SAWMILL

PRACTICES AND PROBLEMS

IN THE APPALACHIAN HILL COUNTRY OF OHIO AND KENTUCKY

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THE IMPORTANCE OF SAWMILLS

SAWMILLING is especially important to the economy of the hill country of Ohio and Kentucky. Here—in a region of unemployment, underemployment, and low per-capita income—sawmilling is one of the few existing industries. The extensive forest resource favors this industry. Yet in the past decade the number of sawmills operating in this region has steadily decreased.

Concerned over this situation, the U. S. Forest Service has undertaken studies to determine what might be done to stabilize the sawmill industry by increasing its efficiency in producing and marketing its products. This is a report on a study to learn more about this industry—the operational characteristics and types of sawmills—and to identify the problems in lumber production.

STUDY PROCEDURE

Before the mills to be studied were selected, the area was divided into five sub-areas (fig. 1). Within each sub-area, mills were selected at random to assure equal representation of comparable operating mills. In all, 40 mills were selected for study.

The mills selected for study were mills that normally sell 500,000 or more board feet of lumber products annually. The 40 mills included some mills that normally sell this quantity of lumber annually, but whose sales in 1960 fell below this average annual.

Mills of this size were chosen because they generally are permanently located, operate year around, and maintain operating records. The mills in this size class account for as much as 75 percent of the lumber marketed in the region.

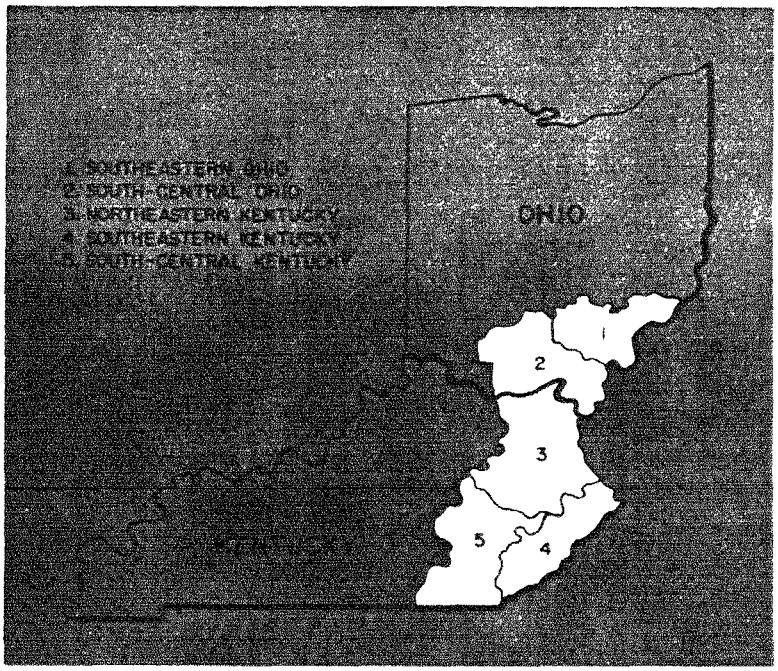

Figure 1.—The hill country of Ohio and Kentucky, showing sub-areas in which sawmills were selected for study.

SAWMILL CLASSES

Three types of mills were found in our study: (1) *grade-lumber mills*—those primarily engaged in producing lumber for sale under National Lumber Association rules;[1] (2) *pallet mills*—those engaged mainly in producing pallet lumber, blocking, and crating; and (3) *local-use mills*—those manufacturing lumber principally for local contractors, farmers, coal mines, and other local users. On this basis, 23 of the sample mills were classed as grade-lumber mills, 9 as pallet mills, and 8 as local-use mills.

Mills of the three types were found to occur in geographic clusters. Most of the pallet mills were located in southern Ohio and northern Kentucky, whereas a large proportion of the grade-

[1]National Hardwood Lumber Association. RULES FOR MEASUREMENT AND INSPECTION OF HARDWOOD LUMBER, CYPRESS, VENEERS, AND THIN LUMBER. NHLA, Chicago, Ill., January 1963-64.

lumber mills and most of the local-use mills are in the southern portion of the study area.

The most likely reasons for the concentration of pallet mills in the northern areas are: (1) the area has a cheap and readily available source of sawlogs; (2) the pallet manufacture in this area is primarily by hand labor and the area has an available supply of unskilled and semi-skilled laborers; and (3) the area is within economic hauling distance of pallet markets.

In the southern portion of the study area, higher quality, less accessible, more heavily forested tracts and the proximity of grade-lumber markets in the furniture industry best explains the development of grade-lumber mills. Here markets for fence boards, barn lumber, mine timbers, and similar products have encouraged the development of local-use mills.

Table 1.—Kind of equipment used at study mills, by mill types
(In percent of mills)

Kind of equipment	Grade lumber	Pallet	Local use	All mills
Power unit:				
Size:				
Under 75 hp.	0	33	13	10
75 to 100 hp.	22	67	37	35
Over 100 hp.	78	0	50	55
Kind:				
Electric	30	56	12	33
Diesel	61	33	76	57
Gasoline	9	11	12	10
Headsaw size:				
Under 56 inches	0	44	37	17
56 to 60 inches	43	23	26	35
Over 60 inches	57	33	37	48
Edger:				
2-saw	30	67	50	42
3-saw	65	22	37	50
More than 3-saw	5	6	0	2
Swing cut-off saw	78	67	62	72
Forklift	35	89	12	42
Double-end trimmer	43	0	25	30
Log turner	35	0	12	22

OPERATIONAL CHARACTERISTICS

Mill Equipment and Facilities

Grade-lumber mills were found to be better equipped than local-use mills, and local-use mills were generally better equipped than pallet mills. This was true for most equipment items—power units over 100 horsepower, headsaws over 60 inches in diameter, 3-saw edgers, double-end trimmers, and log turners (table 1).

The only significant deviation from this pattern was in the use of forklift trucks. Almost nine-tenths of the pallet mills had forklift trucks, compared to about one-third of the grade-lumber mills and one-tenth of the local-use mills. Pallet mills have more need for forklift trucks because they have greater problems in handling materials.

Most study mills were housed in semipermanent shelters with maintenance shops attached. Most had log and lumber yards of 1 acre or larger; most had small office buildings.

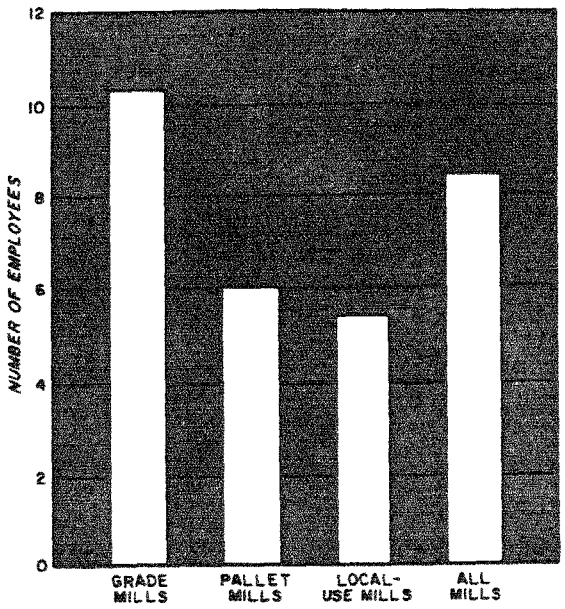

Figure 2.—Average number of production employees, by mill type.

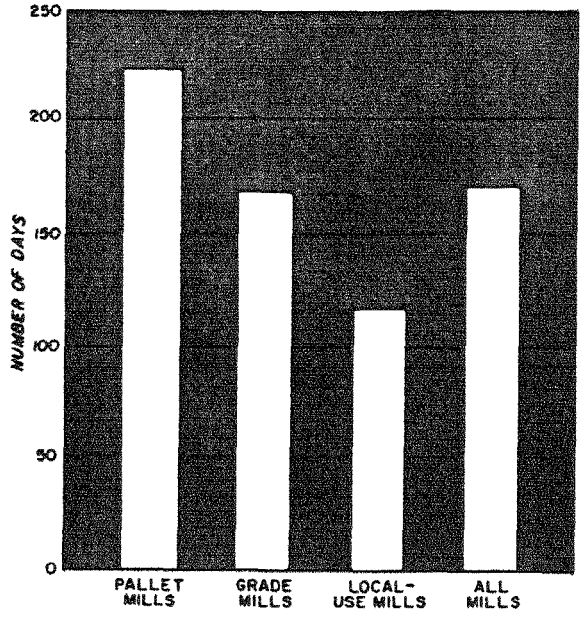

Figure 3.—Average number of working days per year, by mill type.

Employment and Operating Time

On the average, a grade-lumber mill employed 10 production workers; a pallet mill 6; and a local-use mill 5 (fig. 2). However, pallet mills reported the highest average number of working days per year, followed in order by grade-lumber mills and local-use mills (fig. 3). In terms of annual man-days of operation, an expression of both employment and days of operation, the average for all mills was 1,500 man-days, ranging from 650 man-days at local-use mills to 1,850 at grade-lumber mills (fig. 4).

The wide difference among mill types in number of operating days was attributed to effects of local work attitudes and to type of product produced. The number of non-operating days was greatest in the southeastern and south-central study areas of Kentucky (table 2).

In these areas, where the principal concentration of local-use and grade-lumber mills is found, absenteeism among mill workers is high during the winter. This may be a relic from the operations of earlier days when mills were smaller and were usually intended

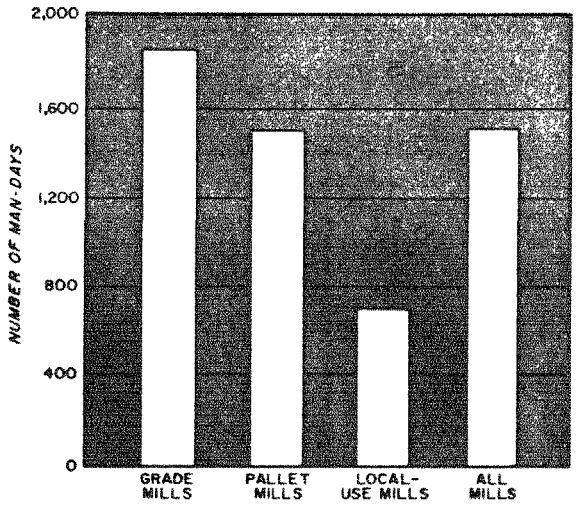

Figure 4.—Average number of man-days operated, by mill type.

to operate only part-time. It was natural then to shut down during bad weather when bottomless roads made travel difficult, and the discomfort of working in open-air mills and sloppy log yards reduced efficiency at the same time it increased the risk of illness and accident. By now, absenteeism during the winter seems to have become an accepted custom. Regardless of the reason, in these areas it is difficult today for a mill operator to assemble a full crew when he wants to operate during the winter season.

This labor problem is not so prevalent in northeastern Kentucky and southeastern Ohio, where most of the pallet mills are located.

Table 2.—Average annual number of non-operating days at study mills, by geographic area

Geographic area	Average annual number of non-operating days per mill
Southeastern Ohio	26
South-central Ohio	35
Northeastern Kentucky	20
South-central Kentucky	101
Southeastern Kentucky	108
All areas	79

Of course, labor in these mills can be used for pallet fabrication during bad weather.

Because the year of study was one of depressed hardwood lumber markets, it might reasonably be expected that this would be listed by operators as the primary cause for non-operating days. However, the primary reason given at all mills for not operating was poor working conditions related to inclement weather—low temperatures, muddy and slippery conditions in mill yards, and frozen logs. Poor weather was blamed for more than three-fifths of the non-operating days, while market lag was given as a cause for about one-tenth (fig. 5).

The operators do not consider lack of log supply as a major cause for non-operating days. However, it must be recognized that many mills did not operate at times because the mill's log suppliers could not produce logs under adverse weather conditions. Thus, as used here, log supply as a cause for non-operating days refers to those days when log suppliers failed to deliver logs for reasons other than weather conditions.

Raw-Material Procurement

Mill operators purchased their timber as stumpage or cut logs in almost equal quantities: 52 percent stumpage and 48 percent cut logs delivered to the mill. However, methods of obtaining logs differed substantially between the northern and southern por-

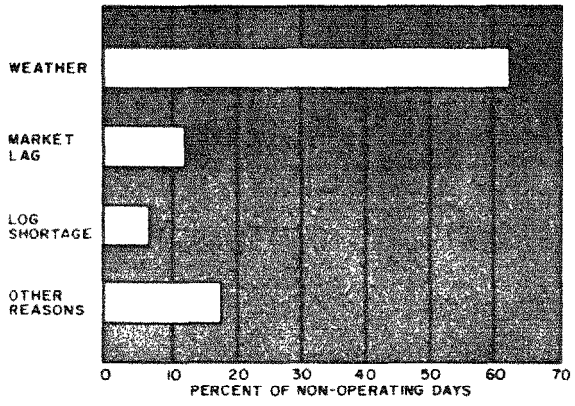

Figure 5.—Operators' reasons for non-operating days.

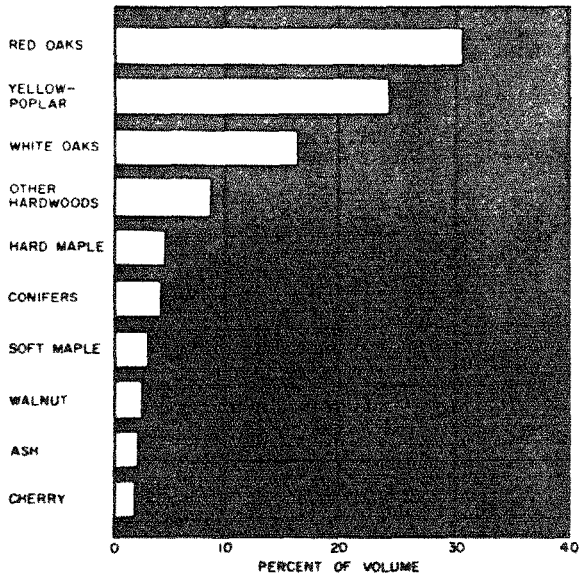

Figure 6. — Log volume purchased, by species.

tions of the study area. Mills in northeastern Kentucky and southeastern Ohio purchased 86 percent of their log volume delivered at the mill, whereas those in southeastern Kentucky bought only 17 percent of their logs on this basis.

The marked regional difference in methods of procuring logs between the northern and southern parts of the study area may be due to differences in timber-ownership patterns and timber accessibility. In the northern part of the study area, commercial forest land is usually divided among many small tracts, and a

Table 3.—Size of logs purchased, by diameter and mill type

Mill type	Percent of logs, by diameter inside bark at small end (inches) of—		
	Less than 12	12 to 20	More than 20
Grade-lumber	12	63	25
Pallet	44	48	8
Local-use	40	50	10
All mills	25	57	18

Table 4.—Distribution of volume output, by product and type of mill

Mill type	Grade lumber		Pallets & pallet lumber	Blocking	Dimension stock	Construction lumber	Local-use lumber	Total
	Percent of total volume							
	Green	Air-dry						
Grade-lumber	13	67	5	2	2	5	6	100
Pallet	11	3	58	12	8	2	6	100
Local-use	14	7	—	—	3	50	26	100

fairly well developed road network provides access to timber tracts. This environment is favorable to small independent logging enterprises.

By contrast, the southern portion of the study area is characterized by large individual timber holdings and relatively sparse road networks. This type of situation generally requires large capital outlays for timber harvesting, both for road construction and for acquiring title to timber. This generally discourages the development of small independent logging enterprises. As a consequence, mill operators in this region generally purchase stumpage and then let contracts for the logging and hauling.

Of the operators who purchase stumpage, two-thirds bought on the basis of a lump sum for the total volume of timber within a property boundary. The others used log-scale or mill-scale volume as basis for payment. Purchase of logs delivered at the mill yard was based almost exclusively on use of the Doyle rule for volume determination. Each mill operator used his own log-grading system or a modification of some existing log-grading system.

Yellow-poplar, red oaks, and white oaks accounted for 72 percent of the total volume of raw materials purchased by the study mill operators. Yellow-poplar was the single species most frequently purchased, representing one-fourth of the total raw-material procurement (fig. 6).

One-fourth of the logs purchased were less than 12 inches in diameter, inside bark, at the small end of the log; and less than one-fifth were over 20 inches (table 3). By mill types, about 2 out of every 5 logs at pallet and local-use mills were less than 12 inches d.i.b., whereas approximately 1 in every 10 logs at grade-lumber mills were in this size class.

Products and Markets

The 40 mills produced more than 52 million board feet of products for the year studied, and grade lumber alone accounted for 61 percent of the total product output (fig. 7).

Type of product produced varied among the three mill types, as would be expected because of the system used to classify mill types. Almost 60 percent of the total lumber volume produced at

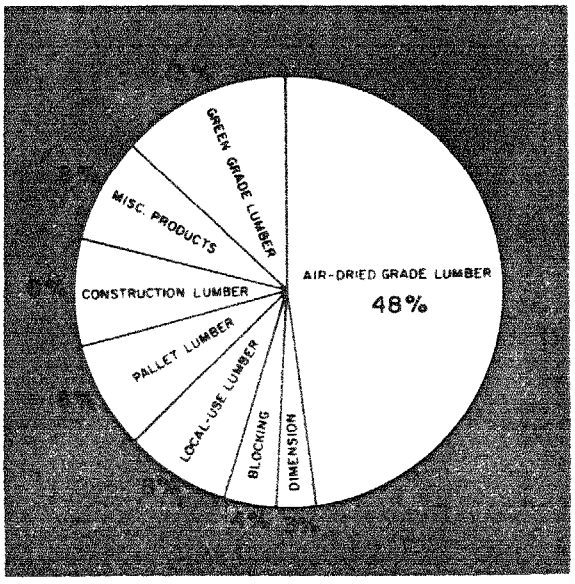

Figure 7.—Products of the mills studied.

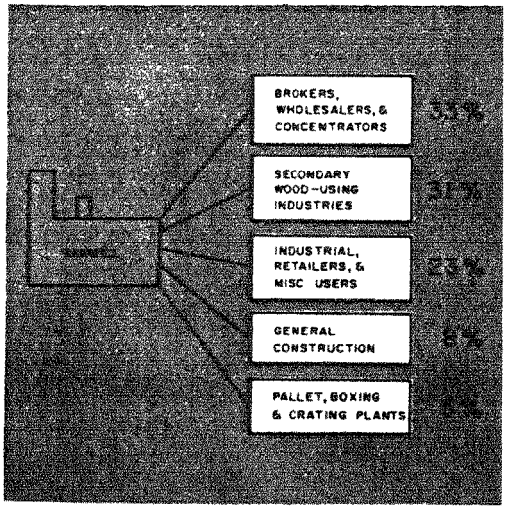

Figure 8. — The principal buyers of products from the study mills.

pallet mills was either sold as pallet lumber to pallet fabricators or was used in pallet construction at the producing mill. At grade-lumber mills, 80 percent of the output was grade lumber; and at local-use mills three-fourths of lumber produced was construction lumber or lumber sold for a variety of local uses (table 4).

The wholesale-broker-concentrator outlet and secondary wood-using industries were the principal buyers, accounting for nearly two-thirds of the product sales volume (fig. 8). Most mill output was sold between 50 and 500 miles from the mill location. Only 7 percent of the total product volume moved beyond 500 miles.

MILL PRODUCTIVITY

Annual Production

Annual lumber production for the study mills averaged 1,300,000 board feet, ranging from a low of 200,000 board feet to a high of 4,000,000 board feet. Average annual output amounted to 1,600,000 board feet at grade-lumber mills, 1,200,000 board feet at pallet mills, and 590,000 board feet at local-use mills (fig. 9).

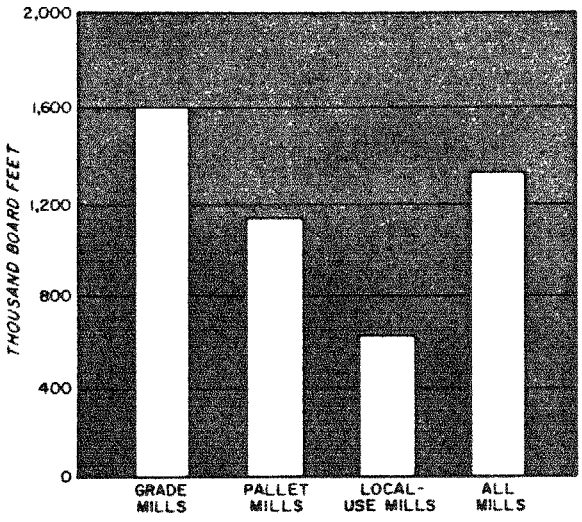

Figure 9. — Average annual lumber production, by mill type.

The rather wide variation in average annual output among mill types appears to be related largely to number of man-days worked. For example, grade-lumber mills operated almost 30 percent more man-days than pallet mills and produced about 40 percent more lumber products. Pallet mills operated about 120 percent more man-days than local-use mills and had about 90 percent more output. The fact that differences in average annual lumber production among mill types were not directly proportional to differences in average man-days operated is perhaps explained by the influence of other factors.

Man-Day Output

Lumber-product output per man-day averaged 920 board feet at local-use mills, 870 at grade-lumber mills, and 690 at pallet mills (fig. 10). Factors apparently accounting for higher labor productivity at local-use mills are: (1) most of the lumber is slash sawed which requires less log handling on the carriage than at mills where most of the lumber is sawed for grade, and (2) most of the lumber is sold ungraded, thus eliminating the additional handling required in end trimming, grading, and sorting.

Of the three mill types, labor productivity was lowest at the pallet mills primarily because production workers often serve in a dual capacity. Part of their time may be spent in lumber production, part in pallet fabrication.

Additional handling of lumber in operations such as end trimming and dipping contributes to lower productivity of grade-lumber mills.

Labor productivity, computed in terms of average value of product output per man-day, was highest at grade-lumber mills, where output value amounted to 78 dollars per man-day. By comparison, labor productivity at pallet and local-use mills averaged about 60 dollars.

Considerable variation in board-foot output per man-day occurred within each of the three mill types—500 to 1,330 board feet per man-day at local-use mills, 360 to 1,550 at grade-lumber mills, and 350 to 1,330 at pallet mills. Statistical analysis showed that variation in labor productivity was highly correlated with differences in milling equipment. Although labor productivity increased with increase in the number of pieces of equipment used, the log turner appeared to contribute most to productivity.

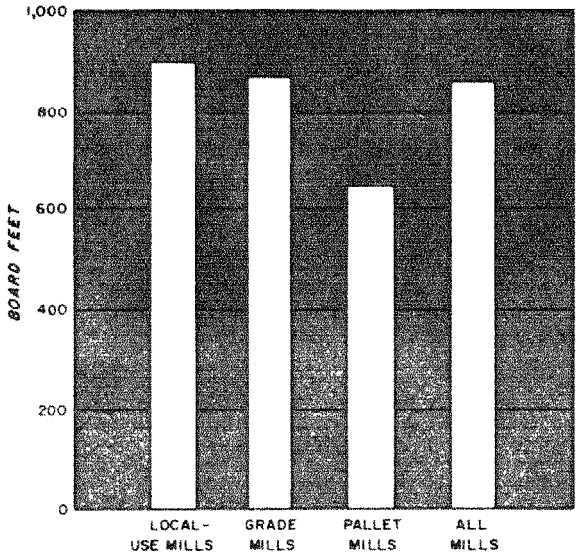

Figure 10.—Average lumber production per man-day, by mill type.

Almost half the variance in productivity was explained by the presence of this piece of equipment.

Tests were also made on the relationship between size of log sawed and labor productivity. The results showed that the proportions of logs sawed in the various log-size classes studied (table 1) were the same for mills of both low and high productivity. This should not be interpreted to mean that the size of log does not affect labor productivity. However, for the log-size classes studied, log size was not a significant cause for variation in labor productivity.

DISCUSSION & CONCLUSIONS

During the course of the study a number of production problems affecting milling efficiency were noted. At most mills, for example, it was observed that production was frequently delayed for various reasons. Often this would amount to no more than a few minutes for each occurrence. However, at some mills, equipment failure caused longer delays. In the aggregate, down time can greatly increase the annual lumber-production costs even though the down-time periods are short. Research to reveal the frequency and cause of production delays could lead to eliminating down time and reducing overall production costs.

Operators blamed poor working conditions associated with inclement weather as the major cause of non-work days. Draining and gravelling log and drying yards, wind-proofing and heating mill sheds, and providing indoor storage or at least storage on raised rollways for one day's log supply would improve working conditions and salvage many days of the present lost work time caused by bad weather.

Certain pieces of sawmill equipment contribute more to productivity than others. This suggests the need for studies of a type that will measure the contribution of various pieces of mill equipment to man-day output. Determining the profitability of investment in individual items of equipment could provide a good guide for improving mechanization throughout the industry.

A variety of grading systems was evident among mills buying

logs on a grade basis. There seemed to be no standardization; most frequently, the system in use was one developed by the mill operator himself. This suggests the need to evaluate the log-grading systems and log-pricing methods used by commercial sawmill operations.

It might be feasible for them to use the U.S. Forest Service standard specifications for hardwood factory lumber logs.[2] This is a grade system that relates log grades to lumber grades obtained from the log. It is now used by a number of hardwood sawmill operators in the East.

The maintenance of records for guidance in eliminating inefficient techniques and operating the sawmill as a business were, in general, poorly organized for most of the 40 mills investigated. The development of a simplified record-keeping system, specifically designed for maintaining records for the type of mills studied, could provide a basis for more accurate decision-making and better business management for the industry.

[2]United States Forest Products Laboratory. HARDWOOD LOG GRADES FOR STANDARD LUMBER. U.S. Forest Serv. Res. Paper FPL-63. 52 pp., illus. 1966.

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