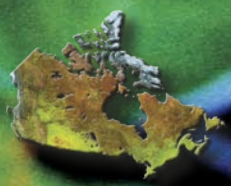
December 2004

ISSN 0706-9413



INFORMATION FORESTRY

Canadian Forest Service • Pacific Forestry Centre

Victoria, British Columbia

Carbon tool released before Kyoto ratification

Natural Resources Canada

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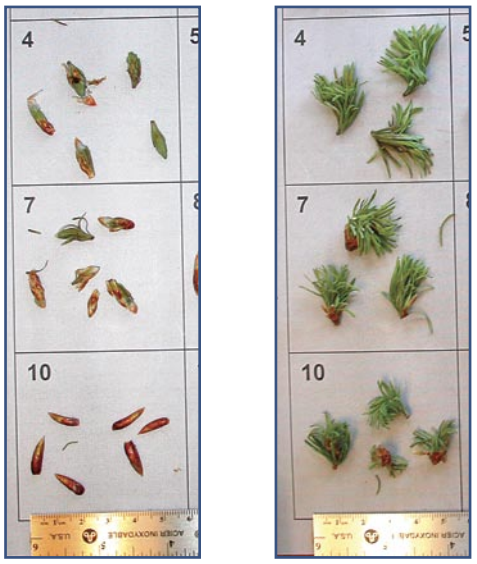
Chemical index predicts local budworm outbreaks

A study linking springtime temperatures to the chemistry of conifer needles may help forest managers predict where outbreaks of western spruce budworm will occur. By analyzing early season variations in terpenes in Douglas-fir buds collected from six sites in southern British Columbia, Canadian Forest Service Research Scientist Jason Nault (**jnault@pfc.cfs.nrcan.gc.ca**) developed a precise chemical index for different stages of bud development.

Terpenes are hydrocarbon molecules that give evergreens their distinctive scent. The composition of the terpene mixture within buds changes rapidly as buds develop, but in a predictable progression. The rate of progression, Nault discovered, is closely tied to site temperature. In cooler places, such as the higher-elevation sampling plots used in the study, or during cooler years, the progression—and bud development—occurs much more slowly.

"If the worms are out of synch with the buds, there is higher early season worm mortality. This high mortality might mean that populations cannot develop into outbreaks," Nault says.

The study may also allow scientists to measure and track climate change and its effects on forests and insect populations. "As seasonal temperatures change throughout Douglas-fir range as a result of global warming, we'll be able to track the climate patterns by measuring terpene profiles in buds. As temperatures change, the rate of bud development will change, and outbreak patterns will also probably change, both geographically and seasonally."



Buds can change rapidly in springtime. These buds were taken from the same sample trees at a high-elevation site near Merritt, on June 11 (left) and June 19, 2003. Before Nault developed the terpene index, bud development was measured visually, a method that lacked precision.

Trees outpace weevil attackers

Even voracious white pine weevils cannot keep well-fertilized spruce trees down. Fertilization of regenerating plantations has long been discouraged because it encourages weevil attack, but a recent Canadian Forest Service–British Columbia Ministry of Forests study indicates that tree growth due to fertilization may outweigh losses due to weevils.

Researchers tracked effects of fertilization treatments on white spruce in a 16-year-old spruce plantation near Hixon, British Columbia. They found that weevils *really* like trees that have been repeatedly fertilized. In fact, fertilizing can cause weevil-attack rates to increase by as much as 30 percent.

"Fertilized trees have longer leaders, which weevils seem to select for, and longer leaders mean more food and more room within the bark for more larvae," says Lara vanAkker **(lara.vanakker@pfc.cfs.nrcan.gc.ca)**, a Canadian Forest Service biologist who is a partner in the study. "Fertilization decreases density of resin canals within leaders, which normally help protect trees from attack, and also increases food availability for larvae within the bark."

However, even increased numbers of munching weevils could not mask the effect of fertilization on tree height. After six years, fertilized trees were 35 percent taller than unfertilized controls—despite weevil damage.

When combined with large radial response, stand volume increment after six years of repeated fertilization was more than three times greater than that in the unfertilized stand, according to Ministry of Forests Silviculture Research Specialist Rob Brockley. "The results from this study indicate that fertilization is a viable management option for increasing productivity and accelerating development of young spruce stands in the interior."

"Especially if done in concert with weevil controls such as use of weevil-resistant stock," says Canadian Forest Service Research Scientist and project co-leader Rene Alfaro **(ralfaro@pfc.cfs.nrcan.gc.ca)**.

The study was funded by the province's Forest Innovation Investment Program.

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:

Effects of fertilization on resin canal defences and incidence…

Twenty-year assessment of four tree species planted in the mountain hemlock zone…

Site temperatures influence seasonal changes in terpene composition…

Non-linear mixed models for repeated data assessment…

Look for these titles as well:

Growth, sporulation and conidia discharge of *Valdensinia*…

Blister-rust-resistant western white pines for British Columbia...

Team releases carbon tracker as Protocol is ratified

Following closely on the heels of Russia's ratification of the Kyoto Protocol on Climate Change, the Canadian Forest Service released a state-of-the-art tool enabling Canada to meet reporting requirements under the agreement.

The operational forest carbon accounting tool, developed and tested by researchers from the forest Service, the Model Forest Network, industry partners and Canadian universities, tracks and predicts forest carbon stocks as they are affected by management activities, natural disturbances and ecological processes. It will help Canada meet international reporting requirements of the Kyoto Protocol and complies with the Good Practice Guidance of the Intergovernmental Panel on Climate Change (IPCC).

"We'd planned to release the tool this year regardless of what was happening with Kyoto," says Pacific Forestry Centre Research Scientist Werner Kurz of the mid-December release. Kurz **(wkurz@pfc.cfs.nrcan.gc.ca)** is one of the leaders of the Canadian Forest Service Carbon Accounting Team. "It's a happy coincidence that the Russian Duma approved the protocol in October: the Canadian Forest Service is prepared, and we're committed to finding workable methods that help Canada report on forest carbon."

The operational-scale Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) builds on more than a decade of research on carbon dynamics in Canada's forests and their representation through earlier versions of the model.

Sophisticated data-import capabilities permit forest analysts to input data from their inventory and growth-and-yield data, harvest schedule, disturbance events and rules, and land-use change data into the carbon-tracking model. A standard interface tool allows data from different regions to be imported, while two custom tools interface with timber-supply planning models in use in a number of provinces.

The tool's design also allows for model updating as reporting requirements and scientific understanding of forests evolve. For instance, during the last year, the carbon accounting team improved representation of natural disturbances within the model, added greater flexibility in definition of types of natural disturbances, and addressed other issues identified by beta-version users.

Even before the latest developments with the Kyoto Protocol, industry partners and consultants were expressing interest in the tool, says Carbon Account Liaison Officer Stephen Kull **(skull@nrcan.gc.ca)**, of the Canadian Forest Service's Northern Forestry Centre in Edmonton.

"Carbon stocks and stock changes are among the criteria and indicators for sustainable forest management. Some of our industry partners have approached us for the model so they can report on carbon indicators and help them with certification." Both the Canadian Standards Association and the Forest Stewardship Council require indicators related to, among other things, carbon stocks and greenhouse gas emissions from forests be measured and reported for a company's practices to be certified as sustainable forest management.

With ratification of the protocol, forest managers and analysts have more reason to incorporate the forest carbon budget tool into operations. When the agreement goes into effect in 2005, Canada will have until 2012 to cut greenhouse gas emissions to 5.2 percent below 1990 levels, and until the end of 2005 to decide whether to include carbon-stock changes resulting from forest management and other land management activities.

To help familiarize forest analysts and managers with the tool, the Model Forest Network sponsored a two-day training workshop in Victoria in November. A second workshop is planned for March in New Brunswick, with additional training to occur across Canada in the future.

To download a copy of the operational-scale carbon budget model and its training manual, or to check when and where the next training workshop will be held, visit **carbon.cfs.nrcan.gc.ca**. The operational carbon accounting tool and support materials are available free of charge.

The operational carbon accounting tool developed by the Canadian Forest Service allows forest analysts to measure the effect of land use change and natural disturbances, such as fire, on a forest's carbon stocks.

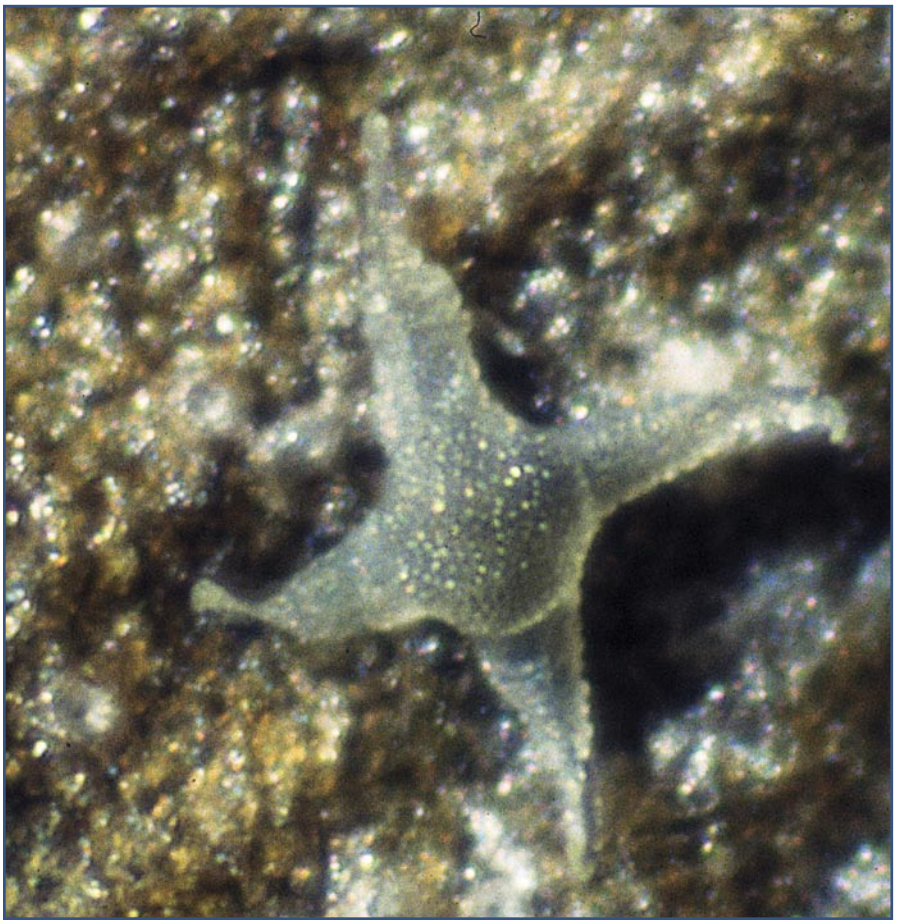
In addition to leading the Canadian Forest Service carbon accounting team, Kurz and colleague Mike Apps helped write *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, recently published by the Intergovernmental Panel on Climate Change (www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm). This report provides guidance on the methods used to calculate and report greenhouse gas emissions and removals. Kurz is convening lead author for Chapter 4, which describes methods and guidelines to meet Kyoto Protocol requirements, and Apps is one of the report's review editors.

Custom-designed model clarifies complex forest systems

From the cover:
Salal slows regeneration of trees in young British Columbia forests. *Valdensinia* may help control salal.

A statistical model recently developed by a Canadian Forest Service researcher provides scientists studying complex forest biology systems with an accurate, detailed, and easy-to-use data-analysis alternative to off-the-shelf software packages. The model developed by Pacific Forestry Centre Research Scientist Steen Magnussen **(smagnussen@pfc.cfs.nrcan.gc.ca)** incorporates algorithms for repeated data assessment of variable effects found in the best off-the-shelf software models, but lacks assumptions and factors that don't apply.

"Commercially available software packages are designed to provide routine solutions to well-known problems," Magnussen says. "Given the complexities of forested ecosystems, the models that forest researchers need are invariably also complex, and require scientists be able to build, fit, and test models to their particular research problems. This can quickly take researchers far beyond what they learned in STATS 101 or what off-the-shelf statistical software packages are capable of."



Magnussen developed a model to compare production of spores by fungus *Valdensinia heterodoxa* over time and under changing temperatures.

Forest pathologist Simon Shamoun **(sshamoun@pfc.cfs.nrcan.gc.ca)** and colleagues were comparing bio-efficacy of two strains of the fungus, *Valdensinia heterodoxa*. "We had completed our tests and had run our data through one of the off-the-shelf models," says Shamoun, whose lab is a world leader in research on *Valdensinia* as a biological control for salal in young, regenerating forests. But when the scientists discussed the project with Magnussen, he suggested that he develop a model specific to the kind of research they were doing, and compare results obtained by the custom and the standard models.

Magnussen's model addressed a number of complex parameters inherent within Shamoun's experiment: the fungi's bio-efficacy had to be maintained over time and under a wide range of temperatures.

"Bio-efficacy in this context was equal to virulency as measured by the number of spores produced in a given time under a given temperature," says Magnussen. "We observed that both spore counts and variability in spore counts increased exponentially over time and were dependent on temperature, with an optimum temperature and a sharp decline at higher temperatures. Hence the model had to be non-linear. We also had to reckon with interactions between counts and variability, and repeated observations made of the same Petri dishes over time."

"Sure enough," says Shamoun, "When we compared data from the two models, they showed very different results." The scientists found the custom model picked up many more nuances in *Valdensinia* spore production than the commercial model did. "The non-linear mixed model indicated distinct differences between how time and temperature affected reproduction in the two strains. Had we limited ourselves to inference based on the off-the-shelf software, our conclusions would have indicated the two fungal strains produced spores equally and were equally sensitive to temperature."

Although Magnussen developed the model to compare fungal virulence, it can be applied to any repeated measurements, such as population of cones on a tree observed over time, or, with minor changes, to continuous-in-time variables such as tree-size attributes.

Scientists at the Pacific Forestry Centre use statistical models in every field of forest research, including remote sensing, biotechnology, insect ecology, and carbon accounting. "Building and testing models that go beyond routine solutions are critical to furthering our understanding of processes and phenomena we study," says Magnussen, "They're also key to maintaining Pacific Forestry Centre's position as a leader in forest research."

Bough pickers strip priceless pines for greenery

Zealous bough pickers collecting Christmas greenery for florists last year stripped foliage from two scientifically invaluable pines. The trees, located near the town of Coombs on Vancouver Island, carried rare matched copies of genes that resist white pine blister rust, a disease that has eliminated western white pine from reforestation efforts and threatens to eradicate whitebark pine from high-elevation sites in British Columbia.

Bough harvesters misunderstood the brightly coloured ribbons and numbered discs that identified the trees as two of very few western white pines in British Columbia that are naturally resistant to the disease.

"It was our intention to begin grafting the lower branches of the Coombs trees onto nursery stock last spring, creating a pollen source for the production of hardier seedlings," says Canadian Forest Service Research Scientist Richard Hunt. Hunt spent many years studying blister rust's impact on western white pine. In 1987, he helped launch a project testing seeds from disease-resistant trees in Oregon. He and his colleagues hoped to find out whether the trees would grow in British Columbia and whether they would remain immune to blister rust damage if grown here.

Seventeen of the trees—including the two near Coombs—turned out to each possess double copies of a gene that resists blister rust. When the trees were bred, their offspring turned out to be completely disease free.

Because they were stripped so severely, the Coombs trees may not survive. And although the 15 other specimens with disease-resistance genes, located elsewhere, remain healthy, potential profits from greenery mean even they are not safe. Prices paid for Christmas greens in season can be as high as $800 a day—more than the timber value of many trees. But, because of their genetic makeup, which scientists hope will form the basis for future, healthy white pine forests in western Canada, the value of each of the disease-resistant pines is incalculable.

"Always check with the landowner before cutting," advises Hunt. "And if you see flagging, tagging or paint marking the tree, find out why it is marked and whether you should avoid it."

Ironically, pruning done properly can help deter blister rust. "If white pine stands are pruned when young, and pruning continues until the trees are pruned to a height of three metres, rust infection can be minimized," Hunt says.

White pine blister rust was first introduced to British Columbia on nursery stock imported from Europe in 1910. It kills its hosts by forming cankers on the bark of trees, cutting off flow of nutrients between roots and shoots. Western white pine is particularly susceptible to the rust, but is naturally resistant to certain kinds of root disease that affect other conifer species common in the province. For this reason, forest researchers are trying to isolate and propagate rust-resistant strains of western white pine to grow in British Columbia.

Bough harvesting for seasonal greenery is part of British Columbia's lucrative, but untracked non-timber forest products industry.

For more information about research into white pine blister rust, visit **www.pfc.cfs.nrcan.gc.ca/diseases/ctd/Group/Rust/rust7_e.html**.

White pine blister rust, a disease that forms cankers in the bark of its host trees, is the only stem rust that attacks white pines.

Yukon study provides foundation for long-term researcl

Canadian Forest Service Forest Health Technician Rod Garbutt was flying over Kathleen Lake, about 30 kilometres south of Haines Junction, in Canada's Yukon Territory in 1994, when he looked up the Alsek River valley into Kluane National Park.

"There was a red glow covering the entire valley within the park," he says. "I knew right then I was looking at a massive infestation. Red attack by beetles is very distinctive."

Ten years later, spruce beetle (*Dendroctonus rufipennis*) infests 300,000 hectares of white spruce forest in the region. Because white spruce is the only conifer that grows in the southwestern Yukon, the infestation has suddenly and dramatically changed a large, sensitive ecosystem.

Garbutt **(rgarbutt@pfc.cfs.nrcan.gc.ca)** and colleagues from the Pacific Forestry Centre recently spent four summers in the region establishing 27 study plots in the infested area within Kluane park and along the Shakwak Trench. With funding from the Yukon government, they gathered and analyzed data that forms the foundation for a long-term study on northern successional patterns and the influence of pests such as spruce beetle and root disease on Yukon forests.

"It's the only baseline data we have on basic forest structure," says Debra Wortley, of the Yukon department of Energy, Mines and Resources which took over responsibility for territorial forest management and development in 2003. "It fills a big gap in the research that's been done on the area's ecology."

According to David Henry, scientists researching how small mammals, birds, vegetation, fungi, spruce beetle and climate change interact in the harsh northern environment are already tapping into the Canadian Forest Service's baseline results to supplement their own studies.

"The forest health transects are providing really good information on vegetation and forest structure in the area," says Henry, a Parks Canada scientist who works with the Kluane Ecological Monitoring Project, a partnership between Parks Canada, the Arctic Institute of North America, the Yukon government, the Canadian Wildlife Service and Yukon College to investigate Kluane-area ecology. "Six of Rod's transects are located adjacent to our study sites, and we're actually hoping to convince the Canadian Forest Service to set up transects next to the rest of our 10 sites in the next year or so. That would provide an added depth and thoroughness to results from our own transects."

Northern forest structure

Fortunately for the northern spruce ecosystem, Garbutt says, "Spruce beetle never kills every host. From a distance, it looks like a sea of grey, but if you look closely, you'll see green trees here and there. There's always a bit of a seed source. There's always a spruce understorey."

In a tree-by-tree assessment of stand structure, Garbutt found that, as a rule, tree crowns in the north support large numbers of branches, which in turn support dense networks of branchlets. When trees die and lose their needles, the branchlets continue to shade the understorey. Many years may pass before there is significant increase in amount of light reaching the forest floor to stimulate understorey growth.

"Some understorey spruce have been sitting there for 100 years or more," Garbutt says. "It'll be interesting to see how they respond when more light becomes available."

The amount of fuel within infested stands increases risk of landscape-clearing infernos, but wildfire is rare in the region. Lightening rarely occurs in that corner of the territory, and the few strikes that do start fires tend to occur at the north end of the infested region where prevailing southerly winds push fires out of the tinder zone and away from Haines Junction. But without a landscape-clearing disturbance such as wildfire or major flood, the unique stand and tree structure found in the region's forests will determine post-beetle succession rates.

Although they normally attack stressed trees unable to pitch beetles out, huge numbers of spruce beetles swarm healthy hosts during epidemics, overwhelming tree defenses. As the trees die, the needles turn red, then fall.

h on the territory's white spruce ecosystem

During the final season of the baseline assessment, Garbutt investigated frequency of root disease *Inonotus tomentosus*, and its influence on beetle infestation. Garbutt and his colleagues had seen a number of blown-down trees, and knew significant amounts of the fungus existed in the soil. Nonetheless, he found that although root disease may play an important role in maintaining background, endemic populations of spruce beetle, there seems to be little relationship between *I. tomentosus* and major spruce beetle infestations.

"It appears the forest here was primed for beetle attack by extreme, long-term drought," Garbutt says.

Climate and Yukon forests

Climate provides background accompaniment to everything growing in the southwest Yukon: short summers with long days, unpredictable temperature changes in spring and fall, sparse precipitation caused by the rain shadow of the St. Elias mountains, and long, dark, cold winters affect growth, decay and development of forest ecosystems.

Recent research by Henry and colleagues working on the Kluane monitoring project shows average growing-season temperatures in the southern Yukon have increased during the last decade or so. Higher summer temperatures boosted transpiration rates by trees faster than soils could replace the moisture. The drought stressed the trees, which then broadcast chemical signals that attract spruce beetles and other opportunistic insects. Already weakened, the trees had limited resources with which to pitch beetles out.

With a succession of mild winters in the mid-'90s, the beetle spread through the southwestern Yukon forest. And in 2004, says Garbutt, conditions were so good, beetles were maturing in one year, as opposed to the two years they normally need in the north, and the insects were attacking spruce trees the beetles would normally ignore.

"The beetles prefer big trees," he says. "The bigger the tree, the better for the beetle: trees over a certain diameter not only provide more food for larvae, but insulate the larvae from winter cold. This year we saw the beetle attack trees only 20 centimetres in diameter. Larvae won't survive winter in trees that small."

He says the move to smaller diameter trees is an indication of how abundant the beetle is, and how scarce appropriate susceptible beetle trees are becoming in some areas.

Foundation for the future

Data collected for the forest health survey is already being used by researchers, national parks managers, community developers and territorial and First Nations governments, but its value will only increase with time. When researchers return to the study plots for follow-up assessments starting in 2010, tracking and analysis of changes occurring to forest stands and effects of pests and disease will begin.

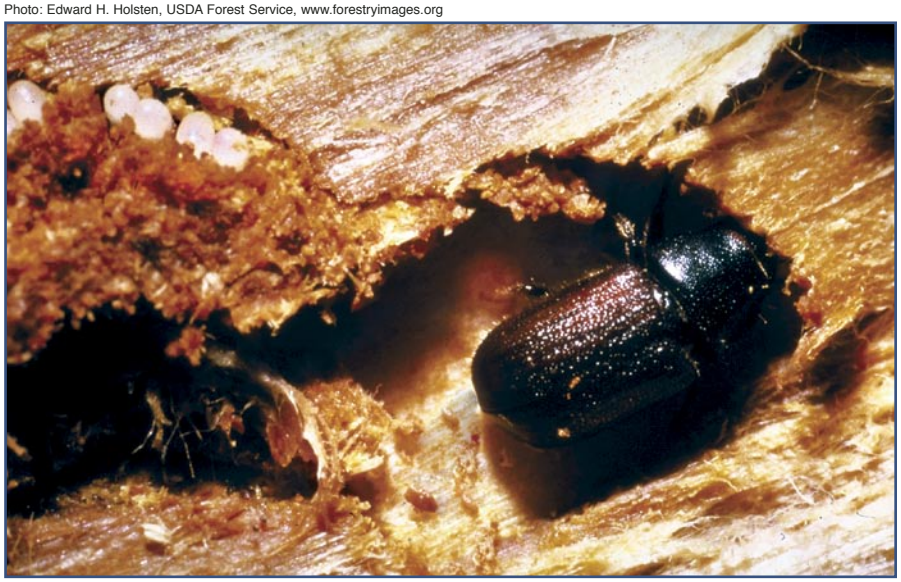
"That's when things will really start getting interesting," says Henry, adding that this is the first long-term study of this nature to be set up in the beetle-prone area. "We'll start to see, on a detailed, quantitative level, how the forests are responding to spruce beetle."

But, Garbutt points out, time runs differently in the Yukon than in forests further south. "Because of climate, things happen slowly there. Things decay slowly. Things grow slowly. To really understand the effects of spruce beetle on the northern forest, we need to assess the plots not just in 10 years, but in 15 years, in 25 or 30 years, and even after that."

The heat is on in Canadian forests

Warm winters throughout Canada in recent years have combined with aging forest stands to create conditions favouring outbreaks of some endemic pests, and the movement of other pests into new regions. Insects benefitting from current conditions include spruce beetle and spruce budworm in the Yukon, and mountain pine beetle, Douglas-fir beetle and hemlock looper in British Columbia.

Photo: Edward H. Holsten, USDA Forest Service, www.forestryimages.org



Native to all northern spruce forests in North America, spruce beetle is a bark beetle. It kills white, Engelmann, and Sitka spruce by interrupting nutrient flow beneath the trees' bark. A fungus disease carried on the beetles' bodies and with which the insects have a symbiotic relationship speeds the death of infested trees.

High-elevation growth study yields results at 20 years

20 years in the Mountain Hemlock zone

All test species survived better than does Douglas-fir, a species planted at all elevations until the 1970s.

Noble fir outperformed other test species on sites with better conditions.

Yellow cedar outperformed other species on less-productive sites, but sustained heavy snow damage.

Although slow to start, amabilis-fir growth improved significantly over time.

"Two decades is long term for most research projects, but it's just beginning to get interesting in terms of forest regeneration," says Al Mitchell, one of almost a dozen Canadian Forest Service, British Columbia Ministry of Forests and industry scientists who joined forces in the late 1970s to investigate high-elevation-reforestation problems and initiated a study to test tree species and stock types planted at high-elevation sites in British Columbia. One of the first such experiments in the region, the study compares performance of amabilis fir, noble fir, western hemlock and yellow cedar at six sites within the Mountain Hemlock zone, a biogeoclimatic zone that ranges from 950 to 1200 metres in elevation on Vancouver Island and the adjacent coast.

Twenty years after seedlings were planted, Mitchell **(amitchell@pfc.cfs.nrcan.gc.ca)** and colleagues assessed tree survival, growth and injuries. While tree height for all four species at 20 years averaged 5.2 metres at the most productive site, non-native noble fir averaged eight metres.

"Noble fir seems to be pre-adapted to these high-elevation, coastal environments," says Mitchell. "Its home range is just across the strait, in Washington and Oregon, so perhaps at one point, it was native to Vancouver Island, as well."

But noble fir outshone other species only on better sites—sites neither too wet nor too dry, slightly lower in elevation and with fairly rich soil. On more marginal sites, yellow cedar, an economically valuable tree, outgrew other species, but experienced considerable snow damage.

"Instead of a nice, straight stick of timber, you get metre-high conifer cabbages, which negates the wood value," says Mitchell. "This is after 20 years, mind you; in 300 years, it would be a different story. Some of those shoots are going to survive snowpack damage and grow up straight and keep on growing."

The assessment also shows that after 20 years, most seedlings that were smaller when planted still hadn't caught up to those that were larger at time of planting. Also, poor site moisture, competing vegetation and root rot caused the greatest mortality during the two decades.

Very little research has been done on these species, or on high-elevation growth. Up until the 1970s, most harvested sites along the coast were replanted with Douglas-fir, regardless of elevation. Even now, research tends to focus on low-elevation species and sites because it is at low elevations where most harvesting and replanting occurs. However, growing demand for timber-supply models for high-elevation species indicates shifts in interest. The British Columbia Ministry of Forests Stand Modelling Research team recently released growth-and-yield model updates that include, for the first time, amabilis fir and mountain hemlock projections.

"In the last few years, there's been growing interest in getting projections for these two species," says Jim Goudie, research leader for the model team. "Because so little data exists, we had to use information from comparable species. Any results from this study and other studies like this are going to be very, very helpful—especially if the studies are maintained over the long term."

And demand for such information will only increase, says Mitchell. "We're climbing higher and higher up the mountainsides to reach available timber. The Mountain Hemlock Zone is the next place people are going to look for wood here on the coast. We have to know what will grow back there, and how we can best promote that."

Canadian Forest Service researchers assessed performance of four high-elevation tree species in British Columbia's Mountain Hemlock zone. The Mountain Hemlock zone comprises 3.5 million hectares of the province's coastal forestlands.

More information about high-elevation silviculture research by the Canadian Forest Service can be viewed at **www.pfc.cfs.nrcan.gc.ca/silviculture/mass/background**

South Moresby account focuses on community goals

Representatives from Queen Charlotte Island communities recently divided $900,000 from the revised South Moresby Forest Replacement Account among projects they regarded as best contributing to the long-term stability of the islands. Their participation in the process results from revisions to the account's strategic plan, which increased both its presence in the community and the amount of local participation in the account's administration.

"When we revised the strategic plan in 2003, we wanted it to respond to changing expectations and needs on the islands," says Dean Mills (**dmills@pfc.cfs.nrcan.gc.ca**), the Canadian Forest Service representative on the South Moresby Forest Replacement Account secretariat. "The result is greater community involvement and direction: basically the community now decides what kinds of projects are funded."

To better enable the account to meet its goals, a series of public meetings on the islands led to increased local representation on the account's management committee. Also, working groups comprised of local stakeholders now are responsible for identifying community needs and reviewing proposals for funding.

The new direction combines the $24-million account's former objectives—sustainable forest management—with a new program that furthers community stability through enhancement of the forest-related economy. Funding for 19 projects, ranging from filling gaps in existing island-forest inventories to developing economic opportunities in remote north-island communities, is laying foundations for the development of viable, new industries on the islands.

"Our goal is, and always has been, sustainability," says the account's managing administrator John Farrell, from his office in Queen Charlotte City. "Not just sustainable forest management, but sustainable communities. We're providing capital for land-use planning, value-added manufacturing, non-timber forest product development, and ecotourism—projects that promise to round out the islands' economy and provide returns for many years."

Community initiatives approved for funding include development of ecotourism attractions such as hiking and interpretive trails, nature centres and traditional longhouses, and non-timber forest products, as well as transitional adult education. Under the account's sustainable forest management program, researchers are documenting wind disturbance patterns, studying forest regeneration, inventorying wildlife, and improving inventories of the islands' natural and cultural forest resources—both completing existing inventories and structuring them so they work seamlessly together. Education and training are integral to the projects, and provide additional bases for long-term community development, says Farrell. "As the land-use plans for the islands are completed, there will be growing need for highly skilled, experienced people to do research, ground truthing, mapping, and project planning, management and administration within the new industries. By providing education and training and experience through these projects, our goal is to ensure island residents are able and ready to fill those needs."

More information on the South Moresby Forest Replacement Account is available at **www.pfc.cfs.nrcan.gc.ca/programs/smfra**

The South Moresby Forest Replacement Account was created in 1988 to help offset reductions in timber supply and employment due to creation of Gwaii Haanas National Park and Marine Park reserves on the islands.

Both the federal and British Columbia governments contributed $12 million to establish the South Moresby Forest Replacement Account. Since then, the account has provided more than $18 million of support to the Queen Charlotte Islands economy.

All projects must be located on the Queen Charlotte Islands or be specifically developed for them.

The South Moresby Forest Replacement Account provides capital to develop projects that encourage sustainable communities in the Queen Charlotte Islands, including eco-tourism opportunities such as those offered at the Mount Moresby Adventure Camp on Mosquito Lake.

Strategy provides blueprint for beetle-research program

What will the post-epidemic world be like? "That is the question people are asking us most often about the current mountain pine beetle outbreak," says Canadian Forest Service Director, Mountain Pine Beetle Initiative and Policy Bill Wilson **(bwilson@pfc.cfs.nrcan.gc.ca)**. "We don't know the answer."

Nobody can forecast the total impact on industry, communities and other stakeholders by the mountain pine beetle infestation—estimated in 2004 to affect 8 million hectares of pine forest in British Columbia, in addition to areas in Alberta—but the Canadian Forest Service is gathering the information that will enable such predictions, and allow those impacts to be mitigated.

A blueprint called the Epidemic Risk Reduction and Value Capture Research and Development Strategy drives the Mountain Pine Beetle Initiative's search for answers. The strategy, developed in consultation with stakeholders, outlines an integrated plan for epidemic-related research to be funded under the $40-million, six-year initiative. Key research areas include identifying and measuring relationships between the epidemic and ecological, economic and social environments of beetle-affected regions, and reducing risk during both the current epidemic and future infestations.

"We're building a foundation of scientifically sound information on which management and mitigation decisions can be based," says initiative Chief Implementation Officer Dave Harrison **(daharris@pfc.cfs.nrcan.gc.ca).** "Instead of providing money to researchers to go charging madly off in all directions to find answers, the strategy points them directly and very specifically towards knowledge gaps that need to be filled."

With the second year of funding drawing to a close, initiative managers find that research results often pave the way for other questions within the strategy to be studied. This allows Harrison and Wilson to fine tune subsequent calls for research proposals. For example, a study evaluating effects of large-scale salvage of beetle-killed timber on forest animals identifies questions to be answered when researchers measure salvage programs for their ability to maintain non-timber forest values—questions that range from the effects of deadwood stands and salvage on terrain hydrology, to shifts in vertebrate populations as deadwood stands age or are salvaged.

The strategy also allows initiative managers to identify broader projects that will be bases for subsequent studies. A series of field plots in three different vegetative zones in British Columbia, for instance, will provide chronosequence data for other beetle-related research projects, including assessment of residual biomass, of post-beetle ecological character and regeneration, and of merchantable lifespan of beetle-killed timber.

"The epidemic is going to effect us for a long, long time, but stakeholders need to make some decisions regarding risk now, " Harrision says. "The strategy helps us to gather together the needed information efficiently and effectively to support those decisions."

For more information on the Mountain Pine Beetle Initiative's Epidemic Risk Reduction and Value Capture Research and Development Strategy, and projects approved for funding and completed, visit **mpb.cfs.nrcan.gc.ca/research/objective1_e.html**

Beetle display tours province

A small, travelling display is helping British Columbians explore mountain pine beetle and its impacts. Created by the Canadian Forest Service, the three-panel exhibit was installed at Fintry Provincial Park, in the Okanagan, where park visitors viewed it throughout the summer.

The beetle display is available for temporary installation across the province. To book, contact Pacific Forestry Centre Communications Officer Alec Tully (**atully@pfc.cfs.nrcan.gc.ca**; telephone: (250) 363-0707).

People

Accolades

Congratulations to Canadian Forest Service research scientists **Abul Ekramoddoullah** and **Richard Hunt** who were recognized by their peers at the 75th annual meeting of the Canadian Phytopathological Society in Ottawa, in June. Ekramoddoullah was awarded the society's prestigious Outstanding Research Award for his contribution to forest science.

Hunt was made a Fellow of the society—a distinction bestowed upon those with outstanding service to the society and to the profession of plant pathology.

Congratulations to seven students doing forest-related research under the guidance of Pacific Forestry Centre scientists. The students were selected for the latest round of Pacific Forestry Centre Graduate Student Awards, worth $5,000 each. From the University of Victoria, **Kim Everett** is studying optimum nutrient balance in Douglas-fir seedlings with research scientist **Al Mitchell**, **Tian Han** is working with scientist **David Goodenough** on a forest chemistry monitoring system using hyperspectral remote sensing, and **Christine Thorne** is putting together a field monitoring kit for nucleopolyhedroviruses of the Douglas-fir tussock moth, under supervision of researcher **Imre Otvos**. **Trisalyn Nelson**, from Sir Wilfrid Laurier University, is conducting spatial and spatial-temporal analysis of landscape scale mountain pine beetle infestations, with scientist **Mike Wulder**. From the University of British Columbia, **Sue Askew** is assessing *Colletotrichum gloeosporioides* as a biological control agent for western hemlock dwarf mistletoe, with **Simon Shamoun** supervising, and **Michelle Cleary** continues her work with forest pathologist **Duncan Morrison** on host response to infection by *Armillaria ostoyae* in the roots of western red-cedar, western hemlock and Douglas-fir in the southern interior of British Columbia. **Patience Byman**, from the University of Northern British Columbia, has begun establishing a framework for documenting stand-level effects of the mountain pine beetle outbreak in sub-boreal forests of northern British Columbia. Her supervisor is **Phil Burton**, based out of Prince George.

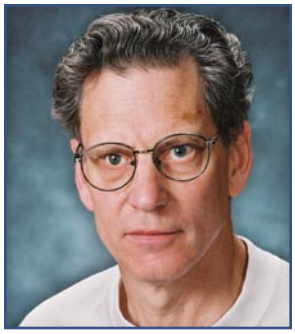
Departures

Richard Hunt retired from the Canadian Forest Service this fall. As project leader for the White Pine Blister Rust project, Hunt worked with a team of scientists from both the forest service and the British Columbia Ministry of Forest to research rust-resistance mechanisms among white pine. Prior to his work on blister rust, Hunt worked with the Forest Insect and Disease Survey, and researched black-stain root disease of conifers.

Returns

Canadian Forest Service Soil Chemistry Research Scientist **Caroline Preston** returns in February from working with the world's expert on black carbon chemistry, Michael Schmidt, at the University of Zurich. During her five months as part of the university's organic geochemistry team, she is compiling information about the amounts, role and effects of burned-wood charcoal, also known as black carbon, in Canadian forest ecosystems. She may even have opportunity to use the nuclear magnetic resonance facilities where chemist Richard Ernst did his Nobel Prize-winning research.

Abul Ekramoddoullah



Rich Hunt

Sue Askew

Comings Events

Capturing Canada's Green Advantage: Biosphere solutions for climate change and the economy: BIOCAP Canada Foundation's 1st National Conference

Ottawa, Ontario
February 2nd & 3rd, 2005!
Information: **www.biocap.ca**

Perspectives: What's your passion?

The 57th Association of British Columbia Forestry Professionals Conference
Prince George, BC
February 23–25, 2005
Information: **www.rpf-bc.org/agm57.html**
Email: **57AGM@sunfor.ca**

FLUXNET-Canada 2005 Annual Meeting Quebec City, PQ

February 25–27, 2005
Information: **www.fluxnet-canada.ca**
Email: **Fluxnet.Canada@sbf.ulaval.ca**

New from the bookstore

National Forest Information System / Le Système national d'information forestière du Canada. (Brochure.) Canadian Council of Forest Ministers, Ottawa.

First Nations Forestry Program British Columbia 2003–2008. Letter of Interest Guidelines and Application 2005-2006. 2004.

The State of Canada's Forests 2003–2004. CFS, Ottawa.

L'État des forêts au Canada 2003–2004. CFS, Ottawa.

Detection and monitoring of the mountain pine beetle. 2004. Wulder, M.A.; Dymond, C.C.; Erickson, R.D. Information Report BC-X-398.

International perspectives on streamlining local-level information for sustainable forest managements: A selection of papers from a conference held in Vancouver, Canada, August 28 and 29, 2000. 2004. Innes, J.L., Hickey, G.M., Wilson, B., editors. Information Report BC-X-400.

Mountain Pine Beetle Symposium: Challenges and Solutions, October 30–31, 2003, Kelowna, British Columbia. 2004. Shore, T.L., Brooks, J.E., Stone, J.E., editors. Information Report BC-X-399.

The Bridge: Newsletter of Natural Resources Canada's First Nations Element of the Mountain Pine Beetle Initiative, and of the British Columbia First Nations Forestry, #13: Fall/Winter, 2004. Murphy, B., editor. PFC, Victoria.

Information Forestry

Published by

Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road,
Victoria, B.C., V8Z 1M5
www.pfc.cfs.nrcan.gc.ca
(250) 363-0600

Editor: Monique Keiran
Distribution: Nina Perreault

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