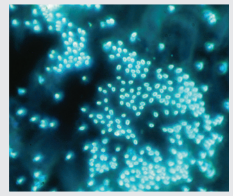
Natural Resources Canada | Ressources naturelles Canada

In Brief






from the Canadian Forest Service – Laurentian Forestry Centre

Number 6 – 2005

Silviculture emulating natural disturbance patterns

Interest in forest management approaches that are based on emulating natural disturbances continues to grow. A research team made up of Canadian Forest Service researchers and researchers from various Quebec universities has identified some management practices that imitate the effects of natural processes in forests.

In their studies, these researchers noted that forest management practices applied at the stand level produced effects that were quite similar to those associated with natural disturbances, although they did identify several major differences. One exception relates to ecosystems that are shaped by fire, such as boreal forests, and the silvicultural practice commonly used in such systems: careful logging around advance growth (better known by its French acronym "CPRS" in Quebec). The research team pointed out that, in these ecosystems, wildfires typically destroy all of the regeneration and burn part of the duff layer, and stand regeneration typically occurs through seed dispersal. Under these conditions, the careful logging approach may influence the mixture of species that ultimately become established and modify the natural succession pattern. In the case of boreal forests, which are characterized by a large proportion of uneven-aged stands of varying structure, researchers recommend using silvicultural practices that will reproduce a variety of age classes, stand types and structural features at the landscape level. The research team also underscored the importance of diversifying silvicultural practices in order to achieve a management regime that is in tune with natural forest dynamics.

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Taking stock of biological insecticides

Globally, chemical pesticides are still widely used, accounting for a very large proportion (95%) of international sales of pest control products. Major efforts are being made, however, to develop biological insecticides and bring them to market, particularly because using biological control measures is in keeping with the principles of sustainable development. This is one of the findings reported by a team of researchers from the Canadian Forest Service and the *Institut national de la recherche scientifique* in an article recounting the development of the primary bioinsecticides that are currently in use. The article describes the composition, characteristics and mode of action of three key types of bioinsecticides and their applications for controlling forest insect pests: *bacillus thuringiensis* (*Bt*), baculoviruses and, lastly, pathogenic fungi (mycoinsecticides), which are less well known and less developed than the first two types.

In view of the successful results attained with bioinsecticides in managing various insect pests, including lepidopterans (e.g. spruce budworm and gypsy moth), the authors expect to see a rapid expansion in the development of such biological control agents over the coming years. They nonetheless point out that a number of hurdles still need to be overcome before these kinds of products can be put on the market: they must be effective, safe and capable of being produced at a competitive cost in relation to chemical pesticides.

Successful genetic transformation of eastern white pine

The soil bacterium *Agrobacterium tumefaciens* is one of the most commonly used vectors for gene transfer applications. The bacterium is naturally programmed to transfer part of its DNA into the genome of plants. Canadian Forest Service researchers have succeeded in creating stable eastern white pine clonal lines by coculturing embryonic tissues from white pine with tissues from *Agrobacterium tumefaciens*. On average, they obtained four lines per gram of tissue thus derived and they showed that up to 50 could be obtained in routine experiments. To measure gene expression in the transferred genetic material, the researchers used three constructs featuring a gene that controls the expression of a green fluorescent protein (GFP) that is not present in plants. This gene is routinely used in laboratory work on the genetict ransformation of plants. The researchers showed that it could be used effectively in the genetic transformation of conifers. This type of transformation may permit the development of eastern white pines that have promising characters such as resistance to white pine blister rust.

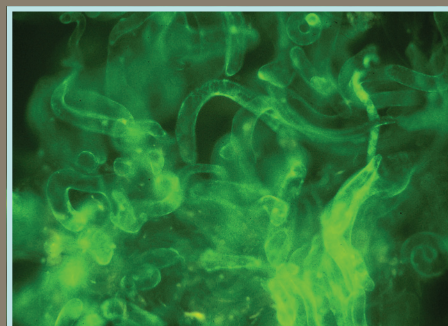

Photo: A. Séguin

The researchers also obtained conclusive results with three spruce species: white spruce, black spruce and Norway spruce.

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Understorey vegetation: a major source of biomass

Some CFS researchers analysed the seasonal dynamics of the understorey vegetation at four forest stations in eastern Canada. More specifically, they looked at the biomass produced by the three main groups of species comprising the understorey vegetation (herbaceous plants, woody plants and mosses) at these stations. Although they found significant differences in the biomass attributable to each of the three species groups at each station, the total within-station biomass did not vary significantly during the growing season, except at the most southerly station. The biomass values did differ, however, from one station to the next, and these differences were attributed to the predominance of certain species and to the light regime, which affects some morphological characteristics of plants, such as leaf area.

Photo: P. Bernier

Species richness was found to vary over the growing season within the different stations. This diversity peaked in late May at the most southerly station and in late September at the most northerly site.

The study also helped to shed light on the important role that understorey vegetation plays in nutrient cycling and in retaining nutrients within the site.

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Improved survey techniques for Collembola

Collembola (springtails) are very tiny arthropods that live in the soil and on the soil surface. These insects have a diversified diet and colonize a variety of habitats. They can be used as indicators of changes in the forest environment associated with forest management practices.

Photo: C. Germain

With this in mind and aiming above all to develop improved population survey techniques for these insects, a Canadian Forest Service entomologist, assisted by some colleagues from the Université du Québec à Montréal, sampled the Collembola populations of 12 sugar maple stands in Quebec using two different techniques. One is a new approach based on the use of pitfall traps; the other is widely used and involves taking soil samples.

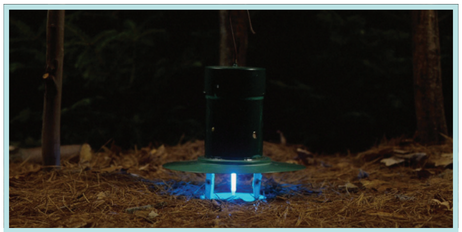

Photo: C. Moffet

By the time this work was completed, 108 species had been collected. These comprise 9 genera and 67 species for which there were no previous records in Quebec and 12 species representing the first records for Canada. The two sampling methods proved to be remarkably complementary since pitfall traps are more effective for sampling species that live on the soil surface, whereas the taking of soil samples works better for soil-dwelling species. The researchers recommend moreover that these two methods be used jointly in future surveys of Collembola populations.

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Refining climate change simulation models

Predicting the effects of climate change on forest productivity using simulation models is a very challenging task. Indeed, the predictions generated by the models that have currency yield very different pictures of the effects of a simultaneous increase in mean global temperature and atmospheric carbon dioxide (CO_2).

Two researchers, one at Lakehead University in Ontario and the other at the Canadian Forest Service, examined the results obtained with two of these models, namely Century 4.0 and FOREST-BGC, in simulating the effects of climate change in a black spruce stand in northwestern Ontario. The two simulation models gave fairly similar predictions, except when the researchers simulated a temperature increase occurring at the same time as an increase in atmospheric CO_2. In this case, the results were divergent. Furthermore, the predicted levels of carbon varied with the different climate change scenarios that were tested. According to the researchers, the combined effects of an increase in mean temperature and a rise in CO_2 are still not well understood, and the simulations generated by the existing models remain problematic. They believe that these models should be modified or new models developed to incorporate a greater understanding of the processes involved.

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