Natural Resources Canada | Ressources naturelles Canada

In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

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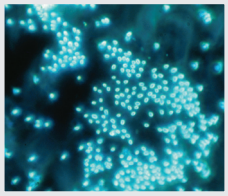


For rapid detection of root rot

Root rot is a common problem in Canada, affecting not only nursery seedlings but also young plantations. In eastern Canada, two hard-to-identify fungi are known to cause this disease: *Cylindrocarpon destructans* and *Cylindrocladium floridanum*.

To support efforts to identify these fungi on affected seedlings, some CFS researchers applied an approach based on polymerase amplification of DNA. They sequenced and amplified some ribosomal DNA segments (ITS) from the two fungi. The DNA sequences obtained were compared with sequences from other fungi and from other agents that infect conifer root systems to determine whether they were related. As part of a subsequent step, the researchers designed DNA probes (segments) specific to the two species.

The DNA probes developed through this work specifically target these two causal pathogens of root rot; they permit detection without the need to first isolate the fungi through culturing, which is a lengthy process and one that calls for taxonomic expertise that is in increasingly short supply. The researchers believe they have demonstrated the promise their approach holds, since it helps to minimize the manipulations involved and ensure more rapid intervention in fungal infections.

For information: Richard Hamelin, richard.hamelin@nrcan-rncan.gc.ca

Harvesting method affects soil quality

The characteristics of a stand, the type of soil in which it is growing, the harvesting method used and the cutting cycle all affect the nutrient losses that occur when biomass is removed through harvesting. A Canadian Forest Service (CFS) researcher worked with two colleagues from the Université du Québec's Montreal and Abitibi-Témiscamingue campuses in a research project that involved determining the relative importance of these different factors. A more specific aim of the project was to develop a model for assessing the risks associated with a negative nutrient balance. They estimated the nutrient losses resulting from the decrease in biomass on an annual basis, taking into account harvesting method, for five of the main boreal forest species. The model also takes account of the timing of the harvest, which typically corresponds to economic maturity.

According to this model, whole-tree harvesting causes a greater nutrient loss than does tree-length harvesting, but the magnitude of the loss varies considerably depending on the species. It was greater in balsam fir and trembling aspen and smallest in jack pine.

In light of these findings, the researchers recommend that the tree-length method be used, particularly for fir and aspen stands growing on thin soils or fluvio-glacial deposits.

For information: David Paré, david.pare@nrcan-rncan.gc.ca

Pruning to control scleroderris canker

Scleroderris canker is a highly virulent disease that can kill large pine trees; it is caused by the European strain of the fungus *Gremmeniella abitina*. It first appeared in Quebec in the late 1970s and began spreading rapidly in the 1980s. There was no effective method of eradicating the disease up until fairly recently.

A Canadian Forest Service researcher tested a systematic pruning approach in a red pine plantation in the Gatineau region, which proved to be very effective against the disease. In 1982, the technique initially involved pruning out the four lowest branch whorls in all trees that were 12 years old. This method was found to reduce the incidence of the disease from 67% to 22%. Nonetheless, this approach was deemed to be too conservative, and the measures used subsequently consisted in severe pruning of the trees and removing and destroying all dead or dying trees. These complementary actions, coupled with the subsequent closing up of the canopy around the mid-1990s, appear to have removed every last trace of the disease. To avoid having to intervene more than once, the researcher recommends that the whorl pruning effort comprise at least the lower half of the crown, and if necessary, two-thirds of the whorls in infected plantations that are less than 20 years old.

For information: Gaston Laflamme, gaston.laflamme@nrcan-rncan.gc.ca

Photo: C. Moffet

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
from the Canadian Forest Service – Laurentian Forestry Centre

For healthy red ash populations

In Quebec, there has been renewed interest in reforestation with hardwood species since the late 1980s owing to the limited supply of quality hardwoods. Unfortunately, hardwood seedlings are known to be sensitive to the competition created by herbaceous vegetation and they are vulnerable to browsing by certain animal species.

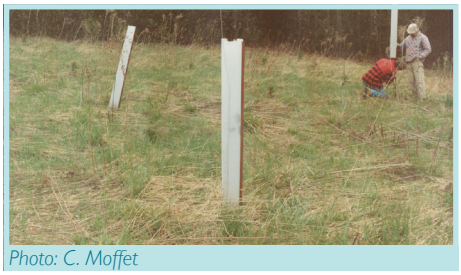

Photo: C. Moffet

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In this context, a Canadian Forest Service scientist set out to determine whether tree shelters could be used to improve the survival and growth of red ash seedlings. In this project, some bareroot seedlings 2+0 were planted on wildlands and cutovers during two consecutive spring periods, and seedling growth and survival were measured over the four years after planting. The protected seedlings exhibited greater height growth and greater diameter growth (root collar) than the controls, and the seedlings planted on cutovers were larger than those growing on wildlands. For example, diameter growth was 16% to 18% greater as of the end of the second growing season. The survival rate was excellent in both cases, albeit slightly higher for protected seedlings. The researcher has attributed this difference to the fact that the protected seedlings were less affected by winter desiccation and browsing by wild animals.

For information: Claude Delisle, claude.delisle@nrcan-rncan.gc.ca

Predicting the effectiveness of *B.t.* spraying operations

The bioinsecticide *Bacillus thuringiensis* does not exhibit a consistent level of efficacy against spruce budworm after spraying operations are carried out. However, a CFS researcher, working in collaboration with a University of Alberta colleague, recently confirmed that a simulation model—the Cooke model developed in 1996—has the capacity to reconstruct the results of aerial spraying operations using *B.t.* in relation to various factors. Field tests, encompassing sprayed areas and control sites, were undertaken recently as a means of validating the model.

Photo: C. Moffet

The researchers studied the functional and mathematical relationships that exist between various parameters related to spraying, the insecticide doses ingested by the insects, atmospheric conditions subsequent to the operation, the characteristics of budworm populations and various *B.t.* efficacy indices. They believe that this model covers the key interactions that occur between the *B.t.* pathogen and the target insect insofar as spraying effectiveness is concerned. The researchers also performed two validations which confirmed the model's ability to predict and effectively measure budworm mortality and the degree of defoliation that occurs after a spraying operation. This model can therefore be considered a valuable decision support tool.

For information: Barry Cooke, barry.cooke@nrcan-rncan.gc.ca

Ozone affects cold hardening in sugar maple

A Canadian Forest Service researcher, working with some colleagues at Agriculture and Agri-Food Canada, studied to what extent the sugar maple's cold hardening ability was modified by exposure to high levels of ozone, a very common pollutant. The researchers exposed sugar maple seedlings to two different ozone concentrations over the course of a summer: one concentration was like that in ambient air but the other was three times higher than the first. In the fall, the seedlings were placed outdoors for the acclimation period.

The researchers first noted a major drop in the CO_2 fixation rate, caused by a decrease in photosynthesis in the seedlings exposed to the highest ozone concentrations. Subsequently, in the same seedlings, the starch concentration decreased and the sucrose level rose during the acclimation period. According to the researchers, exposure to high levels of ozone does not appear to inhibit the ability of sugar maple foliage to adapt to freezing, although changes were noted in the chemical components involved in this process. However, cold acclimation began earlier, and budbreak occurred earlier in the spring. In light of the observed impact on photosynthesis, the researchers feel it is likely that prolonged exposure to high ozone levels would modify the trees' cold hardening ability over the long term.

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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