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# INFORMATION FORESTRY

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




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# Climate models must capture effects on treeline growth

British Columbia is home to some of Canada's highest-elevation forests. In the very highest of these—growing at treeline in or near the true alpine—evergreens hug the ground, twisted and bent by wind and snow pack, with vertical leaders repeatedly pruned by severe winter temperatures, ice, and wind. Many models that predict how changing climate will affect species distribution assume temperature limits both growth and spread of these forests. As global temperatures rise with climate change, these models forecast the forests will straighten, grow tall, and colonize ever-higher slopes.

However, a recent study by Natural Resources Canada Research Scientist Eliot McIntire (Eliot.McIntire@nrcan.gc.ca) suggests these assumptions need re-examination. McIntire and colleague Alex Fajardo, of the University of Montana, tracked growth at high-altitude treelines in the Chilean Andes and Montana's Rocky Mountains. Basal tree cores at the sites show tree growth and colonization up the slopes improved for most of the past 200 to 300 years. This corresponds to a period when global temperatures were just beginning to climb to today's levels out of the very coldest decades of the last millennium.

"Synchrony between temperature and growth and temperature and recruitment clearly occurred during that period in both regions," says McIntire. "Then, during the past half-century, it was lost at all sites." In fact, any improvements in growth that had occurred have since disappeared or reversed.

Kevin Teague, Flickr

A recent study suggests that temperature is no longer the key factor driving tree growth and colonization at high altitudes.

This decoupling of temperature and high-altitude growth and recruitment rates may indicate that the world is entering a period in which temperature no longer drives growth and colonization at treelines, McIntire says. Other factors, such as availability of water, may now be the main constraints.

The findings suggest climate models may need to be modified to separate high-altitude growth and recruitment drivers if they are to capture what is really going on under British Columbia's—and the world's—highest forest canopies.

— *by Monique Keiran*

### Sources, this page

"Reversal of multicentury tree growth improvements and loss of synchrony at mountain tree lines point to changes in key drivers", 2012

"Resistance of half-sib interior Douglas-fir families to *Armillaria ostoyae* in British Columbia following artificial inoculation", 2010

# Seedlings to provide answers to questions of stress

Surrounded by Douglas-fir seedlings, Research Scientist Elisa Becker (Elisa.Becker@nrcan.gc.ca) checks growth in the young trees. Becker and her Natural Resources Canada colleagues will be testing the 7500 seedlings growing at the Pacific Forestry Centre for resistance and tolerance to fungal and abiotic stressors. Beginning next year, the scientists will innoculate one-third of the seedlings with root-rot fungus *Phellinus sulphurascens,* and one-third with fungi associated with wood-boring insects. The remaining seedlings will be stressed with drought.

The seedlings are grown from seeds produced by 99 mother trees from the four British Columbia biogeoclimatic zones where Douglas-fir thrives naturally. Canadian Wood Fibre Centre researcher Mike Cruickshank (Mike.Cruickshank@nrcan.gc.ca) identified the mother trees in previous studies as producing offspring with resistance to root-rot disease *Armillaria ostoyae*.

— *by Monique Keiran*

# DNA library speeds inchworm-moth identification

In the face of rapidly expanding trade and markets, reducing the risk to Canada's forests from exotic pest introductions requires rapid detection and reliable recognition of suspect species. Thanks to recent completion of a comprehensive DNA reference library of looper moths, plant health officials, border inspectors, and entomologists in British Columbia are now as little as 48 hours away from identifying species within this important and diverse moth family.

"The library allows just about anyone who collects a specimen to have it identified within days," says Biodiversity Institute of Ontario scientist Jeremy deWaard, who worked with Natural Resources Canada researchers on the project as a Ph.D. student. "And they don't need to be taxonomists to do so."

The loopers, or inchworm moths, are one of the largest insect families, with nearly 23 000 species worldwide and about 1400 species in North America. Because most larvae and adults within the family share similar colours and patterns, it can be difficult to discriminate species. Adding to the complexity, each life stage of a species differs from other life stages, and sometimes life stages of different species resemble each other more than do life stages within the same species.

As well, with fewer scientists training to become taxonomists, the number of researchers able to accurately identify species is declining. This slows identification by traditional methods based on examination of morphological features further.

"That's the beauty of using DNA identifiers," says Natural Resources Canada Research Scientist Lee Humble (LHumble@nrcan.gc.ca), who oversaw deWaard's work on the project. "No matter the life stage, whether the insect is male or female, or even if it's a smear on a windshield, the DNA sequence we're interested in is constant for each species."

The DNA library provides an accessible catalogue of species-specific "barcodes" against which researchers can compare species samples. The DNA functions like barcodes at grocery store checkouts: when goods are scanned, the computer matches them to stock barcodes in the database and provides information.

The looper-moth library enables researchers to identify the majority of species by DNA, and highgrades mystery or cryptic species for special attention by taxonomists.

Being regional and comprehensive, it also provides a baseline for both native and historically introduced species. When used to identify specimens collected by field staff monitoring species diversity or invasive species introductions, DNA diagnostic tools facilitate detection of novel native or introduced species. For instance, when deWaard and Humble constructed the looper library, they detected a previously unrecognized Eurasian species that feeds on juniper.

To create the barcode library, the researchers sampled and analysed DNA of more than 400 species of loopers from insect collections in British Columbia and neighboring provinces, territories, and states. When compared against morphological characteristics, more than 93 percent of collected DNA codes yielded precise species identification.

DeWaard is investigating those not identified. "The number will rise above 93 percent," he says. "Once we examine the uncertain species further, I'm sure we'll find some of them were misidentified in the first place, and some will require revision."

The researchers may even find species not previously recorded.

Looper moths are an important component of British Columbia forest ecosystems. Because they neither fly well nor migrate extensively, they often serve as environmental indicators. Many loopers are also significant defoliators of important tree species.

*— by Monique Keiran*

## Sources

"A Comprehensive DNA Barcode Library for the Looper Moths (*Lepidoptera: Geometridae*) of British Columbia, Canada", 2011

"DNA barcoding identifies the first North American records of the Eurasian moth, *Eupithecia pusillata*", 2010

Looper moths, or inchworms, such as *Macaria adonis,* are important components of British Columbia's forest ecosystems.

# New modelling software system tracks carbon stored over

Some 45 million tonnes of carbon are transferred every year from forests to the forest products sector. All of this carbon has been removed from the atmosphere by trees, and much of it remains stored in wood products. A new tool developed by Natural Resources Canada is allowing researchers to better track how much forest carbon remains stored in harvested wood products.

The Carbon Budget Modelling Framework for Harvested Wood Products (CBM-FHWP) enables researchers to study carbon stored in, and emitted from, harvested wood products over time in Canada and in countries to which Canadian products are exported.

"Half of the dry weight of wood is carbon," says Natural Resources Canada Research Scientist Werner Kurz (Werner.Kurz@nrcan.gc.ca). "Trees aren't like balloons: They don't release all their carbon to the atmosphere the moment they are cut down. We do a great disservice to the world's vast quantities of harvested wood products if we ignore that they can act as long-term carbon stores."

The Natural Resources Canada researchers built the CBM-FHWP system partly in response to anticipated changes to international rules for reporting forest carbon. Current rules require that countries report all harvested forest carbon as an immediate emission to the atmosphere at time of harvest, as if trees were indeed balloons of carbon gas. The new rules are expected to encourage a more realistic accounting of the lifecycle of carbon in harvested wood. For instance, under the new regulations, wood-based carbon contained in buildings would be considered sequestered for the duration of the wood's service life, thus permitting a more accurate description of when and where emissions from wood products occur.

The CBM-FHWP software system tracks the movement and transformations of carbon through production and lifecycle stages, including eventual disposal in landfills or combustion. As required by international accounting rules, carbon stored or emitted from harvested wood products can be traced back to year and location of harvest.

The software system is not a model. It is a modelling framework, upon which users can

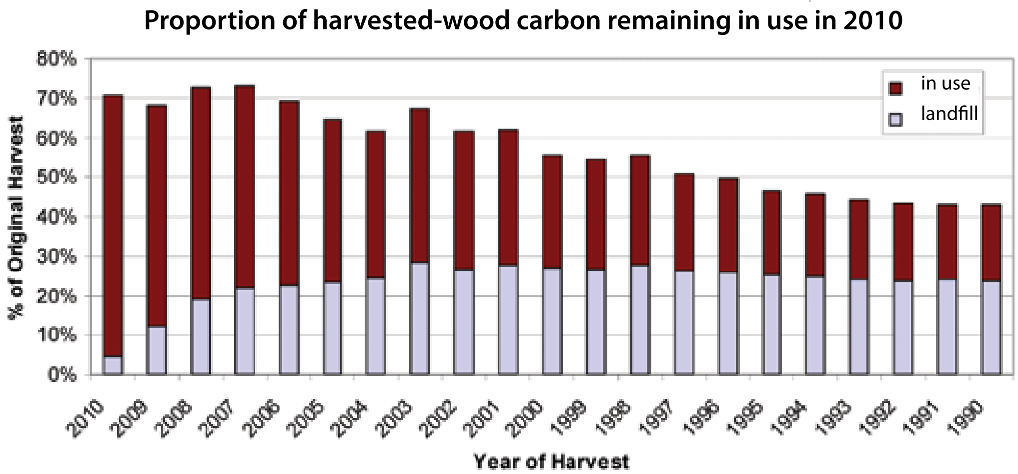
jphilipig, Flickr

By using wood instead of emissions-intensive products like concrete and steel in the construction of the Art Gallery of Ontario, the Vancouver Convention Centre, and the new building at the University of Northern British Columbia, architects and builders are creating long-term stores of carbon from Canada's forests.

Spectrus, Flickr

Too Tall Paul, Flickr

# time in products made from Canada's harvested wood




New modelling infrastructure software tracks carbon stored in products made from harvested wood over time (left). For example, some of the lumber used in New Brunswick's Head Harbour Lightstation has been storing Canadian forest carbon for more than 180 years (below).

build and run models of harvested wood product dynamics. The software provides an infrastructure for modelling, with basic building blocks and rules. Users create models for the system by defining the nature of carbon pools, lifecycle stages, and transformations of products through time and space.

This flexibility allows users to create models varying in scope and resolution—from simple proof-of-concept models to detailed national and global systems—and to answer policy and scientific questions about carbon dynamics in wood products.

For example, the scientists and developers of the Carbon Accounting Team of the Canadian Forest Service are using the tool to analyse scenarios of wood-product use in national-scale climate change mitigation strategies. By compiling data on forest product life stages into a single model, the team is able to quantify carbon stored in wood products manufactured from Canada's forests. The life stages in question include manufacturing, consumer uses, exports, end-of-life disposal, and return to the atmosphere. By creating different product-use scenarios, the researchers are quantifying the impacts on the atmosphere of using wood to displace more emissions-intensive products, such as steel and concrete.

The software is an important contribution to Canada's scientific research on forest carbon.

"By combining the software with our existing CBM-CFS3 (Carbon Budget Model for the Canadian Forest Sector) forest ecosystem carbon model, we are able to account for and analyse the entire lifecycle of forest carbon, from uptake in forests to harvest, product use, disposal and eventual emission via decay or combustion," says Kurz. "The new system allows us to assess strategies for enhancing the potential of Canada's forest sector to mitigate global climate change."

Friends of Head Harbour Light Station

The information provided demonstrates again the important roles Canada's forests play in the global carbon cycle, removing carbon dioxide from the atmosphere, and providing timber and energy to meet society's demands—roles that last long after trees are harvested.

*— by Michael Magnan*

## Source

"An inventory-based analysis of Canada's managed forest carbon dynamics, 1990 to 2008" was published in *Global Change Biology* in 2011.

# Facilitating the sharing of fire-fighting resources

The fire that burned through the town of Slave Lake, Alberta, in May 2011, stretched Canada's fire-fighting resources to the limit. All available water bombers, experienced fire crews, and other personnel and equipment from across Canada were in use at that time. And international partner-agencies were fully engaged with their own emergencies.

"If there had been an increase in fire activity in any other region at that time," says Kim Connors, "I don't know who we could have turned to." As Director of the Canadian Interagency Forest Fire Centre (CIFFC), the non-profit organization that co-ordinates fire-resource sharing among Canada's provinces, territories, and federal agencies, Connors is the first to know when available resources are nearing maximum capacity.

Most major wildfires in Canada require fire managers to draw upon other jurisdictions for fire-fighting resources: trained crews and equipment on the ground and in the air, and experienced experts to direct efforts, deal with logistics, and plan fire-control strategies and tactics.

"It makes more sense for agencies to share resources," says Natural Resources Canada Fire Officer Steve Taylor (Steve.Taylor@nrcan.gc.ca), "than for each agency to maintain all the resources it would need to respond to conditions that may occur only a couple of times every few years."

In fact, Canada's fire-management agencies have shared resources for decades, but formalized the arrangement only in 2003, after the devastating Kelowna fire.

Taylor is now leading a team of researchers from Natural Resources Canada and elsewhere to develop tools to support resource sharing and to manage inherent risks.

We profile two recent projects here.

## Fire load and resource availability tracked online

The Canadian Fire Resource Demand System (CFRDS) provides the first-ever look at fire-fighting resource requirements and availability on a Canada-wide basis.

The new online tool, developed by Natural Resources Canada Fire Officer Steve Taylor and colleagues at Natural Resources Canada and the Ontario Ministry of Natural Resources, forecasts fire load and fire-resource demand and availability across the country. It integrates weather forecasts, statistical fire-occurrence models, resource-use variables, and expert opinion, and it predicts conditions over 14-day periods. Forecasts are generated daily for each of Canada's 50 fire response centres.

Pierre Gazzola, Flickr

TodddBF, Flickr

Most major wildfires in Canada require fire managers to draw upon other jurisdictions for fire-fighting resources, such as water bombers and personnel.

Launched in May, the system was commissioned by the CIFFC. The system's purpose, says CIFFC director Kim Connors, is to help fire-management agencies allocate limited resources as effectively as possible—keeping resources near at hand when need is projected and making excess capacity available to other jurisdictions when conditions are good.

"Agencies are looking for tools and resources to help them manage the challenges of shrinking fire-fighting resources and increasing demand," he says.

The value of the CFRDS depends on fire agencies adopting it and using it regularly during fire seasons. Fire managers populate the system with numbers of anticipated and actual fires occurring each day in their responsibility zones. They override daily "fires predicted" numbers generated by the system with numbers based on their own expertise. And they enter the amount and type of resources used on a daily basis to control fires. This is the first system in Canada that systematically collects this information.

Because the CFRDS runs on the National Forest Information System, Natural Resources Canada's secure, web-based information superhighway, every bit of data entered at the local level automatically aggregates at the provincial, territorial, and national levels.

"The system allows us to be smarter about using the resources that are available across the country," says Taylor. "Fire managers could use it to plan activities up to two weeks in advance."

*— by Monique Keiran*

# Researchers use modelling tool to isolate patterns from variability

The biggest challenge in forecasting fire-season resource needs in Canada, says Canadian Forest Service Forest Inventory and Analysis Research Scientist Steen Magnussen, is the variability in the country's fire regimes.

"The environment, the size of Canada, the weather, the forest structure, larger climate patterns, the fire danger—all that combines to create the variability that we face year to year, location to location," he says. "That's why it is so difficult to predict how many resources are going to be needed anywhere and at any one time across the country."

Borrowing methodologies from the insurance industry, Magnussen (Steen Magnusseun@nrcan.gc.ca) has developed a statistical framework that captures the variability and other key characteristics of Canada's fire regimes on a weekly basis. The framework enabled him and Natural Resources Canada Fire Officer Steve Taylor to estimate how fire events in Canada are distributed in relation to one another across and between 48 regions and throughout a fire season.

"Resource sharing works because we don't usually get major fires occurring in different regions at the same time," Magnussen says. "We wanted to see if that pattern is stable enough that we could do estimates of likelihood: What is the probability of one, two, three provinces experiencing peaks in fire activity at one time?"

The resulting fire-event distribution revealed that, in recent decades, Ontario's fire numbers tend to peak in spring, after snowmelt but before the forest greens up. British Columbia's fire season usually peaks later in the summer—after drought sets in—as happened with the 2003 Kelowna fire.

"This lack of synchrony is essential," Taylor says. "How many regions aren't experiencing fire-occurrence peaks when other regions are? And which regions? Not all jurisdictions have the same amount of resources. For resource sharing to work, it's important to track synchrony and asynchrony with regard to those resource-wealthy regions."

The study is the first step in a project Taylor is leading to determine possible effects of climate change on future fire-resource sharing. "We needed to assess the current situation: What are the chances of peak overlap occurring between jurisdictions now?"

One of the questions Taylor and Magnussen wanted to answer was whether daily, weekly, or biweekly patterns in historical use of fire-fighting resources exist. The amount of data on resource use exists only for the last 25 years, and even that is inconsistent and in some places non-existent.

Digital_Image_Fan, Flickr

A Canadian Forest Service study tracked synchrony and asynchrony of regional wildfire peaks across Canada and throughout the fire season.

"Most fire-management agencies don't track number of firefighters or number of person days," Taylor says. "They can tell you what was used through a season, but not on a day-by-day basis. Even for a particular fire, it can be hard to find that information."

With fire patterns and the statistical joint distribution of fire events now mapped and established in time and space, fire managers can use the system created by Magnussen to determine the likelihood of various fire-event scenarios across the country. And when resource-needs information for individual fires becomes available, the system will enable fire managers and researchers to quantify opportunities for and constraints on sharing resources across jurisdictions.

*— by Monique Keiran*

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*Canadian Forest Service Science Highlights*. How can modelling fire risk help fight forest fires? 2011

# Sitka spruce recovers as a viable plantation species

## Source

*Screening of Sitka spruce genotypes for resistance to the white pine weevil using artificial infestations*, 2008

## On the cover

A 25-year selective breeding and research program has led to Sitka spruce regaining ground in coastal-forest reforestation.

Sitka spruce has been viewed as an unsuitable plantation species for decades in British Columbia. Now, because of efforts by Natural Resources Canada and the British Columbia Ministry of Forests, Lands, and Natural Resources (MFLNR) forest managers are reconsidering the species for reforestation.

A 25-year breeding and research program by Natural Resources Canada Research Scientist René Alfaro (René.Alfaro@nrcan.gc.ca) and recently retired MFLNR scientist John King has led to the current commercial availability of Sitka spruce seedlings that are naturally resistant to the white pine weevil (*Pissodes strobi*). As a result of this research, the Province has modified planting guidelines across the Sitka spruce range and now recommends planting weevil-resistant seedlings on suitable sites on the coast, including in species mixes where most of the block will be reforested to spruce.

"These changes will help increase diversity, bring back this fast-growing species to the forests of British Columbia, and provide additional commercial opportunity for our coastal industry," Alfaro says.

White pine weevil is a damaging pest. It is difficult to control and affects young spruce and pine plantations across Canada. The insect destroys the terminal leader of Sitka spruce reducing growth and creating lumber defects.

Alfaro and King initiated their research after natural resistance to the insect pest was first noted in the 1980s. The program relies on traditional selection and crossing methods, used by mankind for centuries to breed new plant varieties.

"Seedlings from resistant sources have half the attack rate of those from more susceptible sources," says King. "The development and deployment of resistant seedlings are key to successful re-introduction of this valuable component of our coastal forests."

Tree breeding requires decades of work. This program is one of the few examples worldwide of a breeding program for forest-pest resistance that has reached the deployment stage. Working with forest-industry and university researchers, the team also identified traits connected with weevil resistance. These characteristics include, among others, high densities of resin canals and lignified sclereid cells in the bark of the tree's leader. Both traits hinder developing weevil larvae and make trees less attractive for colonization by weevils.

Thanks to the combined research and breeding program, the first marketable seeds were produced in 2004, with the first seedlings planted the following year. The resistant seed is available from two seed orchards in the province. To date, more than 400 000 orchard-produced resistant seedlings have been planted in British Columbia and, this year, more than 80 percent of the Sitka spruce seedlings planted in areas subject to weevil damage will be weevil resistant.

Western Forest Products Forester Annette van Niejenhuis says "We are confident in deploying weevil-resistant Sitka spruce in our regeneration programs. As a bonus, it is also less susceptible than other conifer species to deer and elk damage."

Due to the weevil's impact and to changes in forestry practices, Sitka spruce plantings in the province fell from a level of almost seven million seedlings in the 1980s to fewer than one million annually in 2003.

The breeding program continues with a new generation of trials underway, in which select genotypes are crossed to produce pedigreed seed. Future efforts will focus on finding additional resistant genotypes, understanding the nature of that resistance, and better defining weevil-hazard regions in order to adjust the new deployment guidelines.

*— by Lara van Akker*

Justin Whitehill

Weevil-resistant Sitka spruce genotype 898 stands tall amidst weevil-damaged trees at the Pacific Forestry Centre, in Victoria, British Columbia.

# Researcher awarded for a lifetime of leadership roles

## An interview with Doug Maynard, Soil Scientist

**Joanna Stonechapel:** In addition to receiving many other awards in your 31 years with the Canadian Forest Service, you've recently received the Natural Resources Canada Departmental Achievement Award for Outstanding Leadership. Your colleagues, both inside and outside the public service, say they admire your leadership approach. How do you define good leadership?

**Doug Maynard:** Early in my career a supervisory course instructor said, "To be a good leader, see everything, ignore most, and act on very little." As I learned from my dad, sometimes you do things for the greater good and not necessarily for yourself.

**JS:** This award is in recognition of your numerous leadership roles inside and outside government. What are some examples?

**DM:** Well, I've been the lead on many projects within the Canadian Forest Service, I've been associate editor and editor of the *Canadian Journal of Forest Research* and the *Canadian Journal of Soil Science*, and I've taught courses in soils, geography, and environmental education to undergraduate and graduate students. I'm told that this award is also in recognition of my commitment to the Wood Buffalo Environmental Association (WBEA).

**JS:** What is the WBEA? And what is your role in it?

**DM:** It's a community-based, multi-stakeholder, not-for-profit association based in Fort McMurray that monitors air quality and operates a terrestrial effects monitoring program. Members include industry, three levels of government, First Nations, and non-governmental environmental organizations. The monitoring program was established in the mid-1990s. The first sampling the association did was in 1998 and an extensive series of integrated measurements and soil and foliar sampling has been carried out every 6 years. Air quality is monitored continuously. When it was first created, I was asked to serve on the science advisory committee because I'd studied air pollution and air quality and their environmental effects in the 1980s and '90s. The committee decided what should be measured, how often it should be measured, etc. As the program grew, researchers worldwide got involved, carrying out different studies. At that point, we became involved with determining which projects were scientifically sound, and we reviewed their final research reports.

**JS:** Your contributions to that program have been particularly significant over the past five years. Why is that?

**DM:** In 2007, the science advisory subcommittee, a group of three scientists, revised the whole program to make it more scientifically sound, including adding a number of sites. We also co-wrote a procedure manual detailing the monitoring process from sampling to analysis. Right now we're providing the soil and foliar analyses for the 6-year re-sampling of the monitoring plots.

**JS:** You mentioned that you've been studying air quality and its environmental impact since the 1980s. That's long before it was on many people's radar. What lead you to take this path?

**DM:** My Ph.D. thesis was in soil science, looking at sulphur deficiencies in agricultural crops, so when a job came along looking at sulphur excess, it was a good fit. I was first hired to work on the ng-range transport of air pollutants and *(continued on page 10)*

A long-time leader in soil science, Research Scientist Doug Maynard recently received the Natural Resources Canada Departmental Achievement Award for Outstanding Leadership.

their effects on forest soils. And I worked in the oil sands in the 1980s, monitoring soils as part of a larger study assessing effects of acid deposition on the forest. In the early 1990s, I wrote a scientific review on critical and target loading of acid deposition in Alberta that was used to establish an interim critical load for the province. As part of the national Canadian Forest Service long-range transport of air pollution group, I was presented with a Citation of Appreciation from Environment Canada for our early work on acid rain, which was highlighted by the signing of the 1991 Canada–US Air Quality Accord. Basically, over my career, I've researched disturbance on forest soils, particularly anthropogenic disturbances like industrial development and forestry practices, and on how they may affect soil properties and productivity.

**JS:** Of all the projects that you've been involved with during your career, which are you most proud of?

**DM:** I'm quite proud of my work concerning air quality. As I mentioned, I wrote a report on the critical load of sulphur emissions and that contributed to the petroleum industry's general guidelines for sulphur emissions—not just that industry, but other sulphur-emitting industries. Of course, my research is only one piece of the puzzle that's resulted in a change in consciousness. If there hadn't been work done collectively on air pollutants and acidification, there wouldn't be pressure for the oil sands to reduce their sulphur emissions. My work contributes to the collaborative efforts of so many scientists, environmentalists, and those working in the field over many years.

Another project I'm proud of is a chemical-analysis manual (see Resources on sidebar) that I co-wrote in the 1990s with Yash Kalra, a now-retired chemist at Northern Forestry Centre. It was reprinted many times and several thousand copies were distributed worldwide. We wrote it in kind of a cookbook style: it was user-friendly, so was helpful to a lot of developing countries where there aren't many sophisticated instruments or equipment. At one point, it had been cited in over 419 scientific journals.

**JS:** What changes have you observed in your field over the years?

**DM:** Back in the 1980s, acid rain was the big story, just as climate change is now. There were serious concerns, particularly in Europe and eastern North America, about wide-spread damage to forests. Results since indicate damage did occur, although it was not as widespread as thought. Sulphur emissions have decreased dramatically in western Europe as well as in North America, partly because industry and governments took the concerns seriously.

However, nitrogen emissions are increasing worldwide as a result of burning fossil fuels, but also through production of fertilizers and increased planting of agricultural legumes. Nitrogen is naturally abundant in the atmosphere, and becomes fixed in soil by lightning, certain soil bacteria, roots of legumes (rhizobial), and blue–green algae. Nitrogen fixation creates reactive forms of nitrogen that are biologically available to plants, microorganisms, and animals. After photosynthesis, this is probably the most important biochemical process on Earth; however, when too much reactive nitrogen is produced, ecosystems may become nitrogen saturated, causing nutrient imbalances, soil acidification, changes in biodiversity, and contributions to climate change. To minimize reactive nitrogen, we need to reduce our dependence on fossil fuels and chemical fertilizers, and optimize nitrogen uptake by certain plant species and bacteria.

**JS:** What do you think is the greatest challenge in your field today?

**DM:** In terms of soil research, the greatest challenge is to have it recognized as important in all aspects of forestry. It's been a challenge for centuries. Leonardo da Vinci said in the 1500s, "We know more about the movement of celestial bodies than about the soil underfoot." That remains true today. Dirt just doesn't have the "wow factor" like forest fires or mountain pine beetle outbreaks. In agriculture, there's greater interest because of the 1930s and erosion, but not so much in forestry. Although the interest does seem to be growing somewhat.

The thing is, you can't have a good tree without good soil. Soil is resilient—it can put up with a lot of disturbance and still carry on—but most of our research is funded for very short terms. Trees take a long time to grow and what we've found, particularly in temperate and boreal ecosystems, is that what you see in a stand in the first 3 years is not necessarily what you see in 20 years. Everything changes with time, but in the forest, change may not be evident until canopy closure or even later. The challenge is to secure long-term soil research studies.

**JS:** What has kept you engaged in your research?

**DM:** I have a passion for knowledge and digging in dirt.

*— interview and excerpt by Joanna Stonechapel*

# Canada contributes to forest pest-proofing guide

Forest pests are resourceful globetrotters: they can hitchhike around the world in wood products, packaging, nursery plants, seeds, and soil. Once past the border, they can spread through forests in and on everything from footwear to firewood.

A new guide by the UN Food and Agriculture Organization is helping reduce human-facilitated pest spread and its impacts. Intended for people involved in growing, planting, managing, harvesting, manufacturing, storing, trading, and transporting forest products, the *Guide to implementaton of phytosanitary standards in forestry* offers simple, practical suggestions on what forest-sector workers can do at every step of the wood-commodity production chain to reduce transport of pests. It also provides information on international standards for preventing forest health issues and on the role of forest management practices in implementing phytosanitary standards and facilitating safe trade.

The goal, says Natural Resources Canada Research Scientist Eric Allen (Eric.Allen@nrcan.gc.ca), one of many scientists, plant-health experts, and forest industry representatives around the world who contributed to the guide, "is to protect our own forests from alien pests and to ensure we're not sending pests elsewhere. This means reducing the spread of pests at every step of the forest product chain: planting, managing, harvesting, manufacturing, trading, and transporting forest products."

The *Guide to implementation of phytosanitary standards in forestry* is available online at www.fao.org. For more information on Canada's role in protecting forest health, visit cfs.nrcan.gc.ca


# People

## Accolades

The Canadian Institute of Forestry recently awarded Research Scientist Brian Titus its 2012 Canadian Forestry Scientific Achievement award. The Institute gives the annual award for innovative and outstanding achievements in forestry-related research in Canada. This year, Titus's portfolio of research on human impacts on forest ecosystem sustainability, including fertilization and tree nutrition, non-timber forest products, and the sustainability of increased biomass harvest for bio-energy production, caught the Institute's attention. His work has contributed to a number of important policies and initiatives in Canada, the US, and Europe.

In 2001, the Institute recognized Research Scientist René Alfaro for his work on the white pine weevil–Sitka spruce complex (profiled on page 8).

## Departures

Microarthropod Research Technician Marilyn Clayton retired in January, ending a 36-year career with the Pacific Forestry Centre. Clayton was responsible for the Centre's microfaunal collections and lab. Her research focused on forest and soil mites and collembola.

Research Scientist David G. Goodenough has retired after 39 years with the Government of Canada—21 years with the Canadian Forest Service. While at the Pacific Forestry Centre, he led the Canada–NASA System of Experts for Intelligent Data Management (SEIDAM) project, led and helped implement SAFORAH (System of Agents for Forest Observation with Advanced Hierarchies), and was principal investigator for NASA's EVEOSD (Evaluation and Validation of EO-1 for Sustainable Development) project on hyperspectral research applications for the Canadian forest sector. Goodenough is a Canadian Forest Service Emeritus Research Scientist, a University of Victoria Adjunct Professor in computer science, and a lifetime member of IEEE. He has published more than 250 papers and gave more than 750 scientific presentations.

After 34 years growing and monitoring seedlings, establishing and assessing field trials, and analysing data, Silviculture Research Technician Graeme Goodmanson retired from the Canadian Forest Service this fall. He participated in the Pacific Forestry Centre's Montane Alternative Silvicultural Systems (MASS) and the Levels of Growing Stock (LOGS) projects, and transferred to the Canadian Wood Fibre Centre in 2006.

Scientific editors Joanna Stonechapel and Monique Keiran also said goodbye to the Canadian Forest Service this fall. The two editors spent the last 17 and 9 years, respectively, helping scientists associated with the Pacific Forestry Centre get their research published, copy-editing manuscripts, managing S+T publishing projects, liaising with journals, and writing about Pacific Forestry Centre research. Their work appears in this and previous issues of *Information Forestry*.

# New Publications From the Canadian Forest Service

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*Forest Pest Knowledge Collection and Exchange. Pest Strategy Information System*. 2012. Canadian Council of Forest Ministers, Ottawa. (*Aussi disponible en français*)

*National Forest Insect and Disease Diagnostic and Taxonomic Resources and Tools. Current Situation and Future Considerations*. 2012. Canadian Council of Forest Ministers, Ottawa. (*Aussi disponible en français*)

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*Healthy Forests/Forêts saines*. 2012. National Forest Week, September 23–29, 2012/Semaine nationale de l'arbre et des forêts, du 23 au 29 septembre, 2012. Natural Resources Canada, Canadian Forest Service/Ressources naturelles Canada, Service canadien des forêts. Ottawa. Poster/Affiche.

*Monograph of soil nematodes from coastal Douglas-fir forests in British Columbia*. 2012. Panesar, T.S.; Marshall, V.G.; Royal Roads University, Victoria, BC.

# Events

**PaperWeek Canada 2013:** The Annual Conference of the Canadian Pulp and Paper Industry
February 4–8, 2013 • Montreal, QC
www.paperweekcanada.ca/progr-glance

**ExpoFor 2013**
Forestry: The Future is Growing
Association of BC Forest Professionals Annual General Meeting and Conference
February 20–22, 2013 • Prince George, BC
www.expofor.ca

**Wood markets**
2013 Global Softwood Log & Lumber Conference
May 8–9, 2013 • Vancouver, BC
www.woodmarkets.com/conf_conferences

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