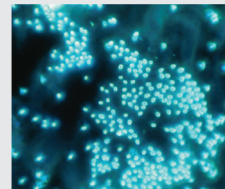




# InBrief

from the Canadian Forest Service – Laurentian Forestry Centre



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## Forecasting the quality of black spruce wood

With increased yield, rotations will become shorter and the use of genetically improved trees will increase. Trees will grow more quickly and will be larger. So how will this affect wood quality?

One factor used for measuring wood quality is density. Canadian Forest Service researchers, along with Université Laval and Forintek colleagues, conducted a study on predicting the density of black spruce wood according to growth rings.

Their research showed that the characteristics of a group of 12 growth rings on a tree could help forecast the wood's density when the tree became older.

This will significantly reduce the time it takes to develop genetically improved trees and will thereby reduce the associated costs.

**For information: Nathalie Isabel,**  
[nathalie.isabel@nrcan-rncan.gc.ca](mailto:nathalie.isabel@nrcan-rncan.gc.ca)

## Death is part of a tree's life cycle

The mortality rate in forest stands can be more or less severe, and the causes of death may vary. Usually, mortality in forest stands is divided into three phases, one of which is a result of competition among trees, which can be described as a self-thinning process of the stand. However, studies on this phenomenon appear contradictory, at least with regard to black spruce. In addition, recent studies have found a new mortality factor in this species, which had been overlooked until now: spruce budworm outbreaks.

To add to the information available on this matter, a Canadian Forest Service researcher, in collaboration with some colleagues at the Université du Québec à Chicoutimi, outlined the mortality pattern of 14 black spruce stands located in the Saguenay region and originating from forest fires and clearcuts performed at the beginning of the 20<sup>th</sup> century, and attempted to explain the mortality patterns observed taking into account various factors, including the age of the stand, competition, and recent spruce budworm outbreaks.

The team found that most trees had died in the 1970s and 1980s, which would suggest that the most recent spruce budworm outbreak is linked to the mortality rate. Their hypothesis was corroborated by significant growth decreases during the outbreak periods. The team believes that, given a partial correlation between mortality rates and the relative density of the studied stands, competition among stems may be a "predisposing" factor, while defoliation resulting from spruce budworm outbreaks may be a "triggering" factor to tree mortality, which mostly occurred among the smallest stems in the stand.

**For information: Jean-Martin Lussier,**  
[jean-martin.lussier@nrcan-rncan.gc.ca](mailto:jean-martin.lussier@nrcan-rncan.gc.ca)

## Forecasting the population dynamics of the gypsy moth



Photo: T. Arcand

A model that would simulate the development of a generation of insects could be useful in assessing the persistence of a given population when it colonizes a new area.

Therefore, Canadian Forest Service researchers looked at ways of modeling the seasonality of the gypsy moth (*Lymantria dispar*), an insect known for attacking deciduous trees and whose population seems to be growing in Canada. In conducting this research, they were able to verify the effectiveness of three existing models for egg development and compared these results with their observations on the hatching rate of caged egg masses in Victoria, British Columbia.

The results of two of the models tested were in line with field observations. When these hatching models were used in conjunction with larva, pupa and adult development models, researchers were able to simulate the seasonality of a whole generation of gypsy moths. Used simultaneously, these models helped to predict the seasonal occurrence of all stages of the insect's life cycle. They proved to be useful decision-support tools for controlling this insect when it moves into a new area.

**For information: Jacques Régnière,**  
[jacques.regniere@nrcan-rncan.gc.ca](mailto:jacques.regniere@nrcan-rncan.gc.ca)

## How to determine which trees are resistant to the white pine weevil

As early as 1930, researchers have observed that some Sitka spruce, the tallest conifer in Canada, could withstand white pine weevil attacks. This insect is well known in Quebec because of the damage it causes to loblolly pine and Norway spruce.

As a result of these observations, researchers identified lineages of resistant Sitka spruce. They then began producing selected trees as part of a major resistant tree selection program for organized by the British Columbia Ministry of Forests.

Canadian Forest Service researchers participate in the program by developing quick methods for identifying resistant trees.



Photo: T. Arcand

One of the methods developed consists in placing resistant and non-resistant spruce seedlings in cages with weevils. They found that weevils were less likely to attack the resistant trees than the non-resistant trees.

This method makes it possible to identify resistant trees more quickly and thus better determine resistance factors.

**For information:** Jan Klimaszewski,  
[jan.klimaszewski@nrccan-rncan.gc.ca](mailto:jan.klimaszewski@nrccan-rncan.gc.ca)

## Forest fires: A 235-year history

A Canadian Forest Service researcher, along with colleagues at the Université du Québec à Montréal, studied forest fires in eastern Canada from 1760 to 1999 in order to characterize the recurrence of fires in a 650,000 ha area, of which 510,000 ha are used for forest management and 140,000 ha are used for agriculture.



Photo: SOPFEU

Using aerial photographs and dendrochronology, researchers were able to determine that, from 1760 to 1853, fires in both areas were rare, but that large segments had burned. This is why close to 50% of the stands still existing were a result of fires prior to 1854.

From 1854 to 1916, the area of the forest fires decreased: less than 5% of the area was affected by fire during this period. Researchers explained that the decrease was a result of a more humid climate, making it less susceptible to major fires. However, in the agricultural area (developed beginning in 1916), the number of fires increased as a result of human activities, but also because more fires were being detected. Despite the increase, the areas burned continue to decrease in both areas.

**For information:** Sylvie Gauthier,  
[sylvie.gauthier@nrccan-rncan.gc.ca](mailto:sylvie.gauthier@nrccan-rncan.gc.ca)

## DNA persistence: Only a few months

As is the case with all transgenic plants, the production of genetically modified forest tree species raises questions among ecologists and the general public, as well as among researchers. Increasingly, we seek to assess potential environmental risks by conducting field trials with these transgenic species.

A group of Canadian Forest Service researchers has conducted studies in this vein. Through field tests, they wanted to find out what would happen to the DNA of the genetically modified species. According to their research, there is a small risk that the DNA be absorbed by microbes in the soil, particularly during decomposition of the leaves and roots. They therefore studied the persistence of DNA using a marker gene in the decomposing foliar tissue from transgenic poplar. They put leaves in permeable bags on the surrounding vegetation on and in the soil.

The study revealed that the DNA with a marker gene persisted no longer than four months in the forest environment and that it degraded more quickly in the soil than on the soil as a result of the relative humidity and the microbial activity of the soil. The researchers were thus able to show that, as a result of the rapid degradation of foliar tissue and based on data taken from other transgenic plant studies, there is little to no risk that the DNA of genetically modified trees be absorbed by soil micro-organisms.

**For information:** Armand Séguin,  
[armand.seguin@nrccan-rncan.gc.ca](mailto:armand.seguin@nrccan-rncan.gc.ca)

### For more information about the series:

Natural Resources Canada  
Canadian Forest Service  
Laurentian Forestry Centre  
1055 du P.E.P.S.  
P.O. Box 10380 Stn. Sainte-Foy  
Quebec (Quebec) G1V 4C7  
418 648-5789

[cfs.nrccan.gc.ca/publications/series/read/2](http://cfs.nrccan.gc.ca/publications/series/read/2)