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In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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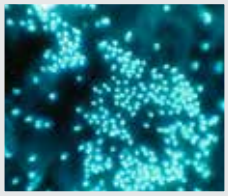


Using sound to measure the mechanical properties of white spruce

The wood from boreal forest conifers is used primarily to make structural building components where mechanical properties such as stiffness play an important role. The programs originally developed for the genetic improvement of conifers were essentially aimed at increasing growth and adaptability. However, recent studies show a negative relationship between rapid growth and the mechanical properties of wood, hence the need to take this into consideration in tree improvement programs.

Canadian Forest Service researchers, in collaboration with their Université Laval colleagues, conducted a study to find a simple, quick and low-cost method for selecting young (15-year-old) white spruce trees with the best mechanical properties. The researchers demonstrated that using an acoustic sensor to measure the speed of sound waves in the trunk gives a good indication of these properties. This technique is therefore a useful tool for selecting trees with the best mechanical properties.

Photo: NRCan

Because these characteristics are hereditary, measuring sound propagation can be used in genetic improvement programs to obtain trees with better mechanical properties for future plantations. Early evaluation makes it possible to accelerate these programs.

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Knowing the environmental issues surrounding the potential use of genetically modified trees

On a global scale, forests play a crucial environmental, cultural, social and economic role. A source of goods and services, forests are subject to pressures stemming particularly from the growing demand for lumber and other forest products, land conversion and soil degradation, as well as climate change. To counter these pressures, it is possible to produce more wood in smaller areas through intensive forest management and highly productive silviculture. This silvicultural strategy incorporates tree genetic improvement methods, including the production of genetically modified trees (GMTs). However, the planting of GMTs remains a controversial topic and concerns have been expressed about potential risks to the environment, among other issues.

This article, prepared by an international panel of experts in silviculture, tree genetic improvement, forest biotechnology and the environment, looks at how the environmental risk assessment used for genetically modified agricultural crops could be applied to genetically modified trees in plantations.

The experts emphasize the importance of differentiating between environmental risk assessments conducted in confined research trials and those carried out in non-confined research trials or in the commercial phase. In this context, it is necessary to bear in mind that the life cycle of trees is longer than that of agricultural crops, which has an impact on the spatial and temporal scale of the assessment. The possible impact of a plantation of genetically modified trees on the biodiversity of the area should also be considered.

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Melting ice affects boreal forests

The effects of climate change in the Arctic, such as the melting ice pack, are being felt not only in Arctic region marine ecosystems, but also in terrestrial ecosystems of boreal forest areas.

A study conducted by researchers from the Canadian Forest Service, the University of Zurich, Université Laval and the Université du Québec à Trois-Rivières established a significant relationship between melting Arctic ice and reduced productivity in black spruce stands in Quebec boreal forests between the 51st and 53rd parallels, right at the current boundaries of managed forests.

It is commonly thought that climate change may promote tree growth, but this study demonstrates the opposite: higher summer temperatures and melting Arctic ice, along with ongoing climate change, are resulting in an increase in the number of drought periods and in physiological responses that reduce the ability to sequester atmospheric CO_2 in boreal forests. These phenomena are resulting in tree growth loss and consequently lower forest productivity, particularly in old-growth black spruce stands.

The relationship between forest productivity and melting Arctic ice will have additional negative impacts as ice melting accelerates and the anticipated regional warming occurs in the coming decades. The study concludes that climate change can be expected to cause major changes in the near future to the structure and composition of forest stands in this region.

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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

In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

In hybrid poplar plantations, ground preparation work promotes root development

The conclusion of a study conducted in the southern boreal forest of the Saguenay–Lac-Saint-Jean region is that the successful establishment of fast-growing tree plantations depends on several factors, including rapid root development and access to soil nutrients. Podzols, a type of boreal forest soil, are made up of several layers, and the supply of nutrients and the presence of roots in these layers rapidly decrease as the depth from the soil surface increases.

The ground preparation work carried out prior to planting changes the vertical arrangement of soil layers and creates microsites that provide better physical conditions. In this study, researchers from the Canadian Forest Service and the Université du Québec à Montréal compared the vertical distribution of the roots of young hybrid poplars in mechanically prepared soil (creation of mounds) and in unprepared soil. They also correlated root distribution with the availability of soil nitrogen. They found that the roots were less abundant in unprepared soil. However, the roots proliferated in the organic layer and the upper mineral layer of the planting mounds. The creation of planting mounds also resulted in a greater availability of nitrogen in the mineral layer of the soil, but had no effect on the organic layer.

Photo: NRCan

Access to a greater volume of soil and a larger supply of nutrients could therefore explain the better plantation results observed when hybrid poplars are planted on sites with mechanical ground preparation.

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Models for assessing the quality of white spruce and jack pine sawn lumber

Knowledge of wood quality is information of considerable economic significance in the wood processing industry. In the case of trees grown in plantations, several factors, such as species, spacing and soil type, have an impact on sawn lumber quality.

White spruce and jack pine are among the most frequently planted species in Quebec. Researchers from the Canadian Forest Service and Université Laval conducted a study in which the objective was to construct a statistical model that could be used to predict variations in the mechanical properties of wood inside tree stems. This model was developed with easily measurable and widely available data, such as distance from the pith, tree height and diameter, and spacing between trees in the plantation.

Photo: NRCan

Two mechanical properties, the elasticity module and the rupture module, were targeted. The elasticity module is a measurement of wood rigidity when increasing pressure is applied that does not cause permanent deformation of the wood, while the rupture module is a measurement of the maximum force that a piece of wood can withstand just prior to fracturing.

The developed model provides a better explanation of the elasticity module than of the rupture module, and the results are better for white spruce than for jack pine. This model will be used to develop sawing simulation software programs to more effectively predict the quality of the sawn lumber and wood chips produced.

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Hybrid poplar plantations have no impact on soil fertility

The demand for forest products is continually growing, as is the pressure to preserve forests. To reconcile these two concerns, the planting of fast-growing species, such as hybrid poplars, in areas designated for more intensive forest management seems to be a worthwhile option. Researchers from the Canadian Forest Service and the Université du Québec à Montréal conducted a study to assess the impact of the planting of hybrid poplars on soil fertility. The research was carried out in 13 hybrid poplar plantations established on abandoned farmland in various regions of Quebec.

The researchers concluded that the presence of hybrid poplar plantations does not deplete soils in the short term; the quantity of available nutrients remains much the same as in unplanted sites. This is due to the ability of poplars to draw the nutrients they need from the soil, even when nutrient availability from minerals in the same soil is low.

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