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TIMBER MARKETING

In Eastern Ohio

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(1)



FOREWORD

Nearly two-thirds of Ohio's forested area is in farm woods with an average size of 19 acres per farm having woodland. Therefore, Ohio's production of timber is largely dependent on the management of these small tracts. An essential part of this management is the process of marketing—essential because marketing is the final measure of whether or not the production of timber is sufficiently profitable to encourage continued care and management.

This study is of timber marketing in a territory which has been producing more timber than any other section of like area in Ohio. It was thought to be a good laboratory in which to study the prevailing customs and practices associated with the harvest and sale of timber products from farm woodlands.

TIMBER MARKETING IN EASTERN OHIO¹

H. R. MOORE AND O. D. DILLER

The Area Studied

The mixed oak forest area of east central Ohio extends from central Knox County to Columbiana County. As is illustrated in figure 1, the area is bounded on the north, south, and west by an area where the beech-maple type of forest is dominant. The mixed oak type, however, persists east to the Ohio

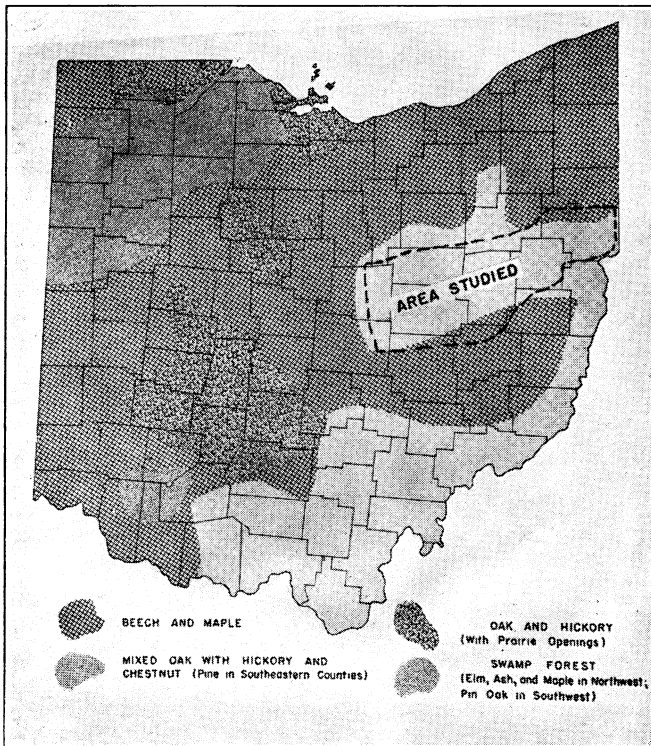


Fig. 1.—This study was confined primarily to the northern segment of the mixed oak forest area.

River from whence it extends southward and broadens out in southern Ohio to include most of the unglaciated region of the State. This study was made only in the northern segment of the mixed oak forest area. Due to a wide range in topography and attending variations in site and soil conditions, the mixed oak type of forest is intermingled with stands often fairly typical of the

¹The authors gratefully acknowledge the contributions made by the following: E. V. Jotter, Soil Conservation Service, through his counsel and advice in organizing the method of study and by providing data on timber sales in Guernsey County; The Central States Forest Experiment Station staff members who were frequently called on for technical advice.

beechn-maple type. The Muskingum series of soils is dominant on the uplands throughout the area studied, and most of the remaining woodland is on this soil type.

Information on individual sales of timber was collected principally from the counties of Carroll, Columbiana, Coshocton, Guernsey, Holmes, and Tuscarawas, with a few sales from eastern Knox and Ashland and northern Muskingum Counties.

Reasons for Making the Study

The principal objective was to derive information from actual timber sales which may help improve timber marketing methods. To date, the monetary returns from woodlands in this area have not averaged sufficiently high to encourage the typical woodland owner to expend much thought, time, or money on woodland management. A progressive deterioration in some woodlands indicates still poorer returns may be in prospect. Unquestionably, practices relating to the harvest and sale of timber have contributed to this situation. The mixed oak forest area is not being pointed out as unique in this respect; it is, however, a good example of a territory which has produced and is still capable of producing more high quality timber products than at present. The land is there. About one-fifth of the area is either wooded or in process of reversion to forest. So far as this study is concerned, the primary question is, "How well do present marketing methods and the attending price structure serve to promote the efficient and profitable use of land for timber production?" A first step in answering this question is to describe the conditions which do constitute prevailing practices and to evaluate the information in practical terms.

Method Used in Making the Study

Most of the information was collected by personal interview with woodland owners who had sold timber, with timber buyers, and with sawmill operators. The purpose was to determine the circumstances and conditions of sale, cutting practices, class of product, and market destination of timber harvested from woodlands in the period from 1940 to 1944. It was determined, insofar as possible, how the current harvest fits into the pattern of past and probable future cuttings from the same tract. So far as practicable, this information was supplemented by an inspection of the woodland to check age of timber harvested, species, residual stand, and cutting practices. Some usable information was obtained in 132 cases although only in 116 were the data considered satisfactory.

The study is based on a random sample and is not a complete census of all timber sales. It was attempted to obtain a uniform coverage of the area by inquiry of informed individuals such as farmers, mill operators, and timber buyers in each community as to the location of individuals who had sold timber.

Trends in Land Use

Land settlement in the area started before the year 1800 and was well advanced by 1840. Conversion of the heavily forested land to cropland and pasture continued unabated until about 1880. Since then the amount of improved land in farms has slowly declined. In the past 60 years, the amount of livestock kept, as measured in terms of animal units, has declined about one-third. Also since 1880, the area in farms has diminished 6 percent and

made, will remain woodland. It therefore is likely that about 9 acres will continue in timber production for each acre which will be converted to other uses. The reversion to woodland caused by abandonment of other uses is a more substantial trend than the opposite tendency mentioned above.

The principal reason for inquiry as to the future plans for use of woodland being harvested was to establish as nearly as possible the status of owners' attitudes and thinking in respect to use of their land for various purposes. The essential point is that most land now wooded is viewed by them as permanent forest land.

Timber Production Mainly from Above-average Sized Woodlands

The Average Size of Woodland.—The census of 1940 reported 15,955 farms in the area of the six principal counties studied. However, only 10,946, or 69 percent of the total farms, reported woodland in an aggregate amount of 204,150 acres or 18.65 acres per farm.

As contrasted with the census, the average (arithmetic mean) size of woodland covered by this survey was 37.39 acres; however, one-half the woodlands contained 25 acres or less. The proportion of the land area in timber on the tracts covered by the survey was 20.54 percent. Typically, small tracts of woodland are intermingled with tracts of cropland and pasture (fig. 3).



Fig. 3.—In eastern Ohio, cropland, pasture, and woodland are intermingled in relatively small tracts. More than 20 percent of the farm area covered by this study was forested.

TABLE 1.—Timber sales grouped by size of woodland, 116 sales, mixed oak forest area, Ohio, 1940-1944

| Size of woodland | Number of cases | Percentage of cases | Acres in woodland | Percentage of total woodland area | Total volume harvested (M bd. ft.) | Percentage of total volume harvested |
|-------------------------|-----------------|---------------------|-------------------|-----------------------------------|------------------------------------|--------------------------------------|
| Less than 10 acres..... | 15 | 12.9 | 90 | 2.0 | 770 | 4.4 |
| 10 to 19 acres..... | 25 | 21.6 | 300 | 6.8 | 1895 | 10.8 |
| 20 to 29 acres..... | 22 | 19.0 | 486 | 11.0 | 2983 | 17.0 |
| 30 to 39 acres..... | 14 | 12.1 | 444 | 10.1 | 1986 | 11.3 |
| 40 to 59 acres..... | 16 | 13.8 | 785 | 17.7 | 2985 | 17.0 |
| 60 to 79 acres..... | 15 | 12.9 | 997 | 22.5 | 3523 | 20.1 |
| 80 acres or more..... | 9 | 7.7 | 1322 | 29.9 | 3388 | 19.4 |
| Total..... | 116 | 100.0 | 4424 | 100.0 | 17530 | 100.0 |

This study disclosed that only in 35 percent of the cases did timber recently harvested come from woodlands of 19 acres or smaller size; and the volume of timber harvested from these was only 15 percent of the total covered by this study. However, this volume was cut from 9 percent of the woodland area which indicates an above average per acre yield from those small tracts which were harvested. The smaller the tract the longer the period necessary to produce the volume desired for a portable sawmill set.

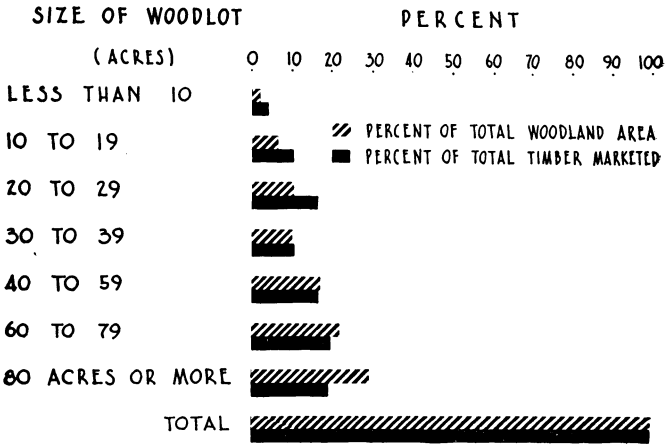


Fig. 4.—Relative area in woodland and relative amount of timber marketed from different sized wood lots, 116 timber sales, mixed oak forest area, Ohio, 1940-1944.

Fifty-six percent of all the timber produced came from woodlands containing 40 acres or more. Quite often owners of small wood lots are reserving the timber for possible home use. Occasionally all the saw timber will be sold, leaving no reserve sufficient for building replacement or repairs. As a rule, however, farmers plan to reserve sufficient timber to replace buildings; many small or average sized farms have no surplus above such requirements—at least, not sufficient surplus to provide the volume for a portable sawmill set which is the most usual method of processing. More frequent use of some other method of marketing is definitely needed to advantageously dispose of the limited timber production of small woodlands.

Different Methods of Selling Timber

For purposes of discussion, sales of timber in the area studied can be grouped into five classes:

- (1) Lump sum sales of miscellaneous or mixed species.
- (2) Sales by mill measure.
- (3) Lump sum sales of selected trees or species.
- (4) Sales by log measure.
- (5) Sales of lumber and other timber products by the woodland owner.

These are not completely alternative methods of sale. Lump sum and mill measure sales commonly apply to mixed species stands of timber. Selected trees or species where quality is a definite factor may be sold lump sum or by log measure. Therefore, the prices associated with the different methods of sale are largely a reflection of quality of material.

Lump Sum Sales of Mixed Species.—The traditional method of selling timber has been to accept a lump sum for all the trees located on a specified tract. Sixty-one percent of the timber sales under observation in this study was of this general class. However, the desirability of retaining a residual stand was recognized by the fact that 31 percent of such sale agreements specified a minimum diameter that could be cut. This minimum diameter usually approximated the smallest size tree which the buyer thought could be milled at a profit and did not represent much reduction in total yield. Individual agreements specified a minimum diameter, stump high, ranging from 6 up to 18 inches with 12 inches the most usual limitation specified. Measured in terms of dollars per thousand, lump sum prices averaged \$7.53, which was lower than by any other method of sale. Several reasons explain why this is the case. In the first place, more poor quality timber is sold lump sum than by any other method. When a buyer pays a lump sum for a tract of timber it is to his advantage to harvest everything which will cover cost of processing. Therefore, some timber of poor quality will be cut which the buyer, if he had to pay anything for it, would prefer to leave in the woods. Lump sum sales on virtually a clear-cut basis indicated an average harvest per acre of 9,431 board feet, whereas similar tracts purchased on a mill measure basis averaged 7,734 board feet per acre.

A second reason for low average prices when purchased lump sum is that no one can be certain of how many hidden defects may exist in standing trees. This point is doubly important in an over-mature stand of timber. Even an accurate estimate of volume in the standing trees would necessarily be discounted to some extent.

In the third place, the average timber owner does not have sufficient information either as to the quantity and quality of his timber to judge its full value and is therefore in a poor position to bargain. The inevitable result has been that some timber of good quality is sold at a price which will permit utilization for purposes which can be filled by low quality timber. Perhaps the best illustration of this point is the fact that all lump sum sales of miscellaneous species were at an average price which would permit the total output to be cut into car blocking.

A fourth point which is illustrated by lump sum sales of timber is that when materials of varying grades are marketed ungraded, the price tends to be fixed by the poorest quality material in the lot.

The importance of lump sum sales of miscellaneous species is indicated by the fact that 61 percent of the sales was by this method and such sales covered 78 percent of the total timber harvested.

Sales by Mill Measure.—Sales by this method covered 9 percent of the transactions and 6 percent of the volume. In general, sales made with the understanding that payment was to be based on the volume sawn at the mill were of miscellaneous species comparable to the average quality of timber purchased on a lump sum basis. But, as mentioned previously, the average volume cut per acre was about 1700 board feet less. Some sales contracts on a mill measure basis, specified different prices by species and grades of material. Sales by mill measure yielded the owners a return of \$79.16 per acre for the stumpage sold as compared with \$71.06 per acre when sale was on a lump sum basis. The average price was \$10.24 per thousand board feet, mill measure.

An occasional sawmill operator has become so well established in his area that purchase on a mill measure basis is standard practice preferred by both seller and buyer. Purely on a dollar return basis, sales by mill measure appear more desirable than lump sum sales. In actual practice, sales by mill measure have been limited because the seller must rely almost wholly on the accuracy and reliability of the mill man who measures the lumber as it comes from the mill. Occasionally difficulty has arisen due to the failure of the buyer to pay when and what the seller thought was due him. Such instances although isolated, influence timber owners to favor a lump sum sale of their timber in a great many cases.

Many timber buyers, particularly those interested in mixed stands of timber, prefer to purchase for a lump sum because of the greater simplicity and freedom from continued obligation to the owner. Once the timber is bought and paid for, usually in advance of the cutting, the timber belongs to the buyer with no questions asked. A well informed buyer can purchase for a lump sum at a little better advantage according to this study, than on a mill run price because of his ability to judge the quantity and quality of stumpage. Isolated cases of lump sum sales, however, indicate that a well informed owner who knows the quantity and quality of his timber can sell lump sum to about as good advantage as on mill measure. It must be recognized that the typical sales by both methods commonly apply to low quality material largely utilized for car blocking, mine timber, crossties, crating, farm building construction, and other uses where rough lumber and timbers are satisfactory.

Lump Sum Sales of Selected Trees or Species.—Eight percent of the sales under observation was for a lump sum to cover disposal of selected trees or selected species and therefore in most cases the factor of quality was an important consideration in the transactions. When reduced to a price per thousand board feet basis, prices realized ranged from \$8 up to \$29 with an average of \$13 per thousand. The lowest price applied to a cutting of so-called cull timber. The higher prices were for cuttings containing a high proportion of white oak of ship timber quality.

Log Measure Sales.—These represent sales of the highest quality timber produced in the area. Eleven percent of the transactions and two percent of the volume were sales by log measure. A complete coverage of all timber sales in the area would undoubtedly show a greater percentage of the volume

to be log sales. Due to the fact that such sales are usually small in quantity and the material trucked away, such transactions are more likely to escape attention than larger sales where the material is sawn on the spot. Therefore log sales probably merit greater emphasis than was indicated by this study.

Sales by log measure from this area, for the period studied, were principally of white oak for ship timber and bending stock, tulip poplar for airplane veneer, white ash for handle stock, and walnut for gun stocks. In addition, a few log sales were of red oak, beech, hard maple, and hickory. In about one-half the cases the logs were graded; the remaining sales were at a flat price for all grades of the same species.

The average price, \$28.69 per thousand board feet, log measure, suggests that the returns from good quality timber can be much more profitable than the returns indicated by sales of mixed stands of timber.

Sales of Lumber.—Some woodland owners choose to harvest their own timber and sell the product as lumber as it comes from the mill. Demand conditions from 1941 to 1944 were favorable to this method because the general shortage of lumber caused buyers to seek out the supply more vigorously than in the immediate past. Eleven percent of the sales and nine percent of the volume covered by this study was lumber sold by farmers.

Quite often a farmer having lumber custom sawn for home use will have surplus lumber for sale. Usually such sales cover only a few thousand feet and are only incidental to the main purpose of cutting for home use. In other cases, however, the main purpose is to sell lumber and an incidental objective is to provide profitable self-employment. Felling and bucking, skidding logs to the mill, and trucking the lumber to market all represent opportunities for utilizing labor and equipment; also, the choice of market and the supervision of the entire process offer opportunity to profit by the price margin ordinarily taken by the timber man for his services. As indicated above, the actual selling in recent years has been easy. Quick disposal is the rule. Before 1940, inexperienced individuals found it difficult to develop satisfactory outlets for their lumber. A common mistake was to cut materials to dimensions for which no standing orders or active demand existed. This resulted in very slow disposal, irregular sales in small lots, and deterioration of the lumber. Under ordinary market conditions, an inexperienced farmer should not engage to saw and market his own timber until satisfactory market outlets have been established.

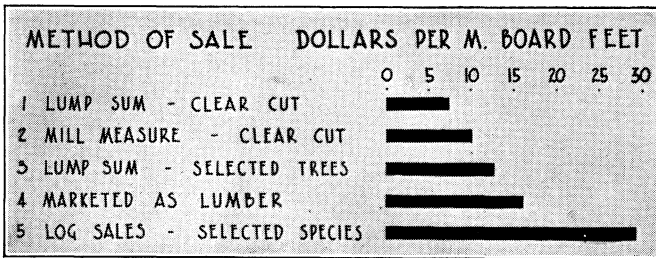


Fig. 5.—Stumpage value realized by different methods of sale. Differences in prices are partly due to the quality of material sold by the different methods.

The type of timber products marketed by farmers was typical of those processed out of mixed hardwoods sold for a lump sum. The average gross price per thousand board feet of lumber sold was \$34.20. The net price realized after deducting production costs³ for felling and bucking, skidding, sawing and trucking was \$16.07 per thousand board feet. The above costs do not include any charge for financing, supervision and management of the marketing processes which may actually be very small or may amount to a substantial sum depending on individual circumstances. The returns from lumber sales by farmers illustrate that a definite opportunity does exist for this method of disposal provided the owner develops an aptitude for this type of enterprise.

Timber Harvested for Home Use

In some communities the amount of saw timber has been reduced to a point where most of what remains is held in reserve for home use. Custom sawing in such communities often follows a similar pattern. A farmer will decide to enlarge or repair some building or construct a new building. A sawmill operator engages to do the sawing. Quite often the volume needed is not enough to justify a sawmill set, but neighbors will haul in enough additional logs to bring the total volume up to 20 to 25 thousand feet. The saw mill moves on, and the neighborhood has enough rough lumber on hand to supply

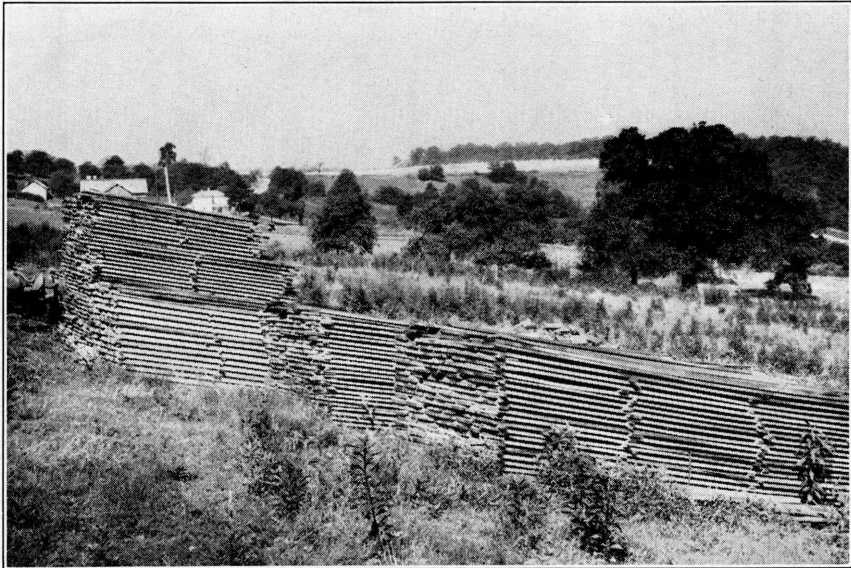


Fig. 6.—An example of custom-sawn lumber for sale and home use. This farmer used 12 thousand board feet of oak for a new 24 × 54 foot combination corncrib and implement shed shown in the upper left background. The stacked lumber consists of 5 thousand feet of oak which is being reserved for home use and 2 thousand feet of black walnut boards which are for sale.

³In some cases these expenses were actual cash outlays. In other cases where the farmer did the work himself with the help of family or other farm labor and his own equipment, the expenses were computed at the contract rates prevailing in the area.

current needs for a number of years. Nearly 9 percent of the cases observed in this study was the harvest of timber for home use. The volume so harvested was less than 2 percent of the total. Perhaps this proportion is abnormally small because in the period covered by this study the major emphasis was on the production of materials needed to promote the war effort.

Custom sawing is done by both portable and stationary mills. The former, as mentioned above, move from place to place supplying mill service to farmers on demand. The average volume cut usually ranged from 15 to 25 thousand feet per set or about one-half the volume considered to be a profitable set by mill men sawing lumber for commercial channels under conditions prevailing in 1944. Due to this small volume, the charge for custom sawing usually is at a higher price per thousand, ranging from \$7.50 to \$12 in 1944 as compared with \$7 to \$10 charged by independent mills sawing lumber for industrial uses. Two other reasons tend to increase the price for custom sawing. First, poor quality timber that is difficult to mill is often selected for home use; second, sawing small quantity orders to specified dimensions.

Permanent mills doing custom sawing in the area were of two types: (1) Small portable mills set up on a permanent or semi-permanent base by farmers or timber men to do their own sawing and incidentally to do occasional custom work on logs delivered to the site; and (2) a mill of a more permanent type and more constant operation. A few such mill men are developing a type of custom service which may become more important than it is at present. Relatively few farmers are equipped to truck logs. At prices ranging from \$15 to \$20 per thousand board feet of lumber, some mill men are offering to

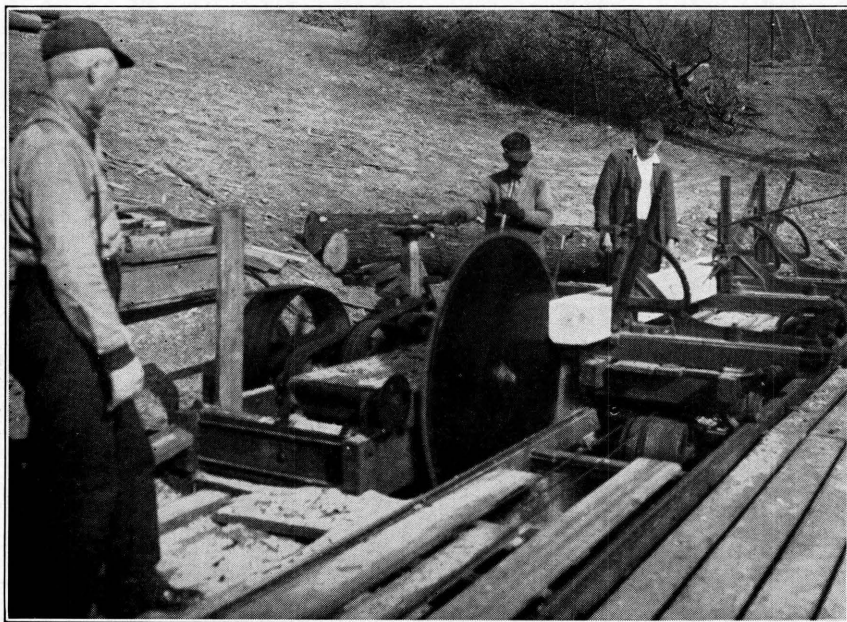


Fig. 7.—A typical portable sawmill. The daily capacity of such a mill is 4 to 5 thousand board feet of sawn lumber.

pick up the logs delivered at the roadside or other convenient spot for loading, truck to the mill, saw and deliver the lumber back to the farm. A mill can supply this service to an area with a radius of 10 to 15 miles. Material not needed by the farmer for home use can be sold to the mill directly or marketed by the mill on a commission basis. This type of service permits the economical harvest of small volumes of timber and fits into a plan of farm woodland management much better than severe cutting at long intervals, a practice encouraged by the portable mill which must have a substantial volume to justify a set.

Annual Need for Lumber on Farms.—Lumber and other timber products from the average farm woods is most profitably used on the farm. In this connection, farmers were asked for an estimate of the average annual use of lumber on their farms. The replies indicated the wide variation in the use of lumber due to the following circumstances. First, on some farms practically no maintenance repair or construction, requiring the use of lumber, has been done for years. This is particularly true where crop and livestock production is at a low ebb, or the operator is advanced in years or in poor health. In some such instances, the land may be headed for abandonment for agricultural purposes. In other instances, following a period of no maintenance, a new operator is in the process of repair and replacement of the farm buildings and the lumber requirements are abnormally high. It can be said, therefore, that the use of lumber on many farms follows a cycle which roughly approximates the length of occupancy by a single owner.

The following points merit consideration: The volume of wood used in building construction on the average farm is approximately 50 thousand board feet. In addition, current repairs, maintenance, and miscellaneous uses range from a few up to several hundred feet of material a year. Assuming an average depreciation of 2 percent a year on buildings, the annual lumber requirements would average around 1000 board feet. From 5 to 10 acres of fully stocked woodland is needed as a reserve to fully meet these repair and replacement requirements. As a matter of fact, the estimates made by 83 farmers indicated an average annual requirement of 1300 board feet. The fact that the group contacted were owners selling timber and perhaps incidentally acquiring a reserve of lumber for home use may have caused estimates of annual requirements to be enlarged.

Fence Posts.—Farmers were asked for an estimate of their annual need for fence posts. Fence construction and repair like that of buildings fluctuates from year to year. In 62 cases, where farmers supplied definite estimates, an average annual need of 40 posts per year for each 100 acres of land was indicated.

Fuel Wood.—In the mixed oak forest area, wood is usually a secondary source of fuel due to the local production of coal. In 44 cases, wood was used in fairly substantial amounts as compared with 39 cases where practically no wood was used for fuel. The 44 cases using wood averaged a little more than three cords per farm per year. In some neighborhoods, particularly in the western part of the area, slab piles are nearly always utilized for fuel.

Costs of Converting Standing Trees into Rough Lumber

Labor and other costs have increased materially since 1940. Lumbermen have found it particularly difficult to maintain an adequate and experienced labor force. It was found in this study that a great deal of variation existed in the expenses associated with the harvest of different tracts of timber. These differences were partly due to the time the timber was cut and milled and to variations in circumstances from one tract to another or from one operator to another.

The costs indicated below illustrate the range in prices received for (1) felling and bucking (2) for logging and (3) for milling when these operations were paid for at a contract price per thousand feet.

| | COST PER THOUSAND FEET OF LUMBER | | |
|---------------------|----------------------------------|----------------|----------------|
| | High | Low | Average |
| | <i>Dollars</i> | <i>Dollars</i> | <i>Dollars</i> |
| Felling and bucking | 5.25 | 2.75 | 4.55 |
| Logging | 6.00 | 2.50 | 4.50 |
| Sawing | 12.00 | 5.00 | 9.29 |
| Total | 23.25 | 10.25 | 18.34 |

Under emergency conditions, contract prices were somewhat higher than indicated above. Also, the above prices do not apply to black walnut and white ash when small quantities are cut in one place.

Extent of Employment Opportunities in Marketing Timber

When a farmer sells grain, meat, milk, fruit, vegetables, and other items, he usually is selling a considerable amount of his own labor, the use of his equipment, and also the use of his land. Why do not more farmers use their labor and equipment in harvesting timber the same as they do field crops? The evidence gained in this study indicates that about one farmer in ten selling timber does receive some monetary return in addition to the value of stumpage and much timber for home use is harvested with farm labor. It must be recognized, on the other hand, that harvesting timber satisfactorily involves some special skills, special equipment and is hard physical labor, particularly to the uninitiated. When timber sales by a farmer are infrequent, as is often the case when clear cutting is practiced and the volume harvested is large, the decision of most farmers is to leave the cutting and skidding to professional woodsmen employed by the buyer. The point may be emphasized, however, that under woodland management planned to provide sustained yield, the woodland does offer opportunity for the use of labor and equipment as do other farm enterprises.

The extent of the employment and income opportunities associated with the marketing of rough lumber at 1944 price levels can be illustrated in approximate terms as follows:

| | Cost per 1,000 board feet of rough lumber |
|-----------------------------|--|
| | <i>Dollars</i> |
| Stumpage price of timber | 10 |
| Felling and bucking | 5 |
| Skidding logs to mill | 5 |
| Sawing | 10 |
| Delivery to market | 5 |
| Management, financing, risk | 5 |
| Total | 40 |

Ten to twelve dollars can be added to or subtracted from the forty dollars total price indicated above to meet the variations in conditions found in individual cases. The above figures serve to illustrate: (1) The relationship between the stumpage price of timber and the milled product (stumpage is usually valued at one-fourth to one-fifth the price of rough, ungraded lumber and timber), and (2) the opportunities a timber owner may have to add to the total receipts he may receive from his woodland by supplying some of the labor, equipment, and management needed to convert standing trees into lumber.

Two experienced cutters can fell and buck 4 to 5 thousand board feet of timber in a day. One man and team can skid about the same amount under average conditions. The above volume is about the top limit of daily production for the typical portable mill manned by two or three men.

Species of Timber Harvested

Woodland owners, mill operators, and timber buyers supplied estimates in respect to the volume of timber harvested by species. It is emphasized that the following figures are estimates. In very few cases was a mill tally by species kept as a record for payment or for other reasons. Occasionally sales invoices supplied like information. These estimates provide an approximation of the relative percentage of the various species being harvested in the mixed oak forest area as determined from a volume of 17.5 million board feet.

| | Percent | | Percent |
|-------------------|---------|----------|------------------|
| Red and black oak | 37.7 | Elm | 2.0 |
| White oak | 33.9 | Ash | 1.7 |
| Beech | 8.6 | Chestnut | 0.9 ⁴ |
| Maple | 8.1 | Walnut | 0.4 |
| Tulip poplar | 3.0 | Cherry | 0.4 |
| Hickory | 2.3 | Other | 1.0 |

⁴Now confined to the harvest of dead trees.

The above figures indicate the dominance of the oaks in this area. Up to the present time, the timber harvested has been mainly of species present in the original forest. Because clear cutting removes these species, the composition of the woodland available for future harvests will be materially different in many cases.

Materials Produced

A very high proportion of the timber milled in the area is sold as rough, green lumber and timbers subject to buyer's inspection but otherwise ungraded. A small proportion is air dried and later processed into flooring, interior trim, and specialized products. The majority of portable mill operators prefer not to grade because only a small percentage of their production will meet the specifications of high quality, high priced materials. Permanent mills are better equipped to saw to accurate specifications and can produce a greater proportion of grade lumber. Estimates by some lumbermen indicated that less than one-fifth of the timber milled by them was potentially top grade; that is, free of knots, checks, decay, discoloration, and insect damage, of good grain and the right species to pass as first quality hardwood lumber.

It is understandable, therefore, why the major portion of the timber production in the mixed oak forest area is utilized as rough lumber and timbers where common defects do not affect utility.

It is suggested that a lumber grade study of the mixed oak forest area might reveal some profitable information in respect to the quality of material which is being processed and also the opportunities for increasing the proportion of grade lumber.

According to estimates of mill operators and occasional sales invoices, it is estimated that less than 10 percent of the timber covered by this survey was cut into inch lumber which would grade No. 1 common or better (a grade suitable for finishing lumber) selling rough-milled at prices ranging up from \$75 per thousand board feet. Approximately 20 percent was cut into inch lumber which would grade No. 2 common or poorer (material suitable for use on farms, around mines, and for crating) selling at prices usually ranging from \$30 to \$50 per thousand.

Approximately one-fourth the cut would be classed as industrial hardwood 2-inch and up and special dimension stock (car blocking not included). The best material classed as industrial hardwood was white oak suitable for ship timber, bending stock, and other industrial uses demanding the best quality.

In 1944, prices for such lumber ranged from about \$60 up to about \$150 per thousand board feet for the rough-milled product. Examples of less exacting uses filled by lower grade materials are: bridge plank, car decking, bulkheads, building timbers, and miscellaneous industrial purposes at prices ranging from about \$40 up to \$60 per thousand.

More than one-third of the total cut was sawn into car blocking, usually 4 inches by 4 inches by 8 feet but ranging down to 18 inches in length. Buyers of car blocking usually do not object to dimensional deviations, to wane or defects. Any common species of wood is satisfactory. These circumstances help explain why some portable mills produce little but car blocking although prices for such material have ranged from less than \$30 up to about \$35 per thousand board feet during the war period. Practically all the car blocking was used by steel mills and allied heavy industries of the Mahoning Valley and northeastern Ohio.

About 10 percent was cut into railroad and mine ties. Some operators concentrate on tie production as do others on car blocking. Prices for tie timbers range a little higher (per thousand feet of material) than for car blocking.

In addition to the above products, occasional operators utilized much of the slab piles for mine caps, cut small trees into mine props, and the taller young oaks for piling. These products would account for less than 5 percent of the total volume covered by this study. The labor shortage particularly restricted the production of mine props, likewise of pulpwood. A small amount of the latter is produced from the softer hardwoods in normal times and still less during the war period.

As indicated elsewhere, sales by log measure, representing about 2 percent of the total volume, are mainly of material suitable for special uses as veneer, tool handles, gun stocks, and other specialties requiring definite qualities of wood provided by certain species. Because few specialty mills are located in the area, the bulk of such material is moved out by truck and rail a distance of 50 to more than 100 miles before milling. Even with this handicap of heavy shipping expense, sales by log measure, depending on the species and quality, ranged from about \$10 up to \$90 and averaged nearly \$29 per thousand board feet (these are stumpage prices, not prices of the milled product). It is unnecessary to point out the desirability of producing as much timber as possible which is suitable for marketing in the log.

More than 90 percent of the lumber produced was sold either locally or to wood using industries located within 100 miles of the point of origin. It is recognized that war-time demands modified the pattern of utilization. Peacetime uses will differ to some extent. The fact will remain that most of the timber harvested is processed into low and medium priced products used within the area or adjacent thereto. Low average quality has tended to dominate the price structure and the pattern of utilization. Opportunities exist for greater profit by producing a greater proportion of high quality material and in selling and processing for specific uses demanding high quality.

Determination of Price

Yield and Quality.—As observed in this study, the volume harvested, under virtually clear-cut conditions, ranged from less than 5 thousand up to 28 thousand board feet per acre. Quality is equally variable. Some trees in a mixed stand may have ten times the stumpage value per thousand board feet of other trees on the same tract. Before selling standing trees, particularly a mixed species stand of timber, the owner should have some definite information relating to both volume and quality. This knowledge is very important if sale is for a lump sum.

A complete cruise of the timber is of course the most accurate method so far devised to estimate the total volume which is intended for harvest and how much of this total is represented by different species. Either an experienced timber man or professional forester is capable of estimating, usually within a few percent, the board feet of lumber in standing trees. Appraisal of the quality of lumber in stumpage by inspection of the standing trees is difficult due to hidden defects. Even experienced men can only make intelligent guesses on quality. This is one good reason why lump sum sales of stumpage are usually low in price. Sales based on log scale and log grade and sales by mill measure lessen the degree of guess work in arriving at the true market value of the timber. The extent to which cruising is an established practice and its effect on price were at least roughly evaluated in this study as follows.

Cruise of Timber.—In 53 percent of the timber sales, owners did not attempt to estimate the amount of timber being offered for sale, relying either wholly on competition among buyers or on estimates made by buyers. In 33 percent of the cases, however, owners made sufficient detailed inspection either alone or with the buyer that the process could be considered as a cruise of the timber although more perfunctory in nature than a professional cruise. In 7 percent of the cases, the seller used the services of a disinterested timber man to cruise the timber and to obtain advice before sale. In 5 percent of the cases, a trained forester cruised the timber in behalf of the seller.

Effect of Cruising on Price.—Where no cruise was made of the timber before sale either by the owner or by someone working in his interest, stumpage sold for a lump sum brought an average price of \$7.57; when cruised by the owner the average price was \$8.03; when cruised by an experienced timber man the average price was \$9.37; when cruised by a trained forester the average price was \$13.79. The timber sold at the last named average price is not, however, strictly comparable to the other transactions because only the more mature trees were marked for cutting and the cruising was more definitely aimed at harvesting timber suitable for specialized products. In no case was

a cruise by a forester associated with a tract which was clear-cut. The essential point in respect to the cruising of timber before sale is that the seller finds it profitable to be well informed on the quantity and quality of the product he wishes to sell.

Location and Site.—Distance to market is another factor affecting price. High quality logs suitable for special products will stand a long haul under the prevailing scale of prices. For instance, yellow poplar, as shown on the cover page, and black walnut logs are trucked a distance of 100 miles or more and white ash at least one-half that distance before milling. In general, however, the longer the haul the lower the price the buyer is willing to pay. Low quality materials suitable only for car blocking and like uses are customarily sawn at the point of origin with no trucking cost before milling. It is advantageous to a community to produce enough quality timber to support a wood working industry in order to reap the advantage of a nearby market. Depletion of high quality materials has reached a point where relatively few specialty mills are located within the mixed oak forest area. More are located in the western part of Ohio than in the eastern part.

Another circumstance affecting price is the felling and logging chance and expense. Some tracts of timber have remained uncut due to inaccessibility and extremely rough terrain. Recent demand and improvements in logging equipment have brought the timber on some such tracts to market.

Competition Among Buyers.—More than one-half (57 percent) of the individuals selling stumpage for a lump sum relied partially or wholly on competition among buyers to establish the price accepted for their standing timber. In some cases, where only one offer was made and accepted, full reliance was placed on the judgment of the buyer. In other cases it was felt that previous sales of similar stands of timber in the same community had established a satisfactory standard of value to sell on a lump sum basis. In case of log sales or sales by mill measure the factor of competition is of less importance because the seller usually has knowledge of the current prices being paid in the locality.

PERCENT OF CASES

| | | |
|--------------------|-----|------------|
| ONE BID ONLY | 44 | ██████████ |
| MORE THAN ONE BID | 56 | ██████████ |
| TOTAL | 100 | ██████████ |
| | | |
| TIMBER CRUISED | 45 | ██████████ |
| TIMBER NOT CRUISED | 55 | ██████████ |
| TOTAL | 100 | ██████████ |

Fig. 8.—Determination of lump sum price.
77 timber sales, 1940-1944.

Competition alone is an imperfect measure of value of standing timber, partly because the buyers concerned may be interested in purchase for utilization in low priced products such as mine timbers, car blocking, crossties and

ungraded, rough lumber and consequently will offer low prices regardless of the proportion of high quality material in the stand. This circumstance is met by some sellers who dispose of their better quality trees on a footage basis and then sell the remaining stand lump sum. Or, some buyers may make a combination offer, paying for selected species by scale, and for all others in a lump sum.

Effect of Competition on Price.—On lump sum sales,⁵ where only one offer to purchase was indicated, stumpage sold for an average price of \$7.63 per thousand board feet. Where more than one offer was received the average price was \$8.12, a difference of 49 cents per thousand board feet which might be attributed to the element of competition.

Volume and Price.—The analysis of this point is based on 64 lump sum sales where the timber was cut to a small diameter. Two points of some significance are brought out. (1) Where the volume sold was less than enough to make a satisfactory sawmill set the price tended to be lower than the average price per thousand for this method of sale of mixed species stands of timber. Most mill men consider 40 to 50 thousand feet to be the minimum size for an economical sawmill set. As indicated by this analysis, some price advantage accrues to the seller up to a volume of 100 to 200 thousand board feet. (2) Larger volume sales, those 200 thousand feet and up, tended to decrease in price realized per thousand feet of timber sold. It is thought that this circumstance is due to two things; first, tracts containing a large volume of timber were usually over-aged and the question of defective material may have entered into negotiations—there are more small tracts of high quality timber than large tracts of high quality timber; and second, it was not found that owners of large tracts of timber were any more methodical in checking volume and quality than owners of smaller tracts of timber. At least the conclusion can be drawn that no unusual bargaining advantages were associated with the sale of the larger volumes of timber as compared with the medium sized volumes which composed this sample.

Average prices per thousand board feet of material sold were as follows.

| Volume Board feet, thousands | Average price Dollars |
|---------------------------------|--------------------------|
| Less than 50 | 6.07 |
| 50 to 90 | 7.29 |
| 100 to 199 | 8.84 |
| 200 to 299 | 7.88 |
| 300 or more | 7.05 |

Timber-sale Contracts

In order to have a mutually clear understanding of terms, every contract to sell standing timber should be put in writing and a copy signed by each party kept by both seller and buyer. All practical purposes can be served by a simple written memorandum. It is to the mutual interest of both seller and buyer that this be done. Due to the fact that standing timber is a part of the land, the contract of sale must be in writing in order to be legally binding on the vendor under all circumstances. Occasionally a buyer has suffered loss or serious inconvenience because an oral contract was relied upon. Probably

⁵Including sales of miscellaneous species and sales of selected trees or species.

more often the seller has felt that the details of the original agreement have not been fully observed by the buyer. Out of 82 sales agreements it was found that 55 percent were reduced to writing in some form and 45 percent were purely oral contracts.

Fire Damage

Some fire damage was in evidence in about one-half the woodlands. It was a major influence in one case observed where three successive fires over an interval of a few years had so damaged the stand that the present harvest was primarily a salvage operation at a salvage price. Control of fires is largely a matter for community action which is now provided for in the area under the auspices of the Ohio Division of Forestry. The future effect of forest fires on timber production should be less detrimental than in the past.

Figure 9 illustrates the type of fire damage commonly found in Ohio woodlands.

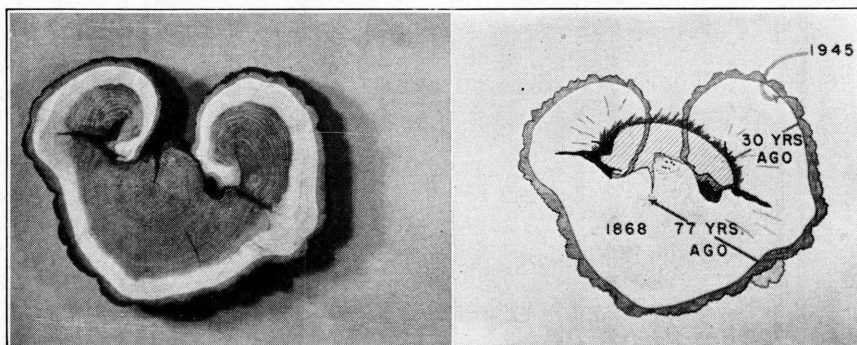


Fig. 9.—Cross section of an oak which was damaged by fire 30 years ago. The result is a distorted, decayed trunk, useless for lumber. Annual growth rings on the tree reveal growth started in 1868, fire seared side of trunk in 1915; tree after 30 years cannot repair damage.

Grazing

Evidence gathered in this study indicates that protection of farm woods from grazing is a growing practice actually in operation in about one-half the cases studied but covering 71 percent of the woodland area harvested (fig. 10).

Most farmers recognize the desirability of protection from grazing particularly when the forest cover is being restored on cut-over lands. The expense of fencing is a discouraging factor. This study appraised the effects of grazing only on relatively mature stands of timber. Damage to pole sized and smaller trees was not covered.

In pasturing a mature stand of timber the damage to the larger trees becomes readily measurable only when a certain intensity of grazing is reached. As measured in terms of price, this degree of intensity was reached only in the smaller woods, those of less than 30 acres. Stumpage prices (clear-cut) from grazed woods averaged \$7.60, from ungrazed woods \$8.87 per thousand board feet of timber sold. The inference is that grazing had increased the amount of obviously defective timber to a point where offers to

purchase were reduced accordingly. The average volume per acre harvested from ungrazed tracts exceeded that from grazed tracts by 1,115 board feet; a difference which might be due to protection from grazing but which might arise from a better residual stand or longer period of growth after previous harvests. Value per acre of stumpage cut from grazed woodlands averaged \$62.75; from ungrazed woodlands, \$83.12.

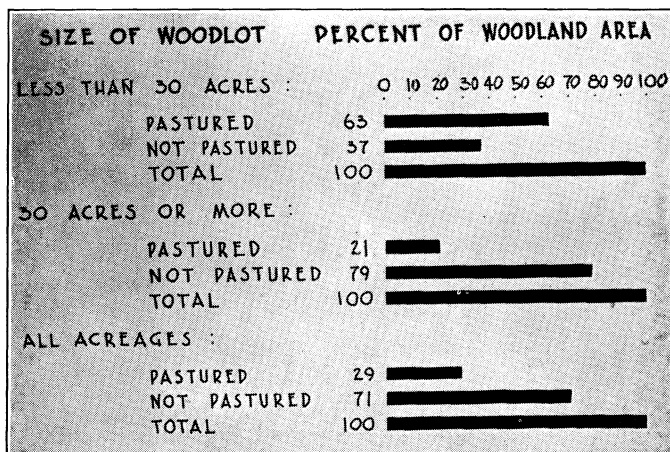


Fig. 10.—Grazing practices on woodlands harvested, 105 timber sales, 1940-1944.

As stated above, the practice of grazing and observable damage to woodlands was most common on the smaller farm units. The following comparisons further indicate how grazing practices are associated with size of woodlands.

| | Number | Average size of woodland (acres) |
|--|--------|----------------------------------|
| Woodlands less than 30 acres, pastured | 34 | 14 |
| Woodlands less than 30 acres, not pastured | 17 | 17 |
| Woodlands 30 acres or more, pastured | 15 | 43 |
| Woodlands 30 acres or more, not pastured | 39 | 63 |

Cutting Practices

What is Meant by the Term Clear-Cut.—As used in this study, the term “clear-cut” was applied to all cases where the merchantable timber was cut to a minimum diameter of 12 inches or less at stump height. A 12-inch tree, so measured, is about the minimum size which will produce one railroad cross tie from the butt log. In a few cases observed, saw timber was cut to approximately a 6-inch minimum diameter which will square one stick of car blocking. Production costs run so high on small diameter timber that mill operators can hardly afford to process it except under a system of lump sum purchase where the real determination of price is based on the larger trees. Figure 11 illustrates the relative frequency of various cutting practices.

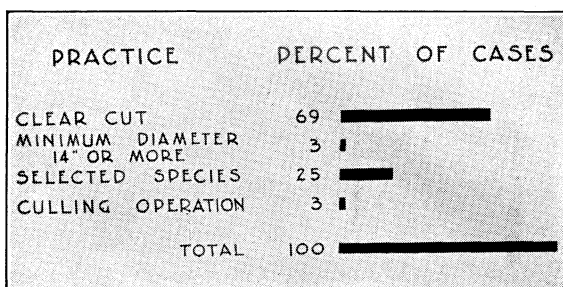


Fig. 11.—Cutting practices, 116 timber sales, 1940-1944.

Clear-cutting excepted, the other practices indicated in figure 11 can, in a broad sense, be termed selective cutting because only part of the merchantable saw timber was selected for removal. In more technical usage, the term selective cutting is associated with woodland management designed to keep the land stocked at all times with an all-age stand of trees.

Figure 12 illustrates the sustained yield or selective cutting method. This chart is based on data collected in a 42-acre woodland in Holmes County. The chart shows a symmetrical distribution of merchantable tree sizes in the stand ranging from 12 to 36 inches in diameter, with the largest volume in the 22-inch diameter class. During 1943, the owner made a timber sale of 42,000 board feet of high-quality tulip poplar. Most of this volume came from the larger trees, representing less than 15 percent of the total stand.

Preliminary growth studies indicate that this woodland is growing at the rate of 3 percent per year or 250 board feet per acre per year. At this rate,

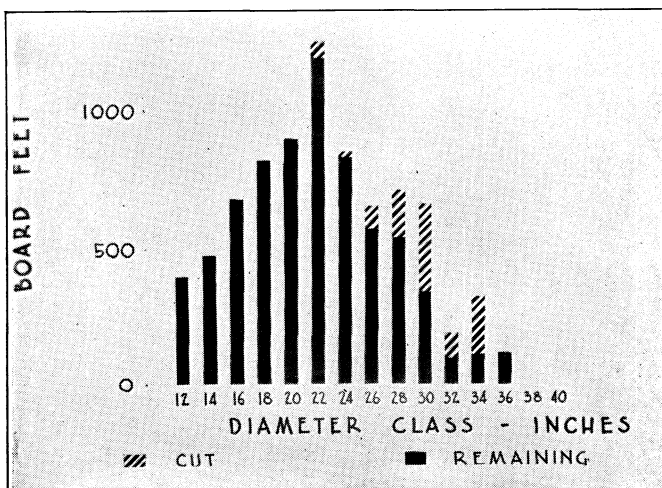


Fig. 12.—Illustration of how the method of selective cutting operated in an eastern Ohio woodland.

only 4 years will be required for growth to replace the timber which was harvested; therefore the farmer can return every 4 or 5 years for successive harvests. This is possible only when a good growing stock is maintained.

Careful measurement of sample plots indicated that in those areas where unrestricted cutting was practiced, 95 percent of the merchantable stand was removed.



Fig. 13.—An example of clear-cutting. All merchantable trees have been removed. An understory of dogwood and hop-hornbeam will retard the reproduction of the more valuable species. From 30 to 60 years or longer will elapse before the next harvest.

Woodland conditions following clear-cutting and selective cutting are depicted in figures 13 and 14, respectively. In figure 13 it is evident that all the merchantable trees have been removed. The existing understory in this tract is mostly dogwood and hop hornbeam which will provide serious competition to the better timber species. Figure 14 shows that under the selective cutting system the larger trees are removed, and a good residual stand will make it possible to return for another cut within a decade.

Length of Cutting Cycle, Average Yields, and Prices

Cutting too small diameters and long periods between harvest have been customary in the mixed oak forest area. Woodland owners interviewed usually anticipated another harvest in from 30 to 60 years when clear cutting was practiced. Where the smaller growth is utilized for piling or mine props, the next harvest of saw timber can hardly be anticipated in 60 years unless small immature timber is harvested or the new crop is of faster growing species than the oaks.



Fig. 14.—An example of selective cutting. Under this method of management the mature saw timber is removed every few years along with crooked, defective, and other less desirable trees.

In 53 cases of clear-cutting it was possible to obtain an approximate check on previous harvests. Probably all eastern Ohio woodlands have had a few trees removed at some time such as choice white oak, tulip poplar, chestnut, and white ash. Nonetheless, in about one-third of the cases of clear-cutting no evidence of previous general harvest either was observed or had occurred within the knowledge of the present owner. In such cases the average yield per acre was 13,558 board feet, 50 percent above the average yield indicated in all cases of clear-cutting of all saw timber. The larger trees in these mature stands were 100 to 200 years old or older. In such cases the harvest is of material stored up over a longer period than is permanently practicable in a small privately owned woodland under a system of clear-cutting. These old stands were usually a mixture of over-mature, defective trees—years past their prime—and sound, high quality trees. Some woods had likely reached the stage where annual decay about balanced annual growth. At the assumed rate of annual growth per acre of 190 board feet it would take 71 years to produce the volume harvested from these old stands.

Yield per acre of the current harvest when the last known harvest ranged around 60 years ago, averaged 11,433 board feet; 45 years ago, 8,547 board feet; and 30 years ago, 5,990 board feet. The severity of cut in the previous harvest from the various tracts is not known; but if the same degree of clear-cutting is assumed for both the previous and most recent harvest, the rate of

annual growth indicated between harvests is practically the same for the three cutting cycles (190 to 200 board feet). Applying this assumed rate of annual growth (more accurately described as annual rate of removal) to all tracts which were clear-cut indicates that the majority of the woods in the mixed oak forest area, once harvested, are on a cutting cycle of around 45 years between harvests but ranging from more than 60 to less than 30 years. A summary of these data and their relationship to price follows.

| | Average yield per acre | Annual rate of removal | Average price per M. Bd. ft. |
|-------------------------------|---------------------------|---------------------------|------------------------------------|
| | <i>Bd. ft.</i> | <i>Bd. ft.</i> | <i>Dollars</i> |
| No previous general harvest | 13,558 | | 7.68 |
| Previous harvest 60 years ago | 11,438 | 191 | 7.61 |
| Previous harvest 45 years ago | 8,547 | 190 | 7.11 |
| Previous harvest 30 years ago | 5,990 | 200 | 7.98 |

The above comparisons indicate no very significant advantage of one cutting cycle over another when clear-cutting is practiced, either in the volume of material produced or in price per unit of product. This qualification should be added: a long cutting cycle should justify its use either by a progressive increase in the rate of annual growth or by an improvement in quality of material, or both, in order to carry the accumulating annual expenses plus interest on same. There is no evidence that this was accomplished by the longer cutting cycles. Another significant point is that all prices were low. They were lump sum prices which under a system of clear-cutting tend to give relatively little consideration to differences in quality, as has been discussed.

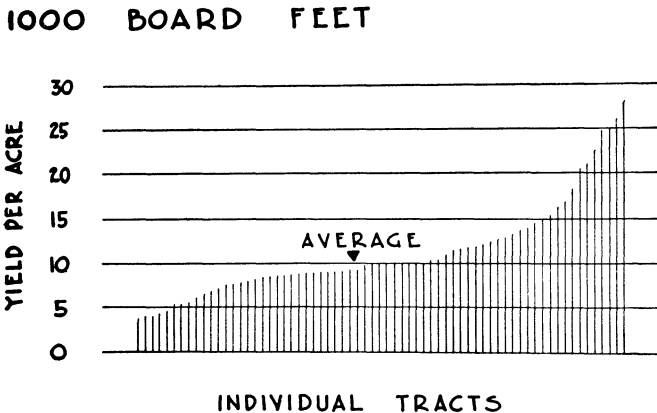


Fig. 15.—Yield per acre on individual tracts of woodland under virtually clear-cut conditions; 67 sales, 1940-1944. The average volume harvested ranged from 4 thousand to 28 thousand board feet per acre.

A cutting cycle shorter than 30 years is at least in partial operation in about one-third of the woodlands covered by this study. Most sales of selected trees, selected species, and in the log are evidence of this fact, but not always. The price advantage of these types of sales has already been discussed. The cutting practices associated with the shorter periods between harvests conform in some degree to the principle of sustained yield management because the whole merchantable stand is not removed at any one time.

In 11 sales (from nine tracts) the evidence supported the opinion that a short cutting cycle was in operation. The following circumstances applied to the last harvest from these woodlands:

- (1) Average size of woodland harvested, 37.3 acres.
- (2) Average length of period since previous harvest, 8.8 years.
- (3) Average volume harvested per tract, 64,289 board feet.
- (4) Average volume harvested per acre, 1,722 board feet.
- (5) Average stumpage price per 1,000 board feet, \$15.03.
- (6) Range in stumpage price per thousand board feet—high, \$60; low, \$9.37.
- (7) Annual rate of removal per acre (1,722 board feet divided by 8.8 years) 196 board feet.
- (8) Annual rate of income per acre, \$2.95.

The rate of annual growth in these woodlands is not known, but it probably would be equal to the annual rate of removal. The presumption would be strong that it would be equal to or exceed the annual rate of removal indicated under clear-cutting management; namely, 190 to 200 board feet per acre. More information is needed to definitely establish the rate of annual growth realized under all the different methods of management, location, and type of forest found in Ohio woodlands. Such research is in progress.

It is not possible to determine from this study whether or not the material removed from the selectively cut woodlands would raise or lower the quality of product available for future harvests. Until this information is assembled, it cannot be determined conclusively whether the price advantage for selective cutting, as practiced in these woodlands, will be maintained, increased, or decreased as successive future harvests are made.

The average annual rate of income per acre realized from sales under the different cutting cycles follows.

| | <i>Dollars</i> |
|------------------------|----------------|
| 60-year cutting cycle | 1.45 |
| 45-year cutting cycle | 1.35 |
| 30-year cutting cycle | 1.60 |
| 8.8-year cutting cycle | 2.95 |

It will be observed that the annual rate of income per acre realized under the three longer rotation periods was not greatly different. There is a material difference, however, when this deferred income is capitalized into land values. For instance, when capitalized at 4 percent and allowance is made for land taxes, the 30-year cutting cycle would support a land value distinctly higher than the 60-year cutting cycle.

Summary and Conclusions

This study was confined to the northern segment of the mixed oak forest area extending from central Knox to Columbiana County. The project was inaugurated to study actual timber sales in order to obtain information which might point out ways to improve present marketing practices.

In the area studied, the period of wholesale conversion of forest land to other uses terminated about 1880. Since then the trend has been in the other direction. At present about one-sixth of the area is wooded and this will likely

approach one-fifth within the predictable future because some crop and pasture land is in process of abandonment. The present era is marking the close of the period of haphazard exploitation of the original forest resources and the beginning of the period when the importance of woodlands as an asset to the area will be largely dependent on skills in woodland management, on more systematic marketing, and on utilizing a larger proportion of the timber for quality products.

Farm woodlands in the area average about 19 acres per farm having woodland, which is also the State average. In contrast, 56 percent of the timber production covered by this study came from woodlands containing 40 acres or more although in one-half the cases sale was from woodlands containing 25 acres or less.

The smaller woodlands often are held in reserve for possible home use or if there is a merchantable surplus the volume may be too small for a portable sawmill set. More than 90 percent of the timber harvested is processed by portable mills which need sufficient volume to operate at low cost. Many small woodlands do not contain this much merchantable timber, even if clear-cut.

Analysis of prevailing marketing practices reveals the following circumstances. Lump sum sales of miscellaneous species of timber represented 61 percent of the cases and 78 percent of the volume harvested; mill measure sales, 9 percent of the cases and 6 percent of the volume; lump sum sales of selected species, 8 percent of the cases and 5 percent of the volume; sales by log measure, 11 percent of the cases and 2 percent of the volume; sales of lumber by woodland owners, 11 percent of the cases and 9 percent of the volume.

Lump sum sales of the total merchantable stand of timber on a tract yielded the lowest average returns per thousand feet of material harvested of any type of transaction. This is partly due to the fact that more poor quality timber is sold lump sum than by any other method, but other attending circumstances are: (1) In approximately one-half the cases owners did not have much information on the quantity and quality of the material sold, relying almost entirely on competition among buyers to establish price; (2) competition among buyers is an inadequate measure of value because all buyers concerned may be interested in processing all the timber into low priced products. Where a seller was well informed as to the quantity and quality of his timber, sale by lump sum method was about as satisfactory as sale by mill measure.

The essential fact is that too few woodland owners have the necessary information to determine the best market price of their standing timber and seldom engage expert assistance to do the job.

Where the timber was processed by portable mills some price advantage was associated with sufficient volume to make an economical sawmill set; that is, from 100 to 200 thousand board feet. Smaller volumes brought a lower lump sum price which was thought due to higher per unit costs of processing. Larger volumes declined in price partly due to the probability of a higher percentage of defective and low quality timber. There are more small tracts of good timber than large tracts of good timber. Owners of large tracts were not as a rule any more methodical in checking the quantity and quality of their standing trees than owners of small tracts.

Although it is evident that the traditional method of selling timber for a lump sum to be clear-cut still prevails, it may also be emphasized that 39 percent of the sales, covering 22 percent of the volume harvested, was by some other method which generally yielded a better monetary return because quantity and quality were given definite consideration.

Every farm has some need for lumber (posts, poles, rough buildings). The most profitable utilization of some woodland on every farm is the production of such materials for home use. Nine percent of the cases observed in this study and two percent of the lumber was production for home use.

Where woodland owners have been in position to harvest and market their own timber as lumber the monetary returns have been relatively satisfactory since 1940 due to vigorous demand. The results at least suggest the opportunities which farm woodlands offer for profitable use of labor and equipment as one of the regular farm enterprises.

Certain woodland management practices were given consideration in the study. Grazing damage was most serious in the smaller woodlands and was associated with lower prices and lower yields of timber.

Cutting practices appear to be a major influence affecting management and income. The majority of the woodlands were on a long cutting cycle with an average of about 45 years between harvests for all the cases studied. In about one-third the cases of clear-cutting no previous general harvest was known. Where previous general harvests were indicated the period between harvests under clear-cutting management usually ranged from 60 down to 30 years.

In about one-third of the cases, a cutting cycle of less than 30 years appeared to be in operation because less than the total merchantable stand was sold. In one-third of these cases, two or more successive harvests indicated fairly well defined management to sustain yield in a short cutting cycle.

The following conclusion is drawn from the information relating to cutting practices in variable-age timber. Any cutting cycle where the total merchantable stand is clear-cut is associated with relatively low returns because so much of the material is either too defective or too small to command a high average price. The price advantage strongly favors selective cutting of trees which have reached the point of economic maturity.

Some modification in the prevailing market structure would encourage farmers to practice more systematic woodland management. Greater emphasis should be given to the trucking of logs to a central point for milling in order to accommodate smaller and more frequent harvests from a higher proportion of the woodlands.

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