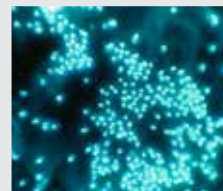




# InBrief

from the Canadian Forest Service – Laurentian Forestry Centre



Number 35 – 2013

## Harvesting biomass for energy, no problem, but...

Researchers at the Canadian Forest Service, in collaboration with researchers from Utrecht University in the Netherlands, have conducted an in-depth analysis of the knowledge and uncertainty linked to the environmental risks of harvesting biomass for energy purposes in boreal and temperate forests. This analysis focussed on three types of biomass: cutting residues, wood harvested after a natural disturbance (fire, insect epidemics and windfall) and roundwood. Researchers also studied the risks of soil degradation, biodiversity loss and changes in carbon levels.



Photo: NRCan

The results have revealed that for the harvesting of cutting residues, the environmental risks are limited to certain sites, e.g. sites with soil poor in organic matter and nutrients.

For its part, the harvesting of roundwood as a source of biomass presents the same issues as the harvesting of roundwood as a source for traditional products. Its use as bioenergy does raise an additional problem in terms of carbon debt since the carbon is not stored in the form of wood products but is released immediately into the atmosphere. As for using wood from salvage harvesting of stands affected by natural disturbances, knowledge is not yet complete regarding its impacts.

In conclusion, the use of forest biomass for energy purposes is not generally a problem, at least over the short and medium term. With the knowledge that has been acquired, researchers now better understand the effects of using biomass for energy purposes.

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## Estimating biomass at the stand level: mission possible

Biopathways is a project that is looking to find new uses for biomass and to determine which ones offer the best outlooks for the forest industry and forest-dependent communities. The development of this pathway requires estimates of biomass quantity that are as accurate as possible and methods for assessing the sustainability of practices that perform well and are transparent and applicable over large areas.

To respond to this concern, researchers at the Canadian Forest Service and Université du Québec à Montréal have developed equations to estimate for the first time at the forest stand level the quantities of biomass and nutrients per tree component (trunk, branch, bark and leaves) and by species. These equations are valid for the 30 main tree species in Canada. With these equations, resource users can estimate the quantities of biomass available for any forest in Canada and the uncertainties connected to these estimates.

Moreover, these equations make it possible to estimate in a standardized way the amounts of nutrients exported from forest stands in harvested products, making it possible to develop environmental sustainability indicators that perform well and are standardized at the national level.

Link: <https://apps-scf-cfs.nrcan.gc.ca/calc/en/calculateur-calculator>

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## National tree tapering models

Information on the quality of forest resources and their economic value is necessary for making decisions not only in terms of forest management, but also throughout the value creation chain. When manufacturing primary processed products, knowledge of tree tapering is a key factor for reducing losses in value and production costs and for streamlining manufacturing processes while maximizing the volume of wood produced. Current tapering models make it possible to optimize the value of the wood processed while calculating the wood volume regardless of how a tree is cut up. However, they vary from one Canadian province to another.



Photo: NRCan

Thanks to tapering data, researchers at the Canadian Forest Service and the Institut national de recherche agronomique in France have developed national tapering models where the inputs are two measurements available in all forest inventory data in Canada: diameter at breast height and tree height.

The accuracy of these national tapering models is similar to that found in previous studies. These models, however, offer the benefit of being standardized across Canada. They therefore make it easier to estimate the value of the tree at the national or regional level before it is harvested.

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## Mixed plantations = more biomass

The plantation of hybrid poplars is one of the options often looked at for producing biomass quickly. However, managers can choose to establish mixed plantations.

Researchers at the Canadian Forest Service and Université du Québec en Abitibi-Témiscamingue have studied the effects of mixed plantations on height and diameter growth and on the quantity of fine roots in two clones of hybrid poplars planted with genetically-improved Norway spruce and white spruce. The impact of various spacing distances between trees was also studied.

The results of these tests conducted in the Abitibi-Témiscamingue region indicated that, after 6 years, the growth rate in terms of the diameter of hybrid poplars was higher in mixed plantations in the two closest spacings. For height, the growth of hybrid poplars was greater in mixed plantations for only one of the two clones tested.

Hybrid poplars in pure plantations developed higher quantities of fine roots than in mixed stands. Once analyzed with growth data, this result suggests a positive association effect. In fact, it would seem that this mixture of hybrid poplars and genetically-improved spruces promotes growth in terms of the diameter of hybrid poplars under conditions of comparable density, but without the necessity of having as large a root system as in pure poplar plantations.

The cost of establishing mixed plantations is higher than for pure plantations, but they may have an advantage in terms of biomass production. The results of this study suggest that mixed plantations of hybrid poplars and genetically-improved spruces have the potential to produce more biomass per unit of surface area.

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## Salvage harvesting after the spruce budworm. The effect of silvicultural treatments 20 years later

Spruce budworm epidemics are the largest natural disturbances that occur in Canadian balsam fir stands. In Quebec, a serious epidemic that ended in the late 1980s devastated millions of hectares of forest. Intensive salvage harvesting operations then took place. Twenty years later, researchers at the Canadian Forest Service and Université Laval compared the effects of three silvicultural scenarios that were undertaken with control stands that were not cut. These scenarios involved no treatment after harvesting, converting the balsam fir stands into black spruce plantations and completing a pre-commercial thinning.

Salvage harvesting operations first of all have an impact on forest structure: they reduce the quantity of dead wood by an average of two thirds. Not only is dead wood less abundant, it presents levels of decomposition that are less variable. This has a negative impact on the diversity of the saproxylic beetles, a group of insects associated with dead wood (they play an important role as an indicator of an ecosystem's integrity).

The level of diversity in the beetles is also reduced by the micro-disturbances generated during forest management following salvage harvesting operations (e.g. site preparation work for planting).

In order to reduce these impacts on the beetles, when planning salvage harvesting operations, sufficient stands affected by the spruce budworm should be left alone to maintain dead wood of sufficient quantity and quality in the area. Furthermore, the work done on salvaged stands should promote a return to their natural dynamics.

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## Double the number of forest fires by 2100?

In eastern Canada, there are various fire regimes. A fire regime can be characterized by the surface area burned, fire severity, recurrence and the number of fires over a given area. Researchers at the Canadian Forest Service and Université du Québec à Montréal wanted to determine if climate change will have an effect on fire regimes.

To do this, they developed a forecasting projection model using the Canadian database for fire regimes. This model uses the fire regimes from the period of 1961 to 1990 as a reference. Using the variables of climate, topography, vegetation and human presence for a certain area, researchers projected how fire regimes might change by 2100.

They observed that the boundaries of fire regime zones will not change much, but that fire regimes will vary a lot within these zones. Based on this model, by the end of the 21<sup>st</sup> century, the surface areas burned and the number of fires will more than double compared with the reference period, for the regions of Ontario, northern Quebec and southern New Brunswick, thereby impacting the commercial forest zone. Further to the north, a part of the non-commercial forests will also be impacted. Furthermore, most fires will occur slightly later in the season.

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