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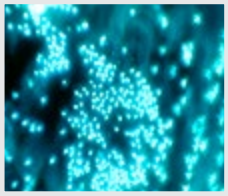
In Brief






from the Canadian Forest Service – Laurentian Forestry Centre

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The effect of precommercial thinning on the growth of jack pine and black spruce

The competition between different tree and shrub species in the boreal forest and its effects on the growth of commercial species is a major source of uncertainty when making precommercial thinning recommendations.

In this study, researchers from the Université du Québec en Abitibi-Témiscamingue, the Université du Québec à Montréal, Quebec's Ministère des Forêts, de la Faune et des Parcs, the Swedish University of Agricultural Science, Humboldt State University and the Canadian Forest Service assessed the effects of the density of competition, the stem diameter to be kept before treatment, the density of competition regrowth after treatment, and the timing of thinning operations on the response of black spruce and jack pine to precommercial thinning.

The study showed that for jack pine, the best results were achieved when precommercial thinning is performed 4 to 9 years following establishment. The researchers also observed that the response of jack pine to this treatment was influenced by factors such as the diameter of the stems treated and the density of competition after treatment. In fact, the greater the diameter of the stems removed, the greater the competition after treatment, which leads to slower growth. However, the researchers did not observe any significant effect of precommercial thinning on growth for either of these factors.

The researchers also observed that alders and willows have a strong regrowth potential after they are cut. Therefore, they recommend avoiding cutting them when the density of these species is low.

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Understanding litter decomposition in the boreal forest

Litter decomposition in boreal forest soils plays an important role in the nitrogen and carbon cycles of forest ecosystems. Litter is comprised of foliage (leaves and needles) and woody debris. In this study, researchers from the Université du Québec à Montréal, the Université du Québec en Abitibi-Témiscamingue, Université Laval and the Canadian Forest Service assessed the long-term dynamics (12-13 years) of carbon and nitrogen during the decomposition of foliage and wood from three boreal forest tree species (trembling aspen, white spruce and balsam fir). The study was conducted by applying various harvesting intensities and procedures, using several decomposition models.

The models proved to be accurate in determining carbon loss from the foliage and wood of these three species. They revealed, among other things, that trembling aspen wood decomposes at a faster rate than its foliage.

The long-term decomposition rate following clearcutting was similar to or faster than the rate observed in non-harvested stands in terms of litter composition, tree species and harvesting residues. Partial cutting had little effect on carbon and nitrogen dynamics.

An overall understanding of the long-term models of carbon and nitrogen dynamics following forest disturbances may help improve our ability to predict the impact of forest harvesting on carbon sequestration and nutrient availability..

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Emerald ash borer: assessing the efficacy of control methods

The emerald ash borer is an exotic insect that attacks all ash species. It was reported for the first time in Canada in 2002, in Ontario. It has since been observed in Quebec, Manitoba and New Brunswick. Although chemical and biological control methods do exist, ways of controlling this invasive pest remain limited. Researchers have developed a successful self-contamination method using *Beauvaria bassiana*, an entomopathogenic fungus. This method uses traps in which the insect is contaminated by the fungus and then released so as to infect other emerald ash borers through mating. To assess the efficacy of this tool, researchers have used a fluorescent powder that is dropped on the insects as they enter and exit the trap.

This study, conducted in southern Ontario by researchers from the INRS–Institut Armand-Frappier and the Canadian Forest Service, showed that the use of this fluorescent powder was effective to track adult emerald ash borers self-contaminated by the entomopathogenic fungus. The results indicate that the powder remains on the insect for approximately 10 days after it has gone through the self-contamination trap, allowing researchers to track its dispersal, habits, and interactions. It has been demonstrated that this type of marking did not in any way affect the insect's survival or the efficacy of the fungus.

The researchers observed that 10% of the emerald ash borers contaminated by the fungus were not marked with fluorescent powder, which indicates that they did not go through the trap). This suggests that *Beauvaria bassiana* is transmitted among individuals, which is the main purpose of this type of trap.

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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

In Brief

Plant neighbourhood and the spruce budworm

The plant neighbourhood effect on damage caused by defoliators has been observed for many plants. However, very few studies have addressed the influence of the plant neighbourhood's composition on defoliation. The plant neighbourhood effect refers to the composition and density of species surrounding a defoliator's hosts.

In this study, researchers from the Université du Québec à Montréal and the Canadian Forest Service observed the plant neighbourhood effect on two spruce budworm (SBW) hosts, i.e. balsam fir and black spruce. The results of this study show that the plant neighbourhood effect on defoliation caused by the SBW varies over time. This effect depends on the proportion of host forest tree species and on the diversity of the neighbouring vegetation's composition. Hence, the researchers found that when fir and black spruce are present, black spruce shows a greater vulnerability to defoliation. It appears that in these stands, the plant neighbourhood effect leads to a greater defoliation of black spruce earlier in the outbreak.

With the help of models, the researchers analyzed different hypotheses regarding the plant neighbourhood effect on defoliation caused by the SBW in its hosts. The hypotheses took into account the type of host and plant composition in the stand, among other factors. The hypotheses were validated both locally and throughout the stand over a period of 10 years.

Future studies aiming to forecast defoliation patterns caused by the SBW should take this factor into account, on the same basis as the temporal and spatial scales. These results could have an impact on the deployment of future control strategies against defoliators and could lead to a better understanding of the temporal dynamics of defoliation based on forest stand composition.

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Predicting residual tree growth after partial cutting

Photo: Miguel Montoro

Partial cutting operations are increasingly used in forest management. However, the high variability in residual tree growth is difficult to explain, which limits the capacity to accurately predict forest productivity following partial cuts. Researchers from the Université du Québec à Chicoutimi, the Chinese Academy of Science and the Canadian Forest Service applied a new approach based on the use of a mathematical function that makes it possible to characterize the growth trend of each tree over time and, thence, to quantify tree growth variability within a given stand. This method of analysis also helps to understand the factors that affect the various patterns of growth, particularly after partial cutting.

This new approach will help managers better understand trees' responses following partial cutting and guide their management practice decisions in order to maximize tree growth.

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Does climate lead to genetic adaptations in pines?

Climate influences the distribution of genetic diversity in natural plant populations, including those of trees. Trees generally show genetic adaptation traits (such as early bud burst and tolerance to late frost or to drought) that can range from moderate to high, depending on the climate. In this study, researchers from the University of British Columbia, the University of Amsterdam and the Canadian Forest Service set out to differentiate the effects of adaptation to the local climate (separation due to the environment) from those resulting from neutral processes (independent of climate), such as separation due to distance and separation due to the colonization of glacial refugia, on the genetic variation of two pine species (i.e. western and eastern white pines).

Photo: NRCan

All of these effects and processes partly account for the genetic variation observed between populations, but it is difficult to assess their respective impacts. The researchers nonetheless identified 25 genes in eastern white pine and 18 genes in western white pine that demonstrate local adaptation to climate. The identification of those genes will lead to a greater understanding of the adaptation measures of pines to climate change.

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