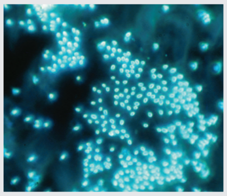
Natural Resources Canada | Ressources naturelles Canada






In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

Number 24 – 2011

The impact of boreal forest fires on the forest mosaic

The composition and structure of forest stands and forest soils have a considerable influence on fire behaviour and its impact in the boreal forest. That is the conclusion of a study done by researchers at the Université du Québec à Montréal, the Université du Québec en Abitibi-Témiscamingue and the Canadian Forest Service, which analyzed 14 different wildfire events in Quebec's boreal forest.

According to the researchers, the presence of white birch and trembling aspen helps to lessen the impact of wildfires. Nonetheless, higher intensity fires tend to be associated with coniferous forests. Also, sites characterized by moist, organic soils lead to low intensity fires, whereas sites with sandy or thin soils typically exhibit more severe effects. Fire impact tends to be less pronounced in open black spruce forests (cover density of 25 to 40%), where many more trees are spared than in dense black spruce stands.

Despite the fact that boreal forest fires are a natural phenomenon, the results confirm the capacity of some portions of forest to escape the devastation caused by wildfire. These results will also enhance our ability to predict the effects of forest fires.

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

Spread of the causal fungus of tomentosus root rot

A recent study done in the Harrington region (Quebec) by Canadian Forest Service researchers, working in collaboration with colleagues from the University of British Columbia and Université Laval, sheds light on the mode of dispersal of Onnia tomentosa, the basidiomycete fungus that causes tomentosus root rot. This disease affects most of the coniferous tree species in North America, but damage is especially important in spruce and pine trees.

Photo: Canadien Forest Service

The study was carried out in a 45-year-old white spruce plantation weakened by the disease. Molecular biology tools were used to study individual fruiting bodies harvested from the plantation and to characterize the fungal genets (group of genetically identical individuals). The findings suggest that site preparation and high density planting of white spruce provided conditions favourable to colonization of the plantation by *O. tomentosa* basidiospores, an event that was followed by vegetative spread of the fungus through root contact between infected and healthy trees. Secondary colonization events involving basidiospores appear to have occurred, which explains the variable size of the genets.

Based on the diameter of the genets and the average growth rate of the fungus (12 to 25 cm per year), the researchers believe that the oldest genets originated at the time of plantation establishment.

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

Shedding light on the evolution of North American forests

By studying the evolution of genetic diversity in tree populations in relation to past climate change events, researchers should be better able to predict the potential response of trees to future climate change. Scientists at Université Laval and the Canadian Forest Service have produced an initial interpretation of the phylogeographic distribution of trees across North America. Phylogeographic studies make it possible to better understand the spatial and temporal adaptation of species and to make more informed recommendations on the conservation of genetic resources.

North American forests have evolved in response to glaciations and other geologically significant events. The different genomes of trees provide data that can be used to measure the impact of these events on the geographic distribution of genetic variation. This research also revealed the existence of refugia occupied by species during glaciations and has made it possible to determine the role that continental mountain ranges played as natural barriers to species migration.

For example, in the boreal zone of North America, two subpopulations of jack pine likely emerged from different refugia located on either side of the Appalachian Mountains. The first subpopulation colonized the northwestern part of the continent, whereas the other subpopulation spread eastward toward the Atlantic Coast. A more recent study on jack pine appears to support the hypothesis that a third refugium existed near the ice sheet in a currently submerged area of the continental shelf.

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

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

Local adaptation of the hemlock looper

Researchers at the Canadian Forest Service, Université Laval and the Université de Montréal tested the hypothesis that host tree age may exert selective pressure and lead to local adaptation in hemlock looper populations. Outbreaks of hemlock looper, a defoliator that is widespread in North America, occur mainly in old balsam fir stands in the northern part of the continent. It is present in a number of ecozones characterized by widely varying floristic composition and age structures, making it an interesting example for testing the hypothesis of local adaptation.

Photo: C. Hébert

The researchers compared the biological performance of two populations: a northern hemlock looper population collected in an overmature virgin boreal forest and a population from a southern mixedwood forest disturbed by harvesting. Larvae from the two populations were reared on foliage from juvenile (25 years), mature (60 years) and overmature (100 years) balsam fir trees. Females from the northern population had higher weight and fecundity values when reared on foliage from overmature trees compared with juvenile trees. This is the first time that local adaptation of a herbivorous insect population to host tree age has been reported. No significant effect of host tree age could be detected for males from either population or for females from the southern population. The results indicate that in virgin forests, northern females can enhance their biological performance by adapting their feeding strategy. This also shows the important role that females play in the evolutionary process.

In practical terms, this ability to adapt should be taken into account to enhance understanding and prediction of hemlock looper outbreaks, particularly in the context of climate change.

For information: Christian Hébert, christian.hebert@nrcan-rncan.gc.ca

Recovery of soil carbon stocks following afforestation

Researchers at the Université du Québec à Montréal, Agriculture and Agri-Food Canada and the Canadian Forest Service conducted a meta-analysis of 33 scientific publications to gain insight into the factors that influence the restoration of soil organic carbon stocks following afforestation of former agricultural land. Previous land use appears to be the most important factor. The researchers found that the positive impact of afforestation is more pronounced in former cropland soils than in former pastures or natural grasslands.

Photo: D. Paré

Forest soils constitute an important organic carbon pool. Clearing of forests to allow farming causes a significant reduction in the amount of carbon stored in the soil. Afforestation of former agricultural land is therefore viewed as an approach with considerable potential for sequestering atmospheric CO_2 and restoring soil organic carbon stocks. However, some of the research conducted so far has yielded conflicting results and the factors that influence the process need to be studied further.

The research also revealed the following trends:

- deciduous species seem to have a greater capacity to store carbon than coniferous species;
- clay-rich soils most likely have a greater capacity to accumulate carbon;
- site preparation intensity may influence the rate at which carbon stocks are replenished;
- the boreal forest appears to have a great capacity for soil organic carbon storage, but carbon stocks are replenished at a slower rate than in other climatic zones.

The data analyzed do not allow any conclusions to be drawn as to whether afforestation can restore soil carbon stocks to initial values.

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

A promising approach for controlling spruce budworm

Canadian Forest Service researchers, in collaboration with colleagues at Université Laval, the University of Kentucky and Brock University, conducted laboratory experiments to test the hypothesis that application of tebufenozide (a bioinsecticide) in early summer can cause winter mortality in spruce budworm larvae in the next generation owing to the product's persistence on foliage.

Tebufenozide induces precocious, and therefore lethal, moulting in spruce budworm larvae. Testing demonstrated the product's efficacy during conventional applications in early summer, which coincides with the insect's fourth larval instar.

In one of these experiments, the researchers noted that the effect of summer application of tebufenozide on larval mortality was carried over to the following spring. Subsequent laboratory tests showed mortality in the second larval stage due to precocious moulting at the onset of diapause (winter dormancy period). It therefore appears that owing to the bioinsecticide's persistence on foliage, first instar larvae that ingest tebufenozide at the end of the summer may undergo precocious moulting in the second instar. The disruption of diapause causes the insect's death.

This research could lead to the development of a new control strategy for spruce budworm.

For information: Michel Cusson, michel.cusson@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

cfs.nrcan.gc.ca/publications/series/read/2

 • ISSN 1925-5756