with many media, but describes carving wood to be her centre. "Wood is where I lose myself and relax. I open my mind to the universe and become a recipient for the stories to come out. With wood this happens most naturally" Arlene said in an interview. Arlene is one of many successful carvers from her area and has learned from master carvers such as the world renowned Earl Muldoe, Walter Harris, and Phil Janzé, to name only a few. Being surrounded by so many mentors, she says has been very impactful on her career as an artist, allowing her to turn to her community for inspiration, advice, and traditional knowledge.

Arlene describes her art as coming from inspirations gathered through a combination of cultural teachings through the feast system, hunting and roaming the land, or being in the bush. She says that her time on the land is her time to dream about the Gitxsan legends, which are re-created for traditional use or creatively adapted with her own unique style.

Arlene interpreted a moment in time from the legends of We-gyet, an important collection of Gitxsan stories, for the piece she carved for the Opening Doors project. She titled the piece We-gyet and the Swans. The instance from one story that she captured is her interpretation of a time when We-gyet is being greedy and tries to gather too many swans, but is intercepted by the frog, who scolds We-gyet for taking more than the land provides. For Arlene, this moment in time emphasizes the need to maintain a balance and always respect the land. This idea of balance is also reflected in the form line design itself – a flowing Gitxsan design where the negative space is just as important as the form line. Arlene steps into this foreboding moment in the story where We-gyet is taking more than his fill, all the while being watched.

> **My work in First Nation fine art is an exploration of new and old techniques. In carving each piece I capture a moment in time; interpreting experiences, history and legend keeping the core of the creation of new art true to my Gitxsan ancestry."**
>
> ***Arlene Ness, authenticindigenous.com***

Prior to agreeing to participate in this project, Arlene had given much thought to the idea of introducing new technologies into her traditional carving style, thoughtfully considering the opinions of her mentors and community members. She pointed out that her people have been making traditional-style art outside of its cultural purpose for quite some time. "That transition is already happening, but we are now limited in how it's being created and our capacities."

Arlene observed an attitude against mass producing the exclusive fine art, while surveying her community members for their opinions on the exploratory project. She acknowledges that this perception comes from people not wanting any loss in quality in an art form that has been honed over millennia, as well as a fear of appropriation of cultural art forms. On the other hand, Arlene also acknowledges that there are trade-offs to consider, as this technology allows a wider audience to appreciate and learn about the art form, while also maintaining very fine quality control in terms of its replication abilities and working on quality wood. Another element to this CNC technology is that the final detailed carving is still done by the artist, only the brunt of the work is done by the CNC scanner. After discovering the intentions of the project and learning that the collaborators were not interested in taking anything in return, she was excited to participate in this joint venture.

The Opening Doors project poses a genuine invitation to Indigenous artists to engage in a new technology that is not appropriating the work. "It is letting us in, giving us the tools. We are an adaptive people historically. Exploring new avenues and technologies is in our blood" Arlene explained. Arlene is pleased to have the opportunity to reduce the physical strain of carving on her body and to have an avenue to expand the marketability of her business.

To Arlene, having the Faculty of Forestry purchase and publicly display her art represents an invitation for Indigenous people to collaborate in utilizing forests sustainably. She hopes that her carved door will let other Indigenous people know that the Forest Sciences Centre is their place too, and will facilitate access to programs at the university. Arlene acknowledges that adaptations of traditional art, such as this door panel, are not just for hanging on walls. Culturally, this art is meant to be an active part of our lives and serve a purpose. In this case, that purpose may be contributing to Indigenous representation in academic spaces. Although this piece of Gitxsan art holds space for Indigenous people in the Faculty, it is important to remember we are living and studying on the unceded land of the Musqueum, Sḵwx̱wú7mesh and Tsleil-Waututh people. Further, it is important to acknowledge that using Indigenous symbols and art to spark conversations is only a start and does not serve as a surrogate for real actions towards reconciling our shared histories. As we move forward having these forms of traditional art more visible on campus, we must also carefully consider the stories and purpose behind each piece, along with the people and the land with which they associate.

Moving forward with this project, Arlene has big plans to build off this initiative. As well as completing several replicas of this piece, Arlene hopes to bridge this project to her home community of Gitanmaax and introduce the CNC technology to carvers from her region. As a former student of the Gitanmaax School of Northwest Coast Indian Art, Arlene has an interest in revitalizing the carving school at the Historical Village 'Ksan. She believes that a project such as this in her community would allow artists to co-create carved pieces and replicas for commercial sale. Arlene believes that a community such as Gitanmaax, and surrounding villages, would celebrate this project and is eager to expose her community to this new technology and to collaborate creatively on projects with the many talented artists from the Skeena region.

Taylor Wale is a Gitxsan First Nation graduate student in the Faculty of Forestry. For further information on the Opening Doors project contact Dr Chris Gaston (UBC department of Wood Science) at chris.gaston@ubc.ca.

Doors by artist Edwin Neel (Kwakwaka'wakw) on display at the new Emily Carr University of Art + Design campus in Vancouver

Tahiry Honko: A community-driven mangrove carbon project in Madagascar

Mangroves occur in over 120 countries throughout the tropics and sub-tropics. These intertidal ecosystems are incredibly biodiverse and provide a wealth of goods and services. From shore stabilization and storm protection, to building materials for boats and dwellings, nursing and breeding grounds for important food sources, and fuel wood and medicine – mangrove ecosystems are vital to the well-being and livelihoods of the many coastal communities that live in and around them. Mangrove forests are also among the most carbon-dense of any forest type, with carbon stocks meeting or exceeding those of their terrestrial peers – temperate, tropical and boreal. Despite their multi-faceted importance throughout the world, mangrove ecosystems are disappearing at an alarming rate, with loss estimates as high as 50% in the past 50 years. The drivers of this loss vary but include clearing for agriculture, aquaculture, and coastal development, and over-harvesting for forest products. Locally, this loss leads to the breakdown and collapse of vital goods and services, the reduction of biodiversity, and jeopardizes what are in many cases already fragile livelihoods. Due to their massive carbon stocks, mangrove loss contributes to the negative effects of global climate change.

The western Indian Ocean island nation of Madagascar – the world's 4th largest island – is home to approximately 2% of the world's mangrove ecosystems. Here, mangroves are vital to thousands of coastal communities but loss from charcoal production, timber extraction and agricultural development is prominent, with recent studies reporting more than 20% deforestation over the past 20 years.

Through their Blue Forests program, the marine conservation NGO, Blue Ventures (www.blueventures.org) has been working with coastal communities at multiple sites along the west coast of Madagascar on community-centered and driven mangrove conservation, restoration and reduced-impact use. In southwest Madagascar, in Helodrano Fagnemotse – also known as the Bay of Assassins due to its checkered history with pirates – the mangrove extent is relatively small (1,500 ha); however, anthropogenic pressures on coastal resources in the area are increasing. A recent study published by Blue Ventures in the journal *Forests* (Mangrove Carbon Stocks and Ecosystem Cover Dynamics in Southwest Madagascar and the Implications for Local Management) documents a net loss of mangroves of 3.2% from 2002-14. The analysis further highlighted widespread transitions from dense, higher stature mangroves to sparse areas, indicating extensive degradation. Measurements and samples taken in a network of field plots were used to calculate total carbon stocks. The largest trees in the area, similar to other high stature, closed-canopy mangroves in East Africa, contained 454,920 (±26,500) kilograms of carbon per hectare.

While these mangroves have many values to locals and their livelihoods, tapping into the value that carbon stocks hold on the voluntary carbon market could help generate critical revenue to both support and incentivize community-led sustainable mangrove management, improve and secure existing livelihoods, diversify new livelihoods, and alleviate human pressure while helping safeguard biodiversity. Along these lines, through a collaboration between local communities and Blue Ventures, a community mangrove carbon project called Tahiry Honko (https://vimeo.com/blueventures/tahiry-honko) – which in Malagasy means to preserve and protect mangrove forests - is being established through the Plan Vivo Foundation. The overall aim of this project is to establish a sustainable, long-term payment for ecosystem services scheme, providing income to communities through the sale of carbon credits. Tahiry Honko is expected to begin selling carbon credits through the voluntary market in 2018. You can read the full study in *Forests* 2017, 8, 190; doi: 10.3390 / f8060190

For further information contact Dr Trevor Gareth Jones at trevor.jones@ubc.ca. Trevor, who coordinates and teaches in UBC Forestry's Master of Geomatics for Environmental Management program, has worked with Blue Ventures since 2011 and is currently their Geospatial and Blue Forests Science advisor.

Locating hot springs through remote sensing

by Suzanne Hopkinson

Growing up down the road from the famous mineral healing waters of aptly-named Saltspring Island, I have always had a strong interest in hot springs. Currently, I study the location of hotsprings as both an ecosystems biologist at Stantec Consulting, in Terrace, BC, and as a student in the Masters of Geomatics for Environmental Management program in UBC's Faculty of Forestry.

As Canada's most diverse province, British Columbia is blessed with over 100 natural geothermal springs, mainly clustered in the coastal and Kootenay regions. Undeveloped, these ecosystems provide high value to wildlife, particularly ungulates, and unique habitat for rare and endangered plants. Popular with locals and tourists alike, many hot springs are also noted areas of importance to First Nation groups, with a rich oral history of use. Currently, hot springs ecosystems are not classified in British Columbia, and are, as such, unregulated under multiple jurisdictions. This confusion inhibits collaboration for management across disciplines, in the industrial, commercial, and government sectors. A complete and updated baseline inventory of hot spring ecosystems in British Columbia may aid natural resource managers to prioritize management objectives and balance conservation initiatives with industry needs.

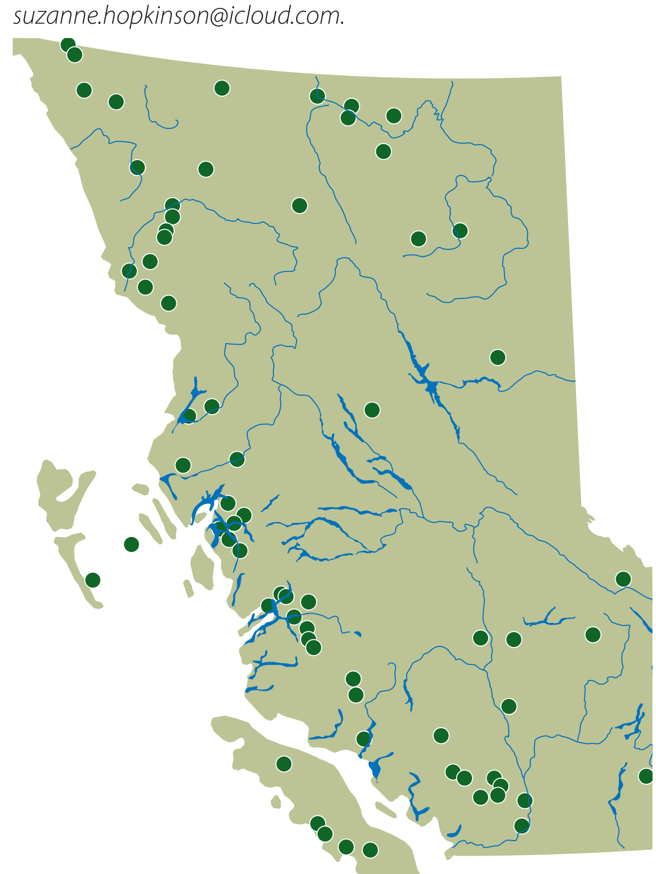
Secretive and remote in nature, locating hot springs has proven elusive to researchers (and bathing enthusiasts!) for decades. Predictive ecosystem mapping models typically cannot accurately forecast wetlands, or small rare communities, but remote sensing technologies may provide a unique solution. Hot springs vary in temperature from 40 to100ºC, and it is this characteristic feature that can be used with satellite infrared imagery to detect thermal anomalies within the landscape. The first step was to calibrate known hot spring locations with thermograms, black-and-white images that represent the emitted thermal energy of natural features. Compiling the dataset of known locations proved informative; data points were often in differing projections, had varying definitions of 'hot spring', and were largely based on oral renditions. In total, 108 points were collected for calibration.

Thermograms from 3 satellites were collected at a provincial scale: Landsat 7, Landsat 8, and ASTER. Both Landsat satellites provided data at a 100m x 100m resolution, which proved to have too high of a pixel size to accurately detect the relative change in thermal emissions from hot spring ecosystems. ASTER, using the Global Emissivity 100m V003 dataset, proved slightly more effective; with a resolution of 90m x 90m. Large hot spring pools such as Banff, Fairmont, and Halcyon were identifiable within urban environments. However, these represent the pools, not the spring itself and ultimately, the pixel size also proved too large to identify other unknown or smaller hot springs.

Though this attempt was unsuccessful, recent research using drones and helicopter-mounted thermal detectors in the US and New Zealand is proving to be more promising. Moving forward, higher resolution data will be compared using the same methodology. The timing of this research is particularly relevant; popularity of hot springs has never been higher, and is anticipated to increase in the future. Furthermore, a growing trend of First Nations governments assuming jurisdiction over natural springs from former Recreation Sites may prove important in resource management decisions. As most hot spring ecosystems are located within provincial parks, another interesting trend that was observed was the increase in fee-simple properties purchased by non-government organizations for conservation purposes. This methodology has potential to identify high-priority areas for future purchase.

Remote sensing technologies used for forest resource management can also be applied to ecological inventories. This type of collective management reflects a more holistic approach to management, with integrated technology and multiple stakeholders. Cumulatively, it is these features that will enable discovery, cataloging, and ultimately enjoyment of British Columbia's rarest wetlands.

For further information contact Suzanne Hopkinson at suzanne.hopkinson@icloud.com.



Known geothermal hot spring locations in British Columbia

The wildfires of 2017

Thirty years in and now this!

by Ken Day

Lia Colasacco (UBC NRC student and summer intern) had a very different learning experience than she bargained for

Our Alex Fraser Research Forest in Williams Lake did not escape the ravages of the 2017 wildfires. On the afternoon of July 7, 2017, we were in Danger Class 5 (extreme) at the Knife Creek Weather station and Danger Class 4 (high) at Gavin Lake, and all our operations were shut down. At Gavin Lake temperatures were high (31.4° C max) and humidity was low (8% min). A dry lightning storm went through the Chilcotin and Cariboo Regions around 3pm, and our weather records show winds gusting to 33 km/h and averaging nearly 20 km/h. Research forest staff left the office late in the afternoon to check for any fire starts, and by that time the City of Williams Lake was surrounded by very active wildfires.

By 7pm, we knew that we were unscathed on our Knife Creek Block but we had several fires on the western side of Gavin Lake Block. We had initial attack underway on the eastern flank of Alpha Fire by 8pm.

That one lightning storm started many more fires than BC Wildfire Service could respond to, including numerous interface fires. Our fire (#C30870) at the Gavin Lake Block was a complex of 7 starts. Research Forest staff (including a contingent from the Malcolm Knapp Research Forest), as well as contractors, were on the fires within hours. Fire-fighting efforts in our area were coordinated at the Big Lake Volunteer Fire Department.

On July 15 an evacuation order was issued due to extreme fire behaviour and growth south of us at Williams Lake. The UBC Research Forest staff evacuated Gavin Lake Camp until July 26, when we returned to find that new guards were established and holding except on Delta fire. We had 50-80 personnel and many pieces of heavy equipment working on our fires. We settled into mop-up and patrol on Alpha, Bravo, Charlie and Foxtrot, working 5 12-hour days with 1 day off. Thanks to the efforts of UBC Forestry Professor Lori Daniels and the sponsorship of the Dean's office, 10 students attended S100 certification courses, and 3 students with previous experience came to Williams Lake to support us. On August 15 we switched to 4 12-hour days with 2 days off. On August 28 the UBC crew was released from our fire.

Over-all, the UBC Research Forest staff and associated temporary hires put in 420 person days of fire-fighting between July 7 and August 28, under the direction of the BC Wildfire Service. The Research Forest had a crew on the ground every day except during a 12-day evacuation period. I am very proud of the effort and effectiveness of our staff.

We would like to publicly state our great appreciation for all the efforts and resources expended to control the fires on our Research Forest. We know that we have benefitted from a fire suppression effort mounted by pilots, equipment owners and operators, staff of major forest companies and consultants, and of course fire fighters from BC, other provinces and territories, and around the world. We are particularly grateful to the community of Big Lake, who threw open their fire hall and their freezers to support hundreds of people every day. We are truly grateful for everyone's efforts to protect our Research Forest!

In the end 1,078 ha of forest burned, and 54.8 km of fireguard was put in place. Sadly, several large and important research installations were ruined. Salvage of timber felled to construct fireguards is now complete, and rehabilitation of guards is proceeding. Road planning and timber development are underway, and we intend to begin salvage logging operations in January. Consideration to the environmental effects of salvage logging are foremost in our minds. Our harvest plans will include experimental controls.

A most interesting outcome is to see the effects of previous silvicultural treatments on fire behaviour. Where stands had been uniformly thinned, even as much as 40 years ago, fire intensity seemed to have been substantially reduced and stand resilience increased. Where stands had been cut by group selection there seemed to be little to no beneficial effect on fire intensity. Where stands were clearcut and planted, the plantations were quite flammable. This seems to be an important area for research in an era where forest and community resilience have taken on a new meaning. Other opportunities for new research projects have arisen too, starting with the monitoring of fire effects by remote sensing, and heading towards the impacts of various insects and diseases.

This year marks the 30th anniversary of the establishment of the Alex Fraser Research Forest. In that time UBC ––––has built an impressive teaching and research facility. The fires of 2017 have certainly impacted our future, but they will also provide new opportunities for research and education.

Ken Day is the manager of the Alex Fraser Research Forest in Williams Lake. He can be reached at ken.day@ubc.ca.

Jon Gaztelumendi (Asst. Operations Supervisor) mopping up a hot spot on alpha fire

East flank of Alpha fire just hours after ignition

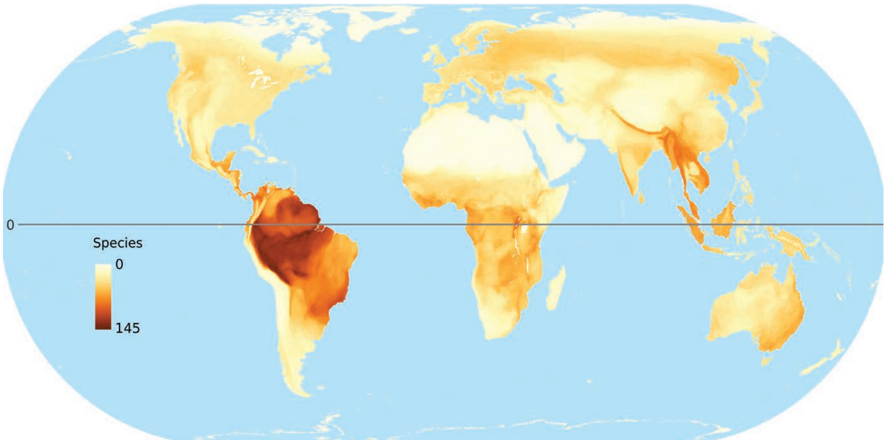
Tree cavities and avian biodiversity – a global perspective


Galahs at a nest cavity in Australia

There are at least 16 species of engineers hard at work in our British Columbia forests, 17 species if you count humans. This group includes 11 species of woodpeckers and 5 species of chickadees and nuthatches that are able to detect a soft spot of decay in a tree and hit the bark with their strong but flexible beaks at high speed (6-7 metres/second) with an impact of up to 1000 g deceleration force to penetrate the outer bark and sapwood of a tree to access the decayed heart wood. In the heartwood of tree trunks or branches, these birds can excavate a hole in a tree that is on average 25 to 40 cm deep for small birds, but can be more than 1 metre deep for the largest woodpeckers. Woodpeckers and other excavating birds are sometimes referred to as ecosystem engineers as they create critical wildlife habitat resources in the forest for an impressive diversity of birds and mammals that use cavities in trees for nesting and roosting. This group includes many ducks (such as the wood duck featured on the cover), owls, parrots and songbirds, as well as squirrels, woodrats and bats. Tree-cavity-using birds and mammals occur in "nest webs", whereby some birds excavate their own cavities in trees, while others (non-excavators) use excavated cavities or cavities formed through natural decay or damage processes. Many tree cavity nesting species require a cavity for breeding (obligate) while others use tree cavities but also use other types of nests such as platform or open cup nests (facultative cavity nesting species). These diverse groups of species can comprise from 15 to over 50% of wildlife species in our forest ecosystems. Aside from their intrinsic biodiversity values as forest wildlife, many of these species play important ecological roles as prey species, and for seed dispersal or insect control, and thus are considered a priority group for forest conservation and management initiatives.

Tree cavities can vary in characteristics such as the entrance size and the depth or volume of the hole. A good tree cavity differs across species, but in general a high quality cavity is one that has a small entrance (just large enough for the bird or mammal to squeeze into the hole) and deep enough that a predator is unable to reach in and remove the eggs or young birds inside. Tree holes are an important wildlife habitat attribute, and there can be fierce competition to acquire a good cavity, as high quality cavities are often limited. Despite the importance of tree-cavity-nesting users in forest ecosystems and their strong links with management and conservation, few scientists consider the entire community of cavity-nesting vertebrates as a functional group, and no agency has developed a global tally of all the species that use tree cavities across different forest systems.

Recently, a group of researchers, including Dr Kathy Martin from UBC's Department of Forest and Conservation Sciences, provided the first overview of all the tree-cavity-nesting birds from every continent (except for Antarctica where the lack of trees precludes the occurrence of this group) to aid in our understanding of this important group of birds. They analyzed the distribution and the conservation status of all species known to nest in tree cavities (cavities defined as holes in trees that a bird can enter such that it is not visible from the outside). They classified species by type (excavator or non-excavator),



Global map of all bird species that nest in tree cavities derived using species breeding range maps and generating a global grid with numbers of species within 10 x 10 km cells

Lewis's Woodpecker, Merritt, BC

geographic region, and conservation threat status. Kathy and her colleagues found that at least 1,878 species (18.1% of all bird species in the world) nest in tree cavities for some or all of the time. About one quarter of tree-cavity-nesting species excavate their cavities exclusively (obligate excavators such as woodpeckers or barbets) or regularly excavate and also reuse existing cavities (facultative excavators such as nuthatches, chickadees and trogons). The remaining 1,357 species (73%) are non-excavators (require a tree cavity for nesting, but cannot excavate one themselves). This global tally of cavity nesting birds will increase as the type of nest used is still unknown for a number of bird species in Africa, Asia and South America.

The habit of using tree cavities for nesting has evolved independently in many families. Tree-cavity nesters occur in 16 avian orders and 72 families, with many cavity nesters found among the songbirds (586 species), woodpeckers (404 species), parrots (371 species) and owls (219 species). In some families, almost all species use tree cavities (eg, woodpeckers, chickadees, trogons, toucans), whereas in other families only about half or fewer of the species use tree cavities for nesting (ducks, geese, kingfishers, falcons).

Kathy and her colleagues found that the geographic patterns of cavity-nesting-bird diversity, in general, mirror the global patterns of avian biodiversity. The highest richness of tree-cavity nesters was found in the Neotropical (678 species) and Oriental (453 species) zoogeographic regions (see map), the regions of highest global avian biodiversity. The lowest number of species (137 species) occurs in our northern hemisphere (Nearctic region) where landscapes typically have 40 to 60 cavity nesting bird species. In general, excavators comprise about 25-32% of the total number of cavity nesters within geographic regions, except for the Australasian region where only 6% of all tree cavity users are excavators (given the absence of woodpeckers and barbets in this region). The Oriental region (Asia south of the Himalayas) has a very high richness of excavators, particularly woodpeckers, and it is likely that new species of woodpeckers will be discovered in this region.

Cavity nesting birds are considered to have above average vulnerability to threats because they require trees and tree cavities for their life requisites of nesting, roosting and foraging, and many human activities result in the loss of trees or forests. About 13% (249 species) of tree-cavity nesters are classified as experiencing major threats (status of vulnerable, endangered or critically endangered as assigned by the International Union for the Conservation of Nature), with 41 species considered critically endangered or extinct (eg, Ivory-billed Woodpecker, Carolina Parakeet, Orange-bellied Parrot, 5 species of Scop's Owl). The highest absolute numbers of threatened cavity-nesting bird species are found in the Neotropics (especially Amazonia in central Brazil), and the highest proportion of threatened species are in Australasia (Australia and New Zealand, 17%).

Overall, the patterns of tree-cavity-nesting species richness appear similar to those found for avifauna in general, with the tropics being especially species rich and the northern hemisphere supporting the lowest number of species. Kathy and co-researchers identified the regions with hotspots of tree-cavity nesters and where conservation measures are most urgently needed (ie, where the most threatened species are found). Of particular conservation concern, the tropical and subtropical regions with high numbers of threatened species are also the regions where the most data are lacking for tree-cavity-nesting birds.

Maintenance of a continual supply of cavities, a process in which the processes of decay and excavators play critical roles, is a global conservation priority. The elimination of trees with cavities through activities such as logging or forest clearing for agriculture or urbanization may lead to population declines that can endanger the persistence of tree-cavity-nesting communities. The next time you pass by a tree with a cavity, consider that about 1 in 5 birds use cavities in trees year round for nesting and roosting, and that individual cavities can be used by up to 5 or 6 species over several decades. Please do your bit to keep the world well supplied with suitable trees and tree cavities for wildlife biodiversity.

For more information, contact Dr Kathy Martin at kathy.martin@ubc.ca or Kathy.Martin@canada.ca.

Immunity in the wild

Photo: Pirmin Nietlisbach

Mandarte Island: a 6 hectare island near Victoria, British Columbia

As we go about our daily business, we are often unaware of the gargantuan task faced by our immune system in apprehending and fighting off infectious diseases and parasites. But immune systems do not only help humans and other animals to resist and fight infectious diseases— variation in the DNA sequences coding for immune genes has also been shown to influence mate choice and reproductive success in several species of animals. As a result, the identification and function of immune genes is of great interest to evolutionary and conservation biologists.

The immune system must recognize different types of pathogens in order to resist them, and the more variation in the immune system, the wider the spectrum of pathogens that can be identified and fought. Sequence variation at immune genes is maintained through the interactions of hosts and parasites over evolutionary time. For example, if a pathogen appears very sporadically, the version of the gene best at identifying it may become rare in a population. However, upon the return of the pathogen, those individuals carrying the rare version of the gene will be better off than the rest of the population. Alternatively, individuals with the most variable set of immune genes may be healthiest or most attractive as mates. At the same time, genetic diversity at immune genes may be reduced by population bottlenecks (when only a few individuals survive an adverse event) and inbreeding, which are often observed in small populations and species at risk. Decreased diversity in immune genes reduces the capacity of populations to cope with emergent diseases, which are likely to become more common with a rapidly changing environment.

The Toll-Like Receptor gene family is an essential front-line component of the vertebrate immune system, able to recognize all major pathogen classes. Each receptor specializes in recognition of a particular pathogen type; for example, one gene in the family recognizes gram negative bacteria, while another recognizes viruses, and still a third recognizes fungal invaders. Once invaders have been recognized, Toll-Like Receptors activate an acute inflammatory response that is the first line of innate host defence. These genes are well-described in humans and some livestock species, but were only recently characterized in songbirds.

Toll-Like Receptors are attractive targets for the investigation of immune genes because they are easy to work with in comparison to other immune genes in songbirds. Following the development of genetic methods for this gene family in 2011, researchers characterized variation in several species. In some species, Toll-Like Receptor gene sequences have been shown to change in predictable ways consistent with expectations that a) immune system function may be conserved or b) new versions of these genes may arise, which could help with the fight against novel pathogens. However, in many small or fragmented populations, changes in immune gene sequences appear random, indicating a phenomenon at work called 'genetic drift'. Genetic drift is defined as genetic changes that occur due to chance events, and such changes tend to carry a greater impact on small populations. While variability in other immune genes has been shown to influence survival, the role of the Toll-Like Receptor gene family on survival, particularly for rare or threatened species, is unclear.

Martha Nelson-Flower is a postdoctoral fellow working with Dr Peter Arcese in UBC's department of Forest and Conservation Sciences. Martha's research has characterised Toll-Like Receptor genes in song sparrows, a well-studied species which occurs across much of North America. She examined gene sequences, and changes in these sequences in coastal southern British Columbia (Mandarte Island). She also conducted pilot analyses of immune gene variability and its effect on survival using the extensive dataset of the Mandarte Island population.

The song sparrow population resident year-round on tiny Mandarte Island (~6 ha near Victoria, BC) has been intensively monitored since 1975. Here, 4-71 pairs of sparrows breed annually; each bird is banded and followed through its lifetime. Since 1993, a small amount of blood has been sampled from all banded birds, allowing researchers to create a precise genetic pedigree for the population. This pedigree allows lifetime reproductive success and inbreeding to be estimated with high precision. Roughly 28% of chicks have extra-pair sires, and the population is moderately inbred allowing the effect of inbreeding in a wild setting to be understood.

Martha identified 4 Toll-Like Receptor genes in song sparrows. Using online tools, she found that evidence of purifying selection could be detected at several sites in 3 of the 4 genes. Purifying selection indicates that even though the DNA sequence may change slightly, the resulting protein structure remains intact, thus maintaining protein function. This is important due to the key role of the Toll-Like Receptor gene family as an immune system front-line defence against pathogens. If the recognition abilities of Toll-Like Receptors are compromised, this could decrease the utility of this genetic surveillance system.

Martha next explored the role of variability in Toll-Like Receptors in survival, and examined how it related to the inbreeding level of each bird. As expected, the more inbred the bird, the lower the variability of its Toll-Like Receptor gene sequences. Normally, an individual might inherit 2 slightly different versions of a gene (one from each parent). However, if the parents are related, it is more likely that they have the same version of the gene, and an offspring would be more likely to get the same version of the gene from each parent, resulting in lower genetic variability overall. When Martha investigated the effects of Toll-Like Receptor variability in survival, she found no effect. However, she also found that individual inbreeding levels had no effect on survival, despite this having been shown multiple times in prior work, albeit with a larger sample.

Cumulatively, these results suggest that Toll-Like Receptors offer a highly accessible route to understanding the causes and consequences of immune gene variation in wild populations. Future work will examine variability in these genes in a larger number of song sparrows to better understand how survival as well as lifetime reproductive success is affected. Overall, analyses of immune gene diversity in the song sparrows of Mandarte Island are likely to advance understanding of the effects of immune gene diversity on the fitness and persistence of wild populations.

Martha Nelson-Flower received her BSc from UBC in 1999, before delving into the fascinating world of the chloroplast genome of the dinoflagellates for her masters research. Martha then spent several years in the Kalahari Desert, South Africa and completed her PhD on kinship and its consequences in cooperatively breeding southern pied babblers at the University of Cape Town in 2010. She is currently an NSERC post-doctoral fellow with Dr Peter Arcese in UBC's department of Forest and Conservation Sciences. For further information contact Dr Martha Nelson-Flower at martha.nelson-flower@ubc.ca or Dr Peter Arcese at peter.arcese@ubc.ca.

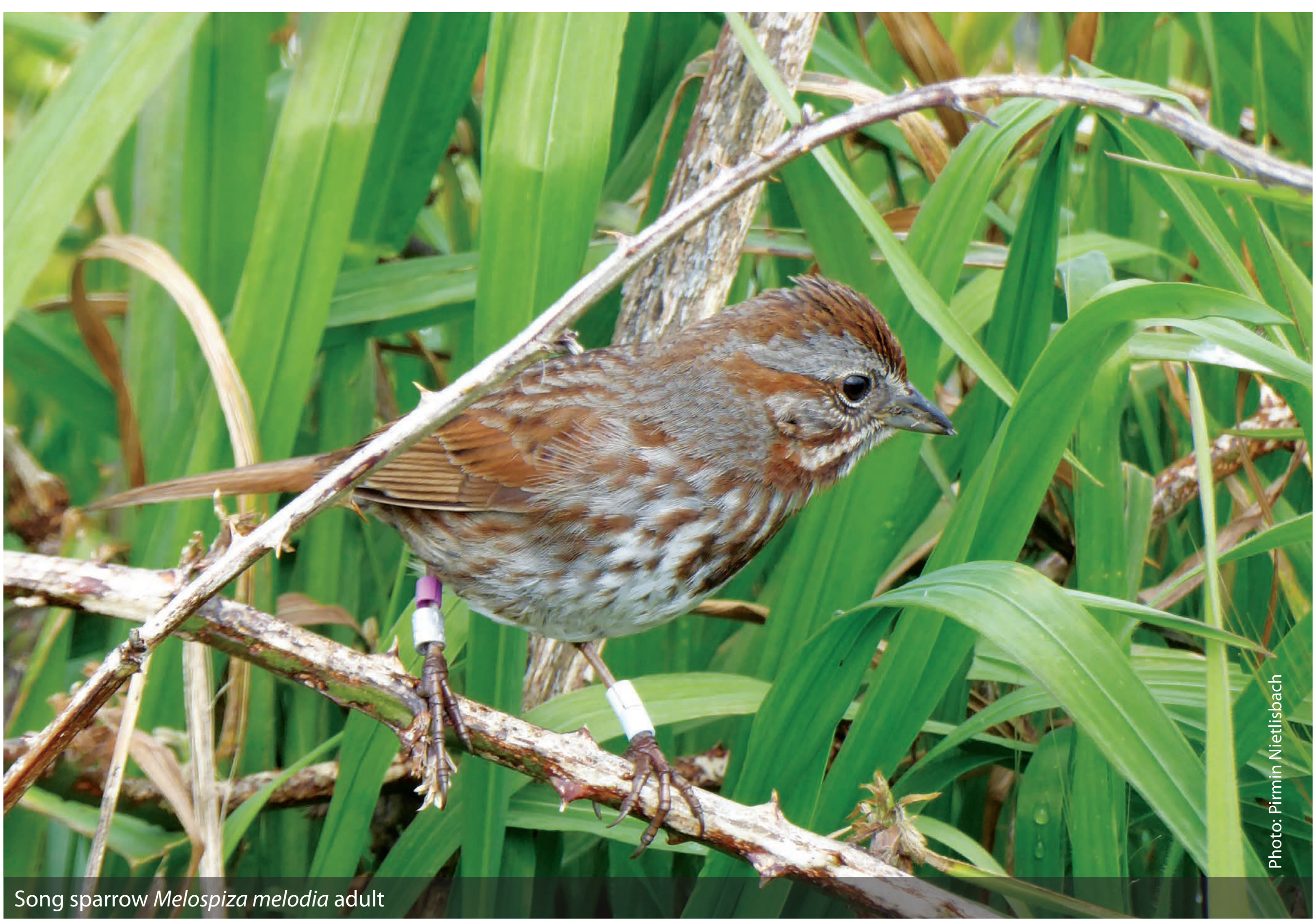


Photo: Pirmin Nietlisbach

Song sparrow *Melospiza melodia* adult

Can we help western redcedar survive in the presence of deer?

In the Canadian Galapagos of Haida Gwaii, the very survival of western redcedar is under threat. This is a tree species of great ecological, cultural, and economic importance, particularly to the coastal First Nations. This "tree of life" is used in their various art forms, including totem poles, woven hats, and baskets. However, redcedar is at serious risk of being obliterated from this legendary landscape due to the introduction of a non-native species, the Sitka black-tailed deer.

Missionaries introduced deer to Haida Gwaii in the late 1800s as a way to diversify food sources for the islands' inhabitants. Without a natural predator, the deer have colonized most of the approximately 250 islands in the archipelago at the phenomenal densities of 13-30 deer per km^2 on the largest islands and even higher on the smaller islands. Redcedar is highly palatable to deer, resulting in low regeneration. The redcedar growing on Haida Gwaii is particularly susceptible to consumption as it contains fewer natural defense compounds than redcedar on the mainland.

The poor regeneration of redcedar due to uncontrolled deer browsing, combined with its historic high harvesting rates, suggest a bleak future for redcedar on Haida Gwaii. However, there may be reason for optimism on the horizon. Catch Catomeris, a Masters student in the Department of Forest and Conservation Sciences, and her supervisor, Dr Sue Grayston, have teamed up with Haida-owned Taan Forest. Together with the FSC-certified forestry company, the researchers are investigating methods to improve redcedar regeneration and survival in the presence of deer. These include the use of deer repellents and the inoculation of soil with fungi beneficial to redcedar.

Since the introduction of the Land Use Objectives Order on Haida Gwaii in 2011, forestry companies are obligated to plant redcedar encased within protective cones in order to prevent browse damage by deer. Unfortunately, these cones are not only costly to purchase and maintain, but can also negatively impact seedling growth. As part of her research, Catch assessed the effectiveness of 2 deer repellents as potential alternatives to the protective cones. The repellents she tested were wolf urine and a commercially-available deer repellent. In one short-term study, using redcedar placed in a cutblock, Catch found that wolf urine reduced browse damage on redcedar boughs by almost a third relative to untreated controls. In a separate study, which is still ongoing, Catch planted redcedar seedlings in the cutblock and treated them with a commercially-available deer repellent. Early results are promising, and this repellent appears to be successful in reducing herbivore damage to the seedlings

Forest managers at Taan have noted that on some sites, where redcedar has been absent for one rotation, redcedar survival is poor even with the use of protective cones. This may be because the essential, mutually-benefcial fungi that naturally live on the fine roots of redcedar are missing from these soils. Redcedar, in contrast to most other tree species in our temperate forests, lives cooperatively with arbuscular mycorrhizal fungi. Populations of these fungi can decline rapidly in soil in the absence of their hosts. As such, Catch is also assessing whether fungal inoculation on sites where redcedar has not been growing for more than 60 years may be a viable method to increase redcedar seedling growth and survival.

This research will provide Taan Forest with critical information on the most effective methods to improve western redcedar growth and survival on Haida Gwaii. This will assist with their commitment to sustainable forestry practices to protect Haida Gwaii's economically and culturally-important tree species.

This project was funded in part by an NSERC Engage grant. For further information please contact Catch Catomeris at c.catomeris@alumni.ubc.ca or Dr Sue Grayston at sue.grayston@ubc.ca.

Forest structure and habitat connectivity

The structure of a forest provides an ideal environment to support biodiversity. The vertical dimensions of a forest canopy create microclimates of environmental conditions that provide homes for a variety of forest inhabitants in the different parts of the canopy. For example, some species forage almost exclusively in the upper level of forest canopies, whereas shrub-dwelling species forage near the ground. Many ungulates, such as woodland caribou, prefer old-growth forests as winter habitat because of the availability of lichen in these areas. In general, structurally complex forest stands point to a high level of forest biodiversity and such stands can provide more habitat niches than single-layer stands. Thus, forest structure is often used as a criterion to identify important habitat patches.

The spatial connectivity of habitat patches also affects how efficiently forest wildlife species can traverse and utilize habitat resources across the landscape. Even though large habitat patches contain more habitat area, they may not be easily reached by wildlife species if they are spatially isolated from each other. In contrast, small habitat patches could provide important stepping-stones in spite of their small size. The spatial pattern of high-quality habitat patches impacts the accessibility of these patches to many mammal and bird species. As rapid land-use changes occur, characterizing habitat structure and analyzing spatial patterns are essential to the understanding of how habitat loss caused by human disturbance could potentially influence habitat quality and connectivity.

Conventional measurement of forest structure requires tedious field surveys or manual interpretation of aerial photos. Airborne lidar (Light Detection and Ranging), as a remote sensing technology, can penetrate forest canopy and detect the spatial arrangement of forest stands accurately and systematically over large areas. The data obtained through this technology provide structural information at the landscape-level for modeling of landscape connectivity. Aria Guo has recently completed her graduate degree under the supervision of Dr Nicholas Coops in the department of Forest Resources Management. She focussed her research on using lidar-based structure classification in the identification of important habitat patches and assessing their landscape connectivity after modeled disturbance events. Her research project is a joint partnership between the Government of Alberta and UBC. Her dataset, provided by the Alberta Ministry of Forestry and Agriculture, covered more than 33 million hectares of Alberta's managed forest and included 10 natural sub-regions of the province.

Aria processed 6 quantified lidar metrics that were related to canopy structure and identified 8 unique structure types across the landscape based on canopy cover, height distribution and variation. She selected the structure type with a high level of structural complexity and stratified them with Landsat-derived forest cover types to construct patch-based habitat networks for assessing habitat connectivity. Aria simulated land-use change events using network analysis to suggest the best conservation scenarios to prevent long-term habitat connectivity loss under changing landscapes in Alberta's managed forest. She observed that conservation strategies that consider both habitat area and the stepping-stone effect of habitat patches can effectively reduce connectivity loss caused by land-use change events. She also used climate change effects as one of her modeling constraints, but noticed that this did not have a profound impact on the spatial prioritization of the protected habitat patches.

Aria's research combines lidar-based structure inventory with forest cover types as a base layer to derive spatially-explicit data for landscape modeling of habitat connectivity at a regional level. As more remotely sensed data are processed and archived, detailed information on habitat types and structure will be available and our capacity to model ecological processes over broad spatial areas will become more and more achievable.

For further information, contact Aria Guo at ariaguo.ubc@gmail.com or Dr Nicholas Coops at nicholas.coops@ubc.ca.

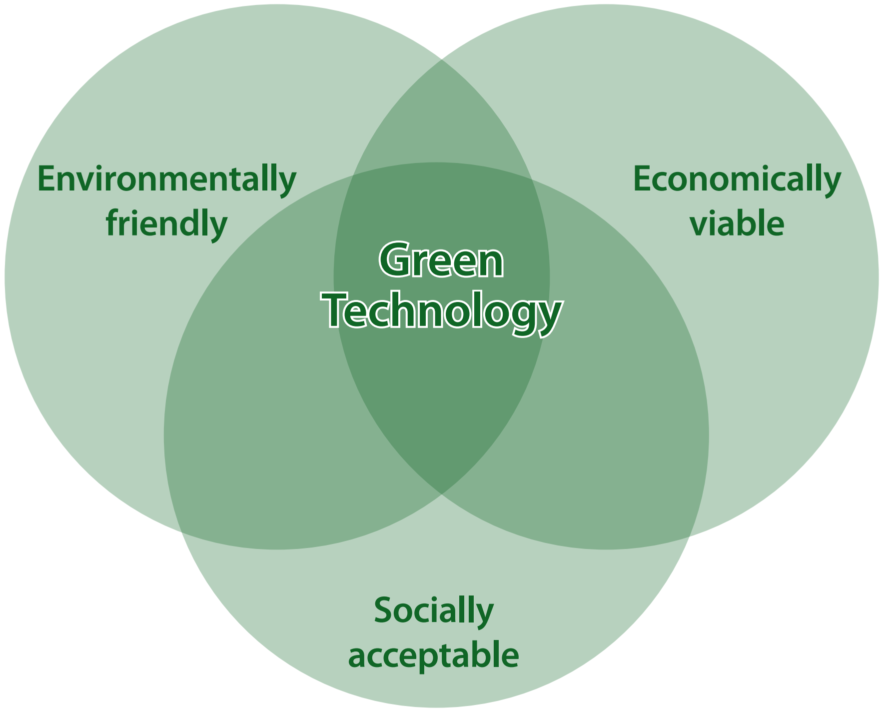
Green chemistry and engineering for forest bioproducts

Time series photgrpahs demonstrating gas barrier properties of transparent nanocellulose film. Emerging smoke is retained in the bottom of the cylinder

Green chemistry does not relate to the colour of compounds in the test-tube, but the societal and environmental impacts on people and the planet. Some of the tenets from the *Green Chemistry Pocket Guide* are grouped around the idea that "Green chemistry uses renewable biodegradable materials which do not persist in the environment." Materials that we can harvest sustainably from the forest fall into this category and UBC's Faculty of Forestry is developing new ways to utilize every last fibre. In so doing, they have focused on another set of green chemistry principles from the Guide "using catalysis and biocatalysis to improve efficiency and conduct reactions at low or ambient temperatures." Catalysis-based reactions are analogous to walking through an airport and walking on the moving walkway—you are traveling the same distance but moving nearly twice as fast; additionally, the walkway is a moving belt so it can be reused by everyone.

Catalysts help reactions proceed faster and can be reused again and again, if they can be recovered from the test-tubes. Interestingly, the Wood Science Department has an emerging expert, Dr Saurabh Patankar, who studied catalysts at the Institute of Chemical Technology in Mumbai, India, during his doctoral research. Dr Patankar joined the department of Wood Science as a postdoctoral fellow (after a term as a visiting Queen Elizabeth Diamond Jubilee Scholar) to learn how to utilize wood fibre as a renewable feedstock. He furthered his expertise of Green Chemistry at UBC when he was selected to participate in the American Chemical Society's Summer School on Green Chemistry and Sustainable Energy last June. From these experiences he, and Dr Scott Renneckar (an associate professor in the department of Wood Science), created a new catalyst that is easy to recover using the idea of sustainable nanotechnology.

This area of research focuses on designing materials at a scale of 100 billionths of a metre, and smaller, that reduces or eliminates hazardous substances. The catalysts sit on the surface of magnetic nanoparticles, which are 1000x smaller than the diameter of wood fibre, allowing them to interact at the



molecular scale with the wood surfaces and be pulled out of flasks using simple bar magnets.

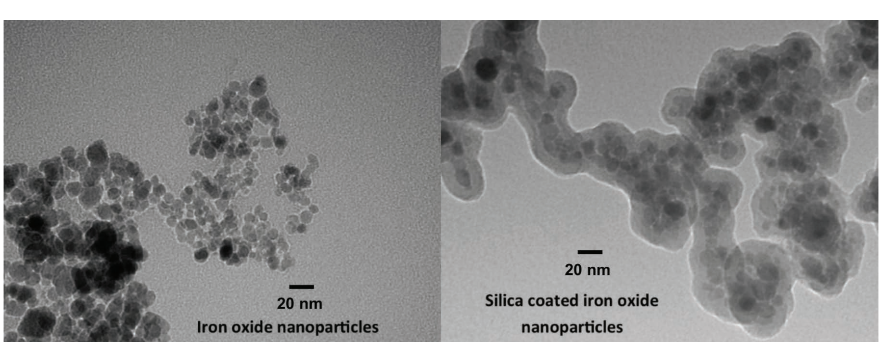
The exciting opportunity that these re-usable catalysts offer is that they are not wasted in the effluent after the completion of the reactions. This outcome makes it cheaper to use the catalysts and, importantly, prevents the release of catalysts that could be toxic to aquatic wildlife from accumulating in the environment. A scientific report on the modification of wood fibre for advanced materials was published recently in *Green Chemistry* (2017,19: 4792-4797). Currently, the researchers use these catalysts in the production of nanocellulose, another sustainable nanotechnology.

Nanocellulose is nature's steel cable allowing excellent mechanical performance of plant-based materials that can grow more than 100m in height. These light-weight rope-like materials are tightly woven into the fabric of the cell wall of trees, constituting over 40% of the mass. Further, they consist of units of sugar connected together in a string-like fashion and are biodegradable, unlike most plastic bottles, at the end of their life cycle. Because of their unique strength properties, nanocellulose extraction from wood and other plant sources is being investigated at the industrial scale. Further nanocellulose is beginning to find applications that range from making concrete stronger, nano-medicine and packaging materials.

Part of the interest in nanocellulose relates to its ability to be transformed through simple processing methods into continuous filaments, foams, and highly iridescent or transparent films. These films have a very tight network making it almost impossible for other molecules to cross the film. A visual example is seen in the photograph, opposite left, where a transparent film of nanocellulose is adhered to the bottom of the glassware and the smoke used for visual effect is retained in the glass. These films are currently being used in commercial applications as odour shields, and have potential to enhance the shelf life of packaged food by limiting oxygen transmission. Innovative products utilizing nanocellulose can provide a revival opportunity for Canada's pulp and paper industry.

Dr Patankar has now turned his attention to using his catalysts on other substrates including lignin from the pulp mill and waste marine biomass such as the shells from prawns to create a whole new platform of compounds useful for society. When asked what was his favourite aspect of the research, compared to his previous work on other catalysts, Dr Patankar replied, "It's difficult to decide, in one case it follows the green chemistry tenet for the conversion of renewable feedstocks for useful materials for society, but on the other hand, it differs greatly from my previous research on catalysts that required high temperatures in a specialized pressurized reactor. This new catalyst works with wood fibre in water, and the reactions proceed near room temperature, which is much more sustainable." However, after a brief pause Dr Patankar continued, "My favorite attribute is that this catalyst is so versatile, it is like a bit of forest pixie dust, it seems to magically work with everything I put into my reaction flask."

For more information about this project please contact Dr Saurabh Patankar at saurabh.patankar@ubc.ca or Dr Scott Renneckar at scott.renneckar@ubc.ca. Further information on Green Chemistry can be found in the Pocket Guide available at www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/principles/green-chemistry-pocket-guides.html.



Electron microscopy image of magnetic nanoparticles

Transparent nanocellulose film

development & alumninews

Congratulations to the Forestry Alumni Builder Award recipients

To celebrate its 100th anniversary, alumni ubc created the Alumni Builder Awards in 2017. These awards recognize alumni who, in their own way, have made important contributions to the success of UBC and its alumni community.

The Faculty of Forestry congratulates Alumni Builder Award recipients ***Gerry Burch****,* ***Peter Pearse*** *and* ***John Worrall.*** *Their professional careers, research and volunteer contributions have enriched forestry, community and the Faculty.*

(William) Gerry Burch graduated in Forest Engineering in 1948. Over his career he had a significant influence on sustainable forestry practices and policies in British Columbia, and helped countless budding young foresters get a start in the profession

After graduating from UBC Gerry became a field forester with BC Forest Products and began a career with the company that spanned 4 decades and culminated in his role as Vice President Timberlands and Forestry.

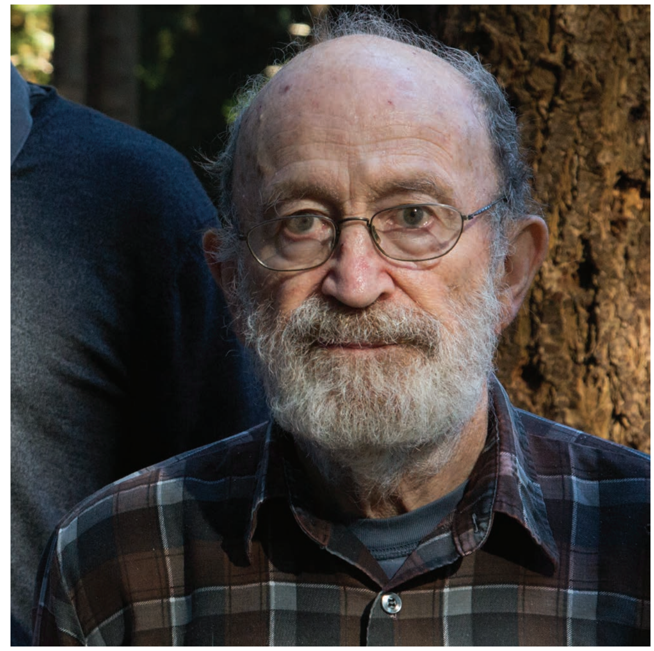
Following that, Gerry served as an Adjunct Professor in the Faculty of Forestry, as well as on many Faculty committees that worked on increasing alumni support for the Faculty's programs, particularly forest genetics. Today, because of Gerry's early contributions and encouragement, more than 70% of the 200 million trees planted each year in BC are from genetically-improved seed.

Gerry assisted with the formation of the BC Festival of Forestry Society in the 1960s, which took over 2000 teachers on tours of rural, resource-based BC communities to develop their understanding of forestry as a critical economic, social and environmental resource.

He served as President of the Association of BC Professional Foresters and President of the Canadian Institute of Forestry.

To support the next generation of foresters, Gerry has established the Gerry Burch Scholarship in Forest Sciences, and prior to that supported the Gerry and Jack Burch Bursary. In addition, he was instrumental in creating a scholarship for graduate students through BC Forest Products. He served as Vice-Chair of the faculty's Alumni Fundraising Committee, and was Co-Chair of the fundraising campaign that resulted in the Forest Sciences Centre building.

Gerry has received many of the profession's top awards, including the Distinguished Forester Award, Canadian Forest Achievement Award, and Distinguished Lifetime Achievement Award. He co-founded the Forest History Association of BC, and completed oral history interviews with over 50 people who contributed significantly to forestry in the province.



Dr Peter Pearse's long and distinguished academic and public service career began with a BSF from UBC in 1956. By combining that with Masters and Doctoral degrees in economics from the University of Edinburgh, Peter became an internationally recognized resource economist, beloved professor, and gifted policymaker.

Peter's career at UBC began in 1962 as an Assistant Professor of Economics. He was appointed Professor of Forest Economics in 1980, a position he held until his retirement in 1996. The following year the Faculty of Forestry named him Professor Emeritus.

Peter has led 2 Royal Commissions. In 1976 the BC government tasked him with a thorough review of its outdated forest policy, which resulted in a new Forest Act and revision of the province's arrangements for licensing and managing Crown forests. These modernized forest policies and practices and continue to have far-reaching impacts on our forest resources and forest industry today.

In 1981-2 Peter headed the Royal Commission on Pacific Fisheries Policy. His recommendations resulted in the quota system in place today that helps ensure the sustainability of Pacific coast fisheries.

Peter has received some of the highest honours available to Canadians, including the Confederation Medal, the Queen's Golden Jubilee Medal, the Canadian Forestry Achievement Award and the Distinguished Forester Award. He is a Member of the Order of Canada.

During his career at UBC Peter served, at various times, as President of the Faculty Association, a member of the University Senate and, for 2 terms, a member of UBC's Board of Governors. His concern about the barriers to higher education faced by Aboriginal students led him to establish, in 2015, the Peter H Pearse Forestry Award to support these students.

After receiving a PhD from Yale University, **Dr John Worrall** returned to UBC, where he had completed a BSF degree in 1963. In 1969, John became an assistant professor in the Faculty of Forestry. He retired from his Faculty position in 2003 after decades of educational leadership. John left a positive impact on generations of students.

For 35 years John taught dendrology to undergraduate students with an obvious love of the topic and enthusiasm for effective teaching. John also taught introductory forestry to non-forestry students, and his ability to connect with people of all academic backgrounds gained him much respect.

John's commitment to student learning extended well beyond the classroom. He supervised student social functions, made himself available for those who were having personal, academic or financial challenges, and worked hard to ensure that all students felt welcome and appreciated.

John received the UBC Killam Teaching Prize twice, in 1990 and 1996. This prize recognizes excellence in teaching, and nominations are made by students, colleagues and alumni. In 2001 he received the UBC Margaret Fulton Award, which is granted to an outstanding individual (student, faculty or staff) who has made a contribution to student development and the university community.

In addition to these UBC-granted awards, John has been recognized on multiple occasions by his former students. In 1996 the alumni from 1975-1989 established the John Worrall Alumni Bursary, which stands as one of the most popular and well-supported special award appeals ever launched by the Faculty. Just a few years later, in 2003, John's colleagues, friends and students created the John Worrall Tree Enthusiast Prize, to celebrate John's retirement and recognize his outstanding contributions to teaching and students.

The Faculty of Forestry is very proud of these outstanding alumni and of all alumni who contribute positively to forestry, community, and society. If these profiles of Gerry, Peter and John remind you of another exceptional alumnus, let us know. Stories of connection, engagement and contribution are always welcome. Contact Michelle Lindsay, Alumni Engagement Manager at michelle.lindsay@ubc.ca or 604.827.0297.

Help take students out of the classroom

To hear students talk about their experiences at Forestry Field School, you'd think they were describing something a lot more, well, transcendent. "A fantastic opportunity," they say. "Amazing." "Has deeply enriched my life." "Invaluable."

Field School is an important milestone in a student's forestry education. After 2 to 3 years of classroom courses in basic sciences, ecology, silviculture, hydrology, and much more, Field School moves the learning environment to the forest.

There, students integrate their course learning, develop powerful observation and diagnostic skills, and work in teams to develop forest management strategies. This experiential learning is a priority for the Faculty, and reflects a commitment to providing a beneficial mix of classroom and field-based instruction.

Students report that Field School has an enormous impact on their academics. Hugh, a fourth-year student in Natural Resources Conservation, said, "Field School has given me the assurance that the forest industry in British Columbia is where I want to grow my career."

Brett, another NRC student, said, "Field School gave me the opportunity to apply my classroom learning to real world scenarios and build on my scientific understanding."

Employers, such as Mauro Calabrese of West Fraser, recognize the value Field School adds to a student's experience. "Getting hands-on field camp experience helps forestry graduates contribute right away when they come to work in the forest industry, because they already have field skills that are assets to future employers," he says.

But Field School is expensive. On average it costs each student between $800 and $1800, depending on the number and location of Field Schools they attend. This effectively increases the cost of their academic year by 13-16%. For many students, covering this fee is stressful, impacting their studies or forcing them to juggle part-time jobs.

Paul Lawson, Director of UBC's Research Forests, has been concerned about Field School fees for many years. "Every year I see students who are dreading Field School rather than looking forward to it, because they have to take on a part-time job or scrimp and save to afford the fee," he says. "I saw that at University of California Berkeley they were able to fund a 5-week field school entirely through donations, and I became convinced we could do the same thing at UBC."

Our ultimate goal is to eliminate Field School fees entirely through an endowment we call the **Field School Fund**. This fund kicked off last year and we are extremely grateful to the donors who have contributed to date, but we are still short of our goal and need your help.

This year, 350 students attended Field School, which is up considerably from 2016. Five Forestry programs have mandatory Field Schools, and this hands-on experience is becoming more popular all the time with students who want to take it as an option.

Please consider making a donation to the Forestry Field School Fund. You can help ensure that students can immerse themselves in practical, hands-on learning without the stress and worry of affordability.

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

Alumnus leads innovations in mass timber

As the President of Structurlam Products, Forestry alumnus **Bill Downing** is the driving force behind a company that is unique in British Columbia and has only one peer in Canada. Structurlam products including Cross Laminated Timber (CLT) panels have gone into structures such as Brock Commons Tallwood House at UBC, and Raleigh Durham Airport in North Carolina, among many others.

Bill Downing received a BSF from UBC in 1984. "I was part of the largest graduating class to date," he says. "Forestry was just rocking when I started my degree. But then we all graduated in the middle of a recession and there weren't enough jobs."

Bill was fortunate to find a job with a small timber company in Creston BC. There he had a broad range of responsibilities, from laying out cutting permits to planning and supervising all the company's silivículture activities. He achieved RPF status in 1987.

"One really challenging project I had was on the east side of Kootenay Lake. We had all sorts of problems, the planning was very complicated, and I couldn't keep track of all the competing interests in my head," he says. "Then I went to a seminar on Geographic Information Systems (GIS) and saw the future of forestry planning. I found a company in Victoria that developed GIS and went to work for them."

The company was PCI Geomatics. Bill helped develop a number of applications on the ground, then migrated into sales because customers found him relatable as a fellow forester. Eventually, as PCI grew, Bill became the manager of the west coast office.

In 1999 PCI purchased technology from a university in the Netherlands, and Bill was tasked with adapting the technology for North America. After a year of being away from his young family for 2 weeks out of every 6, he decided to look for opportunities to stay in BC.

Bill joined BC Wood Specialties Group (BC Wood) in 2000 as CEO. "I was never tempted to leave forestry. There's no better people anywhere," he says.

In 2007 Bill was appointed President of Structurlam Products. "At that time, the company was led by Mark Rufiange, who coincidentally was my neighbor in residence at UBC. We hadn't seen each other in many years, but had reconnected when I was with BC Wood," Bill says.

"In those days, Structurlam was only making glulam – glue laminated timber. I saw CLT at a conference in Europe in 2008, and I was determined to find out if we could manufacture and sell it here," he says. "We spent 2 years doing market research, and by 2010 we had a good business model. We were very fortunate to get some provincial and federal funding as well."

Structurlam opened their CLT plant in 2011 and built demonstration projects to allow engineers and architects to appreciate the potential of the material. "Today, CLT represents three-quarters of our business," Bill says. "When I came here in 2007 we had 80 employees, and now we are the largest private employer in the South Okanagan"

Structurlam's CLT panels and glulam columns were key components of UBC's Brock Commons Tallwood House, the tallest contemporary mass timber building in the world. Tallwood House opened in July 2017 and is a residence for over 400 upper-year and graduate students.

Other notable Structurlam projects include the Rocky Ridge Recreational Facility in Calgary, which features the largest wood constructed roof in North America; Carbon 12, an 8-storey residential building in Portland OR which is the first mass timber structure in the US; and the 2008 renovation of the Art Gallery of Ontario.

In recognition of his vision and leadership of Structurlam, Bill was named runner-up in the Construction category of the Pacific region EY Entrepreneur of the Year 2016 awards program.

"I'm proud to be leading such an innovative company, where we make high quality, BC-born-and-raised products, and share the benefits of building with mass timber," he says.

Reunion recaps

The class of 1982 held their 35th anniversary reunion in Summerland B.C. on June 24. They had a great weekend of bike riding, wine tasting and visiting with old friends.

The class of 1957 hosted their 60-year reunion at Harrison Lake Resort in September. Their reunion included a daytrip to Yale, dinner and dancing.

The classes of 1991-1993 held a reunion during the last weekend of October. Their reunion included a tour of campus, a reception at the Robert H Lee Alumni Centre and dinner at the Marriot Vancouver Airport Hotel. A great time was had by all!

The classes of 1948, 1958, 1968, 1978, 1988, 1993, 1998 and 2008 are celebrating milestones in 2018. The class of 1968 is already planning their reunion, are you from one of the other classes and need help getting started? Contact Michelle Lindsay at michelle.lindasy@ubc.ca or 604.827.0297 for more information.

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