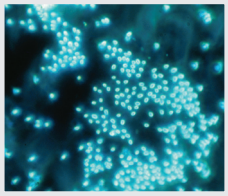
Natural Resources Canada
Ressources naturelles Canada

In Brief






from the Canadian Forest Service – Laurentian Forestry Centre

Number 14 – 2007

The secrets of jack pine revealed through genetics

Jack pine (*Pinus banksiana*) is a coniferous species that ranges across most of Canada. During the last glacial maximum, the species moved out of its range to ensure its survival. Genetic markers can be used to reconstruct the species' history over the past 18,000 years. Researchers from the Canadian Forest Service and Université Laval conducted research on a gene found in the mitochondria of jack pine and identified the presence of 14 different genetic types. However, when they studied the range-wide distribution of this genetic variation, they discovered four distinct groups of populations corresponding to specific regions. There are three relatively homogeneous groups of populations, which appear to represent genetically distinct glacial populations. The first two distinct groups, whose regions split at Lake Huron, are believed to have originated from populations that took refuge to the east or west of the Appalachian Mountains in the southern United States, suggesting that the mountain chain acted like a natural barrier. The third distinct region, which is situated in the Maritimes, may have been recolonized by a glacial population that migrated to the unglaciated continental shelf during the last glacial maximum. A fourth region, located in central Quebec, is thought to have been recolonized at a later stage, as the glacier retreated, by individuals from the other three regions.

Similar studies have been done on black spruce (*Picea mariana*) and on some European forest species. This research is unique in that it uses a minisatellite marker of the mitochondrial DNA to reconstruct the history and specific characteristics of the natural distribution of jack pine.

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Sugar maple-yellow birch stand: harvesting and site preparation influence biodiversity

Timber harvesting in yellow birch-dominated stands results in canopy gaps of various sizes. Researchers from the Canadian Forest Service and the University of Alberta studied the impact of these openings and of subsequent site preparation on the presence of ground beetles, which are recognized as indicators of biodiversity.

Photo: C. Germain

Using pitfall traps, the researchers conducted a survey of ground beetles in canopy gaps of various sizes and in plots that had undergone site preparation.

Their research revealed that smaller numbers of ground beetles were collected in canopy gaps and in plots that had undergone site preparation than in uncut control plots. In addition, there were fewer ground beetles on harvested sites than in plots that had undergone site preparation. It was also determined that small-gap harvesting is more favourable than large-gap harvesting for the maintenance of ground beetle populations.

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Forest dynamics after partial cutting in the Mauricie Region: Status 50 years later

The long-term effects of partial cutting on forest dynamics is a topic that has not been studied much in Quebec. The response of stands to these human interventions should be assessed in order to develop silvicultural strategies that are aligned with the natural functioning of forest ecosystems and that also help to conserve biodiversity.

Using inventory data collected in the Lac Édouard Experimental Forest in La Mauricie National Park, researchers from the Canadian Forest Service and Université Laval studied the effect that partial cutting done in the early 1950s had on forest dynamics in softwood and mixed stands. Changes in vegetation were analysed for the period 1946 to 2001 in 109 stands in the sugar maple-yellow birch bioclimatic domain. Three cutting intensities were studied: light, moderate and uncut.

More than 50 years after harvesting, it was found that the relative proportions of deciduous and coniferous species had not changed. In addition, the harvests resulted in an increase in the relative proportion of red spruce, a highly prized forestry species, and kept competing species, such as mountain maple, from invading the cutovers. Thanks to the accelerated growth of residual stems and regeneration, the total basal area values were equal to or greater than the pre-harvest levels (1946).

Although sporadic, the results show the importance of establishing permanent sample plots to support the development of silvicultural strategies that can help to attain sustainable management objectives.

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

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Effect of geographic origin on the drying behaviour of white spruce wood

In Canada, white spruce is one of the most widely used reforestation species. Plantations established some 30 years ago and comprising hundreds of thousands of hectares will soon become a major source of wood supply for the forestry industry. In comparison with natural stands, however, plantation-grown stock generally comprises a higher proportion of juvenile wood mainly because the trees are harvested at a younger age. This characteristic could adversely affect lumber quality, particularly after the drying process. The geographic origin of the provenances used for reforestation may also affect lumber quality.

Photo: Y. Fortin

In this study, researchers from the Canadian Forest Service and Université Laval analysed the genetic variation among provenances for volume loss (shrinkage) and warping in dried lumber from 36-year-old trees. The wood was obtained from a plantation established by using seeds collected from 25 sites in the Great Lakes-St. Lawrence region. Two drying treatments were evaluated: conventional drying and high-temperature drying.

No significant differences were found among the provenances in terms of shrinkage (loss in length, width or thickness) or warping (bow, crook, twist). The only difference observed between the drying treatments was the lesser width shrinkage with conventional drying. Based on the study results, it was concluded that plantation-grown white spruce wood responded the same way to the drying treatments regardless of the origin of the seed sources.

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What do we know about paludification and forested peatlands?

A team of researchers from the Canadian Forest Service, the Université du Québec en Abitibi-Témiscamingue and the Ontario Ministry of Natural Resources conducted a literature review to enhance understanding of paludification and the implications for the management of forested peatlands. This study centred on black spruce forests in the Clay Belt, which encompasses the northern part of the Abitibi region in Quebec and the northeastern part of Ontario. Much of the timber volume allocated to forest companies in the Clay Belt region is located in forested peatlands and forests that are prone to paludification. Paludification is a natural process that leads to a major decline in forest productivity. It is characterized by the accumulation of organic matter and by sphagnum colonization at the soil surface.

Photo: D. Paré

In addition to assessing the current state of knowledge about paludification, the researchers looked at the impact of forest fires and harvesting on these ecosystems. One finding that emerged from this work is that partial cutting could limit the rise in the water table. The authors also studied the management approaches used in ecosystems of this type around the world, such as drainage, fertilization, site preparation methods and prescribed burning. These are approaches that have potential for halting peat accumulation and sphagnum growth.

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The severity of spring frosts affects the survival of white spruce seedlings

Spring frosts are commonplace in Canada and can cause severe damage to forest nursery stock. These frosts occur at a crucial stage in seedling development: bud burst and the start of annual shoot growth.

Forest nurseries devote special efforts to protecting millions of seedlings that have spent the winter outdoors, exposed to natural conditions.

A joint study by researchers from the Canadian Forest Service and Université Laval focussed on the effects of spring frosts on white spruce seedlings. The research was aimed at evaluating the effects of frosts of varying severity and exposure time on annual shoot growth in white spruce seedlings.

Although cold hardiness decreases in conifers when bud burst occurs and annual shoot growth is initiated, the researchers wanted to measure frost sensitivity during the different stages of bud burst.

It was found that the severity of spring frosts had a greater impact than did the duration of frost exposure. The research findings will help forest nursery operators provide suitable frost protection for white spruce seedlings.

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