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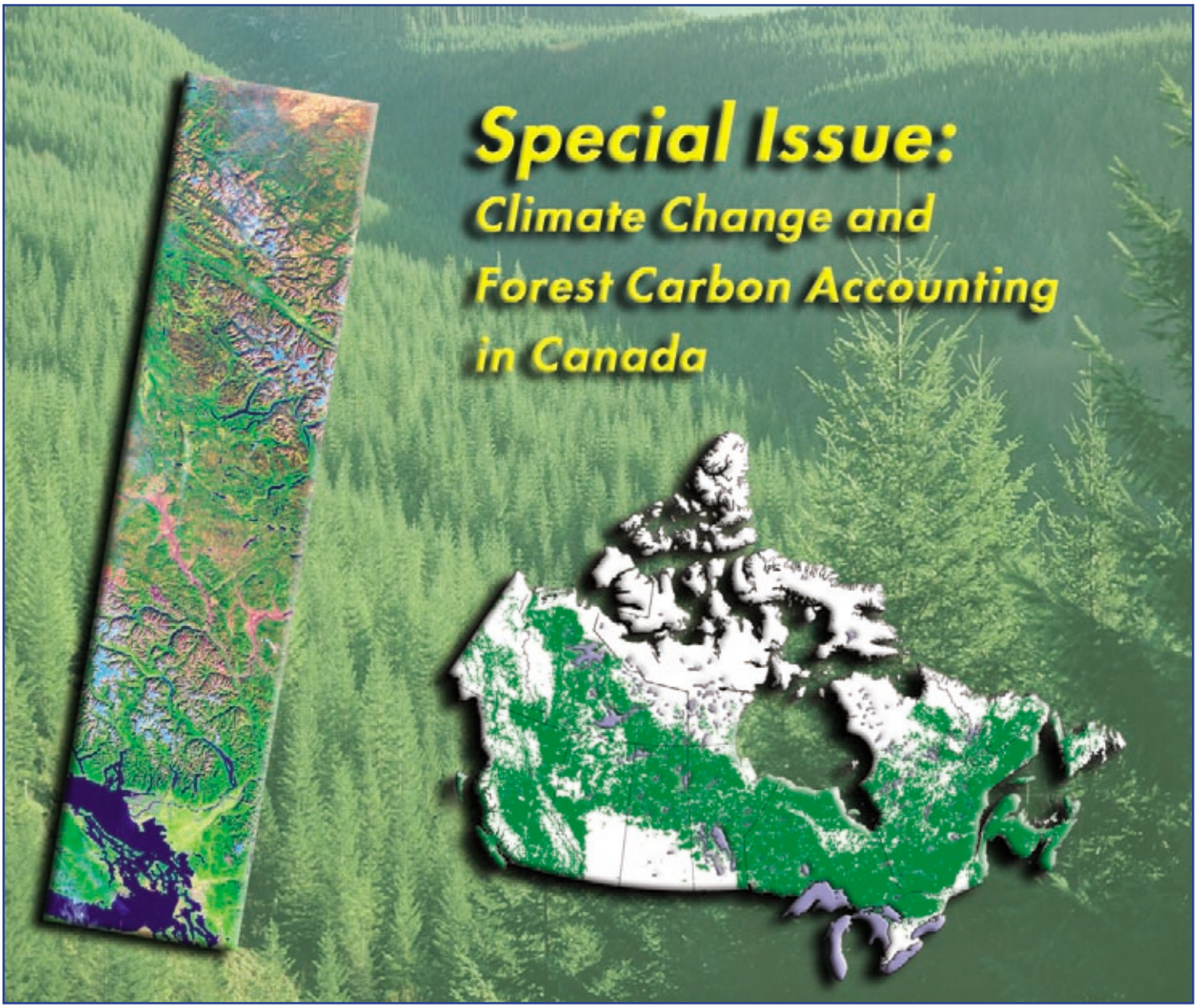

Natural Resources Canada
Canadian Forest Service

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Canada

Climate Change and Natural Resources Canada

"Natural Resources Canada will help to ensure that the country's response to this global issue will include policies that are based on sound science."

"A change in the weather is sufficient to recreate the world and ourselves."
– Marcel Proust, French novelist

Proust could not have known how apropos his words would be today. Long-term change in the average temperature of the Earth, commonly referred to as global warming, is expected to lead to changes in precipitation, wind patterns, and frequency of severe weather events. Such changes could have disastrous environmental, social and economic consequences worldwide. Temperature records indicate that the last decade was the warmest on record and other research suggests that the 20th century was the hottest in over 1200 years. Although scientists recognize that the warming is a combination of human and natural factors, there is increasing evidence that most of the warming over the last 50 years is attributable to human activity.

In 1997 the Kyoto Protocol to the United Nations Framework Convention on Climate Change established an international agreement on quantified greenhouse gas emission targets for all industrialized countries. At that time Canada committed to reducing its greenhouse gas emissions to six percent below 1990 levels during the period between 2008 and 2012. The Canadian government has been undertaking various actions to address climate change over the past decade. For example, recently the Government of Canada released a series of policies and measures to address climate change through Action Plan 2000 which, once fully implemented, are expected to take the country to about one-third of the way to its greenhouse gas emission reduction commitments.

Green indicates forest cover in Canada.

The Kyoto Protocol will go into force if it is ratified by at least 55 countries accounting for 55 percent of industrialized countries' carbon dioxide emissions in 1990. Following consultations with provinces, territories, and the Canadian public, Canada will consider ratification of the Kyoto Protocol and how it should be implemented. Meanwhile, the country continues to develop and deploy the technology and do the scientific research necessary to find solutions to climate change issues and to cut greenhouse gases. Natural Resources Canada is one of the federal departments providing the scientific expertise on global warming.

In partnership with researchers across the country and throughout the world, Natural Resources Canada scientists are working to increase knowledge about potential climate change impacts on the environment and to provide possible means of adapting to those changes. Such research includes comprehensive economic analysis to determine the costs and risks involved with climate change.

"Both nationally and internationally, the issue of global warming requires a linking of science and policy," says Tony Lemprière **(available at Tlemprie@nrcan.gc.ca),** a senior economist with Economics and Statistical Services at the Canadian Forest Service, Natural Resources Canada and a member of Canada's negotiating team in the international climate change negotiations. "Natural Resources Canada will help to ensure that the country's response to this global issue will include policies that are based on sound science."

Global warming has been referred to as one of the most significant issues in the planet's history. Objective, quantitative research is necessary to further international knowledge on the potential impacts of climate change so that strategies can be developed to mitigate or adapt to changing conditions.

Climate Change and the Canadian Forest Service

"Reporting on scales of this magnitude requires partnerships between federal, provincial and territorial governments as well as universities and industry throughout this country and world-wide."

"The world's a scene of changes; and to be Constant, in Nature were inconstancy; For 'twere to break the laws herself has made."
– Abraham Cowley, English poet

In some ways, the relationship between global warming and the forest is a matter of degrees: degrees in terms of temperature; degrees in terms of latitude; degrees in terms of magnitude. An increase of a few degrees in Earth's temperature could cause, for example, forest pests, diseases and fires at higher latitudes, resulting in varying degrees of consequences.

The United Nations Framework Convention on Climate Change addresses global warming at an international level in an attempt to ensure a sustainable future. With sustainability as part of its mandate, the Canadian Forest Service is investigating forest response to climate change in partnership with other federal governmental departments, provincial and territorial governments, industry, academia, and other nongovernmental organizations across Canada and throughout the world.

As steward to one-tenth of the world's forests, Canada has a vested interest in the sustainability of its forests. Besides studying how climate change might cause an increase in forest disturbances, the Canadian Forest Service is also researching possible changes to the forest landscape in terms of ecosystem functioning, range of tree species, and forest structure and composition. Such global warming research is headed by the Climate Change Network at the Canadian Forest Service, Northern Forestry Centre.

The Canadian Forest Service is researching climate change to determine possible changes to the forest landscape.

Although playing an essential part in all climate change research undertaken by the Canadian Forest Service, the Pacific Forestry Centre is particularly focussed on developing a carbon accounting framework for the country. Since carbon dioxide is a major greenhouse gas, estimating the size of carbon exchanges between the atmosphere and the forest is central to climate change research. Whether forest carbon stocks are increasing – a carbon sink, or decreasing – a carbon source, fluctuates over time. The Canadian Forest Service has been tracking carbon stocks and fluxes in forest ecosystems since the 1980s through the Carbon Budget Model of the Canadian Forest Sector, a computer simulation which incorporates observed inventory data and numerically modeled processes. Carbon accounting information is vital not only to address the requirements of the Kyoto Protocol if it is ratified, but for reporting land use changes and carbon credit trading between provinces or internationally, should Canada pursue that option.

"Current climate change research is in part a response to the international need for forest observations on global, regional and local levels," says Evelynne Wrangler **(available at ewrangle@pfc.cfs.nrcan.gc.ca)**, Director of Forest Informaton at the Pacific Forestry Centre. "But reporting on scales of this magnitude requires partnerships between federal, provincial and territorial governments as well as universities and industry throughout this country and world-wide."

The climate change initiatives detailed on the following pages demonstrate some of the current work underway at the Pacific Forestry Centre to ensure that Canada's forests remain sustainable.

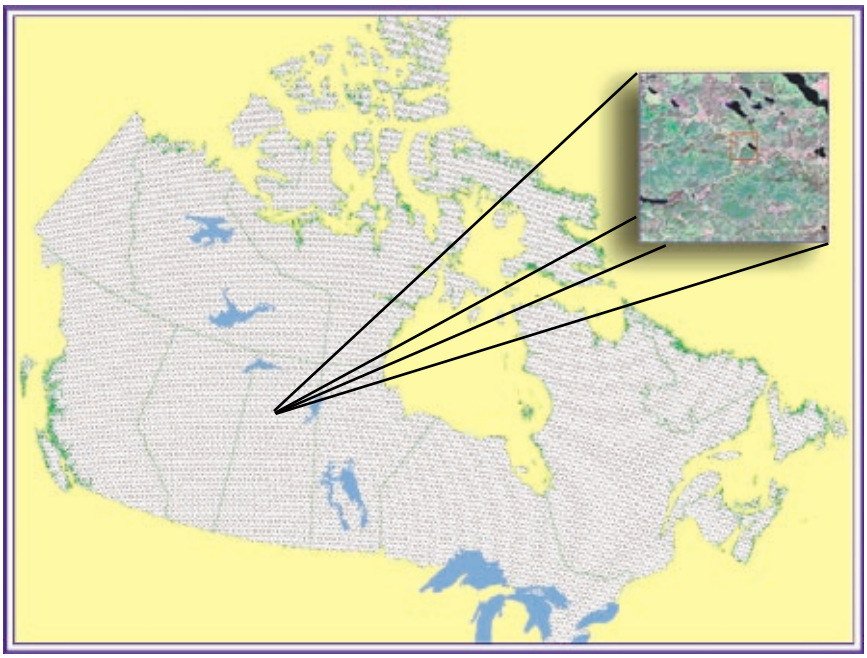
Canada's New National Forest Inventory

"The new inventory will provide national data on status and trends on 25 attributes of sustainability as well as data to support national and international initiatives."

Essential to research on climate change is, of course, the ability to monitor change. The degree to which global warming affects the forest can only be determined by comparing what was to what is. The Canadian Forest Service is developing a new National Forest Inventory to provide accurate, timely data about the state of Canada's forests. Unlike its predecessor, the new National Forest Inventory will use common data standards making it conducive to change assessment.

Every five years for the past approximately 25 years, a National Forest Inventory has been compiled in Canada by aggregating provincial management inventories. Although providing invaluable forest resource information, these inventories reflect data of various areas, ages and standards and therefore cannot be used to accurately monitor change. The new National Forest Inventory, however, is a network of permanent plots located across the Canadian landscape, allowing for successive sampling.

"Having permanent inventory plots means that change can be estimated from repeated measurements," explains Mark Gillis **(available at mgillis@pfc.cfs.nrcan.gc.ca)**, manager of the National Forest Inventory. "The purpose of the new National Forest Inventory is to assess and monitor the extent, state and sustainability of Canada's forests in a timely and accurate manner. The new inventory will provide national data on status and trends over time on 25 attributes of sustainability as well as data to support national and international initiatives such as the Kyoto Protocol and the United Nations FAO Resources Assessment."



The plot design of the new National Forest Inventory.

To provide reliable area statistics, the objective is to survey a minimum of one percent of Canada's land mass. A one percent sample on a 20 X 20 km network results in approximately 22 000 sample plots. For plots located on the 20 X 20 km network, an area of 2 X 2 km around each node will be identified on conventional mid-scale aerial photography, and will be delineated and interpreted in full according to land cover classes and other forest stand attributes. Satellite imagery will be used as a surrogate for aerial photography to provide attribute data for areas not covered by photo or ground plots, for example in Canada's north. Attributes to be estimated from aerial photographs include area, landcover, forest type, age and volume of trees, disturbance activity, land use changes such as reforestation, afforestation and deforestation, mortality, access and human influence, and soil erosion.

"The new National Forest Inventory in combination with the other reporting tools will give us an accurate picture of our forests," says Gillis. "For example, the one percent sample can be enhanced with the remote sensing products being produced through the EOSD initiative." (detailed on page 6)

Although coordinated by the Canadian Forest Service, the new National Forest Inventory is an interagency partnership, dependant on cooperation with other federal departments, the provinces and territories, as well as industry. Essentially, the partners provide the data while the Canadian Forest Service develops the standards, procedures and infrastructure of the new inventory, and conducts the analysis and generates reports. This is all done under the guidance of the Canadian Forest Inventory Committee.

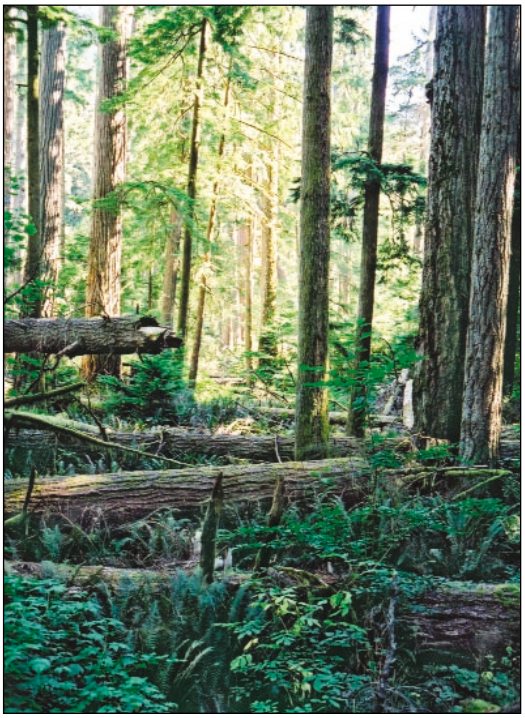
Building a National Forest Sector Carbon Monitoring, Accounting and Reporting System

"We will be able to project into the future and determine the consequences of environmental changes and management activities."

It's a concept expressed by Newton and proven by time: science is indebted to the science that preceded it. Current forest carbon accounting research underway at the Canadian Forest Service is no exception.

The National Forest Carbon Accounting Program is a national initiative involving Canadian Forest Service researchers from across the country with the lead at the Pacific Forestry Centre. The program is developing the framework for a national forest sector carbon monitoring, accounting and reporting system. This framework will be built upon decades of science as well as current research from within the Canadian Forest Service, other federal departments, the provinces and territories, forest industry, universities and other communities.

"For the past decade the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS2) has been applied to analyze past and future forest biomass and dead organic matter carbon stock changes, and has helped explore possible scenarios concerning natural disturbance, forest management, growth and decomposition rates," says Dr. Werner Kurz, **(available at wkurz@pfc.cfs.nrcan.gc.ca),** a research scientist at the Pacific Forestry Centre. "We are now expanding and enhancing that scientific research tool, turning it into an operational tool so that process and risk analyses can be conducted. By tracking what has happened and what is happening with carbon stocks in our forests, we will be able to project into the future and determine the consequences of environmental changes and management activities."



Carbon budget modeling tracks above- and below-ground biomass and the dynamics of dead organic matter in forest ecosystems.

Adds Dr. Mike Apps **(available at mapps@pfc.cfs.nrcan.gc.ca)**, a Northern Forestry Centre research scientist working at the Pacific Forestry Centre, "This initiative will help decision makers at all levels – from the individual wood lot owner to the large forest company, to provincial analysts and national policy makers – make informed decisions concerning the forest in a changing environment. These decisions will be based on sound science that is consistent throughout of the country and is transparent, providing the foundation for verification and validation from the international community."

This new framework will incorporate existing forest information, such as forest inventories, temporary and permanent sample plots, and systems quantifying forest growth and yield developed by the forest community over the last several decades. New scientific methods and models to predict ecosystem carbon dynamics will further enhance the traditional forest information. The system will also obtain information on the extent and impact of landscape-level events such as wildfire, insect outbreaks, harvesting and land-use change, all of which affect carbon stocks and dynamics.

"Forest ecosystems are both large stores of carbon and, depending on the stage of stand development, can either be sources or sinks of carbon," explains Dr. Kurz, a contributor to the Intergovernmental Panel on Climate Change, who is helping to develop the Special Report on Good Practice Guidance on forest carbon stock accounting. "This new accounting framework, operating across a range of spatial scales, will improve our understanding and quantify the contribution of Canada's forests to the carbon cycle. Through scenario analyses of forest management actions, natural disturbances and climate change responses we will be able to evaluate the factors influencing the carbon budget and the extent to which we have control over these factors."

"Although of course we only have limited control over natural disturbances," adds Dr. Apps, also a contributor to the Intergovernmental Panel on Climate Change, "the intent is to develop management strategies that will help forests retain carbon – to be carbon sinks."

Developing the framework for a national forest sector carbon monitoring, accounting and reporting system will continue to be a process involving consultation with federal departments, provinces, territories, the forest industry, universities and other Canadian communities. And, as climate change is a global issue, research will continue in collaboration with researchers across the globe.

Earth Observation fo
Using Space-Based Technol

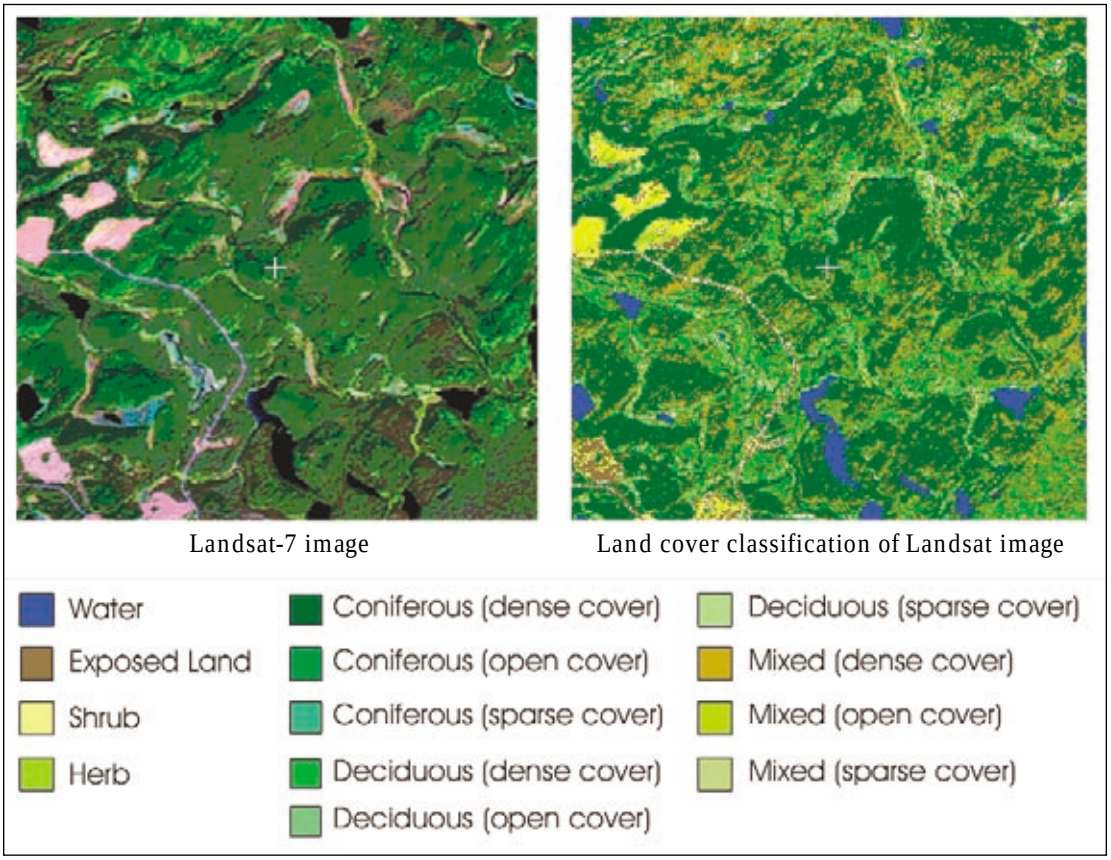
"To respond to national and international issues related to climate change and the sustainable development of its forests, Canada requires a forest measurement and monitoring system that can provide timely forestry information."

Canada's huge landmass is almost 50 percent forest. These forests make a significant contribution to global cycles by filtering air and water, regenerating soils, and preventing erosion. To respond to national and international issues related to climate change and the sustainable development of its forests, Canada requires a forest measurement and monitoring system that can provide timely forestry information. A next generation measurement and monitoring system is being developed to address key policy issues by identifying and bringing together the best available geographic information and tabular data.

The Canadian Forest Service, in partnership with the Canadian Space Agency, has developed an initiative using space-based earth observation technologies to create products in support of the forest measurement and monitoring system. Called Earth Observation for Sustainable Development of Forests (EOSD), the project will produce map products to help address Canada's national and international reporting requirements. EOSD, along with the other projects outlined in this issue of Information Forestry, is a component of the next generation measuring and monitoring systems.

EOSD products include a landcover map of forested areas of Canada that will be produced using Landsat Thematic Mapper data. Change monitoring methodologies and systems will be developed to provide spatially explicit maps of major forest changes. As well, a combination of remotely sensed data and forest inventories techniques are being developed to map the forest biomass of Canada.

"The EOSD project provides satellite data to enhance the basic National Forest Inventory design," says Jim Wood **(available at jwood@pfc.cfs.nrcan.gc.ca)**, Director of Forest Resources at the Pacific Forestry Centre and program manager of EOSD. "Satellite remote sensing will enhance the National Forest Inventory by providing the attribute data for remote northern areas and offering the



The EOSD will use space-based earth observation technologies to create products in support of a forest measurement and monitoring system.

or Sustainable Development:
ogy for Monitoring Canada's Forests

potential to extend the inventory beyond the photo plots. This would provide information on the entire land base."

The EOSD project is also making a significant contribution to the National Forest Carbon Accounting Framework. Wood explains, "The EOSD project will, for example, provide forest cover maps and methods for mapping biomass. The biomass maps will be used to fill gaps in the national biomass inventory. The EOSD project will also provide techniques using satellite data to identify areas affected by land-use change and natural disturbance events such as fire, insects and harvesting, and will help to identify areas where the land-use has changed."

Spatial information will be produced with the aid of automated process that can be used for analysis, visualization, and integration with other national spatial data sets.

"The analysis methodologies, visualization tools, and automated procedures are products which will benefit the value-added industry," says Wood. "EOSD products will be made freely available via the National Forest Information System."

It is anticipated that after the successful completion of the EOSD project, satellite imagery and analysis methods will be an important component of an operational system to monitor and report on Canada's forests.

Satellite Mapping of Canada's Forest Biomass

One EOSD project is the mapping of Canada's forest biomass by satellite. Biomass – the mass of forest matter per unit area – is a basic forest property linked to many forest ecosystem processes. Satellite imagery will provide spatially explicit information on forest biomass for monitoring and reporting on several criteria and indicators of sustainable forest management.

Forest biomass information plays a significant role in assessing carbon stocks and is an important element in global change and productivity models. Biomass is also a measure of forest structure which influences biodiversity. This EOSD project will estimate forest biomass by coupling satellite remote sensing imagery with other environmental data and may extend existing forest inventories into areas where they are either outdated or unavailable.

"The satellite mapping will complement National Forest Inventory efforts to produce complete coverage of the forest biomass of Canada," explains Joan Luther **(available at jluther@nrcan.gc.ca)**, a research scientist at the Canadian Forest Service, Atlantic Forestry Centre in Corner Brook, Newfoundland. "The biomass mapping method that we are working on estimates forest biomass at the forest management stand level using forest cover type and structure information obtained from Landsat Thematic Mapper data. This project will provide the country with a stand-level biomass mapping capability to fill gaps in the national biomass inventory."

Measuring biomass is a complex process requiring modeling at tree and stand levels. Moreover, Canada's large land mass holds a wide diversity of ecosystems of which there is limited data to support modeling efforts. Coupling this with biomass inventory techniques that vary between provinces makes biomass mapping a challenging undertaking.

"Several pilot regions representing the diversity of Canada's ecosystems have been established for developing, testing and evaluating this mapping method," says Luther. "Besides satellite imagery, these pilot regions have databases which include provincial forest inventory sample plots and digital maps, climate attributes such as growing degree days, precipitation and moisture index, national topographic data, digital elevation models and soil landscapes."

This project is just one of the many Canadian Forest Service initiatives which will help provide the world with timely, accurate knowledge about the state of Canada's forests.

The National Forest Information System: A Tool in Support of Carbon Accounting

"The National Forest Information System provides the framework to allow information sharing to happen."

Keeping track of Canada's forests means pulling together information from across the country. Government, First Nations, industry and non-governmental organizations all collect data about the forests in their area, making information on Canada's forests abundant but difficult to piece together. Under the Canadian Council of Forest Ministers (CCFM), Canadian Forest Service researchers at the Pacific Forestry Centre, in cooperation with provincial and territorial partners and Canada's GeoConnections, are working on a framework called the National Forest Information System (NFIS) to access and report information on Canada's forests.

Carbon accounting is an ideal example of how this system could be used. The fluctuating nature of carbon stocks, from carbon sinks to carbon sources, means researchers must keep a regular watch on all the pieces of information to estimate the state of the forests. The NFIS will help them do just that.

"Carbon accounting, like many other forest research areas, requires access to information holdings. The National Forest Information System could be used as a mechanism to access information from provinces, industry and other groups," says Dr. Robin Quenet, **(available at rquenet@pfc.cfs.nrcan.gc.ca)** a research scientist at the Pacific Forestry Centre working on the NFIS development team. "The National Forest Information System provides the framework to allow information sharing to happen."

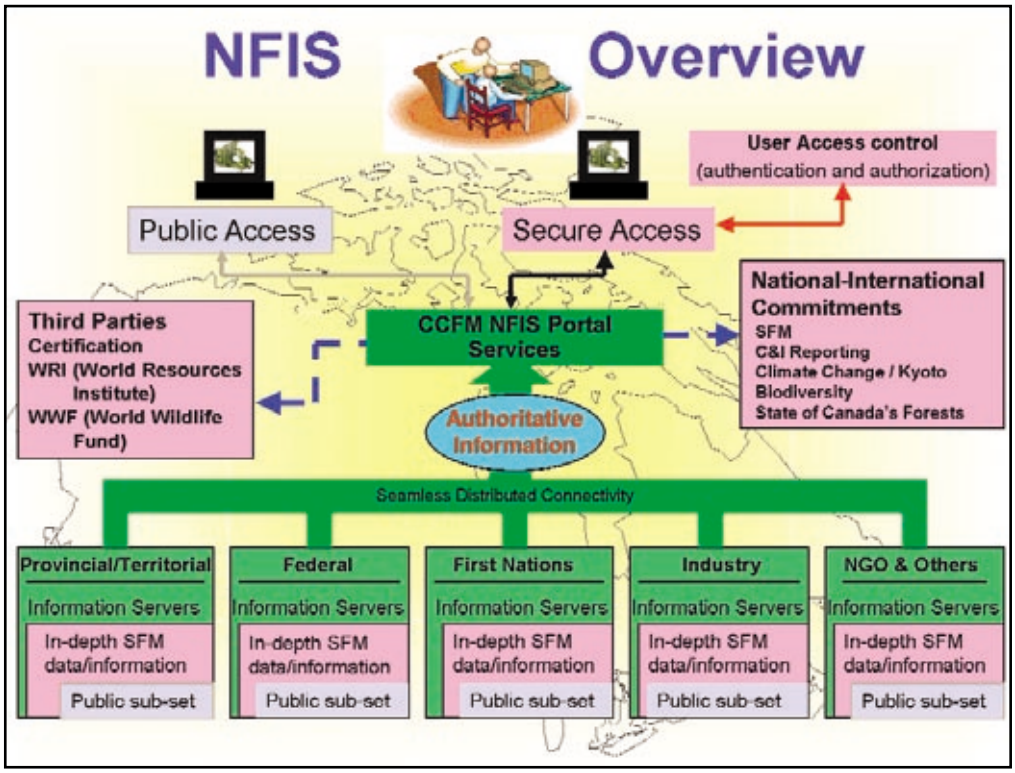
Types of information proposed for sharing on the NFIS include: forest cover including species, age, volume and disturbance history; transportation infrastructure; silviculture activities; protected areas; relief; administrative boundaries and other forestry-related information. Carbon accounting researchers are interested in factors such as forest stand age, management practices and natural disturbances.

Information from different groups will be registered on the NFIS. Researchers can use the system through a Web-based gateway to tap directly into source data held by custodial agencies and other special interest groups. Results of their research can then be captured through NFIS and made available through NFIS Web reporting tools and services.

Access to the information and servers will be secure and controlled. Authentication and authorization user access to information holdings will be controlled by the partnering organizations. Access may range from highly restricted access with full resolution data to synthesized information with unrestricted public access.

"We are building the highway across which information will travel. This highway is based on a data warehouse infrastructure conforming to international standards for the storage and integration of spatial and non-spatial forest resource information and a distributed architecture for locating and accessing the data" says Rick Morrison, **(available at rmorrison@pfc.cfs.nrcan.gc.ca)** a

continued on page 11



The full implementation of the National Forest Information System would provide access to authoritative data sets and information from a variety of sources across the country. (SFM = Sustainable Forest Management)

Tracking Deforestation and its Carbon Consequences

"Canadian Forest Service researchers are developing a reliable generic method of detecting and monitoring deforestation and its carbon consequences."

As human history demonstrates, the conversion of forests to other uses – deforestation – is not a modern phenomenon. But exactly how much forest is disappearing and how does that affect the amount of carbon dioxide in the atmosphere? Canadian Forest Service scientists are developing a way to answer that question by tracking deforestation and its consequences.

"Current estimates on deforestation in Canada are based on the best knowledge available," says Dr. Don Leckie **(available at dleckie@pfc.cfs.nrcan.gc.ca)**, a research scientist at the Pacific Forestry Centre, "but sometimes it has been difficult to obtain reliable information."

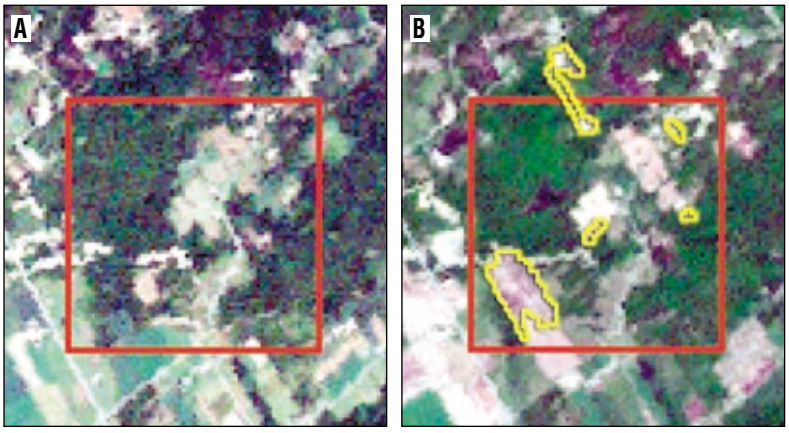
Canada will be required to report on the consequences of deforestation if the Kyoto Protocol is ratified. Also, the United Nations Framework Convention on Climate Change requires reporting on deforestation as part of its national greenhouse gas emissions and removal inventory. Dr. Leckie and other Canadian Forest Service researchers are developing a reliable generic method of detecting and monitoring deforestation and its carbon consequences.

The core design is based on the new National Forest Inventory sampling network, supported by satellite imagery and aerial photography. The basic National Forest Inventory sampling network consists of 2 X 2-km plots on a 20 km grid for which land cover and stand attributes are interpreted from medium-scale aerial photography. Using satellite images from two time periods, forest clearings are highlighted and probable deforestation areas are delineated for an enhanced sampling grid every 10 km or denser. Some areas, close to urban development, may be obvious cases of deforestation. Aerial photography, high resolution satellite data, map information, existing records and on-the-ground visual interpretation will also be used to help confirm some cases of uncertain interpretation. Satellite image interpretation will be adjusted according to known deforestation cases on National Forest Inventory plots determined from air photo interpretations as part of the National Forest Inventory system.

"To test the design, a joint project has been developed between the Pacific Forestry Centre, the Geomatics and Data Acquisition section of the Ontario Ministry of Natural Resources, the Eastern Ontario Model Forest and Environment Canada's Greenhouse Gas Division," says Dr. Leckie. "Two test sites have been identified: 5,000 km^2 of Leeds-Grenville County, which includes part of the Eastern Ontario Model Forest, and another 9,100 km^2 in Simcoe County. On both sites, the results will be interpreted and then compared with photo interpretation of National Forest Inventory plots."

When areas of deforestation have been identified, the next step will be to estimate the amount carbon stock removed. The deforestation estimation work is part of a larger effort and is combined with work of a Canadian Forest Service team developing the Carbon Budget Model of the Canadian Forest Sector to determine the carbon consequences of the deforestation. The stock of carbon on each site prior to deforestation will be estimated by reference to the existing forest inventory information for that site or from average carbon stocks for similar stand types in the region. Carbon accumulation from the new land cover will be accounted for in general terms by estimation and modeling based on the typical values for the new surface cover. The Carbon Budget Model of the Canadian Forest Sector will be used as the basis for the various carbon estimates.

In a country the size of Canada, our vast land base and irregular spatial pattern of deforestation activities pose a challenge for the development of a reliable, operational deforestation monitoring and greenhouse gas accounting system. The integrated system being developed at the Pacific Forestry Centre should form a sound basis for a national deforestation measuring and reporting system.



By using satellite images from two time periods, probable deforestation areas are determined. A: 1990; B: 2000; yellow lines indicate deforestation.

Global Warming Research from the Ground Up

"Global warming will have an enormous impact on the forest carbon cycle which is sensitive to even minor disturbances."

Besides research directly related to how Canada will meet its international reporting requirements, there are many other scientific studies concerning climate change underway across the country. The Pacific Forestry Centre heads one of the long-term studies, the Canadian Intersite Decomposition Experiment (CIDET). A cooperative research project involving 20 researchers from the Canadian Forest Service, other federal departments, universities and provincial governments, CIDET examines litter decomposition and nutrient mineralization in Canada's forests.

Canadian forests store large amounts of carbon in the decaying organic detritus originating from plant litter. Found mostly on the forest floor, detritus is an integral part of the carbon cycle. Global warming will have an enormous impact on the forest carbon cycle which is sensitive to even minor disturbances. Warmer temperatures may increase the rate of decomposition of organic detritus, which in turn could accelerate the rise of atmospheric carbon dioxide levels, thus increasing global warming.

Collecting litter bags at a CIDET site.

Since 1992, CIDET has been examining the relationship between litter decay rates, litter quality and climate. Almost 11,000 bags of foliar litter comprised of Douglas-fir, beech, aspen, black spruce, tamarack, bracken fern, fescue, western redcedar, jack pine, white birch and blocks of western hemlock wood were placed in 21 forest sites across a range of Canada's ecoclimatic regions. Sets of bags are collected annually from four plots on each of the sites and analyzed for weight loss as well as carbon, nitrogen and phosphorous content. Measurements on soils and microclimate are also taken and mean temperature, potential evapotranspiration and total precipitation at each site is collected.

"The rate at which litter decomposes depends on the climate, vegetation structure, soil, and soil organisms found at a site as well as the litter chemistry," says Dr. Tony Trofymow **(available at ttrofymow@pfc.cfs.nrcan.gc.ca)**, research scientist and head of the study. "The most easily decomposed material breaks down within three years but CIDET allows us to look at the effects of temperature and moisture on the more resistant organic matter fractions of this litter."

Dr. Trofymow explains that for short-term decay rates there are three variables which could explain 73 percent of the variance of percent mass that remains after three years, for all sites and material types. These variables are mean annual temperature, mean annual precipitation, and the ratio of Klason lignin (a resistant organic matter fraction) to nitrogen.

"Given the known links between temperature, moisture and decomposition – rates of decay which are based on predictions from three global circulation models for climate change – would increase by four to seven percent of current rates," says Dr. Trofymow. "Eventually we will have enough information to predict the rate of litter decomposition using the models and site data for most forest types in Canada. Such data will be invaluable to the calibration of the Carbon Budget Model of the Canadian Forest Sector."

CIDET complements similar long-term experiments underway in the U.S. and Europe. Such research supports the need for a global understanding of the relationship between climate change and forest litter decay.

Recent Publications

Effects of Silvicultural Systems and Vegetation Control on Tree Growth in a Coastal Montane Ecosystem: Seven Year Results. 2002. Senyk, J.P. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Technology Transfer Note 29. 4 p.

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Report on forest pest conditions, Queen Charlotte Islands, British Columbia, 2001. 2002. Turnquist, R.; Garbutt, R.W.; Nealis, V.G. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. 9 p.

Some management implications from an eastern white pine regeneration experiment. 2002. Burgess, D.S.; Pinto, F.; Wetzel, S. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Technology Transfer Note 28. 6 p.

The effects of prescribed burning on mountain pine beetle in lodgepole pine. 2001. Safranyik, L.; Linton, D.A.; Shore, T.L.; Hawkes, B.C. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-391. 9 p.

The effects of soil temperature and site preparation on subalpine and boreal tree species: a bibliography. 2002. McKinnon, L.M.; Mitchell, A.K.; Vyse, A. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-394. 29 p.

NFIS overview
(continued from page 8)

senior systems scientist at the Pacific Forestry Centre. "We're at the forefront of development in terms of applying distributed architecture to forestry applications."

"Canada has many international commitments. We need to be able to access and integrate information from across the country to meet our reporting commitments. When the information is processed, the system is designed to be a reporting mechanism for international commitments," says Dr. Quenet. "It's a timely thing we're doing."

Three provinces, Ontario, BC and Newfoundland are currently connected and planning is underway to connect all provinces and territories in the next development phase.

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."

Glossary

Afforestation – The establishment of a tree crop on an area which either has never been a forest or where trees have not grown for a very long time.

Deforestation – Clearing an area of forest for another long-term use.

Greenhouse gases – Gases (such as water vapor, carbon dioxide, tropospheric ozone, nitrous oxide, and methane) that are transparent to solar radiation but opaque to longwave radiation. Similar to glass in a greenhouse, these gasses trap heat in the atmosphere.

Reforestation – The reestablishment of trees (by natural or artificial means such as planting or seeding) on an area where forest vegetation has been removed.

IUFRO Silviculture Conference Mountain Forests: Conservation and Management July 29 – August 2, 2002 Vernon, BC Canada

The conference will provide a forum at which forest researchers and practitioners from around the world can present and discuss the latest findings from their research on mountain forests and management issues. Emphasis will be on silvicultural challenges and solutions.

For further information, check the web site at www.mountainforests.net or contact Tom Rankin, Forest Continuing Studies Network, Tel. (250) 573-3092; Fax: (250) 573-2882; E-mail: Tom.Rankin@fcsn.bc.ca

Comings and Goings

Welcome to new director

Evelynne Wrangler, Director of Forest Information.

Welcome to Evelynne Wrangler, Director of Forest Information at the Pacific Forestry Centre.

Evelynne is on a two year Interchange Canada program from the Alberta provincial government where her most recent assignment was Senior Forestry Advisor for the Departments of Environment and Sustainable Resource Development. Her responsibilities included advising Ministers and senior department staff on Canadian Council of Forest Ministers initiatives (including climate change and a national forest information system), liaison with other provincial, territorial and federal forestry personnel, policy analysis, and participation in cross-ministry initiatives related to the forest sector, especially climate change and trade.

Evelynne obtained a B.Sc. (combined Honours) from the University of BC in 1971, a BSc in Forestry from the University of Alberta in 1978, and a Certificate in Management Development at the University of Alberta in 1984. She is a registered professional forester in the provinces of BC and Alberta and a member of the Canadian Institute of Forestry.

Evelynne is a former president of the Alberta Registered Professional Foresters and a former national president of the Canadian Institute of Forestry.

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