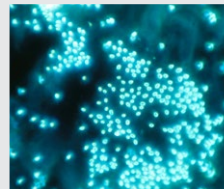




In Brief

from the Canadian Forest Service – Laurentian Forestry Centre



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Increased soil organic matter impedes black spruce seed production

Disturbances play an important role in the distribution of tree species in the boreal forest, as they affect colonization capacities and resiliency. Disturbances occurring at short intervals have already been linked to a decrease in the quantity of seeds. However, little information is available regarding the effects of disturbances when they occur at longer intervals.

In this study, researchers from the Université du Québec en Abitibi-Témiscamingue, the University of Agricultural Sciences in Sweden, the Université du Québec à Montréal and the Canadian Forest Service have shown that in the boreal forest of northeastern North America, the longer the interval between two fires, the more organic matter accumulates on the ground, which causes stress in trees. This stress impedes tree growth and the quantity of seeds available.

Thus, in young forests (60 to 150 years old), the seed banks of mature trees are medium-sized, whereas for younger trees that grew on a thicker layer of organic matter, there are much fewer seeds. In older forests (350 to 710 years old), seed banks are generally smaller. This lack of seeds can affect the regeneration capacity of the area following a forest fire.

For information: Sylvie Gauthier,
sylvie.gauthier2@canada.ca

Decreasing the cutting intensity increases parasitism in the hemlock looper

The hemlock looper is an important forest pest in eastern Canada. It can kill trees after only one year of defoliation. In eastern Canada, balsam fir is the main host of the hemlock looper, while its preferred host is hemlock in the Western provinces.



Photo: NRCan

Parasitism helps mitigate the damage caused by the hemlock looper. In this study, researchers from Université Laval and the Canadian Forest Service found that parasitism of hemlock looper larvae was less significant in stands with 40% partial cutting, compared with 25% partial cutting or non-harvested stands.

Therefore, in order to maintain high parasitism levels in forest stands that are vulnerable to hemlock looper attacks, researchers recommend avoiding partial cutting or maintaining the cutting intensity below 40%.

For information: Jacques Régnière,
jacques.regnieres@canada.ca

Harvesting rates: taking fire probability into consideration

This study, which was carried out by researchers from the Université du Québec en Abitibi-Témiscamingue, the Université de Montpellier and the Canadian Forest Service, shows that fire occurrence was twice as high during the warmest periods (thermal maximum) of the Holocene (from 3,500 to 7,000 years ago) as it is today.

To minimize the risk of changing the forest structure, harvesting rates should be adjusted according to fire probability. The combined impact of harvesting and fire should not exceed the fire frequency observed during the Holocene's thermal maximum.

By reconstructing the Holocene's fire history at the northern limit for timber allocations in northeastern Canada, researchers aimed to establish parameters for determining harvesting rates for this area that would promote sustainable forest management. Researchers showed that current burn rates are within the range of fire frequency observed throughout the Holocene, but that they could come to resemble those observed during the Holocene's thermal maximum in the next decades due to climate change. This would also decrease the quantity of wood available to the industry.

For information: Sylvie Gauthier,
sylvie.gauthier2@canada.ca

Two populations of white pine blister rust in Canada

In Canada, there currently are two genetically distinct populations of *Cronartium ribicola*, the fungal pathogen that causes white pine blister rust: the eastern population and the western population. The specific purpose of this study was to identify the genetic characteristics of these two populations. As a result of this work, it was possible to assess how landscape features, host distribution (all species of five-needle pines), climate and colonization history shape the population structures of this pathogen.



Photo: NRCan

Results showed that the pathogen's eastern and western populations are separated by a natural barrier created by a disruption in the distribution of white pine populations. However, the study also showed a certain degree of contact between the two populations, thereby demonstrating the pathogen's potential to cross this barrier, possibly through human activities (e.g. movement of infected white pine trees or *Ribes* that are asymptomatic).

Such interactions could increase the genetic diversity of the pathogen, which would provide it with greater potential to adapt to white pine defense mechanisms. This study therefore shows the importance of monitoring white pine blister rust and of testing transplant seedlings in order to prevent interactions between the two populations of this rust in Canada.

For information: Philippe Tanguay,
philippe.tanguay@canada.ca

Estimating boreal forest's biomass

North America's boreal forest contains enormous quantities of carbon, a large portion of which is stored in the aboveground parts of trees. Researchers from Université Laval, NASA and the Canadian Forest Service have developed a novel multi-scale approach using satellite and airborne LiDAR data, rather than data obtained from inventory ground plots, to estimate biomass. This approach makes it possible to sample large areas of boreal forest that are often incorrectly inventoried using traditional methods. Researchers thus estimated the total quantity of aboveground forest biomass across all ecozones of North America's boreal forest (Alaska and Canada), according to their main forest cover types and taking the associated uncertainty into account. The main scientific contribution of this research is that the approach draws attention to viable biomass characterization options based on sampling data obtained with emerging satellite and airborne LiDAR technologies.



Photo: NRCan

In this study, the quantity of biomass in North America's boreal forest was estimated at 2,180 megatons, with 46.6% of this biomass located in western Canada, 43.7% in eastern Canada, and 9.7% in Alaska, with a relative error margin below 4%. Overall, these estimates closely resemble those derived from photo plots and Canada's National Forest Inventory maps.

For information: André Beaudoin,
andre.beaudoin@canada.ca

Potential impacts of climate change on wood supply

In Canada, wood supply is planned based on long-term sustainability. Climate change is likely to increase forest fire frequency across Canada. In this study, researchers from the Canadian Forest Service used different models to assess the vulnerability of wood supply to current and future fire risks.

It is expected that the wood supply in certain boreal forest and mountain management units will become very or even extremely vulnerable to fire by the mid-century. Furthermore, in many other management units where wood supply is currently less vulnerable to fire, a decrease in tree growth, even a slight one, would be sufficient to make them moderately vulnerable.

Researchers also present some adaptation measures to deal with these rising risks, such as taking fire risk into account when assessing the amount of wood that can be harvested.

For information: Sylvie Gauthier,
sylvie.gauthier2@canada.ca

For more information about the series:

Natural Resources Canada
Canadian Forest Service
Laurentian Forestry Centre
1055 du P.E.P.S.
P.O. Box 10380, Stn. Sainte-Foy
Québec, QC G1V 4C7
418 648-5789

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