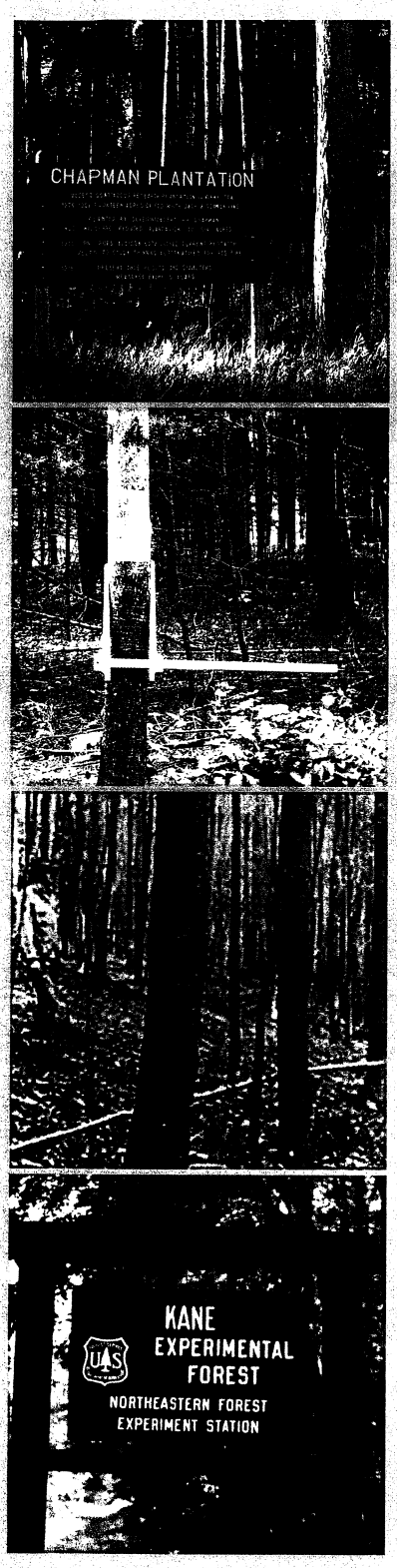
GISF Research Paper 005
June 2006.




# Long-term Silvicultural & Ecological Studies

## Results for Science and Management

Lloyd C. Irland, Ann E. Camp, John C. Brissette, and Zachary R. Donohew

Yale University
School of Forestry & Environmental Studies
Global Institute of Sustainable Forestry

# FERNS: The Forest Ecosystem Research Network of Sites

*J.D. Mills*

**Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia, Canada**

## Introduction

Canada has a significant number of world-class, interdisciplinary, forest-research installations and they have produced an impressive wealth of fundamental information about Canada's diverse forest ecosystems. Many research studies associated with these installations have been productive for several decades.

The Canadian Forest Ecosystem Research Network of Sites (FERNS), initiated in 1997, has networked twenty-two interdisciplinary forest-research installations across Canada. Dozens of world-class studies and data banks are associated with each installation. Originally FERNS was designed to help scientists and other professionals assess the impacts of forestry practices on forest ecology, and to encourage knowledge transfer between scientists. Longterm data collected on other forestry-related topics such as climate, water, moisture, nutrients, and ecosystems provides opportunities to further synthesize knowledge. FERNS is strategically positioned to contribute basic scientific information to emerging national and international initiatives such as the Canadian Council of Forest Ministers' National Forest Information System (NFIS), the climate change programs, the Criteria and Indicators policy, and biodiversity. FERNS also provides a timely opportunity to improve communications between disciplines, policy makers, the public, and forest practitioners.

Canada's forest-research installations have been designed methodically using statistical and scientific rules for replication. Because a wide variety of agencies and interests have been involved, it has been essential to gather a range of basic data about climate, water, moisture, soils, vegetation, disturbances, and forest health. The scope of the data is far more extensive, and often more intensive, than required for single-purpose scientific studies.

The mission of the Canadian Forest Service has been "to promote the sustainable development of Canada's forest resources and the competitiveness of the Canadian forest sector for the well-being of present and future generations of Canadians" (Natural Resources Canada 1999). Within Natural Resources Canada's Sustainable Development Strategy (2001), Minister Goodale stated, "We will advance sustainable development through scientific knowledge, technological innovation, stewardship, and building capacity for sustainable communities."

However, the challenges created by the vastness and diversity of Canada's forests, and the scope and range of variables, are immense. One strategy used by research managers during the 1990s for handling scale issues was to focus funding and expertise on a few major installations. While this approach did stimulate world-class research and enable synergy between disciplines, it also tended to concentrate research data in pockets. The limitations of separate, multidisciplinary forest-research installations were recognized in the mid 1990s. In 1997, the Canadian Forest Service initiated the Forest Ecosystem Research Network (FERNS) to link silvicultural research installations representative of major Canadian forest ecosystems.

This paper will describe the potential linkages of FERNS to new initiatives and provide two examples of interdisciplinary successes in ecological research. It will emphasize the need in Canada for continued support of forest-research installations as a source of basic information about forest ecology. This paper will also underline the practicality of using a networking strategy to capture and extend soft knowledge[1], and for developing ways of making hard scientific results friendlier.

## Interdisciplinary Forest-Research Installations in Canada

Canada has a history of forest research that stretches over the last century. Traditionally, forest research focused on a primary issue, implemented a replicated experimental design, conducted rigorous statistical analysis, and disseminated information through peer-reviewed articles or internal manuscripts (Klenner and Vyse 1999). Forest research over the last three decades has generally moved from an emphasis on single-purpose studies, to broader silvicultural studies, and then to interdisciplinary ecological studies.

From a scientist's perspective, narrowly scaled studies were easier to manage. Unfortunately, these studies were inherently unable to answer broader-scale issues or more-general questions involving operational conditions (Lautenschlager 1999). Interdisciplinary installations enabled a number of new perspectives including:

—the public's environmental concerns can be more easily incorporated into experimental design (although this approach is still not widespread);
—landscape scales (time and space) are appropriate to ecosystem considerations;
—managers and researchers can test their knowledge using landscape-level forest/vegetation management (concepts of adaptive management); and,
—the broadly based "soft knowledge" database provides more flexibility to address emerging national issues.

The recent explosion of digital capabilities and software packages will further expand the usefulness of the interdisciplinary forest installations, particularly in data synthesis and technology transfer. There are several concerns, however, regarding interdisciplinary research installations, including:

—Large forest-research installations are expensive and labour intensive. Managers may be tempted to shift limited resources as new national issues emerge. (Although some installations, such as Petawawa in Ontario, established in 1917, have managed to survive.)
—Scientists and generalists will have to agree on a basic definition that will form the basis for synthesis.

**[1]"Soft knowledge" refers to unrecorded experience including photographs, oral information, and traditional knowledge. It is often in the heads of technical staff and can be highly vulnerable to loss by retirements or transfers.**

—Data are not uniform from installation to installation.
—Scientists may be reluctant to share data before their work has been completed.
—Usually, researchers, technicians, and those associated with major forest-research installations hold vast "soft knowledge"—i.e., accumulated experience. A special effort is needed to archive this information so that it will be useful to practitioners and policy makers.

## National and Global Accountability

During the 1990s, Canada made a number of commitments to report on sustainability to its citizens and to international bodies.. The Canadian Biodiversity Strategy (Federal-Provincial-Territorial Biodiversity Working Group (Canada) 1995), for example, is Canada's response to the Convention on Biodiversity. In 1997, The Canadian Council of Forestry Ministers published a revised five-year strategy (CCFM 1998) that reinforces concepts of forest ecosystems: "Our goal is to maintain and enhance the long-term health of our forest ecosystems, for the benefit of all living things both nationally and globally, while providing economic, social and cultural opportunities for the benefit of present and future generations." The commitment to an ecosystem approach in the 1990s has resulted in significant progress being made towards conserving biodiversity (Neave et al. 2002).

## Certification

The certification movement has accelerated the adoption of an ecosystem approach to forest management and has increased the need for scientifically based information. Today, all jurisdictions within Canada base their forest-management planning on defined ecosystems. Canada has the largest area certified of any country in the world (some 72 million hectares, or 43% of its annual harvest) (Natural Resources Canada 2001).

Canada's strength in sustainability depends on its forest resources—and the entire context of forestry is changing, locally, nationally and globally. Natural Resources Canada has recognized this by establishing an immediate target to develop models and tools for predicting long-term effects of harvesting regimes in Canada's forests (CCFM 1998.) FERNS can support this effort by providing scientific background and knowledge.

## Forest Ecosystem Research Network of Sites (FERNS)

The Canadian Forest Service established FERNS in 1997 to form a national network of 22 autonomous research sites representing major forested ecosystems in Canada. Sites are interdisciplinary and multi-partnered. They represent sound research on sustainable forest management practices and ecosystem processes at the stand level.

The FERNS network was designed to facilitate the application of scientific information for a range of national management objectives. FERNS promotes long-term, forest-management research practices—nationally and internationally; improves linkages among sites; and helps to preserve the long-term research investments of forest research installations.

In 1998, FERNS hosted an international conference, Long Term Silvicultural Research Sites: Promoting the Concept—Protecting the Investment (Mitchell and Vyse 1999). Dr. A. Mitchell summarized essential elements for sustaining long-term research, raised during the conference, as:

—strong project leadership,
—maintaining continuity,
—financial management and securing access to sources of funding,
—open access to the information collected,
—management support, and
—synthesis of project results.

Today, the network encompasses 22 installations across Canada. Partners include provincial forest ministries, universities, forest industry, the Canadian Forest Service, the Canadian Wildlife Service, Forest Engineering Research Institute of Canada, Industry Canada, Department of Fisheries and Oceans, Environment Canada, consultants, and individuals.

## Potential Ties to National Information Handling

FERNS has the potential to synthesize and integrate data into emerging national information systems. The National Forest Strategy Coalition (Natural Resources Canada 2001) underlined the idea that providing an ecological knowledge infrastructure could be the single most important step toward attaining sustainable forest management. National information programs such as the Criteria and Indicators policy, National Forest Information System (NFIS), Model Forest Program, and climate change programs may provide visible linkages for the forest-research installations of FERNS.

Canada's forest ministers, through the Canadian Council of Forest Ministers, are concentrating on a set of criteria and indicators (the Montreal Process) that will form a common information foundation across Canada. Within the context of the Criteria and Indicators process, the Model Forest Program has undertaken the task of providing substance to the concept of Local Level Indicators (LLI). While not all model forests are directly involved with FERNS, they do have a well-established partnership infrastructure involving 11 national and 8 international model forest associations.

The National Forest Information System is an example of an electronic or web-based architecture for gathering and synthesizing information while protecting the jurisdictions and the integrity of the basic data. Even in its infancy, the National Forest Information System has been able to present a composite of information from across the country on a variety of topics. A relationship between FERNS and the National Forest Information System will be very useful.

A new global scientific culture is emerging in which archiving and inter-connectivity of data sets are becoming increasingly important. Researchers across most disciplines in Canada are being encouraged to make their data more widely available. FERNS may be able to offer an important data-management role by providing a means to synthesize and integrate scientific information across a number of sites and studies.

## Examples of Innovative, Interdisciplinary Installations within FERNS

Although each FERNS installation is exciting in its own right, the Turkey Lakes Harvesting Impact Project and the Montane Alernative Silvicultural Systems (MASS) are excellent examples of FERNS' history, diversity, and rich knowledge bases.

### Turkey Lakes Harvesting Impacts Project (LRTAP)

LRTAP was started in 1979 to study the impact of the long-range transport of air pollutants. Researchers incorporated existing studies on ecological functions into new projects researching sustainable forest-harvesting and research-management solutions for uplands sites in the Great Lakes–St. Lawrence Forest Region.

The synergy of the Turkey Lake scientist partnerships is apparent in their output. More than 190 scientific and technical publications have originated from this site. Studies have been consolidated into three areas—the harvesting impacts project (TLHIP), Extended Collaboration for Linking Ecophysiology and Forest Productivity (ECOLEAP), and forest health. In addition, several models—including the dynamic forest soil-vegetation-atmosphere model (ForSVAO), the hydrologic model (ForHyM), and the ion flux (ForIoM) model—have been developed and continue to be verified.

Some lessons stand out:

—For an installation to be as fruitful as possible and of long-lasting value, data collection must be rigorous.
—Data collection must be far more extensive than that required to fulfill the initial objectives.
—An active involvement by a broad range of disciplines and agencies provides the flexibility to respond to shifts in social emphasis.
—Opportunities may exist to use existing data to provide partial answers to emerging national questions.

### Montane Alternative Silvicultural Systems (MASS)

The MASS installation on Vancouver Island, British Columbia is a multi-agency forest research. Partners recognized the need to develop operationally feasible and ecologically sustainable silvicultural systems in old-growth forest in high elevations. An integrated installation such as MASS becomes very complex because of the large areas involved, large industrial commitments, and the relationships between agencies and disciplines.

Cooperating organizations had invested some $5.5 million in MASS to the end of 1999. The body of articles and knowledge is impressive. The installation has enabled new forest management approaches to be implemented operationally. Over 5000 people have visited or seen presentations on MASS. Electronic links have been formed with all collaborating agencies, and a public website has been established. And, of course, visibility has been enhanced nationally and internationally through networks such as FERNS.

## Conclusion

FERNS is a practical network of large, autonomous, forest-research installations in Canada. The wealth of data and information accumulated through FERNS' volume and range of studies has the potential to make significant contributions to Canada's forestry information needs. It is also valuable for providing solid background information when developing policies and making decisions.

The concept of linking research and researchers is not new. More than ever before, credible scientific knowledge is essential in Canada's decision-making processes. Given today's rapidly growing appetite for forest and ecological knowledge, FERNS offers a network that will be more effective and efficient than the information-sharing capabilities of individual installations.

FERNS is representative of Canada's world-class, forest research. We do need continued scientific rigor, as well as sufficient resources, to organize, describe, and synthesize data and knowledge in an appropriate and timely format. The interdisciplinary installations of FERNS will continue to provide a wealth of ecological data and opportunities to synthesize and share ecological knowledge.

Benefits coming from the network of installations and studies include a wider respect between disciplines. FERNS is serving as a lobby for preserving the research investment in these large installations. An appreciation of the extent and context of data and knowledge housed by scientists within the FERNS network is growing.

## References

Canadian Council of Forest Ministers, 1998. National forest strategy, 1998–2003: sustainable forests, a Canadian commitment. Natural Resources Canada, Canadian Forest Service, Ottawa, ON. 47 p. http://nfsc.forest.ca/strategy.html

Federal-Provincial-Territorial Biodiversity Working Group (Canada), 1995. Canadian biodiversity strategy: Canada's response to the convention on biological diversity. Biodiversity Convention Office, Hull, Quebec. 80 p.

Klenner, W. and A. Vyse, 1999. Interdisciplinary research approaches to addressing complex forest management issues. Forestry Chronicle 75(3):473–476

Lautenschlager, R.A. 1999. Improving long-term ecological research for the 21st century. Forestry Chronicle 75(3):477–480.

Mitchell, A. and A. Vyse, 1999. "Long-term silvicultural research sites: promoting the concept - protecting the investment—preface" in Forestry Chronicle 75(3).

Natural Resources Canada, 1999. Canadian Forest Service: a future as dynamic as its past—a century of innovative solutions. Canadian Forest Service, Ottawa, ON. 24 p.

———, 2001. Sustainable development strategy: now and for the future. Sustainable Development and Environment Division, Ottawa, ON. 90 p.

Neave, D., E. Neave, and T. Rotherham, 2002. Canada's forest biodiversity: a decade of progress in sustainable management. Natural Resources Canada, Canadian Forest Service, Ottawa, ON. 57 p.