Natural Resources Canada | Ressources naturelles Canada

In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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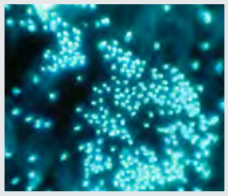


Identifying forests with an irregular structure

Ecosystem-based management in the boreal forest involves the use of cutting methods that promote the maintenance of irregular stand structures extending over a certain proportion of the forest landscape. However, during the planning stages, it is difficult to identify which stands are best treated using an uneven-aged silvicultural system because the forest maps currently available do not include all the necessary data. Researchers with the Canadian Forest Service and Université Laval tested a method to address this issue.

From the analysis of 103 sample plots established in the North Shore region of Quebec (spruce–moss bioclimatic domain), the researchers developed a classification consisting of six forest types ranging in composition and structure from regular (even-aged) stands dominated by black spruce to irregular stands co-dominated by balsam fir and black spruce. The results were overlaid on three types of map—a forest fire map covering the period since 1800, the present ecoforest map available for the area, and a fine-scale version of this map—in order to assess the ability of the existing tools to identify stands with an irregular structure.

The results show that these mapping tools can assist in the identification of forest types with irregular stand structures, with the fine-scale forest map providing the best predictions. The results also confirmed that a large proportion (nearly 60%) of forests in the study area have a complex structure. This is important information to consider in an ecosystem management context.

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Insect colonization of burned trees: A matter of chance?

Saproxylic insect species depend on dead wood for food and shelter. They are attracted to recently burned forests which contain an abundance of dead and dying trees. A team of researchers with the Canadian Forest Service and the Université du Québec à Chicoutimi studied the effect of habitat characteristics on insect colonization. It is generally recognized that habitat attributes and species interactions result in non-random patterns of species occurrence; however, it is difficult to quantify the respective role played by these two factors. Statistical analyses were performed on data obtained from a study conducted in the spruce–moss bioclimatic domain of Quebec in order to quantify the effect of these factors.

Tree species, tree size (stem diameter at breast height) and degree of fire damage were selected as habitat attributes. In most cases, species-habitat relationships explained the aggregation of species (species with the same needs) or their segregation (species that react differently to the same habitat characteristics). The presence of insects was also influenced by interactions between the various insect species, which are themselves subject to habitat constraints. For example, predators and preys were found to co-exist mostly on large trees.

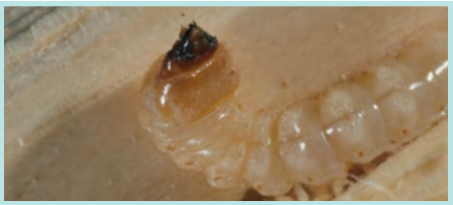

Photo: NRCan

This better understanding of the role that habitat plays in preserving the diversity of insects that colonize burned trees will help to improve post-fire forest management.

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Mountain pine beetle likely to benefit from climate change

Climate change may have a major impact on forest insect outbreaks because of the direct influence of temperature on insect development and population success. Researchers with the Canadian Forest Service, the University of British Columbia, Colorado State University and the University of Freiburg used a modelling approach to study the effect of climate change on the occurrence of mountain pine beetle outbreaks in western Canada.

Photo: K. Bolte

This work showed that a 1°C to 4°C increase in mean temperature greatly increased the risk of outbreaks and that they could occur at higher elevations and latitudes in the future.

Extreme cold temperature variables with a major biological influence on the growth of mountain pine beetle populations were incorporated into a statistical model, along with several other environmental variables, spatio-temporal conditions favourable to insect outbreaks, and topographical variables. To date, few empirical models have used a range of extremely cold temperatures to assess the effect of extreme cold events on the occurrence of outbreaks of this insect.

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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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Winter survival not linked to host tree vigour

The spruce beetle is a pest that preferentially attacks weakened or dying trees. During outbreaks, however, the beetles disperse in large numbers to healthy trees, which provide an additional, higher-quality food source. To survive the winter, the spruce beetle produces natural antifreeze compounds, or cryoprotectants, that provide a tolerance to cold temperatures. Researchers with Université Laval, the Canadian Forest Service and the Institut national de la recherche scientifique investigated the effect of host vigour on the overwintering biology of adult spruce beetles.

This study conducted in Nova Scotia revealed that adult spruce beetles can survive temperatures below -40°C thanks to the production of cryoprotectants. However, they do not produce more cryoprotectants on more vigorous host trees, and the temperature at which their body fluids freeze is not affected by host tree vigour. The beetles exhibited a high level of cold hardiness, as shown by their relatively low mortality rate (15%). In a maritime climate, winter is not likely to be an obstacle for the expansion of spruce beetle populations, provided that host trees are present.

Photo: NRCan

This new information on spruce beetle biology provides insight into population dynamics and facilitates the development of new control methods for this pest.

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Global warming has an adverse effect on old-growth boreal forests

Will the warmer temperatures associated with climate change lead to an increase in tree growth in old-growth boreal forests? Researchers with the Canadian Forest Service and Université Laval have discovered that, in spite of the longer growing season, global warming is actually having an adverse effect on old-growth boreal forests in North America.

Photo: Université Laval

These results emerge from a study that involved analyzing tree growth data for the boreal forest of northeastern North America covering the period from 1950 to 2005. The trends observed were consistent with modelling results: the age and size of a tree modulate its response to temperature and moisture conditions and have an effect on its ability to sequester atmospheric CO_2. As a forest ages, its ability to sequester carbon decreases. This phenomenon is particularly evident in old-growth black spruce stands and is exacerbated by warmer temperatures. As trees age, the soil moisture required for tree growth becomes an increasingly limiting factor.

This work underscores the importance of considering stand attributes such as age and size when examining the effects of climate change on forests.

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The hidden face of biomass

Roots measuring more than one centimetre in diameter account for approximately 30% of the total biomass in forest ecosystems. Researchers with the Canadian Forest Service, Lakehead University and the Université du Québec en Abitibi-Témiscamingue have developed equations to evaluate more precisely the proportion of root biomass in a forest.

In order to develop the equations, they excavated the root systems of mature balsam fir, black spruce, jack pine and trembling aspen trees in the boreal mixedwood forest of Ontario. For each of these species, they examined the relationship between root biomass and stem diameter at breast height (DBH) or height, and between root biomass and both of these parameters. They found that DBH was a better predictor of root biomass than height.

The researchers subsequently tested other equations using their DBH and height data and found that the equations either overestimated or underestimated root biomass. They concluded that the ratio of root biomass to aboveground biomass is difficult to predict and may be influenced by site conditions.

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For more information about the series:

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