T H E S I S

WINTER LOGGING AND MILLING STUDY IN NORTHERN COLORADO

Submitted by

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Chapter I

INTRODUCTION

This paper has as a subject the logging and milling operations of the Michigan River Timber Company during the winter of 1948-49. The operational area was located on the Routt National Forest near Gould, Colorado (fig. 1.).

Purpose

The purpose of this study is:

1. To present an accurate description of a winter logging and milling operation in Northern Colorado.

2. To make time studies of the falling and bucking operations and interpret the data collected from time studies and other sources.

3. To provide basic data for future time and cost studies by Colorado A & M forestry students.

FIGURE 1.

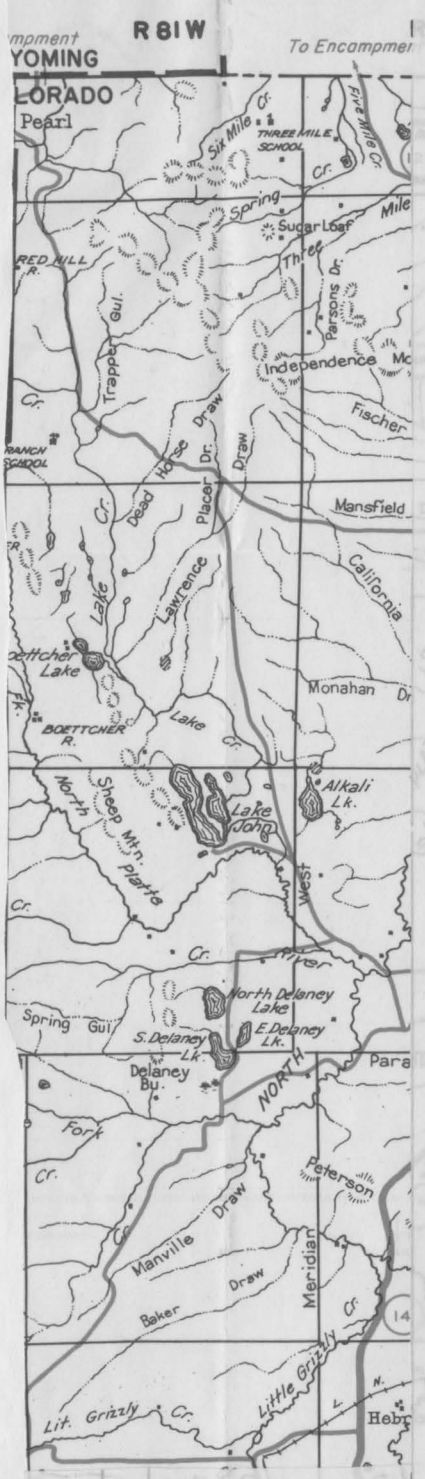
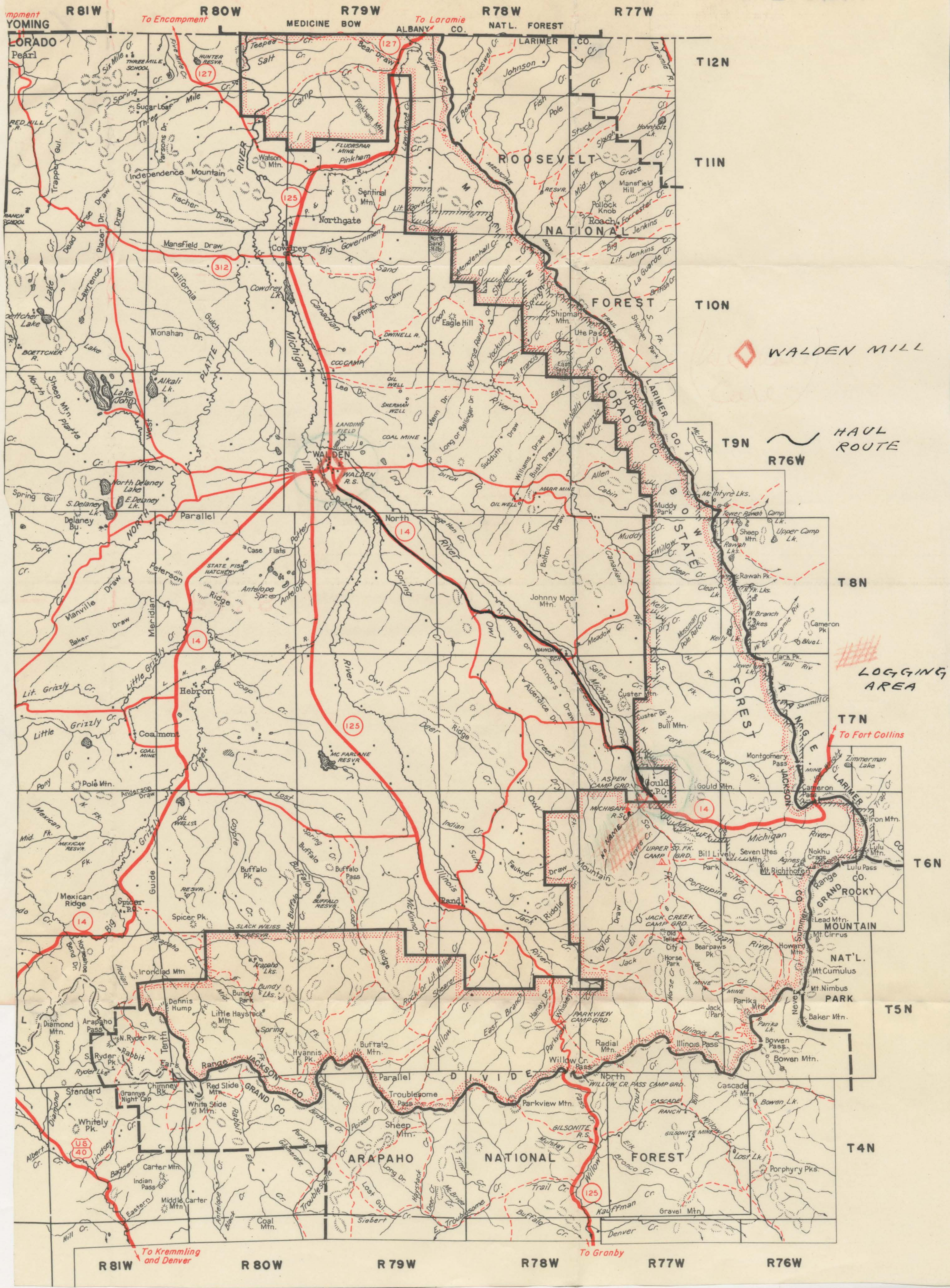

R81W
To Encompment
YOMING
LORADO
Pearl
Six Mile Cr.
THREE MILE SCHOOL
Five Mile Cr.
Spring
Sugar Loaf
Mile
RED HILL
Trapper Gul.
Parsons Dr.
Independence Mc
Fischer
Cr.
House Draw
Dr.
Placer
Dead
Mansfield
Lake
Lawrence
California
Boettcher Lake
Monahan
BOETTCHER R.
Lake
Alkali Lk.
Lake John
North Sheep Mtn. Plants
West
Cr.
North Delaney Lake
Spring Gul
S. Delaney Lk.
E. Delaney Lk.
Delaney Bu.
NORTH
Fork
Cr.
Peterson
Draw
Manville
Meridian
Baker
Draw
Cr.
Little Grizzly
Lit. Grizzly Cr.

FIGURE 1.



R81W
R80W
R79W
R78W
R77W
R76W
T12N
T11N
T10N
T9N
T8N
T7N
T6N
T5N
T4N
WALDEN MILL
HAUL ROUTE
LOGGING AREA
To Encampment
To Laramie
To Fort Collins
To Kremmling and Denver
To Granby
MEDICINE BOW
ALBANY CO.
NAT'L. FOREST
LARIMER CO.
ROOSEVELT NATIONAL FOREST
MEDICINE BOW NATIONAL FOREST
COLORADO STATE FOREST
JACKSON CO.
GRAND CO.
ROCKY MOUNTAIN NAT'L. PARK
ARAPAHO NATIONAL FOREST
CONTINENTAL DIVIDE
WALDEN
WALDEN R.S.
Cowdrey
Northgate
Hebron
Coalmont
Rand
Gould P.O.
Spicer P.O.
Lake John
North Delaney Lake
E. Delaney Lk.
S. Delaney Lk.
Cowdrey Lk.
Alkali Lk.
Watson Mtn.
Sentinel Mtn.
Independence Mountain
Eagle Hill
Shipman Mtn.
Ute Pass
Custer Mtn.
Bull Mtn.
Johnny Moor Mtn.
Cameron Pass
Montgomery Pass
Parkview Mtn.
Troublesome Pass
Willow Cr. Pass
Illinois Pass
Bowen Pass
Radial Mtn.
Whitely Pk.
Diamond Mtn.
Arapaho Pass

Chapter II

BACKGROUND MATERIAL

Timber sale contract

The original timber sale for this area was made in June, 1936, and Michigan River Timber Company has been in continuous operation since then. The sale was for approximately 77 MM feet; however, 98 MM feet have been cut to date and the final cut will be over 100 MM feet. The timber was purchased from an area of about 16,830 acres, in Township 5 and 6N, Ranges 76 and 77W, 6th P.M., within Routt National Forest (fig. 1.). S-sales (1936).

At present the stumpage price is $3.35 per M. ft. b.m. for all three species cut, i.e., lodgepole pine, Ehgelmann spruce, and alpine fir. Pole prices are found in Table 1.

Table 1.--POLE STUMPAGE RATES

Pole Length feet	Price per M linear feet
16-19	$ 4.00
20-29	4.50
30-39	11.00
40-49	18.00

Fig. 2--Strip clearcut to diameter limit. Note contrast with uncut area in background.

Fig. 3--Overmature Lodgepole pine clearcut in blocks, uncut in background. Contrast with Fig. 2.

The timber sale contract requires that on designated areas, all Engelmann spruce 14 inches D.B.H. and over, must be cut. The top diameter of merchantability is designated as eight inches.

Slash must be piled and burned along main roads at the company's expense--this includes approximately six percent of the total sale area. The cutters are required to lop the branches from the entire main stem.

Silvicultural method

The cutting method used in the area is a strip system. These strips run generally along the contour, although on level areas the strips are laid out on a compass line (fig. 2 and 3.). The strip width is from 400 to 800 feet. Block cutting is sometimes practiced on overmature stands of lodgepole pine with no understory.

The allowable annual cut from this portion of the Routt National Forest is 10 MM feet. This means that if Michigan River is cutting 10 MM feet annually no other sale could be made. However, they have not always met their allowable cut, and this year other sales have been made on the district to make up the deficit. This undercut occured mainly during the way years. In 1947 and 1948 the annual production was over 10 MM feet.

Area description

Timber volumes run from 10 to 15 thousand feet per acre, lodgepole pine constituting the major volumes, with Engelmann spruce and alpine fir following in that order. Van (1949).

As might be expected in the lodgepole pine and Engelmann spruce types of the central Rocky Mountains, the topography is rolling to steep, and elevations vary between 9000 and 10,400 feet (fig. 4.).

General picture of yearlong operations

Michigan River has its lumber yard at Walden, Colorado, 22 miles north of Gould (fig. 1.). During the summer some 16 foot logs are hauled from the woods to Walden and milled there. This mill saws about 3000 feet per hour, but does not show much of a profit. Doubtless this is at least partly due to the extremely small average log size--for the summer of 1948 the average 16 foot log hauled to Walden contained 50 ft. b.m.

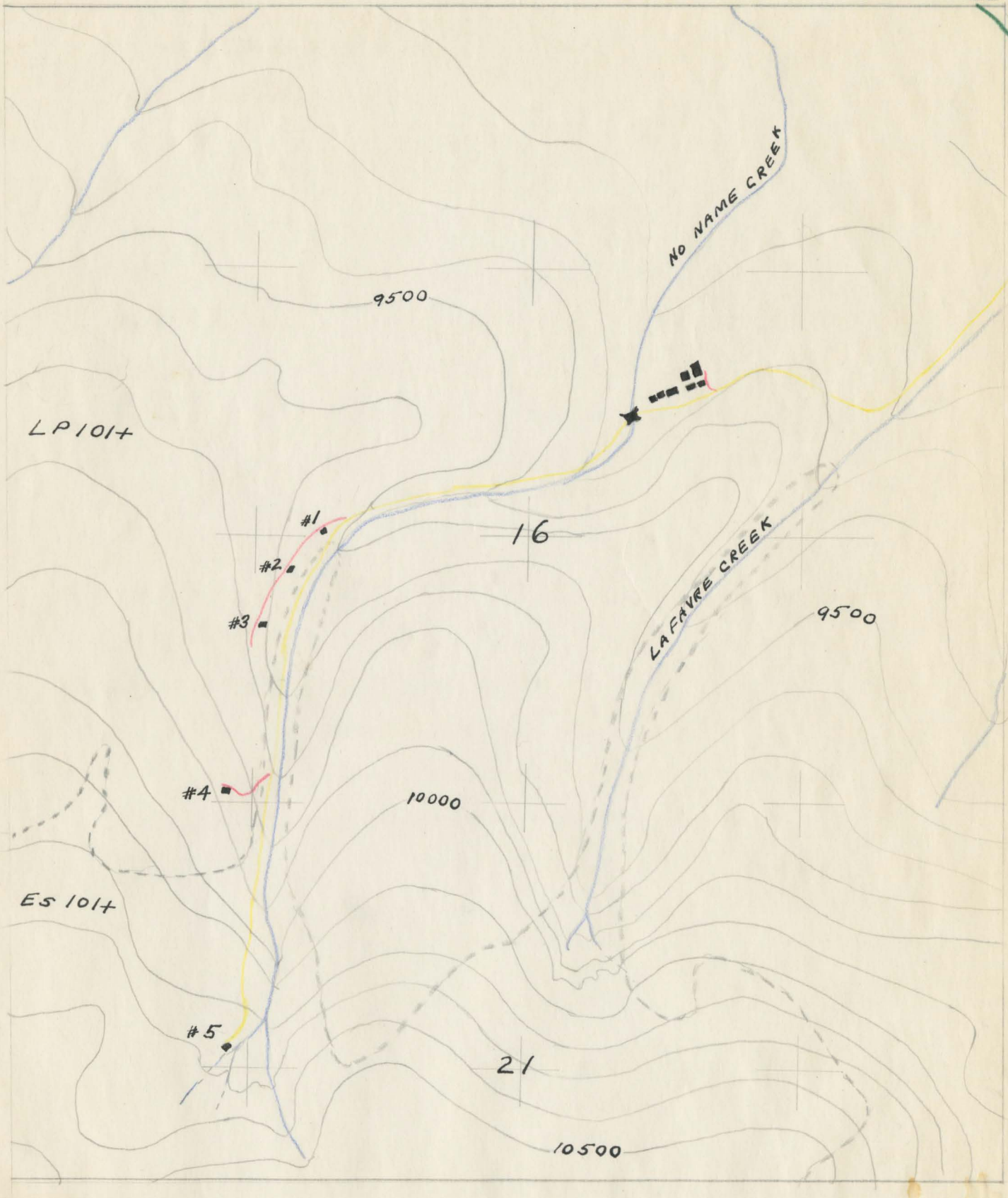
Portable sawmills produced most of the lumber and ties for the operation. Last summer 10 portable mills were contracted by the company, while five portables were in operation during the winter of 1948-49.

All of the skidding is now done by single horse. In 1947 tree length logging with tractors was tried. However, it was found that all leave trees were badly scarred by this type of operation, and the reproduction suffered. Therefore, tree length with cat

FIGURE 4.

MAP OF LOGGING AREA

T 6N, R 77W, 6TH P.M.



STREAM

TYPE LINE

LOGGING ROAD

LOGGING SPUR

BACHELORS CAMP

CONTOUR INTERVAL 100 FEET

→ 3 MILES TO GOULD

#1 ETC. = MILL #1

J. J. G. 3/29/49

logging is permitted only in overmature lodgepole stands which have no understory.

During the winter no scaling is done by the Forest Service on this sale. Mill scale studies are run periodically, at least once a month, and from these studies the ratio is determined between log scale and the number of ties cut. For instance, if 1000 ft. b.m. of logs are scaled on the skidway and from these logs 20 ties are cut plus some side lumber then the ratio is 1000:20 or 50. With this ratio it is only necessary to count the ties sawed, multiply by the number of board feet log scale per tie cut (i.e. the ratio figure) and arrive at the total log scale. The figure will vary on this operation from 50-70, i.e., if the maximum number of ties are cut the figure would be 50 and visca versa. Generally this conversion figure was about 60.

This ratio figure will, of course, vary with area, sawyer, saw, product desired, etc.; however, the study is always current, so little error is incurred.

Chapter III

STUDY METHODS

For the skidding and cutting time studies two stop watches were used to time each phase of the operation. A wrist watch with a sweep second hand was used to record total time. The phase times were then added together and their total checked against the true total. It was found that little error occured in starting and stopping the watches, so after the first day the overall time for an operation was not taken. This allowed more time for observation.

Each stop watch was fastened by a 12 inch cord to a jacket breast pocket, which left both hands free for either note taking or aiding in moving around in the snow which was often waist deep (fig. 5.). Though the temperature reached -30 degrees Fahrenheit, the stop watches functioned perfectly.

The time study sheets were kept in a 5 x 9 inch metal tatum holder that fit easily into a hip pocket, and which provided a firm base for note taking, and prevented the sheets from being damaged. An ideal sheet holder would be one with wooden covers. This type would have most of the advantages of the metal tatum, but would

Fig. 5--Writer on the right tabulating data during time study. Note stopwatch on pocket.

not become nearly as cold to the touch in below zero weather. The 3H pencil used for note taking was tied to a loop of string that was worn around the neck. Measurements were taken to the nearest inch with a steel pocket tape.

Thursday was chosen as the best time study day. On Monday there was the possibility of a hangover from the big weekend; Friday and Saturday the men and horses, particularly the horses, were badly fatigued; Tuesday and Wednesday were probably the days of optimum efficiency, therefore not considered to represent average conditions.

Eight one day trips were made to Walden. Of these, one was to make a preliminary reconnaissance; two to obtain office information at Walden; and five were spent in the woods making time studies, taking photographs, and gathering information on all phases of the operation. These trips were made from the 15th of January until the 17th of March, 1949.

It should be noted that the temperature during the time studies ran from -30 degrees F. to 45 degrees F. The snow depth varied from 2 1/2 to 3 1/2 feet on the level.

Chapter IV

STUDY ANALYSIS

Winter operation outline

This winter, Michigan River employed about 60 men in their woods operations. Five portable mills were in operation.

Generally the mill crew consisted of three men, a sawyer, offbearer, and a tailer. The mill was usually supplied with logs by two or three cutters and two skidders--logs were skidded directly to the skidway.

Both ties and side lumber were produced at the mill and then hauled 26 miles to the lumber yard in Walden.

Most woods labor worked on a contract basis. See Appendix for Union Working Agreement and wage scale.

In the following pages each separate operational phase will be described and discussed in detail.

Cutting

All cutting was done by one man crews, due to the small size of the trees. For the cutting study the average log size was 34.9 ft. b.m. See Table 2.

Table 2.--CUTTING SAMPLE: LOG DIAMETER FREQUENCY, LOG SCALE CONTENT AVERAGE LOG

Length Feet	D.i.b. Small End Inches								
	8	9	10	11	12	13	14	15	16
8	2	4	11	9	7	4	1	1	
10							1	1	
11	8	2	1						
12						1		1	1

Total Number Logs	55
Total Ft. b.m., Scribner D.c.	1920
Average Log Ft. b.m.	34.9

Equipment:--A four foot Simonds Number 223 saw was used by most of the cutters studied. Power saws had been tried several times on the operation, but the men using them could not make a reasonable wage.

Both single and double bitted axes were used by the cutters for limbing and notching. The single bit, of course, was better adapted to driving wedges, while the double bit required less sharpening (fig. 6.).

An eight foot measuring stick was carried by all cutters. Some cutters had a very heavy marking stick which was used to pry the bucked logs apart so the skidder would have an easier time hooking up. Other cutters broke the logs apart by a blow with the axe.

Fig. 6--Cutter equipment: 4-foot cross cut, axe marking pole, wedges, etc. on stump. Note that saw has four back teeth knocked off so that they can't rip shirt or jacket while falling.

The sapwood was generally frozen--this made for slower sawing than during the summer. Kerosene was used to facilitate sawing. Ordinary saw filing methods had to be modified, due to the extreme cold and frozen wood. Raker teeth could not be too deeply throated or they would have a tendency to break off. Rakers were of course kept slightly longer than those for summer sawing.

The cutter carried the following equipment:

1 man saw, 4 foot, (usually Simonds Number 223)
1 axe (pole or double bit)
1 marking pole, 8 feet long
1 shovel, square point and D handled
1 bottle of kerosene
2 to 4 steel wedges
1 saw guage (Simonds, Anderson, or Disston)
2 files

Snow effects:--The deep snow presented many problems. Since this was a government sale a maximum stump height of 12 inches was required--this meant shoveling from two to three feet of snow away from the tree (fig. 7 and 8.). Due to the heavy snow, 10.3 percent of the cutter's working time in the study was spent shoveling the snow. This by itself occasioned a sizeable drop in the average hourly wage.

Snow increased the time to gather equipment,

Fig. 7--Cutter shoveling down to 12 inch stump height.

Fig. 8--Cutter shoveling; note leather case for wedges.

move to the next tree, and the time to move from one cutting place to another while bucking logs. Some of the cutters threw their saw to the next cut, in order to leave two hands free for the marking.

Snow in the crowns of the trees increased danger to the cutter from "widow-makers" and required more careful falling.

Time study terminology and results:--Table 3 gives the form used for the cutting time study. The following general definitions apply:

Shovel time: begins when shovel is first picked up prior to use and ends when shovel is put down and axe is picked up.

Falling time: begins with end of shovel time and ends when tree is on the ground. (swamping around the tree prior to cutting required very little time and was included in the falling time.)

Bucking time: begins for the first log when tree is on the ground and ends when the log is cut through and opened from the rest of the tree.

Bucking time: begins with end of butt log time and ends when the second log is opened from the rest of the stem.

Limbing time: begins with end of last log bucking time and ends when the first tool is picked up.

Gather time: begins with end of limbing time and ends after the tools have been gathered when the first step is taken toward the next tree.

Move time: begins with the end of gather time, includes the time taken to move to the next tree after the tools have been gathered, and ends when shovel is first picked up prior to use.

Table 3.--CUTTING TIME STUDY SHEET

Cutter	Shovel Time	Fall Time	D.i.b. Stump	Bucking								
				Butt 1			Log 2			Log 3		
				D.i.b.	L*	T**	D.i.b.	L*	T**	D.i.b.	L*	T**
A			19	15	8	1:53	13	8	2:57	13	8	3:23
				11	8	1:57	8	11	1:35			
	3:29	8:19	19	15	10	4:00	14	10	5:38	14	8	4:30
				12	8	2:50	9	11	1:43			
			20	16	12	3:45	15	12	3:49	13	12	3:09
				10	8	1:33	8	11	1:22			
	5:06											
B	3:40	2:49	12	10	8	2:29	9	11	2:34	8	11	2:28
	3:26	1:32	12	11	8	3:25	10	8	2:38	9	8	2:51
	2:29	3:53	14									
C	3:10	2:20	14	12	8	3:24	11	8	3:48	10	8	3:27
				8	8	1:16						
D	2:05	2:50	13	11	8	2:14	10	8	3:12	10	8	2:48
	1:51	3:49	13	12	8	3:08	11	8	3:12	10	8	3:10
				9	8	2:11	8	8	2:50			
		3:50	14	13	8	2:18						
E	0:48	3:15	13	12	8	1:45	11	8	1:49	10	8	1:51
				8	11	1:29						
	0:43	1:35	13	11	8	1:09	11	8	1:43	10	8	1:12
	0:39	2:36	13	12	8	1:54	11	8	1:21	10	8	1:35
				8	11	1:03						

* Length of log ** Time

Table 3.--CUTTING TIME STUDY SHEET--Continued

Cutter	Bucking Log 4 D.i.b.	L*	T**	Limb	Gather	Move	Delay	Comments
A	12	8	2:30					
					2:00	0:40	0	
				5:32	1:45	10:00		Tree down when I arrived
	12	8	2:45	4:48				
					0:51	0:57		
B				3:27	1:00	1:00	7:00	"Snoose"
	8	11	2:00	0:30	0:30	0:50	5:05	Tally logs--clear skidder
C	9	8	2:48	2:49				
D	8	11	3:19	1:00	2:00	0:05		Hung tree
	10	8	2:13					
				4:12	4:58			
E	9	8	1:30					Best of all cutters
				2:13	1:23			
	8	11	1:07	1:13	1:21			
	10	11	1:32					
				2:31				End of day

* Length of log ** Time

It should be noted that the bucking time for any log diameter includes the time to move over from the last cut as well as actual sawing time. Most logs were cut in 8-foot lengths with a few 10-foot and 12-foot lengths, and some 11-foot logs were cut to make mine props. Even with the short log lengths much time was spent in moving from cut to cut. On five logs in the bucking study an average time of 30 seconds per log was spent to gather tools, mark, and move on to the next cut. Also included in the bucking time is the time required to measure off the next log with the marking pole and mark the cutting place with the axe.

Only actual working time was included in the tables. Rest or delay time could not be accurately determined, but Rapraeger (1937) used 12 percent for the figure on his Idaho study, and perhaps this figure would not be too far wrong if applied to this study.

Since the average per hour wage was known for cutters D and E of Table 3, it was possible to compute their sampled hourly wages and compare it with their previous hourly wage. This was done in the following manner. Cutter D was timed on two complete trees, which when bucked up yielded 10 logs, totaling 270 ft. log scale. This took 39.68 minutes of work. Working at this same pace he would cut 405 ft. log scale per hour. Since cutters receive $5.30 per M.b.m. his hourly wage

for the timed work would be $2.12 per hour. In the previous two months cutter D averaged $1.80 per hour.

Cutter E cut 400 feet in 40.0 minutes or 600 feet per hour, giving an hourly wage of $3.18. In the two months before the study, cutter E averaged approximately $2.70 per hour.

From these figures a rest and delay percentage of about 15 percent would be indicated. Though the sample is small the delay figure should be generally applicable to the operation.

An examination of Figure 9A shows that 54.4 percent of the total working time of the cutters studied was spent in bucking up the trees. This alone is enough to show how tree length logging can decrease log making costs. This is particularly true in winter logging, because snow increases time spent in moving around during the bucking operation (fig. 10.)

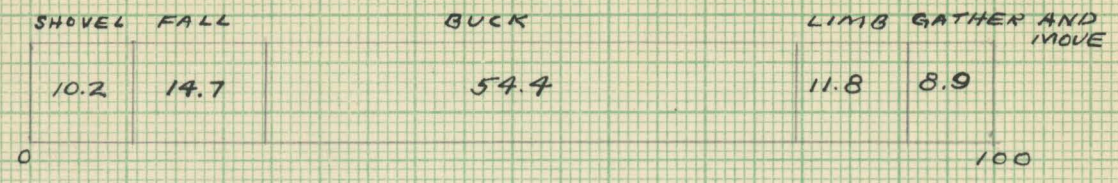
Limbing took 11.8 percent of the work time. This time was greater for the Engelmann spruce than for the lodgepole pine. The average limbing time was three minutes per tree for all species.

Limbing was required for entire length of the main stem, usually the top was cut off at about two inches diameter.

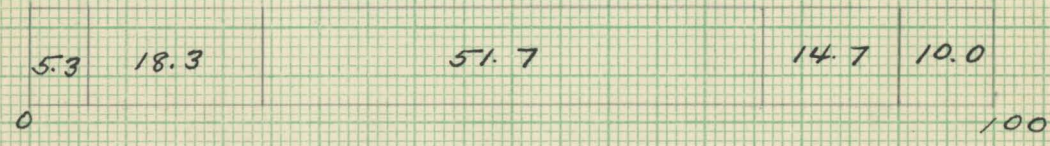
In all graph and table computations any average figure given represents the average of the averages of

FIGURE 9.

A. PERCENTAGE DISTRIBUTION CUTTING TIME ALL TREES STUDIED



B. PERCENTAGE DISTRIBUTION CUTTING TIME OF FASTEST CUTTER: 3 TREES 13 INCHES AT STUMP



C. PERCENTAGE DISTRIBUTION CUTTING TIME OF AN AVERAGE CUTTER 2 TREES 13" AT STUMP

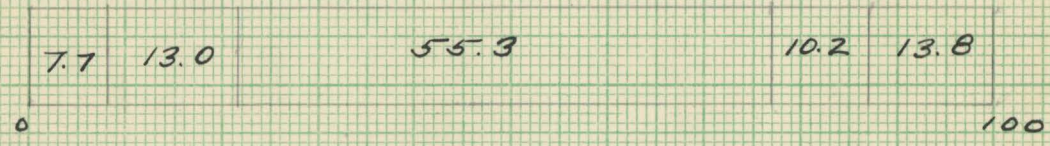


TABLE 4

ACTUAL AVERAGE NUMBER OF MINUTES FOR EACH OPERATION IN FIG. 9B * 9C

OPERATION	FIG. 9B	FIG. 9C
SHOVEL	.72	1.96
FALL	2.48	3.32
BUCK	7.00	14.14
LIMB	1.99	2.60
GATHER & MOVE	1.35	3.52

Fig. 10--Bucking: this operation required 54.4 percent of total working time in cutting study.

the five different cutters. This system is also used in all of the skidding time studies.

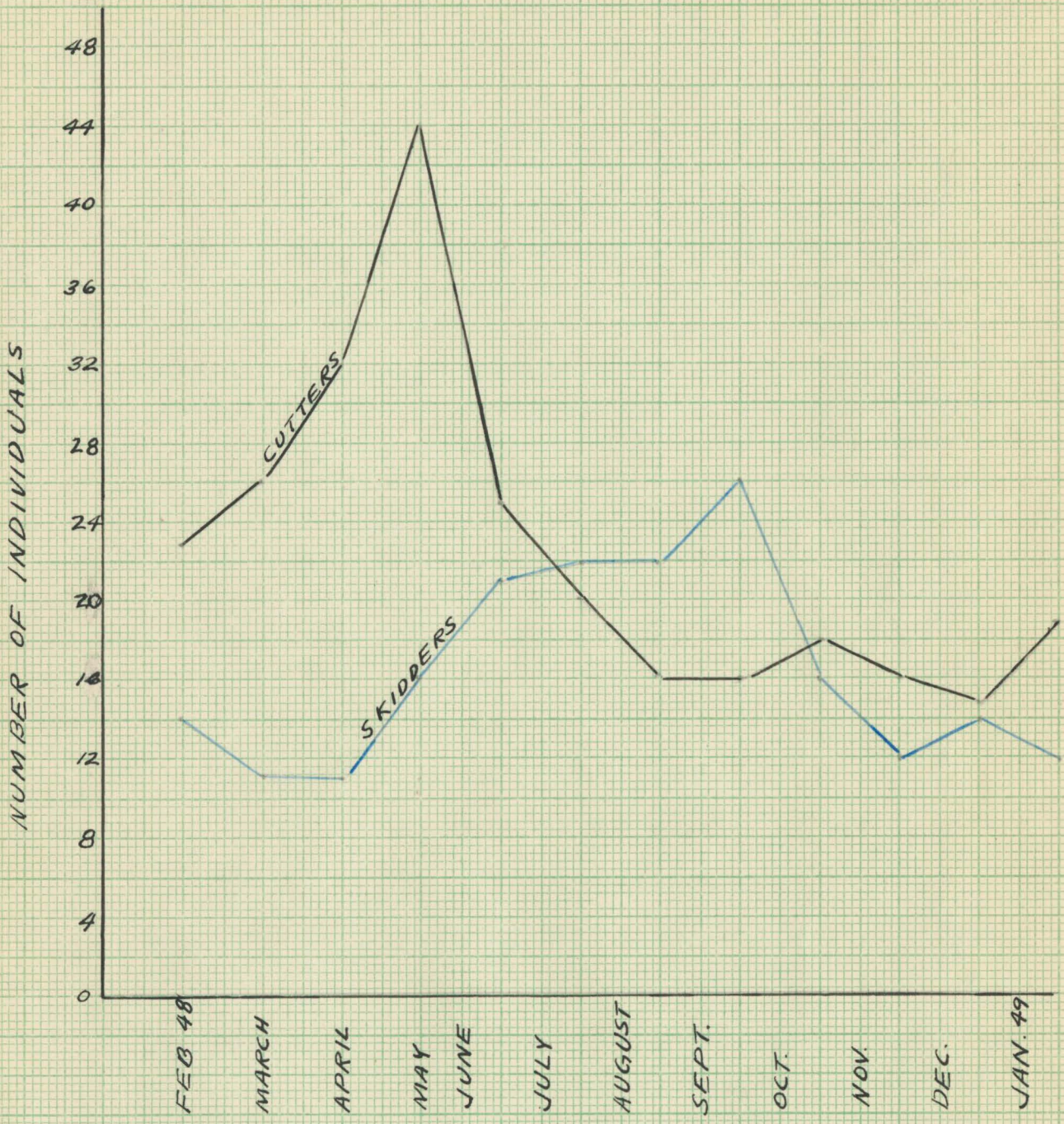
Figures 9B and 9C show the percentage distribution time of two cutters, Cutter B, the faster of the two, spends 51.7 percent of his time bucking, while cutter C spends 55.3 percent on the same operation; thus, the faster cutter definitely spends less of his time bucking.

The actual time spent on the different operations by cutters B and C, correlated with the percentage distribution graphs, shows more clearly the difference between the way in which the two cutters worked up similar trees, Table 4. Snow and timber conditions were similar in each case.

Cutter B was recognized as the fastest cutter on the job. He shoveled away only enough snow to notch the tree and make adequate hand room to use the saw. This was a contributing factor for his superiority over cutter C on the trees studied.

In 1948 the number of cutters varied from 15 to 44. See Table 5 and Figure 11.

FIGURE 11.



NUMBER OF SKIDDERS AND CUTTERS EMPLOYED FEB 1948 – JAN. 1949

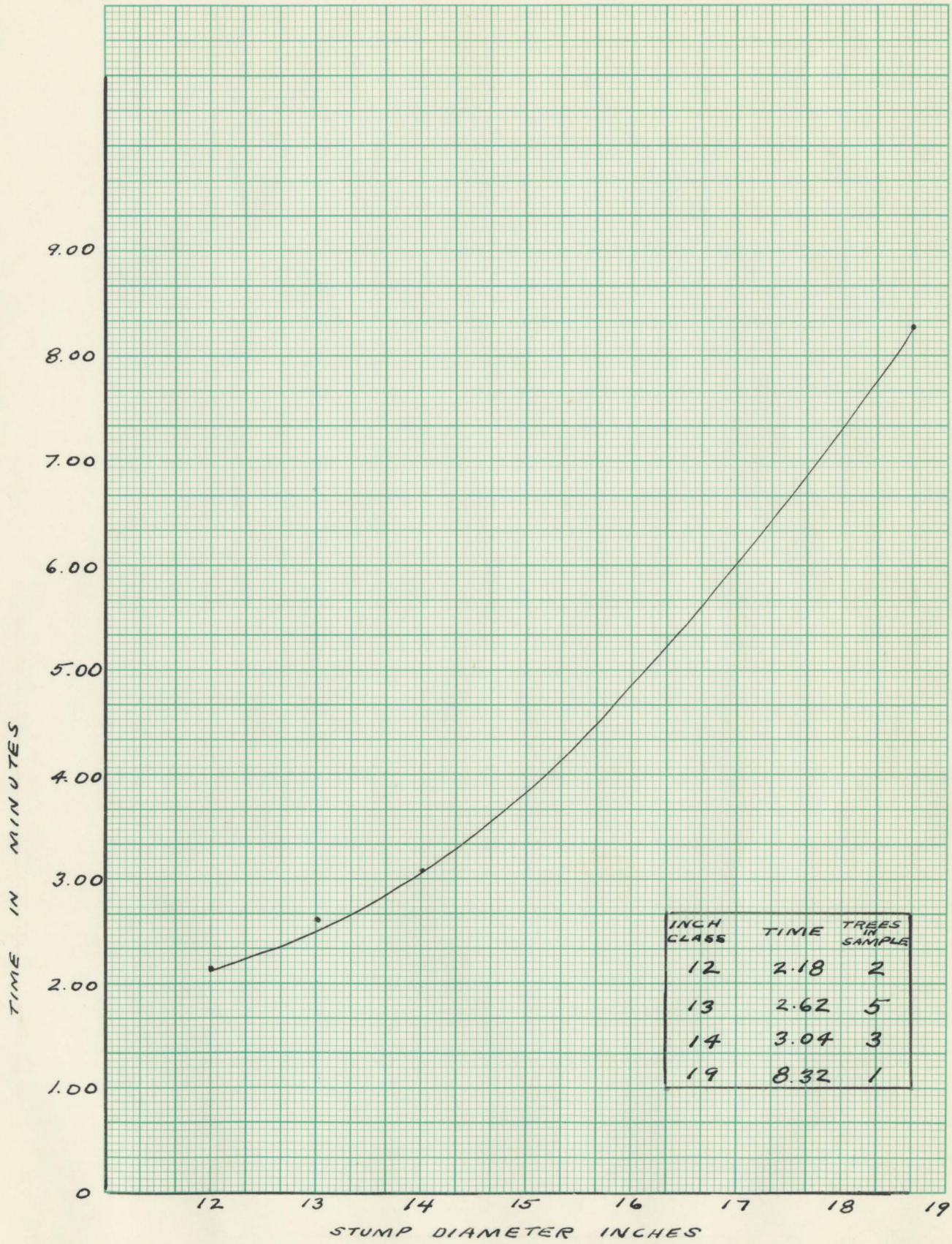
Table 5.--NUMBER EMPLOYED DURING ONE YEAR

Year	Month	Number Employed	
		Cutting	Skidding
1948	Feb.	23	14
1948	Mar.	26	9
1948	Apr.	32	9
1948	May	44	16
1948	June	25	21
1948	July	20	22
1948	Aug.	16	22
1948	Sept.	16	26
1948	Oct.	18	16
1948	Nov.	16	12
1948	Dec.	15	14
1949	Jan.	19	12

Figure 12 pictures the results of the falling time study. A very definite correlation is shown between diameter and time. This graph is based on a small sample, but does show the trend, i.e., as the inch diameter class increases from 12 to 19, the average falling time increases from 2.18 to 8.32 minutes.

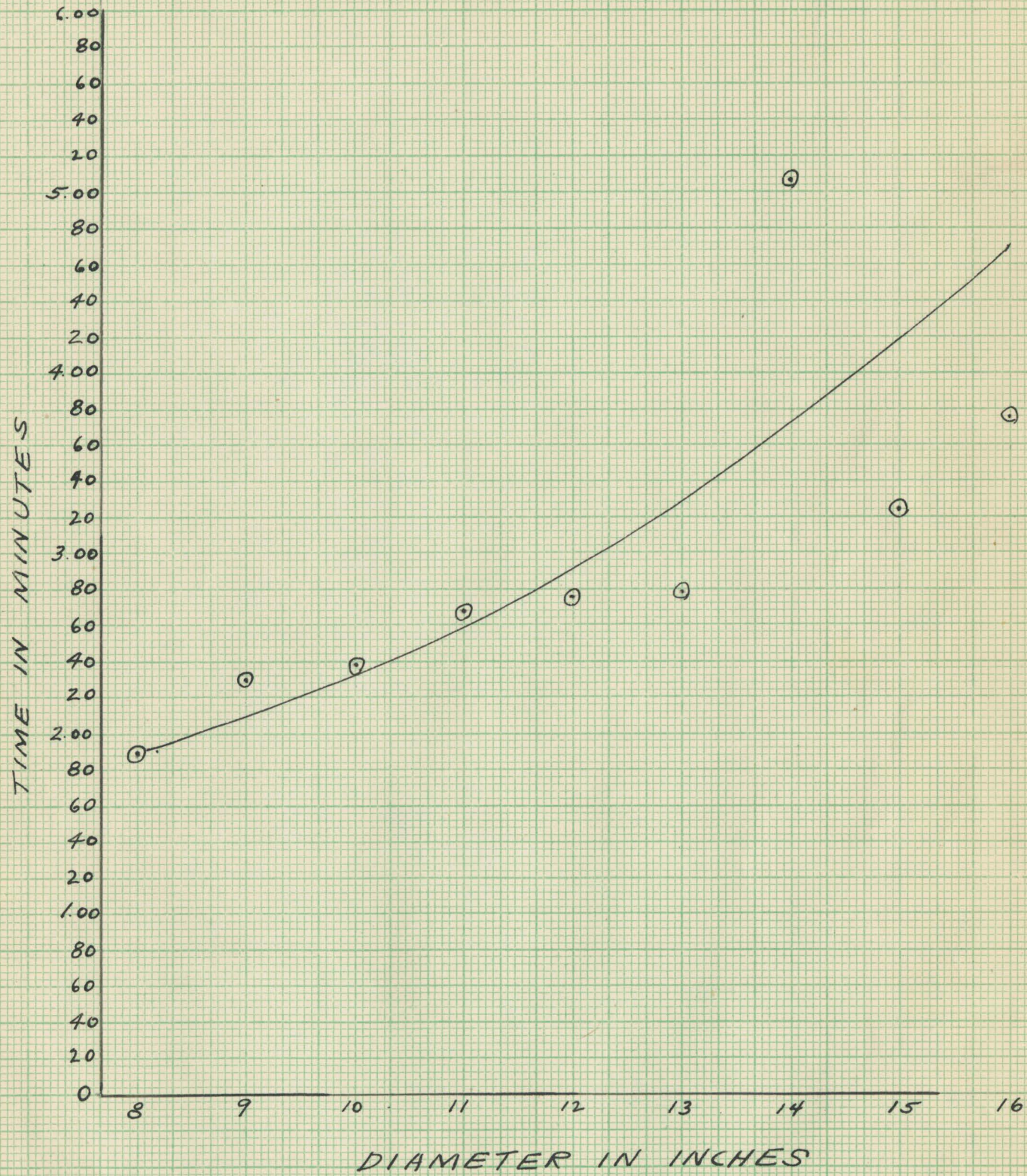
Figure 13 and Table 6 are a summary of the log bucking study. The bucking study included 55 logs. The correlation between log diameter and time is very apparent; as the inch diameter class increases from 8 to

FIGURE 12.



RESULTS OF FALLING TIME STUDY

FIGURE 13.



BUCKING TIME FOR LOGS 8-16 INCHES IN DIAMETER

Table 6.--TIME IN MINUTES TO BUCK LOGS 8 TO 16 INCHES IN DIAMETER

Inch Class	Cutter A		Cutter B		Cutter C	Cutter D		Cutter E		Number of Logs	Average Time
8	1.58	1.37	2.47	2.00	1.27	3.32	2.83	1.48	1.12	10	1.86
								1.05			
9	1.12		2.57	2.85	2.80	2.80		1.50		6	2.30
10	1.55		2.48	2.63	3.45	3.20	2.80	1.85	1.20	12	2.39
						3.17	2.22	1.58	1.53		
11	1.57	1.95	3.25	3.42	3.48	2.14	3.12	1.49	1.09	9	2.68
					3.80	2.23	3.20	1.43	1.21		
								1.82	1.15		
								1.72	1.35		
12	2.30	2.50			3.24	3.08	3.13	1.45	1.59	7	2.77
	2.45	2.50			2.40			1.75	1.98		
	2.84	2.75									
13	2.57	3.23				2.18	2.30			5	2.79
	3.39	3.09									
	2.95	3.38									
	3.65	3.15									
14	5.38	4.30								2	5.06
	5.63	4.50									
15	1.53	4.00								3	3.23
	3.49	1.88									
	4.00	3.83									
16	3.45	3.75								1	3.75
TOTAL										55	

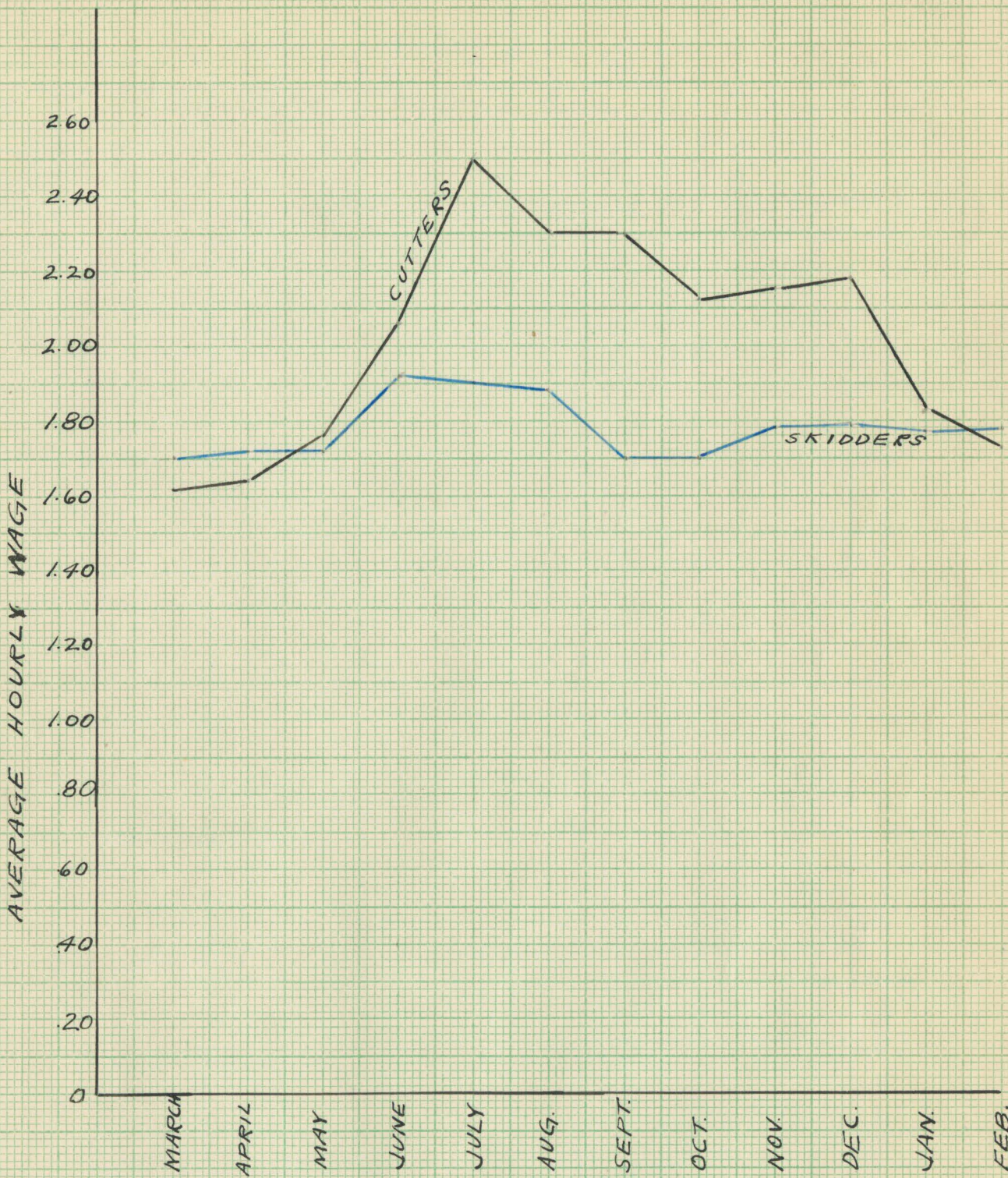
16 the average bucking time increases from 1.86 to 3.75 minutes.

It must be remembered that the bucking time as plotted includes the time spent moving from cut to cut.

Much time was spent asking opinions from the cutters and skidders regarding the effect of the heavy snow on their production. The cutters gave an answer that was confirmed by this study. All of the cutters questioned, said that the snow cut their production from 30 to 35 percent. This is due to the effects already mentioned, i.e., the necessity for shoveling, frozen wood, more time spent moving from tree to tree or cut to cut, and more difficult limbing. From Table 7 we see that the highest average hourly wage for the cutters was $2.50 made in July, an ideal month for both cutting and skidding. The lowest average hourly wage of $1.62 came in March. This is a difference of 35 percent. The cutters seemed to be correct about the effects of winter on their production. Most of their accuracy is doubtless based on their paycheck fluctuations (fig. 14 and Table 7.).

From an inspection of the curve in Figure 14 we see a low of $1.62 and $1.64 occuring for March and April, respectively. In 1948, March was the month of greatest snow depth; in April the thaws began and by May much of the snow was gone; in June the snow had largely

FIGURE 14.



COMPARISON AVERAGE HOURLY WAGE ALL SKIDDERS AND CUTTERS MARCH 1948 — FEB. 1949.

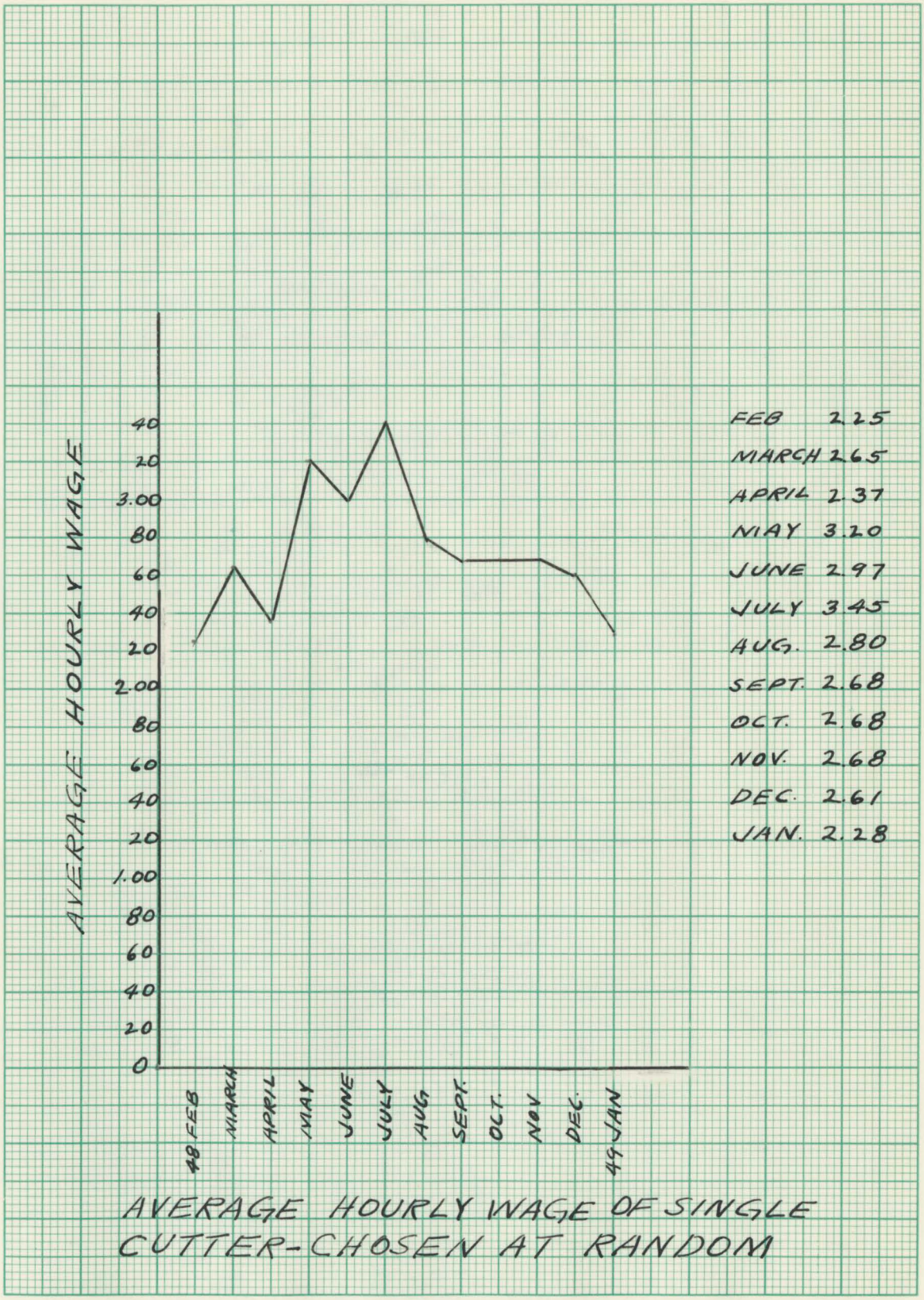
disappeared but the ground was very soft. July, August, and September were good dry months; light snow came in October and November; in December the heavy snow fall began and was deepest in February. This shows the very definite correlation with the average hourly wage earned. (Langendorf 1949)

Table 7.--AVERAGE HOURLY WAGE, ALL CUTTERS AND SKIDDERS, MARCH 1948 THROUGH FEBRUARY 1949

Year	Month	Total Average Hourly Wage	
		Cutters	Skidders
1948	Mar.	$1.62	$1.70
1948	Apr.	1.64	1.72
1948	May	1.76	1.72
1948	June	2.06	1.92
1948	July	2.50	1.91
1948	Aug.	2.30	1.88
1948	Sept.	2.30	1.70
1948	Oct.	2.12	1.70
1948	Nov.	2.15	1.78
1948	Dec.	2.18	1.79
1949	Jan.	1.83	1.77
1949	Feb.	1.73	1.78

The cutter in Figure 15 was chosen at random from among five cutters who had worked from February 1948 until January 1949 as a cutter. The curve is quite

FIGURE 15.



AVERAGE HOURLY WAGE OF SINGLE CUTTER-CHOSEN AT RANDOM

similar to the average curve for all cutters. This graph also shows a maximum wage during July and the lowest wages during March and April 1948 and January 1949.

During the winter an average work day for the cutters is about 8 hours--of this time close to two hours will be spent for eating and saw filing. Saws are generally filed at noon, the operation taking from one to one and one-half hours.

On this operation during the winter, good cutters can average about 2300 ft. b.m. per six hours of actual time in the wood or about $2.10 per hour.

Logs were scaled daily in the woods by company scalers. The skidder was paid on the same scale, which was based on gross contents.

Cutter B, mentioned before, has cut 6000 ft. b.m. in an eight hour day in timber averaging 35 ft. b.m. per 8-foot log, and in two feet of snow. This is a record for the company.

The help is all unionized and the standards for all operations appeared to be high. The logs were always cut completely through for the skidder. The skidder in turn planned his work so he wouldn't interfere with the tree falling.

Together with a contract or piece work wage, an added production incentive to the cutters is to cut enough logs to stay ahead of the skidders. The skidders

in turn must skid enough logs to keep logs on the skidway at the mill. A "hot" operation such as this makes for a competitive spirit usually not apparent when the logs are cold decked.

Skidding

All skidding on the operation was done by single horse, each skidder using from one to three horses (fig. 16 and 17.) This was done mainly because of the small log size. Each horse could pull from one to three logs per haul, making 60 to 100 ft. b.m. in a load.

In the skidding study the average log had a volume of 33.3 ft. b.m. Scribner D.C. (Table 8)

Table 8.--SKIDDING SAMPLE: LOG DIAMETER FREQUENCY, BOARD FEET CONTENT AVERAGE LOG

Length Feet	D.i.b. Small End Inches								
	8	9	10	11	12	13	14	15	18
8	2	10	6	2	8	1	2	2	1
11	5								

Total Number Logs	39
Total Ft. b.m., Scribner D.c.	1300
Average Log Ft. b.m.	33.3

The union agreement established a maximum skidding distance of 400 feet.

Fig. 16--Skidder: note snow depth and single jack hanging on horse collar.

Fig. 17--Horse ready to pull load. Note dog in log, also pole axe and crosscut used for swamping.

Equipment:--Tongs were used by most of the skidders; occasionally dogs were used. In the extreme cold the dogs became very brittle and would sometimes break, either while being driven into the log or while being hit during the unhook operation.

All skidders used a pole axe and one man cross cut saw for swamping. If dogs were used a single jack hammer was used for hooking and unhooking the logs.

Of the 31 horses in the operation 21 were owned by skidders and the company owned the remainder. The wage was $3.75 per thousand ft. b.m. for the man and $1.25 for the horse. A man could use as many horses as he wished--generally two were used.

Skidding terminology and results:--The following terminology applies for the figures and tables in the skidding time study. Table 9.

Haulback time: begins when 1st horse starts from skidway for another load; ends when horses are halted on trail near where hookup is to take place.

Hook on time: begins when haulback time ends; ends when the next horse is called for its hookup. On the last horse, the hookup time ended when the horse started down toward the mill.

Haul time: begins when hook up time ends; ended when first horse was halted at skidway.

Unhook time: begins when 1st horse stops at

skidway and ended when last horse was unhooked.

Roll logs on skids: usually begins when unhook time ends and ends when skidder finished rolling logs and started another operation.

The responsibility of the skidder for the logs theoretically ends when the logs are off the dirt and on the skids. It is customary, however, for the skidder to keep the logs rolled down to where the sawyer can reach them.

Swamping: considered as any operation in clearing that requires cutting with an axe or saw.

Delays: any time spent not connected with actual skidding.

The common delays were for rest, "snoose", sharpen tongs, or talk with a fellow worker. Occasionally delays were caused by not having any more room in skidway for logs, and the skidder felt it was better to wait rather than pile the logs any higher.

Snow effects:--Most of the skidders interviewed felt that the snow caused a drop in production of about one-third. This opinion was not borne out by an inspection of the average hourly wages from February 1948 to January 1949 (Table 7). There we see that the highest average wages earned by skidders occured in the months of June, July, and August. This wage was about $1.90 per hour. The lowest months were March, September, and

Table 9.--SKIDDING TIME STUDY SHEET

Skidder	Haulback	Hook on Time	Logs Lgth.	Logs D.i.b.	Haul Dis.	Haul Time		Roll Logs on Skids	Swamp	Delay	Comment
A	1:36	2:18	8	18	100'	1:23	1:04	1:04	1:16	1:28	Two horses
		1:21	8	10							
	1:25	3:00	8	12	100'	1:19	1:20	0			Slight up hill pull all three trips
		0:35	8	14							
		1:08	8	12							
	1:24	1:08	8	15	100'	1:07	1:31	0		8:00	No room
B	2:17	1:07	8	12	300'	2:27	1:03	0			One horse
			8	13							
C	4:09	1:02	8	10	350'	2:32	1:31	2:15			Two tongs
			8	11							One set dogs
		0:51	8	10							
			8	12							
		6:16	11	8							Balky horse
			11	8							
	2:35	3:21	8	8	375'	1:13	1:10	6:00			
			8	9							
		2:40	11	8							
			8	10							
		0:59	8	9					9:23	1:20	To get log dropped on trail
			8	9							
	3;03	3:49	8	12	400'	3:10	1:22	2:30			
			8	9							
		7:20	8	10							
			8	11							

Table 9.--SKIDDING TIME STUDY SHEET--Continued

Skid-der	Haul back	Hook on Time	Logs Lgth.	Logs D.i.b.	Haul Dis.	Haul Time	Unhook	Roll Logs on Skids	Swamp	Delay	Comment
		4:57	8	9							
			8	8							
	3:50	3:39	8	9	400'	2:21	1:41				
			8	9							
		1:47	11	8							
			8	9							
		5:27	8	9							
			8	9							
	5:05	2:37	8	12	400'	3:15	1:06				
			8	12							
			8	15							
		4:38	8	12						3:04	Busted dog
			8	14							
		2:15	8	10							
			11	8							

October, with an average of about $1.70 per hour. This is a decrease of only 10 percent from the best production and two of the lowest months had very little snow.

The snow both aids and hinders the skidder. Hookup time is definitely increased. Skidders A and C of Table 9 had an average hookup time of 1.62 minutes per log. However, the log is pulled easier due to less friction, and there is less swamping to do. In three feet of snow a horse will not usually sink to the ground, rather the snow compacts and supports him. This packed snow on the skid trail covers many obstructions which would ordinarily have to be removed. One has only to observe the hookup operation in deep snow to appreciate the troubles of a winter skidder (fig. 18 and 19.).

The usual procedure in skidding with two or three horses was to halt the horses on the main skid trail near where the hookup was to be made. Then one horse was called to the skidder and hooked up. If the trail was wide enough the loaded horse was sent just past the other two and halted. Sometimes on a narrow trail the waiting horses were called up past the loaded horse to allow him to move down the trail out of the way. The first horse, in the observed case, was always held until all horses had loads, then they were lead or followed down to the skid way by the skidder. The horse easiest to handle was usually given the lead.

Fig. 18--Positioning the horse for a hookup. Horses don't like snow.

Fig. 19--More Positioning.

Figures 20 and 21 show the "roller-coaster" effect, a phenomenon characteristic of deep snow skidding. The troughs of these undulations can be as much as five feet below the crests, depending on snow depth and texture, length of the logs being hauled, and how much the trail has been used. This effect is hard on the horses and increases haul time. As each load of logs is hauled down, the nose of the log gouges out more snow from the bottom of the trough and deposits it on the slope. Some times on long used trails the trough will get down to the duff layer or below. If 16-foot logs are cut the distance between the crests will be greater than for 8-foot logs. Any slight rise or dip will be greatly emphasized by this effect.

To decrease this obstacle to efficient skidding, pans have been used. Since most skidders would rather have the "roller-coaster" effect than fuss with the pan some other method must be found.

Figure 22A gives the percentage distribution of skidding time on a 400 foot haul, and Figure 22B the percentage for a 100 foot haul.

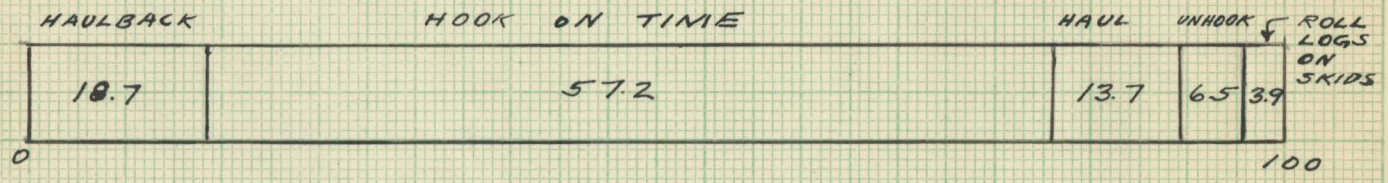
The graph shows that for the 400 foot haul 57.2 percent of the time was spent in hooking up and the haulback was 18.7 percent, as compared with the actual haul time of 13.7 percent. The hookup time is greatly increased because of the snow depth. It would seem that

Fig. 20--The "roller-coaster" effect. A balky horse sometimes has a tendency to stop in a trough. In foreground the skid trail is about level with the unpacked snow.

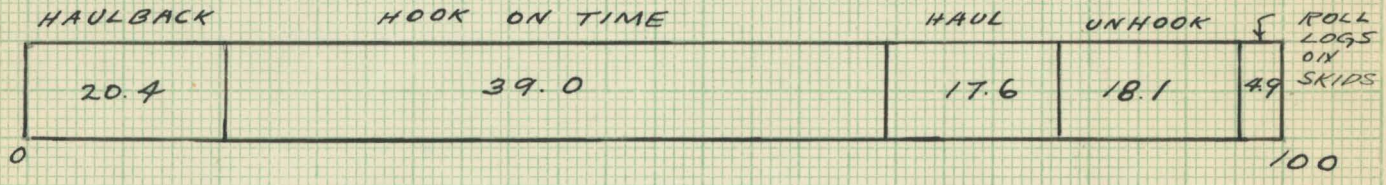
Fig. 21--More "roller coaster" effect.

FIGURE 22.

A. PERCENTAGE DISTRIBUTION OF SKIDDING TIME 400 FOOT HAUL APPROX. TWO LOGS PER HORSE PER LOAD: THREE HORSES



B. PERCENTAGE DISTRIBUTION SKIDDING TIME 100 FOOT HAUL ONE LOG PER HORSE PER LOAD APPROX.: TWO HORSES



in a 100 foot haul the hookup time, being independent of distance, would increase in percentage. In Figure 22B, due to having only one log per horse per haul and only two horses, the hookup time decreased in percentage. In a horse operation such as this, the average log size greatly influences the total time and percentage time of hookup. If the loads average 60 feet and the logs average 60 feet, about half as much time will be spent hooking up as when the logs average only 30 feet.

In the 100 foot haul study the haulback percentage is again greater than the haul time. This appeared to be mainly due to the horses' desire to sustain the momentum of the logs once they were moving; also the grades were usually adverse for the haulback and favorable for the haul.

The following are given as examples of skidder production at different distances.

With 2 1/2 to 3 feet of snow on the ground, skidder C in Table 9, using three horses, skidded 860 ft. b.m. in 103.5 minutes or about 500 ft. b.m. per hour. However, this skidding was all at distances of from 350 to 400 feet. All of the skidding was done on a favorable grade of about eight percent.

Using two horses, on a slightly up hill haul, skidder A brought out 280 feet in 23 minutes or 730 feet per hour. The haul distance was only 100 feet,

however, and the logs were of larger size.

In all cases studied the major swamping had already been done when the time study was made. For this reason swamping time was not included in the percentage graphs.

Figure 14 compares the average hourly wage of skidders and cutters from March 1948 to February 1949. This graph shows that during the months of February, March, and April, the skidders averaged more per hour than did the cutters. However, from May through February the cutters had the higher wage. The greatest difference in wages appeared in July when the skidders averaged $1.90 hourly, while the cutters made $2.50.

The average of the cutters showed a difference between maximum and minimum hourly wage of $.80, while the skidders' difference was only $.22.

The transient labor during the spring seemed to have little effect on the trend of the wage graph.

In June, 1948, a wage increase of $.50 and $.625 per thousand was given to cutters and skidders, respectively. Therefore wages prior to June, 1948, have been increased to the existing pay rates for comparative purposes.

Portable mills

General:--There were five portable mills on the operation. Due to the strip cutting system and the

maximum skidding distance of 400 feet, the mills could only cut from 50-150 M at a set. The mill sets were located by the superintendent or the woods foreman and the D7 cat dozed out the area. Usually the mills were moved by a D7 caterpillar tractor (fig. 23.). On the average, two trips were required to complete the move, the first trip moved the power unit, and the second the tracks, carriage, and edger. Each mill unit was mounted on wooden or metal skids to facilitate moving operations. These mills are extremely portable. A mill can be taken down, moved a quarter of a mile, set up, and be sawing in an eight hour day.

All sawyers owned their mills and were paid a contract wage of $14.25 per thousand feet of lumber sawn, $.306 for each 7 x 9 x 8 tie, and $.286 for each 6 x 8 x 8 tie. From this wage the sawyer pays all wages, repairs, gas, oil, and other expense connected with the mill; the company agrees to move the mill, build roads, and landings, and put logs on skidway at the mill.

Production data:--Production varied of course, depending on log size, product desired, type of power, and skill of the sawyers. But the average mill, sawing the maximum number of ties, could cut around one thousand feet of lumber and ties per hour. Generally two skidders and two or three cutters could keep the mill in logs.

Fig. 23--This D7 built and maintained roads, dozed out mill sets, and hauled portable mills from set to set.

On the mill, as well as the other operations, six hours of actual work constituted a good day of labor. This was due to the distance from camp, steep roads, and adverse weather conditions.

During the summer 65 percent of the production was lumber, the rest going into ties and mine props. This winter, due to large tie orders, more ties were being cut; 7x8x8 ties and 6x8x8 ties were the most common sizes.

Mills 4 and 5 had carriage extensions and on special orders for 16 foot lumber the extensions were used. The other three mills had less power and probably could not have handled the 16 foot logs even with a carriage extension.

Characteristics:--Due to their more efficient power transmission, V belts were used by four of the mills; flat belts were sometimes used on the carriage feed.

Frozen timber was hard on the saws, but the snow also aided milling in some ways. Saws were usually filed twice a day--in the evening and again at noon. Because of the snow the logs were clean when they came to the mill. This meant that the saw teeth wouldn't be dulled as much by dirt and stones as during the summer, when saws are filed four or more times daily.

Each mill had at least one spare saw to be

used in case of emergencies or to alternate with other saws. Saws with inserted teeth were used on all mills (fig. 24.).

The skidway at all five mills consisted of two logs about 30 feet long and eight inches in diameter small end and the large end of the logs were always in line with the carriage knees. The skidway for all five mills had a slight favorable pitch toward the mill so gravity could aid in getting the logs to the carriage (fig. 25.).

I remarked to the superintendent that it seemed as though there was not enough room for the skidders to deck logs on the skidway approach. This meant that sometimes the skidder would either have to wait for some logs to be sawn, or would be forced to pile the logs two or three deep on the skidway. The superintendent replied that if the skidder had too much room, the sawyer would have to spend too much time rolling the logs on the skids. Generally, nowever, the skidder did this himself.

Logs up to 16 inches in diameter were turned on the carriage by some of the sawyers without the aid of a cant hook.

Methods:--The offbearer (one of the offbearers was sometimes called a tailer) shoulders the tie and carries it to the tie pile, a distance of from 25-65

Fig. 24--Typical 48 inch diameter, 8-9 gauge inserted tooth saw.

Fig. 25--Mill Number 3, showing skidway construction skidder in foreground rolling logs for the sawyer. Tie pile in rear.

feet (fig. 26.). All bark was removed from the tie with a long handled peeling spud. In keeping with the portable nature of the mills the edgers were usually light and two bladed (fig. 27.).

The slab disposal was excellent on all mills because there was generally a steep slope just below the mill. The slab pile was always kept burning to prevent excessive accumulation.

Two methods were used to put slabs into the fire. One method had a narrow catwalk built out from the mill platform; the offbearer would carry the slab out to the end of this walk and throw it into the fire. Mills 3 and 4 used what seemed to be an excellent contrivance for slab disposal. For this system, two peeled poles about 24 feet long were mounted parallel to each other, four feet apart, and with a fairly steep pitch toward the slab pile. The slab was placed on the top end of the two poles, and gravity carried it down into the fire. This required less effort on the part of the offbearers, both in not having to throw the slab and in cutting down the slab-carrying distance (fig. 28.).

All mills except number 3 used overhead blowers. At number 3 mill it was necessary to occasionally shovel sawdust away from the outlet end of the blower pipe (fig. 27.).

In the following paragraphs each of the five

Fig. 26--Preparing to shoulder the tie.

Fig. 27--Mill Number 3. One offbearer is carrying tie to pile, while the other runs a board through the edger. This is only mill which did not have overhead blower. Blower outlet is near top of sawdust pile.

Fig. 28--Mill Number 3, showing skid slab disposal method in background. Note flat belt drive on carriage feed.

mills will be outlined as to machinery, methods, and general characteristics.

MILL NO. 1
(fig. 29)

I. General information

A. Type No. 1 American
B. Skidway: 2 logs, 20' long; open approach for skidders
C. Special methods: none evident
D. Number employed: 3

II. Machinery

A. Power type: D4 Caterpiller Diesel tractor, H.P. 45 approx.
B. Belting: V belts, conditions good
C. Saw: diameter, 48"; kerf, 9/32 or 1/4; gauge, 8-9
D. Carriage: length 6'; width 36"; knee spacing 58"
E. Tracks: 30' long: 33" apart
F. Blower type: overhead 6" pipe
G. Edger: none

III. Comment: this mill easiest to move, due to having cat right there and not having an edger

MILL NO. 2
(fig. 30 & 31)

I. General information

A. Type: No. 1 American
B. Skidway: 2 logs, 30' long; 8" small end
C. Special methods: none evident
D. Men employed: 3

II. Machinery

A. Power type: P.A. 50, H.P. 45 approx.
B. Belting: V belts, good condition
C. Saw: diameter, 48"; teeth, 32; kerf, 8/32 or 9/32; gauge, 8-9
D. Carriage: length 6'; width 3'; knee width 59"
E. Track: 30' long; 33" apart

Fig. 29--Mill Number 1. Note power unit, skidway, and the cat walk to slab pit at left of photo.

Fig. 30--Mill Number 2.

Fig. 31--Mill Number 2. Note typical tie mill carriage.

Fig. 32--Mill Number 3. Skidder in foreground knocking dogs out of log. The trucks at this time were behind schedule. Note height of tie pile.

F. Blower type: overhead 6" pipe
G. Edger make: Belsaw Model 87; old

III. Comment: none

MILL NO. 3
(fig. 32 & 33)

I. General information

A. Type: Knight
B. Skidway: 2 logs, 30' long; 8" small end
C. Special method: slab disposal--2 parallel skids about 4' apart, steep pitch
D. Men employed: 3

II. Machinery

A. Power type: U.D. 9, International, H.P. 52 actual
B. Belting: V belts, good condition
C. Saw: diameter, 48"; teeth, 32; kerf, 8/32 or 9/32; gauge, 8-9
D. Carriage: length 8'; width 3'; knee width 59"
E. Track: length 36'; apart 36"
F. Blower: underskids
G. Edger: Belsaw Model 87; old

III. Comment: skids for slab disposal seemed good idea

MILL NO. 4
(fig. 34)

I. General information

A. Type: Turner
B. Skidway: 2 logs, 25' approx.
C. Special methods: skids for slab disposal
D. Number employed: 3

II. Machinery

A. Power type: Waukesha (gasoline); H.P. rated 105, actual 85, due to altitude
B. Belting: flat belts
C. Saw: diameter, 48"; kerf, 9/32 or 1/4; teeth, 40; gauge, 8-9
D. Carriage: length 12'; width 30"
E. Track: length 36'; apart 33"

Fig. 33--Mill Number 3. Squaring up a tie. Pole in foreground is to check log lengths.

Fig. 34--Mill Number 4. Note flat belts, logs are unusually large for this operation. Poles in left foreground used by skidder to roll on another layer of logs.

F. Blower type: overhead
G. Edger: Corley

III. Comment: new sawyer--edger bulky looking

MILL NO. 5
(fig. 35 & 36)

I. General information

A. Mill type: 440 Corley
B. Skids: 2 logs, 30' long
C. Special methods: none evident
D. Number employed: 3

II. Machinery

A. Power type: International (gasoline); H.P. rated 110, actual approx. 90
B. Belting: V belts, conditions good
C. Saw: diameter, 48"; teeth, 40; kerf, 1/4 or 9/32; gauge, 8-9
D. Carriage: length 8'; width 36"
E. Tracks: length 36'; apart, approx. 30"
F. Blower type: overhead
G. Edger: Tower, new

III. Comments: sawyer started last November. Skidway, too short approach

Loading

A typical mill set can be seen in Figure 25. The bulldozer made a landing that was large enough so that the trucks could turn around with very little trouble.

All of the loading was done by hand. The drivers of two trucks would team up and help load one of the trucks, and then load the other truck. Since the ties weighed from 100 to 300 pounds each, two men were almost a necessity for efficient loading.

Fig. 35--Mill Number.5.First cut.

Fig. 36--Mill Number 5.

In Figure 32 the usual arrangement of the tie and lumber piles can be seen, this method greatly facilitated the loading operation. The trucks could back up next to a pile of ties or lumber--this decreased the distance loaders had to walk.

It was not possible to get a stopwatch time on the loading operation, so an estimate made by the mill crew members of three mills and the superintendent was averaged to get an approximate figure. To load a truck such as appears in Figure 37 with ties took two men about 45 minutes. If lumber alone was loaded, the operation would take nearly two hours.

Hauling

The company owns eight trucks, but all of the hauling during the winter is contracted. The trucking wage is $6.80 per M ft. b.m. for logs, and $6.00 per M for lumber.

All of the five trucks now contracted are Army surplus 6 x 6s (fig. 37.). These trucks generally make two trips per day if hauling ties and one trip per day if hauling lumber--5500 feet being an average load. A state road tax of two mills per ton mile was levied on the loads hauled from Gould to Walden.

The trucks haul a total distance of 26 miles, about two miles on a one way logging road with turnouts; two miles on a two lane gravel logging road; and 22

Fig. 37--Army surplus 6x6 hauling ties and lumber.

miles on a state gravel road from Gould to Walden.

Due to heavy snows and high winds the road from Gould to Walden often was drifted over and was closed for as long as seven days at a time, despite the efforts of the county highway department to keep it open.

All logging road construction was done by the company, a D7 cat with dozer blade doing the actual road building. The superintendent located all roads. Throughout the area a ruling grade of 20 percent is used for spur roads, although for short distances this limitation is occasionally exceeded (fig. 38.). The soil is largely decomposed granite, and rock outcroppings are occasionally encountered. Though no detailed cost records are kept at the Walden office of the Michigan River Timber company, the superintendent estimates that initial road cost, plus maintenance, amounts to $3.50 per M feet of logs cut. Particulary during the winter operation the maintenance cost is very high. This winter the D7 cat and driver worked seven days a week keeping the roads opened (fig. 39.). During the warm months seeps tend to make some roads impassible. Therefore, these areas are logged during the winter when the roads and seeps are frozen solid. The road in Figure 38 is of this type.

At Walden the lumber or ties are unloaded by hand and piled in the company yard (fig. 40.). After

Fig. 38--Logging road leading to Mill Number 5. This road in places exceeded 20 percent.

Fig. 39--D7 cat kept this road open. Medicine Bow range in background.

air seasoning the rough lumber is finished to the desired degree and either loaded into box cars and shipped to the buyer, or kept in storage sheds to await shipment (fig. 41, 42, 43, & 44.). Ties are also seasoned and shipped out--usually to the Union Pacific railroad.

Fig. 40--Lumber yard at Walden.

Fig. 41--Vertical resaw.

Fig. 42--Lumber carrier moves lumber to shed, yard, or planer.

Fig. 43--Planer, powered by D7 cat. Box car at left of picture.

Fig. 44--Boxcar loading, storage shed in background. Note Western Pine Association brand on ends of piled boards.

Chapter V

PERSONNEL DATA

It must be remembered that the type of labor employed on the winter operation is not necessarily the same type as the additional men employed during the spring and summer. To a large degree all men in the winter operation are permanent employees, while during the spring and summer many transient laborers are employed, who depart with the coming of cold weather.

See the appendix for the Union Working Agreement and wage scale.

Nationality

Of the 31 men employed on the woods operation, over 50 percent were of Scandinavian descent, with the Swedes predominating. This was particularly true among the older workers.

Age and experience

Generally speaking the oldest class of men on the job were the cutters, the youngest the offbearers.

The sawyers presented two extremes--three of them were old timers and had been sawyers from 15 to 20 years; the other two were comparatively young men who,

though having worked in the woods for a considerable time, had been sawyers for less than a year.

An approximate breakdown on the age of the 28 workers contacted in the study is given in Table 10.

Table 10.--APPROXIMATE AGE DISTRIBUTION IN VARIOUS JOBS

Job	Less than 25	25-40	40-60	Over 60
Cutters	2	1	5	0
Skidders	1	1	2	0
Offbearers	4	5	-	0
Sawyers	-	2	3	0
Scalers	-	-	2	0
TOTAL	7	9	12	0

Many of the ages in Table 10 were estimated; about one third of the men volunteered their approximate age in the course of conversation.

The years of experience seemed to correlate rather closely with actual age, i.e., the cutters being most experienced in woods work, followed by sawyers, skidders, and offbearers, in that order.

Clothing

A combination of deep snow and weather as cold as -30 degrees F. necessitated warm clothing. However, the agility required on all jobs precluded any bulky

clothing.

All of the cutters and skidders wore some type of rubber-shoed boots. Shoe pacs predominated, but a few men wore all rubber boots, 14 to 16 inches high. The mill workers usually wore some type of rubber boot. Many wore heavy rubber overshoes. Only two of the mill men wore leather boots, and they wore a combination ski and mountain boot bought as army surplus.

Because of their warmth and light weight, thick wool pants were generally worn. All of the cutters wore suspenders, while the other workers seemed to favor belts. Many cutters and skidders kept their pantlegs outside of their boots and tied the pant legs down with a piece of cord or rawhide (fig. 45.) This prevented snow from getting inside the boot. Other workers tucked their pantlegs into their boot tops.

Almost without exception, heavy woolen shirts were worn while working and some type of heavy coat or jacket was worn during the lunch hour and on the trips to and from the job.

As might be expected head gear showed the greatest variation among the workers--hunting hats, caps, plaid hats, all were worn--all however had ear flaps.

Many types of gloves were worn. During the milder weather cotton work gloves seemed to be preferred, while some type of leather glove with woolen lining

Fig. 45--Typical skidder garb: shoe pacs, wool pants with tied down pant legs, cotton gloves, and wool shirt.

was favored during cold weather.

There are many reasons for the popularity of wool clothing. It is warm, light, wears well, and sheds snow easily.

Living quarters

Located in the timber about 1 and 1/2 miles from the center of the study area, are the bachelor quarters. Each cabin is used by one to three men (fig. 46.). In this same area are the stables, blacksmith shop, and the like (fig. 47.)

In Gould, is Michigan River's camp for the married men and their families. This village has 66 cabins, a large mess hall, and a schoolhouse (fig. 48.). However, the mess hall and schoolhouse are not open during the winter months.

Fig. 46--Bachelor camp.

Fig. 47--Stables, haybarn in left rear.

Fig. 48--A few of the cabins at the Gould family camp.

Chapter VI

CONCLUSIONS AND RESULTS

During the summer Michigan River Timber Company, in addition to its portables, operates a mill at Walden which even in these times of high lumber prices does not show much of a profit. The cost of getting the logs to the mill yard would be about $26.45 per M.B.F. (See below.) Using the portable mills, the cost would be about $40.45 to deliver lumber to the yard. This is shown below.

Stumpage	$ 3.35	$ 3.35
Cutting	5.30	5.30
Skidding	5.00	5.00
Loading	3.50(estimate)	17.10
Hauling	6.80	7.20
State road tax and administration	2.50(estimate)	2.40(estimate)
	$26.45	$40.45

I do not believe that the Walden mill which cuts 3000 per hour can mill 1000 ft.b.m. log scale for as little as $14.00, which would be necessary if it were to produce lumber at as low a cost as do the portable mills.

Hauling logs to Walden incurs the added expense of loading the logs on trucks (hauling costs are higher particularly when using company trucks, because a truck can haul twice as much lumber as it can logs) and the state road tax will be high, because it is levied on a ton-mile basis.

From the above facts and theorizing, it would seem that of the two types of operations involved, portable mills in the woods are the most economical method of producing lumber for the studied operation.

Product quality would have some effect on determining which method was the best to use, but the writer examined lumber manufactured at Walden and compared it with the product sawed by the portables and there seemed to be little difference in the quality of the two products.

Cutting

1. Power saws have been tried many times on the operation, but the men operating them could not make a reasonable wage, even during the summer. Since power saws are admittedly less mobile than a one man cross cut their main advantage lies in being able to cut faster; however, in the studied operation the average log size was about 35 ft. b.m. This meant a much greater percentage of the total time would be spent moving from cut

to cut than in large timber, and the greatest inherent advantage of a power saw, speed of cutting, would be of considerably less importance.

The cutting time studies showed that only 59.3 percent of the total working time was spent sawing, this excludes time spent moving from cut to cut while bucking; the rest of the time was spent either in moving or limbing where the power saw is either not used or when used increases the time to perform the operation.

Naturally it would be hard to imagine how a power saw weighing 80 to 125 pounds could make good in small timber when it was necessary for the cutters to maneuver in three feet of snow.

Any two man power saw would, of course, have to cut twice as many logs to make the same wage per man, as is made by one man with a cross cut saw. One can easily see how a power saw could saw twice as fast while in the log or tree, but it would increase all travel time as compared to a one man saw. This probably is the main reason for the ability of the two man power saws to supplant the existing cutting practices.

Only two man power saws have been tried on the operation. Perhaps during the summer a one man power saw could do much better than a cutter using a one man cross cut.

2. A comparison between time study hourly

wage and actual previous wage indicated a rest and delay figure of about 15 percent. This is probably somewhat in error due to a small sample, and possible difference in cutting conditions. The indicated figure does, however, agree rather closely with the 12 percent determined by Rapraeger (1937) in his log making study in the Idaho white pine region.

Throughout the time studies workers were asked not to work faster or slower than normally just because they were being timed. This request was probably disregarded in some cases, thus constituting a possible source of error.

3. Of the cutter working time the studies implied that 10.2 percent was spent shoveling snow from the base of the tree, 14.7 percent falling the tree, 54.4 percent bucking it up (includes time to move from one cut to the next), 11.8 percent limbing, and 8.9 percent gathering equipment and moving to the next tree.

It should be remembered that all of these implications are based on very limited data.

4. A comparison of the percentage distribution of working time of a very fast cutter and an average cutter implied that the fast cutter spent a smaller percentage of his time shoveling, bucking, and moving from tree to tree.

5. An inspection of the hourly wage earned

by all cutters from March 1948 to February 1949 shows a difference of 35 percent between the highest hourly wage, $2.50, earned in July and the lowest wage of $1.62 earned in March.

6. The average hourly wage of the cutters was lowest in March and April--these are months of deep snow. The wage then climbed rather sharply to the highest months of July, August, and September, and then dropped sharply in December, January, and Ferbuary, when the snow again was deep.

It is granted that many other factors, such as the influx of transient labor and seasonal fatigue, contribute to the average wage vacillations, but it seems logical that snow depth is a very critical factor.

7. An inspection of the skidders average hourly wage from March 1948 to February 1949, shows the highest average hourly wage, $1.90, was earned during the months of June, July, and August; the lowest wage, $1.70, earned during the months of March, September, and October. This is a decrease of only 10 percent from the highest wage (Table 7 and fig. 14).

8. Since the cutter wage was decreased 35 percent and the skidder wage only 10 percent from the highest wage this implies rather definitely that the snow decreases cutter production more than skidder production. The average skidder wage, however, could be

affected by new men on the job to such a degree that the above implication might be misleading. However, the cutters are less subject to turnover.

9. From May 1948 through January 1949 the cutters received a higher average hourly wage than the skidders. However, during February, March, and April, the months of very deep snow, the skidders had a higher average hourly wage than the cutters (fig. 14.). This definitely implies that the skidders are affected less by the deep snow than are the cutters.

10. Skidding time studies showed that on a 400 foot haul using three horses, each hauling from two to three logs, the percentage distribution of time was as follows: haulback 18.7 percent; hook on, 57.2 percent; haul, 13.7 percent; unhook, 6.5 percent; roll logs on skids, 3.9 percent (Table 9 and fig. 22A.).

For a 100 foot skidding distance using two horses, with one log per horse per load, the percentage distribution of time was as follows: haulback, 20.4 percent; hook on, 39.0 percent; haul, 17.6 percent; unhook, 18.1 percent; roll logs on skids, 4.9 percent (fig. 22B.)

In both of these studies haulback time was greater than haul time. This is probably due, at least in part, to the horses' desire to sustain the momentum of the logs once they were moving; also the grades were

usually adverse for the haulback and favorable for the haul.

11. Skidders A and C of Table 10 had an average hook up time of 1.62 minutes per log.

12. A very noticeable effect of the snow is what the writer called the rollercoaster effect (fig. 20 and 21.) This phenomenon of deep snow is found even on level areas and is hard on the horse and probably increases haul time.

13. Since the cutters stated that one to one and one-half hours of their eight hour day was spent sharpening their saw, it can be concluded that for better production two saws should be taken to the woods. This would permit another hour of productive labor. However, this time spent refers only to a winter operation when the cutter might need a rest and heat from the fire nearly as much as he needs to sharpen his saw.

Chapter VII

SUMMARY

This paper has as a subject the logging and milling operations of the Michigan River Timber Company during the winter of 1948-49. The operational area was located on the Routt National Forest near Gould, Colorado.

The purpose of this study is to present a description of a winter logging operation in Colorado, to make time studies of the falling and bucking operations and interpret the data collected from time studies and other sources.

Time studies made on the cutting operation indicated that of the total working time of the cutters 10.2 percent was spent shoveling snow, 14.7 percent falling, 54.4 percent bucking, 11.8 percent limbing, and 8.9 percent gathering tools and moving to the next tree.

By comparing the hourly wage earned by two cutters in the two months previous to the study with the hourly wage during the time study, a rest and delay figure of 15 percent was indicated.

Comparison of percentage time distribution graphs of a very fast cutter and an average cutter showed that the fast cutter spent a smaller percentage of his

time bucking, shoveling and moving. However, over 51 percent of his time was still spent bucking.

A graph of the average hourly wage for all cutters from February 1948 to January 1949 showed that the optimum months for the cutters were July, August, and September. There was a 35 percent difference between July and March, the months of highest and lowest average hourly wage, respectively. The graph seemed to imply that snow depth was the factor most limiting production.

The highest average wage earned by skidders occured in June, July, and August; the lowest in March, September, and October. The difference between the high and low wage was only 10 percent. This would imply that the snow exerts a greater negative effect on the cutters than it does on the skidders.

The average hourly wage table for all skidders and cutters employed from February 1948 to January 1949 shows that from May through January the cutters averaged more per hour than did the skidders; however, during the months of deepest snow, February, March, and April, the skidders had the higher average hourly wage. This also implies that the skidders on this operation were hindered less by the snow than were the cutters.

The skidding time study for a 400 foot haul gave the following percentage distribution of time: haulback, 18.7 percent; hookup, 57.2 percent; haul,

13.7 percent; unhook, 6.5 percent; and roll logs back on skids 3.9 percent. This was made when two or three logs averaging about 30 feet constituted an average load for each of three horses. In the 100 foot skidding time study haulback time was again greater than haul time.

On this operation cutting was done by strips. All cutters worked as one man crews, using cross cut saws. Skidding was by single horse, each skidder using from one to three horses. Logs were skidded directly to the skidway of the portable mills. The lumber was then hauled 26 miles to the lumber yard at Walden.

The labor was largely of Scandinavian descent with Swedes predominating. The cutters seemed to be the oldest class of men on the job. Woolen shirts and pants were worn by most of the woods workers and some type of rubber bottomed boots were preferred.

Suggested research

1. A cost study should be made to compare the cost of producing lumber at the Walden mill with portable mill production costs.

2. Time and cost studies should be made on summer, spring, or fall operations of Michigan River and compare the results with the implications of this paper.

3. Cost studies are needed on all logging and milling operations in this area so that eventually the

most efficient methods of operation can be determined.

4. Determination of the feasibility of using a one man power saw would be an interesting problem.

A P P E N D I X

WORKING AGREEMENT

THIS AGREEMENT made and entered into this 29 day of April, A.D., 1947, by and between the following employers, individually and collectively, hereinafter referred to as the Employer or Operator, to wit:

Michigan River Timber Company--Walden, Colo.

- - - - - - - - -

- - - - - - - - - etc.

parties of the first part, and the International Woodworkers of America, Local Unions M-214, M-202, M-218, and M-154, affiliated with the Congress of Industrial Organizations by and through their duly elected, qualified and acting representatives, individually and collectively, hereinafter referred to as the Union, party of the second part:

GENERAL PURPOSE

The general purpose of this agreement is to provide mutual relationship for the operation of the plants and camps covered by this agreement; to secure for the employer and the union all the benefits which may be derived from orderly and legal collective bargaining, with a desire to avoid all possible friction, and to promote the general welfare of the operations conducted by the employer. The employer and the union shall be equally responsible for conditions in camps and elsewhere on the operations, and they shall exercise their influence to maintain sanitary camps and to see that the behavior of employees does not detract from the efficiency of the operations or the wellbeing of other employees.

- - - - - - - - -

WITNESSETH: That for and in consideration of the faithful performance of the mutual covenents and agreements, herein contained, the Employer and the Union do hereby agree:

ARTICLE I

RECOGNITION

During the life of this Agreement, the Union shall be the sole collective bargaining agency for all employees in the operation of the Employer, excluding supervisory and clerical employees, ... The Union agrees that it will not recognize any jurisdictional strike or picket line directly affecting the employees of the Employer.

ARTICLE II

SETTLEMENT OF DISPUTES, COMPLAINTS, GRIEVANCES

All disputes, complaints, or grievances arising under or out of this Agreement shall be handled in the following prescribed manner:

a. There shall be elected by the employees in the plant of the Employer under the supervision of the Union a committee of not less than three or more than six members to be known as the Plant Committee. . . ., the persons selected by the Union must be and remain actively employed there in for ninety (90) days immediately preceding their selection, unless the operation has not been active for one year.

b. - - - - - - - -

c. - - - - - - - -

d. In the event that the employer and the union are unable to reach a satisfactory settlement of any complaint or grievance, the employer and the union shall within 48 hours after such final disagreement, notify in writing a committee composed of representative of the operator and a representative of the union. Neither the employer not a member of the union involved in the dispute shall be qualified to sit on this committee. Said comittee shall have authority to take whatever steps are necessary to effect an amicable settlement of the disagreement, but in the event it should be unable to do so, its members shall choose a third party to sit as a member of said committee. Any determination made by a majority of the committee herein provided for

shall be binding upon the parties to this agreement.

e. While any complaint, grievance or dispute is being considered under the procedure provided herein, all employees shall work as directed by the Employer.

ARTICLE III

HIRING, SUSPENSION, AND DISCHARGES

. . ., on request of the employee or the Union, the Employer agrees to state the reasons for suspension or discharge. . . . Any case of suspension or discharge not made the basis of a complaint within two (2) working days from the time thereof, shall be considered as waived . . . .

ARTICLE IV

HOURS OF LABOR

a. The work week shall start on Monday and end on Sunday excepting as to regular power house men, watchmen and employees whose job classification is on a seven day continuous service. . . . .

b. The regular hours of labor shall be five consecutive eight hour days, commencing on Monday and ending on Friday, with the exception of such employees mentioned in a. above, . . .

c. Time and one-half for over time shall be paid . . . .

d. If an employee is absent for part of a day, or a full day or more than a full day, for reasons of his own . . ., such days shall not be counted as days worked for the purpose of computing the sixth day worked in the work week, and he shall receive straight time of rates except insofar as the total hours worked in that week exceed forty (40) hours.

e. If an employee loses time during the work week because of a breakdown or a shutdown, such days shall be counted as days worked for the purpose of computing the sixth day worked in the work week and he shall receive rate and one-half for all hours worked on the sixth day.

f. Holidays not worked shall be counted as days worked for the purpose of computing the sixth day worked in the work week.

g. - - - - - - - - -

h. - - - - - - - - -

i. It is agreed that whenever time is lost during the regularly designated work week, through no fault of the parties hereto, such time may be made up by mutual agreement on the sixth at straight time.

ARTICLE V

SENIORITY

a. . . ., employees will be laid off in the inverse order in which they were hired. When rehiring occurs, employees will be hired in accordance with their seniority. Seniority shall date from the first date of last employment.

b. . . . . The local union and the local employer are privileged to meet and work out a seniority plan . . . .

ARTICLE VI

WAGES

a. - - - - - - - - -

b. - - - - - - - - -

c. During the life of this contract, . . ., any general wage change which may hereafter be made shall take effect on June 1st. . . . .

d. There shall be a pay day every two weeks . . . .

ARTICLE VII

CALL TIME

- - - - - - - - -

ARTICLE VIII

HOLIDAYS

The following days shall be observed as holidays: New Years' Day, Fourth of July, Labor Day,

Thanksgiving Day, Christmas Day and either, Memorial Day or one other day of greater local importance, not less than seven (7) days advance notice to be given as to such choice. All time worked on those days shall be paid for at the rate of rate and one-half.

ARTICLE IX

TEMPORARY CLASSIFICATION

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ARTICLE X

INSPECTION

The Union Representatives, not in the employ of the employer, shall have admission to the premises of the employer on union business, provided however, he shall make his presence known to the employer and not interfere with operations during working hours, ...

ARTICLE XI

LEAVE OF ABSENCE

- - - - - - - -

ARTICLE XII

STRIKES AND LOCKOUTS

. . . . At no time shall employees be required to act as strike breakers or go through picket lines or armed guards, ... Nothing in this Agreement contained shall be construed so as to impair or affect any rights of the Union or the Employees represented by the Union in this Agreement to refuse to handle any goods by it declared unfair.

It is recognized by the parties that timber products are purchased from outside sources.

It is agreed that the Union may, from time to time, advise the Company, in writing, as to outside operations with which it is in controversy, with the understanding that the Company will not,

after receipt of such notice, purchase lumber from such operation until the Union shall have notified the Company that such outside operation has placed itself in good standing with the union.

. . . . . .

ARTICLE XIII

HEALTH CARDS

All cookhouse employees shall be required to have a health card . . . .

ARTICLE XIV

VACATIONS

. . . . . .

Regular, continuous employees having less than five years seniority, but more than one year, shall be entitled to one weeks vacation with forty (40) hours at his regular rate.

Employees having five years continuous service with the company shall be entitled to two weeks vacation with eighty (80) hours at his regular pay.

Vacation period shall be between January 1st and July 1st of each year, unless otherwise mutually agreed. . . . .

For the purpose of avoiding excessive and additional bookkeeping piece workers vacation pay shall be computed on the basis of $1.50 per hour.

ARTICLE XV

UNION SECURITY

a. The employer shall require all employees to join the union immediately upon becoming employed, ...

b. The employer agrees to discharge any member failing or refusing to maintain membership in good standing, within ten (10) days from date of written request from the Union.

c. All contractors and sub-contractors under the employer shall be subject to all of this Agreement in its entirety.

ARTICLE XVI

SUPERSEDES OTHER AGREEMENTS

- - - - - - - -

ARTICLE XVII

REVISION AND TERMINATION

a. Except as it may be affected by the wage clause (Article VI-Section c) this agreement shall remain in full force and effect until June 1, 1949.

b. - - - - - - - -

c. - - - - - - - -

d. - - - - - - - -

e. - - - - - - - -

f. This agreement may be terminated on June 1st of any year by either party giving at least sixty-five (65) days notice in writing to the other party of a desire to terminate. However, both parties agree to meet in negotiations within ten days for the purpose of negotiating possible renewal of the agreement. . . . .

This agreement shall be subject to all the existing laws of the United States, the States of Colorado and Wyoming (depending upon the state in which the employer operates), and such laws as may hereafter be enacted, the executive orders, directives, rules and regulations of any departments of the United States of America.

IN WITNESS WHEREOF the parties hereto have set their hands and seals this 29th day of April, A.D., 1947 as written above.

Michigan River Timber Co.
By/s/ John Doe

PARTIES OF THE FIRST PART

International Wood Workers of America, affiliated with Congress of Industrial Organizations.
Local Union M-214
By/s/ John Jones

INTERNATIONAL WOOD WORKERS
OF AMERICA - C.I.O.
By/s/ Sam Smith
By/s/ Jim Jones
PARTIES OF THE SECOND
PART

APPENDIX "A"

WAGE RATES

SAWMILL AND PLANER OPERATIONS

WAGE RATES	6/1/48
WOODS OPERATIONS	
Cooks (10 to 18 men)	$0.60
Cooks (19 to 24 men)	0.65
Cooks (over 24 men)	0.70
Flunkies (over 18 men)	0.50
Tractor Operator	1.50
Common Labor, includes Powder Man, Barn Boss	1.15
Log Loader Operator	1.35
Hookerman	1.22½
Truck Driver, Semi-Trailer	1.30
Truck Driver, Flat Bed	1.25

When woods piece workers are used for emergency or temporary work on the job, they shall receive the wage placed opposite their names:

Cutter	$1.35
Sawyer	1.35
Skidder	1.35
Off Bearer	1.35

CUTTING AND SMOOTH TRIMMING UNPEELED POLES

	Cutting on Gov't Land
16 ft.	$0.17
18 ft.	0.21
20 ft.	0.26
22 ft.	0.30
25 ft.	0.40
30 ft.	0.52
35 ft.	0.65
40 ft.	0.78

45 ft.	0.945
50 ft.	1.26
55 ft.	1.57
60 ft.	1.90
65 ft.	2.20

SKIDDING POLES

16 ft.	0.12
18 ft.	0.15
20 ft.	0.18
22 ft.	0.19
25 ft.	0.23
30 ft.	0.28
35 ft.	0.40
40 ft.	0.45
45 ft.	0.56
50 ft.	0.75
55 ft.	0.84
60 ft.	1.10
65 ft.	1.30

When a skidder furnishes his own equipment, 33 1/3 % shall be added.

	Government Land
Log Cutting	$5.30 M ft. b.m.
Tie Cutting, 7x9-8	0.205 each
Tie Cutting, 6x8-8	0.175 "
Unscaled Logs, under 10"-8', 10"-12'	0.135 "
Log Skidding	3.75 M ft. b.m.
Tie Cut Skidding, 7x9-8	0.13 each
Props--Cutting & Parking	1.85 c'lm
Cutting Snags	0.35 each
Sawing Ties, 7x9-8	0.07 "
Sawing Lumber	2.25 M ft. b.m.
Off Bearing Ties, 7x9-8	0.13 each
Off Bearing Lumber (Sawyer directed to cut ties.)	4.24 M ft. b.m.
Off Bearing Lumber (Sawyer directed to cut lumber only.)	3.82 M ft. b.m.
Sawed, 6x8-8	0.065 each
Offbearer, 6x8-8	0.12 "
Sawed, 7x8-8	0.0675 "
Offbearer, 7x8-8	0.125 "

Rates of pay not set forth shall be established locally, ...

Note: Private land wages are slightly less.

Retail Lumber Prices, F.O.B., Walden, Colorado.

	#1 Common	#2 Common	#3 Common	#4 Common
1x4 random length S4S or ship lap	$120.00	$110.00	$ 94.00	$ 69.00
1x4 random length car siding or center match	122.00	112.00	96.00	72.00
1x4 R4 rough	115.00	104.00	89.00	64.00

1x6 same as 1x4

1x8 random length, $2.00 per M higher than 1x6 or 1x4.

	#1 Common	#2 Common	#3 Common	#4 Common
1x4 R.L. S4S or SL	$120.00	$110.00	$ 94.00	$ 69.00
1x4 R.L. Car Sdg or CM	122.00	112.00	96.00	72.00
1x4 R4 rough	115.00	104.00	89.00	64.00

1x6 same as 1x4
1x8 random length, $2.00 per M higher than 1x6 or 1x4
1x10 random length, $2.00 per M more than 1x8
1x12 random length, $2.00 more than 1x10
Knotty Pine and center match are $2.00 per M more than S4S and Ship lap
2 in. is about $8.00 per M less than 1 in.
No. 5 common is $35.00 per thousand.

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LITERATURE CITED

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