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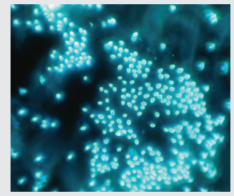


In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

Number 16 – 2008

Regenerating white pine - Undercover plantation and soil scarification

In the past, white pine in eastern North America was harvested on a large scale for more than two centuries. Quality natural stands are now scarcer and regeneration must therefore be done through planting. However, the success of this option is hampered by the activities of an insect, the white pine weevil, and by a disease, white pine blister rust.

The planting of white pine under a partially thinned forest cover combined with soil scarification provides optimum conditions for regeneration, growth and protection against harmful insects and disease. This is the main conclusion of a recent study conducted by Canadian Forest Service and Université Laval researchers to assess various silvicultural scenarios that might be conducive to white pine regeneration.

While providing protection against harmful insects and diseases, a partially thinned forest cover offers the best compromise for the growth of young trees. Soil scarification is also the best alternative solution to forest fires for regenerating white pine while reducing competition from woody species.

The study was conducted at the Forest Research Station in Petawawa, Ontario. The forest stand used for various silvicultural scenarios consisted primarily of white pine and red pine. The experimental design included partial cuttings of various intensities, soil scarification and the use of phytocides.

For information: Pierre Bernier, pierre.bernier@nrcan-rncan.gc.ca

Mountain pine beetle - Effects of cold weather are better known

Photo: Canadian Forest Service

Temperature is the key factor in the natural control of the mountain pine beetle. In a recent research project, Canadian Forest Service and United States Department of Agriculture (USDA) Forest Service researchers gained a better understanding of the insect's cold weather adaptation mechanisms during the same season, from one season to the next, and in various microclimates.

It has been known for a long time that cold temperatures (-40°C) annihilate mountain pine beetle populations. Warmer winter temperatures resulting from climate change have been a contributing factor in the current epidemic period.

The research was used to create a model of the insect's adaptation to temperature. For example, using weather data from an Idaho station, the researchers demonstrated that temperature changes since the early 1990s have contributed to the insect's increased survival during winter and may have resulted in the epidemic that occurred in that region.

The developed model describes and predicts the impact of temperature variations on the populations of this insect, while taking into account various stages of the insect's development. With the onset of climate change, this type of model could help us understand new problem situations that will arise in insect populations because of warmer temperatures.

For information: Jacques Régnière, jacques.regniere@nrcan-rncan.gc.ca

Black spruce and climate change - More growth during a shorter season

The increased concentration of carbon dioxide in the atmosphere could result in greater tree growth. However, the phenomenon is more complex than it appears. For example, in the case of black spruce, a reduction in the length of the growing season must be expected.

In a recent greenhouse study, Canadian Forest Service and Agriculture and Agri-Food Canada researchers observed varied and complex physiological reactions in black spruce seedlings submitted to a higher concentration of CO_2, compared with other seedlings sprouting in the current concentration.

The researchers concluded that, when submitted to a higher concentration of CO_2, black spruce forests could react by forming their buds much earlier in the season. Bud burst in the spring would not be affected. They also noted greater wood production at the end of the growth season, i.e. an 18% increase in dry mass. However, because they worked with trees growing in a controlled greenhouse atmosphere, they stressed the importance of being prudent before forecasting results on a larger scale. Conditions in nature are much more complex and variable than those observed in a greenhouse.

The researchers also noted that the provenance of the black spruce affected the results. Trees from the south, which naturally form their buds later in the season, would be more likely to benefit from the temperature and increased concentration of carbon dioxide in the atmosphere. The seed source is therefore a key piece of information for a species such as black spruce that is found naturally between the 45^{th} and 63^{rd} degrees of latitude north.

For information: Jean Beaulieu, jean.beaulieu@nrcan-rncan.gc.ca

In Brief

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Maple stand dieback - No identifiable defoliation threshold

Some 2,120,000 ha of maple stands were affected by the dieback that occurred in the mid 1980s. The dieback was observed to be a decline in the vigour of the trees that was manifested by smaller, paler leaves and mortality of twigs, stems and branches. The dieback was attributed to a series of factors such as drought, deep soil freezing, insect attacks and the particular nutritional conditions of the soil.

Photo: C. Moffet

However, it was observed in a study conducted by ministère des Ressources naturelles et de la Faune du Québec, Canadian Forest Service and Université de Sherbrooke researchers that when dieback occurs, there is no defoliation threshold beyond which tree mortality inevitably occurs.

Trees that experienced initial defoliation of as much as 75% of their crowns were still living in 1993 when the data gathering was completed. The research findings showed that mortality was separate from the initial extent of foliage loss. The researchers suggested that tree mortality was attributable instead to aggravating factors that destroyed the trees after the dieback appeared. These aggravating factors could be infection from armillaria, a pathogenic fungus, or poor soil drainage conditions.

To complete this study, the researchers analyzed data from 133 semi permanent sample plots located in sugar maple stands in southwestern Quebec.

For information: Guy LaRocque, guy.larocque@nrcan-rncan.gc.ca

Post-fire salvage logging - Changing harvesting methods to regenerate forests more effectively

Photo: D. Charron

Salvage logging after forest fires is being done more and more frequently in Quebec. A study was conducted by Canadian Forest Service, Concordia University and Université du Québec en Abitibi-Témiscamingue researchers to assess the impact of salvage logging on the quality of seedbeds and jack pine and black spruce regeneration. The experiment involving comparisons of regeneration on burned sites where salvage logging was done with regeneration on burned sites where no salvage logging was done was conducted on a large area of burned forest in the Abitibi region.

The black spruce and jack pine forests adapt naturally and reproduce themselves after forest fires. The baring of the mineral soil caused by the passing of machinery creates good seedbeds for conifers. However, logging eliminates the sources of seeds present in the cones of the trees. In salvage logged areas, the soil also becomes drier, which jeopardizes the survival of seedlings. Without subsequent reforestation, these forests will be dominated by trembling aspen whose reproduction success is not affected by the current harvesting method.

To minimize the negative impact of salvage logging and in order to less frequently have to plant conifers to compensate for losses, the researchers suggested that 10% of the conifer seed trees be left in place to serve as seed sources. These residual trees would have an even more positive impact if they were left in place near skidding trails where the loss of regeneration is most widespread. Experiments in that regard are in progress.

For information: Sylvie Gauthier, sylvie.gauthier@nrcan-rncan.gc.ca

Carbon capture in the wood of branches - Foliage production measurement as an assessment tool

For trees, the necessary carbon investment to produce the wood in their branches is directly proportional to the carbon investment in foliage production. This was demonstrated in a study conducted by Canadian Forest Service researchers, who found that for each branch of the four conifer species that were studied, the tree produced a gram of branch wood for each gram of foliage. In the case of trembling aspen, the production was almost two times less, given that the measured ratio was only 0.56.

This branch-leaf relationship is important in order to more effectively assess the net productivity of ecosystems, a knowledge of which is necessary for quantifying the contribution of forests to carbon capture in the current context of climate change. In forest ecosystems, the contribution of branches to carbon capture and recycling has often been underestimated. The use of foliage production as a benchmark value now makes carbon capture estimates easier because it is easier to measure foliage production than branch production.

The researchers also demonstrated that this branch-leaf relationship remains constant even when the fertility of sites, the age of trees or forest density varies. However, they found significant variations from year to year. For conifers, the best seed years were those with lower foliage production. These findings come from a research project on black spruce, jack pine, balsam fir, Douglas fir and trembling aspen in Canada. The trees used in the study were located in Quebec, Saskatchewan, British Columbia, New Brunswick and Ontario.

For information: Pierre Bernier, pierre.bernier@nrcan-rncan.gc.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
Quebec (Quebec) G1V 4C7
418 648-5789

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