branchlines

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In this issue:

UBC Forestry
University of British Columbia

dean'smessage

It is always a pleasure when our members of the Faculty receive national recognition for their efforts. In this issue of BranchLines we celebrate with Simon Ellis his award of a 3M National Teaching Fellowship. This is Canada's most prestigious teaching award, and as far as we know, this is the first time in Canada that a fellowship has been awarded to someone from a Faculty of Forestry. Simon's excellence in teaching is renowned within the Faculty, and I am delighted that he has received this recognition. We similarly congratulate Peter Arcese for the recognition that he has received from the Society of Canadian Ornithology for his research into birds and his work on conservation in British Columbia.

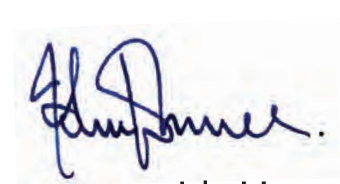
At the end of this issue, we also celebrate another award. Thanks to the generosity of an anonymous donor, we have been able to advertise and promote the most valuable PhD fellowship in forestry anywhere in the world, namely the Future Forests Fellowship. It has been won by Sara Barron, who will be undertaking research into the ways that suburban forests can help communities mitigate and adapt to a changing climate. Suburban forests? Yes – Sara's research will highlight the importance of trees, woodlands and forests in the urban environment, an area of research that has been neglected for too long in British Columbia. We often forget all the non-timber benefits that trees and forests can bring, and this is particularly evident in urban and suburban areas.

The articles in this issue reflect once again the diversity of the research being undertaken in the Faculty of Forestry. The work on glulam timber and radio-frequency heating to control pests reflects the important focus of some of our faculty members on the needs of British Columbia's local forest products industry. The university has an important role to play here, and needs to work in collaboration with organizations such as FPInnovations and individual companies to ensure that our research can help meet some of the forest sector's needs.

However, it is also important that we understand our environment better and the potential impacts of activities such as forestry on the environment. The article on the effects of sedimentation on stream communities is an example of this type of research, whereas the article dealing with cross-ecosystem subsidies illustrates how important it is to understand basic ecosystem processes. The description of the AdapTree project, which is looking at how seed transfer policies should be changed in the light of climate change, combines basic and applied research, something that we seem to be able to do well in the Faculty of Forestry thanks to its diverse make-up.

Our international efforts continue, and this year a group of students from our new Master of Sustainable Forest Management program developed a management plan for an area of Mexico. The team was exposed to a range of unfamiliar management issues, broadening their experience and their ability to deal with the unforeseen once they move into the forestry profession.

Finally, I would draw your attention to the article on perceptions of advocacy at the science-policy interface. This is an interesting area, particularly in view of the current allegations that government scientists in Canada have been prevented from even presenting their basic scientific results. Just how far can a scientist go in the science-policy debate? The article identifies some clear guidelines that may help others recognize where the boundaries of acceptable levels of advocacy lie.



John L Innes
Professor and Dean

forestrynews

Simon Ellis wins 3M National Teaching Fellowship

We are delighted to announce that **Dr Simon Ellis**, associate professor in the Department of Wood Science and director of the Wood Products Processing program, is being awarded this year's 3M National Teaching Fellowship. This award is recognized as Canada's most prestigious teaching award. Simon is an outstanding educator – a Killam Teaching Prize winner and consistently one of the highest rated instructors in the Faculty of Forestry. His dedication to and passion for teaching has also meant that he has become the proverbial 'go-to' resource in our Faculty for matters related to the undergraduate experience and teaching; the importance of this role in a Faculty cannot be overstated. He has served as the Faculty's director of Recruitment and Co-operative Education and chairs the Faculty's Teaching and Learning Committee. Simon is also very active in university-wide teaching efforts and has been very involved parlaying his knowledge about teaching in programs offered by the Centre for Teaching, Learning and Technology. Most recently, Dr Ellis was assigned the task of developing and implementing the process of Peer Review of Teaching in the Faculty and is one of the principal actors in establishing a successful '2+2' program with students from Chinese partner universities. Congratulations Simon.

Peter Arcese awarded for lifetime contributions in ornithology

Dr Peter Arcese, Forest Renewal BC Chair in Conservation Biology, has received the 2012 Doris Huestis Speirs Award of the Society for Canadian Ornithology for outstanding lifetime contributions in Canadian ornithology. Peter, a PhD graduate of UBC (Zoology, 1981) was an associate professor in North America`s first department of wildlife ecology (University of Wisconsin-Madison) before returning to UBC in 1999 to take up one of several newly established FRBC Chairs. Since then, Peter has published over 60 papers with dozens of undergrad and graduate students on birds, plants and mammals of the Pacific Northwest and Africa, contributed the scientific model adopted to prioritize and design the reserves of the BC's Great Bear Rainforest, and worked on a host of marine and terrestrial birds that rely wholly or in part on BC forests. Peter currently leads efforts to prioritize and conserve forest and woodland ecosystems of the Georgia Basin via his roles as a director of the Nature Trust of British Columbia and technical committee co-chair of the recently announced Coastal Douglas-fir Partnership (BC Ministry of Forests). Peter has received a number of significant awards previously, including, as an NSF Young Investigator, Outstanding Advisor, Killam Senior Research Fellow and is an elected Fellow and Councillor of the American Ornithologists Union. Congratulations Peter.

They had 3 minutes...

The Three Minute Thesis (3MT) challenges graduate students to present their research in 3 minutes or less to a non-specialist audience. The competition began in Australia as a fun event for graduate students. This year, UBC graduate students participated for the 3rd time with 10 heats across campus. The Forestry heat included 11 students, presenting on a great diversity of research topics. Our 3 top place winners were: 1st place Douglas Bolton (Response of boreal forest structure to disturbance across gradients of productivity) and tied 2nd place Chelsea Nilausen (Biotechnology to save our forests?) and Amadeus Pribowo (Make the switch: Enzyme recycling to improve the economics of waste biomass refineries). This is probably one of the most fun (and challenging) events for our graduate students, as well as an insightful and enjoyable experience for the audience. We were really happy to see such a good turn out this year and, as with last year's event, such professional and engaging performances. Well done to all participants. Keep an eye out for announcements in early 2014 for the next 3MT event – the presentation evening is open to everyone.

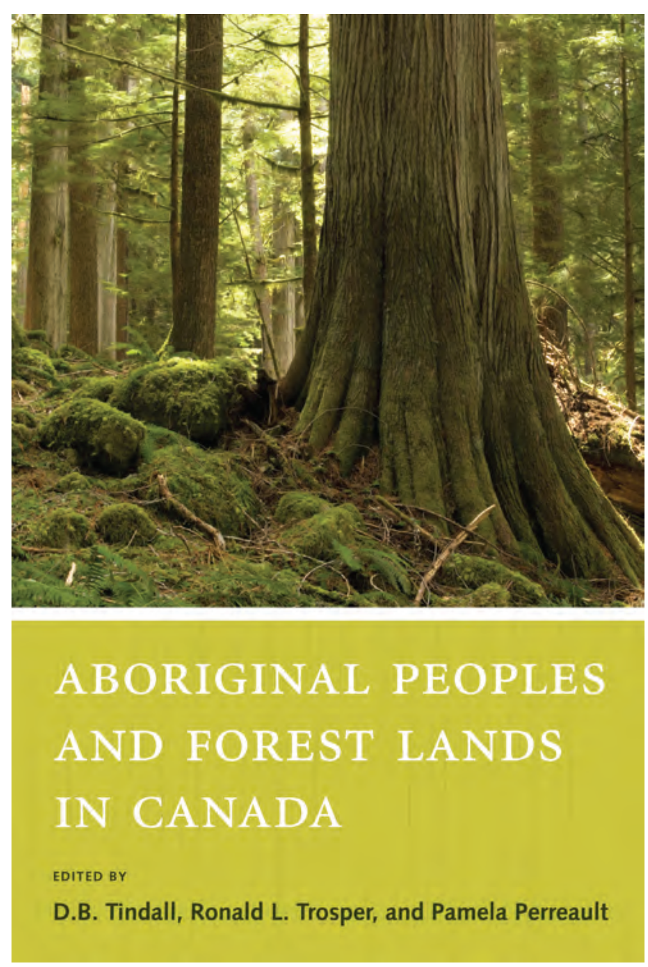
New book

Aboriginal Peoples and Forest Lands in Canada

Aboriginal people in Canada have long struggled to regain control over their traditional forest lands. This new book brings together the diverse perspectives of Aboriginal and non-Aboriginal scholars to address the political, cultural, environmental, and economic implications of forest use. The book discusses the need for professionals working in forestry and conservation to understand the context of Aboriginal participation in resource management. It also addresses the importance of considering traditional knowledge and traditional land use and examines the development of co-management initiatives and joint ventures between government, forestry companies, and Aboriginal communities.

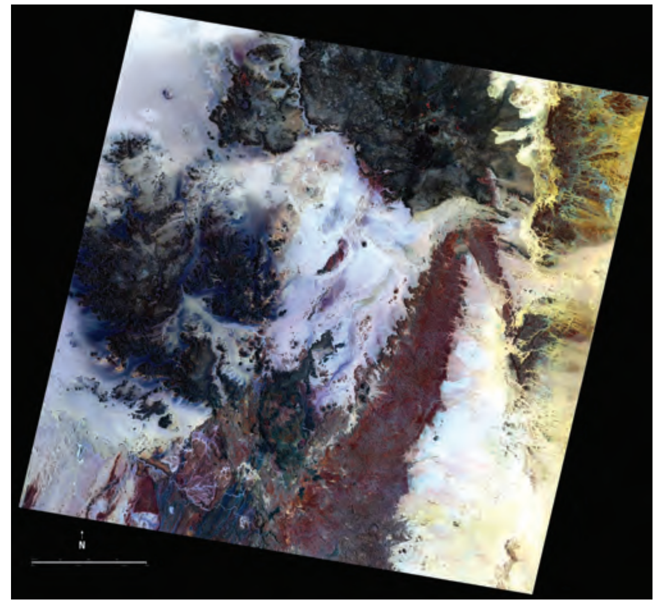
The book is co-edited by David Tindall, Ronald Trosper, and Pamela Perreault. It involves contributions by a number of current or former UBC Faculty of Forestry professors including: David Tindall, Ronald Trosper, George Hoberg, and Stephen Sheppard. It also involves contributions by a number of current or former Forestry graduate students including Pamela Perreault, Holly Mabee, John Lewis, Jason Forsyth, and Laura Bird.

For details on purchasing the book, go to: www.ubcpress.ca/search/title_book.asp?BookID=299173822.



New Landsat satellite launched

The Landsat Data Continuity Mission spacecraft (to be called Landsat 8) was launched safely in orbit on February 1st and is sending telemetry back to Earth. After 90 days, the US Geological Survey will begin to provide ongoing free data which will extend more than 40 years of satellite observations critical to water management, forest monitoring, urban planning and agriculture. Adjunct professor Dr Mike Wulder (Canadian Forest Service) is part of the Landsat Science Team and was part of the NASA press conference about the launch and the significance of the Landsat series of satellites. See www.youtube.com/watch?v=M3DyFchi-cg. Mike works with Dr Nicholas Coops in the Department of Forest Resources Management and Integrated Remote Sensing Studio on many projects using time series analysis of Landsat data for forest growth, disturbance and forest structure assessment.



Snowy owls in the lower mainland

Snowy owls, iconic birds of northern tundra ecosystems, symbolize the north and pristine wilderness. They are a frequent subject of Canadian art, a favorite animal for children's stuffed toys, and were formerly featured on our Canadian $50 bill (1988-2006). Most snowy owls stay in the arctic year round, able to survive during the long, cold and dark winters. They feed on lemmings or other small rodents that show strong population cycles. When lemming populations increase, snowy owls produce many young. Every 3 to 5 years, a food crunch happens when rodent populations collapse. Snowy owls adjust to this collapse in their food supply by extensive movements, often migrating to southern Canada and the northern USA. In the winters of 2012 and 2013, between 25 and 75 snowy owls spent over 4 months on the dykes of Boundary Bay in the lower mainland, much to the delight of thousands of naturalists, photographers and curious onlookers. Here, the birds are easily visible and appear almost as curious as their many human observers. Many of these owls are young birds. The past 2 years may seem exceptional but in fact, snowy owls visit the lower mainland and the Pacific Northwest every year, with the first notable irruptions recorded in the winter of 1889-1890. Snowy owls have been observed as early as September 13th on Sea Island, and have stayed in Ladner until May 12th.

SNOWY OWL FACTS: Snowy owls are the second largest owl in Canada, the largest being the great gray owl. They can live up to 10 years in the wild and up to 28 years in captivity. Snowy owls get whiter with age with some old birds being completely white. The snowy owl is the provincial bird of Quebec. Between 10,000 and 30,000 pairs are estimated to breed in Canada.

Subsidies in nature

A century ago the predominant view of ecosystems was that they were separate, self-regulating systems and that most of the dynamics of an ecosystem could be explained by processes internal to that system. We now know that many ecosystems are highly dependent on inputs from adjacent ecosystems. This is most obvious at the water-land interface, and while it is easy to imagine gravity causing things such as leaf litter and terrestrial invertebrates to fall into water, the contributions of aquatic ecosystems to the land are less well known. Many of these materials turn out to be essential resources for consumers in the adjacent ecosystems. We have come to refer to these flows of material as cross-ecosystem resource subsidies, since they subsidise (at least in the short term) consumers in the recipient ecosystem. Dr John Richardson's Stream and Riparian Research Group in the Department of Forest and Conservation Sciences has been trying to understand the ecological consequences of these resource subsidies.

One well-known example of a resource subsidy is the large amount of terrestrial leaf litter that falls into streams. A guild of small freshwater invertebrates, and sometimes fish and tadpoles, feed on the decaying leaf litter after it is partially processed by microbes to convert the cellulose to easier-to-digest materials. Some of our older experiments demonstrated that the input of leaf litter was one of the limiting resources for stream productivity. Since then others have done an experiment excluding all leaf litter resulting in near collapse of a small stream ecosystem. Recently, we have been able to demonstrate differences in productivity of small streams containing the same kinds of species. These differences are the result of different litter inputs which depend, of course, on the type of riparian (stream bank) trees present.

In many coastal streams, resident cutthroat trout can be the top predator, but it turns out that in these low-productivity streams they spend a lot of their time watching for invertebrates dropping into the water from the forest. In one experiment we divided 2 streams into many reaches and marked the cutthroat trout. Half the fenced-off reaches received a supplement of mealworm larvae every day. The fish receiving the extra food grew a lot faster than the control fish that still had access to instream prey and natural inputs of terrestrial insects, showing that the fish have the capacity to grow much faster but they are limited by food inputs. To look at the inverse of this pattern, we covered several stream reaches with plastic sheets (about 50 m long replicated 4 times) and found that excluding terrestrial invertebrates reduced growth rates of trout by half. This past summer, visiting scientist Dr Takuya Sato (about to move back to a new position at the University of Kobe as an associate professor), PhD student Kirsten Campbell and I did an experiment to determine how critical the timing of these inputs might be. We used 2 versions of the addition experiment – fish in fenced-off stream reaches either got extra prey for 2 months early in the summer, other reaches for two months in the early autumn, or some fish just received the natural input rates. Again, we found that the fish getting extra food, regardless of timing, grew much faster. The flexibility in their responses suggests their growth is limited by food supply and explains the strong density dependence noted in stream fish.

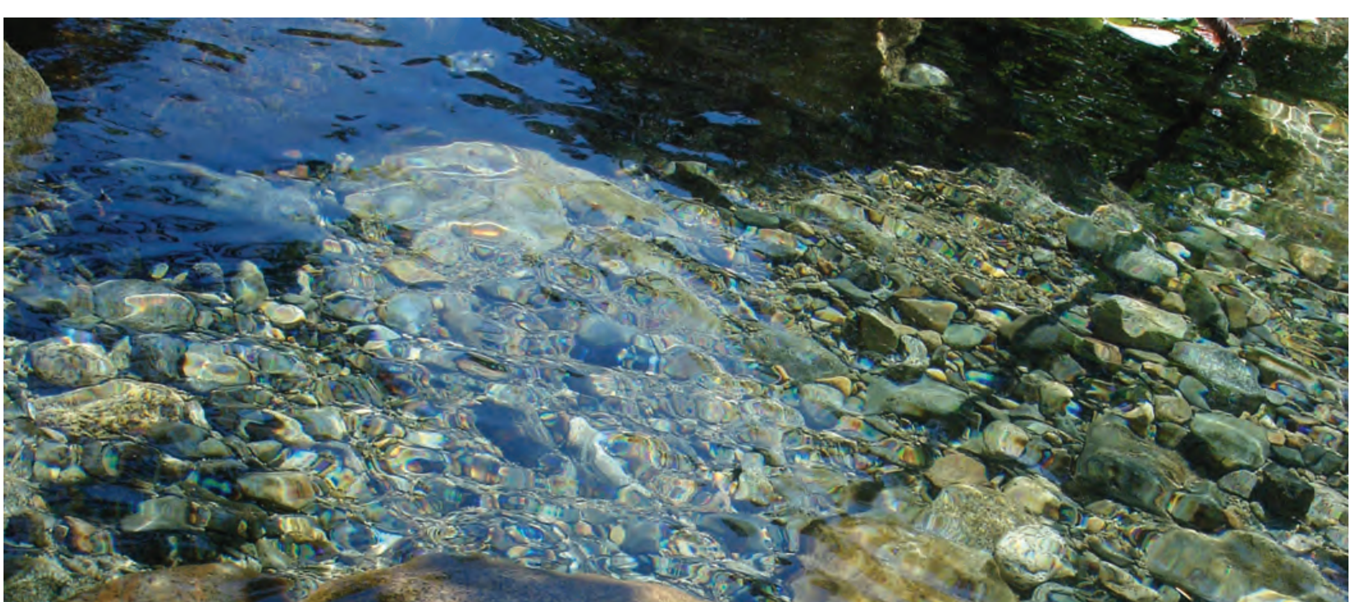
These cross-ecosystem resource subsidies also go the other direction. For instance, many species of aquatic insects in streams have a terrestrial adult stage. As these adults fly up out of the stream, there are many predators waiting for them. These predators might include swallows, dragonflies, bats and other species. One of those other predators includes spiders, many of which attain high densities along streamsides feeding on the adult aquatic insects. Former PhD student, Dr Laurie Marczak (now a professor at University of Montana) and I experimentally reduced the numbers of adult aquatic insects reaching the streamside using a plastic "hoop house" over several reaches of streams. As a result of reducing the numbers of adult aquatic insects we found spider densities declined by about 20 to 70% depending on the species of spider. This was despite the fact they still had terrestrial prey insects available to them. Again, this experiment shows the high level of dependence of consumers on cross-ecosystem subsidies.

As a further example, a former post-doc Dr Yixin Zhang (now professor at Texas State University) and several others of us looked at the contribution of salmon carcasses to small stream ecosystems. Salmon are considered to be a cross-ecosystem resource subsidy as over 98% of their body mass is derived in the ocean and is then brought back to streams in a form that is a convenient resource for some species. We found that in streams with experimentally added carcasses, stream invertebrates chose to eat salmon over decaying leaves.

We have several directions for this research program. For one, we would like to know how characteristics of these resource pulses affect their recipient populations. Would a very large, but short-term pulse of subsidy resources have the same impact on consumers as a smaller, but longer-lasting pulse that delivered the same cumulative amount of food over a longer period of the life cycle of the consumer? There are practical reasons for these questions as we change the timing, magnitude and duration of these resource inputs by altering the surrounding forests.

Shifts in forest composition, particularly the riparian vegetation (such as from conifers to red alder) may have huge impacts because of the differences in the quality and timing of leaf litter inputs to streams. These changes in forest composition also affect the kinds and amounts of terrestrial invertebrates falling into streams which coho salmon juveniles and cutthroat trout seem highly dependent upon. All of these cross-ecosystem flows provide one more reason to ensure we manage riparian areas carefully, beyond the obvious impacts to temperature and flows.

Dr John Richardson is professor and head, Department of Forest and Conservation Sciences. For further information visit his website at http://faculty.forestry.ubc.ca/richardson/ or contact him directly at john.richardson@ubc.ca.



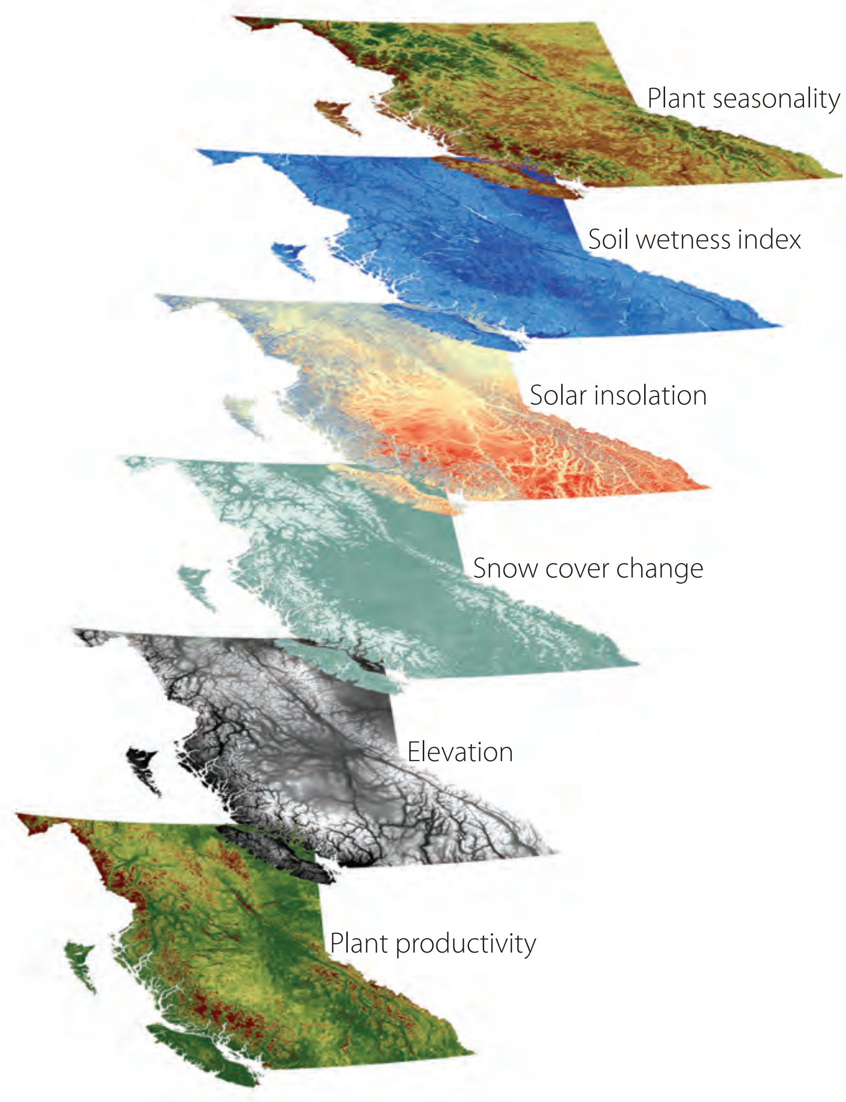
A new look at ecosystems in BC

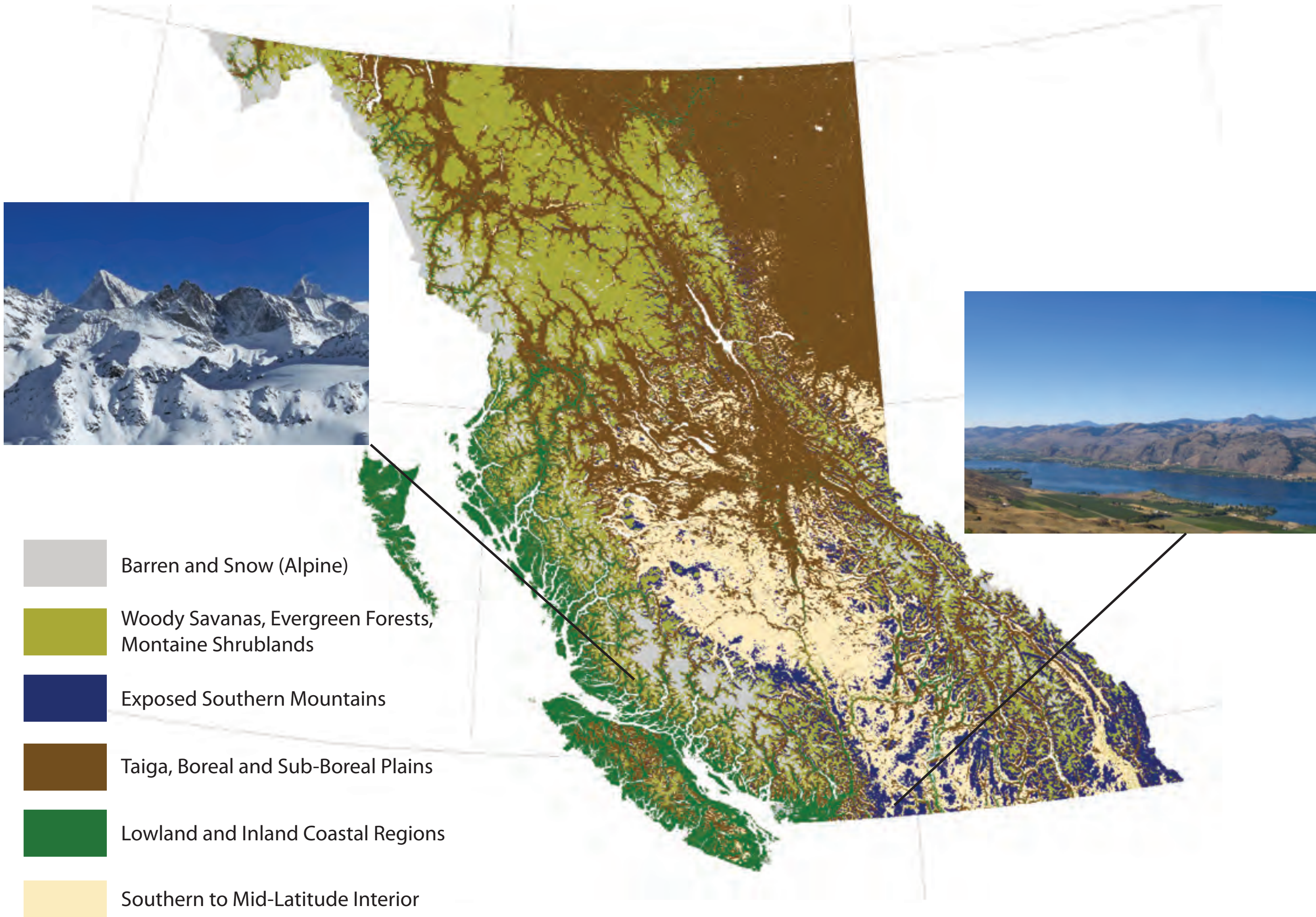
Remote sensing is uniquely capable of synoptically covering large areas in a repeatable and cost effective manner. Data from sensors onboard aircraft and satellites has already improved our insights into land cover and land cover change, forest growth and function as well as allowed for delineation of anthropogenic and natural disturbances. The wide variety of satellite and airborne remote sensing imagery available to users has allowed many applications to be developed and made operational.

Researchers from the University of Victoria (UVic) and the University of British Columbia (UBC) have developed a unique view of British Columbia's ecosystems from space. We have captured aspects of the province's physical environment, vegetation productivity, and available energy by acquiring and transforming satellite imagery and elevation data into landscape information.

Using Moderate Resolution Imaging Spectroradiometer (MODIS) data onboard the TERRA and AQUA NASA remote sensing satellites, we created geospatial models of annual maximum vegetation production, annual seasonal vegetation growth and spring snow cover melt. By analyzing latitude positions, changes in elevation, and surrounding topography we also derived models of potential solar radiation and soil moisture (adjacent figure). We integrated the landscape indices into an ecosystem classification using a robust and repeatable clustering method. The results provide British Columbia with a method for consistent and continuous ecosystem modelling, and offers a complement to the classification systems that already exist.

Our ecosystem model divides the 94 million hectare province of British Columbia into broad terrestrial ecosystem regions and displays intricate details of the environment, highlighting a great diversity of ecosystem types in the mountain regions of BC, which would be rather hard to model and monitor, over continuous temporal and spatial scales, using traditional field techniques. The classification is hierarchical so maps are available at varying degrees of complexity, such as this one at a smaller level of 6 classes (see figure on opposite page). On the 16 class classification, 10 of the classes describe the Northern Boreal, Coastal Mountains and Southern Interior Mountains, and 6 describe the coastal lowlands, Georgia Depression, interior, Boreal Plains and Taiga Plains. Examining the patterns between the cluster categories indicates that the highly dispersed ecosystem types occur most often in the intermediate elevation zone, moderate dispersion at the highest elevations, and homogeneity in the lowland areas where elevation remains relatively constant. From the photos in the figure opposite we can see that the ecosystem model is able to recognize barren mountainous peaks in the coastal mountains, as well as





desert like conditions with meandering water ways in the southern interior region.

The success of traditional ecosystem classification products, such as the BC Ministry of Forests' biogeoclimatic zone system (BEC), indicates the benefits of mapping tools that support ecosystem management and conservation. When compared to BC's BEC zones the newly developed regions occupy similar spatial areas in the coastal, Taiga, and Boreal Plains. However in the mountainous zones, which cover an expansive latitudinal range, a larger number of regions were included, given the breath of their ecological diversity. Overall the classification systems exhibit greater levels of detail in alpine environments and increased homogeneity in the central and southern interior.

We have built upon holistic ecosystem modelling theory to include current and seasonal ecological dynamics into ecosystem classifications and provide ecological information in the under-sampled regions of BC, complementing existing ecosystems maps.

As satellite data are readily updatable, our approach provides information for monitoring changes in vegetation production and climate seasonality. By integrating information on dynamic ecosystem processes with static landscape structural information, we can provide a viable model for monitoring the broad-scale effects of climate change and landscape disturbance on ecosystem health. The approach can also offer an unbiased broad-scale assessment of British Columbia's ecosystem diversity that can be used as a supplement to traditional in-situ biodiversity assessments to provide detail in under-sampled regions of BC or areas experiencing landscape change. For example, the team is now assessing the ability of these new ecoregions to delineate bird species turnover (Beta diversity) in British Columbia using the BC Breeding Bird Atlas data set.

These results provide BC with a robust ecosystem monitoring approach which can be transferred to other regions around the world.

This research has been funded by the BC Innovation Council and was conducted by Jessica Fitterer (UVic), along with coauthors Dr Nicholas Coops (UBC Faculty of Forestry) and Dr Trisalyn Nelson (UVic). Jessica states: "our ecosystem modelling approach provides a value-added monitoring capability to the current ecosystem classification, which will provide information for targeted field assessments by providing an early warning system of landscape change".

For further information, contact Dr Nicholas Coops, Department of Forest Resources Management at nicholas.coops@ubc.ca.

The AdapTree Project

Do our forests look good in these genes?

Foresters have long known that "local is safest" when collecting seeds for reforestation. Experience last century showed that if seed was taken from a population adapted to a very different climate from the planting site, then there was a considerable risk that trees would be unhealthy and unproductive. As a result, current seed transfer policy in British Columbia restricts seed movement between collection and planting site locations. This approach has until now maintained the genetic match that natural selection has generated between populations and the historic climates they are adapted to.

However, human-caused climate change is rapidly creating a mismatch between native populations and the environments they inhabit. The optimal seed sources for today's environments are different to those of 50 years ago, and in another 50 years, climate models suggest they will be from even more distant populations. There is a need to move to climate-based seed transfer systems and to consider strategies such as 'composite provenancing' that use the increased genetic diversity of mixed seed sources to buffer against the uncertainties of future climates, much as a diverse investment portfolio buffers against financial downturns. Just as planting more than 1 species buffers risk, planting more than 1 seed source for a species may also mitigate risks.

To better adapt our reforestation choices to new climates, we need to understand the adaptation of trees to temperature and moisture regimes. Traditional field-based provenance trials provide excellent information on survival and growth, but they take a long time, considerable resources, and do not reveal the genetic basis of adaptive trait differences among populations.

The AdapTree Project is harnessing state-of-the-art genomic tools to unravel the genetic basis of adaptation to climate, to map geographic variation in important genes across our heterogeneous landscapes in western Canada, and to evaluate the amount of variation for those genes in reforestation seed lots produced by selected parents in seed orchards. On the basis of these results, our ultimate objective is to make seed transfer recommendations to policy makers in British Columbia and Alberta.

Thanks to seed donations from many companies and government agencies, we began our study with natural stand seedlots from over 250 locations in BC and Alberta for both lodgepole pine and interior spruce. These natural populations capture the full range of adaptive variation in these species, and reveal the effects of millennia of climate-related natural selection on these trees. Seedlings from these seedlots have been grown in 4 simulated climatic regimes with varying temperature and moisture conditions in environmentally controlled chambers, and have been assessed for climate-related traits including growth, timing of bud break and bud set, and injury from heat, cold and drought stresses. The climatic regimes in the growth chambers simulate spring, summer and fall temperatures at cold, mild, and hot locations; test the effects of drought at the warmest temperatures; and also simulate natural seasonal patterns of daylength. By assessing population performance in these experimental environments, we can separate genetic from environmental causes of variation in key traits, and we can search for the genes responsible.

The search for the genes causing variation in these key adaptive traits would have been impossible even a decade ago, but the technological revolution that allowed for sequencing the first human genomes has generated a vast array of tools for prospecting for genes. The genomes of conifers like pines and spruces are huge: Each cell contains approximately 20 billion base pairs of the genetic code. This is approximately 7 times larger than the human genome. Over 99% of this DNA does not code for genes, and much of it represents the accumulated scrap heap of hundreds of millions of years of evolution. Prospecting for the genes themselves was a daunting task until technologies like 'targeted sequence capture' technology were invented. Prior to this, searching for genes of interest was like searching for information available in a single chapter of a book by wandering through a large library with no cataloguing system and no labels on the books.

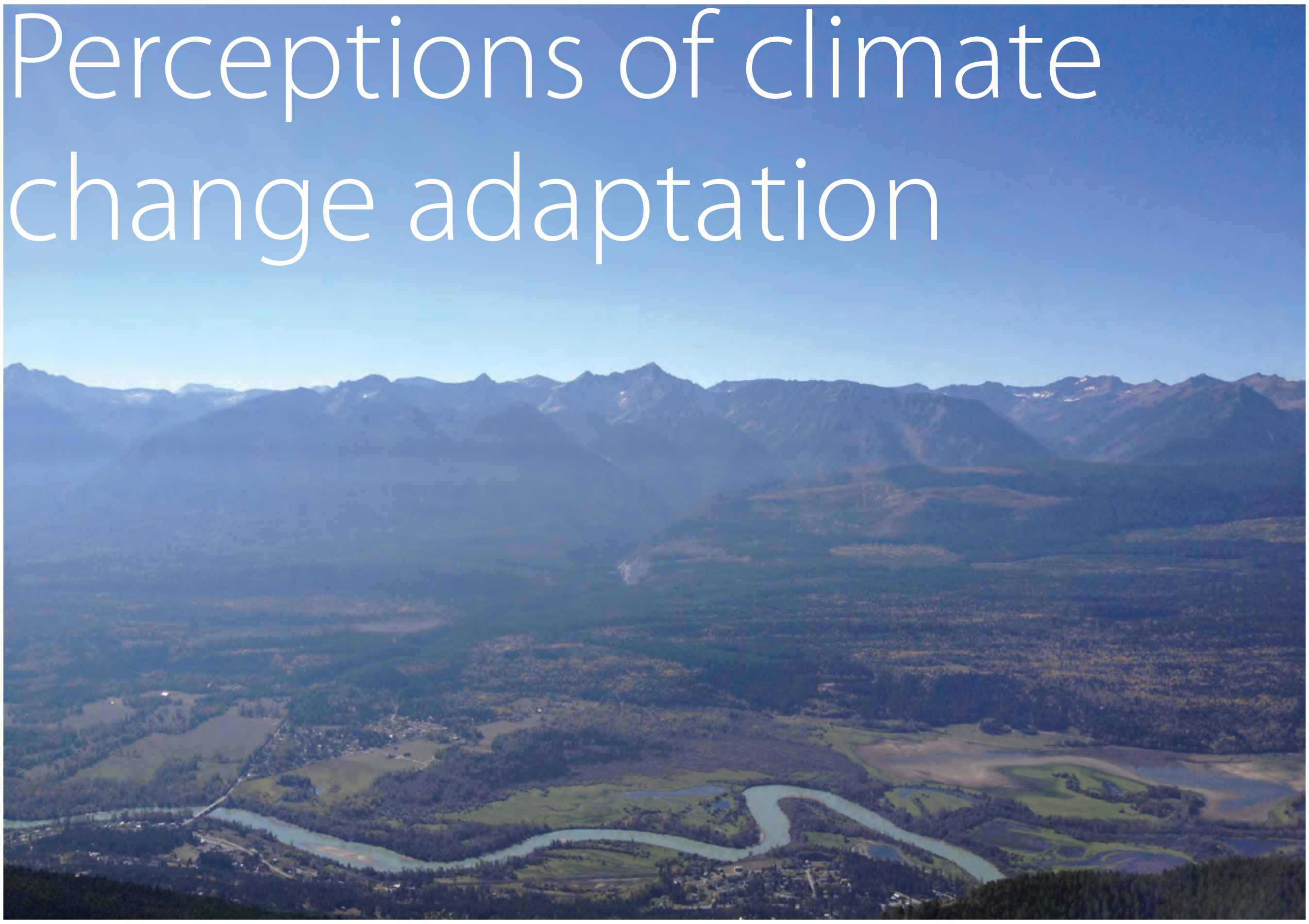
Targeted sequence capture technology involves fragmenting the DNA into relatively small pieces using sound waves, applying molecular tags called probes that match the functional gene sequences of interest, and then attaching a magnetic adaptor to each probe. Then genes of interest can be "captured" with a magnet and their DNA sequenced on a high-throughput sequencer. The probes we designed target the majority of the functional genes in the genome. Using this technology, we will be sequencing approximately 30,000 genes in 700 seedlings of both lodgepole pine and spruce. We will use the results to select a smaller number of genes that exhibit patterns of variation correlated with climatic or geographic variables, as well as genes that are associated with important adaptive traits. These genes will then be genotyped in upwards of 10,000 seedlings from both natural populations and from seedlots produced by ~20 seed orchards per species in BC and Alberta, giving us great statistical power to identify those important for adaptation to climate.

With the objective of informing seed transfer policy, this project also has a large socioeconomic research component designed to achieve a better understanding of the perceived benefits, risks and levels of acceptability associated with a range of strategies for adapting forest management to climate change, including the assisted migration of species and seedlots within species. This research involves ecological modeling, economic predictions, focus groups and interviews with stakeholders and end users in BC and Alberta, as well as surveys of the general public, community leaders, and forestry professionals (see the article overleaf by Molly Moshofsky for more information on some of this research).

Accomplishing the goals of this project requires a large and multidisciplinary research team and considerable resources. The AdapTree project is funded by Genome Canada, Genome BC, Alberta Innovates Bio Solutions, and the Forest Genetics Council of British Columbia. The AdapTree project leaders are Sally Aitken (UBC) and Andreas Hamann (University of Alberta). Co-investigators include evolutionary biologists Loren Rieseberg and Michael Whitlock (UBC), forest population genomics expert Jason Holliday (Virginia Tech), climate change and ecological response expert Tongli Wang (UBC), socioeconomics of forest dependent communities expert Rob Kozak (UBC), and resource policy expert Debra Davidson (University of Alberta). Pia Smets is the project manager. Our collaborators include tree breeders, tree improvement program managers, and scientists involved in sequencing the first conifer genomes. However, most of the work is being conducted by an energetic, innovative and highly productive team of post-doctoral scientists, technicians, and graduate students too numerous to list (see photo). Perhaps the most important product of a project like this is the training of highly qualified people who learn from today's projects and technologies how to solve tomorrow's problems.

For more information, see the AdapTree Project website (http://adaptree.sites.olt.ubc.ca/) and the Aitken lab blog The Modern Forest (http://blogs.ubc.ca/aitkenlab/author/aitken/) or contact Sally Aitken at sally.aitken@ubc.ca.

Perceptions of climate change adaptation



Forests play a critical and diverse set of roles on our planet, including the provision of vital ecosystem services such as water purification and carbon sequestration, cultural benefits that are highly valued, and bountiful goods that contribute significantly to Canada's gross domestic product and labour force. However, the ability of this critical social-ecological system to provide these services, values, and resources is being altered by climate change. Trees are adapted to the local climates in which they grow, but as climate variables, such as seasonal mean temperatures, rainfall, and timing of seasons become more volatile, many tree populations will fall out of sync with their surroundings. Potential effects of such maladaptation include decreases in stand productivity and yields, increased drought stress, and increased vulnerability to biotic and abiotic disturbances. This presents challenges for forest management. Specifically, seed transfer guidelines based on the historic distribution of British Columbia's biogeoclimatic zones will no longer be accurate or even relevant. In anticipation of this mismatch between seed source and climate, research is presently being conducted at the Faculty of Forestry by the AdapTree team (see article by Dr Sally Aitken in this issue) to determine the feasibility of developing a climate-based seed transfer system that would facilitate population migration of commercially important tree species in BC and Alberta. This technique is known as 'assisted migration'.

The concept of assisted migration is not without controversy within certain scientific circles. The debate mainly focuses on the potential for unintended consequences when introducing new species into an ecosystem. Over the past decade, as the effects of climate change on species habitats have become clearer, the debate has become more nuanced. For instance, facilitating the migration of populations within a species' natural range comes with lower risk to the colonized ecosystem because that species already occurs in the ecosystem structure. This is not to say that there is no risk. Indeed, one source of uncertainty lies in society's limited capability to model complex ecological and climatic systems that depend on unpredictable future human actions and behaviours.

In an effort to bring the conversation about assisted migration to the broader public and to gain a deeper understanding of how people perceive risks of climate change adaptation in Western Canada's forests, focus groups were hosted with Registered Professional Foresters (RPF), environmentalists, and small business owners from four towns in BC and Alberta. The objective of this research was to examine the attitudes and general understanding of climate change and the acceptance of assisted migration as a potential mitigation strategy in forest management. In order to represent the diversity of attitudes that exist across rural regions, 2 of the towns were chosen for their characteristically high forest dependence, while the other 2 possessed more diverse local economies. It should be noted that this qualitative research can only be situated within the specific geographical, political, and historical context of the regions under study and results are not generalizable to a wider population. However, focus groups do have the advantage of providing a deeper understanding into how people respond to new and complex concepts such as how assisted migration can help forests adapt to climate change.

To date, focus groups in the 2 BC communities have been conducted and results analyzed. Some of the key preliminary findings from the focus groups with RPFs are presented below. The first community visited (in the Cariboo region) was heavily forest dependent and the majority of participants across the groups were quite knowledgeable of forest practices in the area. The first focus group in this town comprised a wide spectrum of RPFs working in small-scale, First Nation, and large-scale forestry settings. Attitudes in this group regarding the existence and causes of climate change were highly mixed, with many participants not acknowledging that climate change was anthropogenic or even occurring. That said, some of these participants did perceive changes on the local landscape, attributing them to climate change, albeit with some uncertainty. For instance: "Something is going on here, I don't know what it is but… for us to have gone through all the temperature spikes… like your [tree] leaders are growing good, but so are the bloody bugs that are coming along to take care of them." Other participants believed that much of the information pertaining to climate change was "anecdotal" and did not trust the sources that supplied these data. It seems that the environmental movement has played a major role in forming the perceptions that RPF participants had about climate change, harkening back to the tense times in the 1980s and 90s that pitted environmental activists against industrial foresters.

When considering the prospect of facilitating migration of tree species through reforestation, it was considered acceptable to continue increasing the resiliency of the stands through planting diverse seed stock and that assisted migration may indeed be needed over the next rotation cycle. Interestingly, the case of the recent range expansion of Western larch was discussed at length. The sentiment that planting this species further north will not work because the climate is presently unfavourable was echoed throughout the Cariboo region group. One participant remarked: "Why would you move Western larch up here? Because you think maybe humans are causing climate change? Because, you know, it's gonna fail! It's gonna fail! I can predict that real clear."

In contrast, participants in the RPF focus group that took place in the mixed economy case study community (in the Rockies region) generally acknowledged the existence of climate change, without much in the way of cynicism or distrust. The participants in this group were all working in small-scale forestry settings and preferred enacting local management strategies on the premise that there was enough existing species and genetic diversity to facilitate adaptation without major changes to current seed transfer practices. However, they were generally open to a careful intermixing of new provenances into management plans because this allows for forest managers to monitor the effects over "…a 20 year period […], without impact[ing] the whole landscape." Emphasis was continually placed on avoiding large-scale prescriptive management protocols.

Ultimately, human values and perceptions play a critical role in the adoption of new techniques and technologies. Understanding how such perceptions and misconceptions are formed allows us to implement more appropriate ways of reaching out and making positive changes in the complex, multifaceted social-ecological system that is a forest.

Molly Moshofsky is completing her MSc thesis under the supervision of Dr Rob Kozak in the Forests and Communities in Transition (FACT) Lab, and as part of the Genome Canada-funded AdapTree project at the Faculty of Forestry. She can be reached at m.moshofsky@gmail.com.

Canadian glulam timber

Failed 1.2 m deep beam at US Forest Products Lab

Expanded use of structural wood products in the commercial building sector will require continued improvements in product efficiency and product performance. Glue-laminated timber (glulam) is an important class of engineered wood product favored by many architects and engineers. In Canada, the manufacturing of glulam members and the grading rules of laminating stock are stipulated under Canadian Standard CSA O122. This standard relies on a visual grading and stiffness assessment of the laminae (lamstock) used to build different grades of glulam.

Until recently, the B-F grade was the highest grade of lamstock designated for the extreme tension zone of glulam beams. In this grade, knots or other similar defects exceeding 10 mm and local slope of grain steeper than 1:16 are not permitted within 13 mm of the edge of the outer tension face lamination. These grading rules were set up many decades ago and were based on the characteristics of the available resources at the time. More recently, Canadian glulam manufacturers have recognized that the scarcity in supply of B-F grade material has reduced the competitiveness of Canadian glulam in terms of costs and supply. With the support of Natural Resources Canada's Value to Wood Program, BC Forest Innovation Investment and the Canadian glulam industry, the University of British Columbia has undertaken a multi-year glulam research program focusing on the issues of resource characterization, standard development, product performance evaluation, and code/standard implementation.

UBC's glulam research program (led by Dr Frank Lam in the Department of Wood Science) involves both experimental and computer modeling approaches. Laboratory investigations have helped establish new grading rules for Canadian lamstock. These studies have examined the characteristics of the visual defects of the lamstock such as knot size, knot distribution, and slope of grain. Although such studies are often tedious and time consuming, they form an invaluable database to benchmark the resource. Mechanical properties of the lamstock were quantified in a full-scale test program with non-destructive testing for the stiffness of the laminae, destructive testing for the tension strength of the laminae, and destructive testing of the tension strength of the finger joint connections of end jointed laminae.

The test results provided the input database for the computer modeling approach using a stochastic finite element program, ULAG, developed at UBC's Department of Civil Engineering. A careful verification process was used to check the model predictions against full-scale test results. Besides verification, the database was used to establish base design properties for Canadian 24F glulam beams built with the newly proposed lamstock grading rules. The verified software can also be used to simulate virtual construction of glulam beams/columns with progressive loading until collapse to investigate the capacities and failure behaviors of different layups of glue-laminated timber.

Glulam beam testing: Over 100 full-size glulam beams were tested for their bending stiffness (non-destructive) and bending strength (destructive). The depth of these beams ranged from 150 mm to 1.2 m. The B48 beams (see table) were some of the largest size glulam beams ever tested destructively in full size. In fact, limited space at UBC required collaboration with colleagues in the US Forest Products Laboratory and testing of these giant beams was done in Madison Wisconsin.

The test results support minor modifications to the characteristic design values of Canadian 24F glulam beams. The ULAG model was also successfully verified against the full-scale test database resulting in a useful tool for evaluation of strength properties of glulam beams. Results also indicate that current design procedures for the bending strength of Canadian 24F glulam beams smaller than the reference size of 0.13 m x 0.6 m x 9.1 m are too conservative. Changes to the Canadian code on Engineering Design in Wood are being considered to allow upgraded design procedures.


Full-scale column tests

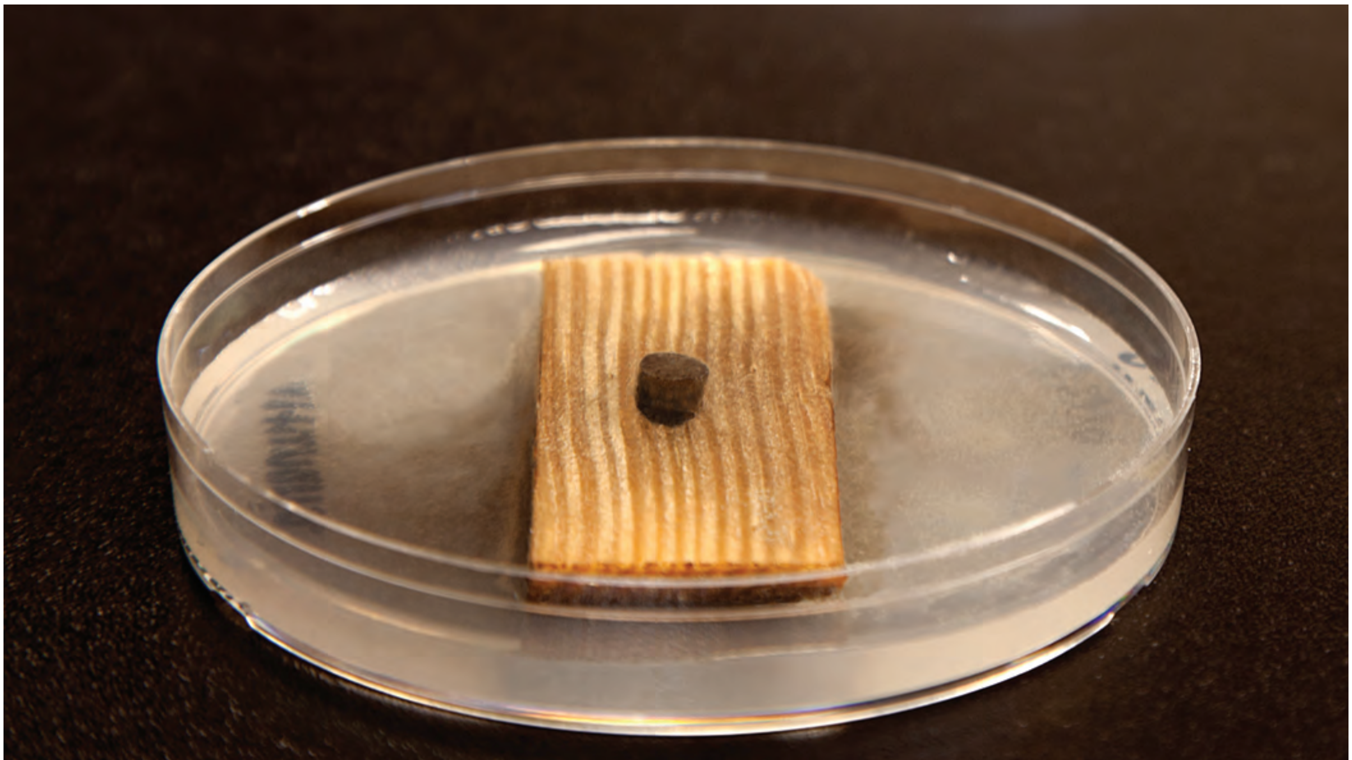
Glulam column testing: Full-scale intermediate column tests and numerical analyses on Douglas-fir 16c-E glulam columns were performed at UBC. In parallel, small-scale short column compression tests were conducted at APA - The Engineered Wood Association in the USA. The results indicate that the design values for 16c-E glulam columns in the Canadian code on Engineering Design in Wood seem to be slightly conservative even though the tested glulam was made with laminate having a lower modulus of elasticity (MOE) than the requirement of CSA O122. Changes will be considered to adjust the MOE requirement for the laminate for glulam columns. Such changes will result in a more efficient glulam column product that would lead to a safer glulam column design.

The intricate relationship between the performance and cost of structural wood products can govern the success and the commercial life of a product. Continued improvements in this relationship will lead to more rational glulam column designs. The UBC research initiative is supporting the Canadian glulam industry in meeting its challenges through the development of comprehensive databases and reliable tools to support the upgrade of their products and improve their competitive position against steel and concrete in the building sector.

For further information contact Dr Frank Lam, Senior Chair of Wood Building Design and Construction, at frank.lam@ubc.ca. The Chair currently involves six UBC colleagues in Wood Science, Civil Engineering and Architecture with the objective of developing holistic building solutions for the expanded use of wood products in structures.

Type of Beam	B6	B12	B24	B36	B48
Beam depth (mm)	152	304	609	914	1210
Beam width (mm)	130	130	130	130	175
Test span (m)	2.74	6.38	10.96	16.45	21.78
Sample size	30	24	36	12	12

Pest free wood through radio-frequency heating



Fungus free RF pasteurized wood sample

Forest health is threatened by different types of pathogens many of which are introduced through the global movement of people and goods, including green wood and wood packaging. Once established, exotic forest pests can become invasive and cause catastrophic, irreversible damage to the ecological integrity, productivity, and sustainability of our forests and wild lands. Federal and provincial governments, including plant health regulatory agencies and the general public are recognizing the spread of invasive organisms as a major issue.

Movement of forest products around the world has been impacted by the changing way importing countries are governing standards of plant health requirements. Pest regulatory agencies, including the Canadian Food Inspection Agency are adopting resolutions urging every country to implement rules that ensure the treatment of all wood at point-of-origin. The intent of such rules is to establish general criteria for reducing living organisms harboured in wood to as close to zero tolerance as is feasible with current technology. These issues are more frequent as we move products into new ports. Because quarantine measures from importing countries have the potential to quickly eliminate markets in Europe and Asia, with no recourse from the wood industry in Canada, it is important that reliable and cost-effective industrial methods are available for treating wood that is affected by such pests.

Currently, wood product infestation is minimised using conventional heat sterilization treatments or fumigation with methyl bromide. With British Columbia's rapid growth of log exports to China, and the pressure for greener alternative treatments, the Canadian industry is investigating alternative phytosanitary treatments such as chemical pressure impregnation, dielectric (microwave or radio-frequency) heating, gamma irradiation and vacuum methods.

An alternative approach, such as heat-treatment in convective chambers in which wood fibres are exposed to a hot fluid (air or steam), is widely used by the industry and is more "environmentally friendly" and widely acceptable. However, convective heat treatment is not always economically feasible, especially for larger size material, and the use of steam can cause numerous problems in product quality. The process also consumes high-energy and produces toxic fluids from the wood extractives, which must be treated, or burned creating additional costs to the industry. Furthermore, green wood exposed to a hot fluid will dry, thus defeating the objective of exporting wet fibre.

The technology of dielectric heating for pasteurization uses less energy, allows larger product components to enter the market place and allows pasteurization of the products without altering the workability of the fibre (especially if higher temperatures are used). Researchers at UBC's Wood Drying Laboratory, led by Dr Stavros Avramidis, have been using dielectric heating at radio frequencies (or RF heating) as an effective heating and drying method for the past 2 decades. Waves at RF frequencies penetrate wood and begin to rotate and vibrate the dipolar water molecules in liquid form in the pores and bound form in the cell-walls thus producing thermal energy within the whole body of the material. This is similar to microwave heating, but more efficient since RF waves can penetrate deeply into high density materials such as wood, something that microwaves cannot achieve. Because the heat production is homogeneous and immediate, the temperature of the wood increases quickly and there is minimal loss of moisture and no shrinkage. Loads of wood (batch processes) can be heated up with the plastic strapping already in place for later shipping (and without the use of stickers) in a swift, volumetric and efficient way. Dedicated chambers for pasteurization of wood can be quickly installed and easily used by personnel that can be trained in less than 1 hour. In addition, due to their ease of assembly and mobility, such chambers can readily be moved from one location to another in a short time.

Wood products free of pests can now be obtained in short periods of time. Heat generated within the wood/water system can kill the microorganisms (fungi, nematodes and insects) in 20 to 30 minutes. The proof of concept has been successfully accomplished, the technical analysis relating to schedule development and process optimization has been completed, physical phenomena modeling within the material is finalized, and the hardware technology and design is done. Commercially sized RF units are already in use by the industry for drying timbers. Such units do not need any hardware alteration and can readily be used for phytosanitation purposes. Successful commercial implementation of this new process allows the industry to move away from the use of potentially toxic chemicals and a heating method that could degrade wood and reduce its export value.

This work is the result of a recently completed 4-year NSERC-Strategic grant that received support from the BC industry and FP Innovations. Scientists working on this diverse project, led by Dr Stavros Avramidis, included Dr Colette Breuil (also from the UBC Department of Wood Science), Dr Adnan Uzunovic from FP Innovations, 2 PhD students (1 now a faculty member at a Romanian university) and 2 post-doctoral fellows (1 now a research associate at UBC and the other now a research scientist at the Forestry and Forest Products Research Institute of Japan).

Discussions are already underway with the phytosanitation standards approval body of the United Nations Food and Agriculture Organization committee and sub-committee for acceptance of radio-frequency waves as alternative treatments and for the development of relevant guidelines for the use of such technology in commercial phytosanitation.

Dr Stavros Avramidis can be reached at stavros.avramidis@ubc.ca.

Phytosanitation does not mean sterilization – wood can still be attacked by fungi if re-wetted

Social networks and the environment

What factors shape values, attitudes and opinions about forestry? How do newspaper reporters decide who to talk to when reporting on forestry issues? Why are some groups more influential than others in debates about climate change? These are some of the questions that David Tindall and his colleagues have studied through social network analysis (SNA). We describe some basic concepts and terms associated with SNA, as well as recent findings. These are illustrated in diagrams that can be downloaded from the internet at http://faculty.arts.ubc.ca/tindall/2013branchlines/figures_all.pdf

A social network is a set of social units and the interrelationships amongst them. Social units are called nodes, and relationships are called ties. While in contemporary discourse social media (SM) and social networks are often used interchangeably, from the perspective of SNA these are not one and the same thing. Relations entailed through SM may be considered one type of social network, but other types of social networks have existed for millennia, and SM should be thought of as a subset of the broader concept of social networks. Social networks can be viewed from the perspective of ego networks or from that of whole networks. Another technical distinction is that between one-mode networks and two-mode networks.

Social Capital and Community Resilience

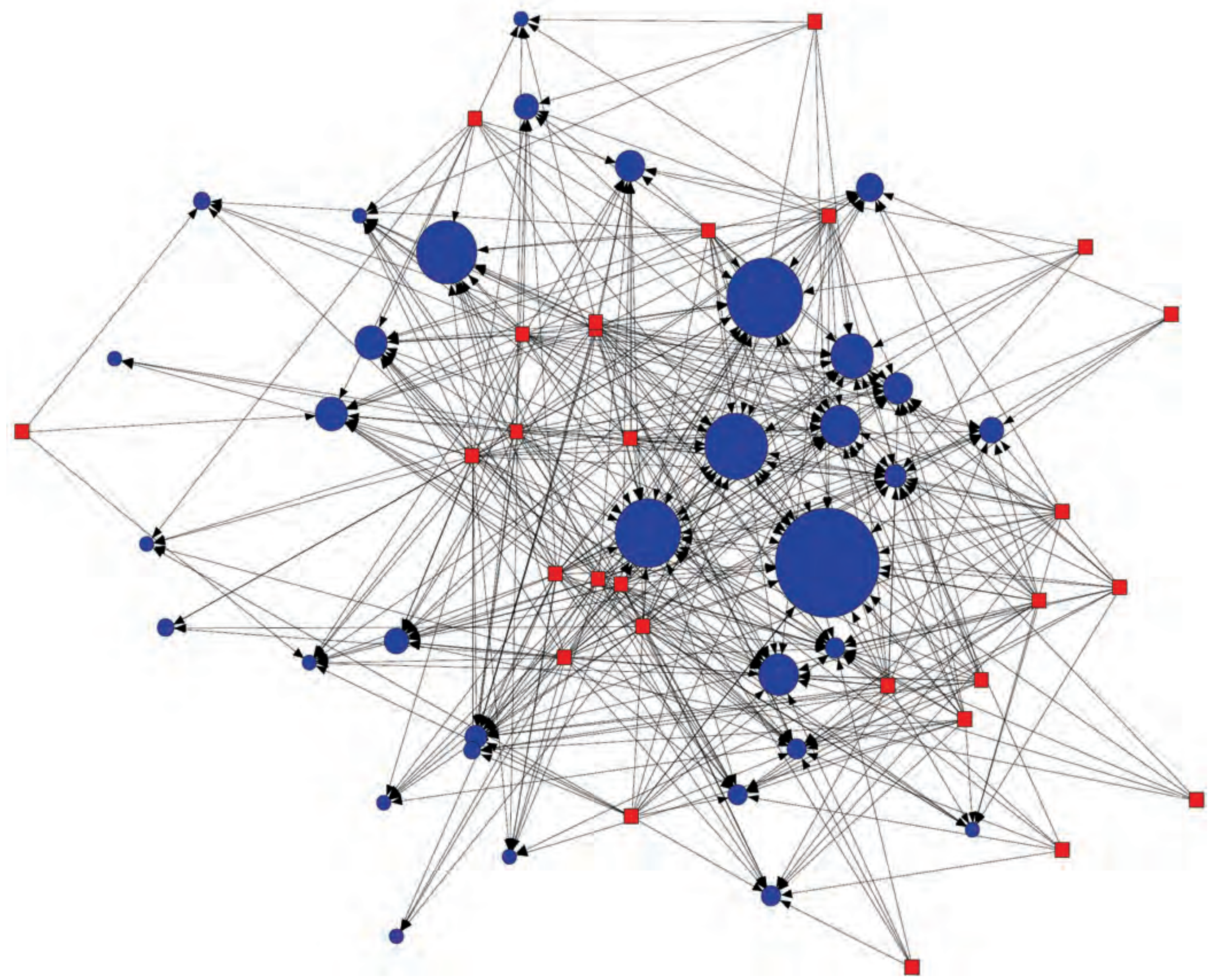
David Tindall has conducted a number of projects on networks and social capital. Although the term network is a metaphor, network analysts have relatively concrete ways of measuring network properties. One measure is density, which is the number of ties that exist as a function of the total that could possibly exist. Density can indicate "integration" and "social cohesion", which in turn are common indicators of social capital. Network structures can affect communication and the flow of information, the provision of social support, trust, the development of social norms, and the formation of cultural capital – all of which are predictors of community resilience. A forest community with relatively high social network density is more likely to be able to respond positively to a crisis, like the pine beetle epidemic, than a community with low density. Another important concept is centrality. High network centralization can be useful for enhancing communication. If a forest community is threatened by an imminent crisis such as a forest fire adjacent to the community, the community could mobilize for collective action more efficiently if its social network is relatively centralized.

The Diffusion of Information and Social Influence

One recent study found that environmental activists who were relatively more central in the social network of environmentalists were significantly more likely to be cited by the newspaper media in reporting about forestry issues. A study on forest values by Howard Harshaw and David Tindall that found people with more diverse social networks (eg ties to people from a greater array of occupations and organizations related to forestry) had significantly more diverse identities (related to natural resources), and had significantly more diverse forest values. This insight is useful when considering the composition of land-use planning committees and processes – particularly when managing for multiple uses is an objective. Another recently published study (with Howard Harshaw and Stephen Sheppard) found that members of the general public (in Vancouver, Kelowna, and Armstrong) who had ties to people working in the forestry sector had more positive evaluations of public participation opportunities in forest management planning. This suggests that those working in the forestry sector can provide information and positively influence others regarding forestry issues though social network ties.

The Environmental Movement

In studying the environmental movement both in British Columbia (with regard to harvesting in old growth forests), and nation-wide in Canada (focusing on a variety of issues), we have demonstrated that social network ties to other environmental organization members is an important statistical predictor of participation in the movement. Further, several recent publications have examined network "outcomes" of



environmental movement participation. One demonstrated that participation in the environmental movement is positively associated with the development of greater social capital (in the form of network diversity). Another found that members of the general public who had ties to members of environmental organizations had more negative evaluations of forest management.

An earlier study examined network ties amongst members of the organization Share Our Resources in Port Alberni during the period commonly referred to as "the War in the Woods" (in the 1990s) in BC. Share was an organization that mobilized in response to environmentalist campaigns to preserve old growth forests in British Columbia. Analysis revealed that the more ties that Share members had to environmental movement organization members, the more active they became in Share activities. These types of social network interactions (with environmentalists) were "negative" in the sense that they involved conflictual relations, and served to fuel the conflict between some members of forestry communities and urban based environmentalists.

Discourse Analysis

Network analysis is a general methodology that can be applied to a variety of phenomena for relational analysis. Recently some social scientists have applied this method to study discourse. In one study, open-ended survey question responses were analyzed, and network methodology was utilized to examine discourse over climate change. In another recent study led by Mark Stoddart, discourses over conflicts about the Tobiatic Wilderness in Nova Scotia, and the proposed Jumbo Pass Ski Resort in British Columbia were analyzed.

Climate Change

Currently David Tindall is working on several projects examining social aspects of climate change in Canada. In one, he is leading, with Mark Stoddart, the Canadian component of a larger international research project – nicknamed COMPON – that will provide a comparative international analysis of social networks and climate change policy formation. At present there are over 20 countries (on 5 continents) involved in the project. The project was described in the journal Nature (see www.nature.com/climate/2009/0908/full/climate.2009.73.html). For more information about COMPON see www.compon.org.

Dr David Tindall is an associate professor in the departments of Forest Resources Management, and Sociology at UBC. He can be reached at david.tindall@ubc.ca.

Perceptions of advocacy at the science-policy interface

The best available science is critically important in natural resource policy decision making. As a result, scientists are often drawn into policy debates. However, the appropriate role for scientists in policy decisions remains controversial, and many scientists are reluctant to engage in public disputes. One of the most difficult dilemmas at the interface between science and policy is whether or not scientists should be advocates of certain positions, and if so, under what conditions? Elements of advocacy can be found in the mandate of professional associations, the pages of many scientific journals, and in the academic community. There are also different levels of advocacy. Many scientists agree that when engaging in advocacy, there is a line that should not be crossed, yet no consensus on where to place it. Although advocacy can be advantageous to public policy outcomes, it may compromise research results and be detrimental to a scientist's reputation.

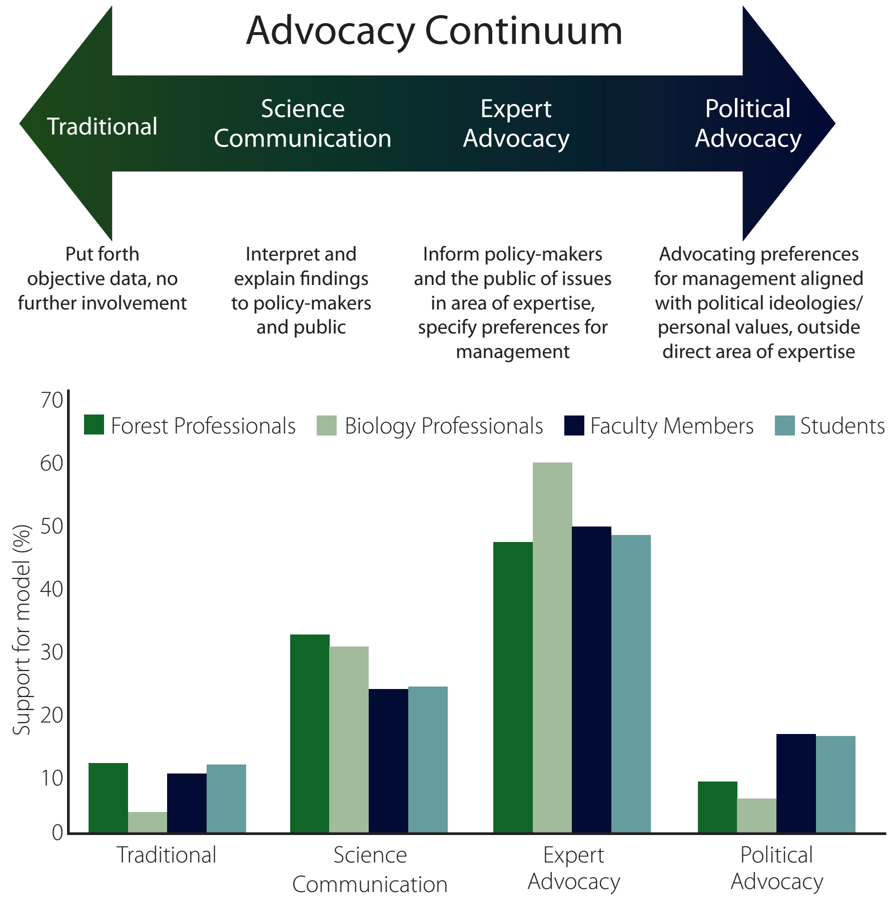
While there are many arguments for and against advocacy by scientists, a predominant deterrent for scientists advocating specific policy preferences, and a fear of many who do, is the risk of losing their scientific credibility. Given the politically charged, controversial nature of many resource management policy issues, the perceptions of the science community and general public can play a significant role in the policy outcome.

Under the supervision of Dr George Hoberg, masters student Andrea Rivers has studied issues of advocacy and credibility in natural resource management science through a self-administered web survey of resource professionals, academic scientists, and students. Members of the Association of British Columbia Forest Professionals, the British Columbia Association of Professional Biologists, UBC faculties of Forestry, Science, Land and Food Systems, and a multi-disciplinary sample of undergraduate students (including students from the Faculty of Forestry) were recruited to participate in the study. Responses from the 4 groups were analyzed to examine the influence of attitudes toward science, environmental issues, and demographic characteristics on an individual's support for advocacy by scientists. Another objective was to explore the relationship between support for advocacy and perceptions of credibility.

For this study, an advocacy continuum with 4 models of scientist involvement was derived from the literature. The models included traditional science communication, expert advocacy, and political advocacy. When presented with definitions for each model, respondents were most supportive of 'expert advocacy'.

The questionnaire also presented respondents with a series of statements concerning attitudes toward science in society, and environmental issues. Responses to these statements were summed and averaged into numerical values measured on two different scales. The first scale measured respondent's attitudes toward science. The second, known as the New Ecological Paradigm scale, is a widely used measure in environmental sociology and was used to measure pro-ecological attitudes toward environmental issues. A series of regression models performed with these values, and a selection of demographic variables, revealed that attitudes toward science had a significant positive influence on individual's support for advocacy in the total sample. Although many demographic characteristics such as age, gender, and education were not found to be significant predictors of an individual's support for advocacy in these models, political affiliation was identified as a significant influence. Respondents with a 'right' political affiliation were more than twice as likely to support lower models of advocacy. This left-right political divide over support for advocacy is consistent with previous research and suggests there is a greater likelihood of controversial policy issues becoming politicized. These findings underscore the risks of credibility loss as a consequence of political advocacy.

To explore the connection between support for advocacy and scientific credibility, respondents were also presented with hypothetical scenarios across the advocacy continuum and asked to rate their perceived credibility of the scientist involved. Risks to credibility were generally found to increase across the advocacy continuum, yet qualitative results suggested perceived credibility levels can be influenced by other factors such as credibility of source, and mode of communication. Taking into account these findings, and the support for advocacy results, 'expert advocacy' is supported, while 'political advocacy' is not. The results of both components



of the study suggest that if a line were to be drawn on the advocacy continuum with regard to credibility risk it would fall between these 2 models. This conclusion was drawn given the high proportion of support for 'expert advocacy', lower support for 'political advocacy', and low credibility perceptions of scenarios at the political advocacy end of the continuum.

Although no significant differences in support for advocacy were found between the various groups sampled, members of professional associations and academic scientists were distinguished from the total sample by differing values and demographic characterizations. Forest professionals scored significantly lower on the pro-ecological attitude scale than the other groups, and were also the most likely to support the 'traditional' model. Biology professionals were distinguished from the complete sample with the highest proportion of support for 'expert advocacy', and had significantly higher pro-environmental attitudes than the other groups. Faculty members were also distinguished from the total sample as pro-ecological attitudes were found to have a significant positive influence on support for advocacy in this group. There was not a significant relationship between these variables in the resource professional or student samples.

Although arguments for and against advocacy persist in the science community, many scientists support, and actively engage in, advocacy at the science-policy interface where threats to scientific credibility remain a serious concern. Qualitative results suggest that it is important to follow the rules of science, avoid value statements, and clearly separate scientific results from policy preferences. These guidelines would protect scientific credibility when engaging in science policy disputes. Advocacy can offer meaningful contributions to policy development. Therefore, it is important that such guidelines be followed to avoid jeopardizing the benefits of expert advocacy.

For further information contact Andrea Rivers at andrea.e.rivers@gmail.com.

Exploring forestry in Mexico

by Stacey Auld, with Brad Pollard, Carlos Molina, and Masahiro Saiga

Clockwise from left: Masa, Stacey, Carlos and Brad on a lookout over the pine-oak forests of Mazati in Mexico

Mexico is known to many of us here in the north as a place of hot sun, beaches, mariachi bands and vacations. For 4 graduate students, it is now also known for its complex forest industry.

Brad, Carlos, Stacey, and Masa, from the UBC Master of Sustainable Forest Management (MSFM) program, recently journeyed to Jalisco, Mexico, to study the high elevation pine-oak forests for their FRST 558 management project. The 2500 ha parcel of land they went to visit is known locally as "Mazati", the local indigenous name for deer. Before the current owner, Jorge Pereda, bought the land, each parcel had been affected by a unique disturbance history, combinations of heavy degradation by erosion, illegal logging, opportunistic harvesting of fuel wood, fire, and hunting. Jorge has considered a variety of options for his property including an exotic animal game park, eco-tourism, residential developments, high-intensity harvesting, and carbon sequestration. The MSFM group was tasked with reviewing the current forest condition and operations, as well as the land's potential for timber production and conservation, and providing a comparative assessment of several different management options. Ultimately, Jorge is most concerned with improving the forest's health, structure, and diversity in innovative ways while continuing to generate cash flow to cover the costs of government rent and caretaker staff.

Our base for the visit was the mountain town of Tapalpa. After passing through Guadalajara, across a broad hazy valley filled with salt-flats, and up through dry slopes dotted with cactus and oak, we finally reached a wide pass and were rewarded with the sight of long-needled pine forests. The climate and biology of the Mexican volcanic mountains were spectacular. In Mazati, which ranges from 1700 to 2600 metres above sea level, summer-like heat of 25^{0}C in the daytime – and sunburn – was followed by near-freezing temperatures overnight, like a high elevation desert. Aspect had a powerful influence on the forest diversity ranging across the high elevation peaks of Mazati, from dry oak forest (*Quercus* spp) on low elevation dry sites, through pine-arbutus mixes on steep south-facing slopes, to lush cool draws with lianas and rare basswood (*Tilia* spp) trees on the north-facing slopes. The *Pinus* species we encountered were 3- and 5-needle varieties, but with needles exceeding 15 cm in length.


Brad gets a close-up of a local agave in Mazati

The most common pine was *Pinus lumholtzii*, a drought tolerant variety with silvery, pendulous foliage that shimmered in the breeze. While common in the area, this pine occurs only in the volcanic belt of Mexico, and nowhere else in the world. The oak varieties we encountered were semi-evergreen, with gnarled and twisted stems, and thick, leathery, glossy leaves, more like large shrubs than trees in most areas. While recognizable as pine and oak, these trees were undeniably different to those in our northern forests.

Working in Mexico offered several distinct challenges, including communication. Luckily our team included Carlos from Spain, who was invaluable in communicating with the forest technicians and local residents, gaining experience in simultaneous translation as we pieced together details of the forest, the Mexican governance structures and the cultural reliance on the land.

The biggest challenge for us in this management project is understanding the cultural history and life of Mexican forests found in the Meseta de Tapalpa region. Forest resources are viewed opportunistically, and proximity may be interpreted as entitlement. Poaching of firewood, gravel, and timber, grazing by cattle, bark removal by locals to harvest resin, and occasional fires tearing through dry brush, have all occurred on the Mazati lands in the past, and may still occur at times when watchful eyes are not present. At Mazati, one part of the land is adjacent to a local ejido ("ey-hee-dō"), a type of common land tenure that is granted to a defined group of people for their general use and which can never be sold – in essence, a commons. The low fence dividing the ejido from Mazati is a weak deterrent to the occasional customary forest user, who may have been a resident of the area before the fence existed. Recently, someone lit a fire beneath a wooden gate that had been erected to complete the perimeter of the Mazati lands, and which prevented access to a small roadside quarry. Wildlife has been intensively hunted, with the result that little wildlife other than birds is seen at Mazati. The managers are excited that a few pumas have been spotted recently, and have started work restoring the wild turkey (guajolote) populations. They are even hope to start a small herd of the Mazati deer native to Mexico but which remain locally scarce.

Beyond purposeful human activity, the forests have also been periodically affected by fires. Though the forest is in an area with a long dry season where we would expect fires to be a part of the normal disturbance regime, the last 2 fires were caused by a maize field burn spreading out of control, and a pickup truck going off the road. Each parcel in Mazati has a unique history, with different past owners, species compositions, and historical events shaping its current condition. Figuring out the diversity of species originally present in Mazati and which species will thrive best in its varied sites constituted a large part of our research. There is little if any intact forest to use as an example, and human interactions have had an important effect on their development.

Our team is looking forward to learning more about this unique forest ecosystem, and helping Jorge develop a strategy to manage Mazati into the future, as well as opening new pathways for future cooperation between Mazati and UBC.

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


View through *Pinus lumholtzii* and *P devonia* to volcanic rock formation in Mazati

Stream communities struggle with excessive sedimentation

Sediment in running waters is a naturally occurring phenomenon. However, differnt types of land use, such as forestry, agriculture or construction can cause an increase in the natural sedimentation rate. Inappropriate forestry activities may also cause increased light penetration, deterioration of water quality, increased sediment movement, and alterations to the hydrology of aquatic ecosystems. These changes can bring about the destruction of aquatic habitats and reductions in the diversity and abundance of aquatic life as well as present challenges for human water supplies.

Excessive amounts of dissolved sediment increase water turbidity and thus reduce the growth of algae and aquatic plants affecting the entire aquatic ecosystem. Sediment also occurs in streams as solid material either in suspension, such as silt or clay, or as bedload. This coarser bedload is most often sand, which slides, rolls or bounces along the streambed by the force of moving water. While moving and eventually depositing on stream bottoms, this sediment may profoundly harm salmonid reproduction and benthic biodiversity.

Salmonids lay their eggs in gravel, where they develop and hatch into alevins and eventually emerge to open water as fry. High sediment deposition on these spawning sites decreases their permeability and reduces interstitial flows within the incubation zone. In such conditions, developing embryos face lower oxygen levels and their metabolic waste products are not carried away, which usually increases their mortality. In addition, sediments may form a physical barrier to emerging fry. Sedimentation is an example of a process that induces a physiological response in developing salmonid embryos

Alevins may decrease the risk of predation through synchronous timing of emergence. Early-emerging fry may face a higher predation risk than later-emerging fry, but they may also have an advantage due to earlier access to feeding territories. But could salmonid fry show flexibility in a life cycle trait, the timing of emergence, under high sedimentation?

Dr Pauliina Louhi is a postdoctoral fellow from Finland working with Dr John Richardson in the Department of Forest and Conservation Sciences. Pauliina established an experiment to find out whether the survival and emergence of brown trout alevins were affected by sedimentation and (or) chemical cues from predatory fish, burbot. She used 24 laboratory channels (80 cm long, 60 cm wide) containing brown trout eggs amongst gravel with three levels of sediment additions. Burbot were either present or absent in the open water.

Pauliina observed that alevins in low sediment gravel postponed emergence when exposed to predator odour, whereas alevins in the high-sedimentation treatment showed no response to predators. More importantly, alevins that received high sedimentation had larger yolk sacs at emergence compared to control fish. Alevins typically use their yolk sacs for feeding during those few weeks that they spend inside the gravel after hatching. They start feeding on emergence to open water. As poor oxygen conditions during ontogenetic development affect fish muscle development, it is quite possible that those fry exposed to high sedimentation and carrying larger yolk sacs are poor swimmers and more vulnerable to predation or downstream displacement.

Such sublethal effects of increased sedimentation have only recently been acknowledged, but it may be that conditions experienced during early life will also decrease the fitness of emerging fry or overwintering survival of young-of-the-year salmonids, eventually translating to a low quality, or number, of migrating fish.

But it is not just salmonids that suffer from excessive sedimentation; one expects organisms at all trophic levels of the stream community to be affected by it. For example, increased sedimentation may decrease the biomass of periphyton algae by covering the submerged surfaces and thus reducing the food supply of invertebrates, tadpoles and fish feeding on algae. Deposited sediment may also cause serious decline in the abundance of leaf-shredding and filter-feeding invertebrates at the same time, as filter-feeders rely on small particles derived from the feeding activity of shredders. Overall the changes in functionally important species or traits may reduce the rate of organic matter processing and cause changes in food webs.

"Human-caused changes to the streamsides and catchments can increase sediment movement rates and overwhelm the capacity of stream systems to cope. This may result in severe consequences for associated ecosystem processes in streams, and ultimately for the provision of important ecosystem services to humanity."

Biotic interactions among trophic levels are difficult to predict under abiotic stress such as sedimentation, as within-level processes can equalize or exceed the effects of the most efficient species. In a further experimental study in UBC's Malcolm Knapp Research Forest, Pauliina randomly assigned a battery of 14 outdoor, flow-through stream channels (13 m long, 25 cm wide) to 4 treatments: 1) fine sand addition, where 60-70 % of the streambed was covered with sand, 2) addition of predatory invertebrates, 3) both sand and predator additions, and 4) controls with no added sand or predators.

Based on preliminary results, there was an increase in the number of emigrating invertebrates and a decrease in the benthic density, suggesting an immediate avoidance or displacement reaction to sediment addition. The addition of predators did not cause significant differences in response variables, although the pattern was similar. On the other hand, predators grew better in channels with sand (sand may have filled the interstitial spaces of gravel causing loss of hiding spaces for other invertebrates). A negative trend in the decomposition rate of leaf litter and algae biomass following sand additions also suggests that sedimentation may decrease rates of stream functioning and alter the biotic interactions among trophic levels.

Most running water courses are closely connected to their catchments and rely on their riparian areas to provide their energy source in the form of riparian vegetation and terrestrial invertebrates. Human-caused changes to the streamsides and catchments can increase sediment movement rates and overwhelm the capacity of stream systems to cope. This may result in severe consequences for associated ecosystem processes in streams, and ultimately for the provision of important ecosystem services to humanity.

For further information, contact Dr Pauliina Louhi, visiting postdoc from the University of Oulu, Finland, at pauliina.louhi@oulu.fi, or visit http://cc.oulu.fi/~palouhi/.

development & alumninews

Future Forest Fellowship changes the landscape of graduate research

Sara Barron is equally passionate about trees and people. And as the recipient of the Future Forest Fellowship, she will dedicate her PhD research to both of these passions.

Her research, which will start this May, focuses on the ways suburban forests can help communities mitigate and adapt to a changing climate, and how an understanding of related social preferences can influence the achievement of future resilient, low-carbon communities.

"If people live in denser neighbourhoods, it has a whole host of benefits. For example, it leaves more land for natural environments which can mitigate the effects of climate change," says Sara, who has decided to focus her research on suburbs because they take up a lot of land.

Sara will develop and apply a new cross-disciplinary framework for planning climate change solutions, using a socio-ecological approach. That means equal weight on the science and the social issues of a neighbourhood.

"In my experience with community engagement projects, I have learned that if people don't like it, they won't do it, regardless of what the research says," she says. "Social systems and cultural preferences are incredibly important in determining what our neighbourhoods look like."

Sara's framework will also address climate change threats and opportunities, as well issues such as fire risk and the shortened lifespan of urban trees. A case study community engagement exercise in a Surrey neighbourhood will allow Sara to test the framework further.

These original ideas have earned Sara the Future Forest Fellowship, the world's largest scholarship for forestry. It was created by a private Canadian foundation to draw attention to how forestry research impacts global issues.

The fellowship assures Sara of $60,000 per year for 3 years, with an additional 4th year if required. Sara's research proposal beat out applicants from a number of countries including Poland, India, Iran, Brazil, the US and the UK.

"Receiving this award has been amazing, and a huge honour," she says. "It's a confirmation that the things I care about are also things the Faculty cares about. These are important issues for now and for our future."

Sara received her Masters of Landscape Architecture at UBC and a BA in Geography from SFU. She has received the Canadian Society of Landscape Architects Award of Merit, Masuno Travel Award, and Governor General's Academic Medal, among others. Sara will be working with Dr Stephen Sheppard in the Collaborative for Advanced Landscape Planning (CALP).

The Future Forest Fellowship is a clear expression of the impact of philanthropic support on graduate-level research. The Faculty is deeply grateful to the private foundation that made this landmark contribution.

You can make your own contribution to research today. Please contact Emma Tully, emma.tully@ubc.ca or phone 604.822.8716 for more information.

Annual Loon Lake BBQ – You're invited

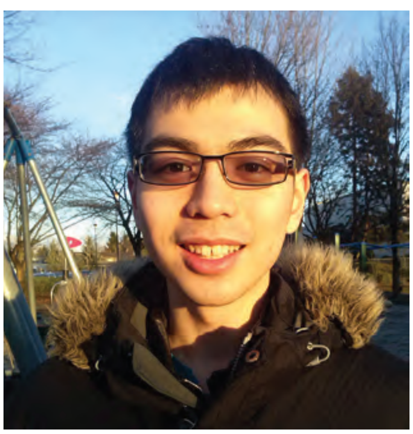
It's almost time for the annual Forestry Alumni BBQ, so make sure to mark Thursday, April 25th, 2013 in your calendar and prepare for the trip out to the Malcolm Knapp Research Forest at scenic Loon Lake. Join us for an afternoon walk down memory lane as we tour the forest and visit the students during their Spring Camp. All alumni and friends are welcome! Contact Janna Kellett at 604.827.3082 janna.kellett@ubc.ca to RSVP or for more information.

Introducing the Faculty's new alumni officer

We are delighted to announce that Janna Kellett started in the role of Alumni Relations Officer on March 4th, 2013. Janna has been with the Faculty since October 2011, previously as the Development Coordinator. Please contact Janna to find out more about how you can get involved in your alma mater; or for help with planning a reunion; to find out more about being a mentor; or to find out about upcoming events.

Janna can be reached at janna.kellett@ubc.ca or by phone at 604.827.3082.

Kapoor Singh Siddoo Foundation provides enduring support for students



For many students at UBC, receiving a scholarship is a welcome surprise: you're working hard and keeping your grades up and suddenly there's an unfamiliar email in your inbox and you're jumping up and down.

"It was by far the largest amount I was ever awarded ... It meant I could continue to focus on my education without the financial pressure to maintain a part-time job at the same time as school.

Trueman Lam is a 4th-year student in the Wood Products Processing program who has done a good amount of jumping up and down in the past 2 years as the recipient of the Kapoor Singh Siddoo Scholarship in Forestry.

"The first time I found out I was very excited," he says. "It was by far the largest amount I was ever awarded, and basically covered 8 months of residence fees. It meant I could continue to focus on my education without the financial pressure to maintain a part-time job at the same time as school."

Growing up in Port Moody, Trueman enjoyed woodworking in high school. He originally set his sights on BCIT, but got good marks and applied to UBC instead. On graduation, Trueman will receive a BSc in Wood Products Processing with a minor in Commerce.

"Excelling academically is hard," he says. "It demands ridiculous time commitments and is often mentally straining and stressful. Because of this scholarship, if I do choose to work during my school terms (and I did do so last term), it was and would be because I enjoyed the work and not because I needed the money."

Trueman's hard work and determination today is an echo of the hard work and determination of Kapoor Singh Siddoo, in whose name 3 scholarships have been established in the UBC Faculties of Forestry and Medicine.

Kapoor Singh Siddoo was born in India and then immigrated to Canada, where he prospered in the forestry industry. He was a believer in giving back and wanted to share his good fortune equally among his country of birth and his adopted home. This was an important guiding principle for him. His gifts to UBC began as early as 1955, through 2 annual scholarships.

The Kapoor Singh Siddoo Foundation was formed by Kapoor Singh Siddoo, his wife and 2 daughters, Jagdis and Sarjit. "My father wanted to leave a legacy of his love for the forest in perpetuity; we have now done so with the establishment of the Kapoor Singh Siddoo Foundation Endowment," said Dr Jagdis Siddoo.

The Foundation established 2 scholarships in the Faculty of Forestry and 1 in the Faculty of Medicine at UBC, and together these scholarships have supported 107 students to date, including Trueman Lam.

"I'll always be grateful for the Foundation's generosity," he says, and we at the Faculty of Forestry echo that sentiment. Our sincere thanks to the Siddoo family and the Kapoor Singh Siddoo Foundation for decades of faithful support.

If you are thinking about how to support our students, please contact Emma Tully, emma.tully@ubc.ca or phone 604.822.8716 for more information.

New exhibit at VanDusen Botanical Gardens

March 21 – June 9

Climate Change and Trees is an educational indoor exhibit by UBC's Faculty of Forestry that explores the effects of climate change on some of the tree species found in VanDusen's collection. The exhibit consists of 19 interpretative panels, each representing a species of tree in the Garden, that explore how those trees are adapting (or not) to the climatic changes occurring in the natural habitats.

Visitor Centre Discovery Room
VanDusen Botanical Garden
5251 Oak Street (37th & Oak St.)
Vancouver, British Columbia
V6M 4H1

See www.vancouver.ca/vandusen for directions and hours of operation. Admission is free.

Pinus parviflora, Japanese white pine

Electronic versus paper?

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