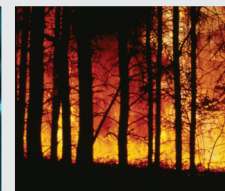
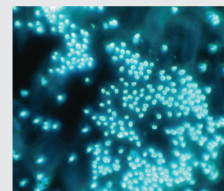
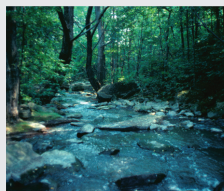




# InBrief

from the Canadian Forest Service – Laurentian Forestry Centre



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## A tool for classifying stand structure

Forest stand structure is a key element in biodiversity and should be taken into account from a sustainable forest management perspective. Stands should be managed so as to perpetuate their structural characteristics, such as the distribution of diameters within the stand.

Researchers at the Canadian Forest Service (CFS) and the Montreal Campus of the University of Quebec have developed a tool to quickly describe stand structures based on collected inventory data. They have also demonstrated a possible application of this tool and classified the stand structure of two contrasting regions in Quebec: the eastern spruce-moss forest region and the northern portion of the western spruce-moss forest region.

When the tool was used to analyse sample plots in the inventories of the two regions, it was possible to classify the stands into three structural types: even-sized, uneven-sized and inverse J-shaped. Nearly 90% of the western black spruce forest region is composed of pure black spruce stands, contrary to the eastern black spruce region. Most of the western black spruce forest stands are even-sized (62%), while almost 70% of the eastern black spruce forest stands are uneven-sized or inverse J-shaped.

Based on these results, the researchers concluded that it was possible to develop an effective tool for classifying thousands of stands quickly. By assessing the extent of various structural types in a region, it would be possible to more effectively plan developments that would help to maintain percentages of each type in a landscape as well as the ecological integrity of ecosystems.

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## Use of fluorescence for easier analysis of the growth rings of hardwoods

Analysing the growth rings of diffuse-porous hardwoods is a time-consuming, difficult task because the growth rings do not often show a clear separation between earlywood and latewood. The drying and sanding methods that are currently most often used do not always help to clearly delineate the rings, therefore complicating the task of dating and measuring them.

The fluorescence method is a simple, effective process for improving the visual detection of growth rings of diffuse-porous hardwoods. It involves the planing of fresh samples, which are then marked with a fluorescent dye and analysed under an ultraviolet light source.

CFS researchers have compared the costs and productivity of both methods and the results are conclusive: they can both be used to identify the same number of growth rings, but the fluorescence method detected narrow rings more easily. It reduced sample preparation time by 39%, compared with the sanding of dry samples, and cut costs by 33%, excluding the costs of the cold room required for this method. No significant difference was found in the amount of time required to read growth rings.

Compared with the sanding method, the fluorescence method is much faster and reduces labour costs significantly. Suitable for analysing tree sections or carots, the method makes it easier to identify the growth rings of coniferous species.

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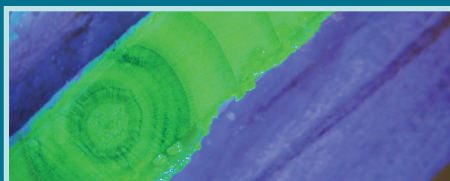


Photo: J.-M. Lussier

## FireSmart forest management: for the sustainable development of forest ecosystems

Sustainable development practices must be carried out in many of Canada's forest ecosystems in such a way as to minimize the socio-economic impact of forest fires and maximize their beneficial ecological effects. The objective of most forest management practices nowadays is to completely eliminate fires owing to their potential risks to public health and safety and timber operations. However, these practices are not economically feasible nor ecologically desirable.

The concept of fire-smart forest management developed by researchers at the Canadian Forest Service, Ontario's Ministry of Natural Resources and the Alberta Land and Forest Service is a pragmatic approach for achieving two seemingly contradictory objectives. The first is to use forest management activities in a planned, proactive way to reduce the land area ravaged by unexpected fires and the risks associated with prescribed burns. The second is to manage fires from a landscape perspective so as to maximize their ecological benefits.

Implementing the smart-fire concept involves several challenges such as integrating forest management and fire management techniques and changing the attitudes of the general public and resource management professionals. Forest management professionals will have to consider fires a major component of ecosystems and accept their unpredictable character and potential socio-economic impacts.

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## Developing models to measure forest productivity

As part of the ECOLEAP Project, CFS researchers want to identify the impact of environmental factors on the functioning of physiological processes and to link these factors to forest productivity. To achieve this, they are developing and validating models that will help them extrapolate their observations of landscapes.



Photo: M.A. Giasson

## Modelling of balsam fir photosynthesis

ECOLEAP Project researchers have developed a model that takes into account a host of components related to the key processes controlling photosynthesis inside the canopy. The objective of this model is to estimate the value of the parameters of a larger model that could be used to calculate forest productivity and include climate in long-term growth estimates. By applying the detailed model to balsam fir, it was possible to test several major assumptions for simplifying the modelling of photosynthesis. The researchers also demonstrated that non-linear phenomena, such as the reaction of photosynthesis to temperature variations, tend to become linear when one goes to a larger scale. For example, instantaneous leaf photosynthesis reacts fairly strongly to air temperature, but photosynthesis of the entire canopy reacts to a much lesser degree, which simplifies the representation of this phenomenon on a stand scale. The researchers also studied the contribution of various needle cohorts to total tree photosynthesis, and these results were included in a subsequent study carried out to estimate the impact of budworm defoliation on fir growth and survival. Lastly, the researchers demonstrated the need to take needle age into account in the sampling of canopy properties so as not to overestimate their overall productivity.

## Validation of a transpiration model for sugar maples

One of the challenges in developing links between environmental limitations and forest productivity is to generate relationships on the right temporal and spatial scale. We know, for example, that drought reduces tree growth, but the development of a quantitative relationship to understand this phenomenon correctly in our growth models or the verification of existing relationships requires empirical, control plot-scale data on tree transpiration and soil water content during droughts. ECOLEAP researchers obtained such measurements in a sugar maple stand during a summer in which a severe drought occurred. These measurements were used to make adjustments to a simple transpiration model in which the effect of reduced water content was taken into account. With the results of this analysis, it was possible to verify an empirical relationship linking soil water content and photosynthesis that is already being used in physiological growth models. Moreover, transpiration measurements were used to check gas exchange estimates taken from a maple photosynthesis estimating model. In a context of climate change, there is a risk of drought having a severe impact in some parts of Canada and estimates of its impact on growth should be correctly demonstrated in our models.

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Photo: Canadian Forest Service

## Forest vegetation simulator (FVS) growth model passes the test for Northern Ontario

Forest resource planning involves environmental, social and economic issues and must take into account modelling and evaluation tools that generate reliable forecasts. Among the many simulators that exist, the Forest Vegetation Simulator (FVS), originally developed by the United States Department of Agriculture's Forest Service, is frequently used to plan the growth and yield of many types of forests in North America. It can also simulate the effects of silvicultural treatments, regeneration methods and cutting activities, including commercial and pre-commercial thinning, not to mention the effects of problems related to insects, disease and forest fires.

Researchers at the Canadian Forest Service, Ontario's Ministry of Natural Resources and Forest Analysis Ltd, together with Tembec Inc and the Canadian Ecology Centre, wanted to determine whether the Lake States variant of the FVS (LS-VFS) could be used to satisfactorily forecast the growth and yield of Northern Ontario's main forest types. They compared the LS-VFS forecasts using historical data from permanent sample plots in black spruce, white spruce, jack pine and trembling aspen forests in Northern Ontario.

Their analyses demonstrated that, despite a few reservations and the inconsistency of certain aspects, particularly between the growth trend in the predicted basal area for young trees and the trend observed in the forest types in the study, the LS-FVS variant provides consistent predictions of growth in Northern Ontario's main forests.

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