Canadian Wood Fibre Centre, in Collaboration with Alberta Innovates, FPInnovations, University of BC and Biomass Innovations Ltd., Completes the Detailed Measuring And Monitoring of On-Site Recovery, Processing and Transportation Options at the Ellerslie Short Rotation Woody Crop (SRWC) Technical Development Site in Edmonton

The ultimate goal of afforesting with SRWC (3-20 year rotation) is to maximize volume and value to land owners and industry. The fast-growing resource is a predictable and sustainable feedstock for use in the production of conventional forest products and for bioenergy and other bio-products to grow the Canadian bioeconomy.

The mature SRWC plantation, established and managed as a demonstration site by Natural Resource Canada's Canadian Wood Fibre Centre (CWFC) in Edmonton was harvested in the winter of 2018-19 with a focus on evaluating a variety on-site mid-supply chain options to process harvested SRWC crops to the desired size and characteristics required by end users.

The harvesting of the 18-hectare Edmonton SRWC plantation offered a unique research and development opportunity for CWFC to intensively measure, monitor and verify various harvesting, pre-processing, and transportation systems consistent with a commercial supply chain.

Detailed time and motion studies for all the equipment and weight measurements were completed to determine recovered volumes for all harvested materials.

The trees were felled, delimbed, piled and transported to a local pulp mill and the residues were chipped to various sizes.

Full tree permanent sample plots were destructively sampled to validate growth trajectories, partition the tree components and determine carbon values.

The high yield afforestation trees were felled, delimbed, piled and transported to a local pulp mill and the residues were chipped to various sizes.

The large stems for each plantation established between 2002 and 2005 were tracked separately by cultivar and age (14-17) and were transported to a local pulp mill using self-loading haul trucks with the weights validated with the pulp mill scales.

A portable, whole tree chipper powered by a tractor PTO was used to chip the harvest residues with the material blown into a chip trailer for delivery and weight analysis by cultivar and age (14-17).

Afforestation Average Volumes	2002 (17 yrs)	2003 (16 yrs)	2004 (15 yrs)	2005 (14 yrs)
Pulp Tonnes/ha	152.85	168.96	163.59	116.05
Biomass Tonnes/ha	55.32	37.80	33.03	35.60
Tonnes/ha	208.17	206.76	196.62	151.65
MAI m^3/ha/yr	15.46	16.86	16.73	13.35

Concentrated biomass plantations were harvested using a Claas Jaguar Harvester, a forage harvester with a drum chipper (11.09 Tonnes/ha) and an Anderson BioBaler, a tow behind drum harvester and baler that creates round bales of full stem willow and hybrid poplar (3.0 Tonnes/hr).

Of the 31 salix and 2 hybrid poplar cultivars established between 2005 – 2007, two culivars, NM-6 hybrid poplar (11.48 ODT/ha/yr) and Salix dasyclados (11.10 ODT/ha/yr) performed the best. The remaining cultivars averaged less than 6 ODT/ha/yr with only Salix purpurea and P-38 hybrid poplar being above 3.1 ODT/ha/yr.

A tractor powered tub grinder (1130 Haybuster) was used to reprocess the round bales created by the BioBaler to produce woody biomass of various desired size and characteristics required by end users. Productivity ranged from 5.86 (2" Screens) to 12.86 (5" Screens) tonnes per hour.

To reduce transportation costs and enhance storability of woody biomass, a locally designed and manufactured woody biomass compaction unit prototype was demonstrated to compact and package woody biomass into dense, easily transported round bales. The compaction prototype created woody biomass bales that resulted in an increased bulk density of the piled mulched material from 84.9 ODKG/m3 to an average of 242.89 ODKG/m3, ranging from 216.96 (5" Screens) to 265.73 ODKG/m3 (1" Screens).

The 2004 high yield afforestation trial identified a total increase of 149.5 ODT/ha consisting of 81.7 ODT/ha merchantable stem, 16.6 ODT/ha residue biomass, 7.6 ODT/ha onsite residues, 16.5 ODT/ha litter and 21.1 ODT/ha in stumps and roots sequestering a total of 75.8 tonnes/ha of carbon. Incorporating the 15-year increase of soil carbon of 11.9 tonnes/ha, the site sequestered 321.7 tonnes CO2 eq or an average of 21.4 CO2 eq tonnes/ha/yr.

CWFC believes that the data collected and shared will prove to be invaluable to industry in developing workable business cases, with realistic financial inputs to potentially include SRWCs into their fibre supply mix. This information can also be used to assess the feasibility of recovering harvesting residues from natural forests for biomass.

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