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Productivity of a cable yarder teamed with a feller-buncher and a grapple skidder

Abstract

Cable yarding permits harvesting of trees on slopes greater than 40%, but the high cost of this approach has limited its use in eastern Canada. This report presents FERIC's observations of a cable yarding system that integrated a mechanized felling component and extraction with a grapple skidder. Although the costs at roadside were greater than those of an operation on flat terrain, the approach is a viable option for harvesting high-quality stands on steep slopes.

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Figure 1. The TLD3000 cable yarder extracting bunches of trees prepared by the feller-buncher.

Introduction

Several forest regions in eastern Canada contain stands on terrain that is too steep for conventional harvesting systems, even though the trees are located near mills and are often of very good quality. Cable yarding (Figure 1) provides access to these stands, but yarding costs are not competitive with the cost of conventional harvesting on flat terrain. The goal of this study was to describe an approach intended to reduce the overall costs of cable yarding.

Context

FERIC's study occurred in the fall of 2000, on the limits of the Senneterre (Abitibi, Que.) division of Norbord Industries Inc. The stand was composed of around 1100 stems/ha of jack pine (57%)

Figure 2. The grapple skidder bringing bunches of trees to the cable yarder.

and black spruce (43%). The soil had a good bearing capacity and the slope ranged from steep to very steep. The CPPA terrain class ranged from 2.3.5 on the slopes to 2.2.1 at the top of the hill.

The cable yarding was performed by a TL-3000C yarder manufactured by TLD Gauthier Inc. This equipment has been described by Meek (1996) and Gingras (2000). Where possible, the operation also used a Prentice 730 feller-buncher with a Gilbert 1255 head and a Caterpillar 525 grapple skidder. Harvesting the entire site required the use of three distinct systems. The first, used in the steepest sections (average slope of 43%) consisted of manual felling and choking of individual trees, followed by cable yarding. The second system, on less steep sections (slope of 0 to 30%), involved mechanized felling and bunching, followed by cable yarding of bunched trees (Figure 1). The third system, used on the top of the hill, paired the feller-buncher with a shuttling phase that used the grapple skidder to bring the trees to the cable yarder (Figure 2).

Results

Table 1 presents the productivity of the three systems that we studied. The mean cycle time for cable yarding was longer with individual trees than with bunched trees because the hookup time was longer. The increased productivity made possible by bringing bunches of trees to the yarder with the grapple skidder was primarily attributable to the greater number of trees extracted per cycle.

The feller-buncher did not have a leveling system, but was nonetheless able to work on slopes of up to 28%. Its production ranged from 160 to 180 stems/PMH, and was independent of the slope. The resulting productivities ranged from 19 to 28 m^3/PMH, depending on the mean volume of the harvested stems (which ranged from 0.11 to 0.16 m^3/stem).

Cable yarding combined with felling and bunching of the trees was more productive and less expensive than the costs in previous FERIC studies (Meek 1996; Gingras 2000), whereas the system with manual felling had a typical productivity and cost given that it was used in the steepest areas of the site. The overall soil disturbance level was comparable to the results of previous studies, with more than 90% of the area undisturbed or only slightly disturbed. The risk of erosion after harvesting thus appeared quite low.

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Table 1. Results of the time study of cable yarding, plus summary of costs. (The cable yarding distance was standardized at 150 m; n.a. = not applicable.)

	Manual felling	Mechanized felling and bunching	
	Cable yarding of single trees	Cable yarding bunches of trees	
		No skidding	Skidding of trees to the cable yarder
Total cycle time (min)	7.75	4.72	4.62
Average slope (%)	43	14	0
Mean number of stems/cycle	6	8	15
Mean volume/stem (m^3)	0.16	0.15	0.13
Productivity			
Stems/PMH	46	102	195
m^3/PMH	7.4	15.3	25.4
Estimated direct cost ($/$m^3$)			
Cable yarder	21.10	10.40	6.60
Feller-buncher	n.a.	4.90	4.90
Grapple skidder	n.a.	n.a.	3.60
Total[a]	21.10	15.30	15.10

[a] The estimated total direct cost of *full trees* at roadside, excluding supervision, transportation of machines, profits, and other overhead costs. The cost of the cable yarder includes the cost of one operator and manual felling with two fellers, plus choking and unchoking.

Implementation

- During harvesting in mountainous blocks, it will often be necessary to rely on manual felling in the steepest sections to complement the use of fully mechanized systems. The overall cost will be a function of the proportions of the total volume harvested with each system and the corresponding cost ($/$m^3$) of that system. For example, our study area had 20% of the volume on steep slopes (>30%), 30% on slopes of from 0 to 30%, and 50% on the top of the hill, and the weighted cost would become: (0.2 x \$21.10/m^3) + (0.3 x \$15.30/m^3) + (0.5 x \$15.10/m^3) = around \$16.40/m^3.
- Note that these costs are specific to FERIC's study and could vary depending on specific site factors, and particularly depending on the mean volume of the harvested stems.
- To minimize the costs of cable yarding, reduce the volume harvested manually as much as is feasible. To increase the proportion of the site that can be harvested with a fully mechanized system, the feller-buncher should be equipped with a leveling system.
- Where the terrain permits (e.g., on the tops of hills), bring the wood to the cable yarder with a skidder. This practice will increase the volumes transported by the cable yarder before it

must be relocated, thereby reducing the relative amount of relocation time, and will increase the payload per cycle.

- The work performed by manual fellers on steep slopes is strenuous. To avoid accidents caused by fatigue, workers should alternate jobs between felling plus choking, choking alone, and unhooking after cable yarding.

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For more information on the TL3000 cable yarder, please contact:

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