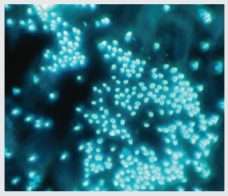
Natural Resources Canada
Ressources naturelles Canada

In Brief






from the Canadian Forest Service – Laurentian Forestry Centre

Number 13 – 2007

Climate change: national tree biomass equations

The positive role that trees and forests can play as carbon sinks is often mentioned in connection with global warming caused by greenhouse gas emissions. Through photosynthesis, trees capture carbon dioxide (CO_2) and incorporate it into their biomass. Tree biomass can be estimated as the sum of the biomass of all parts of the plant-wood, branches, bark and leaves-except the roots.

Canadian Forest Service (CFS) researchers have produced a set of equations that can be used to assess tree biomass across the country with the ultimate goal of deriving a forest carbon budget for Canada. The new equations for estimating biomass were derived from data collected during the 1980s under the ENergy from the FORest research project (ENFOR), which focussed on forest biomass.

The result is a set of national equations that can be used for a given species, a group of species or for all species combined. There are two types of equations: those based on dbh only and those based on both dbh and height.

Biomass calculation tool:
http://www.cfl.scf.rncan.gc.ca/calculateurs-calculators/biomasse-eng.asp

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In black spruce: stem-only harvesting helps to reduce soil acidity

In eastern Canada, whole-tree harvesting, which involves felling trees and hauling them to the roadside for delimbing, is the most widely used harvesting method. In many cases, the whole-tree method is less costly than the stem-only method, which consists in delimbing trees in the stump area and transporting only the boles to the forest road.

In a recent study, a CFS researcher working with some colleagues from the Université du Québec à Montréal discovered that stem-only harvesting reduces soil acidity in black spruce stands. The researchers compared the mineral composition of the soil in a black spruce forest that had undergone stem-only harvesting with soil composition in some black spruce stands subjected to whole-tree harvesting, in an area north of the Gouin Reservoir.

Photo: D. Paré

The researchers concluded that the slash left on the cutover in the forest that underwent stem-only harvesting had a significant beneficial effect in minimizing soil acidity. However, the beneficial effect was limited to the organic layer of the most acidic soils.

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Decision support tool for selecting black spruce provenances

A team of researchers from the Canadian Forest Service and Université Laval have developed a geographic information system (GIS) that is designed to assist forest managers in selecting black spruce provenances for reforestation. Black spruce is one of the main components of Canada's boreal forest. Every year in Quebec some 60 million black spruce seedlings are planted. The GIS is based on the results of a study of 90 families from 30 different provenances which centred on a number of genetic characters, such as growth and phenology (bud burst and bud set), that play an important role in adaptation to a new environment.

Thanks to the study findings, it is now possible to map the likelihood of successful transfer of black spruce provenances. Adaptation to altitude, latitude and aridity conditions are the factors believed to have the greatest influence on the survival and development of these provenances. For example, trees derived from a high-elevation (about 700 m) provenance can be planted in numerous locations at high latitudes or high elevations with a high likelihood of success. By contrast, provenances from the foothills of the Appalachians are much less likely to be suitable for deployment on a broad scale. Most of the sites located north of the St. Lawrence River, for instance, are unlikely to permit the successful establishment of this provenance.

This tool will be helpful for finding ways to cope with climatic variations that could lead to extreme climatic events in the future.

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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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Boreal forest: mixed stands are more productive

Black spruce forests have a low productivity of 1 m^3 per ha per year. Trembling aspen stands growing on comparable sites are twice as productive. In black spruce-feathermoss stands, the low productivity of black spruce is attributable largely to paludification, a phenomenon caused by the accumulation of organic matter. However, black spruce itself is believed to contribute to the poor quality of the litter and the soil.

Researchers at the Canadian Forest Service and the Université du Québec en Abitibi-Témiscamingue recently conducted a study in the Abitibi region, within the western black spruce-feathermoss bioclimatic domain, which focussed on the productivity of black spruce stands containing a proportion of trembling aspen. Mixed stands of black spruce and trembling aspen were found to be more productive than pure stands.

Photo: X. Cavard

The researchers nonetheless observed competition between the two species for the ecosystem's limited resources. The results point up the greater overall productivity of the ecosystem of mixed stands. However, in some cases the presence of trembling aspen reduces black spruce productivity in mixed stands, whereas in other cases, the aspen trees help to maintain this productivity. It all depends on the relative proportion of trembling aspen, the position of the trees in the forest cover and soil productivity. Mixed stands in the boreal forest also hold more promise in terms of promoting biodiversity.

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Commercial thinning of balsam fir stands: simulation errors must be taken into account

In a recent study, a process-based simulation model was used to assess the impact of commercial thinning treatments in some balsam fir stands in the Réserve faunique des Laurentides. This type of model is usually reserved for scientific research. However, certain precautions were taken to ensure that the variables needed to run the model could be assessed using forest inventory dendrometric data.

Photo: J.-M. Lussier

The simulation model shows mixed results for commercial thinning in balsam fir stands. This is because thinning enhances the growth of small-diameter stems (<0.1 m^3), but not that of large-diameter stems. The results after 20 years indicate, with a confidence level greater than 95%, that the merchantable volume of the thinned plots does not recover to the level found in the untreated control plots. However, when model error is taken into account, the confidence level drops to 70%, which means that there is a 30% probability that the merchantable volume of the thinned plots will reach the same level as the untreated controls after 20 years.

Silvicultural treatments such as commercial thinning give rise to forest types whose structure cannot be predicted by conventional yield tables. Using models that represent growth processes more accurately is the best way to predict growth following such treatments. However, failure to take into account modelling uncertainty can lead to misuse of the results. Having a clear understanding of the level of error is just as important for a forest manager as understanding the prediction itself. The work done in this study shows how this uncertainty can be taken into account in the final assessment of the modelling results.

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A site index that takes stand dynamics into account

In order to estimate the productivity of forest stands, site conditions are generally represented by the site index. This index is based on the relationship between the age and height of the dominant trees in sample plots.

A team of researchers from the Canadian Forest Service and the ministère des Ressources naturelles et de la Faune du Québec made site index calculations using both temporary and permanent plots. Forest productivity estimates derived from the index based on temporary plots are biased, whereas estimates derived from the index based on permanent plots are not. Bias created by the use of temporary plots is due to the fact that the dominant trees are not always the same over time. Permanent plots capture this aspect of stand dynamics because the data can be used to track changes in dominant trees over time.

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