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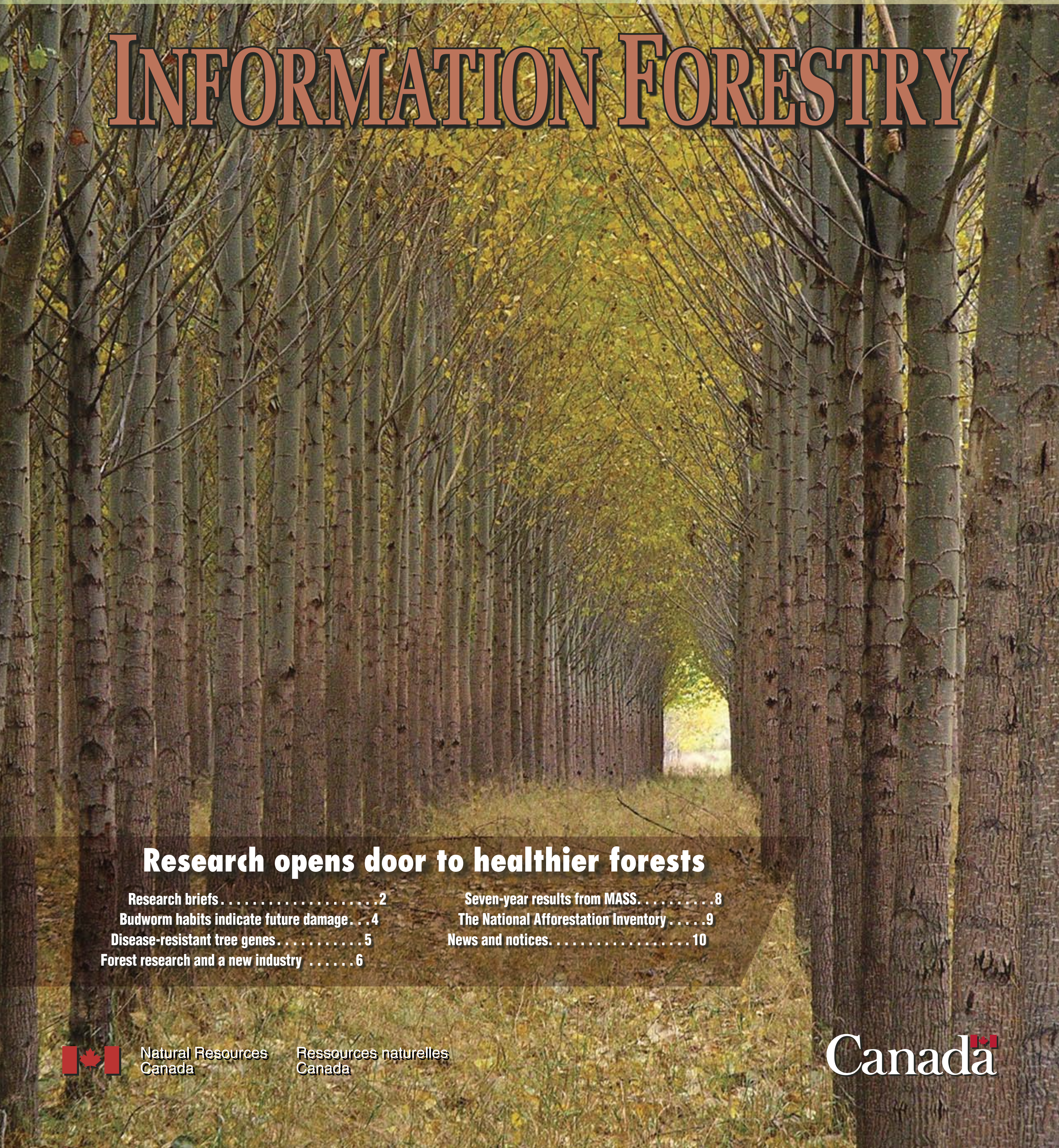

Research opens door to healthier forests

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Insects provide window on forest soil ecology

Tiny, wingless insects common to Canada's forests may be barometers to forest-soil health, according to a recent Royal Roads University–Canadian Forest Service study. Researchers examined diversity and food preferences of collembola—primitive insects that are one of the most abundant groups of forest-soil insects.

The researchers determined abundance of non-specialized fungus-feeding collembola to be most significant for predicting microbial biomass in forest soils.

"These species are opportunists," says Jan Addison, Royal Roads University soil ecologist and adjunct professor, and leader of the study. "Their presence in samples with high microbial biomass may be due to their ability to respond quickly to ephemeral resources as they become available."

In study plots representing early regenerating (7 to 9 years after clearcutting) forest, researchers found detritus-eating collembola to be proportionately much more abundant than fungus eaters, possibly due to lack of food supplies for the fungivores, and limited inputs of fresh litter. Proportions of various fungus-eating collembola increased in older, more established forest plots.

The key to the results was in determining collembola diet. By examining stomach contents of collembola found in 228 bags of needles and wood chips placed in Coastal Forest Chronosequence project study plots on southeastern Vancouver Island, Addison identified four distinct food preferences, including one that had never been considered by scientists.

"Conventional wisdom about collembola has been that they eat fungi," says Addison. "We found that most collembola species collected in our study do indeed eat fungi, but are particular about kinds of fungi: some eat only dark fungi, some eat light fungi, some eat both. We also found species that prefer detritus—bits of decayed organic matter."

For years, scientists had tried to determine the role collembola play in forest-soil ecosystems, searching for correlations between collembola abundance, litter decomposition and soil microbial biomass. Results were disappointingly inconsistent.

But when Addison and her colleagues broke springtails down into feeding groups, consistent patterns emerged.

"We just took the research one step further," Addison says. "By classifying collembola into feeding groups, we were able to find good correlations between feeding groups and other aspects of soil ecology."

Further information on the Coastal Forest Chronosequence project is available at: **www.pfc.cfs.nrcna.gc.ca/ecology/chrono**

Forestry centre shares web-system expertise

"Few web-based expert systems for decision support exist in any field, let alone forestry," says Canadian Forest Service Senior Research Scientist Alan Thomson. "The Pacific Forestry Centre is a world leader in the deployment of these systems."

With both software and experience in developing, maintaining and upgrading web-based expert systems, the Canadian Forest Service is using its expertise to develop similar tools for forest services elsewhere. One recent project is a system that assists forest and farm managers in the United Kingdom with herbicide-use management.

The system, based on UK herbicide laws and regulations, facilitates a user's search for a herbicide appropriate to a site, weed mix, time of year and crop. The system, which can be seen at **www.pfc.cfs.nrcan.gc.ca/management/herbicide**, then directs users to specific sections within extensive, multi-volume manuals for further information about suggested herbicides, as well as to product-application directions.

"It's a dynamic system with customized responses," says Thomson (**athomson@pfc.cfs.nrcan.gc.ca**), who built the tool in consultation with colleagues at the UK Forestry Commission. "Each interaction is site specific and case specific. A manager can run through multiple sites, and the system will respond to the different constraints and requirements."

By facilitating and speeding up the process of responding to routine inquiries, the system not only provides near-instant replies to users who are often time constrained, it frees experts to focus on complex questions the system cannot answer.

The web-based herbicide-expert system applies only to the UK; however, the Pacific Forestry Centre hosts and maintains a number of interactive Canadian expert systems on its website. These include a diagnostic program for common tree diseases of British Columbia (**www.pfc.cfs.nrcan.gc.ca/diseases/CTD/index_e.html**), a lodgepole pine nutrient advisor (**www.pfc.cfs.nrcan.gc.ca/silviculture/lodgepole/index_e.html**), and a mushroom identifier (**www.pfc.cfs.nrcan.gc.ca/biodiversity/matchmaker/index_e.html**).

Cecidophyopsis' effect on Pacific yew

Found in the bark of yew trees, taxol works as an anti-cancer agent, and the demand for it is straining yew populations. So in 1992, Canadian Forest Service scientists began a research project to ensure the sustainability of Pacific yew.

Pacific Forestry Centre Research Technician **Marilyn Clayton** (**mclayton@pfc.cfs.nrcan.gc.ca**) found that the Pacific yew's number one enemy is the yew big bud mite (*Cecidophyopsis psilaspis*), a pest she calls a "virtual eating machine."

"This species had never really been worked on," she says. "The inadequate description was over 100 years old—we set out to learn everything about them." She cut branches from Pacific yews growing at the Colwood Fuel Depot and dissected their buds.

"They're incredibly small and streamlined little beasties," Clayton says. The mites have only two pairs of legs, rather than the usual four. They live and are active almost all year long.

Yew big bud mites, brought over from England by settlers bearing mite-filled yews, burrow between bud scales and eat the contents of the bud. This causes the yew to grow into a contorted, damaged tree.

Clayton's study, coupled with the centre's other yew big bud mite projects, makes the Pacific Forestry Centre the authority on Cecidophyopsis psilaspis. The information could prove invaluable in the fight against the mite. "We already know that spraying is useless, due to the mites being protected inside the buds," says Clayton. "But we need to keep the Pacific yew population going at a sustainable level. And by describing this relatively unknown species, we're doing our part."

Getting to the root of biotronic Douglas-fir

"We want to find the maximum rate Douglas-fir seedlings can grow," said Pacific Forestry Centre tree physiologist **Alan Mitchell** (**amitchell@pfc.cfs.nrcan.gc.ca**). "And we want to find the optimum nutrient ratio to do that."

The experiment, conducted by Mitchell and University of Victoria Forest Biology graduate student Kim Everett, is made possible by the forestry centre's biotronic units. The Swedish-made machines allow researchers to regulate the precise amount of nutrients that enter the experimental system, according to Everett. As Mitchell says, "Only these machines can achieve this kind of control. They're cool machines!"

Mitchell and Everett seek to determine the optimum nutrient ratio of ammonium and nitrate that would make Douglas-fir seedlings—chosen because of their desirability for reforestation on Vancouver Island—grow the fastest. They are testing six different ratios of ammonium and nitrate to see which works best.

Douglas-fir grown in a biotronic unit look like any other normal seedlings. But underneath, their dangling roots receive a constant spray of nutrients. The roots soak up nutrients from the solution faster and with fewer complications than from soil.

The rationale is that the higher the concentration of nutrients, the better the nutrient uptake. "We're looking for the fine line between nutrient efficiency and nutrient toxicity," Everett says. The unit uses sensors to monitor nutrient levels so that when a seedling takes up some food, the machine adjusts its nutrient levels, ensuring that the seedlings have constant nutrients available for uptake. By giving seedlings free access to nutrients, the researchers will be able to determine what the maximum growth rate is with a particular nutrient combination.

"This experiment gives us great insight into how Douglas-fir seedlings take up and use ammonium and nitrate, which will eventually allow us to better understand the regeneration process," says Everett. She expects once they determine the best nutrient combination, she and Mitchell could begin applying the solution in nursery trials next spring.

Kim Everett tests how precise nutrient ratios affect Douglas-fir seedling growth.

Long-term research predicts short-term insect damage

The cycle of the two-year-cycle spruce budworm

The parent moth lays its eggs on spruce or subalpine fir in early summer.

Larvae hatch in July, and immediately seek shelter, where they moult and overwinter.

Emerging the following year, larvae briefly feed on new foliage before again seeking shelter for the rest of the summer and the next winter.

Larvae emerge again, and feed voraciously on new shoots until the insects become adults.

Research by Canadian Forest Service scientists allows forest managers to predict damage by the two-year spruce budworm caterpillar. In examining field data collected by researchers in the 1950s and more recently, Pacific Forestry Centre Insect Ecologist Vince Nealis determined that the amount a two-year budworm caterpillar eats during its first feeding season indicates how much damage the insect will cause the following year. The method is not only more accurate but easier and more flexible than what forest managers had been using.

The usual way of predicting defoliation by budworms is to count egg masses laid in the previous year. However, historical records show a weak relationship between egg-mass density of two-year-cycle spruce budworm and defoliation.

"Even the most experienced observer can fail to find and count all the egg masses or insects on a branch," says Nealis (**vnealis@pfc.cfs.nrcan.gc.ca**).

Unlike most budworm species in Canada, which live for a single year, the two-year-cycle spruce budworm lives for two years. The life cycle creates alternating years of apparent light, then more severe defoliation, which impacts tree growth and timber value.

After analyzing historical data collected during British Columbia's last two-year-cycle spruce budworm outbreak in the 1950s, Nealis and technician Rod Turnquist established study plots in mature spruce–fir forests near Prince George, British Columbia, to see if the defoliation pattern could lead to reliable damage predictions. For four summers, the researchers collected half-metre-long branch tips from sample trees, and measured defoliation.

The researchers pinpointed a linear relationship within the feeding pattern for damage; later tests with independent data correctly predicted the amount of defoliation in 14 of 15 stands.

Nealis points out that the prediction works only at a stand level. Little is known about the impact two-year-cycle spruce budworm has on large landscapes over long periods of time. Although two-year-cycle spruce budworm and its relatives, eastern spruce budworm and western spruce budworm, affected almost 900,000 hectares of British Columbia forest last year, few researchers study conifer-eating budworms—mainly because the insects' outbreak cycles are so long and their long-term impacts on landscape and on regional timber-based economics are so subtle.

Unlike bark beetles, which kill trees outright and quickly affect communities and regional economies, budworm damage acts slowly on host trees. The caterpillars don't strip a tree of all its foliage, but feed only on new growth. Several years of repeated defoliation during an outbreak may pass before a tree dies. And with the two-year feeding cycle of the two-year-cycle spruce budworm, the effects can stretch out for many years.

"The last outbreak of spruce budworm occurred in the 1950s," says Nealis. "Basically, no researchers working in Canada today were around to study that outbreak and see how it developed and affected the overall forest."

According to Nealis, the few researchers studying budworms today are trying to answer basic questions about the insects' biology—behaviour, nutrition, reproduction, and natural enemies. These are questions, Nealis says, "that will be of great benefit when the next outbreak occurs."

For more information on the two-year-cycle spruce budworm, visit **www.pfc.cfs.nrcan.gc.ca/entomology/defoliators/budworms/2year_e.html**

Two-year spruce budworm eats only new buds, and lives only in mature spruce–subalpine fir forests at high altitudes in western Canada.

Researchers investigate gene family with potential

Canadian Forest Service researchers have uncovered in conifers a large, complex family of protein-producing genes that aid in many aspects of tree health, from growth and development to disease and frost resistance.

To date, the scientists have identified 19 such pathogenesis-related-10 (PR-10) genes in western white pine, and another five in Douglas-fir, white spruce and sugar pine. The genes and their proteins are relatively well understood in flowering plants, but the research taking place at the Pacific Forestry Centre is the first to examine this gene family in conifers.

And the story told by the genes in conifers differs greatly from that told in flowering plants. In flowering species, PR-10 genes are few, and their functions tend to be limited to somehow aiding growth and development, or defence response.

"In conifers, these genes make up a huge and very diverse family," says Molecular Forest Pathologist **Jun-Jun Liu** (**jliu@pfc.cfs.nrcan.gc.ca**), who isolated many of the western white pine PR-10 genes being studied. Throughout the 350-million-year evolutionary history of conifers, "outside factors have forced this group of genes to diversify to take on an extremely varied range of functions and expression patterns not seen in any other group of plants."

The abundance and diversity of the PR-10 gene family provides great potential for breeding desirable genes into tree stock, as well as developing ways to biochemically test trees for particular genetic traits. For instance, Pacific Forestry Centre researchers experimenting with the first known western white pine PR-10 gene, which confers frost resistance, have patented a way to easily and reliably detect dormancy induction in both white pine and more problematic white spruce seedlings—an important trait for the hundreds of millions of seedlings planted out every year which must withstand Canada's unpredictable weather. As well, researchers are selecting and inter-breeding western white pine trees that carry single-gene resistance to white pine blister rust. Since its introduction to North America in 1910, the rust has practically eliminated economically valuable western white pines from British Columbia forests.

Other ways in which PR-10 genes may potentially make conifers stronger and healthier include providing multiple levels of genetic resistance to single diseases, protecting tissues around a tree's wound sites from infection, creating protein signals that indicate when and how a tree is stressed, or providing protection against drought or chemical poisoning.

But before scientists can tap the full potential of this complex gene family, many questions about the PR-10 genes remain to be answered. For instance, each gene carries the recipe for a unique combination of amino acids that comprise its own gene-specific protein. This protein is what induces dormancy, or protects plant cells against cold, or chokes off fungus-infected tree tissues. Scientists have identified 19 conifer PR-10 genes, but detected only 12 corresponding PR-10 proteins, using laboratory-generated antibodies.

"At this point, our protein-detection methods are pretty crude," Liu says. "We developed antibodies that key into certain amino acid sequences on the proteins, but not all PR-10 proteins may carry those sequences. It may also be that expression of some proteins is very low. We just don't know."

Scientists are also trying to identify the genetic switches that turn protein production by PR-10 genes on or off or increase or decrease PR-10 protein production, and what external factors trigger those switches. How PR-10 genes are expressed is another research challenge: the genes are present in every cell throughout the body, but some initiate protein production only in the roots of trees. Others may do so only in the stem, or in needles, or in cones or seeds. Determining how the proteins actually function, or do their jobs, is another area of research that will take time, effort and new methodologies.

"We thought the study would take only a couple of years and would involve looking at only one or two genes and their proteins," says **Abul Ekramoddoullah** (**aekramoddoullah@pfc.cfs.nrcan.gc.ca**), who identified the first-known conifer PR-10 protein in the Pacific Forestry Centre lab in 1989. "But every time we solve one mystery, we uncover whole new areas of inquiry that need to be explored."

Study of the PR-10 gene family and related proteins in conifers at the Pacific Forestry Centre has resulted in four U.S. patents registered by the Canadian Forest Service. Identifying and being able to select for defense-related traits in forest nursery stock will help protect economically valuable species from pathogens and other environmental stresses, as well as maintain productivity and biodiversity of forests.

Molecular Forest Pathologist Jun-Jun Liu isolated many of the western white pine PR-10 genes being studied at the Pacific Forestry Centre.

Research disproves danger of recycled fine logyard wastes

Logyard fines go full circle in the recycling loop in a project that examines rehabilitation of logging roads. Researchers from the University of British Columbia and the Canadian Forest Service have mulched seedlings planted in the sites' compacted soils with composted fines and are comparing survival and growth with those of seedlings planted on old logging roads without mulch.

"We're providing seedlings with additional forest floor to root in and draw nutrients from," says Preston. "We're returning part of the forest to the forest."

"There are a lot of misconceptions about wood waste," says Soil Chemistry Research Scientist Caroline Preston. "When I tell people I study logyard waste, they practically recoil and start going on about how toxic wood waste is and how dangerous phenolics from wood leach into ground water and poison it, and so on."

Using laboratory and nuclear magnetic resonance facilities at the Canadian Forest Service, Preston analyzed the chemistry of fine debris collected from logyards across British Columbia as part of a project with the Forest Engineering Research Institute of Canada to look at viable solutions to disposal of industry wood waste. The debris consists of small pieces of logs and bark, mixed with dirt, leaves, needles and water—material called logyard fines. Fines are generally all that is left at logyards after the logs have been shipped for processing and larger pieces of waste wood and bark collected for industrial fuel.

Her results: the debris does not contain high levels of phenolics or other chemicals. In fact, Preston says, "Logyard fines are chemically similar to what makes up the forest floor in British Columbia."

To analyze forest fines, Preston ground up samples, packed them into capsules the size of vitamin pills, and inserted them into the nuclear magnetic resonance spectrometer. The machine determines chemical fingerprints of samples by measuring vibration in atomic nuclei.

Those results helped prompt development of a new industry in the province. With further impetus provided by recent pollution- and waste-control laws, businesses are transforming waste produced by the province's two largest industries—fisheries and forestry—into piles and bags of British Columbia coastal forest floor that gardeners can spread over flowerbeds and vegetable patches.

"We screen fines from all of Canfor's logyards," says Helene Waugh, an owner of Sea Soil, a northern Vancouver Island business operating out of Port McNeill. "Out of that, we get just under 20,000 m^3 of compost a year. And we just went on board with TimberWest and Western Forest Products to screen their fines this year, so our production is increasing."

Sea Soil is one of five Vancouver Island businesses that combine wood debris from the timber industry with fish waste to create high-grade composts. Laboratory tests of the product confirm Preston's chemical debris analyzes: the compost contains virtually no heavy metals. It is, in fact, touted as one of the safest products for use in gardens.

And the market for the compost just keeps growing, says Terry Gay, owner of Earthbank Resource Systems, of Courtenay, British Columbia. "People who try fish compost never go back to using what they'd been using in their gardens before, and more and more people discover it every year."

In addition to solving waste-disposal and pollution problems, and creating community-based employment, Earthbank, Sea Soil, and other fish-and-fine-compost businesses on the island have helped eliminate the practice of burning logyard and mill wastes in open pits. Smoke from the pits often blanketed nearby seaside communities, but now that fines are collected for compost, area residents breathe clean air, passengers aboard cruise ships enjoy clear views of the island's coastline, and gardens flourish.

The way in which wood wastes have been dealt with traditionally in logyards gave the wastes their poisonous reputation, Preston says. "If tonnes of wood waste are piled up near a stream or river, high amounts of phenolics can leach out. But if you spread those wastes out like the way they're spread naturally through a forest, you're just spreading out a piece of forest floor."

Database collects information on tree planting in Canada

Thanks to a new database designed by the Canadian Forest Service, people who plant trees on pastureland or industrial sites can rest assured that their efforts will be noticed. The web-based National Afforestation Inventory is the country's first standardized Canada-wide system for reporting tree-planting activities that convert non-forested land into forest.

No mechanism existed prior to the database's development for Canadians to report such activities.

"We really had no ability to report how much afforestation was going on," says Pacific Forestry Centre scientist **Thomas White** (**thwhite@pfc.cfs.nrcan.gc.ca**). "It's not a core activity of the forest industry, so neither it nor the provinces track it consistently. If they measure it at all, it's typically rolled up with other activities."

Funded by the Forest 2020 Plantation Demonstration and Assessment program, a federal initiative to encourage industry, local governments, First Nations and other landowners to establish plantations of fast-growing trees on unforested land, the database also ties in with the Canadian Forest Service's Forest Carbon Accounting program. When the Kyoto Protocol became law in February, reporting by Canada of land-use change activities such as afforestation, deforestation and reforestation became mandatory. The National Afforestation Inventory conforms to scientific and technical reporting requirements developed by the Intergovernmental Panel on Climate Change (IPCC).

"Trees take atmospheric carbon dioxide, which is a greenhouse gas, and convert it into fibre," says Research Scientist **Werner Kurz** (**wkurz@pfc.fcs.nrcan.gc.ca**), the leader of the Canadian Forest Service Carbon Accounting Team. "Afforestation enlarges Canada's forest carbon sink by increasing the area of trees that are taking up and storing carbon."

The diversity and number of individuals and agencies doing afforestation complicate tracking of afforestation. "Instead of dealing with 10 provinces, we were looking at hundreds of participants" says White.

White and his colleagues across all CFS regions could not expect all the various afforesters to devote great amounts of time and effort to reporting tree-planting activities. This meant reporting had to be made easy. The user-friendly, internet-based system allows participants to enter, review, and report information on their afforestation activities. After verification and quality control, the information is added to the national database.

Registration of afforestation reporters and use of precise geographic information helps to eliminate duplicate reporting that could result from so many afforestation participants, some of whom might be involved in the same tree-planting projects. This, in turn, lead to a need to set up systems to protect the privacy of reporters and landowners. Although precise information about location and timing of afforestation activities, as well as size of area and species planted, is required for reporting purposes, much of that information is viewable only by pre-registered and approved analysts. Reporting individuals control how much detail about their tree-planting projects is made publicly available. Summary reports are accessible to all users of the internet-based system.

The National Afforestation Inventory includes all areas planted under the Government of Canada's Forest 2020 program, a program encouraging the planting of fast-growing trees on non-forested land, such as this poplar plantation at Huscroft, British Columbia.

With those challenges overcome, the database is the first standardized and centralized reporting system for afforestation, and the first national source of information about afforestation in Canada. The inventory is an integral part of Canada's National Forest Carbon Monitoring, Accounting and Reporting System that is being developed to meet international reporting requirements. The information on areas afforested is converted into carbon sink estimates, using the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS). Thus a direct link is established between the information on Canadian afforestation activities reported through the inventory, and the reporting requirements on carbon sinks. Under the Kyoto Protocol, Canada as a nation will be credited for carbon uptake resulting from afforestation activities undertaken in the country since 1990. How "carbon credits" from afforestation projects could be awarded through a domestic offset system and traded with other industries are issues still being assessed.

The National Afforestation Inventory is found on the web at **https://nai.nfis.org**. To access the database, you must first register for a National Forest Inventory System (NFIS) account. If you don't have one, an error message will appear upon entering the National Afforestation inventory, stating you need an NFIS profile. Follow the directions to **https://ca.nfis.org/access/login.jsp** in order to register.

From the cover:

According to the National Afforestation Database, more than 55,000 afforestation activities in Canada occurred from 1990 to 2002, leading to about 110,000 hectares of new forest and woodland.

Study compares alternative silviculture systems

Located near Campbell River on Vancouver Island, the Montane Alternative Silvicultural Systems project, a research and operations partnership founded in 1993, is one of the first operational demonstrations in coastal montane forests of the Pacific Northwest to compare conifer regeneration, nutrient cycling and biodiversity in conventional and alternative silvicultural systems that vary in retention and dispersion of overstorey trees, as well as size of forest opening.

Can single trees and groups of trees be retained in cutovers and not compromise regeneration? A 10-year study testing alternatives to clearcutting show single trees and groups of trees can be retained in cutovers on coastal high-elevation sites and not compromise regeneration. As part of the Montane Alternative Silviculture Systems (MASS) Project, a joint study led by Canadian Forest Service Research Scientist Dr. Al Mitchell (**amitchell@pfc.cfs.nrcan.gc.ca**) explores limitations to growth of regenerating seedlings imposed by different levels and patterns of overstorey retention.

Currently, the focus of forest management in British Columbia is shifting toward partial cutting and retention systems, based in part on the assumption that forest structure, habitat, biodiversity, and healthy ecosystem processes form links in a sustainability chain. However, if those systems result in poor regeneration performance, they may not be desirable options to clearcutting. "Our goal was to compare growth limitations in young trees in different silvicultural environments, and to determine which system would best encourage regeneration," Mitchell says.

Mitchell and his team investigated growth limitations on planted amabilis fir and western hemlock seedlings in three alternative silvicultural systems: small 1.5-hectare openings (Patch Cuts), in areas where single trees were retained (Green Tree Retention), and in areas where 25 percent of the pre-harvest stand was retained, dispersed over the cut block (Shelterwood). They then compared those systems with a conventional clearcut. To try and understand the degree to which growth might be limited by shade or poor nutrient availability, fertilizer and vegetation control were applied to subplots within each of the silviculture treatments.

The Montane Alternative Silviculture Systems team investigated growth limitations on planted amabilis fir and western hemlock seedlings in three alternative silvicultural systems, from 1993 to 2003.

Ten years after planting, survival and growth in both fir and hemlock was poorest in shelterwood areas, which retained the most canopy, compared to survival and growth in clearcut, green-tree and patch-cut systems among which only small differences existed.

"The poor growth in the shelterwood with dispersed retention suggests that silvicultural systems with large amounts of overstorey retention are too shady for efficient regeneration," says Mitchell. "However, when overstorey retention was grouped, as in the forest surrounding the patch cuts, growth was comparable to that in clearcuts, and possibly benefited from the influence of the surrounding forest mitigating climatic extremes."

Competition for nutrients and shade from understorey vegetation may be other important growth limitations. Tree volume in plots treated with vegetation control alone and in combination with fertilizer was more than double that in untreated hemlock and triple to quadruple that in untreated fir in all silvicultural systems. These treatment effects increased with time, despite vegetation control having been discontinued after the fourth year. Even in more open silvicultural systems, competition for nutrients from species like fireweed and huckleberry exacerbated already low nitrogen availability in soils of coastal montane forests. This supports the idea that limited nitrogen contributes to reduced or stagnant growth in conifer regeneration—a phenomenon frequently observed following clearcutting on montane sites.

"This study shows us that early mitigation and alleviation of light and nutrient limitations through vegetation control can have dramatic and lasting benefits on growth of regenerating shade-tolerant conifers," says Mitchell. This and other studies of regeneration, biodiversity and nutrient cycling at the MASS site have been instrumental in providing essential baseline knowledge applicable to the implementation of variable retention silviculture systems for forest management in coastal British Columbia.

For more information on the Montane Alternative Silviculture Systems partnership, visit **www.pfc.cfs.nrcan.gc.ca/silviculture/mass/background_e.html**

International standard will reduce risk to world's forests

Canadian Forest Service Research Scientist Eric Allen is a member of the Canadian team that helped draft guidelines to regulate the use of raw wood as packaging material in international trade.

Now he's helping make sure people understand the science behind the guidelines.

"Infested solid wood packing materials—the crates, spools and boxes that support and brace everything from blocks of granite to foreign sports cars—have been implicated as the source for several recently discovered exotic forest pests, notably the pine shoot beetle now established in Southern Ontario, Quebec and the northeastern U.S., the Asian longhorn beetle in New York and Chicago and the pine wood nematode in Portugal," says Allen, who works at the Pacific Forestry Centre.

Allen spoke to more than 180 delegates from national plant protection agencies representing more than 85 countries at a wood packaging implementation workshop held in Vancouver, February 28–March 4. The purpose of the workshop was to provide participants with the information and guidance they need to begin developing implementation plans for the packaging guidelines, known as International Standard for Phytosanitary Measures No. 15.

In short, ISPM No. 15 calls for two things: that wood packaging material be treated, either with heat or methyl bromide; and that it bear a globally recognized mark confirming treatment. Countries in Europe, North America and Asia will begin full implementation of the standard in 2005.

"The workshop, funded by the Standards and Trade Development Facility, was important because it provided a forum for people to establish their certification methods. This will go a long way toward reducing the likelihood of unnecessary trade disruptions," says Allen who, as Chair of the International Forestry Quarantine Research Group, helped organize the workshop with the International Plant Protection Convention Secretariat and in co-operation with the Canadian Food Inspection Agency and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service.

The workshop was one of three meetings in British Columbia at which policy makers, scientists and program managers from plant protection agencies from across Canada and around the world met to discuss with alien invasive forest pest strategies and international trade issues. Members of the International Forest Quarantine Research Group met in Victoria in mid-February to discuss its ongoing research regarding forest protection issues and the new international trade standard for wooden packaging materials, ISPM #15. The research group analyzes available science on which international forest protection agreements, such as the standard, are based, identifies and works to fill research gaps, and provides scientific advice on plant protection strategies to organizations such as the UN's International Plant Protection Convention (IPPC) and the Technical Panel on Forest Quarantine of the Interim Commission on Phytosanitary Measures (ICPM). And following the Vancouver meeting, members of the ICPM Forest Quarantine Technical Panel reconvened in Victoria for another meeting at the Pacific Forestry Centre.

"This is an issue with clear global trade implications, and it's not going to go away," says Paul Addison, Director General of the Pacific Forestry Centre, which hosted two of the meetings. "The Canadian Forest Service is a key proponent of strategies that deal with alien invasive species that threaten our forests and our trade agreements. It is vital that plant protection scientists, policy makers and industry representatives from around the world meet and find ways to deal with this issue."

Visit **forestry-quarantine.org** for more on the wood packaging implementation workshop.

Students from Marigold Elementary School, located just down the road from the Pacific Forestry Centre in Victoria, provided more than 85 hand-drawn and coloured flags to decorate Simon Fraser University's Morris J. Wosk Centre for Dialogue, the venue of the Vancouver wood packaging implementation workshop. Each flag represented a different country that was participating in the workshop. As a thank you, delegates donated $320 to the school for the students to participate in a world aid project.

Research network monitors forest carbon changes

Scientists from the five Canadian Forest Service research centres are participating in an international study measuring carbon dioxide exchange between forests and peatlands and the atmosphere. Fluxnet operates research stations at more than 250 sites around the world; the seven research stations operated by Fluxnet–Canada monitor carbon fluctuations in southern Canada. Most focus on forest and peatland sites disturbed by fire or harvesting.

"Our objective is to address some of the fundamental scientific questions upon which Canada's climate change policy is being based," says Pacific Forestry Centre Research Scientist and Soil Ecologist **Tony Trofymow** (**ttrofymow@pfc.cfs.nrcan.gc.ca**), who studies decomposition rates and ecosystem processes such as fine root biomass and production near Campbell River, Vancouver Island. "The government needs estimates of how climate, natural disturbances and forest management affect carbon cycling processes, and it needs to be able to defend those estimates and how they were arrived at to the international community."

The national-level database that will result from the five-year Canadian part of the study will link short- and long-term records of carbon fluxes at the flux tower sites to longer-term changes in tree growth and carbon stocks. This will provide the "gold-standard" data sets that will help Canada's government and scientists establish parameters for and test the models on which national climate change policy is based.

At each of the sites, Fluxnet towers measure changes in carbon dioxide, heat and humidity in mature and disturbed forests and peatlands along an east–west national transect across Canada. Researchers will combine the measurements with studies of soils and vegetation to develop relationships between simple climate variables and net ecosystem carbon exchange.

World Forests, Society and the Environment

Authors and editors of the IUFRO (International Union of Forest Research Organizations) Special Project World Forests, Society and Environment met in Victoria in January. The four-day workshop included analyses of recent global changes that have occurred in relation to the sustainable management of world forests. The outcome was the production of a policy brief, which highlights the main findings, policy implications and recommendations of the project, and is to be released in May at the United Nations Forum on Forests. Several Canadian Forest Service research scientists participated: René Alfaro, (fourth from left, front row, standing) is one of the book's senior editors, as well as a lead author; other lead authors from the forest service include Sen Wang and Brad Stennes. The Canadian Forest Service's Director General of Policy, Economics, International and Industry Branch Jim Farrell, Senior Policy Advisor, International Affairs Division Mike Fullerton, and Pacific Forestry Centre Director of Forest Resources Program Jim Wood also attended.

People

Departures

The Pacific Forestry Centre recently said farewell to Senior Research Scientist **Mike Apps**, co-leader of the Canadian Forest Service's Carbon Accounting Team. A physicist by training, Apps joined Forestry Canada 25 years ago, and has earned international recognition for his research on the role of northern forests in global change, and their contribution to the global carbon budget. He served as a convening lead author for the Intergovernmental Panel on Climate Change, as well as review editor for the panel's *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, and has been awarded the Canadian Institute of Forestry's International Forestry Achievement Award, a Canadian Forest Service Achievement Award for science, and a National Merit Award for Excellence in Technology Transfer.

Damage Appraisal Technician **George Brown** also left the Pacific Forestry Centre this spring, after 38 years with the forest service. Since 1981, Brown assisted in assessments of pest impacts on quantity and quality of wood in trees and forest stands, and helped develop methodologies and databases to facilitate impact assessments. Prior to that, he surveyed British Columbia forests as a Forest Insect and Disease Survey ranger.

Head of Microtechnique Services **Lesley Manning** retired from the Canadian Forest Service in January. Manning joined the Pacific Forestry Centre in 1974 as a tree physiology technician in the Bark Beetle Project; in 1983, she was appointed as a biologist and manager of the centre's micro-technique facility. During her 22 years with the facility, Manning provided Pacific Forestry Centre researchers with investigative support in light microscopy, scanning electron microscopy, and transmission electron microscopy, as well as scientific photography and digital image-processing services.

Good wishes to Forest Health Technician **Leo Unger**, who also retired this winter, in order to spend more time hiking, working on photography, and growing unusual fruit trees. As part of a team responsible for monitoring and assessing changes in forest health, Unger spent many years conducting forest surveys, providing critical information about international forest quarantine issues, and developing and testing methods to more effectively monitor and assess forest health.

Accolades

Four British Columbia students received Pacific Forestry Centre graduate student awards this winter. The $5,000 awards are intended to help students complete their studies and further their careers in forest science while working with scientists from the forestry centre.

Thomas Hobby, of the University of Victoria, conducts research on mitigating catastrophic forest fires via fuel load reductions using Monte Carlo cost–benefit analysis, with Forest Economist **Brad Stennes**.

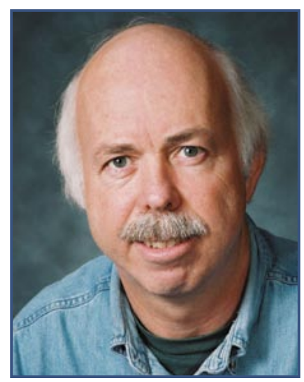
Cornel Lencar, of the University of British Columbia, continues work on Incorporating Bayesian belief networks as management decision support tools to predict geographic spread and risk for mountain pine beetle, under supervision of Scientist **Les Safranyik**.

Greg Smith, University of Northern British Columbia, works with Research Scientist **Allan Carroll** on the life history of *Pseudips mexicanus* and interactions with endemic mountain pine beetles.

Under Research Scientist **Simon Shamoun**, University of British Columbia's **Philippe Tanguay** continues microscopic investigations of interactions between the hyperparasite *Colletotrichm gloeosporioides* and its host western hemlock dwarf mistletoe.

Leslie Manning

Mike Apps



George Brown

Sources

For more information on research featured in this issue, search the Canadian Forest Service Online Bookstore, bookstore.cfs.nrcan.gc.ca, for these journal articles:

Growth limitations of planted conifers regenerating under Montane Alternative Silviculture Systems…

Insect–host relationships influencing disturbance by the spruce budworm….

Functional role of Collembola in successional coastal temperate forests….

Physiology and molecular biology of a family of pathogenesis-related PR-10 proteins of conifers.

Differential expression of multiple PR10 proteins in western white pine…

Characterization, expression and evolution of two novel subfamilies of Pinus monticola cDNAs…

Characterization of Picg5 novel proteins...

…Nuclear magnetic resonance characterization of logyard fines…

A web-based expert system for advising on herbicide use in Great Britain.

Carbon credits and afforestation.

New from the bookstore

Planting futures. First Nations forestry program poster (11 x 14.75 or 18 x 24) 2005. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

Planter l'avenir. Affiche du Programme forestier des Premières nations (11 x 14.75 ou 18 x 24) 2005. Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie du Pacifique, Victoria, C-B.

Evaluating the effects of large-scale salvage logging for mountain pine beetle on terrestrial and aquatic vertebrates. 2004. Bunnell, F.L.; Squires, K.A.; Houde, I. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia. Mountain Pine Beetle Initiative Working Paper 2004-2.

Sample plan to measure tree characteristics related to the shelf life of mountain pine beetle-killed lodgepole pine trees in British Columbia. 2005. Thrower, J.; Willis, R.; De Jong, R.J.; Gilbert, D.; Robertson, H. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia. Mountain Pine Beetle Initiative Working Paper 2005-1.

Assessment of potential for remote sensing detection of bark beetle-infested areas during green attack: a literature review. 2005. Niemann, K. Olaf; Visintini, Fabio. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia. Mountain Pine Beetle Initiative Working Paper 2005-2.

Regional Economic Implications of the Mountain Pine Beetle Infestation in the Northern Interior Forest Region of British Columbia. 2005. Patriquin, Mike; Heckbert, Scott; Nickerson, Christy; Spence, Michelle; White, Bill. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia. Mountain Pine Beetle Initiative Working Paper 2005-3.

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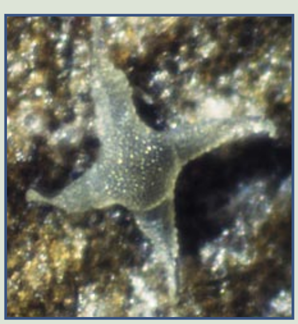
bookstore.cfs.nrcan.gc.ca

Next Issue

Remote detection and assessment of infected trees

and

Effects of soil disturbance on tree growth.



Coming events

Forests in the Balance: Linking Tradition and Technology

IUFRO World Congress 2005
August 8–13, 2005, Brisbane, Australia
Information: www.iufro2005.com
gary.bacon@dpi.qld.gov.au

Forest Rebellion: Leading Change

Canadian Institute of Forestry Conference and AGM
August 21–25, 2005, Prince Albert, Saskatchewan
Information: aatkinson@serm.gov.sk.ca
www.cif-ifc.org/rebellion

A Future Beneath the Trees

International Symposium on Non-Timber Forest products, Community Economic Development and Forest Conservation
August 25–27, 2005, Centre for Non-Timber Resources, Royal Roads University, Victoria, B.C.
Information: www.ntfpconference.ca
ntfp@royalroads.ca

Volume and value in managed stands

Coastal Silviculture Committee Summer Workshop
June 22–23, 2005, Duncan, B.C.
Information: EllisD@mala.bc.ca

National Forest Week

The Boreal Forest, A Global Legacy
May 1–7, 2005.

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