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In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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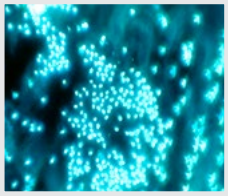


Western and eastern white pines: can the past vouch for the future?


Photo: NRCan

Understanding how these two tree species have adapted to past climatic conditions can help us predict how they will react to future environmental changes.

In this study, researchers from the University of British Columbia and the Canadian Forest Service showed that the existence of natural barriers, such as mountain ranges, have influenced the recolonization process of western white pine since the last glacial period and, therefore, its genetic diversity. Western white pine is mainly found in the mountains of western North America. A significant decrease in the genetic diversity of this species has been observed in the north, which reflects a recolonization process involving rare seed dispersal events over long distance. Such events would have helped the seeds cross natural barriers.

On the other hand, the recolonization process of eastern white pine, which grows in the less mountainous regions of the eastern portion of the continent, seems to have been little affected by the presence of natural barriers. The greater genetic diversity found throughout its distribution area suggests that the species expanded its range progressively.

Furthermore, the researchers observed two genetically distinct groups, each encompassing a number of subgroups, in the two species. These different subgroups indicate the presence of several refugia during the last glacial period. These results will help adjust genetic diversity conservation programs and predict the effects of future climatic conditions on western and eastern white pine populations.

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Ants and fire

Dead wood is an important component of a forest's ecosystem. It is the result of the natural death of trees or of significant disturbances, such as forest fires. A number of insects feed on or live in dead wood, where they dig galleries and thereby contribute to the nutrient recycling process. Wood decomposition begins immediately upon the death of a tree and involves a great number of organisms. Researchers from the Université du Québec à Rimouski, the Université du Québec à Chicoutimi and the Canadian Forest Service have examined the role of ants in this process.


Photo: NRCan

Their study, conducted over a 60-year period following a boreal forest fire, focused on how ants use dead wood as a nesting site. The researchers collected over 1,600 pieces of dead wood and found 263 ant nests built by eight different species.

These results show that the number of ants found in dead wood resulting from a forest fire increases over the first 30 years following the fire, before progressively decreasing. The researchers also noted that the carbon/nitrogen ratio, which is an indicator of decomposition, was lower in wood containing ant colonies, which indicates greater decomposition. These results show that ants have an impact on the dynamics of these two elements in dead wood. The researchers also noted that dead wood that had been attacked by longhorn beetles was more likely to be colonized by ants afterwards.

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Is climate change a threat to boreal forests?

The boreal forest is one of the world's largest biomes; it represents approximately 30% of the Earth's forests and provides a number of important ecological services at the local and global scales. Two thirds of the boreal forest are being managed, mainly for wood production purposes. Both managed and unmanaged forests contribute to carbon sequestration and climate regulation.

Most of the boreal forest has maintainted, at least partially, its adaptation cababilities and some degree of resilience, which allow it to cope with the current levels of disturbance (fires, insect outbreaks, etc.).

The climate change projected until 2100 as well as land and resource use will be increasingly widespread and faster than they are at present. This constitutes a threat to the health of boreal forests. In this study, researchers from the University of Helsinki and the Canadian Forest Service found that there already are several regional forest management options that could be implemented in order to reduce the projected impacts of climate change. Faced with the extent of the anticipated risks, the researchers recommend that international policies be implemented to support forest management initiatives aiming to improve the adaptation capabilities of boreal forests and mitigate the impacts of climate change.

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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 woodland caribou, an umbrella species?

Photo: Jean Tanguay, Québec couleur nature 2011

One of the greatest challenges in conservation biology is the protection of biodiversity despite the increase in human activity in wildlife habitats. A study conducted by researchers at the Université Laval, the Université du Québec en Outaouais and the Canadian Forest Service tested the concept of an "umbrella species" in a boreal forest setting. This concept is based on the principle that it is possible to protect all biodiversity by protecting a single sensitive species, i.e., the "umbrella species". To do so, the researchers studied how the implementation of the woodland caribou recovery plan in the boreal forest could protect all animal communities.

They sampled species of birds, insects and small mammals within forests of various ages in the Côte-Nord area of Quebec; these forests either resulted from forest fires or harvesting. They modelled the distribution of 95 animal species over a territory spanning 90,000 km^2. Based on the caribou recovery plan, they also compared the impact of various harvesting scenarios on animal populations.

They found that a forest management strategy focused on maintaining caribou populations, e.g., by extending the intervals between harvests and reducing removal levels, would effectively preserve animal populations and the integrity of the boreal forest. The forest management scenarios studied during this research project led to the identification of disturbance thresholds for forest managers according to conservation objectives.

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Climate change: no benefits for black spruce

Black spruce forests represent an important economic resource in North America. The global warming forecasted by climate change scenarios has led many researchers to predict increased forest growth at northern latitudes.

However, a study conducted by researchers at the Canadian Forest Service has shown that the global warming predicted by the end of the 21st century would decrease the productivity of Canadian black spruce forests, despite the longer growing seasons.

To reach this conclusion, the researchers used dendrochronology and growth models to study the impact of climate fluctuations on the growth of black spruce trees between 1970 and 2004. They noted that higher temperatures combined with limited soil water availability limited tree growth.

Using a growth model, the researchers were able to estimate the growth of black spruce trees according to different climatic scenarios. Although rising temperatures may eventually improve growth conditions in northern Canada, in southern black spruce forests, this benefit would be offset due to reduced soil moisture; this moisture is essential to tree growth.

This decreased productivity would also lead to a decrease in the forests' carbon sequestration capacity.

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Climate change and carbon in boreal forests

Globally, the boreal forest ecosystem has a significant impact on the carbon cycle. Nearly 25% of the planet's carbon is found in this ecosystem's trees, understorey species, soil and roots. Soil carbon levels can be up to twice as high as those found in the trees and undergrowth. Over the next few decades, climate change could impact the boreal forest ecosystem's carbon sequestration capacity.

The purpose of this research undertaken by scientists at the Université de Sherbrooke and the Canadian Forest Service was to examine the extent to which the carbon content of balsam fir and black spruce ecosystems, two dominant species of the boreal forest, could vary along a climate gradient of approximately 4°C in eastern Canada. Researchers found no significant differences in terms of carbon contents in the trees, understorey species, dead stems, litter and soil of the experimental sites. The only significant differences among these sites were found in the carbon pools of fine roots, which was greater in the south than in the north.

The results of this study show that the average annual temperature only has a slight effect on carbon allocation within balsam fir and black spruce ecosystems subject to similar climate conditions.

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