CFS CANADIAN FOREST SERVICE
SCF SERVICE CANADIEN DES FORÊTS

Atlantic Forest Science

Under the Microscope

A Message from the Director General Atlantic Forestry Centre

It gives me great pleasure to launch my newsletter *Atlantic Forest Science – Under the Microscope*. I believe that communication is key to all that we do. My goal is to provide you with current news and information on AFC science, programs, projects, researchers and more!

My first year with the Canadian Forest Service has focused on looking at the strengths and opportunities of the science program at AFC. Since my arrival in the Fall 2003, I am particularly proud of our newly created science teams. These teams will be tackling problems in three main areas of work: biodiversity, climate change, and economic enhancement. We are working hard to answer questions and to find solutions to the problems facing our forests and the industry it supports.

Communication is best when it is two-way. I welcome your comments on this first issue of *Atlantic Forest Science – Under the Microscope*. You are key to its success!

Sincerely,

Dr. John E. Richards
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Science – Policy Links at the Atlantic Forestry Centre

Estimating the Value of Reduced Ozone Exposure on Managed Forests for Environment Canada's Air Quality Valuation Model

A senior scientist at the Atlantic Forestry Centre has developed dose-response functions (DRF) that calculate the effects of ozone exposure on tree growth for two tree species: trembling aspen (*Populus tremuloides*) and white birch (*Betula papyrifera*). This work has contributed to the ongoing capacity development of Environment Canada's Air Quality Valuation Model (AQVM) to estimate the value of reduced ozone exposure to managed forests in Canada.

The AQVM is a computational model designed to estimate the human health and environmental benefits (or damages) associated with changes in Canada's ambient air quality. It computes changes in annual (physical) impacts, and the associated economic benefits for over 20 human health effects and five environmental effects.

Environment Canada uses AQVM to support the climate change and clean air policies of the Government of Canada. The current development plan, which includes this DRF project, supports the 2004–2005 review of the Canada-wide Standards for Particulate Matter and Ozone.

Biomass mapping in Newfoundland using Landsat TM imagery

Ms. Joan Luther, working out of AFC's Corner Brook, NL site, has collaborated with researchers across the country to develop a practical method for large-scale mapping of forest biomass using information on forest type and structure derived from Landsat TM imagery. The method, BioCLUST (BIOmass from Cluster Labeling Using Structure and Type), consists of a suite of procedures that involve (i) hyperclustering a Landsat TM image, (ii) semi-automated labeling of the clusters with forest type and structural information, and (iii) applying stand-level models derived from field plots to predict biomass as a function of height and crown closure within forest species type classes. BioCLUST was developed and tested on a study area in western Newfoundland; it was tested at both pixel and landscape scales by comparing predicted biomass values with biomass measured at field plots and mapped using existing photo-inventory stand maps.

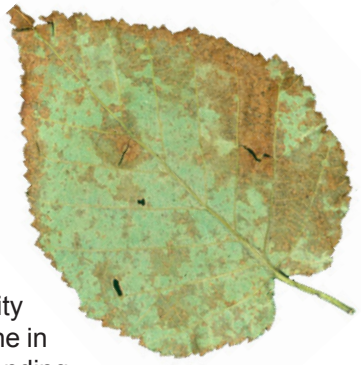
Biomass is a complex attribute to infer from the spectral information contained in a Landsat TM image. Therefore, developing a method, such as BioCLUST, to derive a forest biomass map from a Landsat TM image is not a trivial exercise.

For more information about this research, contact Ms. Luther directly at jluther@nrcan.gc.ca.

Estimating acid-fog deposition in Bay of Fundy forests in New Brunswick

Dr. Roger Cox and colleagues from the University of New Brunswick have developed an empirical model for estimating acid-fog deposition on forests, using data collected over two 3-year sampling periods (1986–1989 and 1996–1999) on summer fog-water chemistry, fog frequency, meteorology, and leaf wetness. The study area is located on the Point Lepreau Peninsula in southern New Brunswick. Cox and his colleagues have adapted an empirical algorithm that embodies the major fog-deposition factors (e.g., liquid water content and wind velocity) and forest-specific parameters (e.g., canopy surface roughness and leaf area index (LAI)). Although there are few studies on acid-fog deposition using empirical models, it is considered the most reasonable approach to estimate the concentration of seasonal mean deposition.

This suggests that the chemistry of these summer fogs, either at sea level or at high elevation, may be a good indicator of any changes resulting from emission controls and that the lower annual concentrations in sulfate and acidity during the period of 1996–1999 may be indicative of the success of these pollution control efforts at the emission sources following the signing of the Canada–US Air Quality Accord.

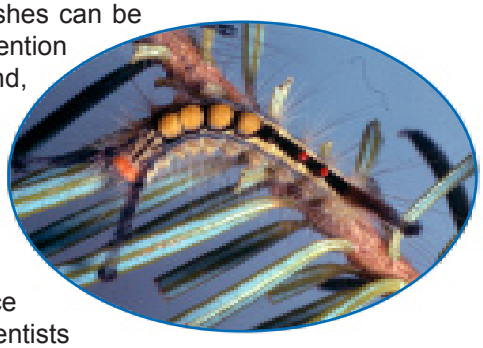


The two time periods involved in the studies provided an opportunity to evaluate the effects of the application of air-pollution controls in the United States and Canada, after the signing of the Air Quality Accord (1991) on fog-water chemistry and deposition of acidity, nitrates, and sulfates to Fundy coastal forests. As expected, a substantial amount of variability existed in the concentrations of acidity, sulfates and nitrates in fog water. However, a decline in seasonal sulfate concentration was evident from 1987–1989 to 1996–1999, with corresponding decreases in acidity concentration.

For more information about this research, contact Dr. Cox directly at rcox@nrcan.gc.ca.

Natural control of whitemarked tussock moth populations in Nova Scotia

Drs. Graham Thurston, **Chris Lucarotti**, and **Tom Royama** of the AFC have been collaborating with Dr. Kees van Frankenhuyzen of the Great Lakes Forestry Centre to study how naturally present diseases control whitemarked tussock moth populations in Nova Scotia. If disease-related population crashes can be predicted, scientists will be able to advise managers when spending on intervention measures is unnecessary. The tussock moth causes severe defoliation and, ultimately, mortality, and it is threatening one of Canada's most economically important tree species, the balsam fir. Hundreds of thousands of hectares are affected. In past outbreaks of this insect, scientists suspected that disease played a significant role in the sudden decline of populations. Caterpillars showed obvious signs of disease and attack by a pathogenic fungus, or telltale signs of viral infection. During the most recent tussock moth outbreak in Nova Scotia between 1996 and 2001, which covered most of the province and threatened 2.4 million ha of forest land, the Canadian Forest Service scientists initiated a study to learn more about the role of disease in population control. They gathered data from a number of sources, including aerial defoliation surveys, on-ground egg-mass surveys, field sampling of larvae, laboratory rearing, and microscopic examination of larval cadavers. Through careful study and evaluation of the data, they determined that two diseases played a significant role in the dramatic population collapse of tussock moth: a pathogenic fungus, *Entomophaga aulicae*, and a viral disease, NPV. Both these diseases were widespread among tussock moth caterpillars in areas of moderate to severe defoliation in Nova Scotia. The scientists also found that disease occurrence and its impact on the population varied considerably over time and location. More



The ability to predict where and when naturally occurring diseases will control outbreak populations of tussock moth will help managers focus their control measures where the need is greatest, where moth populations are healthy and relatively disease free.

For further information on this research, you may consult CFS-AFC Impact Note No. 42 or you may contact Dr. Thurston directly at gthursto@nrcan.gc.ca, Dr. Lucarotti at clucarot@nrcan.gc.ca, and Dr. Royama at troyama@nrcan.gc.ca

Environmental impacts of harvesting white spruce on Prince Edward Island

Dr. Taumey Mahendrappa conducted a 6-year (1991–1997) study in P.E.I. to determine the environmental impacts of harvesting white spruce given the increasing trend toward whole-tree harvesting in the Maritimes region of Canada. The study investigated the potential impacts of different harvesting methods on nutrient loss and growth rates of different tree species planted in the treated areas. It consisted of three main treatments conducted in old-field white spruce: whole-tree harvesting with chain saws (WTH), in which almost all the aboveground biomass was removed from the site; stem-only (SO) harvest, consisting of chainsaw felling and removal of only the merchantable boles from the site; and control (CON), an uncut area. Mahendrappa installed glass-body lysimeters, connected to hanging-bottle vacuum generators, at three depths to collect soil leachates, which were then analyzed for pH and various anions and cations. He also measured soil temperatures at three depths.

Mahendrappa's results clearly demonstrate differences in the growth rates of the two species, white spruce and white pine, planted in the study area. In light of these results, the importance and necessity of choosing appropriate species best suited to the site cannot be overstated. This is especially true if we are to establish plantations to grow biomass for energy production in a continuous and sustainable manner.

Environmental impacts . . . *(continued)*

The hourly mean temperature immediately below the organic horizon in the WTH blocks was 8–10ºC more than that in SO blocks. The daily mean temperature also showed a similar pattern. Concentrations of nitrate and hydrogen ions were higher in the leachates collected from SO blocks than from WTH blocks. The estimates of calculated quantities of nutrients lost from WTH blocks were higher than those from SO blocks. Ground vegetation recovered within 2 years following harvest and the calculated Shannon-Weiner biodiversity index showed no difference in index values among different treatments. The height growth of trees planted during May 1992 in the harvested blocks is greater in SO blocks than in WTH blocks. Planted eastern white pine trees are generally taller than planted white spruce trees.

For further information on this research, contact Dr. Mahendrappa directly at tmahendr@nrcan.gc.ca.

Spotlight

◆ **Dr. Alex Mosseler** and **John Major**, of AFC, are co-investigators in a project led by Dr. Om Rajora, Canada Research Chair in Forest and Conservation Genomics and Biotechnology, University of New Brunswick, that has been awarded a significant NSERC grant. Up to $686750 spread over a period of 5 years is available to the project team to fund genomics work on black spruce, one of the most economically important forest tree species in Canada. The research has socioeconomic, ecological, and environmental implications for the long-term health, productivity, and sustainable management of forest resources. The markers developed will potentially assist early selection for traits related to productivity and adaptation to climate change, resulting in increased genetic gains and savings of millions of dollars to the Canadian forest industry.

◆ **Hurley, J.E.** April 2004 - Awarded $5000 of an $11,000 grant from the Nova Forest Alliance for work in a collaborative project with the Nova Scotia Dept. of Natural Resources on spruce beetle risk in the wake of Hurricane Juan in 2003.

◆ **Mahendrappa, M.K.** Has been instrumental in initiating the first model forest in India, the Kodagu Model Forest Trust, which is located in Kodagu District, Karnataka State. Dr. Mahendrappa has been appointed as a director to the board of this MF and has also been named Official International Representative of the board, with full power of attorney to negotiate on its behalf.

Coming Events 2005

APRIL

21-23 Envirothon - Nova Scotia

21-24 Envirothon - Newfoundland

MAY

1-7 National Forest Week
The Boreal Forest, A Global Legacy

4-7 Salon de la Forêt - Edmundston, N.B.

12-16 Envirothon - New Brunswick

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