Improving the efficiency of forest biomass supply chains in Canada

Sylvain Volpé & Dominik Roser
FPInnovations, 570 boul. St-Jean, Pointe-Claire (QC) H9R 3J9, Canada
dominik.roser@fpinnovations.ca

Summary

Purpose and integrated harvesting of forest biomass is still in its infancy across Canada and consequently, new technologies and know-how transfer are needed to ensure the efficiencies of evolving supply chains that support the growing bioeconomy in Canada. Efficiencies can be warranted and improved by a better understanding of the underlying challenges that currently prevent efficient forest biomass supply chains. So far, in Canada, system-wide optimization has taken place mostly through incremental changes. However, in order to substantially improve existing biomass procurement systems, more fundamental system changes, supported by basic and applied research, are needed.

FPInnovations has been pursuing technology and know-how transfer from jurisdictions where biomass is already established as a viable product. The aim is to investigate game changers that will improve the efficiency of biomass harvesting in Canada by carrying out theoretical and subsequent practical analysis of some of these game changing ideas. FPInnovations has, for example, been involved in trials to investigate how thinning treatments can contribute to make forest biomass a viable source of fuel and at the same time prevent wildfires in rural communities. Integration of biomass harvesting into traditional harvesting practices has been another focus area of recent activities.

In the Canadian context, the research described above is essential to build the confidence of companies recovering forest biomass Research results are already being implemented by local stakeholders across Canada however, in order for widespread uptake of new technologies and harvesting systems a critical mass of successful projects is needed to convince sceptics that forest biomass harvesting can be economically sustainable.

Keywords: bioenergy, integrated harvesting, thinning operations, technology & know-how transfer, forest biomass harvesting technology

Background

The growing forest-based bioenergy sector in Canada needs a sustainable supply of feedstock. The availability of feedstock is a primary issue, and securing a sustainable supply of fibre is one of the main challenges for the developing bioenergy industry. Consequently, non-traditional feedstocks are being considered.

Supply chains for delivering alternative sources of biomass are also needed to ensure long-term, continuous, sustainable supplies. Purpose-grown energy crops and other alternative sources of woody biomass, such as salvage cuts, thinnings and FireSmart treatments, in particular, can supplement harvest residue feedstocks when market conditions reduce harvest activity. Since those sources are just being developed, there are many opportunities to increase their use and decrease costs. Equipment is needed to efficiently harvest and deliver the alternative sources of biomass, which are considerably different from conventional harvest residues.

Supporting supply chains design and technology transfer

In order to produce suitable feedstock in remote communities, small scale procurement and transport equipment that allows for the production and transportation of different grades of logs and biomass is essential. However, at present there is very little knowledge about such supply chains in Canada. At the same time there are large opportunities to create markets for biomass coming from incidental forest operations such as Firesmart treatments or thinning operations. In order to take advantage of these opportunities it is necessary to adapt existing supply chains or to implement technologies that have been developed in other jurisdictions. However, such efforts need a coordinated effort in order to make sure that the right technology is employed in the right circumstance. Local stakeholders need adequate information about the available technologies and supply chains in order to support the production of local energy.
FPInnovations has been investigating how FireSmart treatments can contribute to making forest biomass a viable source of fuel across western Canada and how tools such as accumulating felling heads could be applied in the Canadian context. Numerous benefits can arise from this research. For example, the biomass market for wood produced from FireSmart treatments will improve the financial feasibility of that treatment and provide a viable source of energy, particularly in rural communities. Moreover, alternative sources of biomass can be obtained closer to the combined heat and power (CHP) plant, thereby reducing the cost of transporting feedstock compared to the cost of using harvest residues recovered from greater distances.

This study, which collected and compiled information based on the scientific and technical literature, as well as on field studies, summarizes the current factors affecting the potential use of biomass from FireSmart treatments across western Canada.

The study had the following goals:

- Fill a knowledge gap and provide answers to uncertainties about the amount of biomass that might be available from FireSmart treatments to supply the biomass sector in British Columbia and Alberta.
- Determine the approximate cost of a FireSmart treatment without biomass recovery.
- Determine the additional cost of recovering the material and delivering it to a community within a 10 km radius or to a CHP plant less than 150 km away.
- Estimate the maximum size of a community plant that can be supplied sustainably only with biomass recovered from FireSmart treatments.

Results and Discussion

The research on FireSmart treatments costs, productivity, and biomass potential is scanty, and there is a definite need to learn more about those preventive measures and better define locally available volumes of biomass. In the past, Canada had little incentive to promote bioenergy sources because our supplies of fossil fuel and hydro-electric energy were relatively cheap and abundant. However, Canada's increasing commitment to green energy could change attitudes to promote energy sources with reduced CO2 emissions, which include fuels like forest biomass.

FireSmart treatments are an excellent source of feedstock in the western provinces, where they have the advantage of taking place close to isolated (First Nations) communities and of having the potential to feed biomass boilers which can replace aging diesel-fired boilers. The volume of potential biomass available from FireSmart treatments was estimated at 2.5 million odt/year for British Columbia and 850 000 odt/year for Alberta if 100% of treatments are clear-cuts. The 100% thinning scenario could supply 740 000 odt/year for British Columbia and 255 000 odt/year for Alberta. The maximum size of a bioenergy plant (ORC) running at 100% capacity for a community supplied sustainably and only with biomass recovered from FireSmart treatments (100% thinning scenario) was estimated to be 133 kWe.

The cost of a FireSmart treatment without biomass recovery varies from $400/ha to $2100 /ha depending on the stand and treatment. The cost of recovering roadside biomass from FireSmart treatments and delivering it to a community located within 15 km was estimated to be $50 /odt (about $500/ha). The additional cost of recovering the material and delivering it to a CHP plant located 150 km away would be $30/odt (about $300/ha), the difference being entirely due to the extra transport cost. Harvesting small-diameter trees from thinning of the understorey of stands costs about $3000/ha, and transport of 15 km is estimated to be $700/ha. So the total cost of harvesting logs and biomass from FireSmart thinning treatments and delivering them to end-users located 15 km away would be $4200 /ha while still providing protection from wildfire.

It is important to mention that the availability of biomass will depend on the kind of treatment (clear-cut or thinning), the products harvested on site (saw logs, pulp logs, or biomass), distance to the end-user, the conversion technologies used (chippers, grinders, or boilers), and the market price for more expensive heating fuels like oil and propane.

Conclusions

FireSmart community grant programs, like the one that exists in Alberta, could be sources of funding to fire-prone forest communities for wildfire prevention and could help to support the recovery of biomass by bridging the gap between treatment cost and product revenues. At the same time, the use of biomass from FireSmart treatments also supports the utilization of local renewable resources and creates job opportunities for local residents. However, this green source of energy is facing numerous challenges. One of the main challenges is that, in most cases, feedstock supply chains do not yet exist, so successful technology transfer and implementation will be essential in order to establish a reliable supply of high quality chips to the biomass energy system. Furthermore, decision makers also have to improve hosting conditions related to forest tenure so that communities can take advantage of the local resources surrounding their communities.