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INFORMATION FORESTRY

Root rot-resistant species provide alternatives

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Natural Resources Canada

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Canada

Satellite imagery used to determine time since harvest

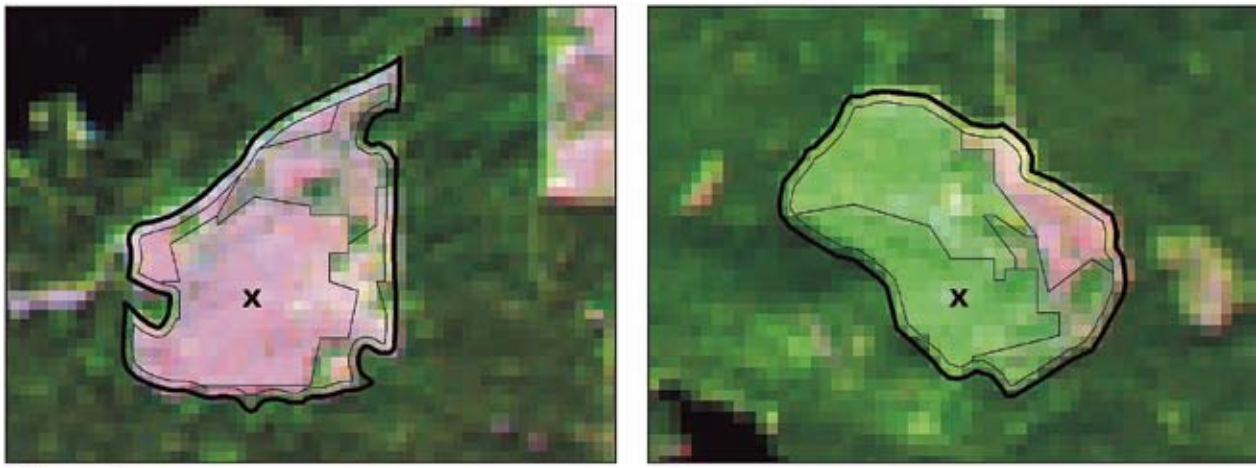
Forest disturbances are often sources of carbon: knowing time since harvest or other disturbance is required to ensure the integrity of data used in carbon budget models. Where this information is unknown, Canadian Forest Service researchers have developed a method to estimate age of regenerating forest stands, thereby providing approximate disturbance date.

Forest Geomatics Research Scientist Mike Wulder (**mwulder@pfc.cfs.nrcan.gc.ca**) and his colleagues did this by studying imagery of lodgepole stands in northeastern British Columbia taken by the Landsat Thematic Mapper—a satellite capable of recording the spectral response of forests. This set of image data was chosen because it contains 20 years' worth of information. "Some types of satellite imagery are collected upon request, but these images were gathered continuously, so there is a rich historical archive."

By analyzing factors indicating regeneration, such as vegetation density and an image-derived attribute called "wetness," the researchers identified how spectral classes in the imagery relate to ages of forest stands on the ground. They segmented the image data into homogenous spectral units within the forest inventory polygons, with each segmented unit representing different spectral characteristics and forest ages. "By breaking down the polygons to these structural units, we were able to apply rules to exclude trees within the polygon that were not harvested and to base our age estimates only on the spectral values indicating recent harvest or regeneration," says Wulder. "Using this approach we were able to produce spectral class–age values to represent polygons and capture recent disturbance."

In addition to generating data appropriate for input to carbon models, the method can be used to help keep forest inventory databases up-to-date.

"Our wider goal is to ensure that we produce the best possible numbers to capture the characteristics and dynamics of Canada's forests," says Wulder.



Forest inventory polygons have been segmented into spectral-class units that represent different forest ages: pink areas show regenerating forest; the dark green areas show older forest. The polygons show 7- (left) and 13-year-old regeneration.

Environment key to western white pine resistance

Idaho's R.T. Bingham discovered how to breed white pine blister rust-resistant trees, which were then placed into a seed orchard from which the Canadian Forest Service has obtained most of its interior western white pine seed ever since. However, when grown in British Columbia coastal sites rather than in the interior of the province, the Idaho seedlings are more prone to white pine blister rust infection.

"At first, we thought it was a different race of the fungus on the coast," says Canadian Forest Service Research Scientist Rich Hunt **(rhunt@pfc.cfs.nrcan.gc.ca)**. He inoculated RTB F2 seedlings—as the Idaho offspring were designated—with white pine blister rust five times, and then placed them at coastal and interior sites. The results confirmed seedlings in the coastal sites are far more susceptible to the fungus.

"The higher rate of infection was caused by the difference in environment," Hunt says. The inoculum source had no effect on infection rates, a theory supported when Hunt found that resistance mechanisms putatively employed by western white pine, such as needle shed, for example, did not occur except as the result of poor growing conditions.

The predicted rate of infection in RTB F2 seedlings was 30 to 35 percent, but on coastal sites, Hunt found 98 percent infection. "The longer growing season found on the coast must be bad for the trees, as it gives the fungus more chance to grow. Other possible factors, such as high temperatures and moisture levels, are similar between some coastal and interior sites."

Hunt hopes his research will lead the way for screening for white pine blister rust-resistant RTB F2 trees on the coast. "We should breed the trees with the best gene pool. That way we could have western white pine that flourish on both the coast and in the interior."

New grid makes forest measurements more meaningful

The way we measure and monitor our forests nationally is about to change. In response to growing demands for more and detailed forest resource information, an inter-agency collaboration coordinated by Natural Resources Canada will introduce a new national forest inventory in 2006. It will replace the old Canada Forest Inventory.

"This is an exciting and dramatic example of how the way in which we gather, compile and report nationally on our forest resources continues to improve," says National Forest Inventory Manager Mark Gillis **(mgillis@pfc.cfs.nrcan.gc.ca),** of the Canadian Forest Service, in Victoria.

In the 1970s, information about wood volume, and tree and stand characteristics was compiled by hand and based on questionnaires filled out by forest managers. In the 1980s and 1990s, a computer-based system was introduced to summarize the same sort of data. It was an improvement—and cost-effective. But the data was still only as up-to-date and accurate as the provincial and territorial inventories from which they were taken. That meant some data were up to 20 years old and all were collected to variable standards; no accurate baseline existed upon which to compare inventories from 1981, 1986, 1991 and 2001.

The National Forest Inventory, or NFI, is different. Not only will it collect and report information using a set of uniform standards, it will supplement information from ground plots and photo plots with earth observation data from remote sensing satellites. Repeated samplings will allow for monitoring of change in Canada's forests, permitting projections, or forecasts. As well, the inventory will provide a framework for collecting additional data relevant to reporting progress towards sustainable development and data related to forest health (insect damage and disease infestation), biodiversity and forest productivity. The inventory system is designed to make possible successive reporting of 25 sustainability attributes, as well as data to support national and international initiatives such as the Kyoto Protocol, the United Nations Framework Convention on Climate Change, and the United Nations Food and Agricultural Organization's Resources Assessment, and to meet other emerging needs.

"This is a plot-based system of permanent observational units located on a national grid," says Gillis.

It consists of a network of permanent plots located across Canada. To provide reliable statistics, the objective is to survey a minimum of one percent of Canada's land mass. A one-percent sample on a 20 x 20-kilometre network means approximately 22,000 sample plots. For plots located on the network, an area of 2 x 2 kilometres around each node will be identified, and will be surveyed using air-photo interpretation to identify land-cover classes and other forest-stand attributes. Ground plots will be established on a sub-set of these nodes to collect information typically not available from aerial photographs. Satellite imagery will be used to provide attribute data for areas not covered by aerial photo or ground plots—in Canada's north, for example. The photo and ground plots will be remeasured every 10 years to provide reliable annual statistics for the country.

Although coordinated by the Canadian Forest Service, the National Forest Inventory is a collaboration among many agencies such as federal departments, the provinces and territories, and industry. Under the auspices of the Canadian Council of Forest Ministers, National Forestry Database Program, agencies provide data while the Canadian Forest Service develops and maintains standards, procedures and infrastructure, conducts analyses, and generates reports. The success of the NFI depends largely on the combined strength of this collaboration.

"The design of the new National Forest Inventory provides, for the first time in Canada, a comprehensive forest resources dataset that is statistically consistent, field-sample verified, and electronically accessible," says Ken Snow, Manager of Forest Inventory for Nova Scotia's Department of Natural Resources, and a past chairperson of the inventory committee. "Some of the data will be available to forest researchers and practitioners through the Internet, and will provide a credible source of information on Canada's forests to address a wide range of issues."

More about the National Forest Inventory is available at **www.nfi.cfs.nrcan.gc.ca**

The new National Forest Inventory is based on a national network of permanent sample plots

Species selection affected by *Armillaria* disease

A Canadian Forest Service scientist and his graduate students have determined which tree species could help reduce damage caused by *Armillaria ostoyae* in regenerating stands.

A native fungus, *A. ostoyae* causes major problems for British Columbian foresters. Forest management systems are tailor-made for *A. ostoyae*—when mature stands are harvested, the fungus is given free rein to colonize stump and root systems, which are then referred to as inoculum. "A few years after planting, the roots of regenerating trees will contact the inoculum and become infected," says University of British Columbia graduate student Michelle Cleary. "They don't have the stored energy to battle the fungus, so there is quite high mortality in younger trees. This eventually leads to gaps in the stand and understocked plantations."

Research Scientist Duncan Morrison (**dmorrison@pfc.cfs.nrcan.gc.ca**) found that the most popular reforestation species, Douglas-fir, is very susceptible to the fungus. But after excavating root systems of diseased western larch stands, University of British Columbia graduate student Richard Robinson observed that larch appeared to be more resistant to the fungus than Douglas-fir is. "Western larch, while infected, were able to stop the advance of the fungus; we wanted to see how well it could resist *A. ostoyae*," says Morrison. Robinson set out to find whether western larch was a viable candidate for inclusion in Douglas-fir plantations, where their superior defense mechanisms could afford the stands a better chance of reaching rotation age.

University of British Columbia graduate student Michelle Cleary excavates the roots of *Armillaria ostoyae*-inoculated conifers to study their host response to infection. Research Scientist Duncan Morrison says that this research could aid foresters wanting to detect families of trees that show the most effective reaction to stop the advance of the fungus. "They can take their seed or breed these trees to develop resistant trees to better regenerate sites. Our studies describe what results the researchers should test for—these factors are what they should identify their candidates by."

Scientist and students found that conifers protect themselves from the fungus by forming a necrophylactic periderm, a protective layer of cells around infected bark tissue in the root.

Older trees are better-equipped to fight infection and mortality, but much of their energy is spent on defense, resulting in reduced growth. In 1994 and 1995, Robinson and Morrison studied Douglas-fir and western larch stands with infections on their roots; in 2004 and 2005, Cleary studied juvenile western hemlock and western redcedar. They did this by inoculating roots of healthy trees with *A. ostoyae* in interior forests of British Columbia; this enabled them to identify and characterize resistance mechanisms, including necrophylactic periderm formation and callusing.

Robinson found that western larch are better than Douglas-fir at stopping the advance of the fungus. "The more layers of periderm they can produce, the better they are able to contain the infection. It is a battle of resources," says Morrison. "Whoever has the most resources wins."

Cleary's research shows that necrophylactic periderm formation occurs at a higher frequency in cedar compared to western hemlock and Douglas-fir, and that not only do cedars suffer less mortality but resistance in cedar occurs earlier than in most other conifers—including western larch. "Cedar has a higher frequency of callusing at an early age. The decline in mortality as the trees grow older happens much earlier in cedars, too. It puts up barriers very quickly, which limits the extent of the fungus' invasion which otherwise might result in higher mortality rates in cedar."

This research will benefit foresters seeking environmentally friendly and cost-efficient alternatives in the battle against the fungus. Options to managing root disease in second-growth forests include stumping, which removes stump and root systems following harvesting; biological control; and planting more tolerant or resistant host species to serve as a barrier to disease spread among susceptible conifer tree species.

Tolko Industries Divisional Silviculture Forester Bob Johnson says, "These studies are important because *Armillaria ostoyae* has such a major impact on our regenerating stands, so anything we can do to reduce this impact will have significant results." Johnson thinks that Cleary's study in particular suggests that inclusion of western redcedar in higher proportions alongside Douglas-fir when regenerating infested sites could reduce the overall impact of *Armillaria ostoyae*. "It's win–win if it works."

To find out more about root rot-disease research at the Pacific Forestry Centre, as described on this page and on page 5, visit **www.pfc.cfs.nrcan.gc.ca/pathology/rootd/index_e.html**

Protein expresses to assist root-rotted Douglas-fir

Canadian Forest Service scientists have provided information that may lead to breeding of a laminated root rot-resistant tree.

Molecular biology technician Arezoo Zamani and Research Scientist Rona Sturrock have isolated a type of protein in Douglas-fir (*Pseudotsuga menziesii*) that may act as an antifungal agent against laminated root rot. Due to its presence in Douglas-fir and its similarity to pathogenesis-related protein thaumatin, the scientists named it *P. menziesii* thaumatin-like protein (*Pm*TLP).

Douglas-fir is the most economically important species susceptible to laminated root rot, making management of the fungus critical.

Zamani, Sturrock, and others had been studying a Douglas-fir endochitinase, an enzyme that degrades fungal cell walls, when they discovered another protein present. "It was different from the endochitinase, so we pursued it in the hopes that it was another protein with antifungal properties," says Zamani **(azamani@pfc.cfs.nrcan.gc.ca).**

The scientists studied root and needle tissues from juvenile and mature Vancouver Island Douglas-fir. They characterized the protein sequence by isolating the host's DNA, meaning that *Pm*TLP is now identifiable; it shows a sequence pattern similar to a maize antifungal thaumatin-like protein. "We found that, in different zones of the same root, *Pm*TLP was induced in areas infected by the fungus much more than in uninfected areas," says Zamani. "Needles of infected trees also showed *Pm*TLP expression."

Although these proteins have been studied in maize and tobacco, little research has been done on conifer pathosystems and their defense proteins. When in contact with fungal mycelia, thaumatin-like proteins are thought to increase membrane permeability of fungal cells, causing the cells to dissolve. This work lays the groundwork for functional analysis of *Pm*TLP. It may be important for defense, as it is a secreted protein found mostly in the fluid between plant cells, and so is on the frontline against the fungus' attempt to penetrate the cell.

"A long-term goal," says Zamani, "would be to breed and grow trees with several pathogenesis-related proteins and defense-related enzymes overexpressed, which would help to slow or break down the fungus causing laminated root rot and enhance trees' chances of survival in the forest." The research could also lead to production of large quantities of *Pm*TLP in the lab, as well as coordination of research on other plant-pathogen interaction systems in conifers and development of a method that allows foresters to determine whether Douglas-fir are infected with laminated root rot.

"This research is just another piece of the puzzle," says Sturrock **(rsturrock@pfc.cfs.nrcan.gc.ca)**. "We've found that there is a relationship between protein expression and laminated root rot—this is the first step—and it contributes to the general knowledge about how Douglas-fir reacts to stress, and especially to pathogens."

Michael Stoehr, research scientist for the British Columbia Ministry of Forest's Douglas-fir breeding program, says that this research will enable foresters to one day plant susceptible species like Douglas-fir on sites with laminated root rot; other species often planted on such sites are less valuable than Douglas-fir.

"Now that Canadian Forest Service scientists have identified the proteins and what they do, 10 years from now we may be able to trigger Douglas-firs to produce these proteins in the same way that human beings are vaccinated by attaching the protein-coding gene to a promoter that stimulates the production of *Pm*TLP only after the roots are attacked. Then the trees can produce the proteins and attack the fungus and eliminate it before it harms the tree."

Laminated root rot kills trees, like the infected Douglas-fir pictured here, from the bottom up by interfering with the roots' uptake of water and nutrients.

West Coast research on insect that eats young conifers

From the cover:
Western hemlock is an important early successional species in British Columbia's Haida Gwaii (Queen Charlotte Islands). It regenerates well in open areas such as cutblocks, often outcompeting other coastal species such as western redcedar and Sitka spruce, which are frequently devastated by introduced deer.

A Canadian Forest Service study measuring the effects of a caterpillar on second-growth conifers in Haida Gwaii off British Columbia's central coast, has caused researchers in Nova Scotia to take a second look at regenerating forests in Cape Breton.

The caterpillar in question, blackheaded budworm, eats conifer needles. The caterpillars strip trees from the top down, killing the trees' leaders. Western hemlock, the caterpillars' meal of choice in British Columbia, does not replace its leaders easily, so trees that have been defoliated become hedge-like—stunted and full of knots. This decreases the trees' timber value. And because outbreaks of the insect occur regualarly every 10 to 15 years, forest managers can expect the already-damaged stands to be hit again in the next few years.

In 2000, Pacific Forestry Centre insect ecologist Vince Nealis **(vnealis@pfc.cfs.nrcan.gc.ca)** and colleagues travelled to British Columbia's central coast to examine the effects on young western hemlock stands of a budworm outbreak documented across 170,000 hectares in the mid- to late-1990s.

According to Nealis, all of the trees in the Haida Gwaii study stands lost significant growth as result of the blackheaded budworm outbreak in the region in the 1990s. "What's more, many of the trees still had not recovered even five years after the outbreak ended." These findings may affect future forest management and timber supply.

"What we found in that study is that 100 percent of trees in the infested stands suffered defoliation and that this usually resulted in loss of growth," Nealis says. "What's more, many of the trees still had not recovered even five years after the outbreak ended."

Even more disturbing, the greatest damage was to the tallest trees in spaced stands—negating growth gained as a result of pre-commercial thinning. Western hemlock is the dominant conifer species to successfully recolonize cutblocks created when old-growth cedar, spruce and hemlock were removed from the Haida Gwaii archipelago (also known as the Queen Charlotte Islands) in the 1960s and '70s. Because western hemlock regenerates densely, forest managers had thinned the young stands in the 1980s and 1990s to improve growth.

"It would appear thinning has exacerbated the damage from the budworm outbreak," says Nealis. "In some cases, the trees are shorter now than before they were thinned, 10 years ago."

Researchers in Nova Scotia, who first looked into Nealis' work because of a problem with blackheaded budworm in Cape Breton, are finding similar results. In the Maritimes, the caterpillar feeds on balsam fir. Outbreak of blackheaded budworm has recently begun across 150,000 hectares of regenerating fir in Cape Breton, where spruce forests were devastated by spruce budworm in the late-1980s.

"The feeding patterns seem to mirror what's going on in hemlock out west," says Canadian Forest Service Entomologist Graham Thurston **(Graham.Thurston@nrcan-rncan.gc.ca)**. "We're getting indications that the damage is greater in spaced stands than in denser stands, and that it's top–down. We're getting top kill on some of the trees, the same as Vince is finding out west."

The Nova Scotia Department of Natural Resources has put together an integrated pest management plan for the growing infestation, including investigating an aggressive monitoring program involving pheromone traps and applying for approval to spray affected stands with biological control pesticide Btk, or *Bacillus thuringiensis* var. kurstaki. An aerial spray trial was conducted earlier this year; researchers from both the province and the Canadian Forest Service, Atlantic Forestry Centre, are analyzing cuttings from sprayed trees to determine the bacteria-based pesticide's effectiveness in controlling the caterpillars. By using different kinds of traps, and different rates and constituents of blackheaded budworm moth pheromone, the researchers are

prompts similar studies in Nova Scotia

A bug by two different names? In western North America, blackheaded budworm goes by the scientific name, *Acleris gloverana* (above); in eastern North America, it is known as *Acleris variana*. The two may be regional variations of the same species, but DNA comparisons to prove this have yet to be done. Blackheaded budworm is found British Columbia, in New Brunswick, Cape Breton, and Newfoundland.

also evaluating the effectiveness of pheromone as a monitoring tool for the insect.

The Nova Scotia researchers are also looking into its ecology. Thurston and his colleagues are investigating native pathogens and parasites that may be used to help both control caterpillar population levels and explain why blackheaded budworm infestations grow and grow, and then suddenly crash. They're also looking at density–damage relationships—the number of insects in an infestation, and how much damage they do on trees at certain ages.

Nealis is starting similar impact-related research in Haida Gwaii. The information that he, Thurston and their colleagues collect regarding long-term affects of blackheaded budworm outbreaks will help forest managers make informed decisions. It may result in, for instance, a re-examination of management practices and harvest schedules for susceptible regions. Companies may stop thinning juvenile stands of susceptible species if the studies show that, over decades, trees hard-hit by blackheaded budworm when they are young never fully recover from the loss in growth. Timber- supply managers may adjust annual allowable cuts for at-risk areas.

"If we determine that a population of such and such a size causes this much defoliation, what does that actually mean in thinned and unthinned stands in terms of growth and yield?" says Thurston. "What does it mean for annual allowable cut?"

"This is the kind of information we need to increase certainty in timber supply forecasts," says British Columbia Ministry of Forests' Senior Timber Supply Analyst Albert Nussbaum. "The more certain the impact of an outbreak—based on scientific data like those provided by Vince and company—the more exact we can be with our models, and the better we can make adjustments in harvesting schedules and annual allowable cut. If we don't have that information, we have to run a series of sensitivity forecasts that examine the entire range of possibilities."

Nealis is also replicating the Nova Scotia pheromone study. The Atlantic Forestry Centre provided duplicate samples of the blackheaded budworm moth pheromone synthesized in the centre's chemistry lab. Data from the British Columbia study will be compared to Cape Breton data, and will hopefully provide information on how the insect's population levels can be monitored in west coast stands.

The timing is about perfect: according to the clockwork-like schedule of blackheaded budworm outbreaks, the next major infestation is already brewing in Haida Gwaii.

"We haven't seen the last of blackheaded budworm in these stands," says Nealis. "They're huge smorgasbords of suitable young trees, and they're going to be hit again in the next few years."

West coast host susceptibility to blackheaded budworm:

- Stands younger than 40 years old are more susceptible than older stands.
- Most severe defoliation occurred in the upper crowns of trees.
- Defoliation was most severe in spaced stands.
- Mortality and incidence and average length of top stripping was greater in spaced stands.

Cooperative project tackles beetles at the border

"Mountain pine beetles are here, and they could spread," said Ken Porter, Director of Alexander Forest Services, a corporation of Alexander First Nation, situated just west of Morinville, Alberta.

That's not good news. In British Columbia, the mountain pine beetle infestation has destroyed millions of lodgepole pine, a major species in the province's commercial harvest. Alexander First Nation owns forested land close to the Rocky Mountains, around Fox Creek—right in the path of the spreading epidemic.

"We want to protect our forests, and stop mountain pine beetles from spreading further in Alberta," explained Porter. "So first, we needed to train people how to control mountain pine beetle attacks."

To accomplish that, Porter joined forces with Natural Resources Canada and the Province of Alberta. Through the Mountain Pine Beetle Initiative (MPBI), managed by the Canadian Forest Service from Pacific Forestry Centre in Victoria, Natural Resources Canada provided more than $20,000 toward a project to enhance the capacity of Alexander First Nation in mountain pine beetle management and control.

Alberta's Ministry of Sustainable Resource Development provided funds to house the trainee crew in Grande Cache and transport them daily to and from field sites in Willmore Wilderness Park, an area in Alberta close to the British Columbia border, north of Jasper National Park. Beetles are beginning to show up in lodgepole pine stands in the park. The Province of Alberta also provided mountain pine beetle training and supplied all the equipment used in the project.

"It was very much a case of practical, on-the-job training," Porter pointed out. "The Alberta government wanted the infested trees in the park destroyed. We wanted to enhance our capacity for beetle control, and Natural Resources Canada provided assistance through MPBI."

Porter explained that all last March, the Alexander First Nation crew drove three hours from Morinville west to Grande Cache every Sunday. They spent their working days during the week in the park, learning and actually doing mountain pine beetle control.

"They got lots of hands-on experience finding, felling, and burning beetle-attacked trees, to keep the insects from spreading to healthy trees nearby" Porter said. "The usual procedure was falling, bucking to length, and burning the infested trees."

Falling and burning infested pine trees is a well-established direct control measure, implemented in many places to prevent spread of mountain pine beetle and save as many trees as possible.

Porter observed that most of the sites where the Alexander First Nation crew worked were within 50 kilometres of the Alberta–British Columbia border. He added that forest companies operating nearby are very concerned over the possibility that mountain pine beetles could spread further within Alberta.

"We're not treating this threat lightly," Porter emphasized. "We're really trying to minimize the possibility that the mountain pine beetles will continue to spread."

Cold temperatures in late fall–early winter would end the outbreak, but with Alberta experiencing milder winters in recent years—without the low-temperature periods that kill overwintering beetle broods—control efforts are necessary to manage the infestation.

Porter concluded that the fall and burn project proved a real success, and he'd like to see more Alexander First Nation members become involved with the beetle initiative.

Information about Mountain Pine Beetle Initiative programs for First Nations and federal lands can be viewed at **mpb.cfs.nrcan.gc.ca/federal/index_e.html.**

Partnership battles beetle

Through the Mountain Pine Beetle Initiative, the Government of Canada's $40-million, six-year response to the epidemic, managed by the Canadian Forest Service out of Pacific Forestry Centre in Victoria, BC, Natural Resources Canada funded a project enabling Alexander First Nation to enhance its capacity in beetle management and control.

The Province of Alberta contributed funds to house, equip, and transport band members to field sites in Willmore Wilderness Park, Alberta. In addition, Alberta provided training.

In 1994, Alexander First Nation became the first Alberta band to sign and complete fire suppression contracts with the Alberta government. The project gives band members an opportunity to gain employment in beetle control and assist other Alberta First Nations in developing mountain pine beetle control measures in their forests.

Alexander First Nation band members prepare to burn mountain pine beetle-infested wood in Willmore Wilderness Park, Alberta. With support from Natural Resources Canada and the Province of Alberta, band members were trained to identify, fall, and burn infested trees.

Scientists share their research with the public

October 14

National Science and Technology Week celebrates science and technology that affect everyday life, and in British Columbia's interior, a lot of everyday lives are being affected by a tiny brown beetle. A discussion on mountain pine beetle at Prince George's The Exploration Place kicked off the week's celebrations for Natural Resources Canada in the province. Manager of the Pacific Forestry Centre's northern projects Phil Burton, Pacific Forestry Centre insect ecologist Allan Carroll, University of Northern British Columbia beetle researcher Kathy Lewis and Pacific Forestry Centre Graduate Student Award-winner Patience Rakochy presented the latest information about the beetle. The next morning, Rakochy toured local families through beetle-infested forest in Prince George's Bittner Park.

October 15

Natural Resources Canada scientists from both the Canadian Forest Service and the Geological Survey of Canada joined in the festivities at Vancouver's Science World to present talks to young people. Pacific Forestry Centre Research Scientist Al Mitchell used his "photosynthesis machine" to demonstrate photosynthesis, proving to audiences that trees do, indeed, pass gas.

"All plants on earth exchange gases," says Mitchell. "If they didn't, we wouldn't be able to breath or eat. Using this amazing photosynthesis machine, I can show people how quickly trees respond to their environment. Photosynthesis is a silent process—fortunately. Otherwise, the world would be a much noisier place."

October 18—19

Pacific Forestry Centre research officers Glenda Russo (left) and Patricia Woods Perkins toured young scientists, parents and neighbours around the centre's David Douglas Trail.

Geological Survey of Canada seismologist Garry Rogers described his groundbreaking research on regular, periodic timing of high earthquake probability on the west coast, called Episodic Tremor and Slip, which got adults in the audience wondering if they can purchase regular, periodic earthquake insurance. Also from the Geological Survey of Canada, sedimentology expert Kim Conway introduced visitors and staff to amazing glass sponges living off the shores of British Columbia. Canadian Forest Service Remote Sensing Analyst Morgan Cranny talked about the satellites that whiz around our planet recording imagery that can be used to learn about what's going on across Canada.

National Science and Technology Week 2005

October 23

It was back to Vancouver's Science World to wrap-up the week's celebrations. There, Canadian Forest Service technician Laura Byrne introduced audiences to some seductive-looking aliens that have invaded British Columbia: "Some pretty flowers growing in your garden have escaped and are threatening to over-run some of our most endangered ecosystems," she says. Morgan Cranny repeated his hit performance on satellites and the use of satellite imagery in science, and was followed by a demonstration by Research Scientist Mike Wulder on how the Canadian Forest Service uses satellite imagery to map mountain pine beetle attack in British Columbia.

People

New Director General takes Pacific Forestry Centre helm

The Pacific Forestry Centre recently welcomed its new director general, Susan Farlinger. Before moving to the Victoria position, Farlinger served as Regional Director, Oceans, Habitat and Enhancement, Pacific Region, with Fisheries and Oceans Canada. In that capacity, she had been responsible for planning, financial allocation and program management of regional programs in oceans-integrated management, habitat protection, environmental assessment, and salmonid enhancement. She was also routinely involved in establishing science priorities and goals, including having served as Chair of the Pacific Science Advisory Review Committee.

"Susan's rich experience in science and management will continue to serve her well in her new role at the CFS, and I look forward to her contributions as an essential member of the CFS management team," says Assistant Deputy Minister, Canadian Forest Service Brian Emmett. "The importance of the forest sector to the B.C. economy and the impact of the mountain pine beetle infestation on the province make the director general at Pacific Forestry Centre a key player."

Paul Addison passes the "torch" to new Director General Susan Farlinger. The torch was given to Addison at a staff Christmas party after he became director general in 1998.

Farlinger received B.Sc. and M.Sc. degrees from the University of Guelph. Joining the federal government in the late 1970s, she held various positions in Fisheries and Oceans Canada: as research biologist, fishery manager, treaty negotiator and both Area and Regional Director of several portfolios in resource management. She has managed programs of up to 300 professional staff in multiple areas and in multidisciplinary teams, and has successfully directed extensive consultations with a range of client groups. She has experience working with British Columbia First Nations, and has led negotiations of agreements and partnerships with the province's and Yukon counterparts in a variety of areas, including habitat protection, oceans management, and fisheries. Directing development and implementation of the Environmental Process Modernization Plan for Fisheries and Oceans in the Pacific Region and the development of a framework for assessing the environmental impact of aquaculture in B.C.'s coastal area are just two of her many achievements within that department.

Farlinger takes the helm of the forestry centre from Paul Addison, who led the research centre since 1998.

Coming Up

ExpoFor 2006

The Association of British Columbia Forestry Professionals Conference and 58th Annual Meeting.
Victoria, BC
February 22–24, 2006
Info: www.abcfp.ca

Sources

Gene Cloning and Tissue Expression Analysis of a PR-5 Thaumatin-Like Protein…

Necrophylactic periderm formation in the roots of western larch and Douglas-fir trees infected with Armillaria ostoyae. I. The response to abiotic wounding in non-infected roots.

Necrophylactic periderm formation in the roots of western larch and Douglas-fir trees infected with Armillaria ostoyae. II. The response to the pathogen.

Estimating time since forest harvest using segmented Landsat ETM+ imagery.

Environmental and inoculum-source effects on resistance of Idaho F2 western white pine…

Mountain Pine Beetle Initiative Interim Report 2005.

Possible Forest Futures: Balancing Biological and Social Risks…

Funding for Forest Fuel Management…

Arrivals

Brian Aukema is the new landscape ecologist, staffed by the Pacific Forestry Centre, at the University of Northern British Columbia, in Prince George. Aukema comes to the position from the University of Wisconsin, where he had been working with Canadian Forest Service Research Scientist Allan Carroll on Mountain Pine Beetle Initiative projects.

Based out of Prince George, **Justin Calof** is the new Mountain Pine Beetle Initiative forestry liaison officer for northern British Columbia. Calof conducts information sessions, coordinates workshops, and promotes the Mountain Pine Beetle Initiative to client groups, visits private landowners' property and First Nations' Reserve lands and provides information and advice on the mountain pine beetle and the Initiative, and reviews applications, creates funding contribution agreements and monitors current Initiative projects. He replaces Helena Adamowicz, who returned to the British Columbia Ministry of Forests.

The Pacific Forestry Centre's newest forest economist, **Brian Peter**, specializes in Canada–U.S. forest policy trends, Asia–Pacific forest products trade, and economic issues in forests subject to wildfire and mountain pine beetle. Peter also participates in interagency analyses to support the development of the Canadian Wildland Fire Strategy. He first began working at the Pacific Forestry Centre in the Mountain Pine Beetle Initiative and Policy Research Section in early 2004, after graduating from the University of British Columbia Faculty of Forestry, where he studied the economic and timber supply impacts of forest fir.

Accolades

The United States Patent Office has granted patent number US 6,913,920 B2 to the Canadian Forest Service for the work of Pacific Forestry Centre Research Scientist **Simon Shamoun** and researcher Susanne Vogelgsang on the fungus, *Valdensinia heterodoxa*, and its culture, formulation and delivery systems, as well as its use as a biological control agent for salal.

The Pacific Forestry Centre awarded four Graduate Student Awards this fall. **Deirdre Bruce**, of the University of Victoria, is working with Research Economist **Bill Wagner** to synthesize challenges and opportunities in community forestry in British Columbia. **Michelle Cleary**, University of British Columbia, is continuing her investigations with Forest Pathologist **Duncan Morrison** into host response to infection by root disease *Armillaria ostoyae* in western red-cedar, western hemlock and Douglas-fir in the southern interior of British Columbia. **Ian MacKenzie** and **Colin Robertson**, of the University of Victoria, are both working with Research Scientist **Mike Wulder.** MacKenzie is working out a way to detect mountain pine beetle hot spots using local spatial statistics; Robertson is exploring the effects of wind and temperature on spatial temporal patterns of mountain pine beetle dispersal. The $5,000 awards are intended to help student-recipients complete their studies and further their careers in forest science while working with Pacific Forestry Centre scientists.

Simon Shamoun

Justin Calof

Brian Peter

Next Issue

Estimating carbon risk

Determining the shelf life of mountain pine beetle-attacked wood

New from the bookstore

The state of Canada's forests 2004–2005. The boreal forest. 2005. Natural Resources Canada, Canadian Forest Service, Headquarters, Planning, Operations and Information Branch, Ottawa.

L'État des forêts au Canada 2004–2005. La forêt boréale. 2005. Ressources naturelles Canada, Service canadien des forêts, Administration centrale, Direction de la planification, des opérations et de l'information, Ottawa.

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Optimizing Drying of Mountain Pine Beetle Wood. 2005. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Mountain Pine Beetle Initiative Working Paper 2005–12.

Improving Value Recovery of OSB from Post-Mountain Pine Beetle Wood. 2005. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Mountain Pine Beetle Initiative Working Paper 2005–13.

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Machine Stress Rated (MSR) Lumber Grade Recovery of Post Mountain Pine Beetle Wood. 2005. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C. Mountain Pine Beetle Initiative Working Paper 2005–21.

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