



# FRONTLINE

policy perspectives

## The Forest Bioeconomy: Balancing Economic Opportunity with Ecological Sustainability

Note 5



### BACKGROUND

The decrease in global demand for newsprint, the strong Canadian dollar and the decline in North American housing construction related to the recession have all had significant impacts on the forest sector in Ontario and across Canada. Canadians have been broadly impacted by the current decline of the forest industry. For example, in Ontario approximately 16,000 direct forestry jobs have been lost since 2008. These ongoing structural and cyclical impacts on the forest industry have stimulated interest in alternative uses of forest resources, providing motivation for companies and communities to broaden their economic portfolios beyond traditional forest products. In particular, opportunities are being explored to replace products currently made from petroleum resources, such as fuels, plastics, foods and pharmaceuticals, with 'bioproducts' made from renewable forest resources.

These emerging business opportunities fall under the banner of the 'bioeconomy'. The forest bioeconomy has the potential to help revitalize

the forest sector, to contribute to energy sustainability, and to provide rural communities with opportunities for economic diversification.

Currently, forest harvesting in Canada is guided by the best available science to ensure it is done in a sustainable manner. A shift to a bioeconomy may have the effect of increasing the intensity of forest harvest which could result in the removal of trees previously considered unprofitable. Sustainability guidelines are being developed proactively to ensure that Canada's forests continue to provide the desired goods and services expected by citizens over the long term. Scientists and policy makers are directing their attention toward this challenge.

### The Science behind the Challenge

Simply put, a bioeconomy is an economy that uses living plants (biomass) as the raw materials for the industrial production of energy and other products. The broad definition of biomass refers to biological material that comes from living or recently living plants, including roots, trunks, branches, bark, needles, leaves and fruit. However, in the current context of the forest bioeconomy in Canada, only the above-ground, live portion of the tree is viewed as a potential source of biomass for bioproduct manufacturing<sup>1</sup>. Historically, harvesting operations left some biomass (usually as branches, tree tops, and unmerchantable trees) in the forest. This practice was mainly driven by mechanical limitations of harvesting equipment and by economics, but the current market may provide an economic incentive to remove more material. If forests are to be harvested differently in the bioeconomy, it is critical to understand how much tree biomass should be left in the forest to sustain healthy ecosystems.

Harvesting has traditionally occurred when trees have reached maturity to maximize their economic value. Biomass harvesting operations may remove additional material from the site and can be carried out on younger or lower quality stands with trees normally considered to be less commercially desirable. Since it may not be necessary

1. While policies vary amongst Canadian provinces, most, including Ontario, currently allow only living limbs, tree boles and tops to be harvested.

to wait for trees to mature, biomass harvest rotations may be shorter than those for traditional operations. These shorter harvest rotations, in turn, could affect the coarse woody debris legacy of the forest. Coarse woody debris refers to dead trees and branches in the forest that provide habitat for a wide variety of organisms, from microbes to mammals, while gradually releasing nutrients back to the soil as they slowly decompose. If harvesting occurs at shorter intervals and more trees are removed, then a smaller proportion of the trees will become coarse woody debris, possibly affecting habitat availability and nutrient cycling, and thus future forest biodiversity and productivity. Biomass harvesting regulations currently do not allow for the removal of coarse woody debris; shorter rotations could reduce inputs to the forest even if this debris is not being actively removed. Related questions arise with respect to the effects on soil and plant biodiversity, long-term productivity, and vegetation composition.

Current harvesting guidelines in Ontario require leaving selected trees for habitat and other ecological values, and these rules would still apply with more intensive harvest practices. In many respects forest biomass harvesting would be equivalent to full tree harvesting, a common practice in many forest stands. Biomass harvesting, like full-tree harvesting, will not remove all biomass due to equipment and economic limits. Furthermore, the area of allowable harvest under a sustainable forest management plan may not necessarily increase with more intensive harvesting. Finally, any added operational costs and technical barriers are factors that must also be considered in biomass harvest decisions.

## POLICY INFLUENCING SCIENCE

### The National Picture

The federal government plays an important role in providing scientific information to decision-makers who develop national and international policy positions. The Department of Natural Resources Act requires the federal Minister of Natural Resources to seek to enhance the responsible development of Canada's natural resources, to promote domestic and international market access for products, and to carry out research regarding developments affecting Canada's natural resources. Natural Resources Canada (NRCan) strives to achieve its objectives in ways that are in line with sustainable resource development and use as directed in the Federal Sustainable Development Strategy.

With respect to the forest bioeconomy, this mandate is primarily delivered by NRCan's Canadian Forest Service (CFS). The federal government recognizes that the emerging bioeconomy may provide opportunities for forest companies and entrepreneurs to capitalize on emerging markets for materials made from renewable forest resources. In meeting its commitments to Canadians, the CFS supports the development of the bioeconomy within an environmentally responsible and economically competitive framework. It does this in part through the work of its scientists across Canada who, along with other collaborators and stakeholders, are leading multi-disciplinary studies of the ecological and socio-economic impacts of forest biomass harvesting.



### Collaborating with Ontario

The emerging forest bioeconomy in Ontario is being further guided by provincial legislation. The Ontario Ministry of Natural Resources' (MNR) strategic document, Our Sustainable Future - A Renewed Call to Action and the Policy Framework for Sustainable Forests, provides direction to those who create forest management policies and practices. The Crown Forest Sustainability Act (CFSA) regulates the sustainable management of Crown forests as carried out through policies and practices in the Forest Management Planning Manual. As with traditional forest harvesting, biomass harvesting is also regulated under the CFSA. Forest harvesting in Ontario is

governed by a broad policy framework that is guided by adaptive management principles, which use the latest science-based information to address uncertainties. In support of the sustainable use of forest biomass, both federal and provincial scientists are informing potential changes to such legislation and policies through new and ongoing research projects.

In recognition of the need for regional, collaborative research in the emerging forest bioeconomy, a Bioeconomy Technical Working Group was formed in 2009 under the Canada-Ontario Memorandum of Understanding Concerning Cooperation in Forestry (MOU). The working group brings together research scientists and forest policy specialists from CFS and MNR to identify options to address the most relevant science and policy needs. The Coordinating Committee for the MOU serves as a forum for the federal and Ontario governments to respond to opportunities that foster science-policy linkages.

## SCIENCE INFLUENCING POLICY

In Ontario, CFS scientists at the Great Lakes Forestry Centre (GLFC) play a lead role in research to support the bioeconomy. The provincial government has jurisdiction over forest management and is directly engaged in these studies, which facilitates rapid exchange of knowledge and incorporation of results into policies and practices. Knowledge exchange occurs largely through publication of peer-reviewed journal articles and via distribution of electronic newsletters (e.g., GLFC e-Bulletin), broadcast of webinars, publication of technical notes (e.g., Frontline Express series), and through working group and outreach activities.

Bioeconomy studies have been designed to answer ecological questions related to different intensities of forest biomass removal, and to better understand the socio-economic implications of such activities. Examples of key projects are presented here.

Ecological implications of lower amounts of coarse woody debris in the managed forest are being studied by experimenting with gradients of biomass removal varying from complete retention to complete removal. In addition, the sustainability of intensive forest biomass removals is being investigated by examining the interactions between harvest intensity and biodiversity, soil nutrition, and site productivity on jack pine and black spruce sites at the newly established Island Lake Biomass Harvest Research and Demonstration Area near Chapleau, Ontario. This research is being carried out by GLFC scientists Rob Fleming, Paul Hazlett, Lisa Venier, Isabelle Aubin and Kara Webster, in collaboration with MNR scientist Dave Morris as well as industry, community and First Nations partners.

Because of the difficult financial situation of many forestry companies, less money is being spent on expensive silvicultural activities such as thinning. The consequence of decreased silvicultural investment is that high value trees are often growing in less-than-optimum growing conditions, which can have significant impacts on their wood quality at time of harvest. The bioeconomy may provide an economic incentive to remove the lower value trees to improve the growing conditions for trees of a higher value. The cost of removing these trees can be offset by using them to make value added products or by selling them to other companies. Biomass harvesting is being investigated as a potential approach to carrying out stand improvement activities in the Great Lakes-St. Lawrence forest as part of the Eastern Ontario Hardwood Initiative. Suzanne Wetzel (CFS, Canadian Wood Fibre Centre) Trevor Jones (MNR), industry and academic partners are working collaboratively on this project.

Researchers at GLFC are also investigating ecological and economic impacts of many forestry issues related to the bioeconomy through computer modeling. Changing opportunity costs can affect decisions regarding potential land uses, such as establishing short-rotation, purpose-grown woody biomass plantations on agricultural lands. The Forest Bioeconomic Model (CFS-FBM) has helped inform decisions and policies and can provide answers to questions regarding the potential for these activities in Ontario and across Canada. For instance, what energy price changes could affect forest management decisions? Under what conditions would woody biomass from forest plantations become an attractive energy source? What research is required to decrease uncertainty and increase financial attractiveness? This work is led by a multi-disciplinary group at GLFC including Dan McKenney, Denys Yemshanov, Darren Allen, John Pedlar, Kathy Campbell, Kevin Lawrence, Pia Papadopol and Marty Siltanen.

## CONCLUSION

The emerging bioeconomy is being examined for its potential role in forest sector transformation, climate change mitigation, and rural job creation. NRCan-CFS is pursuing a number of collaborative studies that will investigate the environmental and economic impacts associated with biomass harvesting. Results from these bioeconomy studies will be used to inform forest policies and practices and identify research gaps in support of sustainable forest management.

## SUGGESTED READING:

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