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Secondary Manufacturing in BC:
The Strengths, Challenges and Opportunities

In BC, secondary manufacturing is a significant component of the forest sector and its importance is expected to increase.

As forest management objectives continue to shift from timber harvest to ecosystem sustainability, forestry jurisdictions are increasingly interested in expanding secondary manufacturing opportunities in an effort to, at least in part, retain economic activity. In BC, secondary manufacturing is a significant component of the forest sector and its importance is expected to increase.

Secondary manufacturing (often termed value added) is the conversion of primary wood products into other products. Examples include remanufacturing and engineered wood products, windows, doors, cabinets, flooring, mouldings and furniture. The manufacture of such products provided approximately 15 percent of direct employment and 12 percent of forest product sales in BC during the 1990s.

"Part of the interest to expand secondary manufacturing is in response to technological advances and highly automated manufacturing that has produced considerable structural unemployment in traditional forestry," explains Dr. Bill Wilson, Director of the Industry, Trade and Economics Program at the Canadian Forest Service, Pacific Forestry Centre. "The skill set of displaced workers can, to a limited degree, complement a transition to secondary manufacturing. But rising timber prices, international competition in commodity grade products, high rates of technology mobility, and a need for continued access to public timber have also increased interest in secondary manufacturing."

BC's high quality of timber supports secondary manufacturing.

A significant part of the Canadian secondary manufacturing sector is in BC. The province's timber species and quality of timber, an established manufacturing capacity and a strong global market presence support secondary manufacturing. Also, BC's energy costs are highly competitive and the province has an institutional structure that supports research and market development. As well, environmentalists view secondary manufacturing as a means of preserving additional forest land with minimal consequent job loss.

But increasing the level of secondary manufacturing presents major economic challenges in terms of wood supply, labour costs and marketing. In order to reduce the investment risk, Dr. Wilson suggests that BC industry take full advantage of its existing sector strengths. "These include high quality timber, the ability to manage and, increasingly, be seen to manage forests on a sustainable basis, a well-developed infrastructure, an established presence in major markets, a research infrastructure, and existing co-operative market development efforts."

Dr. Wilson has partnered with business, Forest Renewal BC and various government agencies to provide rigorous information on the opportunities and challenges to secondary manufacturing. A comprehensive analysis of the current structure and significance of BC's secondary manufacturing is now being published. Based on this research, Dr. Wilson believes there are opportunities for expansion in BC. "But," he cautions, "secondary manufacturing will continue to be a challenging business market with considerable investment risks."

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Exotic Beetles – A Threat to North American Forests.

These insects have the potential to kill vast numbers of trees and greatly modify or disrupt native North American forest ecosystems.

Many scientists are looking beetle-browed over exotic beetles that are being discovered for the first time in North America. These insects have the potential to kill vast numbers of trees and greatly modify or disrupt native North American forest ecosystems.

Although non-indigenous insect species have been making their way overseas since the beginning of trade among countries, few survived the long trip. Now, however, technology has greatly reduced travel time and allowed for an increase in the number of containers being shipped at once. In addition, many commodities are packed with untreated wood that may be infested with insects or fungi. Couple these facts with a phenomenal increase in world trade, direct shipping, and personal travel, and it is not surprising that more exotic pests are arriving on our shores.

"Exotic wood-boring beetle species transported in packaging are causing great concern around the world," says Dr. Leland Humble, a research scientist at the Canadian Forest Service, Pacific Forestry Centre. "One species, the eight-spined spruce bark beetle (*Ips typographus*), which has the potential to devastate our forests, has been intercepted both in Canada and the U.S. but is not yet known to be established on the continent. However, the Asian long-horned beetle (*Anoplophora glabripennis*) is established in New York and Chicago, the lesser cedar longicorn beetle (*Callidiellum rufipenne*) is recently established in North Carolina, the pine shoot beetle (*Tomicus piniperda*) is established in southern Ontario, Quebec and the northeastern U.S., and the brown spruce longhorn beetle (*Tetropium fuscum*) is established in Halifax, Nova Scotia."

photo by Klaus Bolte

The brown spruce longhorn beetle is one of the exotic insects currently threatening Canadian forests.

These beetle species are arriving without their predators and parasites. In their new environments, some species are exhibiting new attack behaviours. In Europe and Asia, for example, the brown spruce longhorn beetle attacks already weakened trees, while on the east coast of Canada, it is destroying apparently healthy red spruce.

Another example of atypical behaviour has been observed in the lesser cedar longicorn beetle. "This insect, originally from northern Asia, is not considered a serious pest in countries like Japan, as it usually attacks freshly felled cedars and cypresses," explains Nick Humphreys, a forest health technician at the Pacific Forestry Centre. "But in North America this woodborer has been found in nursery stock in Connecticut and in a stand of eastern redcedar in North Carolina. This insect has to be considered a threat to all native species of cypress, juniper, and cedar, including two of Canada's most valuable timber resources, western redcedar and yellow cedar."

Once initially established, eradication is necessary to prevent expansion and permanent establishment in the region. To combat the invasion of the lesser longicorn beetle, the Legislature of Connecticut passed an emergency regulation to eradicate infestations and prohibit movement of infested materials. In an effort to control the Asian long-horned beetle population in New York and Chicago, thousands of trees have been cut. And in Halifax, Nova Scotia, thousands of infected spruce in a heritage park were removed and burned.

Dr. Eric Allen, a research scientist at the Pacific Forestry Centre, has recently been involved in helping draft a global standard for the treatment of wood packing material under the United Nations Food and Agriculture Organization, International Plant Protection Convention. "Of course, the ideal situation is to prevent the transfer of insects in raw packing material. One goal is to have an international standard requiring all wood from all countries be treated. But once a pest is established, measures must be taken to prevent the destruction of North American forests."

In Canada, the Canadian Forest Service has been providing scientific support to the Canadian Food Inspection Agency to address the introduction of exotic insect species. Because the insects are exhibiting unusual behaviour in a foreign environment, current scientific literature cannot be relied upon and research will set a precedent for the continent.

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To Rot a Lot or Not: Humus in Northern Forests

Researchers suggest that any decisions about how much humus should remain on a site be based on a sound understanding of the causes of humus accumulation.

It's been said that too much of a good thing can be bad. When it comes to humus in northern forests, this may be the case.

Humus is the decomposing plant (and some animal) residue found on the forest floor. Most northern forests have a surface layer of such organic matter. Besides being a key source of nutrients, humus, if incorporated in the soil, aids in moisture retention and soil structure. However, it may also be a nutrient sink that competes with trees for nutrients.

"Generally speaking, humus is beneficial to the forest," says Dr. Doug Maynard, a research scientist at the Canadian Forest Service, Pacific Forestry Centre. "But in northern forests there can be a thick build-up of organic material which doesn't provide a good bed for revegetation. This accumulation at the soil surface can also affect the forest ecosystem by immobilizing nutrients, making them unavailable for plant uptake."

Humus accumulation depends on temperature, moisture conditions, and characteristics of the litter. These factors affect soil microorganisms which in turn also affect the rate and completeness of decomposition. In tropical or subtropical forests, humus does not accumulate to the same extent because soil biota thrive in warm, moist environments, helping to completely decompose the organic material. As well, the litter composition of northern forests differs from that in southern areas.

"In deciduous forests like aspen, where the pH of soil is high, organic matter tends to incorporate into the soil, but where there is litter made of conifer needles, as in most of BC, there is a build-up of organic material," says Dr. Maynard. "In addition to the rate of organic matter decomposition, humus accumulates according to the type, frequency and intensity of disturbance."

A major disturbance in northern forests is fire, which can either burn through the humus layer and expose mineral soil, or, as in the case of crown fires, leave the organic layer unaffected. Another disturbance that may affect the rate of humus decomposition is an insect outbreak, which can reduce the canopy cover thereby changing temperature and moisture conditions.

Harvesting and site preparation may stimulate nutrient release and improve seedbeds, and thus may improve short-term productivity. But researchers do not advocate eliminating humus, as organic matter is essential to long-term site productivity.

"In general, at sites where humus has accumulated at the surface, practices that activate but not eliminate humus would be preferred," explains Dr. Cindy Prescott, assistant professor in the Department of Forest Sciences at the University of BC. "At sites with small amounts of humus, practices that minimize disturbance should be considered."

Both researchers suggest that any decisions about how much humus should remain on a site be based on a sound understanding of the causes of humus accumulation, rather than a belief that the amount of humus present is somehow just right for the current forest.

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Humus accumulates according to the type, frequency and intensity of disturbance.

Updating Forest Inventories with Remote Sensing

Remotely sensed data can inexpensively and relatively quickly augment forest inventories by detailing changes within polygons.

Remote sensing is, in essence, the opposite of astronomy. Rather than viewing space from the satellite of Earth, remote sensing is viewing Earth from a satellite in space. And, as astronomers group stars into constellations, foresters group areas with similar forest characteristics into stands, also known as polygons. Remote sensing can help determine changes within those polygons.

Sound forest management decisions are made according to changing conditions of the landscape. At present, inventories are created by combining ground sampling data with aerial photos in a Geographic Information System (GIS). Although this process provides fairly accurate detail of forest attributes within a polygon, it is very expensive, time consuming, and can quickly become outdated. Remotely sensed data from, for example, the Landsat Thematic Mapper (TM), can inexpensively and relatively quickly augment forest inventories by detailing changes within polygons.

"In a perfect world, inventories would be taken annually to ensure they accurately reflect what is occurring within an area," says Dr. Mike Wulder, a research scientist at the Canadian Forest Service, Pacific Forestry Centre. "But by the time the data is collected, organized, delineated into polygons, digitized into a computer and analyzed, a long time has elapsed before the forest manager receives the information. By then, the landscape could have greatly altered. Remote sensing, however, can be used to update the information relatively quickly."

Satellites have digital sensors that provide picture elements (pixels) of small areas over large land masses. As sunlight falls on an object, light is reflected back to the satellite in various wavelengths. When, for example, infrared energy falls on a leaf it is reflected, but on non-vegetative areas such as roads, it is absorbed. These differences are indicated as light or dark pixels. In this way, changes resulting from, for example, logging, insect defoliation, or disease, are recorded. Data collected by the conventional inventory process can be updated to include such changes.

"This new information is aggregated into the existing polygon as another attribute and is then included in the GIS," explains Dr. Wulder. "So besides the GIS system indicating standard attributes such as biomass, tree species, and forest density, the forest manager can have an indication of change from the remotely sensed data. A single new attribute indicating the observed degree of change is added to each polygon, so the forest manager does not have to deal with all the pixels found within a polygon indicating change."

Dr. Mike Lavigne, a research scientist at the Canadian Forest Service, Atlantic Forestry Centre in Fredericton, adds, "In New Brunswick, complete coverage by aerial photography is on a 10-year cycle and during this interval about 25 percent of the forest could experience major change. Given this high rate of change and also because requirements of land owners to report on changes are insufficient to maintain an accurate record of the state of the forest, resource managers are considering using satellite remote sensing to monitor changes in the years between successive coverage by aerial photography."

The scientists emphasize that remote sensing will not replace the traditional inventory process. What is recorded by satellite must be linked to what is happening in the forest. But as a means of quantifying change within forest polygon inventories, remote sensing is a valuable tool for resource managers.

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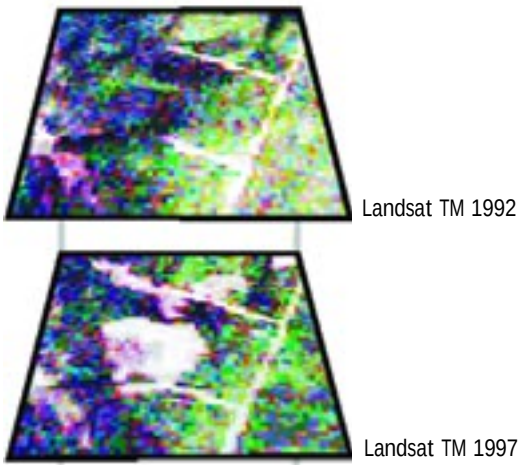

Landsat TM images indicating change over time on a forest site.

Studying Possible Effects o

Research suggests that large-scale fires will be more common as the climate grows warmer.

Cover story

As you tried to warm your frozen hands near the fire during this past cold Canadian winter, the threat of global warming may not have seemed so ominous. But extreme change in weather, even if it feels colder, only further indicates that global warming is occurring. And that may mean an increase of fires far greater than in that hearth you were standing near.

Forest fires have always been of great concern to forest countries like Canada. But despite natural annual fluctuations, fire predictions have been based on somewhat predictable weather patterns. But how will changes in those patterns affect predictions and forest fires in general? The Canadian Forest Service, in collaboration with scientists world-wide, has been researching the relationship between climate change and the potential impacts on forest fire activity.

"Forest fires are highly sensitive to weather and climate," says Dr. Mike Flannigan, a research scientist with the Canadian Forest Service, Northern Forestry Centre in Edmonton, Alberta. "Under current climate change projections, fire frequency and severity can be expected to increase significantly in parts of Canada, with potential major impacts on the global carbon budget."

The global carbon budget is at the core of the climate change issue. Global warming is, basically, a rise in temperature of the atmosphere due to the greenhouse effect, or the retention of the sun's energy by the atmosphere due to a build-up of gases. These gases, the most common of which is carbon dioxide, are transparent to solar radiation but opaque to long-wave radiation, thereby trapping the sun's heat in the atmosphere like glass does in a greenhouse. Studies indicate there has been an increase of carbon dioxide in the atmosphere since the onset of the Industrial Age when humans started burning fossil fuels extensively.

But doesn't the process of photosynthesis mean forests are a sink for carbon? Forests use solar energy to convert carbon dioxide from the atmosphere, storing it in the biomass above and below the soil surface. But fire releases the carbon from the organic matter through the process of combustion. And often fire leaves behind a large influx of dead, decomposing material which also releases carbon.

"Looking at the combustion process alone, we find that on average, forest fires are releasing 27 tera-grams of carbon dioxide per year. That's about 20 percent of what is released through fossil fuels," explains Dr. Flannigan. "Further, it takes 20 to 30 years for the carbon sink to recover after a fire. Studies suggest that if there are enough large-scale disturbances such as fire, the Canadian forest could become a source rather than a sink for carbon."

Research suggests that large-scale fires will be more common as the climate grows warmer, but warming will not be uniform throughout the world nor within Canada. Droughts are predicted in some areas while other areas will have increased flooding.

"National fire statistics demonstrate that during the 1970s about 1.5 million hectares per year burned, but in the 1990s that figure increased to 2.8 million hectares," says Dr. Flannigan. "It's important to note that fire is not necessarily bad for the forest. Some species thrive when fire burns away the overstorey, allowing light-demanding species to thrive. Others flourish in mineral soil where the organic material has been burned away. And still others, who have thick bark and can survive moderately intense fires, have cones that open in fire. But the increase of severe fires over the last few decades cannot be ignored. If this trend continues, changes in disturbance regimes such as fire could have a larger impact on Canadian forests than climate change itself."

Developing Models to Understand and Estimate Climate Change Effects on Forest Fire

Weather forecasters have a difficult time predicting changes on a daily basis, never mind what's going to occur in 100 years. But scenarios are being created based on comprehensive historical collections such as digital GIS databases using satellite imagery. As well, general circulation models and regional climate models are used with the Canadian Forest Fire Danger Rating System to project future fire climate scenarios.

f Climate Change on Forest Fire

Numerous General Circulation Models suggest an average global temperature increase of 0.8 – 3.5°C by 2100, a change unprecedented in the last 10,000 years. Substantial changes are expected for land in northern latitudes, with the greatest warming expected in winter and spring.

"We have coupled such information from the general circulation models with our Canadian Forest Fire Weather Index System to predict future fire danger levels," explains Mike Wotton, a forest fire research officer at the Canadian Forest Service, Great Lakes Forestry Centre in Sault Ste. Marie, Ontario. "This Fire Weather Index system is a series of daily cumulative moisture codes and indexes which predict moisture contents of three distinct fuel layers and integrates these measures to provide daily predictions of potential fire behaviour. In our climate change work, we have focussed on a summary index called the seasonal severity rating which gives a good indication of the potential fire severity over an entire season."

More severe fires may not necessarily result from higher temperatures. A doubling of atmospheric carbon dioxide is predicted, with increases in evaporation over land due to rising air temperatures. Changes in the regional patterns and intensity of precipitation are expected, affecting fire severity.

"More precipitation could result in fewer fires," says Wotton, "but with increased storm activity there is the possibility of more lightning-caused fires so we are studying lightning prediction models as well."

There are other factors to consider in making future fire estimates, like migration of species. If a changing climate results in more deciduous trees, forest fires may not be as severe. And as more forests yield to agriculture and urban sprawl, there is less threat of wildfire. Climate change also affects insect populations, diseases, wind-throw, age structure, and forest composition, all of which influence fire regimes.

Not only are the effects of climate change difficult to predict but so are the sources that influence climate change like changes in solar radiation, volcano activity, plate tectonics, and albedo (see glossary on page 11) and of course, human interaction such as the burning of fossil fuels. But research, including recent studies on the relationship between ocean surface temperatures and fire occurrence, continues.

"My best guess is a 50 percent increase in Canadian forest fires by the year 2050, but that figure could be completely incorrect," adds Dr. Flannigan. "Scientists world-wide are helping to establish high-latitude global change transects in North America and Eurasia, under the International Geosphere-Biosphere Program. These permanent transects will support multi-disciplinary studies into the impacts of global change on northern ecosystems, including the changing impacts of forest fire regimes."

Further study on the changing conditions in the fire-weather relationship will help researchers predict possible outcomes and the most appropriate adaptive measures.

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Fire releases carbon from organic matter into the atmosphere.

Combining Traditional Ecological Knowledge with Science

The Hahulthi project is an attempt to combine traditional ecological knowledge with current science research to accurately practice sustainable forest management.

If you want to understand a west coast old-growth forest, talk to the people who have been living in it thousands of years before that 800-year-old giant cedar was just a seedling. That's the basic logic behind the Long Beach Model Forest Hahulthi project.

The Long Beach Model Forest is one of 11 Canadian Model Forests funded through the Canadian Forest Service. Model forests demonstrate how partnerships can develop among individuals and organizations with diverse forest values and how such pooling of expertise and resources can result in innovative approaches to sustainable forest management. The Hahulthi project is one of the ways that the Long Beach Model Forest Society is promoting that objective on 400,000 hectares of temperate rainforest on Vancouver Island, BC, an area which includes the Nuu-chah-nulth Central Region First Nations in Clayoquot Sound.

The Nuu-chah-nulth explain that Hahulthi refers to their system of the hereditary Chiefs' ownership and accountability to their traditional territories and their people. For generations, the Nuu-chah-nulth's deep respect for nature has resulted in a unique understanding. Chief Councillor for the Tla-o-qui-aht First Nation, Moses Martin, states that it is not the resources that need to be managed, for they manage themselves naturally. It is the human interaction with the resources that must be managed. In the past, this traditional ecological knowledge has been insufficiently understood by forestry planners in the area. The Hahulthi project is an attempt to combine traditional ecological knowledge with current science research to accurately practice sustainable forest management.

"This project was precipitated by a scientific panel of leading forest management experts who recommended that forest planning and practices include the Nuu-chah-nulth interests and traditional ecological knowledge," explains Bodo von Schilling, general manager of the Long Beach Model Forest Society. "A working group consisting of Long Beach Model Forest directors, First Nations, partners and other interested parties developed this project to inform regional planning bodies about Hahulthi and its value to sustainable development as well as to the Nuu-chah-nulth people. This project is very important for all the people in the region."

Through research, interviews, workshops and presentations, the Hahulthi project has been defining the meaning and practices of Hahulthi resource management. The project works toward building relationships between First Nations and non-First Nation cultures and ensures that knowledge is exchanged in a respectful manner.

"This Long Beach Model Forest project is one of the most interesting proposals funded by the Model Forests' Enhanced Aboriginal Involvement Working Group," says Bill Wagner, Model Forests coordinator at the Canadian Forest Service, Pacific Forestry Centre. "It builds a bridge connecting First Nations and non-First Nations communities, bringing them together in understanding."

Adds Crystal Sutherland, one of two First Nations natural resources coordinators for the Long Beach Model Forest, "I think of the project as a river with parallel banks. On one riverbank lies traditional ecological knowledge while the opposite bank contains western science. Resource decision makers can cross the river and draw from the best information on both sides. If they use all the information available to them to make the best sustainable resource decisions, they are acting wisely and have a better chance of success."

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First Nation groups meet to discuss traditional ecological knowledge and the Hahulthi project.

First Five Years of Forestry Funding for First Nations

The First Nations Forestry Program has been providing seed funding to enhance First Nations' participation in forest-based businesses.

All great forests start from small seeds. In the same sense, for the last five years the First Nations Forestry Program has been providing seed funding to enhance First Nations' participation in forest-based businesses.

The First Nations Forestry Program was established in April 1996, funded by Natural Resources Canada, Canadian Forest Service and the Department of Indian Affairs and Northern Development. The program's five-year term ended on March 31, 2001, but funding has just been extended for another year. Over that time, the program supported First Nations' skill development in forestry as well as forest-based business operations and projects. The program also supported the establishment of business partnerships both on and off reserves.

In BC, the First Nations Forestry Program is delivered through a management board composed of twelve members (nine of which represent First Nations and three representing the Canadian Forest Service, the Department of Indian Affairs and Northern Development, and the BC Ministry of Forests) who review and approve project proposals. Applications are received in response to annual call letters that are distributed to all bands and tribal councils as well as interested businesses, organizations and individuals in BC.

"Each proposal is individually reviewed and evaluated against program guidelines and criteria and approval is based upon project merit," says Nello Cataldo, BC Collaborative Forestry Program manager at the Canadian Forest Service, Pacific Forestry Centre. "Because there are so many bands (197) and tribal councils (34) in BC, the management board decided to fund as many communities as possible, which has meant an emphasis on seed or "start-up" funding. Also, priority is given to bands who have not received funding in previous years if the proposals are sound."

In the past five years, 219 project proposals were approved. Projects included market and feasibility studies, business plans, forest management planning, business development, joint ventures and partnerships, silviculture treatments, and forest management and business training. Funding was also provided in support of First Nations organizations, minor capital investments and assisting with workshops, meetings and conferences relating to forestry. Almost 9,000 person-weeks of employment and over 800 direct jobs in First Nations communities were created with the projects approved by the First Nations Forestry Program.

"We received funding from the First Nations Forestry Program in 1996 and 1999," says Dixon Terbasket, natural resources manager for the Lower Similkameen Indian Band near Keremeos BC. "Working with Jeremy Crow, the band's natural resources coordinator, we have been trying to create the capacity for training in land-use planning, wildlife and fisheries management to ensure the area for future generations. The plan is to have more and more people involved in successful sustainable forestry management."

One means of enhancing First Nations participation in forestry may be through a networking forum similar to the Council of Forest Industries. The First Nations Forestry Program management board in BC has initiated discussions about a new association called the Aboriginal Forest Industries Council. This group would act as a technical forum, providing training and advocating industry and consulting services to the aboriginal forest industry. Bands, tribal councils, forestry businesses and industry have expressed support for the idea. An interactive website about this initiative is at: www.aficouncil.org.

For more information about the First Nations Forestry Program, check the national website at www.fnfp.gc.ca, or the First Nations Forestry Program in BC at www.pfc.cfs.nrcan.gc.ca/main/programs/fnfp, or contact Nello Cataldo at ncataldo@pfc.cfs.nrcan.gc.ca.

Log home building for business development and training – Nooaitch Band.

Studying White Pine Regeneration

A multi-disciplinary and multi-agency group of scientists, foresters, and technicians helped plan and design the study and have annually assessed the early results.

Eastern white pine (*Pinus strobus L.*) is important in North America because of its high-quality timber, its role in wildlife habitat and recreational opportunities, and because it has a significant spiritual value. But there has been a reduction of high quality white pine stands due, in part, to past harvesting practices.

To accurately assess the impacts of silvicultural treatments on white pine regeneration, and to ensure sustainability of this resource, the Canadian Forest Service initiated a statistically sound long-term field study in the Petawawa Research Forest near Chalk River, Ontario. A multi-disciplinary and multi-agency group of scientists, foresters, and technicians helped plan and design the study and have annually assessed the early results.

"The study was initiated in 1994 and annually since 1995, six dataloggers equipped with suitable probes have been used to monitor environmental conditions in the understories during the growing season," says Dr. Darwin Burgess, a research scientist at the Canadian Forest Service, Pacific Forestry Centre. "Measured variables include light, soil nutrient availability, soil temperature, soil moisture, air temperature, relative humidity, and rainfall. The main goal is to characterize the environmental conditions necessary for establishment and early growth of white pine seedlings."

Managers may be able to scarify sites prior to harvesting to establish pine regeneration.

A 27-hectare area of 110-year-old natural eastern white pine was treated with three different intensities (one-crown-width opening, two-crown-width opening, and no thinning) of partial cutting. Partial cutting is known to be a suitable harvesting method for eastern white pine in the Chalk River area because of the tree's shade tolerance and its susceptibility to white pine weevil damage when grown in open areas. Site preparation treatments included brush control, scarification, scarification and brush control, and no site preparation. White pine seedlings were underplanted in subplots.

Natural regeneration of white pine has been greatest on non-thinned areas. Generally, the greater the number of seed trees left after thinning in a good seed year, the more regeneration can be expected. Brush control appeared to have little or no effect on pine regeneration establishment.

"Early results indicate that partial cutting in mature pine stands can be completed without causing significant damage to residual trees," says Dr. Suzanne Wetzel, a research scientist at the Canadian Forest Service, Ontario Forestry Centre in Sault Ste. Marie. "And we found that wind-throw losses were small, overall, with the highest percentage occurring in the heaviest thinning treatment area."

Early results show that scarification improved pine regeneration numbers and stocking. Scarification, or mechanical site preparation, is the breaking up of the forest floor to expose the mineral soil thereby enhancing seedling establishment. The process also improves moisture conditions and reduces competition from understorey vegetation.

"The increased root growth of the pine seedlings following scarification may well compensate for any reduction in soil nutrient concentrations," explains Dr. Wetzel. "Nitrogen deficiencies can have a significant effect on total pine seedling biomass. But now, five years after disturbance, nutrient differences are diminishing."

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Glossary

Albedo – the fraction of light that is reflected by the earth's surface

Biomass – organic material, living or dead, above or below the soil surface such as leaves, branches and roots

Datalogger – a portable computing device used to make measurements, collect readings and store data for periods of time

Geographic Information System (GIS) – an organized collection of computer hardware, software and geographic data designed for capturing, storing, updating, manipulating, analyzing and displaying all forms of geographically referenced information

Pixel – "picture element" is the ground area corresponding to a single element of a digital image data set

Plate tectonics – theory dealing with the dynamics of the earth's outer shell (the lithosphere) consisting of a number of plates which move relative to each other and interact at their boundaries, diverging, converging, or slipping relatively harmlessly past each other

Sink – any process, activity or mechanism (e.g. photosynthesis) that removes greenhouse gases or precursors of those gases from the atmosphere

Source – any process or activity (e.g. forest fires) that releases greenhouse gases into the atmosphere

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Comings and Goings

Comings and Goings

Welcome to Werner Kurz, a research scientist working in climate change and landscape ecology. Werner's primary work at the Pacific Forestry Centre is in regional and national carbon budget modelling and the development of landscape planning tools. Werner was most recently employed as a forestry team leader at ESSA Technologies Ltd. in Vancouver.

Welcome to Jim Whybra, UNIX/Oracle Specialist. Jim is responsible for UNIX-based systems within the Pacific Forestry Centre and will be the Oracle DBA. Previously Jim was a programmer/analyst in the software engineering program at the University of Victoria.

Studying White Pine Regeneration
(continued from page 10)

The researchers also found that brush control provided the sites with favourable light conditions which increased soil temperatures as well as available nutrients.

"The long-term effects of these silvicultural treatments on pine regeneration success have yet to be determined but early white pine stocking and growth responses look promising," says Dr. Burgess. "In time we should be able to quantify in detail the understorey environmental conditions necessary to both establish eastern white pine regeneration and accelerate its early growth."

Eastern white pine ranges from Newfoundland to southeastern Manitoba and south through the northeastern and north central United States.

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Upcoming Events

Upcoming Events

The North American Forest Insect Work Conference: May 14 - 18, 2001 – Edmonton, Alberta, Canada

Hosted by the Canadian Forest Service, Alberta Land and Forest Service, and the University of Alberta, the overall objective of the North American Forest Insect Work conference is to consider and discuss the current status and future needs of forest entomology education, research, forest health and forest pest management in North America. For more information, check the web site, http://nofc.cfs.nrcan.gc.ca/nafiwc/or contact Jan Volney, Canadian Forest Service, Natural Resources Canada, (780) 435-7329; email nafiwc@nofc.cfs.nrcan.gc.ca.

The 93rd National Annual General Meeting of the Canadian Institute of Forestry: August 12 - 16, 2001 – Whistler, BC, Canada

Within the theme *Inheriting the Future*, this Canadian Institute of Forestry meeting will concentrate on the challenges and changes facing Canadian forest practitioners in the coming decades. It's an opportunity to share experiences and discuss strategies for dealing with impacts of rapid ecological, social and economic change on forest management at the local level. For more information, check the web site, http://www.cif-ifc.org/agm2001/default.htm or contact Robin Clark at (604) 737-0838; fax: (604) 737-4262; email rclark@istar.ca.

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