Natural Resources Canada | Ressources naturelles Canada

In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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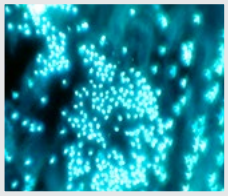


Boreal forest: Will global warming affect soil carbon pools?

The boreal forest stores great quantities of carbon in its soil, but how this carbon will respond to global warming is not certain. In this study, researchers from the Memorial University of Newfoundland, the University of Kansas and the Canadian Forest Service evaluated the impact of an increase in temperature on the decomposition process of various soil carbon pools in the boreal forest.

The results of this study show that an increase in temperature accelerates the decomposition

Source: NRCan

of organic matter in boreal forest soils, thereby increasing carbon emissions. This phenomenon occurs in all carbon pools, but more so in the case of the more stable carbon stored in deep soil layers.

Faster decomposition rates could affect the global carbon cycle. In fact, if decomposition (carbon source) speeds up and is not mitigated by an increase in forest productivity (carbon sink), the amount of carbon emitted by these forests could also increase.

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Boreal forest: fire or harvest?

Natural disturbances such as fire and insect outbreaks play an important role in boreal forest dynamics. They contribute to its renewal and maintenance. Fire is by far the most important disturbance in terms of area and territory affected. However, in the boreal forest of eastern Canada, logging activities have gradually increased and, in certain sectors, they have become the greatest disturbance. For instance, between 1973 and 1997 in the region west of Lac-Saint-Jean, 205,635 hectares of forest burned, while 413,054 hectares were logged.

These two types of disturbance have a more or less severe impact on the ability of these forests to renew themselves. Using satellite images of the boreal forest of western Quebec, researchers from the Université du Québec à Montréal, the Université du Québec en Abitibi-Témiscamingue and the Canadian Forest Service compared the forest's renewal capabilities after logging and after fire.

They showed that the western Quebec boreal forest recovers at a faster speed in harvested stands than in burned stands, since harvested stands are only found in productive areas, whereas burned forests are found in a variety of environments. However, in the case of productive stands, forest recovery takes place at a similar speed after logging than after fire.

This research will contribute to the development of ecosystem management approaches that aim to emulate natural disturbances.

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Fire and carbon in boreal forests

Accounting for 32% of the world's forest carbon, boreal forests are comparable to tropical forests in terms of carbon stocks. The length of time the carbon is stored in the various ecosystems has a significant impact on its overall cycle. Carbon contained in the aboveground biomass of boreal forests is one of the key elements in understanding the role these forests play in the carbon cycle.

Forest fires fulfill an important function in boreal forest dynamics, and so researchers from Université Laval, the Université du Québec en Abitibi-Témiscamingue and the Canadian Forest Service undertook a study to determine if it was possible to predict variations in aboveground biomass carbon based on the time elapsed since the last fire. According to existing carbon budget models, carbon stocks are not related to variations in forest composition, nor to environmental factors. Nonetheless, the time elapsed since the last fire is an important variable in explaining changes in forest succession and carbon stocks.

This study demonstrates that at forest landscape level, biomass carbon quantity increases with the time elapsed since the last fire through an increase in forest cover density. Therefore, a forest carbon assessment can be performed at a greater scale than at the stand level without using yield tables.

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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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Short-rotation culture of willow and hybrid poplar: Is nitrogen an asset?

Interest is increasing in the short-rotation culture of hybrid poplar and willow on abandoned farmland in Canada. These two species grow quickly in general, even with high density per hectare. In terms of biomass production, they can be harvested 2 to 8 years after planting.


Source: NRCan

The purpose of this study conducted by researchers from the Université du Québec en Abitibi-Témiscamingue, the University of Alberta, and the Canadian Forest Service was to develop a method that would significantly shorten the selection process of the most productive clones per unit area for bioenergy production by basing it on physiological and morphological parameters. The study monitored the morphological characteristics of seven poplar clones and five willow clones planted according to three spacing patterns and fertilized at two different levels of nitrogen.

The study showed that reducing the space between the trees from 60 to 20 cm reduces leaf area by 50%. However, the aboveground biomass per tree remains relatively unchanged. This could be explained by an increase in tree height per unit of leaf area when spacing is reduced.

By comparing trees growing 60 cm apart and fertilized at a low nitrogen rate with trees growing 20 cm apart and fertilized at a high nitrogen rate, the study revealed that collar diameter, crown width and leaf area are similar in both cases. In terms of height, trees growing 20 cm apart may outgrow those growing 60 cm apart. Nitrogen fertilization could therefore minimize the negative effects of competition among trees.

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Understanding the microbiota of spruce budworm

Every year, the industry loses a considerable quantity of wood because of defoliating insects such as the spruce budworm (SBW). Controlling these pests is a constant challenge, and scientists are always trying to find new control methods. Over the last few years, researchers have been particularly interested in control methods that are based on insect microbiology. The study of the intestinal flora of insects is one of the new subjects sparking interest, especially in the case of insects such as the SBW for whom this flora could have an important impact on its health.

The bacteria present in the intestine of the SBW may play a role in its digestion, its immune capacity and its development. In this study, researchers at Université Laval, Dalhousie University and the Canadian Forest Service identified the effects of various rearing factors, including diet, on the composition of the intestinal flora of SBW larvae. Among other things, they observed that certain bacteria are dominant, particularly those of the genus Pseudomonas, and that there is a greater diversity of microorganisms when the larva feeds on a synthetic diet rather than on fir or black spruce.

Gaining a better understanding of SBW biology will make it possible to develop increasingly efficient control methods.

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Predicting the duration of spruce budworm outbreaks: beware!

The anticipated changes in climate should have a significant impact on insect outbreaks, particularly in boreal forests. Being able to foresee natural disturbances, such as spruce budworm (SBW) outbreaks, is a valuable asset in the development of climate change adaptation strategies.


Source: NRCan

Researchers with the Canadian Forest Service showed that predictions of SBW outbreak duration vary according to the data and the statistical algorithm used. The researchers studied a number of SBW outbreak prediction models using two sets of explanatory variables (including climate data) and six statistical algorithms. They observed that future outbreak predictions vary over time, making them highly unreliable for some regions and much more precise for others.

Model-related uncertainty should be taken into consideration when using modelling in the planning of adaptation strategies.

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