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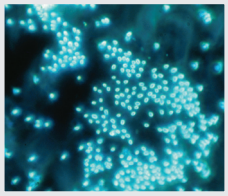
# In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

Number 11 – 2006






## Genetic improvement - Producing white spruce trees with longer fibres

Genetic improvement could enable us to produce white spruce trees with longer fibres, which in conifers are known as tracheids. Wood with longer fibres is more desirable for the forest industry.

Normally, the first objective of genetic improvement is to produce faster-growing trees. In general, this results in shorter tracheids. However, there are exceptions, and it is thus possible to genetically improve white spruce trees while respecting that criterion.

In the forest industry, longer fibres translate into better structural quality for wood products and better tear-resistance in paper. Tracheid length varies from one tree to another. To obtain longer fibres and better uniformity in supply, cloning would be the best option. Vegetative reproduction techniques (cuttings) are already widely used for the production of plants used in reforestation in Quebec. Therefore, it would be possible to take this into account in the current genetic improvement program for young trees used in reforestation.

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## Climate change - White spruce trees: Slowly but surely

Over the next few decades, it is expected that periods of drought will become much more frequent in boreal forests. White spruce, a species that grows slowly, would be more adaptable to the dry conditions that may occur.

*Photo: M. Lemieux, Le Québec en images, CCDMD*

That was what a researcher with the Canadian Forest Service discovered in a recent study, after exposing 12 families of white spruce to drought-like conditions. The families had been selected based on their growing characteristics. Three categories of seedlings (slow, medium and fast growth) were grown in a controlled environment. After 21 days of growth, drought-like conditions were introduced, and several variables associated with photosynthesis, particularly chlorophyll fluorescence, were measured on the seedlings.

The results of the research revealed that the slow-growing white spruce genotypes would adapt more easily to the new dry conditions that could result from climate change than those that grow at a medium or fast pace. Furthermore, chlorophyll fluorescence could be used to select trees that are best suited to dry conditions. These results suggest that the ability to withstand drought should be integrated into the selection criteria of existing genetic improvement programs to ensure the success of reforestation programs in the future.

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## Genetic improvement of black spruce: Producing better quality wood

Black spruce genetic improvement generally aims to produce wood with better industrial qualities. According to a recent study conducted by researchers from the Canadian Forest Service, the Université du Québec en Abitibi-Témiscamingue, the Université Laval and Forintek, this is entirely possible.

Until very recently, the purpose of traditional genetic improvement programs was to increase yield volume by selecting trees for their growth characteristics. However, current research indicates that wood from enhanced tree plantations or second-growth forests may have inferior characteristics both for the wood industry and the pulp and paper industry. Indeed, the proportion of juvenile wood is higher because of the fast growth of the trees and the short cutting cycles.

Laboratory analysis confirmed the presence of a higher proportion of juvenile wood, and thus revealed lower wood density and inconsistent wood characteristics. These parameters have a noticeable effect on the mechanical and technical properties usually sought after by the industry, particularly compared to wood from old, natural stands.

However, wood density depends on genetic factors. In the past, researchers in genetic improvement have shown that it was possible to select black spruce individual trees, families and provenances based on this characteristic. Genetic selection must not only focus on maximum production volume; it must also include this important criterion.

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*This publication is part of a series that presents popularized summaries of scientific articles written in whole or in part by Laurentian Forestry Centre researchers.*

Canada

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## The boreal forest of southwestern Quebec - Characteristics of its fire regime and silviculture prescription: Climate is the determining factor

Photo: Natural Resources Canada

A study conducted by researchers from the Canadian Forest Service and the Université du Québec à Montréal revealed that climatic factors, particularly precipitation and summer maximum temperatures, play a determining role in the fire dynamic of Quebec's southwestern boreal forest. They also observed that lightning fires cover larger geographical areas than man-made fires, even though 62% of fires are caused by human activities while only 38% are caused by lightning.

The study, which was conducted using data from the government of Quebec on the history of fires observed between 1945 and 1998, covered an area stretching from the Abitibi region to east of Lac Saint-Jean, and included the balsam fir-white birch and the western black spruce-moss bioclimatic domain. These two ecosystems, which contain fewer hardwoods, are more susceptible to serious fires, a situation that is reflected in the higher proportion of jack pine forests.

In general, the forest mosaics of these two sub-domains include mature and old-growth forests with even- and uneven-aged structures. Researchers suggest maintaining this natural structure through a silvicultural approach. In some regions of the spruce stand where fire recurrence is high, the current management strategy that consists in recreating the even-aged structure of these stands could be maintained. However, conserving the old forests of this ecosystem should be made a priority, given that the higher frequency of forest fires makes them rarer.

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## Global warming - A significant impact on the interior forests of western Canada

During the course of this century, average temperatures are expected to rise by 1.4 and 5.8°C. This change will affect forest growth and ecosystems functioning. Although researchers are expecting beneficial effects from the prolonged growing season and increased carbon dioxide level, they are also anticipating negative impacts, including increased ground-level ozone, more frequent native and exotic insect outbreaks, increased diseases occurrence, increased fire frequency, etc.

Photo: J. Larouche

Interior forests in western Canada are at risk of being more severely affected by global warming. They are located in an area that is already highly susceptible to periods of drought, and the expected climate change will expand the portion of the area in which severe drought could affect tree survival.

Two researchers from the Canadian Forest Service studied the anticipated impact of global warming on these forests and came up with several solutions to adapt forest management to these new conditions. Among other things, they suggest helping forests to adapt by selecting trees that are more drought-resistant and by introducing species that are better adapted to such conditions. They also suggest planting larger trees and concentrating planting activities during the wettest period of the year.

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## Thousand-year-old forests in Abitibi

A study of the forests in the Abitibi Clay Belt, conducted by researchers from the Canadian Forest Service, the Université du Québec à Montréal and the Université de Montréal, revealed that certain old-growth forests in Abitibi might have escaped forest fires for the past thousand years.

All of the forests of the Clay Belt, which is located in the northwestern part of the Abitibi region, have been hit by forest fires in the past. Using carbon-14 dating, researchers discovered that this was also the case in the oldest forests. However, because of peat bogs, lakes and rivers, which act as natural fireguards, some forests are protected against fires. When we add chance as a factor, it is entirely possible that some forests might have remained untouched by forest fires for several centuries, even for a thousand years.

However, it was long assumed that the fire cycle was much shorter, which was the rationale behind a form of forest management that, in an attempt to imitate nature, consisted in cutting all trees on a cutting cycle of 60 to 100 years. A forestry approach aimed at sustainable development should now take into account this new knowledge. Certain portions of the territory could be managed by imitating the uneven-aged structure of old-growth forests. Other old-growth forests could be preserved because they help maintain biodiversity.

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