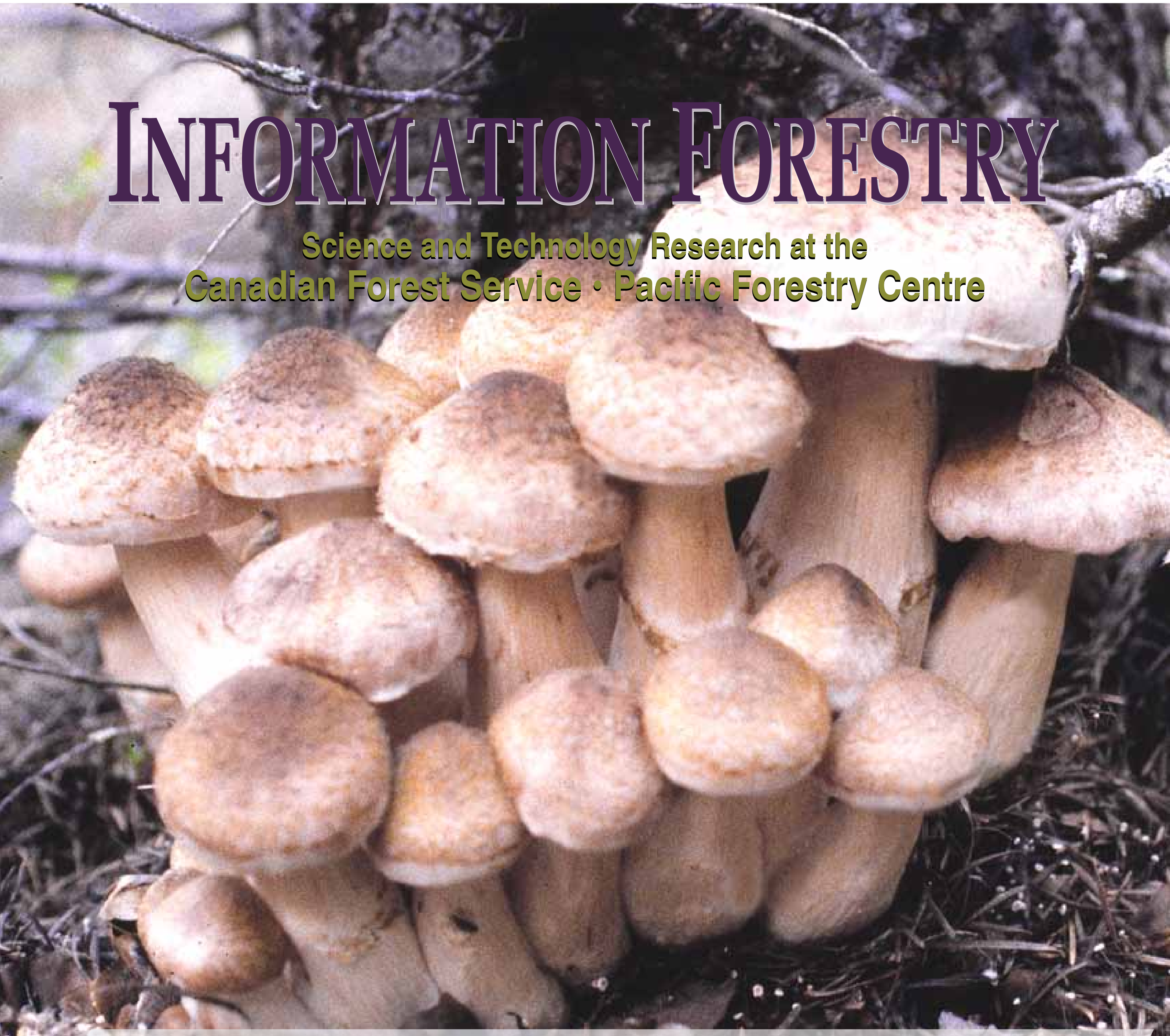
Natural Resources Canada / Ressources naturelles Canada

Information Forestry

Science and Technology Research at the Canadian Forest Service · Pacific Forestry Centre



May 2011
ISSN 0706-9413

Canada

Increasing resistance to *Armillaria* in Douglas-fir


Mike Cruickshank, CFS

Bottom of stump of infected tree, clearly showing the infection.

Most trees become infected with root or butt rot in their lifetime, which can cause serious economic damage. **Mike Cruickshank** (mike.cruickshank@nrcan.gc.ca), with the Canadian Wood Fibre Centre at the Pacific Forestry Centre, is currently looking at ways to reduce impacts by increasing host tolerance to pests.

"Trees react differently to disease, but when tree growth is affected, wood quality will be affected as well. This is a major issue upstream on the value chain, where people rely on consistent wood quality," said Cruickshank. Douglas-fir, a common and economically important tree species in British Columbia, is heavily affected by root rot, and the impacts are increased in second-growth stands. "Our current focus is on Douglas-fir, although there has been interest from provinces to look at spruce as well," said Cruickshank.

Most tree improvement programs focus on traits such as growth in height, tree size, and tree form. But Cruickshank and his team are looking at another trait for selection: host tolerance. Host tolerance allows an infected tree to survive and to grow well.

Tree diseases are widespread in nature, and are often enhanced in managed stands where their natural control in space and time has been altered. However, there is currently very little information available about disease impact on tree growth at the stand level.

In other words, can a tree survive, and if so, what effect does disease have on its growth and wood properties? Tree growth and wood properties are important economic traits. So Cruickshank and his team conducted several field studies and a greenhouse study to look at the effect of disease on survivorship, tree growth, and wood properties.

The large-scale greenhouse study identified resistance to *Armillaria ostoyae* in half-sib families of interior Douglas-fir. The best- and worst-surviving families were inoculated under field conditions in 22-year-old progeny trials. This confirmed the greenhouse results, and allowed for observations on long-term growth.

Results showed that the best-surviving family had high growth before infection, but suffered the most growth impact and consequently the lowest infected growth. Other families with moderate to good survival showed a smaller impact from root disease on growth after infection.

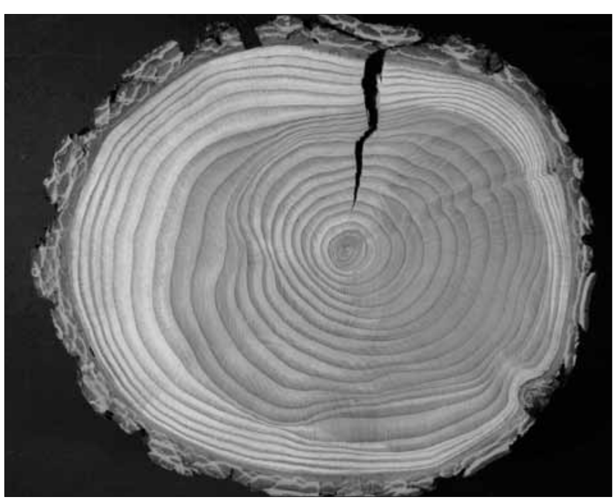
Cruickshank recommends that, besides looking at commonly studied traits like height growth and tree size, host tolerance should also be considered in multiple trait selection. This will help to identify faster-growing families with high disease tolerance, good survivorship, and desirable wood properties as well.

"We believe that a combination of disease tolerance or resistance traits could maximize growth after infection, reduce wood heterogeneity, and probably affect product of choice and value, which can make a difference in today's markets," said Cruickshank.

There is an increasing interest in this work since the families resistant/tolerant to *Armillaria* species may also be resistant to other insects and diseases.

When talking to Cruickshank, it is hard not to see his passion for the project. There is very little known about this subject, and about the effect of climate change on root disease, which is worrying. Preliminary results showed that with climate change, the incidence of root rot should increase. Licensees are interested in what trees to plant since root disease is one of their biggest problems, especially in combination with the uncertainty of the effects of climate change.

Cruickshank works closely with geneticist Barry Jaquish of the BC Forest Service on this project, and also receives assistance from FPInnovations. **Antoine Lalumière** and **Dominique Lejour** of the Canadian Wood Fibre Centre, Pacific Forestry Centre, have assisted with data collection and analysis. *–K.M.*


Mike Cruickshank, CFS

Quality disc: Douglas-fir stump top cross section showing the abrupt changes in annual ring width that form areas of ring expansion and compression caused by root disease.

The role of tariff and non-tariff trade barriers in the global forest products trade

©iStockphoto.com/pelicankate

In January, it was announced that India was removing restrictions on the importation of Canadian spruce, pine, and fir lumber after years of banning these products due to fears of invasive pests. This complements Canadian efforts to develop and diversify markets for forest products. While India currently imports little softwood lumber, its market has potential for the Canadian sector over the coming years. The lifting of this trade barrier is an example of the relevance of recent research undertaken by scientists at Natural Resources Canada's Pacific Forestry Centre in Victoria.

Although global consumption and trade of forest products has expanded over the past few decades, many tariff and non-tariff barriers to trade exist. As international agreements have significantly reduced tariffs, the relative importance of non-tariff barriers (NTBs) has increased. NTBs can take many forms. Some barriers are formed by a nation placing restrictions on the quantity of imports or exports over a certain time frame. US actions against Canadian softwood lumber exports are examples of such trade barriers. Other NTBs target the value of the traded good without using a tariff. These include customs surcharges, import taxes, licence fees, mandated minimum/maximum price limits for imports, prior deposits, and anti-dumping and countervailing duties.

Some less obvious NTBs include producer or exporter subsidies, financial assistance, tax concessions, or export encouragement schemes that aim to make domestic producers more competitive in international markets. NTBs can also take the form of complex import licensing procedures, customs procedures, and financial transactions, often used to support domestic industries. The most complex issue is the use of phytosanitary and technical standards or forest management certification and product labelling requirements. These may be required and justified to meet laudable public policy objectives or they may be unnecessary and serve simply to protect domestic products.

"As a country with vast forest resources that is highly dependant on access to foreign markets, it is extremely important for Canada to be aware of the risks of tariff and non-tariff measures in the Canadian forest products sector, the potential factors leading to these distortions, and their economic effects," says **Dr. Lili Sun** (lili.sun@nrcan.gc.ca), a Canadian Forest Service economist at the Pacific Forestry Centre. "The importance of trade to the Canadian forest sector and the apparent increased risk of trade barriers motivated me and my CFS colleagues **Bryan Bogdanski** and **Brad Stennes,** with Kees van Kooten of the University of Victoria, to examine the issue."

The study examined the factors that could trigger the imposition of trade barriers. It is useful for countries to understand these factors in order to develop proactive strategies to deter or mitigate them. Factors identified include political motivation, economic incentives, and trade retaliation. For example, the benefits of free trade are diffuse and the winners are unclear, whereas the gains from trade protection typically benefit a well-defined group that know how they benefit. This asymmetry means that protection may be politically efficient even it is not economically efficient. Furthermore, a trend towards increased use of NTBs versus tariffs is gaining political support because tariff reductions clearly benefit consumers and the use of NTBs, which are relatively hard to understand, serve to support domestic producers.

Sun and her colleagues examine the economic impacts of tariff and non-tariff barriers in the global forest products market using the Global Forest Product Model developed by Joseph

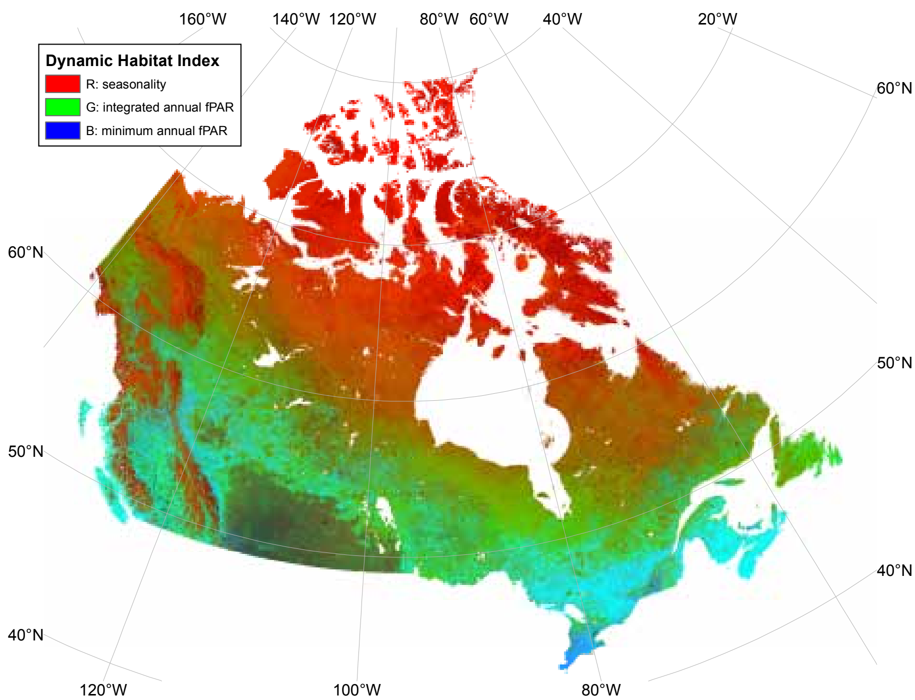
...continued on page 4

Source

The role of tariff and non-tariff trade barriers in the global forest products trade: A Canadian perspective. 2010. Sun, L.; Bogdanski, B.E.C.; Stennes, B.; van Kooten, G.C.

Available from the CFS online bookstore: bookstore.cfs.nrcan.gc.ca/

BioSpace: Developing an early warning system for Canada's



Spatial patterns of the dynamic habitat index. These metrics can be used to identify hotspots of biodiversity and biodiversity change.

Boundless, unspoiled nature is part of Canada's national identity. Large ecosystems, particularly in the North, experience minimal human impacts and function quite naturally. However, as you travel south into areas where human activity and biodiversity both increase, the potential for conflicts between people and native species increases and often results in ecological processes that are modified by human behaviour. Tools that support sustainable development and resource management while incorporating the needs of Canada's vast biodiversity are now vital to policymakers and conservation managers.

In order to meet international conservation targets, Canada needs a mechanism to ensure that continued development and natural resource management are consistent with the maintenance of biodiversity and ecosystem services, as well as to provide early warnings of changes to our natural heritage.

Researchers at the Pacific Forestry Centre, in collaboration with the Canadian Space Agency and the University of British Columbia, have developed such a framework for monitoring biodiversity across Canada's vast landscape—nearly 10 million square kilometres. This project, BioSpace: Biodiversity monitoring with earth observation data, uses information from earth-observing satellites to characterize key drivers of biodiversity. Variability in these drivers between locations can indicate those parts of Canada most important to the maintenance of biodiversity. Variation over time can highlight areas with changing conditions that may be detrimental, or beneficial, to biodiversity. The patterns and processes BioSpace highlights can also inform on the status of important ecosystem goods and services, including forest products, salmon fisheries, carbon storage, and water quality.

Since our last look at BioSpace in *Information Forestry*'s August 2008 issue, a lot has been accomplished. BioSpace is maturing as a project and is well received in academic and policy circles. The project is "doing some of the best national-scale biodiversity analysis anywhere," lauds Dr. Steve Running, Regents Professor of Ecosystem Sciences at the University of Montana.

Five key BioSpace data products, described below, are currently being incorporated into national and regional monitoring protocols and conservation planning activities.

Vegetation productivity — This is the most widely accepted, broad-scale driver of biodiversity. The productivity of an ecosystem is an index of the amount of biologically available energy and, thus, is related to the number and diversity of organisms that can be supported. However, productivity is not constant year-round

Understanding trade barriers *...continued from page 3*

Buongiorno of University of Wisconsin–Madison and others. Their results support concerns that tariffs and NTBs negatively affect the trade and production of forest products. Global welfare increases associated with the removal of NTBs and/or tariffs are relatively small, but specific country-level impacts can be much larger.

Among the 25 major countries studied, 19 of them experience net producer/consumer gains from free trading. The largest observed were in Japan, Germany, and Canada with net gains of $US2.4 billion, 1.6 billion, and 1.3 billion respectively. These results must be used with caution as they are based on simulations and the 2006 Canada–US Softwood Lumber Agreement is not included. The results do clearly indicate that efforts to reduce unnecessary obstacles to trade can result in large benefits to trading nations. *–L.S.*

ecological assets

(see figure below), and unique components of annual productivity may influence ecosystems differently. Three of these components—minimum annual productivity, total annual productivity, and seasonality—have been combined into a dynamic habitat index (DHI). Changes in the DHI, which is measured annually, can indicate habitat quality dynamics. BioSpace researchers have demonstrated that the DHI is relevant to bird and butterfly biodiversity. Ongoing work is also relating the DHI to moose habitat quality, caribou migration patterns, and the spatial distribution of protected areas in Canada.

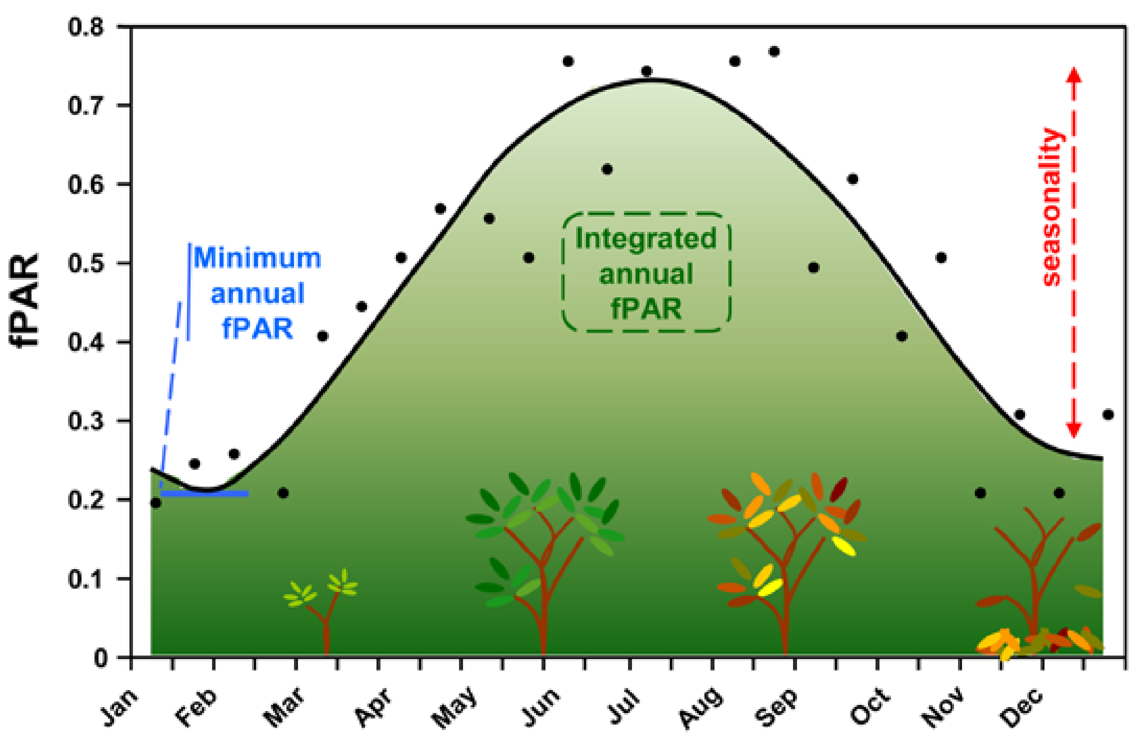
Snow cover — Winter conditions and snow dynamics may be as, or even more, important to biodiversity as productivity in a northern location such as Canada. New BioSpace research is investigating the relevance of snow cover to biodiversity, contrasting productivity and snow patterns, and developing a snow-based, winter-time DHI.

Land cover and forest fragmentation — Types of habitats and their spatial arrangement provide information on the distribution of biodiversity and habitat quality. BioSpace research has demonstrated that land cover can be used to predict bird biodiversity and it effectively represents distinct butterfly communities. Additionally, BioSpace research shows that land cover and forest fragmentation together are related to both the age distribution of forest stands and the population trends of Pacific salmon. The importance of natural versus human causes of fragmentation varies across Canada.

Disturbance — Abrupt changes in vegetation condition may influence biodiversity and can be detected from satellites.

Ecosystem classifications — Canada's large size and diversity make it difficult to reliably generalize statements about environmental condition. BioSpace has evaluated and developed ecosystem classifications of productivity and snow regimes that can be used to delineate more accurate monitoring and reporting units. Productivity regimes successfully represent patterns in both butterfly communities and snow cover. In contrast, the widely used ecozone framework is less effective at capturing winter-time conditions.

"What's exciting about BioSpace is its scope and variety," says **Meg Andrew** (margaret.andrew@nrcan.gc.ca), a post-doctoral fellow at the Pacific Forestry Centre. "BioSpace integrates many types of information to characterize environmental condition along a number of axes. The result is a very important dataset that we are using to address a diverse range of research questions and management needs." *–M.A.*



Vegetation productivity measured by fPAR (fraction of absorbed photosynthetically active radiation) in a year. BioSpace's dynamic habitat index incorporates this to inform on habitat condition and biodiversity status.

Sources

Idiosyncratic responses of Pacific salmon species to land cover, fragmentation, and scale. 2011. Andrew, M.E. and Wulder, M.A. Ecography. In Press. doi: 10.1111/j.1600-0587.2010.06607.x

How do butterflies define ecosystems? A comparison of ecological regionalization schemes. 2011. Andrew, M.E., Wulder, M.A., and Coops, N.C. Biological Conservation. In press. doi: 10.1016/j.biocon.2011.01.010

Comparison of a regional-level habitat index derived from MERIS and MODIS estimates of canopy light absorbance. 2011. Coops, N.C., Michaud, J.S., Wulder, M.A., and Andrew, M.E. Remote Sensing Letters 2(4): 327–336.

For more information

Français - http://scf.rncan.gc.ca/soussite/biospace/accueil
English - http://cfs.nrcan.gc.ca/subsite/biospace

Assisted migration: A new frontier in forest ecology


Leaf Petersen (hojaleaf, flickr)

Western larch

Throughout Earth's history, forest species have experienced numerous shifts in climate. Warming and cooling periods, changes in precipitation, and other trends have all been continuing stories within dynamic forest landscapes. These changes constantly challenge plants; as individuals, they occupy fixed positions in the environment. Adapting to these changes, trees and other forest plants respond through physiological resilience, and through dissemination of their pollen, seed, and propagules. Where climates shift, species shift to follow their optimal climate niche or "envelope"; in effect, the forests migrate.

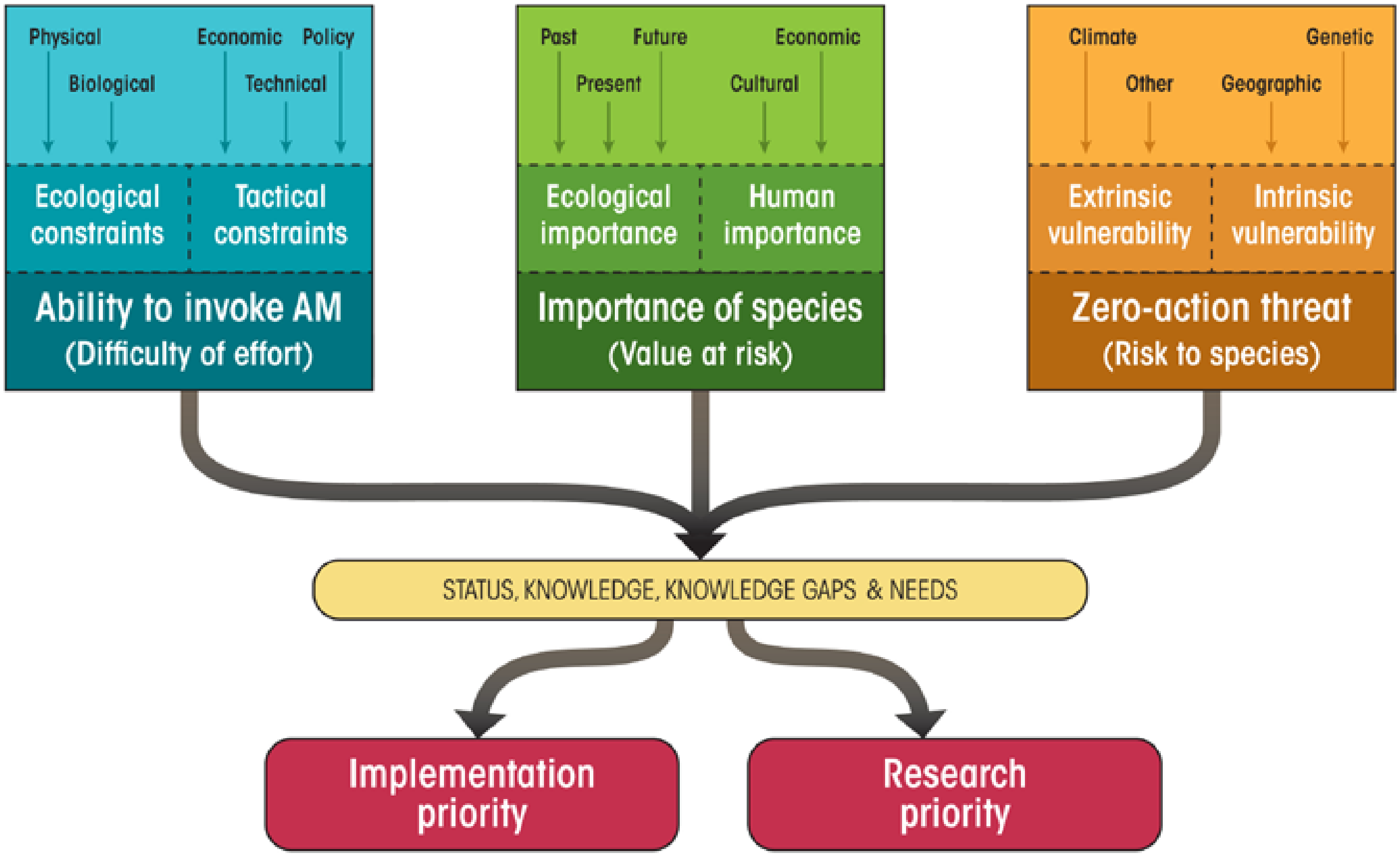
Enter our modern climate, and the changes currently projected to occur throughout Canada. In many cases, the pace of change is expected to outstrip the capacity of plants migrate. Forest trees continually experiencing warmer temperatures may become maladapted; potentially within the time-frame of one timber rotation. The deleterious effects of maladaptation (reduced growth, increased susceptibility to disease, disrupted phenology, etc.) could conceivably lead to declines in the productivity of some ecosystems, and challenges to their integrity.

Assisted migration, or the "human-assisted movement of organisms," is a strategy that could be used for adaptation to the potential impacts of climate change in forest ecosystems. In forestry contexts, assisted migration of tree species has received particular attention, although it could be applied equally to understorey plants and other organisms. Regardless of the target, it is a pre-emptive option that might have the potential to ensure the persistence of genotypes at a smaller scale, or maintain health and productivity with more extensive implementation.

There are substantial uncertainties relating to assisted migration of tree species, and these are naturally attended by concerns. One concern is the potential for invasiveness if a species is moved beyond its natural range; in other words, the migration may be "too successful." On the other hand, there is a concern that we do not know enough about the factors that could limit successful assisted migration efforts. Attempts to assist the migration of species may be ultimately constrained by factors that limit migration or cause maladaptation, e.g. different photoperiods, different soil types, geographic barriers, or fragmentation of the landscape. If assisted migration is to be implemented, more knowledge is needed to inform decision making and reduce uncertainties and concerns. Arguably, studying the deliberate movement of intact forest species is a brand new branch of ecology.

In operational forestry, assisted migration has different conceptual modes. One mode involves the relatively low-risk, short-distance movement of genotypes within the existing range of a tree species. This mode fits well within extant forestry practices, and focuses on maintaining healthy and productive forests during the course of a rotation. Data from provenance trials and models using climate projections based on local climate models or general circulation models (GCMs) can be used to refine the movement of genetic material within the range of a species. In British Columbia (BC), some specific adjustments of seed source regulations have been made to provide for the implementation of this approach; this mode of assisted migration is already being implemented for important commercial species. Also in BC, industry, community and research forests, and the Province (via AMAT – Assisted Migration Adaptation Trials) are establishing experimental plantations to assess the viability of this mode of assisted migration.

Another extant mode of assisted migration involves marginal extension of the range boundaries for a species. This is also a relatively short-distance mode, although the ecological unknowns increase. There have been efforts in BC



This framework highlights factors involved in prioritizing assisted migration efforts and research for forest tree species. Complex decisions emerge when the movement of forest ecosystems is contemplated.

to translocate western larch, ponderosa pine, and whitebark pine a marginal distance beyond their usual limits in small experiments in operational settings.

PFC researcher **Richard Winder** (richard.winder@nrcan.gc.ca) is part of a Canada-wide Task Group of CFS scientists, provincial agencies, and academic researchers developing a comprehensive assessment of the state of knowledge of assisted migration in Canada. The contribution from PFC will focus on ecological implications of various assisted migration scenarios, knowledge gaps concerning species and ecosystem vulnerabilities, and methods of prioritizing various assisted migration efforts. As part of this broad initiative, a summary report to the Canadian Council of Forest Ministers (CCFM) will be produced to inform decision making concerning assisted migration as a forest management strategy for adaptation to climate change.

–R.W.

Whitebark pine

Jane Richardson (Dcrjsr)

Fungi: Identifying resilient international travellers

When we hear the phrase "Alien and Invasive Species," most of us think of disease organisms and insect pests that could threaten our ecosystems if they were introduced from other areas of the world. Invasive pest species do have the potential to threaten the health of Canadian forest species: they could cause ecological and economic damage on a landscape level, or they could pose a perceived contamination threat to the international trade of Canadian forest commodities with countries that have quarantines against those pests.

Several Canadian Forest Service (CFS) scientists, including **Dr. Brenda Callan** (brenda.callan@nrcan.gc.ca), conduct research on the identification and eradication of invasive pests and prevention of their establishment. Callan, a CFS mycologist and a member of the Invasives Research Team at the Pacific Forestry Centre in Victoria, British Columbia (headed by **Dr. Eric Allen**), identifies potentially invasive fungi and provides scientific advice to regulatory agencies like the Canadian Food Inspection Agency.

The majority of her focus, though, is on the "flip side" of invasive species research: reducing trade barriers to provide better market access to Canadian forest products. This involves the detection and identification of indigenous fungi associated with Canadian commodities such as untreated conifer lumber and logs from British Columbia (BC).

Most of the common pathogens of conifers grow and produce spores on the foliage, branches, roots, or bark of the tree: parts removed during the logging or milling process and not found on traded lumber. Callan's research shows that untreated, milled wood still harbours a great number of fungi, but the vast majority belong to taxonomic groups that have non-pathogenic or saprophytic (living off of decaying organic matter) life cycles.


Brenda Callan, CFS

Culturing fungi from wood chips removed from lumber.

A single log may host hundreds of distinctly different isolates of these harmless fungi. Some of the isolates are known wood decay fungi, but they pose little threat in lumber because they are unlikely to form fruiting bodies or spores on sawn wood. A few species, such as *Heterobasidion occidentale* (formerly known as *H. annosum* in Canada), which is associated with root disease and stem decay, can be detected at very low levels in untreated lumber.

In order to identify pests that are of concern to quarantine agencies in other countries, regulatory officials often refer to host-fungus indices such as those available at the PFC Herbarium website: www.pfc.cfs.nrcan.gc.ca/biodiversity/herbarium. These lists may include well over a hundred species of fungi associated with a given plant host if it is a well-studied tree, such as Douglas-fir; but not all fungi deserve to be placed on a quarantine list.

In fact, only a small percentage of fungal species on such lists are likely to occur in milled wood, just a fraction of those species might actually be pathogenic, and even fewer might have a life stage that could produce infective spores on the wood. *H. occidentale* is one of those few species: it is a known pathogen and also produces infective conidia (asexual reproductive bodies) in a mould-like bloom on colonized wood.

Callan and her team are conducting a second study to determine if a piece of untreated lumber colonized by *H. occidentale* is capable of maintaining viable fungal colonization under various conditions. They made custom lumber from western hemlock trees that were determined in the field and laboratory to be colonized by *H. occidentale*. Rough-cut cants of wood were milled into dimensional lumber by a portable sawmill. The lengths were then sampled extensively to confirm that they were fully colonized with the fungus (even though they were not yet showing symptoms of decay).

The resulting products are being monitored in various scenarios on the grounds of the Pacific Forestry Centre, including partially buried fence posts and a small lumber stack. Scientists provide feedback from this kind of research to regulatory agencies, which helps them narrow down

continued on page 9...

Bioenergy feedstock modelling: Information for the expanding bioenergy sector

A key part of the initial interest in bioenergy at the Pacific Forestry Centre can be attributed to the mountain pine beetle (MPB) outbreak. As the MPB infestation rapidly expanded, analysts were forecasting that vast tracts of damaged timber would go unsalvaged by the traditional forest products sector. During the housing boom in the United States, sawmills in the British Columbia Interior were running at full capacity, creating a surplus of woody residuals. The abundance of supply coupled with growing global energy demands, particularly if supply came from renewable sources, made an expanded bioenergy sector seem like a natural fit.

The enthusiasm for bioenergy was tempered by the knowledge that the surpluses created by the MPB outbreak were temporary. A different feedstock supply dynamic would likely be present in a post-outbreak environment and in other regions across Canada where salvage harvesting was not taking place: cheap, excess mill residuals would be less abundant or already used, meaning that a new or expanding bioenergy sector would likely need to pay more to source the feedstock they required. This could jeopardize the feasibility of bioenergy facilities and/or result in increased competition for fibre with existing users.

These factors were brought to light earlier than expected when the recession in the global economy hit the forest products sector. As sawmills closed or operated at reduced levels, the surplus of cheap mill residuals quickly dried up, making it necessary for prospective bioenergy producers to look at sourcing costlier feedstock supplies from logging residuals or standing timber. It also became apparent that there was a need for enhanced spatial and temporal modelling of feedstock since, due to its bulky nature, transportation costs would be a large component of delivered costs. Furthermore, feedstock supply would likely be highly interconnected with market conditions in the broader forest sector. In collaboration with Dr. Kees van Kooten at the University of Victoria, Pacific Forestry Centre researchers **Brad Stennes** (bstennes@nrcan.gc.ca) and **Kurt Niquidet** (kniquide@nrcan.gc.ca) developed two models that differed in spatial scale to investigate these issues further.

One model focused exclusively on the Quesnel forest district, a region in the midst of the MPB infestation. The model was used to identify the source and cost of feedstock for a prospective 187-MW bioenergy facility over a 25-year period. The results showed that feedstock costs would more than double over the planning horizon. The rising costs were attributed to two main factors: 1) in the future, feedstock would have to be sourced from more distant stands, and 2) as a result of declining sawlog content, bioenergy production would need to carry a higher proportion of the development and extraction costs over time.

While the model provided an in-depth picture by incorporating detailed forest inventory and spatial information specific to the Quesnel district, Stennes, Niquidet, and van Kooten recognized that the results could not be applied to other regions in

Sources

Bioenergy from Mountain Pine Beetle Timber and Forest Residuals: The Economics Story. 2011. Niquidet, K.; Stennes, B; van Kooten, G.C. Biomass and Bioenergy (In review).

Implications of Expanding Bioenergy Production from Wood in British Columbia: An Application of a Regional Wood Fibre Allocation Model. Stennes, B., Niquidet, K.; van Kooten, G.C. 2010. Forest Science 56(4): 366–378.

Modelling bioenergy uptake in the British Columbia fibre allocation and transport model. Pacfic Forestry Centre, Canadian Forest Service, Victoria, BC. Stennes, B.; Niquidet, K. 2011. Information Report BC-X-431.

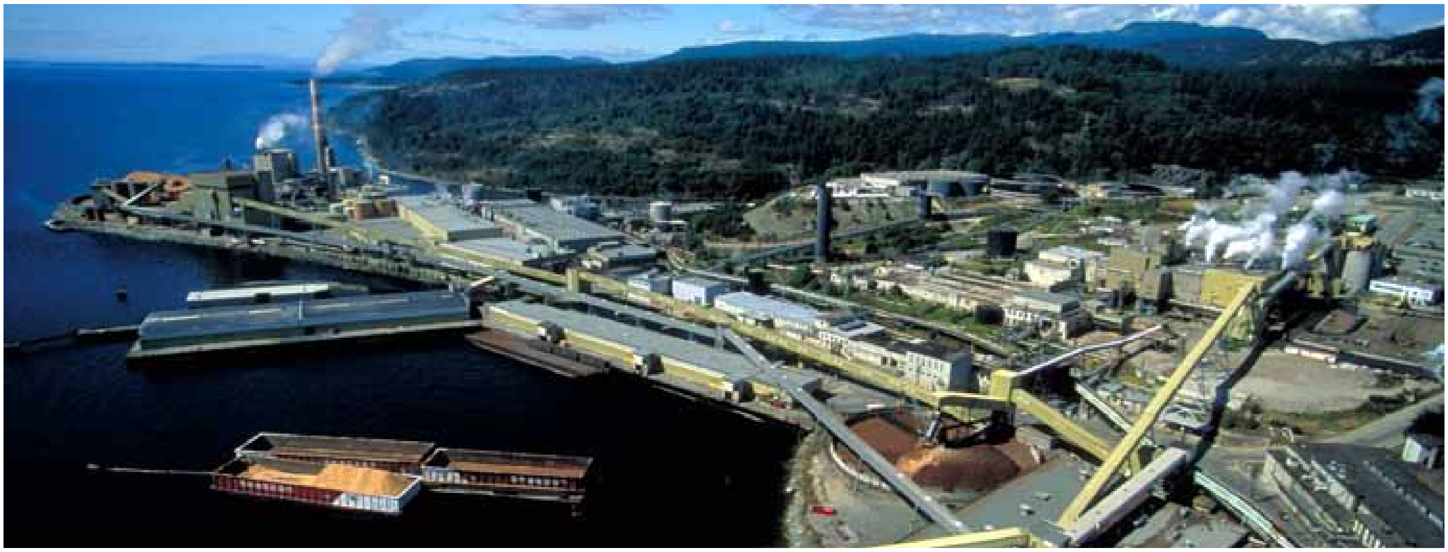
continued on page 10...

Detecting fungi*...continued from page 8*

restrictive quarantine lists to a small number of pathogenic species that have valid potential for establishment if accidentally introduced through logs or lumber. This provides researchers with the ability to target their work toward the organisms and commodities that warrant additional methods of detection, mitigation, and risk reduction. *–B.C.*

Brenda Callan, CFS

Sampling boards at the sawmill.



Dave Harrison, CFS

...continued from page 8

the province or the country. More importantly, the model lacked fibre supply and demand interaction across districts and between sectors.

A province-wide model was created to fully capture these dynamics. The fibre allocation and transport model divides the province of British Columbia into 24 regions. Each region has a representative forest sector defined by processing capacity, timber supply, and cost structure, and regions are linked by a large transportation matrix. Fibre is allocated across sectors and regions through a linear programming formulation that maximizes net revenues subject to resource and capacity constraints. The model allows researchers to simulate the impact of additional bioenergy capacity on the existing sector under a wide range of supply and demand conditions. When demand for lumber is low, the addition of bioenergy capacity can have a positive impact on the harvesting sector because it adds value to the system, thus improving profit margins. Nonetheless, despite the availability of MPB-attacked stands, fibre is not harvested in a direct, standing timber-to-energy fashion. When allowable annual cuts are eventually reduced due to the MPB, energy producers will increasingly be forced to compete with other users such as pellet plants and pulp mills to meet their feedstock requirements.

The scenarios from these models highlight several challenges associated with bioenergy expansion. In particular, if bioenergy capacity is to increase, facilities will need to be prepared to face higher feedstock costs. Also, depending on supply and demand conditions, bioenergy production can act as both a complement and a competitor to Canada's existing forest sector. Pacific Forestry Centre researchers are now expanding these models to include the Prairie provinces. *–K.N.*

On the cover

Mike Cruickshank, CFS

Mushrooms, or fruiting bodies, of *Armillaria*.

Events

2011: International Year of Forests
United Nations
http://canadaforests.nrcan.gc.ca/article/events
http://www.un.org/en/events/iyof2011/events.shtml

Engineering the Forest Value Chain
34th Annual Council on Forest Engineering Annual Meeting
June 12–15, 2011 Québec City, QC
https://www.cirrelt.ca/COFE2011/

Carbon Management in BC Ecosystems
Columbia Mountains Institute of Applied Ecology
June 15–16, 2011 Nelson, BC
http://www.cmiae.org/Events/#carbon

IUFRO Tree Biotechnology 2011: From Genomes to Integration and Delivery
International Union of Forestry Research Organizations
June 26–July 2, 2011 Arraial d'Ajuda, Brazil
http://www.treebiotech2011.com/

People in Places: Engaging Together in Integrated Resource Management
Coastal CURA (Community-University Research Alliance)
June 26–29, 2011 Halifax, Nova Scotia
http://www.coastalcura.ca/peopleinplaces2011.html

Canada's Forest Conference 2011
Canadian Institute of Forestry AGM and 103rd Annual Conference
September 18–21, 2011 Huntsville, ON
http://www.cif-ifc.org/site/2011_huntsville

National Forest Week 2011: Canada's Forests – Branching Out
Canadian Forestry Association
September 19–25, 2011 Nationwide
http://www.canadianforestry.com/html/outreach/forest_week_e.cfm

People

Departures

Bob Ferris started with the Forest Insect and Disease Survey (FIDS) in 1982. Bob first worked in the Okanagan area of the Kamloops region, then in the Vancouver Island region and the Prince George region, surveying from the Cariboo to the Yukon. While Bob's survey and monitoring work included most of the forest pests of British Columbia, he was an expert in the biology of the European pine shoot moth, larch casebearer, two-year cycle budworm, eastern spruce budworm, forest tent caterpillar, and saddleback looper. Bob lent his considerable field and laboratory expertise to many projects: the Coastal Forest Chronosequence (CFC) study and the Canadian Intersite Decomposition ExperimenT (CIDET) from 1996 to 2005; a series of BC Forest Investment Account-funded research projects on ectomycorrhizal fungi and variable retention forestry from 2002 to 2009; and studies conducted at the Canadian Carbon Plan Fluxnet Coastal BC Station sites near Campbell River from 2002 to 2011.

Arrivals

The PFC welcomes our new pathologist, **Dr. Elisa Becker,** to the Forest Innovation and Dynamics Division. Dr. Becker most recently worked at the Pacific Forestry Centre as a visiting fellow from 2008–2010 with Simon Shamoun and the Sudden Oak Death research group as a lead researcher. Elisa received her PhD from the University of Victoria in 2003 where she completed her dissertation titled "Systematics, efficacy and population dynamics of the biocontrol fungus, *Chondrostereum purpureum,*" and is recognized as an authority on the use of *Chondrostereum* as a biocontrol.

Dr. Elizabeth Campbell recently joined PFC as a Research Scientist (Beetle Disturbances). Elizabeth received her Ph.D. from Université du Québec à Montréal where she studied impacts of spruce budworm outbreak on boreal forests. Prior to joining PFC, Elizabeth was a scientist with the British Columbia Forest Service, where she led a key climate change science initiative that provided science-to-policy guidance for adapting forest management. Dr. Campbell has conducted research on beetle disturbances for several years and previously worked on tree-ring studies of mountain pine beetle disturbances with Dr. René Alfaro here at PFC.

Before joining the Pacific Forestry Centre as Publications Officer, **Barb Crawford** spent 9 years working as a wildlife biologist and environmental consultant in various positions that took her from Ross River, YT to Val Marie, SK and everywhere in between. After more than 2 years of training and freelancing as an editor and technical writer, roles that have been an important element of her work for many years, Barb has relocated from Calgary, AB to fill this position at the PFC.

Accolades

The United Way honoured Natural Resources Canada's Pacific Forestry Centre in January with an award for the best 2010 employee charity campaign for Greater Victoria. The recognition was a result of great teamwork between all sectors that make PFC their home: the Canadian Forest Service, Shared Services Office, Communications and Marketing Branch, and NRCan Library. Thanks in part to their efforts, the 2010 United Way campaign in Greater Victoria brought in $6.21 million to help the community.

CFS Merit Award – Collaboration: Deforestation Monitoring Group
Thanks to the Canadian Forest Service (CFS), Canadians now have a better understanding of the nature and magnitude of deforestation. Using an archive of Earth observation imagery, members of the Deforestation Monitoring Group produced annual deforestation estimates for Canada from 1970 to 2009 to support a variety of national and international reporting requirements and to support policy and negotiations. Their work is used by CFS' Carbon Account team, Environment Canada, and Agriculture Canada, and forms the target baseline for the recently adopted *BC Zero Net Deforestation Act*. Congratulations on this outstanding achievement to team members **Don Leckie, Andrew Dyk, Sally Tinis, David Hill, Stephanie Ortlepp,** and **Frank Eichel**.

Congratulations to recipients of **CFS Long Service Awards** at the Pacific Forestry Centre:
20 Years–**Brenda Callan, Simon Shamoun**
30 Years–**François Gougeon**
40 Years–**Jane Foster**

Environmental Science Advisory Committee (ESAC) – CFB Esquimalt:
Recognition awards were presented to the following PFC staff for their contributions to ESAC: **Nello Cataldo, Arthur Robinson,** and **Andrea Schiller** of the Federal Lands Program; and Research Scientist and chair of ESAC, **Tony Trofymow.**

New publications from Pacific Forestry Centre

Mountain Pine Beetle Working Papers

Mountain pine beetle survey in the Peace Region of British Columbia and adjacent areas in Alberta. 2011. Pellow, K.W.; Thandi, G.; Unger, L.S. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Mountain Pine Beetle Working Paper 2010-05.

Impacts of climate change on mountain pine beetle habitat connectivity in western Canada. 2011. Riel, W.G.; Burnett, C.; Fall, A. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Mountain Pine Beetle Working Paper 2010-04.

Forest health and mortality of advance regeneration following canopy tree mortality caused by the mountain pine beetle. 2011. Lewis, K.J. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Mountain Pine Beetle Working Paper 2010-03.

Mountain pine beetle range expansion: Assessing the threat to Canada's boreal forest by evaluating the endemic niche Final Report Ver. 1.1. 2011. Bleiker, K.P.; Carroll, A.L.; Smith, G.D. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Mountain Pine Beetle Working Paper 2010-02.

A synthesis of the hydrological consequences of large-scale mountain pine beetle disturbance. 2011. Schnorbus, M. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Mountain Pine Beetle Working Paper 2010-01.

Information Reports

Fertilization and thinning effects on a Douglas-fir ecosystem at Shawnigan Lake: 32-year growth response. 2011. Omule, A.Y.; Mitchell, A.K.; Wagner, W.L. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report FI-X-005.

Condition, growth, and projected yield of lodgepole pine and interior spruce 20 years after rehabilitation of an understocked site in north-central British Columbia: The Stony Lake trial. 2011. Whitehead, R.J.; Cortini, F.; Taylor, S.W.; Linnell Nemec, A.F.; Goudie, J.W.; Vallentgoed, J.; Polsson, K.R. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report FI-X-006.

The economics of salvage harvesting and reforestation in British Columbia's mountain pine beetle-affected forests. 2011. Peter, B.; Bogdanski, B.E.C. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-425.

Mountain pine beetle: A synthesis of the ecological consequences of large-scale disturbances on sustainable forest management, with emphasis on biodiversity. 2011. Bunnell, F.L.; Kremsater, L.L.; Houde, I. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-426.

Markets for forest products following a large disturbance: Opportunities and challenges from the mountain pine beetle outbreak in western Canada. 2011. Bogdanski, B.E.C.; Sun, L.; Peter, B.; Stennes, B. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-429.

Development and survival of the spruce beetle, *Dendroctonus rufipennis,* in stumps and windthrow. 2011. Safranyik, L. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-430.

Modelling bioenergy uptake in the British Columbia fibre allocation and transport model. 2011. Stennes, B.; Niquidet, K.; van Kooten, G.C. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-431.

Other Publications

Environmental Science Advisory Committee: 2009/2010 Annual Report. 2011. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Copublished by the Department of National Defense.

Journal Articles

An inventory-based analysis of Canada's managed forest carbon dynamics, 1990 to 2008. 2011. Stinson, G.; Kurz, W.A.; Smyth, C.E.; Neilson, E.T.; Dymond, C.C.; Metsaranta, J.M.; Boisvenue, C.; Rampley, G.J.; Li, Q.; White, T.M.; Blain, D. Global Change Biology.

Assessment of Colletotrichum gloeosporioides as a biological control agent for hemlock dwarf mistletoe (Arceuthobium tsugense) 2011. Askew, S.E.; Shamoun, S.F.; van der Kamp, B. Journal of Forest Pathology.

Changes in the structural composition and reactivity of Acer rubrum leaf litter tannins exposed to warming and altered precipitation: climatic stress-induced tannins are more reactive. 2011. Tharayil, N.; Suseela, V.; Triebwasser, D.J.; Preston, C.M.; Gerard, P.D.; Dukes, J.S. New Phytologist.

Characterizing stand replacing disturbance in western Alberta grizzly bear habitat, using a satellite-derived high temporal and spatial resolution change sequence. 2011. Gaulton, R.; Hilker, T.; Wulder, M.A.; Coops, N.C.; Stenhouse, G.B. Forest Ecology and Management 261(4): 865-877.

Climate change and forest diseases. 2011. Sturrock, R.N.; Frankel, S.J.; Brown, A.V.; Hennon, P.E.; Kliejunas, J.T.; Lewis, K.J.; Worrall, J.J.; Woods, A. Journal of Plant Pathology 60(1): 133-149.

Comparing the impacts of mitigation and non-mitigation on mountain pine beetle populations. 2011. Coggins, S.B.; Coops, N.C.; Wulder, M.A.; Bater, C.W.; Ortlepp, S.M. Journal of Environmental Management 92(1): 112-120.

Facilitation in bark beetles: endemic mountain pine beetle gets a helping hand. 2011. Smith, G.D.; Carroll, A.L.; Lindgren, B.S. Agricultural and Forest Entomology 13(1): 37-43.

Visit the Canadian Forest Service online bookstore to order or download Canadian Forest Service publications:

bookstore.cfs.nrcan.gc.ca

The catalogue includes thousands of publications and research articles by Natural Resources Canada, Canadian Forest Service.

Information Forestry: Science and Technology Research at the Pacific Forestry Centre Canadian Forest Service is published three times annually by Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, 506 West Burnside Road, Victoria, British Columbia V8Z 1M5; cfs.nrcan.gc.ca/regions/pfc; telephone: 250.363.0600.

To order additional copies of this or any Canadian Forest Service publication, visit the Canadian Forest Service online bookstore at bookstore.cfs.nrcan.gc.ca, or contact Pacific Forestry Centre publications Distribution Clerk, Nina Perreault (telephone: 250.363.0771; email: PFCPublications@nrcan-rncan.gc.ca). Contributing writers in this issue: Katalijn MacAfee, Lili Sun, Meg Andrew, Richard Winder, Brenda Callan, and Kurt Niquidet. Subscribe or mailing address changes: PFCPublications@nrcan-rncan.gc.ca. Please address questions, comments, suggestions, and requests for permission to reprint articles that appear herein to the editor, Shelley Church (telephone: 250.363.0626; email: PFCPublications@nrcan-rncan.gc.ca).

Info-Forêts est aussi disponible en français. Veuillez accueillir une exemplaire de la librairie du Service canadien des forêts : librairie.scf.rncan.gc.ca

Printed in Canada