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In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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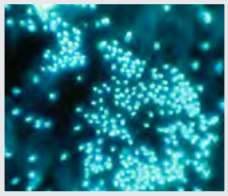


Modelling wood density within the stem: a journey through space and time

Tree value can no longer be measured by standing volume alone. The properties of the wood, including density, also have to be considered. How do we characterize this density at different locations in the stem and how do we test relevant hypotheses? The answer lies in a statistical model developed by researchers from the Canadian Wood Fibre Centre of the Canadian Forest Service and McGill University.

From a statistical point of view, a tree can be seen as a source of spatio-temporal data. Its expanse is represented horizontally by diameter and vertically by height. The role of time is played by annual growth rings. The multidimensional "tensor normal distribution" model developed by these researchers makes it possible to estimate the variance and dependency of a wood property for different years and at different locations in the stem.

To test their model, the researchers analyzed a set of wood density estimates for white spruce obtained using tomography; this technique allows thin section reconstruction of images from various parts of the stem divided into small cubes, and indirect density measurements to be taken.

From a practical standpoint, one noteworthy benefit of using this multidimensional model is that it requires fewer samples compared with previous models.

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Native and exotic poplars: a fruitful marriage?

Several species of poplar are found on the Canadian Prairies, including balsam poplar and Russian poplar. The former are native and grow in patches, while the latter are exotic hybrids. Russian poplars are often crossed with native poplars for use as windbreaks on agricultural land. Russian poplar became a preferred species due to its adaptability to extreme continental climate conditions. Some 17 million of these trees have been planted in the past century.

Photo: P. Talbot

To what extent do native balsam poplars naturally cross with exotic poplars? That is the question examined by researchers from the Canadian Forest Service, Université Laval and Agriculture and Agri-Food Canada.

In poplars, trees are either male or female. Genetics have made it possible to identify the parents of a hybrid and thus determine that the rate of natural hybridization between native and exotic poplars is 2% or less. In addition, researchers have discovered that the success of hybridization is largely attributable to the seeds of exotic female poplars. However, because the pollen (from male trees) has a better dispersion capability, this reduces potential hybridization zones. Studying herbarium specimens has confirmed that exotic characteristics have been present in balsam poplars in Western Canada for 40 years.

New insights regarding the environmental risk associated with the presence of hybrid poplars with exotic components will be particularly useful for planting program managers and certifiers.

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Fires and springtime temperatures: a matter of size

How have forest fires evolved since the last glaciation? That is the question examined by researchers from the Canadian Forest Service, Université du Québec en Abitibi-Témiscamingue, Université de Montréal, Université Laval, Université de Montpellier and Université Aix-Marseille. The researchers studied carbon found in sediment at the bottom of nine lakes in the Abitibi region. Their findings will be applicable to the entire coniferous boreal forest of eastern North America.

Both the number of fires and the amount of biomass burned in these forests have decreased over the last 3000 years. However, the fires are covering increasingly larger areas. To explain this phenomenon, the researchers demonstrated that fire size correlates with average springtime temperatures, which have increased by just over 1°C in the last 5000 years.

With anticipated global warming, the increase in fire size will affect forest planning and firefighting costs.

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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.

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from the Canadian Forest Service – Laurentian Forestry Centre

What habitat do chanterelles seek out in the boreal forest?

Chanterelles are one of the most popular and most consumed mushrooms in the world. In spite of this, few studies have focused on their ecology and habitat requirements. Researchers from the Canadian Forest Service and Université Laval have studied the productivity and requirements of this mushroom in two jack pine stands originating from boreal forest fires located near Girardville, in the Lac-Saint-Jean region. These forest environments are known to be conducive to the growth of chanterelles. One of the objectives was to better understand the microconditions and time of year in which the chanterelle was present in order to optimize harvesting.

The study served to confirm the presence of the species *Cantharellus cibarius* var. *roseocanus* for the first time in Eastern Canada. The first chanterelles appeared around mid-July and continued to emerge until the end of September. The average lifespan of the mushrooms was 35 days. Depending on the year and the sites, productivity ranged between 0.23 and 3.85 kg/ha.

At the sites studied, the most favourable microhabitats were those with high stand density, a high carbon-to-nitrogen ratio and an abundance of moss.

Photo: C. Rochon

The presence of goldenrod and sweet fern associated with jack pine was an indicator of productive environments, while the presence of ericaceous plants was unfavourable. The study also revealed a positive correlation between mushroom density and total rainfall 1 week prior to fructification, and with the temperature observed 2 weeks prior to fructification. Lastly, the absence of chanterelle colonies along the trails indicates that the prevailing conditions there are not suitable for it. This fact supports the idea that ectomycorrhizal fungi, such as the chanterelle, are better suited to natural forest conditions.

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Spruce budworm outbreaks: heading north

Researchers from the Canadian Forest Service have developed a model that simulates the response of the spruce budworm (SBW) to climate change, and thus predicts possible changes in its distribution range. The model indicates that global warming will have an impact, as the distribution range will move northward where temperatures are more suitable to the insect's development cycle.

The researchers also found that the model's predictions are consistent with the current SBW outbreak in Quebec, which is located further north than usual. This shift in their distribution range will affect stands not previously exposed to the SBW, including black spruce stands. This change in the disturbance regime may affect tree development and regeneration ability.

These findings will have an impact on the development of new methods of spruce budworm control for all of Canada.

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Poplar leaf rust: resistance triggers unmasked

Pathogenic fungi release a multitude of molecules that facilitate tissue penetration and colonization in their host trees. The trees, in turn, have developed mechanisms to recognize some of these molecules and develop resistance to block the development of disease. These fungal molecules, called effectors, are produced in the first stages of interaction and trigger host resistance. These effectors are under selection pressure and evolve rapidly in order to escape recognition by the host tree.

Researchers from the Canadian Forest Service, Université de Nancy and Université de Gand have identified all possible effectors of poplar leaf rust, the most rampant poplar disease worldwide. To do so, they thoroughly examined the rust gene catalogue, and genes that were activated at the very start of infection and evolved more rapidly were identified as possible effectors.

This discovery in forest pathology should make it possible to accelerate the selection of poplars displaying long-term resistance to rust and the development of molecular detection tools aimed at preventing the introduction of new strains of poplar leaf rust.

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