Volume 1, No. 1, Spring 1997

Network News

Forest Health & Biodiversity

Canadian Forest Service - Atlantic Forestry Centre

Science and Technology Networks

The Canadian Forest Service (CFS) is reorganizing its science and technology (S&T) programs to better reflect the changing circumstances and needs of Canada's forest sector.

The CFS has adopted a national network-based approach to deliver its entire S&T program. These networks will allow the CFS to address national and international issues while delivering programs through regional research centres. The networks will be better suited to create partnerships and alliances, between the CFS and outside agencies, to undertake specific projects and to identify and address strategic national issues.

Ten S&T Networks are being put in place: Forest Health, Climate Change, Forest Biodiversity, Forest Ecosystem Processes, Effects of Forest Practices, Landscape Management, Fire Management, Pest Management Methods, Tree Biotechnology and Advanced Genetics, and Socio-economic Research.

The Science and Technology Program

The CFS's S&T program promotes sustainable forest management and a competitive Canadian forest sector through the development and implementation of knowledge, databases and technology.

The main purpose of the S&T program is to support the forest sector to develop the tools to ensure sustainable forest management.

The CFS S&T program has five themes:

- Developing technologies to integrate information and to support decision-making
- Maintaining and enhancing forest ecosystem health
- Maintaining and enhancing forest ecosystem productivity
- Forests and global systems
- Enhancing industrial competitiveness and preserving market access

Almost all elements of the program affect sustainable forest management and, directly or indirectly, affect access to global markets, wealth and job creation, and the protection and maintenance of environmental quality. Some elements (e.g., fire management and biological control) also affect public health and safety.

What is the focus of the networks?

Networks are formed around strategic policy issues and associated research priorities at the regional, national and international levels, according to the mandate, resources, facilities and expertise of the CFS. In time, as the networks attract more partners, the scope of the networks may grow to reflect a more complete array of needs and opportunities across the sector.

To ensure that the S&T Network activities are relevant to the forest sector, the programs will not only build on a series of scientific partnerships and alliances, they will also focus on the transfer of technology to resource managers and other clients, links between corporate policy and sector policy, and international agreements and commitments. In future, S&T Networks will encompass most of the CFS's science-related program activities in response to national and international policy issues.

Continues on page 2

Contents

Natural Resources Canada
Canadian Forest Service
Ressources naturelles Canada
Service canadien des forêts
Canada

Forest Health & Biodiversity Networks

The Atlantic Forestry Centre will assume the lead for two of the ten national S&T networks. Although the critical mass of expertise for Forest Health and Forest Biodiversity networks will be located in Fredericton, there will be expertise in each of the other four CFS establishments located across the country and these two S&T networks will be accessible through any of these CFS centres of excellence.

Forest Health Network: this network comprises three fundamental programs, each program having strategic focuses:

The Air Pollution Effects program will

- conduct research to clarify the role of air pollutants and UV-B radiation in the changing health of Canada's forests
- develop new scientifically-based tools and indicators to improve the accuracy of forest health assessments
- provide scientific support for departmental and government commitments under memoranda of understanding (MOUs) and treaties/conventions dealing with air pollutants.

The Methods Development program will

- determine indicators of change and their incorporation into effective and pertinent monitoring systems
- provide analytical tools to integrate monitoring data and generate sound assessments of forest health
- link the atmospheric research activities of the Network, other CFS science and technology networks and external agencies, such as the USDA Forest Service and Environment Canada, in collaborative development and implementation of health indicators.

The Monitoring and Analysis program will

- provide information to departmental policy makers for use in formulating policies or negotiating national and international agreements and regulations
- contribute to the enhancement of Canada's international trading position through Criteria & Indicators(C&I) and quarantine-related activities
- report on how the health of Canada's forests is changing and, in cooperation with the other Network program elements, determine why it is changing

The Forest Biodiversity Network, similar to the Forest Health Network, consists of three, strategically-oriented programs:

Program 1 focuses on the development of methods, measurement and benchmarks, and it comprises:

- the development of methods and indicators of forest biodiversity
- the measurement of forest biodiversity and population viability
- the identification of "critical" or "keystone" species, habitats and ecosystems.

Program 2 is specific to the assessment of impacts on forest biodiversity and is concerned with:

- the impacts of human activities on genetic, species and ecosystem biodiversity
- the relationships between forest biodiversity and environmental changes, particularly climate change.

Program 3 will develop and refine protocols and provide recommendations and advice for conservation strategies in Canada and internationally.

continued from page 1… **Science and Technology Networks**

How are the networks organized?

Each network will be led by one of the five CFS centres. Regardless of their specific locations, the networks will be national and international in scope, strategic in their approach to forest science and policy issues, and efficiently managed so that their outputs exceed the sum of what the individual centres could achieve alone.

Each network has developed a full business plan that defines current partnerships and is linked to the CFS and Natural Resources Canada corporate strategic business plans.

What can the CFS offer partners?

As a national agency, the CFS can ensure that the forest community across the country is aware of information and technologies developed in Canada or elsewhere.

Joining the CFS in a network partnership will also mean:

- easy access to research results and technologies;
- greater involvement in priority setting (e.g., through NABFOR); and greater input to ensure research addresses sector needs.

What kinds of collaborations are available?

Collaboration between CFS networks and outside agencies can take the following forms:

- Partnerships – Under this type of collaboration, both sides contribute resources (monetary and/or in-kind) to support a specific project or issue. The outside agency may receive certain agreed upon deliverables from the project or the network as a whole.
- Alliances – The CFS and the outside agency collaborate formally or informally, but without sharing of resources. The alliance might take the form of agreeing on the direction of certain issues and/or sharing information.

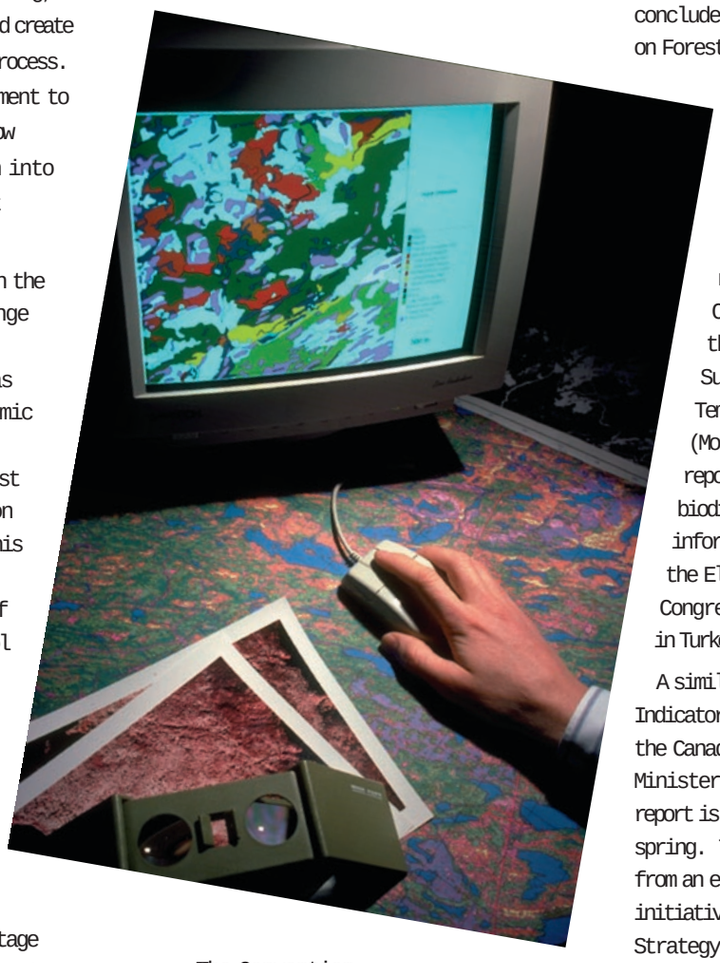
In summary, if the Canadian forest sector hopes to compete successfully in world markets, it must meet international demands for sustainable forest management. More research will be needed to meet these demands, a need that cannot be met by government or outside agencies alone. By collaborating on joint projects and strategic decisions, the CFS and outside agencies can maximize the use of scarce resources, bolster their research efforts and maintain Canada's reputation as a world leader in sustainable forest management.

Policy & Science: How they relate

Policies may only offer guidance to governments, or may have the force of law. Conventions are international laws, often worded generally to allow countries to sign on. They commit countries to conduct research and monitoring, prepare scientific reports, and create a Secretariat to manage the process. They often include an agreement to negotiate protocols that allow problems to be broken down into achievable steps and may set binding targets.

Canada is a major player in the Convention on the Long-Range Transport of Air Pollutants (LRTAP). This agreement was struck in 1979 by the Economic Commission for Europe, Canada, and the U.S. The first protocol under LRTAP was on sulphur dioxide, in 1987. This was followed by a 1991 protocol on nitrous oxides of nitrogen, and then a protocol on volatile organic compounds (VOCs). Canada did not sign the VOC protocol, as Ontario has been unable to commit to a 30% reduction in emissions. Canada is promoting a critical load approach rather than percentage reductions for future LRTAP protocols, which may include persistent organic pollutants and heavy metals.

The International Plant Protection Convention (IPPC) deals with quarantine and plant health. Parties to this Convention agree to issue phytosanitary certificates ensuring that their plant product exports are free of injurious pests. The IPPC describes functions of a national plant protection organization, such as monitoring and control of significant plant pests. Reports on these activities are made to the U.N. Food and Agriculture Organization. Revisions to the IPPC are under discussion, including creation of a new international Commission on Phytosanitary Measures.



The Convention on Biological Diversity was a product of the 1992 Earth Summit. It deals very broadly with three issues: conservation of biodiversity, sustainable use of its components, and equitable sharing of benefits from use of genetic resources. Parties to this Convention will be preparing reports on domestic implementation measures for their next meeting in May 1998. There are no protocols at present, but a biosafety protocol dealing with international movement of genetically modified organisms is currently under negotiation.

Canada promoted the idea of an International Forest Convention during deliberations of the recently concluded Intergovernmental Panel on Forests. The April 1997 meeting of the U.N. Commission on Sustainable Development will debate if and when to move ahead with this effort. In the interim, Canada is preparing a national report under the Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process). This report, which will include biodiversity and forest health information, will be tabled at the Eleventh World Forest Congress Meeting, October 1997, in Turkey.

A similar domestic Criteria and Indicators initiative was approved by the Canadian Council of Forest Ministers in March 1995, and a report is scheduled for release this spring. The C&I initiative emerged from an earlier domestic policy initiative, the 1992 National Forest Strategy, which contained a number of items relevant to biodiversity and forest health. Examples are completion of ecological land classifications and protected areas networks, and creation of a national reporting system on forest biodiversity. An evaluation of progress under this 5-year strategy is under way with a view towards developing a successor strategy this summer.

by Dr. Ole Hendrickson
CFS Ottawa

Conservation Science of Red Spruce (*Picea rubens* Sarg.)

Throughout much of its range, red spruce is in decline. As a result, members of the Biodiversity Network at the Atlantic Forestry Centre (AFC) have initiated a study of conservation biology and genetics of red spruce. Historically, red spruce has been an important component of eastern forests, with a Canadian range extending from Ontario to Nova Scotia. In mainland Nova Scotia, and along the coast of New Brunswick, it is important commercially and ecologically. However, in other parts of its range, including Ontario, Prince Edward Island and Cape Breton, the species is much less common than it once was. In the United States, where it extends as far south as North Carolina, it has been estimated that there is now only 1/5th as much red spruce as there once was. Throughout its range, the old-growth remnants of red spruce serve as both a reminder and an archive of a truly majestic forest.

The status of the species varies greatly across its geography. Where it is thriving commercially, as a tolerant conifer, there is increasing interest in managing red spruce in uneven-aged forests. In areas where red spruce populations have been largely eliminated, there is a desire to restore the species across the landscape, in part because it lends itself well to "softer" forest management styles that are increasingly demanded by the public.

Throughout its range, there is considerable concern about the impact of hundreds of years of exploitation on the quality of the trees that we see today. After many years of cutting the best and leaving the worst, the "good genes" may be in short supply. In particular, the variety of genes in today's red spruce forests may be lower than that of most other conifers. This question is being addressed by the AFC team.

Complicating the genetics picture is the fact that red and black spruce are capable of crossing to produce hybrids that are part red and part black spruce. There are indications that clear-cut logging has increased the frequency of hybrids across the landscape because red spruce is adapted to growing in shade conditions under a forest canopy. Black spruce grows best in the open, and in areas where red spruce has been clear cut, the young trees that grow back often appear to be partly black spruce. The amount of crossing between the two species is hotly debated, however, and the team at AFC hopes to finally put the question to rest.

Red Spruce tree at Abrams Lake, Nova Scotia.

It is clear that red spruce is declining in the US, apparently as a result of the combined effects of climate and air pollution. This lends a further timely dimension to the study of this species. US studies have shown that red spruce responds negatively to winter climate variability. Such variability may increase dramatically with climate change over the next century. If monitored closely, red spruce may act as a "bio-indicator" of climate change in eastern Canada. Thus, by intensively studying red spruce, lessons learned and approaches developed for uneven-aged forest management, restoration, species hybrids, and climate change, can be applied to other species and systems.

A specialty of the Biodiversity Network at the Atlantic Forestry Centre is genetic aspects of conservation. Strong collaboration is imperative to execute a well-balanced scientific investigation. Dan McKenney, of CFS's Great Lakes Forestry Centre, is modeling the climatic limits to the range of red spruce. In collaboration with other scientists in the fields of ecology, entomology and ornithology, we will establish how species-level biodiversity in managed red spruce stands compares with that of natural ones, and what the impacts of various silvicultural regimes are on biodiversity, temporally and spatially.

The newly initiated study is progressing on several fronts. Individual tree seed collections have been made in Ontario, New Brunswick and Nova Scotia, mostly from "old-growth" forests. These will serve to assess the reproductive capacity of the species and as a "genetic benchmark" for future work in managed and disturbed ecosystems. In addition, we are taking advantage of older, pedigreed genetic test plantations to study the physiology and molecular genetics of red x black spruce hybrids.

To initiate the project and foster collaboration, the Biodiversity Project recently hosted a mini-workshop entitled "Red Spruce: The Status of the Species Across Its Con-

Quality Assurance in Forest Health Monitoring

Do you include those dead branches and twigs in the inner crown?", and so begins a QA/QC field exercise to standardize a Forest Health Network (FHN) monitoring team.

QA/QC, short for quality assurance/quality control, is a process with a simple goal: enable an organization to produce a reliable product with the consistent application of methods supported by training and testing. The Forest Health Network must provide reliable scientific data to support a number of decision-making functions that ultimately may impact forest policy.

FHN personnel are responsible for the Acid Rain National Early Warning System (ARNEWS) and the North American Maple Project, plot-based monitoring systems utilizing an array of parameters. QA/QC is a high priority issue because of the extensive nature of the plot networks and the number of personnel, involving all CFS establishments.

In forest health, the possibility of observer error and thus the need for a QA/QC program is critical because many crown condition variables are subjective estimates rather than objective measures.

The task of monitoring biological processes is to determine change over time and to establish trends. Assessments by a variety of observers over several years can only provide meaningful data when observers are calibrated to the same level of understanding regarding parameter estimates. Assessments that reflect change must be "real" rather than the result of observer variability due to individual bias or interpretation error.

Testing for hardwood crown rating.

The task of quality assurance has been carried out for several years now, providing the necessary feedback in data confidence levels. In 1995 and 1996 the primary focus has been to more fully integrate quality control into the operational monitoring framework. A national workshop was last held in Victoria, BC in mid-June of 1996 to achieve this.

Forest Health Monitoring Unit Leaders, representing each of the CFS establishments, agreed to an implementation framework with top-down approach to training and plot cross-checks. Unit Leaders reviewed the methods for selected parameters and standardized themselves through practice and testing procedures to keep observer error at a minimum.

Unit Leaders, responsible for regional monitoring activities, then held their own training and standardization workshops, employing the same methods and protocols.

A series of cross-checks this past summer, approximately 20% of ARNEWS plots across Canada, completed the quality control picture and when summarized will provide a measure of variability or level of agreement.

The Forest Health Network is endeavoring to enhance its monitoring ability through collaboration and will continue its involvement in integrated, interdisciplinary studies at the local, ecozone and national levels. QA/QC, as a prerequisite, will provide the basis for such partnerships.

by Edward Hurley
Atlantic Forestry Centre

Our Forest Canopies: Where Few Have Gone Before

The Canadian Forest Service (CFS) is literally climbing to new heights in the quest for knowledge of forest biodiversity. In collaboration with the University of Victoria, Forest Renewal B.C. and MacMillan Bloedel, the CFS is gathering new, important data about one of our last unexplored biotic frontiers: the old-growth forest canopy.

"We know very little about these canopies," explains Dr. Leland Humble, research scientist at the CFS' Pacific Forestry Centre (PFC) in Victoria. PFC's current canopy studies aim to understand the structure of the canopy arthropod community within the montane old-growth forest, and how it is affected by proposed alternative silviculture systems.

To this end, PFC's Insectary is currently extracting arthropods from canopy samples collected at the Montane Alternative Silviculture Systems (MASS) research site near Campbell River on Vancouver Island. At the MASS site, situated on MacMillan Bloedel private lands, more than 15 research studies are examining various aspects of the ecology and management of mid to high elevation forests. Humble, in collaboration with Dr. Richard Ring and Neville Winchester of the University of Victoria are examining the arthropod communities in the canopies of the two dominant tree species, amabilis fir and western hemlock, and their responses to silviculture systems.

"The MASS site provides a unique opportunity to study the canopies, see what's really going on up there," says Humble. "We're making use of the MASS site, Forest Renewal B.C. funding, MacMillan Bloedel infrastructure and UVic's accessing technology and background research. It really links a great deal of research ideas and technologies, so we can work together."

Collecting the branch and lichen samples is a formidable task. Samples are retrieved from the tree tops using a combination of rock and mountain climbing techniques developed at UVic. Researchers climb up into the canopy via a simple rope system, to heights of up to 39 m. More than 240 branch and lichen samples are collected this way every month, after which they are returned to PFC's Insectary, sorted, processed and identified by staff. This quantitative sampling is supplemented by the collection of more than 360 individual trap samples per month.

Collecting samples in the forest canopy

It is perhaps in the identification process where the real mystery lies. Preliminary examinations of canopy branch samples have revealed the presence of two undescribed species of Cecidomyiidae (gall midges) on shoots of amabilis fir, and one in cones of western hemlock. The presence of large populations of both hemlock and balsam woolly adelgids within the old-growth canopy was also a bit of a surprise, says Humble.

"So much is unknown. That's why we need to obtain a comprehensive overview of the arthropods associated with the forest canopy," says Humble. PFC is therefore working towards expanding the current reference collection with these and other samples collected at research projects taking place across B.C. Access to accurately identified specimens makes future identifications more efficient and effective, to better serve research taking place all over Canada and the world.

PFC's canopy studies form a key part of the efforts of the CFS' Forest Biodiversity Network (FBN), one of ten national research networks targeting specific forest issues. Understanding the impacts of forest management and other human and environmental pressures on forest biodiversity is one of the FBN's goals. Another is building strategic partnerships with other government departments, industry, and academia, which will better enable forest scientists to uncover and tackle some of the issues related to biodiversity.

"Everything we're learning through canopy studies will help form a baseline of information that will be invaluable to all aspects of maintaining forest health and biodiversity," says Humble. "We really are breaking new ground."

This "new ground" just happens to be hundreds of feet up in the sky.

by Carol Wong
Pacific Forestry Centre

Environmental Landscape Modelling for Diversity and Forest Health

Dan McKenney, an environmental economist at the Great Lakes Forestry Centre, works with the biological big picture. In collaboration with Australian ecologist, Brendan Mackey, his team has developed and compiled information databases on climate, elevation, soil, trees and wildlife for all of Ontario. Using a computer-based Geographic Information System (GIS), they mapped the environmental characteristics of the province then conducted landscape level modelling to produce new data that can be used to allow scientists and managers to make predictions about what they will find in a given area. McKenney explains that by knowing exactly "what should be where", decision-makers will be in a better position to choose what to protect, where to harvest, and what to restore.

"To assess the importance of an old-growth stand, for example," McKenney says, "we have to know if there are other such stands around. Are there other places that can be harvested if there is a conflict with wood supply? To answer questions like these, we need landscape models."

The goal of this work in Ontario, known as the Bio-environmental Indices Project (BIP), is to look for ways to examine trade-offs between wood production and conserving biodiversity. In developing a picture of the potential of the land to produce different types of products and values, McKenney hopes that we will be able to better understand the trade-offs in the decisions that we make. Bio-environmental indices are a series of measures that describe the most favorable environmental conditions for various plant and animal species, using climate, moisture levels, soil type and topography. By putting the indices together, along with existing biological inventories of what is now present on the land, it becomes more obvious where old-growth cedar may still be found, or where habitat is suitable for pileated woodpeckers or wood turtles.

An intensive patch of wild leek in a rich hardwood understorey.

McKenney and his team are now extending the BIP concept to the whole of Canada under the National Georeferenced Information for Decision Makers Project (NATGRID), which he hopes will help to link the CFS networks, by providing a spatial environmental framework and facilitating data sharing. They have begun the work by building a National Digital Elevation model.

The NATGRID project is expected to have applications for both the Biodiversity and Forest Health Networks. Applications include: facilitating the identification of indicators of wildlife habitat availability and suitability; estimating species distribution and abundance for conservation planning; developing cost effective approaches to designing field survey and monitoring programs; genetic resource management planning; and assessing representativeness of protected areas.

As an example of the value of McKenney's work within the Biodiversity Network, researchers at the Atlantic Forestry Centre hope to collaborate with the Great Lakes Forestry Centre group to develop maps of present and potential distribution of red spruce within its historic range using bio-environmental indices. This will help the researchers to decide where to focus conservation and restoration efforts. Within the Forest Health Network, the representativeness of current forest plots is being evaluated and a selection process

CFS S&T Networks

Forest Health Network
Lead Centre: Atlantic Forestry Centre, Fredericton, NB
Network Manager:
Thomas Sterner
Tel: 506-452-3500

Forest Biodiversity Network
Lead Centre: Atlantic Forestry Centre, Fredericton, NB
Network Manager:
Gerrit van Raalte
Tel: 506-452-3500

Tree Biotechnology & Advanced Genetics Network
Lead Centre: Laurentian Forestry Centre, Sainte-Foy, PQ
Network Manager:
Arienne Plourde
Tel: 418-648-5847

Forest Ecosystem Processes Network
Lead Centre: Laurentian Forestry Centre, Sainte-Foy, PQ and Great Lakes Forestry Centre, Sault. Ste. Marie, ON
Network Managers:
Bill Meades (GLFC) and Denis Ouelette (LFC)
Tel: 418-648-5847 (PQ) and 705-949-9461 (ON)

Climate Change Network
Lead Centre: Northern Forestry Centre, Edmonton, AB
Network Manager:
Surj Malhotra
Tel: 403-435-7210

Fire Management Network
Lead Centre: Northern Forestry Centre, Edmonton, AB
Network Manager:
Denis Dubé
Tel: 403-435-7210

Socio-economic Research Network
Lead Centre: Northern Forestry Centre, Edmonton, AB
Network Manager:
Steve Price
Tel: 403-435-7210

Effects of Forestry Practices Network
Lead Centre: Pacific Forestry Centre, Victoria, BC
Network Manager:
Paul Addison
Tel: 250-363-0600

Landscape Management Network
Lead Centre: Pacific Forestry Centre, Victoria, BC
Network Manager:
Murray Strome
Tel: 250-363-0600

Pest Management Methods Network
Lead Centre: Great Lakes Forestry Centre, Sault Ste. Marie, On
Network Manager:
Errol Caldwell
Tel: 705-949-9461

FYI

Volume 1 No. 1 - Spring 1997
ISSN 1206-7210

Network News is published regularly by the Atlantic Forestry Centre for the Forest Biodiversity and Forest Health Networks of the Canadian Forest Service and its partners and collaborators.

Correspondence and article submissions may be directed to:
Canadian Forest Service
Atlantic Forestry Centre
P.O. Box 4000
Fredericton, N.B., Canada
E3B 5P7

http://www.fcmr.forestry.ca

Produced by Morrison Marketing Inc.
One Market Square
Saint John, N.B.
E2L 4Z6

Printed in Canada on Jenson Satin a 50% recycled paper containing 10% post-consumer waste.