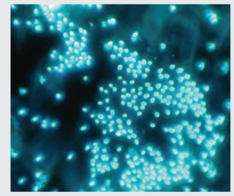
Natural Resources Canada | Ressources naturelles Canada

InBrief

from the Canadian Forest Service – Laurentian Forestry Centre

Number 19 – 2009



Climate change - Potential effects on black spruce growth and yield curves

In the boreal forest, allowable cut calculations are based on periods of up to 150 years. The growth and yield curves used in these models assume that growing conditions do not vary over time. However, climate predictions point to significant changes over such a time period, which could cause a discrepancy between growth forecasts and future observations.

One solution to this problem would be to incorporate climate sensitivity into these curves. Growth and yield curves already have an inherent level of uncertainty. A team of researchers from the Canadian Forest Service and Université Laval set out to determine how likely it is that the expected effects of climate change will cause predictions of forest stand growth to be off by more than the uncertainty linked to the current predictions derived from growth and yield models.

The simulation results suggest that the growth of black spruce strata could increase by about 29% in the study area over the next century. The incorporation of the uncertainty associated with climate change effects into forest growth predictions indicates, however, that a difference of this magnitude would only result in a modified growth 67% of the time.

Hence, while the results suggest that climate change may affect growth scenarios, if the allowable cut calculation is modified to incorporate the potential effects of climate change, there is a 33% chance of using erroneous harvest levels. Therefore, the level of uncertainty is a key piece of information that forest managers need to take into account in decision making.

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

Climate change - Increase in the frequency of extreme forest fire years in Canada

Photo: Parcs Canada

Extreme forest fire years could become more frequent by the end of the 21st century. This is a major finding that emerged from a modelling study carried out by a Canadian Forest Service researcher in collaboration with a Climate Risk Analysis colleague using Canadian forest fire data and climate change predictions.

The magnitude of the predicted increase in forest fire frequency varies according to the greenhouse gas emissions scenario used. Under a moderate emissions scenario, it is predicted that by the end of the century every fifth year would be an extreme fire year. Under the more pessimistic scenario, every third year would be an extreme fire year. The frequency of extreme fire years could even exceed the range of historical variability of the past 300 years. In the late 20th century, high intensity fire years occurred only once every 7 or 8 years.

Extreme fire years are years characterized by a proportionally greater number of large fires, that is, those exceeding 200 hectares.

In an extreme year, forest fires in Canada emit as much carbon into the atmosphere as all Canadian industrial emitters combined. In addition, these extreme forest fire years drive the vicious circle whereby more carbon is released from forests, thus accelerating global warming.

For information: Martin Girardin, martin.girardin@nrcan-rncan.gc.ca

Jack pine - Can biomass estimates for jack pine be derived from allometric relationships?

Researchers with the Canadian Forest Service, the Université du Québec à Montréal and FPInnovations recently conducted a study aimed at deriving better estimates of certain allometric relationships (relationship between different parts of a tree) in jack pine. A first model shows that a branch's foliage biomass is inversely proportional to its depth within the crown and is proportional to its diameter.

The researchers found that, at the tree level, foliage biomass is proportional to crown length and it varies with stem age and taper. In addition, the ratio of sapwood area at the base of the crown to tree foliage biomass is proportional to stand density, whereas the branch basal area to foliage biomass ratio is constant.

In total, 84 jack pine trees were used as the basis of the research: 16 from Petawawa, Ontario, 18 from New Brunswick, and 50 from central Quebec. The tree-level allometric relationships were calibrated using a mixed-effects simultaneous regression.

For information: Chhun-Huor Ung, chhun-huor.ung@nrcan-rncan.gc.ca

In Brief from the Canadian Forest Service – Laurentian Forestry Centre

Balsam fir-yellow birch bioclimatic domain - The composition of the original forest influences the regenerating stand

A silvicultural study conducted by some Université Laval researchers in collaboration with Canadian Forest Service colleagues provides insight into post-harvesting vegetation succession in the balsam fir–yellow birch bioclimatic domain.

One of the challenges that forest managers face is predicting the type of forest that will result from a harvesting operation. In the study area, the composition (deciduous, coniferous or mixedwood) of the original forest cover appears to be a key predictor since it has an influence on the regenerating stand. This is particularly true when black spruce is present or the deciduous component is dominant.

Photo: C. Delisle

Advance regeneration also plays an important role. Tall conifer regeneration appears to contribute to larger timber volumes. On some sites, the deciduous component of the lower strata (i.e., young trees) appears to persist and gradually increase in proportion over time. In the balsam fir forest, severe spruce budworm defoliation of balsam fir promotes white birch and trembling aspen regeneration; however, this does not necessarily mean that these deciduous species will invade the site. Finally, site fertility has an important impact as well.

The study area, located 100 km west of La Tuque in the western balsam fir–yellow birch bioclimatic subdomain, consists of a mosaic of very diverse stands that have been shaped by harvesting and by recurrent spruce budworm outbreaks. According to the researchers, the harvesting operations conducted in the late 1950s essentially corresponded to cutting with protection of regeneration and soils (CPRS) and cutting with protection of high regeneration (CPHR).

Spruce-lichen forest - Jack pine, the best species for reforestation

Photo: S. Dagnault

Jack pine appears to be the best species for reforestation in the spruce–lichen bioclimatic domain owing to its natural resistance to moisture stress. Periods of drought causing a water deficit represent a significant limiting factor for this type of ecosystem.

This is a key finding of a study conducted by researchers from the Université du Québec à Chicoutimi in collaboration with Canadian Forest Service researchers in a forest sector north of Lac Saint-Jean. They used an experimental layout designed to assess the growth and survival of seedlings over the first three growing seasons after planting. The researchers also tested several site preparation methods to increase the performance of seedlings planted in spruce–lichen forests within the commercial forest zone. Harvesting areas in spruce–moss stands treated by scarification were used as controls.

Jack pine seedlings showed better growth performance than black spruce seedlings. The use of a disc trencher for site preparation enhanced water availability for the plants, thereby reducing planting shock and contributing to enhanced seedling growth and survival. It appears that this scarification method also has a positive effect on soil nutrient availability.

Although seedlings planted on spruce–lichen sites scarified with a disc trencher showed a similar survival performance, their height and diameter growth was 30% lower than that of seedlings planted on spruce–moss sites.

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

Enhanced growth of black spruce regeneration in the Abitibi region

In the spruce–moss forest of the Clay Belt, current silvicultural practices result in a relatively undisturbed carpet of mosses and sphagnum. Although this type of ground cover is conducive to black spruce seedling germination and establishment, a research team wanted to determine the net benefit for the growth of this species.

To answer this question, a team of researchers from the Canadian Forest Service and the Université du Québec en Abitibi-Témiscamingue conducted laboratory tests to evaluate the quality of different soil samples from this environment.

Black spruce trees were planted in pots containing different types of soil sampled from the surface soil layer after a fire or after harvesting and site preparation, or sampled at a greater depth, such as from humified moss layers and mineral soil.

The study showed that fibric surface soils are of low quality and not conducive to the growth of black spruce, whereas more humified soils, found at a greater depth, as well as burned soils are of higher quality.

These results indicate that on sites subject to paludification, disturbances caused by harvesting or site preparation allow trees to take root in fertile soil layers, thereby promoting the growth of black spruce seedlings.

For information: David Paré, david.pare@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

Partenariat innovation forêt

FPInnovations

Canada

© Her Majesty the Queen in Right of Canada 2009 • ISSN 1925-5756