FPInnovations

BIOMASS RECOVERY
INTEGRATED HARVESTING OPERATIONS

Integrating biomass recovery operations into traditional forest harvesting activities is critical for successfully implementing a bioventure. A biomass recovery trial was conducted in the La Tuque area in Québec. The study was realized under the BELT project and supported by the Council of the Atikamekw Nation (CNA) and Neste, a global leader in renewable solutions. The trial aimed to measure how much biomass can be extracted by two different harvesting systems including four topping diameter scenarios. It also validated the BiOS model, an FPInnovations tool that predicts the volume and cost of biomass recovery.

Two harvesting systems – full tree (feller-buncher / grapple skidder / roadside stroke delimber) and cut-to-length (harvester and forwarder) – were used in a mixed wood forest. The prescribed silvicultural treatment was harvesting all merchantable stems with protection of advance regeneration, including retention of forest clumps.

Biomass manipulation

The **cut-to-length (CTL)** harvester operator was asked to position the tops on the side of the trail to avoid running over them and in such a way as to facilitate their recovery by the forwarder. Tops were placed on the opposite side of the roundwood logs to minimize handling. **The full tree harvest (FTH)** operator was instructed to add the unmerchantable trees to the bunches instead of crushing them to the ground. The remainder of the felling operation was not affected by the different biomass recovery scenarios since the scenarios differed only during roadside delimbing. The delimbing operation was not affected by handling the tops, and all delimbing residues were recovered by the skidder and piled in heaps behind the tree-length piles.

Results

The preliminary results show that biomass recovery is a feasible and viable operation when integrated into roundwood harvesting operations and proper care is taken to ensure that all activities are coordinated. A key component is that both systems provided the necessary ground residues at the stumps to prevent soil degradation. The CTL system has shown great potential to recover biomass, even though handling big tops was more problematic and required more time due to the forwarder's limitations. Preparing neat roadside residue piles appeared to be more challenging in an FTH system and would require a better operational set-up.

Table 1 shows how topping diameters influenced biomass recovery. More volume per hectare is recovered when the topping diameter is larger. When the topping diameter increased from 10 cm to 14 cm, this trial demonstrated that biomass recovery increased by 74% in the CTL system and by 59% in the FTH system.

Table 1: Quantities of biomass available at roadside and left at the stump for the different topping scenarios and comparison with BiOS prediction

System	Scenario	Biomass available at roadside	Biomass left at the stump	Total biomass	Compared to BiOS prediction
		ODT/ha	ODT/ha	ODT/ha	(%)
Cut-to-length (CTL)	10-cm top, control[1]	0	66	66	180%
	10-cm top	24	27	51	130%
	12-cm top	36	28	64	96%
	14-cm top	44	22	66	97%
	Average	35	26	61	109%
Full tree harvest (FTH)	10-cm top, control[1]	23	25	48	112%
	10-cm top	43	17	60	102%
	12-cm top	20	26	46	70%
	14-cm top	45	26	72	123%
	Average	39	23	62	101%

[1]*Without biomass recovery.*

The results indicated that BiOS predictions underestimated the quantity of residues in the CTL 10-cm scenario sites and that they were quite accurate for the 12-cm and the 14-cm scenarios. The BiOS predictions were quite accurate for the FTH system. This allows the model to be calibrated to reflect reality in future predictions.

More information

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"Guidelines for forest fibre collection" is expected to be produced by FPInnovations to support recovery operations in different harvesting systems.