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ABSTRACT: Decisionmakers, loggers, managers, and planners need to understand and have methods for estimating utilization and productive time of cable logging systems. In making an accurate prediction of how much area and volume a machine will log per unit time and the associated cable yarding costs, a reliable estimate of the availability, utilization, and productive time of the cable machine must be known. This study analyzes the important estimators for the Christy SWY III cable yarder operating in the southern Appalachian Region of the Southeastern United States. Shift data were collected on 12 logging units of timber sales on the National Forests in North Carolina from April 1986 through August 1987. The Christy SWY III is a small cable yarder and the results can be generalized to similar cable yarders and applications to estimate better the yarding costs for small cable systems.

KEYWORDS: Cable logging

INTRODUCTION

Cable logging technology is again being applied in the Eastern United States (Paul, 1980; Virginia Polytechnic Institute, 1982; Sherar, et al, 1986; LeDoux, 1985; Baumgras and LeDoux 1986; Lombardo, 1987). Numerous time and motion studies have been conducted (Fisher and Peters, 1983; Rossie, 1983; Baumgras, 1984) and generalized stump-to-mill computer packages have been developed (LeDoux, 1985). Although much work has been completed and reported, decisionmakers, loggers, managers, and planners need to understand and have methods for estimating the availability, utilization, and productive time of cable logging. Particularly in Eastern cable operations, this data often must be estimated from work completed in other parts of the country or in other countries. Errors in estimating equipment utilization or system productive time can result in incorrect estimates of logging production and costs, causing detailed time-study data to be less useful. In many cases, utilization data are collected concurrent with time-study data, then used to estimate productivity and costs. Data collected in this short period rarely represent the true

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availability of the logging equipment or the utilization and productivity of the logging crew.

In this study, the availability, utilization, and productive time of the Christy SWY III cable yarder are analyzed over a long and continuous period of time.³ The Christy SWY III is a small, low-priced cable yarder and the results can be generalized to other yarders of the same class in similar applications. The results can be used to assist decisionmakers, loggers, managers, and planners in understanding the availability, utilization, and productive time of cable logging and in more accurately predicting logging costs of eastern cable harvesting systems. The data also contribute to the body of cable logging knowledge.

STUDY AREA

Data were collected on three timber sales of 12 logging units on the National Forests in North Carolina from April 7, 1986, through August 19, 1987. The data collection period was continuous and included logging throughout a winter season when normal operations must be severely curtailed. The logging units were typical of skyline units in the Southern Appalachian region of the Eastern U.S. with ground slopes averaging 50-60 percent in ridge-cove hardwood-type terrain.

LOGGING EQUIPMENT DESCRIPTION AND OPERATION

Gilkey Lumber Company has owned and operated the Christy SWY III since July, 1984. It has logged almost exclusively on National Forest land in Western North Carolina since that time. The company logging crew has worked together on this yarder for several years and has achieved a high degree of consistency not often found in Eastern cable logging crews. Although the Christy yarder is equipped with a haulback drum, the drum was rarely used except to log a limited amount of sidehill timber where the haulback was needed to return the Mini-Christy carriage to the choker-setting point. During almost all of the data collection period, the machine used only the skyline and mainline drums in a gravity ("shotgun") outhaul logging configuration.

DATA COLLECTION

The shift data were recorded by the logging crew using the activity descriptions shown below. Data was recorded by the logger to the nearest 1/4 day. The foreman recorded daily the activity(ies) that had occurred during the course of the scheduled work day.

³The use of trade, firm, or corporation names in this paper is for the information and convenience of the reader. Such does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

Definition of Activities

Scheduled Days -- Scheduled operating time for the equipment and logging crew. Normally five days per week. Sometimes a Saturday was worked to make up for a lost day during the week.

Move-in/out and Set-up/take-down Days--The time required to move the machine in and out of the sale area, or move between sales, and the time to set up and take down the machine after and before moves.

Change-Landing Days--The time required to take the machine down, move to the next landing on the same sale area, and set the machine back up again.

Machine-Not-Available Days--The time that the crew could not cable log because the machine was down for repairs. Does not include scheduled maintenance time for the machine.

Machine-Available/No-Work Days -- The time that the crew could not or did not work, although the machine was available for work.

Yarding Days -- The time that the machine and the crew spend yarding logs, changing roads, and performing routine maintenance.

DATA SUMMARY

Data were summarized for each unit logged, as shown on the Unit Data Summary Form (Fig. 1). Days were summarized as recorded in each activity, and availability, utilization, and productive time were calculated for each unit. Figure 1 also shows additional data summarizing the physical attributes of the logging unit, timber stand, and logging operation. The data has been summarized to estimate the average daily production of the Christy SWY III over the data collection period, but is not presented in this manuscript. Table 1 displays the summary of the logger-collected data by unit.

AVAILABILITY, UTILIZATION, AND PRODUCTIVE TIME

For the twelve logging units on which data were collected, calculations of the machine availability, utilization, and crew productive time were made. Calculations were based on the following definitions:

Availability--Total time the machine was mechanically available to the crew for yarding of timber (includes moves/set-up, landing-changes, machine-available/no-work and yarding days).

$$((2) + (3) + (5) + (6))/(1)$$

Forest:	NFSNC	Unit Number:	6
District:	Grandfather	Unit Acres:	33
Sale Name:	Mitchell Creek		
Unit Data:			
No. of sawtimber trees	1288	Total Mbf	214
No. of pulpwood trees	0	Total cunits	141
No. of landings used	4	AYD*	450 feet
Silviculture presc.	CC	Total turns	1563
		Pct. stems	100
		Pct. stems	0
Equipment descriptions: Christy SWY III			
Rigging configuration: Live Skyline, gravity			
Logger: Mickey Conner			
Dates of data collection: August 8, 1986 through October 17, 1986			
Logging Data:		(1) Scheduled days	53.0
		(2) Move-in days	0.5
		(3) Change-landing days	1.5
		(4) Machine-not-available	0.0
		(5) Machine-available/no work days	17.0
		(6) Yarding or skidding days on skyline volume	34.0
Production summary per yarding day:			
Sawtimber trees per day	38	Mbf per day	6.3
Pulpwood trees per day	0	Cunits per day	4.1
Acres logged per day	.97	Turns per day	46
*AYD = average slope yarding distance from map.			

Figure 1.--Data Summary Form.

Table 1.--Logging data recorded in each activity, by unit.

Activity	Unit											
	MC9	MC8	MC3	MC5	MC4	MC6	IC1	IC2	JM4	JM5	IC5	IC6
1. Scheduled days	10.0	12.5	14.0	24.5	30.5	53.0	21.0	17.0	50.0	21.0	38.0	55.0
2. Move in/set up	0.5	0.75	0.5	0.5	0.5	0.5	1.5	0.5	1.0	0.5	0.0	1.0
3. Change landings	0.5	1.0	1.25	0.5	1.0	1.5	1.0	0.5	1.0	0.0	0.5	1.5
4. Machine not avail.	0.0	0.5	1.25	4.25	1.5	0.0	0.0	0.0	1.5	1.5	7.0	3.5
5. Machine available (no work)	0.0	0.5	0.5	1.0	0.0	17.0	4.0	8.0	15.5	5.5	1.5	5.0
6. Yarding days	9.0	9.75	10.5	18.2	27.5	34.0	14.5	8.0	31.0	13.5	29.0	44.0
7. Average turns per day	NA	NA	NA	NA	NA	46	43	49	48	42	51	49

Table 2.--Availability, utilization, and productive time by logging unit in percent.

	Unit											
	MC9	MC8	MC3	MC5	MC4	MC6	IC1	IC2	JM4	JM5	IC5	IC6
	Percent											
Availability	100	96	91	83	95	100	100	100	97	93	82	94
Utilization	100	96	88	79	95	68	81	53	66	67	78	85
Productive time	90	78	75	74	90	64	69	47	62	64	76	80

Utilization--Total time the machine was used by the crew, (including moves/set-up, landing-changes, and yarding days).

$$((2) + (3) + (6))/(1)$$

Productive time--Total time the crew and machine spend yarding timber.

$$(6)/(1)$$

The results for availability, utilization, and productive time are shown by logging unit in table 2.

SUMMARY AND CONCLUSIONS

The average machine availability for all units was 94 percent throughout the data collection period. Only two units, MC5 and IC5, show low availability, 83 percent and 82 percent respectively. The machine downtime on these two units was due to transmission repair, shaft and bearing repairs on the skyline drum, and repairs to the communication system. Over the study period, the machine lost 21 days due to mechanical repairs. During some of those days while waiting for parts, the crew maintained production by ground skidding areas near the roads and landings.

The average machine utilization rate for all units was 77 percent. The average productive time for all units was 72 percent. As expected, the utilization and productive time of the machine and crew was low during the winter logging season. Units IC2, JM4, and JM5 were logged from November 15 through April 3. In addition, MC6 was logged from August 11 through October 17 and had 12 days of missed work due to extremely wet weather. In most cases, landing sizes were not adequate to cold deck more than several days production, so when the haul road was in poor shape for hauling, the crew worked at other jobs. Move-in/set-up time averaged approximately 3/4 of a day for all units. Landing changes averaged about one day for all units.

As more information is collected on the availability, utilization, and productive time of Eastern cable operations, better estimates of system production and costs can be made. This study summarized data for the Christy SWY III small cable yarder operating under typical conditions of the Southern Appalachian mountains in Western North Carolina.

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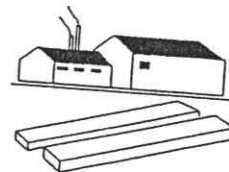
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