Natural Resources Canada | Ressources naturelles Canada

# In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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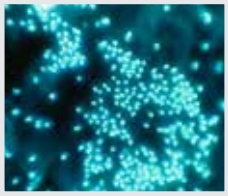


## Climate change: genes involved in adaptation of black spruce

Black spruce is a very common conifer in North American boreal forests and is well adapted to a wide variety of environmental conditions. Researchers at the Canadian Forest Service, Université Laval and the ministère des Ressources naturelles du Québec were looking to identify the genes responsible for this adaptation. In order to do so, they studied black spruce of various origins, subjected to different climates and presenting extreme values for two characteristics, bud break period and height, two characteristics recognized as being connected to adaptation. They then used genetic markers found in a few hundred genes and various statistical methods that made it possible to associate the values of these two characteristics with the markers.

They found some 20 regions of the black spruce genome and some 30 markers belonging to as many genes that were associated with one of the characteristics or both. By successfully identifying the regions of the genome and gene markers associated with the differences in bud break and height growth, the researchers demonstrated the potential for using this type of information to better manage black spruce genetic resources, especially in climate change conditions. These results are valid for eastern Canada.

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## Conservation of soil carbon after a disturbance: Advantages of deciduous trees

The composition of boreal forest stands varies based on soil conditions (drainage and fertility), climate conditions and disturbances (fires, insects and forest management). Boreal forest soil is also recognized as being one of the largest deposits of carbon on the planet.

In this study, researchers from the Canadian Forest Service, Université de Montréal, Université du Québec en Abitibi-Témiscamingue and Lakehead University wanted to determine how the composition of boreal forest stands impacts the stability of soil carbon. They noticed that in stands that contain more deciduous trees, soil carbon is more stable given its chemical characteristics and because it is at a lower depth than in coniferous stands. The accumulation of soil carbon in the latter is connected in part to cooler temperatures under the tree cover, a condition that disappears when the stand is disturbed.

In conclusion, after a disturbance, the soil in stands that are dominated by deciduous trees tend to better maintain their carbon content than soils with stands dominated by coniferous trees.

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## A parasite to counter the hemlock looper

The hemlock looper is an indigenous insect found everywhere in Canada. It is considered a major defoliator for balsam fir in the East and for hemlock in western Canada. Hemlock looper epidemics occur suddenly and spread very quickly. Severely-impacted trees can die in the space of a single season. The loopers lay their eggs in September and they hatch late the following spring.

Parasites play a key role in the natural control of this insect, particularly *Telenomus coloradensis*, a small wasp that parasitizes looper eggs. Researchers at the Canadian Forest Service, Université de Montréal and Université Laval have studied the effectiveness of this *Telenomus* in attacking the looper.

The adult wasps emerge at the end of July, but since there are no looper eggs before September, they enter a type of dormancy. Wasps can spend the winter as adults or in the form of larvae developing inside the looper egg. If they spend the winter as adults, the wasps can become active again early the following spring, thereby extending their period of attack against the looper. Researchers have noticed that these wasps are very effective in the spring, but much less so in the fall.

This new knowledge on the parasitism of *Telenomus coloradensis* makes it possible to better understand its life cycle and could help to better predict the damage caused by the hemlock looper.

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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

## More deciduous trees, fewer fires?

The introduction of deciduous trees into boreal forests is a possible strategy for reducing the risk of forest fires within the context of climate change. The presence of deciduous trees in a stand would make it less susceptible to fire. However, the effectiveness of this strategy still needs to be demonstrated.

In this study, researchers from the Canadian Forest Service, Université de Montréal, Université du Québec en Abitibi-Témiscamingue, the Centre national de la recherche scientifique (France) and the Institut botanique de France combined their data from analyses of charred particles and pollen from sediment in boreal forest lakes in eastern Canada with climate models and the modeling of forest fire frequency.

The analysis of charred particles found in lakes revealed that the frequency of forest fires was higher 6,000 to 3,000 years ago than during the pre-industrial period (around 1750), and this was due to a warmer and drier climate. However, in the southern part of the area studied, the frequency of fires was not significantly different from that of the pre-industrial period. Researchers concluded that the elevated risk of fire in the south 6,000 to 3,000 years ago was counteracted by a larger number of deciduous trees.

*Photo: NRCan*

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## The timing of salvage logging after a fire has an impact on tree regeneration

After a forest fire, salvage logging for industrial purposes must be done as quickly as possible to prevent wood degradation, namely by wood-eating insects. However, the regeneration of burned stands can be negatively impacted if salvaging occurs too soon, if seed dispersal has not yet occurred.

*Photo: NRCan*

Researchers from the Canadian Forest Service, Concordia University and Université du Québec à Montréal have conducted a study on the seed dispersal of black spruce and jack pine after a fire. Results indicated that over a period of 5 years following a fire, 90% of the seeds from the two species had been released. However, for jack pine, this dispersal rate is achieved within 1 year, whereas for black spruce, this percentage is only achieved after the fifth year.

Rapid salvage logging will have less of an impact on jack pine regeneration, whereas this same logging will considerably reduce the number of black spruce seeds available for regeneration.

This study helps in determining the ideal period for harvesting in order to promote the quality of the wood and the quality of the regeneration.

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## The looper is betrayed by its genes

The hemlock looper is a caterpillar considered to be one of the most severe defoliators in North America. Although it can feed on the leaves of several tree species, it causes the most serious damage to balsam fir and eastern hemlock.

In Quebec, previous research had identified two "ecotypes" of loopers, i.e. two populations of the same species that present distinct biological differences. The main difference resides in the fact that, under identical rearing conditions, the caterpillars from one ecotype go through four larval stadia, whereas the development of the caterpillars of the other ecotype requires five stadia.

Since the looper ecotype with four stadia causes the most serious damage and that its geographic distribution can change under the effects of climate change, researchers from the Canadian Forest Service have undertaken the task of identifying genetic markers in order to differentiate one ecotype from the other without having to rear them. This would make it possible to monitor the geographic distribution of the looper over time and develop a forecasting tool.

The 27 genetic markers identified in this study make it possible to correctly differentiate the two ecotypes in 95% of cases. These markers could now be used to develop an easy technique for identifying the looper ecotypes.

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