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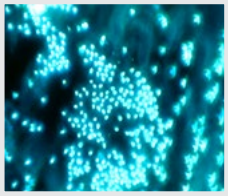
# In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

Number 59 – 2021






## Caribou and recurring wildfires: learning from the past

Wildfire is one of the main natural disturbances driving ecosystem dynamics. Over the years, animal species, including the caribou, have adapted their behaviour to these disturbances. Despite frequent forest fires, the decline of woodland caribous probably started with increased logging in their distribution area.

The study carried out by researchers from the Université du Québec à Rimouski, Université Laval, Université du Québec à Montréal, and the Canadian Forest Service, aimed to confirm whether or not the offspring of caribous that had experienced wildfires more easily adapt to changes in their habitat. Past experience with wildfires could enable them to better perceive the signs associated with canopy opening after logging and adjust their be-haviour accordingly.


*Photo: NRCan*

The results revealed that caribous living in areas with high fire rates avoid areas of recent fire (< 5 years) as well as areas of recent logging. Caribous without this ancestral experience were more likely to choose recently disturbed habitats. Although caribous are sensitive to human disturbances such as logging, they seem to adjust more readily if they have previous experience with fire.

In a context in which logging and road development may be the cause of increased mortality of boreal caribous in the boreal forest, this study supports the idea that the logging of areas that are historically free from fire disturbance may threaten the sustainability of caribou populations living there.

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## When investing in fire management increases revenues…

Wildfire is a component of the dynamics of boreal-forest ecosystems. It can have negative economic impacts such as a loss of forest resources, property, infrastructure, as well as higher expenditures incurred to manage them. The vast majority of management costs are associated with suppression expenditures (initial attack and suppression). But what about pre-suppression investments (fire prevention and detection)?

Researchers from Université Laval, the University of Toronto and the Canadian Forest Service sought to understand the economic impact of forest fire management on timber production in three regions of Quebec. They assessed the impact of pre-suppression expenditures on the increase in net revenues expected from wood harvesting and processing using cost-benefit analysis models depending on annual burn rate.

Analyses show that an increase in pre-suppression investments reduces the risk of forest fires and suppression expenditure. Under these conditions, the expected net revenue from the sale of harvested wood products increases in parallel with the decrease in burnt areas. As a result, higher pre-suppression expenditure could reduce risks associated with wood supply.

Pre-suppression investments should therefore be considered as a mitigation measure in forest management plans where there is a high risk of forest fires.

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## What factors influence successful fire suppression?

Many fire-prone countries are investing in the protection of local communities and resources. For instance, in addition to investing at least $250 million annually, Canadian fire agencies have implemented prevention and control strategies to reduce the effects of fires in intensively protected areas.

Based on work previously carried out by the Société de protection des forêts contre le feu (SOPFEU), researchers from the University of Lleida, Université du Québec à Montréal, SOPFEU and the Canadian Forest Service analyzed different factors preventing the achievement of fire suppression objectives before a fire exceeds three hectares.

Results show a suppression rate of 88% when considering the influence of operational objectives (detection, initial attack, and fire control) on successful suppression outcomes along with other factors such as fire intensity, cause, fuel type, year, workload, and homogeneous fire zones over a 20-year period. The suppression rate varied regionally, from 53% in the northernmost area to 96% further south in deciduous forest. In addition, detection and control had a significant effect on suppression success in relation to fuel type, ignition cause, fire intensity, and zone variables.

This study underscores the importance of having operational objectives and highlights regional differences in successful fire suppression and final fire size. Results will help fire protection agencies to optimize their fire management system.

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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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## Are salvaged trees a sustainable source of energy?

Dead, damaged, and low quality trees that remain after natural disturbances in the boreal forest represent a source of raw materials for the bioenergy market. This resource is already being used commercially in many ways and other uses are under development. Mobilizing this biomass is quite challenging and its large-scale exploitation also raises environmental sustainability concerns.

*Photo: NRCan*

Researchers from Queen's University, the University of Wisconsin, Université Laval, the University of British Columbia, and the Canadian Forest Service examined the potential for using trees salvaged from natural disturbances to provide bioenergy by assessing various issues.

Analyses show that Canadian policies could regulate the harvesting of this biomass by setting guidelines. For example, they could establish a minimum amount to be left on the harvest site. Moreover, since annual harvestable quantities remain uncertain due to the variability of disturbances, researchers recommend that disturbances and where they occur be included in planning over an extended period of time. Given that uncertainties remain as to the development of competitive and profitable supply chains because of logistical reasons, researchers recommend the use of models that integrate environmental and socio-economic data. The study also shows that this biomass is of suitable quality to be used as bioenergy due to its low moisture content.

Bioenergy from salvaged trees can mitigate climate change, but the time required to see benefits varies from a few years to several decades.

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## 80 years of monitoring: a closer look at the soil-vegetation relationship

In eastern Canada, the forest landscape has undergone major changes since the country's colonization. Stands that were once dominated by conifers have become more deciduous. On the one hand, this change in forest composition has led to new nutrient dynamics in the soil. On the other hand, the soil in turn influences the forest composition.

Researchers from the Université du Québec à Rimouski, the Université Laval, Biopôle Clermont-Limagne and the Canadian Forest Service sought to understand the long-term effects of forest composition change on the properties of the various soil horizons using data on forest dynamics collected over the past 80 years in the south of the St. Lawrence River in Quebec.

The gradual increase in the proportion of hardwood species has led to soil property changes, especially in the O-horizon. Researchers note that an increase in the proportion of maples at the expense of conifers over several decades has resulted in increased availability of nutrients in the O-horizon as well as in the underlying B-horizon. However, they observed that the original substratum, i.e. the C-horizon of the soil, remains the determining factor in explaining current soil properties. Analyses also show that the composition of the original forest has no influence on the current soil properties where a change in forest composition has occurred. This suggests that the soil changes rapidly depending on the change in forest cover.

*Photo: NRCan*

This study provides a better understanding of the factors influencing soil-vegetation relationships in the context of longer-term forest species migration.

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## Black spruce: is salvage logging still beneficial?

Spruce budworm (SBW) outbreaks are an important component driving forest ecosystem dynamics in the Canadian boreal forest. Post-SBW salvage logging is often used by the forest industry to reduce economic losses, but could interact with the outbreak to affect advance regeneration.

Researchers from Université Laval, Université du Québec à Montréal and the Canadian Forest Service set out to determine the impact of SBW outbreaks and post-outbreak salvage logging on the defoliation of advance regeneration in coniferous stands of eastern Quebec. They compared post-outbreak susceptibility to defoliation depending on regeneration height, species (black spruce and balsam fir), and type of stands (fir to black spruce gradient) in harvested and non-harvested sites.

This study shows that salvage logging in black spruce-dominated stands could affect advance regeneration. Indeed, the defoliation rate of advance regeneration in the harvested stands reached 30%, compared to less than 10% in the non-harvested sites. This defoliation reduces growth rate and potentially increases tree mortality rate. The stand's composition could thus shift from being black spruce-dominated to being balsam fir-dominated, thereby increasing its susceptibility to future SBW outbreaks.

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 ISSN 1925-5756