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In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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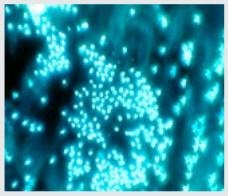


Climate change: genetics and dendrochronology to the rescue

The response of trees to climate change will be largely influenced by their evolutionary potential and genetic background. In this study, researchers from the Université du Québec en Abitibi-Témiscamingue, the Université du Québec à Montréal, the École Pratique des Hautes Études Paris-Sorbonne, the Université de Lyon and the Canadian Forest Service studied populations of Eastern white cedar in Canada's boreal forest. They first assessed the radial growth of Eastern white cedar populations along a latitudinal gradient based on growth rings and compared it with the genetic diversity of the population. Then, they examined growth in relation to climate at the regional level and tested its correlation with environmental variables and the population's genetic structure.

The results of this research show that combining tree-ring climatology studies and population genetics studies is a promising way of analyzing the trees' capacity to respond to climate change in natural stands. At the regional level, analyses indicate that the response of growth to climate is directly related to the stand's environmental variables (for example, the amount of seasonal precipitation and the temperature regime). Analyses show that the effects of genetic variables are sometimes mistaken for those of environmental variables, while the characteristics expressed by individual trees are controlled by both of these factors. Nevertheless, genetics have the greatest impact on the trees' responses to summer drought and spring temperatures. Therefore, there is hope that the species may be able to adapt genetically to climate change.

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What impact does the use of residual biomass have on plants?

It is recognized that the presence of residual forest biomass affects the nutrition and productivity of trees. The growing interest in the use of this biomass for the production of bioenergy raises numerous questions concerning the effects of biomass removal on the forest.

To answer these questions, researchers from the ministère des Forêts, de la Faune et des Parcs du Québec, the Université du Québec en Abitibi-Témiscamingue, Université Laval, the Université du Québec en Outaouais, the Centre for Forest Research and the Canadian Forest Service studied three hybrid poplar plantations located in Quebec's Saguenay–Lac-Saint-Jean, Lower St. Lawrence and Eastern Townships regions. The plantations were established on sites with varying soil and environmental characteristics. The researchers were thus able to study the impact of logging residues on the availability of water and nutrients for plants.

The study showed that the logging residues left on site had no short-term (two years) impact on the growth of hybrid poplar plants. Logging residues affect a number of factors that are linked to tree growth. However, these factors can have opposite effects on plants, thereby cancelling themselves out. For example, the presence of logging residues contributes to decreasing soil temperature, which in turn decreases tree growth in boreal regions. However, it can also negatively affect the growth of the competing vegetation that surrounds the plants, thereby helping to cancel out the former effect.

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Boreal forest: a tool to predict regeneration after fire

Fire is the main disturbance affecting the boreal forest of North America. Black spruce and jack pine are the dominant species in this forest and are well adapted to fire. However, after a fire or following salvage logging, it may happen, for various reasons, that the stands do not regenerate adequately.

This study was conducted by researchers from Humboldt State University, the Université du Québec en Abitibi-Témisamingue, the Université du Québec à Montréal and the Canadian Forest Service. It presents, in model form, a tool that predicts the density of natural regeneration after fire at the landscape level (with or without salvage logging) in black spruce and jack pine stands.

They used this tool to simulate planting needs based on three post-fire intervention scenarios: no intervention, salvage logging the first winter following fire, and salvage logging two to three years after fire. The simulations showed that planting needs varied greatly from one scenario to the next.

This tool can help forest managers and foresters determine regeneration needs in a timely manner following fire. It can also be used to determine the most appropriate period and area for salvage logging and other silvicultural treatments.

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Prescribed burning following clearcutting to reduce the effects of paludification

Paludification is a natural process by which the layer of organic matter on the ground continuously thickens. Among other repercussions, tree growth progressively decreases as the layer of organic matter grows.

Photo: NRCan

In this study, researchers from the Université du Québec à Montréal, the Université du Québec en Abitibi-Témiscamingue, the CEMAGREF and the Canadian Forest Service examined the effects of clearcutting followed by prescribed burning on understory species composition in comparison with clearcutting followed by silvicultural practices limiting soil disturbance, such as harvest with regeneration protection (HARP). The study was carried out in black spruce stands affected by paludification.

Analyses of ground vegetation performed at the plot level, site level and treatment level allowed researchers to examine the respective results of each treatment.

The results of this study suggest that clearcutting followed by prescribed burning represents a sustainable alternative to the current silvicultural practices performed in stands undergoing paludification. This treatment would preserve the biodiversity of understory vegetation and it would maintain – and may even increase – productivity in these stands.

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Growing hybrid poplars: a vector of poplar leaf spots?

Exotic diseases are often introduced as a result of human activities, such as transporting material over long distances, homogenizing forests and agricultural lands, and planting exotic species at a large scale in urban settings.

This study was carried out by researchers from the University of British Columbia, the Canadian Food Inspection Agency, the British Columbia Ministry of Forests, Lands and Natural Resource Operations, Université Laval and the Canadian Forest Service with the goal of identifying and mapping the presence of the fungus *Septoria musiva*, which causes poplar leaf spots in natural stands of poplar in western Canada and in hybrid poplar plantations in British Columbia. The researchers also hoped to examine the possible existence of a relationship between the genetic profiles of the poplars being studied and their susceptibility to the disease. The ultimate goal of the research was to assess the risk that this fungus could spread beyond the plantations of hybrid poplar, thereby becoming a threat to natural poplar stands in western Canada.

The results of this study suggest that human activities (including hybrid poplar cultivation) have an impact on the introduction and spread of the *Septoria musiva* fungus in British Columbia.

In order to minimize the dissemination of the fungus when transporting plants, the use of molecular detection tools and phytosanitary protocols, such as fungicide treatments, is recommended. The impact of this disease could also be minimized by selecting and planting trees that are resistant to it.

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Estimating standing timber volumes using satellites

Standing timber volumes (m^3/ha) are a key forest attribute to consider in the planning and management of forest resources, and when estimating carbon stocks.

Researchers from Gamma Remote Sensing, Stockholm University, the Woods Hole Research Center, the Swedish University of Agricultural Sciences, the Friedrich Schiller University, the International Institute of Applied Systems Analysis, the Max Planck Institute for Biogeochemistry and the Canadian Forest Service examined the accuracy of standing timber volume estimates across the entire Northern Hemisphere for the year 2010. These estimates were calculated using an EnviSat–ASAR satellite radar (ENVIronment SATellite–Advanced Synthetic Aperture Radar) and a proven methodology. The researchers used close to 70,000 ASAR images, each showing an area of about 1 km x 1 km.

For the four regions studied, standing timber volume estimates were found to be more accurate in boreal and temperate forests than in subtropical and polar areas. At a larger scale, the study showed that ASAR data provide relevant and unprecedented estimates of standing timber volumes for three continents (North America, Africa and Eurasia) and four ecological areas, including Canada's temperate and boreal forests. This study significantly contributes to the assessment of global forest carbon stocks.

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