April 2007

ISSN 0706-9413

CFS CANADIAN FOREST SERVICE
Pacific Forestry Centre
Victoria, British Columbia

INFORMATION FORESTRY

Effects of harvesting on tree-friendly fungi identified

Natural Resources Canada
Ressources naturelles Canada

Canada

Mildew found infecting valuable native landscaping shrub

Reports of the first documented case of powdery mildew on salal in Canada should serve as warning to British Columbia nurseries who grow the evergreen shrub for landscaping and the florist trade, says a Natural Resources Canada expert on the plant.

"Powdery mildew could affect growing stock," says Canadian Forest Service Research Scientist **Simon Shamoun (sshamoun@pfc.cfs.nrcan.gc.ca)**. "Nursery and plantation owners need to watch for the fungus on their plants, and look to manage it."

Powdery mildew grows filaments into tissues of infected plants, and sucks water and other nutrients from those tissues. This causes spotting on leaves, distortion and loss of leaves, death of small twigs, and can eventually even cause plants to die. Infection also inhibits seedling growth.

Fortunately, says Shamoun, powdery mildew can be controlled by fungicides and biological control agents.

Shamoun and his research team at the Canadian Forest Service, Pacific Forestry Centre, have spent the last 17 years studying the population dynamics, biology and genetics of salal and its associated fungus pathogens. Much of their research focuses on how to control salal in regenerating conifer stands, where the hardy shrub competes for nutrients to the detriment of conifer seedlings. However, Shamoun says powdery mildew won't help his team in their search for biological control agents of salal: "Powdery mildew is an obligate parasite: it requires living tissue to survive. It cannot be cultured in a medium in a lab, which means it would be difficult to culture sufficient quantities to be used effectively for biological control."

Seedling 15 weeks after inoculation with the fungal agent causing powdery mildew on salal.

View or download Beese and colleagues' *Prescribed burning impacts on some coastal British Columbia ecosystems*, Information Report BC-X-403, or order Zhao and Shamoun's "First report of powdery mildew on Gaultheria shallon in Canada," from the Canadian Forest Service online bookstore, **bookstore.cfs.nrcan.gc.ca**

First report from 20-year study released

Baseline fuel-consumption and soil-impact data for a long-term study on the effects of high-severity prescription burning on British Columbia coastal forest ecosystems have recently been made available. The report, the first in a series to be published during the next year on the 20-year study, quantifies the basic physical impacts of fires of differing severity on woody debris and soil.

In the mid-1980s, scientists from the Canadian Forest Service and forest company MacMillan Bloedel (now Western Forest Products) conducted a series of burns of different severities on harvested Vancouver Island sites. Their goal was to examine the effects of prescribed burning on fuel consumption, tree growth and site nutrition. High-severity fall prescribed burns were once widely used as a forest management tool in coastal British Columbia, in part to reduce slash on harvested sites to reduce fire hazard and make replanting easier.

The researchers found woody debris consumption increased with increasing fire severity, and consumption of forest floor, and woody debris plus forest floor, as well as depth of burn and mineral soil exposure, were all significantly greater on higher-severity fall burn sites. "The study showed us that reduction in woody debris on a site can be achieved just as well with low-severity spring fires as high-severity fall fires," says Canadian Forest Service Fire Research Scientist **Brad Hawkes (bhawkes@pfc.cfs.nrcan.gc.ca)**, one of the study's collaborators, "and—unlike high-severity burns—without substantial loss of soil organic matter."

However, says Western Forest Products' Forest Ecologist Bill Beese, lead author of the report, high-severity fires also reduced competition from evergreen shrubs for a much longer time, which improved growth of planted seedlings—results that will be published in a subsequent report during the next year.

The key, he says, is that, if resource managers are considering prescribed burns, "they need to consider their objectives carefully—whether the objectives are silvicultural, hazard, wildlife, recreational or social—and then plan the lowest-impact burn that will meet those objectives."

This is the longest-running study to examine effects of fire on British Columbia coastal forest ecosystems. Most similar studies last two to five years.

Beetle studies investigate effects on forest hydrology

In many areas of British Columbia, the mountain pine beetle epidemic will kill enough trees to significantly change forest hydrology. Research into riparian management, salvage harvesting, and rehabilitation processes can help assess the potential impacts of these changed natural water systems on reforestation, aquatic ecosystems and public health.

As few studies to date have examined this concern, Natural Resources Canada's mountain pine beetle program launched a series of integrated projects to fill the knowledge gap. Hydrology is the science dealing with the occurrence, circulation, distribution, and properties of the waters of the earth and its atmosphere. The Federal Mountain Pine Beetle Program is investigating the impact of beetle attack on reforestation, aquatic ecosystems, and public health to assess best riparian management, salvage harvesting and rehabilitation practices.

Collectively, the studies will generate a suite of models designed to examine the effects of large-scale tree mortality on forest hydrology—a complex phenomenon further complicated by British Columbia's diverse ecosystems. "The results will allow forestry managers to evaluate the relative impact of projected hydrological change within forest stands and across forest landscapes," says the program's Chief Implementation Officer **Dave Harrison (daharris@pfc.cfs.nrcan.gc.ca).**

Healthy forests regulate water through interception of precipitation and groundwater flow, and through transpiration. These processes inhibit snow melt, and pump water and nutrients through the soil and back into the atmosphere. However, after extensive beetle attack, water and nutrients ordinarily absorbed by trees can raise the water table and increase net flow of water into rivers and streams. Such an unbalancing may, in the short term, damage river channels and destabilize slopes, and, in the long term, alter the soil conditions necessary for reforestation.

Researchers from the University of British Columbia, the University of Northern British Columbia, the British Columbia Ministry of Forests and Range, and the Canadian Forest Service are investigating a range of beetle impacts on hydrology, including how much dead wood is entering and potentially altering flow hydraulics and channel shape—changes which could upset aquatic habitats and fish-egg incubation processes. Other studies are examining the effects of changes in hydrological systems on ablation—the reduction in volume of glacial ice by thaw and evaporation—as well as hydrological affects of salvage harvesting, reforestation, and watershed revival.

Two additional studies will add to the model matrix. One examines the effects of increased pulse, or water influx, at the stream-release point. The other will correlate detailed hydrological information collected 20 years ago in the Bowren Lakes watershed following a large-scale insect outbreak with present conditions. When finished, it will provide the basis for an evaluation framework of hydrological change within areas impacted by mountain pine beetle and subsequent harvesting operations.

Order a copy of *Review and synthesis of potential hydrologic impacts of mountain pine beetle and related harvesting activities in British Columbia*, Mountain Pine Beetle Initiative Working Paper 2005–23, from the Canadian Forest Service online bookstore (**bookstore.cfs.nrcan.gc.ca**) for details on possible mountain pine beetle-related hydrological effects. For more information on Natural Resources Canada's mountain pine beetle research and programs, visit: **mpb.cfs.nrcan.gc.ca**

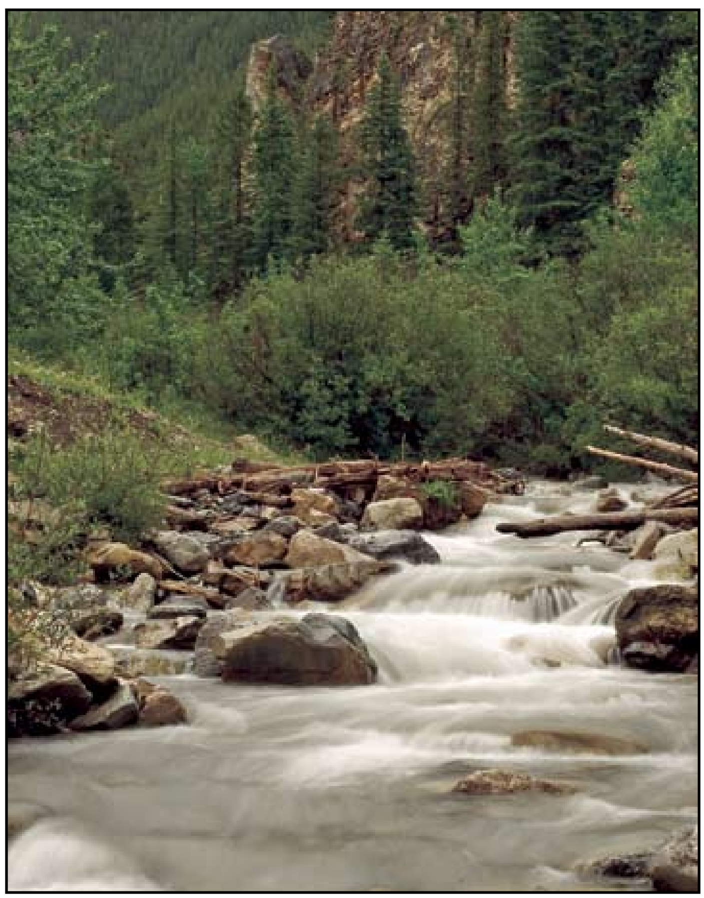


photo: © 2006 iStock, Steven Tulissi

Forests regulate water by intercepting precipitation and groundwater and through transpiration. Researchers are studying the effects of large-scale tree mortality due to the mountain pine beetle epidemic on hydrological processes in British Columbia's forests.

Canadian forest landcover classification map details

As Natural Resources Canada, with assistance from the Canadian Space Agency, wraps up production this year of the last remaining segments of a cross-country map detailing Canada's forested land cover, researchers, planners, GIS specialists and resource managers from across North America are downloading and using the product as quickly as it becomes available.

"Nothing else like it exists over Canada at that resolution," says University of British Columbia (UBC) Research Scientist Dennis Duro, who along with the UBC Canada Chair in Remote Sensing Nicholas Coops at the university's Forest Science Centre will be using the land cover data in the digital maps to help them assess Canada's biodiversity, or species richness.

"It's the only Northwest Territories-wide product available—apart from some coarse-resolution classifications," says Evelyn Gah, Protected Areas GIS Specialist with the Government of the Northwest Territories' Department of Environment and Natural Resources (GNWT-ENR). The NWT is an area for which little satellite data has been processed into readily available, useable form. "We have the option of using this data or having no data at all for large parts of the NWT."

According to Morgan Cranny, Remote Sensing Data and Product Coordinator for the Earth Observation for Sustainable Development of Forests (EOSD) initiative, which is producing the map from Landsat satellite data in collaboration with the provinces, territories and other federal agencies, the map team has had "dozens of requests for the data from universities, government agencies, and research organizations. And for the tiles that haven't yet been released, people are contacting us regularly, wanting to know when they can access them."

More than 500 of 610 planned map segments, or tiles, have been posted for download from the internet during the last 15 months, with the remainder due to be completed this year. The classified tiles detail 21 landcover classes, including 10 showing forest categories, as they existed in about 2000. At 25-metre resolution, the tiles are the highest spatial resolution satellite-derived map data available for the extent of Canada covered. The tiles are based on Canada's national topographic system (NTS) mapsheet framework, and follow the spatial framework and nomenclature of the existing 1:250,000 map series, allowing for simple integration with other spatial datasets. Each product tile represents an area of about 15,000 square kilometres.

"People who download the tiles can piece them together without losing data integrity or information," says Cranny (mcranny@pfc.cfs.nrcan.gc.ca). "They can then use that information in their own landscape and land cover studies either as is or as source information to generate their own value-added products."

"Using single scenes of Landsat data to produce land cover information is common practice," says Canadian Forest Service Forest Geomatics Research Scientist **Mike Wulder (mwulder@pfc.cfs.nrcan.gc.ca)**. "However, it is relatively uncommon to develop a map covering a large area by combining several Landsat scenes, let alone hundreds of them. The EOSD map product is unique in providing that relatively fine resolution of what's going on in forested ecosystems across all of Canada."

Uses and interpretations

The EOSD land cover map was developed primarily to support Canada's national and international reporting requirements of forest management and biomass, including the Canadian Council of Forest Ministers' Criteria and Indicators, the State of Canada's Forests annual report, and the United Nations Framework Convention on Climate Change. Meeting those commitments requires quantifying the composition, distribution, structure and dynamics of Canada's forests over time.

Cranny says the tiles will be used to provide information for biomass estimates, for climate change modelling, and for the National Forest Inventory—particularly for northern forest regions where there are few ground or photo plots, and forest inventory people have had to base the land cover classifications on limited information.

However, the data can be used to generate other information. Duro and his colleagues, for instance, will use the tiles to help them assess Canada's biodiversity in support of other national and international commitments: Canada's Species at Risk Act, 2003, and the 1992 Convention on Biological Diversity. The EOSD map will help the researchers establish a baseline of habitat fragmentation for various species in Canada.

"The EOSD provides us with a relatively high-resolution product of habitat composition and configuration across Canada," says Duro. "A systematically produced remote sensing dataset at this resolution over such a large area was simply not available before." The UBC researchers will integrate EOSD data with coarser-resolution indicators of biodiversity derived from other earth observation platforms, such as elevation, vegetation productivity and an index of disturbance.

"Although we'll be able to examine how coarse-scale changes to vegetation productivity and disturbance events may affect biodiversity over space and through time," Duro says, "the EOSD data will provide additional context needed to

kinds of vegetation covering much of the country

understand how changes in habitat composition and structure at finer scales might affect regional biodiversity."

The EOSD team classified all Landsat images that intersect with Canada's forested ecozones, which cover about 60 percent of the country. Because of image overlap, about 80 percent of the country was mapped, and all land cover types found in those images were classified. For biodiversity assessment purposes, that means the map includes not just forest-cover classifications, but classifications for wetlands and other kind of non-forested land cover.

This broad classification of all land cover benefits users of the map data in Canada's north, as well. In the NWT, Evelyn Gah and her colleagues have used EOSD map tiles since January 2006 as one of several inputs into a site selection model to help identify areas of ecological importance under the NWT's Protected Areas Strategy. As with the UBC researchers, the NWT protected areas group is looking at biodiversity, and is integrating the EOSD data with other datasets that include potential surrogates for biodiversity.

Data Accuracy

As with any land cover map derived from satellite imagery, accuracy must be considered. The challenge to improve and determine accuracy increases with amount of area covered and when areas lacking in ground-sampled data against which to compare information are covered. In Canada, much of the forested area has never been ground sampled because of inaccessibility, remoteness, and cost.

The EOSD team mitigated some degree of possible error by drawing on local and regional land cover expertise among provincial and territorial partners. And when Canadian Forest Service researchers compared the map's classification accuracy with geo-referenced video data of Vancouver Island's rugged interior, collected when they were testing new air-truthing technology, they found the map's accuracy was within the range the EOSD had established as acceptable.

"We hit our target," says Mike Wulder, the lead scientist for the EOSD land cover program. "The validation activities we have undertaken to date have shown that the EOSD classifications for a test region were within our acceptable error boundaries—around 80 percent accurate."

Further product validation based on air-truthing is occurring. Data have been collected for northern Manitoba, southern Nunavut, and parts of Quebec, and will be used to verify the map data in the coming months. The goal, says Wulder, is to publish the EOSD map's overall accuracy with an error bar, as well as the average accuracy and an error bar for each individual class. "Users would be able to look at the accuracy reports and adjust their applications and expectations accordingly."

"We're providing the best-available data possible within our budget and mandate," says Cranny. "Ultimately, the users are the ones who will decide the value of the product, and whether and how to use it."

Many collaborators provided data, expertise, support and assistance to the Canadian Forest Service, including the Canadian Space Agency, the Centre for Topographic Information–Sherbrooke, the Provinces and Territories, and other federal agencies. Visit **eosd.cfs.nrcan.gc.ca**, or check the Canadian Forest Service online bookstore for publications. The EOSD map tiles are available, free of charge, for download from the SAFORAH site (**www.saforah.org**) or National Forest Information System (**nfis.org**).

EOSD map tiles include 21 landcover classes, including 10 related to forest cover. Prince George, British Columbia, is shown at the right.

Compatible management benefits industry and communities

Survey shows…

Active compatible management must contain three elements to be successful:

1. Knowledge. Forest companies familiar with local non-timber product harvesters and buyers, and the commercial qualities of the desired plants and their habitats, better understand how forest management activities might affect them.
2. Communication. This permits forest management plans to be tweaked to suit, for example, the timing of the harvest of a non-timber forest product species; conversely, non-timber harvesting plans can also be tweaked.
3. Training. For example, non-timber product harvesters who learn proper silvicultural techniques can prune stands to forest company specifications while collecting boughs.

"Western Forest Products deals with non-timber forest products regularly, providing access and information to people in the industry" says company Tree Improvement and Research Coordinator Annette van Niejenhuis. "We have things happening that are of mutual benefit, and our personnel have been involved in numerous related pilot studies."

For instance, Western Forest Products' fertilization program helps the salal industry. The Vancouver Island company fertilizes trees for eventual harvest, but salal bushes in the stands also benefit. "We are looking for improved growth in the conifers," says van Niejenhuis, "but the salal also benefits." And then salal harvesters come in and remove the greenery to sell to florists.

A recent survey of such activities across North America indicates forest management that includes activities that benefit both forest companies and the non-timber forest products industry increases a forest's overall value. "Non-timber forest products are an important part of the practice—not just the theory—of sustainable forest management," says Canadian Forest Service Research Scientist **Brian Titus (btitus@pfc.cfs.nrcan.gc.ca)**, one of the authors of the study.

Non-timber forest products are plants or parts of trees with economic, social or cultural value. They include foods such as fiddleheads, mushrooms and berries, greenery used for floral arrangements or landscaping, bark and branches for crafts such as baskets, and even pharmaceuticals such as taxanes, which are found in yew and ground hemlock needles and are used in cancer treatment.

In the Queen Charlotte Islands–Haida Gwaii, some forest companies delay tree harvesting in good mushroom habitat to allow pickers more years in which to harvest.

"We see compatible management opportunities as existing along a continuum from inactive to active," Titus says. Inactive strategies use existing forest management tools to enhance the value of non-timber forest products. Western Forest Products' fertilization program fits near this end of the continuum, as would, says Titus, "maps developed for forest management that show road networks, forest cover, ecological zones and topography. They can be used to identify places where particular non-timber forest products grow best, and when to navigate safely and efficiently in the woods."

Active compatible management strategies have an explicit objective to increase both timber and non-timber values. For instance, Western Forest Products recently conducted western white pine-pruning trials: harvesters received both training on how to prune and access to product, and the stands were made more resistant to white pine blister rust, an introduced fungus that has decimated native white pine in British Columbia.

Other companies share scheduling information with wreath-makers so balsam fir boughs are harvested just before the stands are felled, or allow non-timber forest products people access to sugar maple stands in Quebec to prune ground hemlock blocking the trails and to sell the boughs to pharmaceutical companies. On Vancouver Island, non-timber product harvesters cooperate with local forestry companies to salvage plants from future roadbeds once they have been surveyed. Sought-after species such as salal, western sword fern and Oregon grape are then sold as sustainably harvested native plants and greenery.

Strategies that increase company profits and maintain safety are most likely to attract forest company investment, says van Niejenhuis; otherwise, activities will remain informal. "We will continue to make information available to non-timber forest products people, and continue to support this economic development in the rural communities in which we operate."

Moreover, says Titus, "the survey's case studies will be encouraging for forest managers considering options in their own areas. We were able to find examples throughout North America where the local non-timber forest products sector could benefit from virtually every silvicultural treatment or forest management activity you can think of."

View or download a copy of Titus and colleagues' "Compatible (or co-) management of forests for timber and non-timber values," from the Canadian Forest Service online bookstore, **bookstore.cfs.nrcan.gc.ca**

Beneficial fungi affected by harvesting regime and rotation

Scientists are only beginning to identify the complex interactions between organisms that live within forest soils, the minerals and nutrients that make up the soil, and the plants that grow out of it. In a recent study, Canadian Forest Service researchers contributed a few more pieces to the puzzle of what goes on underground after a forest stand is harvested.

They examined how ectomycorrhizal fungi recolonize harvested areas in different-aged forests. Ectomycorrhizal fungi grow on the surfaces of plant roots and are integral to the health and biodiversity of northern forests.

"They are obligate associates with trees," says Research Scientist Tony Trofymow, one of the scientists involved in the study. "And they are important for the health and nutrition of the tree, so if you lose species, you may affect the future productivity of the forest, as well as lose biodiversity." Some ectomycorrhizal fungi help plant roots absorb nutrients from the soil; some protect plants from pathogens; others protect them from drought.

Trofymow (ttrofymow@pfc.cfs.nrcan.gc.ca) and Forest Soil Biologist **Renata Outerbridge (routerb@pfc.cfs.nrcan.gc.ca)** planted ectomycorrhizae-free seedlings in harvested clearings next to old-growth and second-growth forest patches at one of Weyerhaeuser's (now Western Forest Product's) adaptive management monitoring sites. The Coast Forest Strategy, an ecosystem-based approach to forest management initiated in the late 1990s, includes variable retention harvesting. This approach leaves patches of forest or dispersed trees within a cut area for wildlife habitat and to act as sources of seeds or inocula of various organisms to conserve biodiversity in managed forests.

After two years, Trofymow and Outerbridge sampled seedling roots for ectomycorrhizal fungi at 5, 15, 25 and 45 metres from patch edges. They found fungi had colonized many seedlings. However, both abundance and diversity of ectomycorrhizal fungi decreased with distance from stand edges.

"It dropped dramatically, and then went into a slow decline," says Trofymow. "For ectomycorrhizal fungi, the stand edge effects are much steeper than we thought."

"We also found the total number of different types of ectomycorrhizal fungi was consistently higher in the plots next to old-growth stands," says Outerbridge. "Those plots had more unique ectomycorrhizal morphotypes than the second-growth plots as well."

Ectomycorrhizal fungi spread primarily via tree-root contact. The difference in percentage of colonization and in total numbers of species between samples taken from plots next to old-growth versus second-growth stands may reflect differences in habitat suitability, or may be a legacy of how large the original clearcuts were, and if 80 to 100 years of regeneration are long enough for all fungi to spread across the clearing.

"When we began our monitoring program in 1998," says Western Forest Products' Forest Ecologist Bill Beese, "we had very little experience as to which were the most viable approaches to variable retention and which would be most beneficial to the most species. We knew that it wouldn't be 'one size fits all.'" He says the ectomycorrhizae study tested the ability of small retained patches to act as a source for carry over of the fungi from the previous stand to the new stand.

Outerbridge and Trofymow are now working on projects to determine rates of recolonization of harvested areas by the fungi, the level of retention that best ensures ectomycorrhizae diversity on a site, and how well single retained trees serve as sources of ecotomycorrhizal fungi.

Information on ectomycorrhizal fungi in British Columbia's forests can be obtained at the British Columbia Ectomycorrhizal Research Network website: **www.pfc.cfs.nrcan.gc.ca/biodiversity/bcern/index_e.html**. Outerbridge and Trofymow's results are published as "Diversity of ectomycorrhizae on experimentally planted Douglas-fir seedlings in variable retention forestry sites on southern Vancouver Islands," available through the Canadian Forest Service online bookstore, **bookstore.cfs.nrcan.gc.ca**

The greatest decline in colonization by ectomycorrhizal fungi occurred within 15 to 20 metres of retained patch edges.

Researchers identified 34 morphotypes of ectomycorrhizal fungi from roots of seedlings grown for two years in plots adjacent to old-growth patches; 14 were unique to those plots.

In plots next to second-growth patches, scientists found 27 morphotypes; seven were found only in those plots.

From the cover:

Many of the samples collected by Outerbridge and Trofymow, including OrtoGrShgCor2523, are identified only as morphotypes—descriptions of colour and form.

The study of ectomycorrhizal fungi is fairly new: work continues to determine which fungi represent new species and which represent known species, such as *Truncocolumella citrina.*

Forest inventory summarizes land classifications, tree

"There is increasing pressure on Canada by the international community to provide consistent, complete and accurate information on our forests," says Natural Resources Canada, Canadian Forest Service Director of Forest Information **Jeff Dechka (jdechka@pfc.cfs.nrcan.gc.ca)**. "This information needs to address concerns of status and protection, biodiversity, and economic and social values of forests, as well as how our forests are changing over time."

To help meet such needs in the immediate future, Natural Resources Canada, Canadian Forest Service has released a compilation of information available as of 2001 on the extent and status of Canada's forest resources. Canada's Forest Inventory 2001 is based on 48 different data sources, including existing provincial and territorial forest inventories. Stand-level data provided by the provincial and territorial management agencies are converted to a national classification scheme, and then aggregated to the map-sheet, and provincial and national levels for storage in a relational database and geographic information system, providing statistical reporting, mapping and spatial-analysis capabilities.

Information from the inventory is used by federal, provincial and territorial governments to support decisions on policy, trade and science initiatives, and to respond to regional, national and international inquiries about Canada's forests.

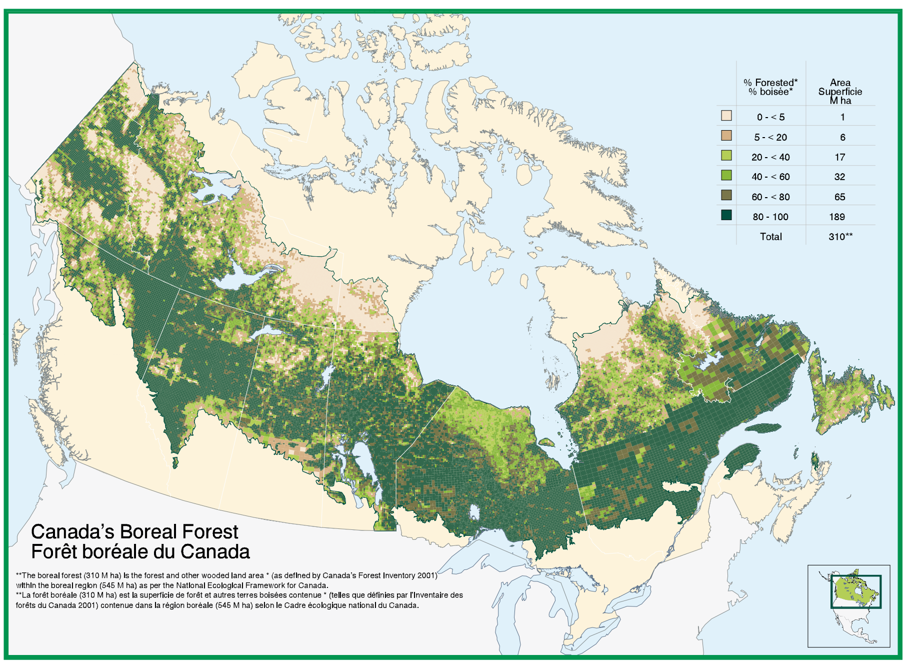
The 2001 inventory improves on earlier versions of Canada's forest inventory by including revised land classifications (increasing the number of land classes from seven to 67), an expanded list of tree species, expanded coverage to include the entire land area of Canada, and an estimation of forest biomass.

In an overview report of the inventory published this winter, National Forest Inventory Manager **Mark Gillis (magillis@pfc.cfs.nrcan.gc.ca)** and Forest Inventory Officer **Katja Power (kpower@pfc.cfs.nrcan.gc.ca)** summarize forest information within the inventory according to landcover classification, volume, biomass and other types of data. Summaries of forest inventory information by region and terrestrial ecozone are also included.

To demonstrate the value and potential of the national inventory, Gillis and his team also analysed information within the inventory regarding Canada's boreal forest and regarding the country's protected areas. "We wanted to show that analyses of the forest by geographic area, by series of related terrestrial ecozones, or by protection status was possible," says Gillis.

CanFI 2001 will be the last national forest inventory produced in Canada that is based on existing inventory data. The approach used to generate national inventories since 1981 has many advantages: it is cost-effective; the process is well established and accepted by contributing agencies; it provides detailed information about Canada's forests that is consistent with forest management information, and it contains location-specific information on characteristics and quantity of the forest resource, thereby providing mapping and spatial analysis capabilities. However, because it is based on existing data sources, the data can be up to 25 years old. In addition, the approach generally lacks information on non-timber attributes and is of unknown precision, which leaves reports derived from the data open to challenge. It also does not allow tracking of the rate and nature of changes to the Canada's forests over time.

"Because the Canadian Forest Inventory compiles information from existing sources, we're dealing with different ages of information collected to different standards and definitions," says Gillis. "This makes comparisons very difficult between, say, a compilation done in 1991 to a compilation done in 2001. The inventory is really more or less a statement of the best available information at the time; it does not provide a baseline against which change can be determined."



The Canadian Forest Inventory 2001 report includes an analysis of information available within the inventory about Canada's boreal forest.

species and forest biomass estimates for all of Canada

Canada's next generation of national forest inventory

To address CanFI's limitations and to meet new business demands, the Canadian Forest Inventory Committee—comprising managers of forest inventory from federal, provincial and territorial governments—have developed a new approach to produce a national forest inventory. Instead of a periodic compilation of existing information from across the country, the National Forest Inventory (NFI), which was introduced in 2000, is a plot-based design consisting of permanent observational units located on a national grid.

The new inventory will assess and monitor the extent, state and sustainable development of Canada's forests in a timely and accurate manner. By collecting and reporting information to uniform standards, it allows for consistent reporting across the country on the extent and state of Canada's land base to establish a baseline of where the forest resources are and how they are changing over time.

"Essentially, the NFI is designed to establish a baseline from which we can assess change," says Gillis. Change is the biggest gap in forestry information in Canada, he says, and "the need to be able to assess change is becoming more and more important—both nationally and internationally."

For instance, the United Nations Food and Agriculture Organization (FAO) requires information for its Global Forest Resource Assessment, a regular review of forests and forestry around the world. It examines current status and recent trends for about 40 variables covering the extent, condition, uses and values of forests and other wooded land, with the aim of assessing all benefits from forest resources.

"The FAO has been after change information for a long time," says Gillis. "For the Global Forest Resources Assessment 2005 [the most recent assessment], they were looking for data from 1990, 2000 and 2005. Our data was from circa-2001—and some was much older."

In addition to providing consistent estimates for traditional forest inventory attributes, the new National Forest Inventory approach provides a framework for collecting data related to forest health, such as insect damage or disease infestation, biodiversity and forest productivity, as well as additional data relevant to the reporting of progress towards sustainable development and other social and economic values supported by forests.

The new approach is being implemented in cooperation with the provinces and territories. Natural Resources Canada, under the guidance of the Canadian Forest Inventory Committee, coordinates National Forest Inventory activities; provincial and territorial partners provide input into sampling designs and provide data; the Government of Canada develops standards and procedures, as well as supplying infrastructure to conduct analysis and generate reports. The National Forest Inventory initiative also has the support of federal, provincial and territorial forest ministers on the Canadian Council of Forest Ministers (CCFM).

An overview of CanFI 2001 has been produced by Gillis and Power: *Canada's Forest Inventory 2001*. More information on the 2001 Canadian forest inventory and the new National Forest Inventory is available at **nfi.nfis.org**

Canada's Forest Inventory 2001, at a glance

Canada's forests contain more than 29.4 billion m^3 of merchantable wood volume.

Of Canada's total area (998 million ha)

- 40% is forest and other wooded land;
- 31% is forest land.

Of the forest and other wooded land (402 million ha), the ownership pattern is:

- 78% provincial;
- 14% federal (including the territories);
- 8% private.

Of the stocked forest area (275 million ha), the forest type distribution is:

- 66% softwood;
- 22% mixedwood;
- 12% hardwood.

Of the stocked forest volume (29.4 billion m^3), the species distribution is:

- 77% coniferous;
- 23% broad-leaved.
- Spruce, pine, balsam fir and aspen/poplar are the major species.

Of the stocked forest area, an estimated:

- 31% is young;
- 37% is mature or overmature;
- 32% is uneven aged or unclassified for maturity.

Sources

For more information on research related to articles featured in this issue, download or order the following Natural Resources Canada, Canadian Forest Service publications and journal articles from the Canadian Forest Service Online Bookstore, bookstore.cfs.nrcan.gc.ca.

First report of powdery mildew on Gaultheria shallon in Canada.

Prescribed burning impacts on some coastal British Columbia ecosystems, BC-X 403.

Review and synthesis of potential hydrologic impacts of mountain pine beetle and related harvesting activities in British Columbia, Mountain Pine Beetle Initiative Working Paper 2005–23.

Compatible (or co-) management of forests for timber and non-timber values.

Diversity of ectomycorrhizae on experimentally planted Douglas-fir seedlings in variable retention forestry sites on southern Vancouver Islands.

Canada's Forest Inventory 2001, BC-X 408

Monitoring Canada's forests: The National Forest Inventory.

Canada's national forest inventory: monitoring the sustainability of Canada's forests.

Canada's National Forest Inventory (responding to current information needs).

Monitoring Canada's Forests: Earth Observation for Sustainable Development of Forests Land Cover.

Satellite land cover mapping of Canada's forests.

Earth Observation for Sustainable Development of Canada's Forests

Monitoring the sustainable development of Canada's forests from space: the EOSD project.

Operational mapping of the land cover of the forested area of Canada with Landsat data: EOSD land cover program.

Earth Observation for Sustainable Development of Forests (EOSD): Project Overview.

Events

Forest Leadership Conference
May 8–10, 2007
Vancouver, B.C.
Information: www.forestleadership.com

20th Annual Global Forest and Paper Industry Conference
PricewaterhouseCoopers
May 10, 2007
Vancouver, B.C.
Information: www.pwc.com/fpp
Contact: Martina Luketic
Email: forestandpaper@ca.pwc.com

Decisions for Sustainability: Forest Estate Models for the Future.
June 12–14, 2007.
Victoria, B.C. Canada
Information: www.femc2007.net
Contact: Jeff Stone
Email: jeff.stone@gov.bc.ca

From Science to Sustainability: Knowing, understanding and applying
6th North American Forest Ecology Workshop
June 18–22, 2007
Vancouver, British Columbia
Information: www.nafew2007.org

A Global Vision of Forestry in the 21st Century–International Congress
September 30–October 3, 2007
University of Toronto, Ontario
Information: www.forestry.utoronto.ca
Contact: Amalia Veneziano
Email: a.veneziano@utoronto.ca

Climate Change Impacts on Boreal Forest Disturbance Regimes
6th International Conference on Disturbance Dynamics in Boreal Forests
May 30-June 2, 2007
Fairbanks, Alaska
Information: ww.icddbf.uaf.edu

Forests in Settled Landscapes:
Working Together to Protect and Enhance
Canadian Institute of Forestry 99th National AGM; CIF Southern Ontario Section and University of Toronto 2007 National Forestry Conference
August 19–23, 2007
University of Toronto, Ontario
Information: cif@cif-ifc.org

34th Annual Microscopical Society of Canada Meeting
June 12--15, 2007
Edmonton, Alberta
information: Diana Hinse, dhinse@nrcan.gc.ca
www.phys.ualberta.ca/MSC-2007

People

Arrivals

Shane Sela, Forestry Specialist with the Canadian Food Inspection Agency (CFIA) Plant Health division, has taken office quarters at the Pacific Forestry Centre to facilitate cooperation between the Canadian Forest Service's Forest Alien Invasives group and the CFIA. The two agencies have been working closely together for several years on issues and research pertaining to invasive alien forest insects in Canada.

Entomology biologist **Josie Smith** rejoins the Pacific Forestry Centre, also under the CFIA's Alien Invasive Species Program. She is responsible for screening trap-captured insects for introduced species and determining invasive insect diagnostics—part of the joint CFIA–Canadian Forest Service surveillance program for invasive insect introductions. Smith had worked previously at the forestry centre, from 2001 until last year.

Departures

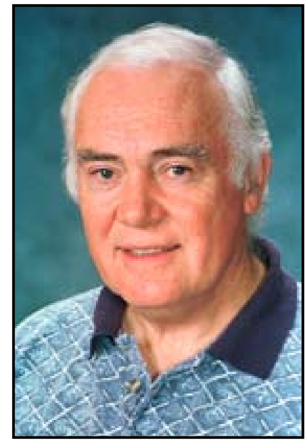
Integrated Resource Management Research Manager **Robin Quenet** is retiring from the Canadian Forest Service this spring. Quenet is project manager of the Canadian Council of Forest Minister's National Forest Information System, and defines and develops Web-based application services addressing criteria and indicators for sustainable forest management management reporting.

Prior to joining the Pacific Forestry Centre, Quenet founded and ran FORGIS Resource Consultants Ltd., a specialized British Columbia forestry consulting company specializing in integrated resource management, environmental impacts, growth and yield, GIS data capture and analysis, data base management systems and integrity evaluation, forest resource information systems and other related areas. From 1979 to 1987, he was manager of forest inventory methodology with the British Columbia Ministry of Forests Inventory Branch, where he was responsible for the design and implementation of the provincial forest inventory database and the development, enhancement and implementation of the Continuous Forest Inventory, including forest classification, stratification and sampling, growth and yield and forest inventory statistics. Prior to 1979, Quenet was project leader of Operations Research at the Pacific Forestry Centre.

Accolades

Four students working on forest-related research with Pacific Forestry Centre scientists recently received Pacific Forestry Centre Graduate Student Awards. The $5,000 awards were initiated in 2003 to encourage young people to pursue forest research as careers and to develop the forestry centre's relationships with forestry departments at Canadian universities.

From the University of Victoria: **Deirdre Bruce** is compiling a synthesis of challenges and opportunities in community forestry in British Columbia, under guidance of Research Economist **Bill Wagner; Ian MacKenzie** is researching the use of local spatial statistics to detect mountain pine beetle hot spots, and **Colin Robertson** is conducting a spatial–temporal analysis of mountain pine beetle infestations—both students working with Forest Geomatics Research Scientist **Mike Wulder**. From the University of Northern British Columbia, **Honey-Marie Giroday** is researching the spatial and temporal patterns of mountain pine beetle outbreak progression through novel habitat, under the direction of Research Scientist **Brian Aukema**.



Robin Quenet retires

Next Issue

Climate change and mountain pine beetle

and

Reducing fire risk in community–forest interfaces

To order publications on-line,

visit the Canadian Forest Service Bookstore at:

bookstore.cfs.nrcan.gc.ca

Search our catalog of thousands of forestry publications. Order copies quickly and easily using a virtual "shopping cart."

New from the bookstore

BC-X Information Reports

Spruce beetle and the forests of southwest Yukon, 2000–2004: an establishment report. Garbutt, R.; Hawkes, B.; Allen, E. BC-X 406.

Modeling the effect of landscape pattern on mountain pine beetle. Hughes, J.; Fall, A.; Safranyik, L.; Lertzman, K. BC-X 407.

Canada's Forest Inventory, 2001. Power, K.; Gillis, M. BC-X 408.

Mountain Pine Beetle Initiative working papers

Dawson Creek Mountain Pine Beetle Spread Analysis: Application of the SELES-MPB Landscape-Scale Mountain Pine Beetle Model in the Dawson Timber Supply Area and Tree Farm License 48. Fall, A.; Shore, T.; Riel, B. Mountain Pine Beetle Working Paper 2006–18.

Evaluation of in-woods chipping options for beetle-killed lodgepole pine wood. Bicho , P.; Hussein, A.; Yuen, B.; Gee, W.; Johal, S. Mountain Pine Beetle Working Paper 2006–19.

Sampling attributes related to the shelf life of mountain pine beetle-killed lodgepole pine in north–central British Columbia. Thrower, J.S.; Harrison, D. Mountain Pine Beetle Working Paper 2007–01.

Radar observation and aerial capture of mountain pine beetle, *Dendroctonus ponderosae* Hopk. (Coleoptera: scolytidae), in flight above the forest canopy. Jackson, p.; Straussfogel, D.; Lindgren, S.; Mitchell, S.; Murphy, B. Mountain Pine Beetle Working Paper 2007–02.

Optimization of gluing, lay-up and pressing for mountain pine beetle plywood. Wang, B.; Dai, C.; Wharton, S. Mountain Pine Beetle Working Paper 2007–03.

True shape and defects data from mountain pine beetle-affected stems. Brdicko, J. Mountain Pine Beetle Working Paper 2007–04.

Integrating silvicultural control of mountain pine beetle with wildlife and sustainable forest management. Chan-McLeod, A. Mountain Pine Beetle Working Paper 2007–05.

Stand-level effects of the mountain pine beetle outbreak in the central British Columbia interior. Hawkins, C.; Rakochy, P. Mountain Pine Beetle Working Paper 2007–06.

Environmental effects on host selection and dispersal of mountain pine beetle. Reid, M. Mountain Pine Beetle Working Paper 2007–07.

Assessment of the economic (pulping and pulp quality) effects of increased lodgepole pine in SPF chip mixtures. Dalpke, B.; et al. Mountain Pine Beetle Working Paper 2007–08.

Mountain pine beetle dispersal: the spatial-temporal interaction of infestations. Robertson, C.; Nelson, T.A.; Boots, B. Mountain Pine Beetle Working Paper 2007–09.

Cost implications for thermomechanical pulping and brightening for blue-stained chips. Hu, T.; Johal, S.; Yuen, B.; Williams, T.; Osmond, D.; Watson, P. Mountain Pine Beetle Initiative Working Paper 2007–10.

Calculating the risk of mountain pine beetle attack: A comparison of distance- and density-based estimates of beetle pressure. Wulder, M.; White, J.; Dymond, C.; Nelson, T.; Boots, B.; Shore, T. Mountain Pine Beetle Initiative Working paper 2007–11.

Identifying Insect Infestation Hot Spots: An Approach Using Conditional Spatial Randomization. Nelson, T.; Boots, B. Mountain Pine Beetle Initiative Working Paper 2007–12.

Evaluation of risk assessment of mountain pine beetle infestations. Dymond, C.; Wulder, M.; Shore, T.; Nelson, T., Boots, B.; Riel, B. Mountain Pine Beetle Initiative Working Paper 2007–13.

Other

Environmental Science Advisory Committee: 2005 Annual Report. 2006. Environmental Science Advisory Committee, Canadian Forces Base Esquimalt, Victoria, BC. Co-published by the Department of National Defence.

The Bridge: newsletter of the British Columbia First Nation's Forestry Program. #16: Fall/Winter 2006.

First Nations Forestry Program British Columbia. Letter of Interest Guidelines and Application 2007–2008.

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
Contributing writers: Ian Hendy,
Monique Keiran

Questions, comments, suggestions, or
requests for permission to reprint?
Telephone (250) 363-0779; fax (250) 363-0775; or
Email: **PFCPublications@pfc.cfs.nrcan.gc.ca**

Information Forestry is also downloadable from our
online bookstore at **bookstore.cfs.nrcan.gc.ca**