forest management note

Note No. 23 Northern Forest Research Centre Edmonton, Alberta

HARVESTING FOREST BIOMASS WITH A DIKA SIDE CUTTER

Recent interest in forest biomass as an energy source has stimulated a search for improved methods of harvesting biomass. New technology is needed to increase harvests and to better utilize the whole tree. In January 1981 the Canadian Forestry Service approached Dika Construction Co. Ltd. in Rycroft, Alberta, to develop a prototype side cutter. This paper describes its technical specifications and field testing. A more detailed description of this machine is available in ENFOR Report P-163, *Costs of harvesting aspen stands for energy production*, available from the Northern Forest Research Centre.

The Dika side cutter (Fig. 1) was designed to operate as a blade mount on a crawler tractor. It cuts trees in a swath that can be set at 3.8-5.5 m wide. Vertical adjustment of the blade is made hydraulically by the tractor operator. A pusher bar located on the top of the blade, 3.7 m above the ground, guides the trees so they fall to the right side. The bar can be adjusted to facilitate cutting trees of different sizes. The pusher bar is set forward when diameter at breast height (dbh) of a tree is 10-25 cm and the bar is set back when dbh is more than 25 cm.

The side cutter was field-tested under winter conditions in two trembling aspen stands near Rimbey, Alberta, in March 1981. Two stands were cut: one 37 yr old (3.8 ha in size) and one 58 yr old (4.9 ha in size). The younger stand had 3700 stems/ha with an average dbh of 18 cm, and the older stand had 832 stems/ha with an average dbh of 30 cm. In order to compare productivity and costs of harvesting, half of each stand was harvested with the side cutter, and the other half was cut with a chain saw. The cutter was initially tried with a low-power (175 kW) Caterpillar D8H tractor. This test was quite effective for felling trees up to about 25 cm dbh at a speed of 5-6 km/h. For larger trees, however, this tractor has insufficient power to shear off the trees at a constant speed. A second run was frequently required to sever tree stems. A Caterpillar D8K tractor (224 kW) was used to overcome this difficulty. This tractor proved to be powerful enough to shear off even the largest trees while maintaining a constant rate of travel at various speeds.

Productivity of the Dika cutter mounted on the smaller Caterpillar tractor exceeded the productivity of tree bunching and land piling equipment by about four times. To utilize the side cutter and tractor to their full capacity, four loaders were required for bunching and piling trees (10-50 trees in a bunch, depending on their size). Field tests showed that a 966 Caterpillar Loader or a Model 20 Hough 3 Yardloader with a payload capacity of 4090 kg would be suitable for the task.

Analysis showed that about 14% of the biomass in harvest residues, mainly in the form of branches, was left on the ground in the younger stand. In the older stand, biomass harvest residues amounted to 11%.

The cutter mounted on the smaller tractor harvested 12-13 times more volume than a chain saw in the younger stand (Table 1). The same cutter mounted on the more powerful D8K tractor harvested 14-15 times more aspen by volume than a chain saw in the older stand.

The costs of harvesting with skidding and piling in the younger stand were $28.60/t (ovendry) using the side cutter and $39.30/t (ovendry) for the chain saw (a difference of 37%). This is a result of the high capital cost and the rental fees associated with the crawler tractor and the side cutter. Similar cost differences occurred in the older stand, where the cost of chain saw harvesting was 34% higher.

The Dika side cutter proved to be suitable for harvesting forest biomass under winter conditions. To determine its full potential, summer field tests need to be conducted.

W.J. Ondro
H.M. Stewart
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Table 1. Harvesting of forest biomass using the Dika side cutter and a chain saw in two trembling aspen stands

	Younger stand		Older stand	
	Side cutter[1]	Chain saw	Side cutter[2]	Chain saw
Volume (t (ovendry)) harvested per machine hour	39.5	3.5	89.0	6.0
Area (ha) harvested per hour	0.38	0.03	0.81	0.05
Number of stems harvested per machine hour	1388	111	615	42

[1] Dika side cutter mounted on a D8H Caterpillar tractor (175 kW power, 5.6 km/h speed).
[2] Dika side cutter mounted on a D8K Caterpillar tractor (224 kW power, 7.2 km/h speed).

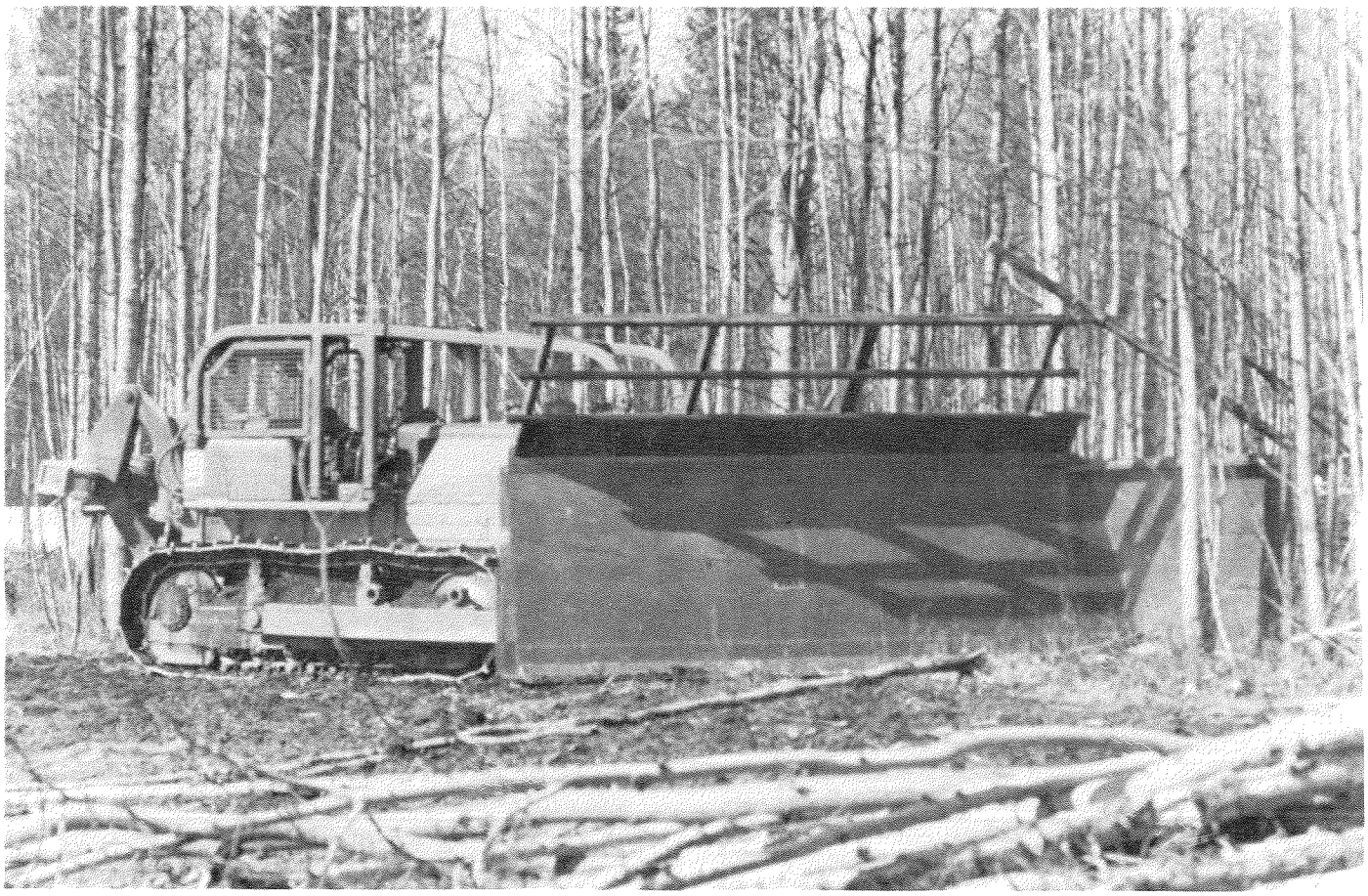

Figure 1. The Dika side cutter mounted on a Caterpillar D8 crawler tractor.

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Northern Forest Research Centre
5320 - 122 Street
Edmonton, Alberta
T6H 3S5 (403) 435-7210

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