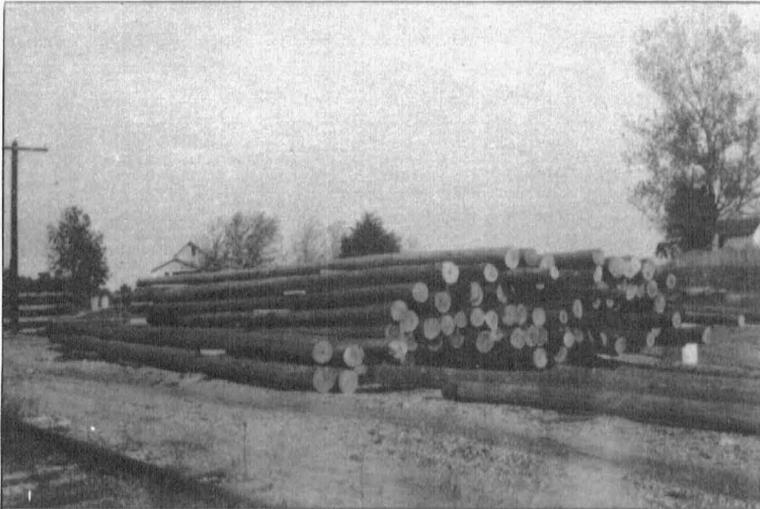


UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

M. F. MILLER, *Director*

Marketing Missouri Farm Timber Crops

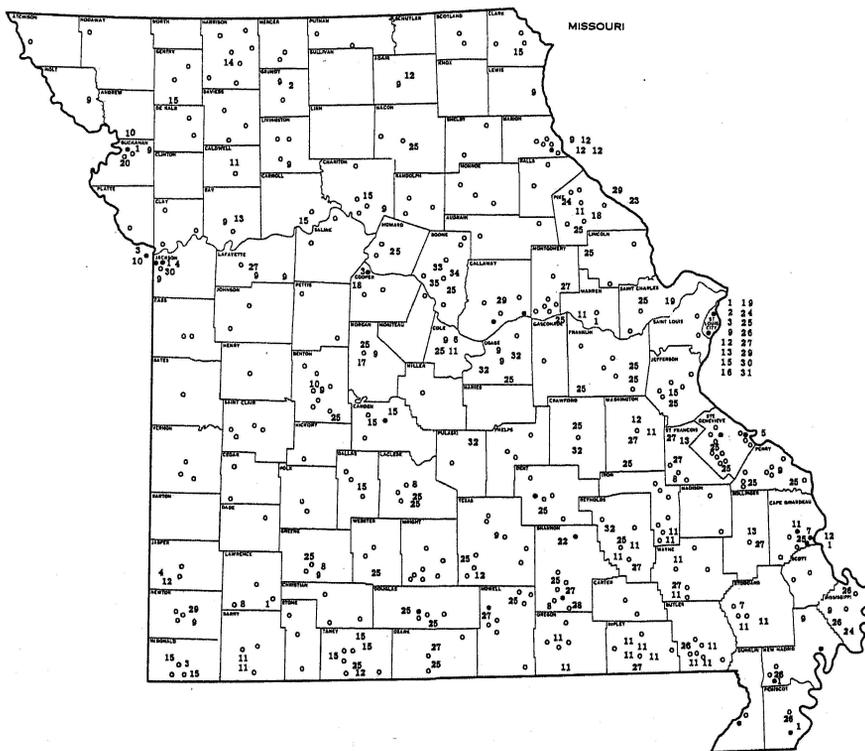
RALPH H. PECK, WILLIAM C. SECHRIST, C. WILLARD LEACH



Shortleaf Pine Telephone poles and piling in southeast Missouri. These poles are from 30 year old trees. Much more can be realized from material of this size for poles or piling than for lumber.

*Missouri Agricultural Experiment Station, and Forestry Section,
Missouri Conservation Commission, Cooperating.*

COLUMBIA, MISSOURI



MAP OF MISSOURI SHOWING LOCATION OF THE MORE IMPORTANT WOOD-USING INDUSTRIES CONTACTED DURING WOOD-USING INDUSTRY SURVEY, 1940-41.

Legend

- | | |
|--|---|
| ● Sawmills (over 500,000 bd. ft. annually) | 18. Pipes—smoking |
| ○ Sawmills (small) | 19. Pulpwood (paper) |
| 1. Boxes and crates | 20. Saddle stirrups |
| 2. Caskets | 21. Sawmills (see symbols) |
| 3. Commission | 22. Shingles (wood) |
| 4. Creosoting Plants | 23. Shredded wood |
| 5. Crutches and canes | 24. Small dimension stock |
| 6. Decoy ducks | 25. Stave mills (tight) |
| 7. Farm Implements (wood parts) | 26. Stave mills (slack) |
| 8. Oak flooring | 27. R. R. tie yards (only few shown. Yard in most every county) |
| 9. Furniture (all kinds) | 28. Wagon hubs |
| 10. Gun stocks and blanks | 29. Veneer (box and basket) |
| 11. Tool handles and blanks | 30. Veneer (furniture) |
| 12. Millwork (sash, doors) | 31. Wood fiber |
| 13. Mine timbers | 32. Wood distillation (charcoal) |
| 14. Mouse traps | 33, 34, 35. Airplane propellers, skis, archery bows. |
| 15. Novelties | |
| 16. Pencils | |
| 17. Pins and brackets (Telephone) | |

Marketing Missouri Farm Timber Crops

RALPH H. PECK, WILLIAM C. SECHRIST, C. WILLARD LEACH

*Missouri Agricultural Experiment Station, and Forestry Section,
Missouri Conservation Commission, Cooperating.*

Woodlands make up one-third the total surface area of Missouri. Of the 15,500,000 acres in forest cover, almost one-half, or 7,000,000 acres, are owned by farmers as farm woods. This represents one-fifth of all farm land and averages 27 acres of woods per farm. These farm woods are the most productive forest lands in the state. Yet, in the aggregate they produce about one-fourth the income and products of which they are capable, and quality of the wood is steadily declining.

The reason for this unsatisfactory condition lies in the customary neglect or improper management by most farm operators. Many harvest fuelwood, posts, poles, and possibly a little saw timber. Few operate their own small sawmills or use home grown wood efficiently. Through careful utilization a large part of the home wood requirements can be supplied from trees of low sale value. Tall, straight trees, containing several sawlogs, should be reserved either for sale or for future farm building construction.

Farmers have lacked reliable information as to proper methods of measuring, harvesting, and selling timber products and have often been the prey of shrewd log buyers in the past. The purpose of this publication is to guide the average woodland owner in effectively disposing of his mature timber after it has been grown. It is the opinion of the authors that if farmers can be shown a profit in timber crops under efficient marketing methods, increased production will follow.

Wood Production for Home Use and Sale

The farm woodland is an actively producing unit of the farm and merits the same consideration and attention as does crop or pasture land. Its primary purpose should be to supply all of the wood needs of the farm. Protection from fire and overgrazing are the first steps toward achieving this objective. Cultural practices, such as thinning, improvement cutting, pruning and planting, form the second step toward improving the quality, composition, and rate of growth. Production can thus be directed toward needed products rather than unmerchantable wood.

Home needs for lumber and wood should always be given first consideration. Wood products are both bulky and heavy in relation to their value, and profits on small and low quality trees are often absorbed by hauling costs if transported any great distance. It is to the owner's economic advantage to use low quality material at home and offer for sale only the more valuable products.

Round or hewn poles, as well as finished lumber, can be used effectively on farms. This type of construction is economical, requires only hand tools, and when properly joined together forms shelters which are serviceable for many years. Straight poles with little taper form walls of uniform height and thickness when large and small ends are alternated. Green poles should be peeled immediately as removal of bark reduces damage from both insects and fungi. Foundations of stone or concrete are desirable unless especially durable or treated wood is used in contact with the ground. Log and pole structures are heavy and the labor required is greater than ordinary construction. Skilled labor is seldom needed. Spaces between logs are made weatherproof by chinking with clay or mortar. From the standpoint of appearance, such buildings might well be located away from public highways, although in many instances this type of building is even more attractive than finished lumber.

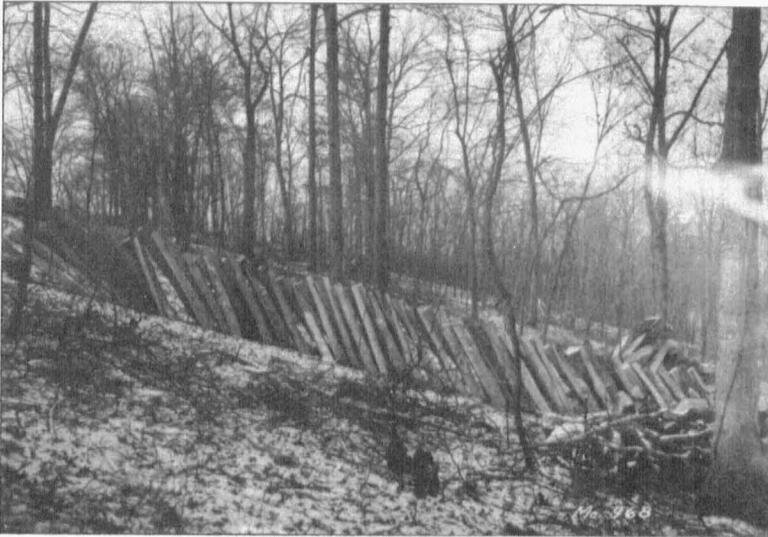


Fig. 2.—White oak fence posts obtained from a farm woodlot improvement cutting. Over 500 posts and a large quantity of fuel wood were obtained from overmature and defective trees on 4 acres. The woods have been left in a better condition.—Courtesy Soil Conservation Service.

Where lighter construction is desired and a sawmill is located within hauling distance, logs and poles may be sawed to the dimensions desired. The so-called "custom" mills usually saw logs either for half the lumber or for a flat rate of from \$5.50 to \$9.00 per thousand feet board measure. Both logs and lumber are hauled by the owner, and the sawmill operator retains all sawdust, slabs and other waste material.

Felling and hauling are best done during the slack winter season, particularly when the ground is frozen and covered with snow. After all logs, bolts, tie cuts and other products to be sold or sawed are hauled out, the remaining top and branch wood can be worked up in the woods into posts and fuel. Close utilization of this material will conserve many valuable trees. Small poles removed in thinnings may be sawed in half and squared on the edges for use as rough siding, studding or fencing. Large logs may be sawed into lumber for new construction and repairs. Many short or narrow boards, produced from small or defective logs, may be used to advantage in farm building construction, and can often be cut from trees which have little or no sale value. Broken topped or dead trees, if sound and still standing, provide lumber just as satisfactory for farm use as that sawed from healthy trees.

If a planing mill is available, choice boards of selected species may be finished for cabinet work or interior trim in the home. Planed boards require less paint and present a smoother, more attractive appearance, but are no more serviceable than rough boards. Boards

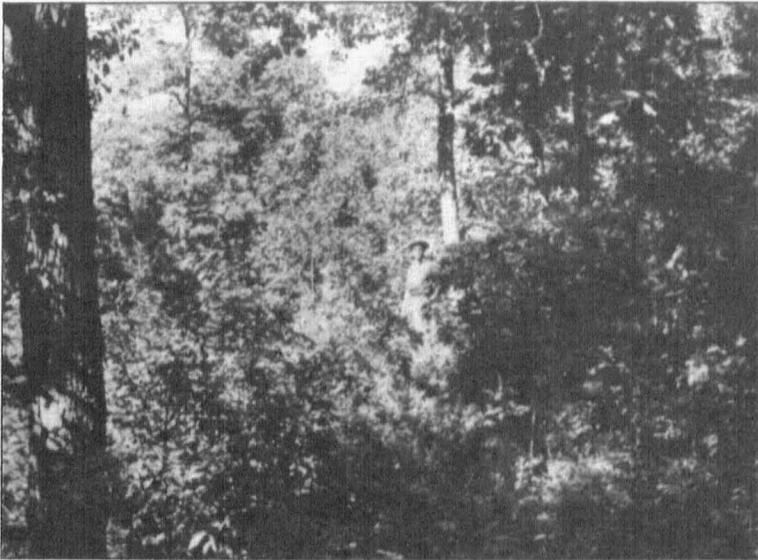


Fig. 3.—A well managed woodlot with abundant natural reproduction. Trees of all sizes from seedlings to sawlogs are present. Compare with Fig. 4.—Courtesy A. B. Meyer.

should never be used or planed until thoroughly dried for from 4 to 6 months. Proper seasoning increases the length of useful life of lumber through increasing its resistance to decay, and reduces shrinking, warping and checking. A reserve supply of seasoned

lumber should be kept on hand ready for use as needed. Suggestions for proper methods of piling and seasoning are given on page 17.

Each species of wood should be selected for the specific use to which it is best fitted. Durable species should always be used in contact with the ground, as posts or foundation timbers, or wherever moist, humid conditions exist. Non-durable woods will give excellent service in dry situations, such as partitions, floors and ceilings. Resistance to wear, shrinkage and discoloration, hardness, nail holding capacity, strength, and appearance are a few of the other properties which vary widely in the different woods and should be considered when selecting building materials. U. S. D. A. Farmers' Bulletin No. 1756, Selection of Lumber for Farm and Home Buildings, is an aid in economic utilization of native woods.

In cutting wood for home use, the following rules should be followed:

1. Sound, dead trees will make better fuel for immediate use than green trees. They will also make usable lumber, posts or poles.
2. The poorest quality trees which will furnish the needed products should be cut first. Low cut stumps, and utilization of small diameter topwood, will provide more wood from fewer trees.
3. Trees located on gully or stream banks useful for preventing erosion, and those growing on the outer edges of stands where they serve as a windbreak, should be left undisturbed.
4. Trees with short boles and wide crowns, commonly called "wolf trees," use too much space for the value of the products grown and should be removed at the first cutting.
5. Each cutting should be made with the objective of improving the remaining stand through utilizing inferior trees.

Common Units of Measure for Wood Products

Cord.—A standard cord is a stack of 4 foot wood piled 4 feet high and 8 feet long, containing 128 cubic feet of stacked measure. A long cord is also 4 feet high and 8 feet long but is made up of sticks longer than 4 feet. Similarly, a short cord contains sticks less than 4 feet in length and is often termed a "rick". To determine the number of standard cords in a stack of wood, multiply length by width by height of stack (all in feet) and divide by 128. Products sold by the cord include fuelwood, pulpwood, handle and stave bolts, mine props and other small and relatively low value pieces.

Board Foot.—This unit expresses volume in terms of sawed lumber, and is equal to a board 1 foot square and 1 inch thick. To determine the number of board feet in a piece of lumber, multiply width in inches by thickness in inches by length in feet and divide by 12. The Roman numeral "M" is commonly used to designate 1,000 in measurement of lumber. Thus 5,000 feet board measure is written as 5 M ft. b.m. Not only sawed lumber but standing timber and felled logs as well are sold on the basis of board feet. The measure or

"scale" of a log or tree indicates the number of board feet of sawed lumber which can be obtained, exclusive of all waste such as slabs and sawdust.

Piece or Linear Foot.—Many products, sold mostly in round form, such as posts, poles, piling and mine timbers, are sold by the piece or linear foot. Where these units are used it is usually necessary to specify the diameters at either end which will be accepted.

Stave Foot or Chord Foot.—Used for measuring the volume of stave and heading bolts. This measurement is the distance in a straight line from corner to corner of a split bolt across the sawed face. Only the heart or red wood is measured.

Tie Cut.—A term used for buying tie material in the standing tree. Any log that will saw out a railroad tie is spoken of as a tie cut, and will vary with the size of the tie.

Bolt or Billet.—A piece of round or split wood under 6 feet in length.

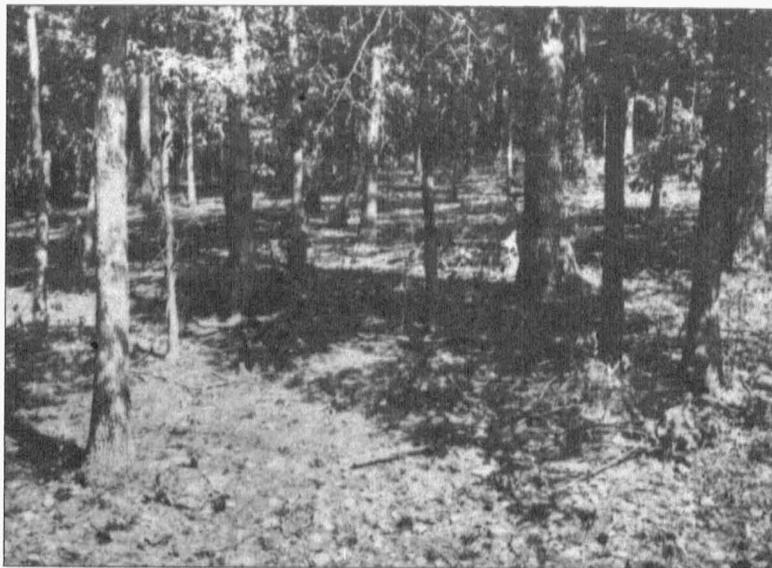


Fig. 4.—An overgrazed woodlot showing the absence of ground cover and reproduction. Under present conditions this woodlot cannot produce timber on a continuous basis. Woodlots supply very little food in comparison with good pasture.—Courtesy A. B. Meyer.

Sales of Standing Timber

A thorough knowledge of all available markets for timber is essential to successful selling. Profitable marketing depends upon two essentials: First, a supply of products for which there is an active demand; and second, an understanding of what, where, when, and how to sell.

The species, sizes, and volume of merchantable timber ready for harvest affect the price which can be obtained for logs and stumpage. Logging hazards such as steep slopes, streams, swamps, and long hauls from stump to mill, increase logging costs and reduce the price which standing trees will bring.

It is always good practice to contact as many prospective buyers as are available before making a sale. This may be done through advertising timber for sale in the local newspapers, or through posting invitations to bid, either by mail or on public bulletin boards. Usually the County Extension Agent is in a position to advise as to prospective buyers. A sample invitation to bid is shown in the Appendix.

If trees of several different species are offered it will usually pay to sell the different species separately for special uses rather than to dispose of all to one sawmill.

It is seldom if ever advisable to sell timber for a lump sum per acre or for the entire tract. It takes very little time to scale logs after they have been cut and scaling establishes a definite basis of measurement acceptable to both parties.

If it is necessary to sell the entire tract for a lump sum, however, an estimate of the volume of merchantable trees should be prepared in advance and the price based on this estimate. Instructions for estimating standing timber are shown on page 9. In either case, the owner should mark all trees to be cut in agreement with the terms of the contract.

Stumpage and log prices fluctuate but little from year to year and standing timber, even though it is mature, does not deteriorate rapidly under normal conditions. A better price will usually be realized through carefully investigating all markets rather than by accepting the first offer.

After a price has been agreed upon, a written contract should be made to protect both buyer and seller and to prevent future disputes. Without such a contract, the buyer is tempted to remove only those trees on which he can realize the highest profit at the lowest possible cost, which usually means unnecessary damage to the remaining stand. The contract, moreover, binds the seller to furnish a given volume and quality of timber, subject to restrictions which are known in advance, upon which the buyer can base his plans for economic utilization. The essential points to be covered by the timber sale contract are as follows:

1. Description and location of timber or products.
2. Price, manner, and time of payment.
3. Regulations regarding cutting, scaling, and removal.
4. Statement clarifying transfer of title and specifying methods of settling disputes.

Estimating Volume of Standing Trees

There are several methods of estimating the net merchantable volumes of trees, all of which require measurement of diameter and merchantable height.

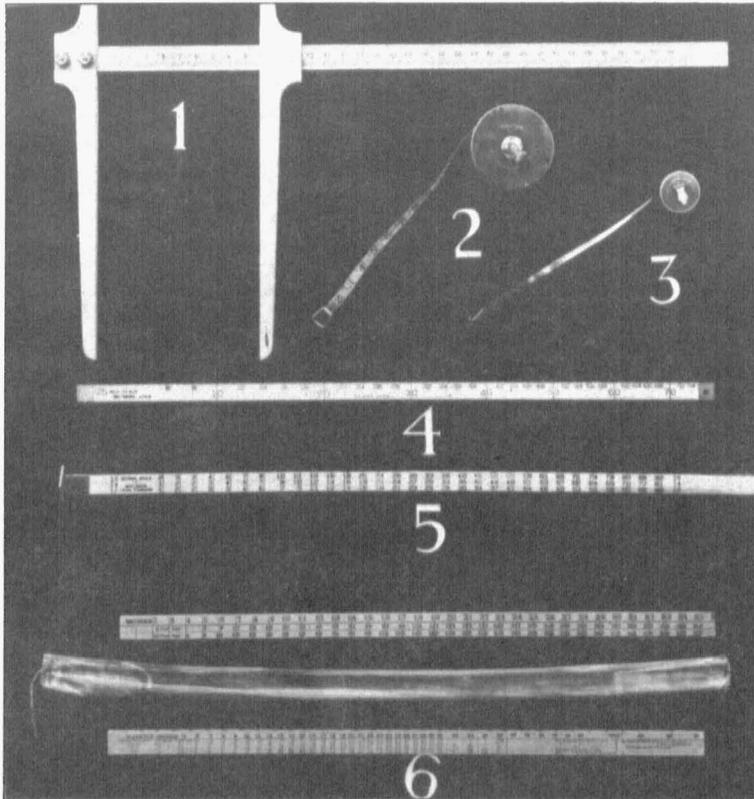


Fig. 5.—Common instruments used for measuring trees.

1. Calipers—Used for measuring tree diameters.
2. 100 foot metallic tape—For measuring ground distances and tree circumferences.
3. Diameter tape—The diameter is read directly from the tape.
4. Biltmore stick—Contains four scales: Diameter, height, log scale, and inch rule.
5. Scale stick—For estimating the net volume of a log by measuring the diameter of it at the small end inside the bark.
6. Tree scale sticks and canvass container—One stick bears the International log scale and is used as No. 5. Other stick bears a tree scale for estimating contents of the standing tree.

Diameter is always measured at breast height, exactly $4\frac{1}{2}$ feet above the ground. On steep slopes breast height should be measured at the side rather than on the upper or lower slope. Tree diameters may be measured with a Biltmore stick, with tree calipers, or with a measuring tape. If circumference is measured it may be con-

verted to diameter by dividing by 3.1416. The following table expresses diameter in reference to circumference. To make a diameter tape from an ordinary tape, place the numbers under heading "**Diameter in Inches**" on the reverse side of the tape opposite the number on the tape under heading "**Circumference—Ft. & Inches**". By putting the tape around the tree and reading the new numbers on the back of the tape, the diameter of the tree is found directly.

This table may also be used as follows: Measure the circumference of the tree by using an ordinary tape. Record the circumference of the tree in the field. Later the corresponding diameters can be read directly from the following table. Example: If the reading on the tape is 40" or 3' 4", the diameter from the following table is 13".

DIAMETER-CIRCUMFERENCE TABLE

Diameter Inches	Circumference Ft. & Inches	Diameter Inches	Circumference Ft. & Inches	Diameter Inches	Circumference Ft. & Inches
5	1' - 4"	17	4' - 5"	29	7' - 7"
6	1 - 7	18	4 - 9	30	7 - 10
7	1 - 10	19	5 - 0	31	8 - 1
8	2 - 1	20	5 - 3	32	8 - 4
9	2 - 4	21	5 - 6	33	8 - 7
10	2 - 7	22	5 - 9	34	8 - 11
11	2 - 11	23	6 - 0	35	9 - 2
12	3 - 2	24	6 - 3	36	9 - 5
13	3 - 5	25	6 - 6	37	9 - 8
14	3 - 8	26	6 - 10	38	9 - 11
15	3 - 11	27	7 - 1	39	10 - 2
16	4 - 2	28	7 - 4	40	10 - 5

Height may be determined by measuring with a Merritt hypsometer, or by estimating the number and length of merchantable logs in each tree. A light pole, 12 to 16 feet long, held or stood beside the tree will aid in estimating height.

Tree Scale Stick Method.—Diameter and height must be measured with a specially constructed tree scale stick. A set of scaling sticks containing one tree scale or cruising stick and one log scale stick may be obtained from the Federal Land Bank at Springfield, Massachusetts, for \$1.00. The tree scale stick contains a Biltmore scale for measuring diameter, a Merritt hypsometer for measuring merchantable height, and a volume table, from which contents in board feet, or in cords, can be read directly.

Volume Table Method.—A tree volume table gives the average number of board feet which a tree of any specified height and diameter will saw out. Trees are tallied according to species, height, and diameter, and the volumes read directly from the volume table after the cruise has been completed. A tally sheet, see Figure 6, should be used in the field. Tallying is most efficiently accomplished

in the space provided by a system of dots and dashes as shown below. Each dot or dash represents one tree.

1 2 3 4 5 6 7 8 9 10
 :: :- - □ □ □ □

		SPECIES																	
		White Oak			Black Oak			Hickory			Basswood								
D.B.H.	Inches	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
8																			
10																			
12																			
14																			
16																			
18																			
20																			
22																			
24																			
26																			
28																			
30																			

* Figures under species indicate number of logs in tree.

Fig. 6.—Sample sheet for tallying trees when volume tables are to be used.

Log Rule Method.—In this method, the volume of a tree is determined by estimating the number and size of logs in a tree. The length and the diameter inside bark at the small end of each log is

Species	Butt Log			2nd Log			3rd Log			Total Scale
	Diam.	Leth.	Scale	Diam.	Leth.	Scale	Diam.	Leth.	Scale	

Fig. 7.—Sample sheet for tallying contents of trees when log rule method is used.

estimated by eye and the board foot contents read from a log scale stick or table.

A convenient tally sheet for field use may be ruled off similar to the sample shown in Figure 7.

Estimating Timber by Sampling

For the average farm woodland of 30 acres or less, the best practice is to estimate the contents of every tree. This is termed a 100 per cent estimate. For larger areas or for timber which is fairly uniform but of low value, it is sometimes advisable to make a partial estimate of from 5 to 50 per cent of the total area. This method is cheaper, since it involves much less time and labor, but cannot provide as accurate an estimate as the complete survey.

If sample areas are used, they must be selected systematically. A certain percentage of the woodland must be measured (10, 20, or 50 per cent is commonly used) and the samples (strips or plots) must be spaced at regular intervals over the entire area. The board foot volumes obtained from the plots must be multiplied by the proper figure to obtain total volume for the area. In all cases the larger the portion cruised, the more accurate the final results will be.

Circular Plot Method.—Circular sample plots are preferable to those of other shapes, since one man can stand at a point designated as the center and tally all trees within the proper radius, thus eliminating the necessity of measuring the outer boundaries. Circular plots of $\frac{1}{5}$ or $\frac{1}{4}$ acre (radii 53 feet and 59 feet respectively), located at regular intervals along a compass line, are commonly used. Distances are measured in chains rather than feet. One chain is equal to four rods or 66 feet, and 10 square chains equal one acre. Therefore $\frac{1}{5}$ acre plots located 2 chains apart, along compass lines spaced 10 chains apart, provide a 10 per cent estimate. The same result is obtained with $\frac{1}{5}$ acre plots 4 chains apart or $\frac{1}{4}$ acre plots 5 chains apart along lines spaced 5 chains apart.

Strip Method.—This varies from the circular plot method only in the size and shape of the sample used. Strips one chain in width extending entirely across the woodland are laid out at regular distances (5, 10, or 20 chains apart). All trees of merchantable size which occur on the strips are tallied in the same manner as in the circular plot method. Area cruised is readily computed since each chain of strip is equal to one square chain or $\frac{1}{10}$ acre. This method requires more than one man, however, because it is impossible for one to count trees and measure distances at the same time.

Determining Board Foot Contents of Logs

Log Rules.—Logs are sold by scale, which indicates the number of board feet of merchantable lumber in one inch boards which can be sawed from each log. Several log rules are used in Missouri, the most common being the Doyle, the Scribner, and a combination

of these two known as the Doyle-Scribner. These rules vary in the contents given logs of various sizes. In general the Doyle rule gives low values to small logs, but is fairly accurate on logs over 2 feet in diameter. The Scribner rule is more uniformly accurate and should be insisted upon by farmers selling timber whenever possible. The Doyle-Scribner gives low values to all logs and should never be used without full knowledge of its faults.

Scaling.—Scaling requires measurements of log length and diameter. Length is measured in full feet and each log must contain about four inches extra length to allow squaring ends of boards after sawing. A log exactly 10 feet long, with no trimming allowance, would be scaled as a 9 foot log. Diameter is measured to the nearest full inch, inside bark, at the small end. Since logs are seldom perfectly round 2 measurements are made at right angles to each other and averaged. For example, one measurement might show 16 inches and the second 16 $\frac{3}{4}$ inches. The average would be 16 $\frac{3}{8}$ which would be given the scale for a 16 inch diameter log.

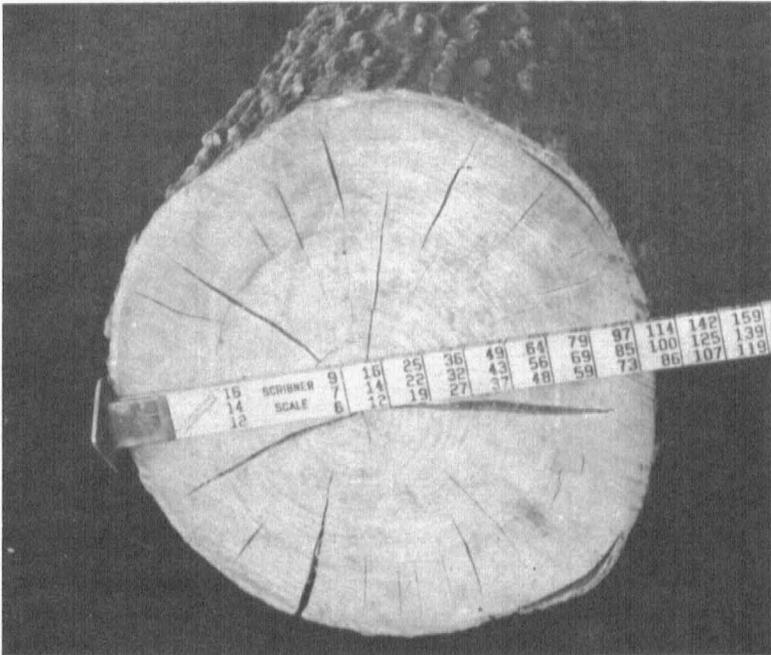


Fig. 8.—Log scale stick in use. If the log were 16 feet long its board foot volume would be 97 feet; if 14 feet, 85 ft. b.m.; if 12 feet, 73 ft. b.m.

Log scale sticks are convenient since actual board foot contents of various sizes of logs can be read directly. However, for a few logs, a long pole, marked in even foot lengths, and a yardstick will be just as satisfactory. Board foot contents of each log can be

read from a printed log rule, and the number and contents recorded in a notebook and marked on the small end of the log with lumber crayon. Different species should be recorded separately.

Deducting for Defect.—Any defect which reduces the sound, usable content of logs must be deducted from the sound scale. Defects include heart rot, deep surface butt rot or injury, rotten sapwood, ring shake, crook or cracks. Sound knots, twisted grain or stain are not defects, although they may cause a reduction in log grade. Defect must be measured or estimated in board feet and this figure deducted from the gross scale of each unsound log.

Scale book records.—Scale records should be kept in a notebook under headings as shown below:

Log No.	Diam. (Inches)	Species Length (Feet)	Scale (bd.-ft.)	Defect (bd. ft.)	Net Scale
1					
2					
3					

Marking Trees to be Cut

The forest owner should select each tree to be cut and mark it accordingly before the cutting crew enters the woods. No other person is sufficiently interested in future timber crops to be allowed to mark trees. Trees to be cut may be marked by blazing with an axe or by "spotting" with paint. Usually two marks are made on each tree, one at breast height, and one about 6 inches above



Fig. 9.—Improvement cutting in a young stand removes dead, defective, and inferior trees from the woodlot and furnishes fuelwood and posts. Such long lengths will be cut later to suitable stove lengths on a buzz saw.—Courtesy Soil Conservation Service.

ground. This leaves a mark on both stump and butt log, and prevents cutting of unmarked trees. A light single bladed axe, with a raised design or initials on the head, is best, since this design is stamped in each blaze and cannot easily be counterfeited. All marks should face in the same direction so they may be readily recognized by the felling crews.

Marking rules.—All mature trees, ready for cutting and suitable for sale, should be marked. Overmature trees should also be marked for felling, even though they may be highly defective. Each cutting should be planned to improve the stand. Inferior trees, even though small and unmerchantable, should be marked with the merchantable trees, if the logging crew will agree to fell them. If such arrangements cannot be made on a satisfactory basis, then an improvement cutting should be made following the main harvest, to clean the stands of undesirable immature trees and insure a second crop of high quality. Marking to a definite diameter limit is not satisfactory since in many cases thrifty, fast growing trees large enough for sawlogs should be reserved, and many smaller trees, defective in butt or top, should be removed. Marking should be heavier in dense stands than in light. In general, if stands are well stocked a volume equal to the growth since the last cutting should be marked for harvest.

Transportation of Logs

Logs are extremely bulky and heavy in relation to their value and transportation problems and costs become an important item in marketing. A saving of money and shipping space is obtained when the rough logs can be cut into the finished product at or near the woodlot.

For short hauls within the woodlot area, a team of heavy draft horses skidding the logs is most satisfactory. In some cases it is possible to do satisfactory skidding with the farm tractor. More damage to saplings and seedling reproduction is likely to result from tractor use, though it may be faster under certain conditions.

Most farm wagons are not built to withstand heavy loads over rough ground and are seldom practical for hauling many large logs. The use of a wagon will depend on its sturdiness, the size of logs or bolts, and the type of road. Flat bed trucks, preferably with dual wheels are the most satisfactory device for hauling logs and bolts to the mill or loading point, especially if the distance is a matter of miles. The size of truck is dependent upon the size of logs and their weights.

Tables A and B (see Appendix) give the weights of different species of wood in terms of the units of measure for different products, and are helpful in estimating transportation costs. Because of the variation in weight and volume, it is often desirable to know how much of any product can be shipped in a railroad car. Table

D gives the capacity of railroad car in terms of the more common woodlot products.

Sawmills

Small portable sawmills can be operated by two or three men and can saw from one to two thousand board feet of lumber daily. Such mills skillfully operated are capable of producing high grade rough lumber. They are moderate in cost when compared with other farm machinery and are reported to have a long useful life.



Fig. 10.—A portable sawmill with steam power unit. The mill is located so that logs can be easily rolled onto the carriage.—Courtesy A. B. Meyer.

A small mill requires a rigid foundation or base if the lumber is to be square and uniform. If the mill is located on a slight slope, gravity can be well employed in the movement of logs and lumber, thus reducing the labor. Shed protection to keep out sun and rain is an economy over a long time for the life of the outfit is greatly reduced by exposure and rust.

Power commonly used on these small mills is obtained from an old automobile engine equipped with a special power take-off and governor to maintain the speed during heavy loads. This power is bolted to a framework and is more or less stationary. Another source may be the farm tractor. Sawing is done when other farm work is not pressing and there need be no conflicting uses for the tractor. If the tractor is light weight and mounted on rubber tires, special bracing of the tractor may be necessary to prevent creeping

and excessive belt slippage and wear. A minimum of 12 or 15 brake horsepower is required, and for larger mills cutting many big logs up to 40 horsepower is recommended.

Small sawmill ownership, like other farm machinery, should depend upon the amount of work available for it. Occasionally it will be found profitable for the individual farmer who has a large woodlot of high quality trees to own and operate his own sawmill. Cost must include yearly depreciation, interest, repairs, housing, taxes, and insurance as well as the operating costs of gasoline, oil, and grease. If an economy is not to be realized after considering all of these costs plus a reasonable charge for labor, the purchase and operation of a small sawmill is not advisable.

The cooperative ownership of a sawmill has much to recommend it. Here the costs of a mill are divided among the several part-owners. Where one farmer does not have enough sawlogs to justify the expense of his own mill, a group of cooperative farmers each with his own small woodlot can make a sawmill pay dividends. The more lumber cut annually, the lower the cost per thousand feet board measure. Cheap lumber for farm use should be the first objective of such organization. Surplus lumber of the sizes and quality in demand may sell for enough to pay all the lumbering operation costs and create a cash reserve.

In advance of sawing for sale, it is well to determine the market requirements for material of certain species and sizes. Investigate first and then proceed to cut. This applies equally to cutting up logs in the woods and running the logs through the sawmill. Waste, with consequent reduction in profits, results from failure to locate the market before beginning to harvest the crop. There is always plenty of time to investigate possible markets. Timber, it must be remembered, is essentially different from field crops in one respect—there is seldom any necessity for quick harvesting.

Some small mills can be made truly portable and moved from one woodlot to the next. The net value of the sawed lumber is increased through reduced log transportation costs. Attachments for making shingles and siding are available for most of these mills. Edgers and planing mills for finishing lumber produced by portable saw-mills increase the sale value of the products.

Care of Green Lumber After Sawing

Whether lumber is to be sold or kept for use on the farm, it should be properly cared for after sawing. If not carefully dried it will decrease in grade and value.

1. Green lumber should be stacked off the ground using stickers between each layer of boards.

2. All stickers should be the same thickness. 1-inch edgings are satisfactory. Those at the ends of boards should be 3 to 4 inches wide and extend over the ends of boards to reduce checking.

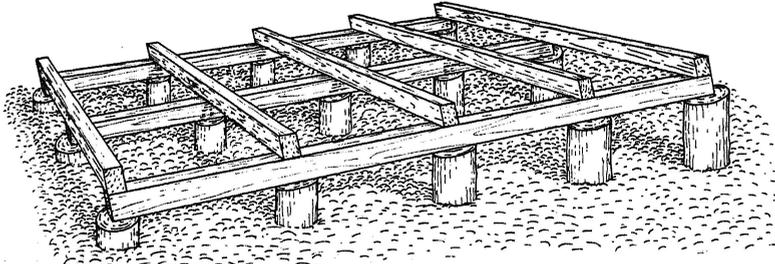


Fig. 11a.—A solid foundation for the green lumber during the drying period is made of logs and 4"x6" timbers sloping 1 inch per foot so the lumber will shed water.

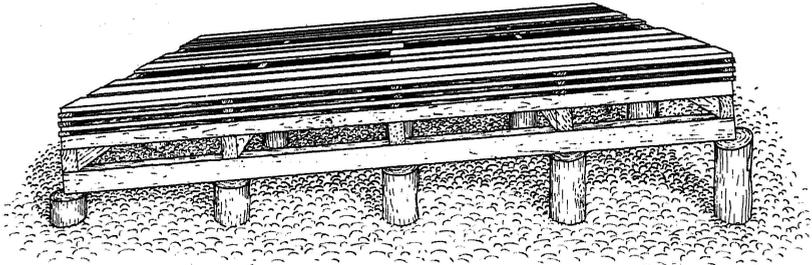


Fig. 11b.—Short lengths of boards may be worked into the pile at random. Two inches between the boards permit the air to circulate freely.

3. Stickers should be not over 3 feet apart and placed directly above each other.

4. Lumber of the same thickness and approximately the same length should be piled in one stack if possible.

5. Locate lumber piles where there is good air circulation.

6. Keep the area around piles free from weeds, brush and other debris such as edgings and bark. This will allow better air circulation, remove conditions favorable to decay, and reduce the fire hazard.

7. Cover the piles. Edgings and scrap pieces are suitable for this purpose.

8. After air dried for 6 to 8 months, lumber piled in a dry building is practically free of deterioration.

9. Fence posts which are dry and are not to be used for sometime should be stored under cover off the ground. Remove bark before storing.

10. Lumber which has started to decay should not be stored with sound lumber.

11. Keep a supply of well seasoned lumber on hand for use on the farm.

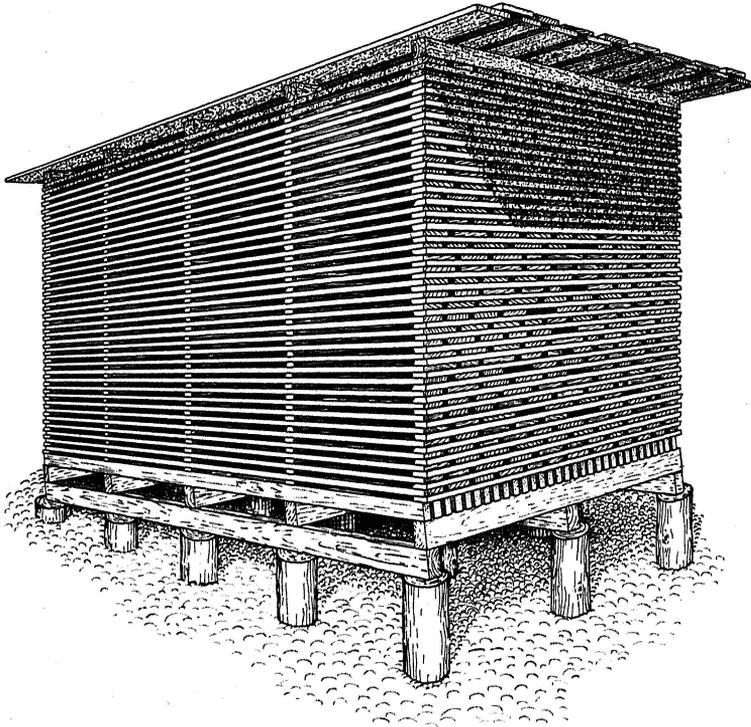


Fig. 11c.—Correct method of piling green lumber for seasoning. Better circulation of air could be obtained by keeping all boards of the same width directly above the one below, thus eliminating the staggered spaces. Two by fours can be placed on edge at the bottom of the pile. Slabs may be used for roofing.

Cooperative Marketing of Woodlot Products

Missouri farmers have found cooperative marketing of some of their produce a profitable venture, but the woodlot owners have not been availing themselves of the advantages of cooperative marketing of timber or its products. Marketing of woodlot products is detailed and complex and most farmers accept the first offer made to them rather than to investigate further. As is shown elsewhere in this publication, this generally proves costly if not disastrous to the welfare of the farmer and his woodlot.

The average farmer who has only a relatively small quantity of material to sell periodically is at a great disadvantage. His knowledge of forest products and their markets is unavoidably limited. He often produces so few logs to sell that it is impractical for him to ship great distances or search for the best markets, yet he cannot ignore their value. Thus he feels he must take whatever he can get without further questioning.

The advantages of farm forest cooperatives extend beyond simple marketing. A steady flow of wood products develops in the well managed cooperative. Cash receipts are regular for the grower, and a continuous and sure supply of raw material is furnished the manufacturer. The manager can devote his time to studying markets and market requirements, and make suggestions to the grower for improving his woods and satisfying industries wants. Many different sizes and species are bought for special uses. It is the duty of the cooperative to find markets which can most efficiently utilize the material its members are growing. The farmer with only one choice black cherry log, for example, must saw it into lumber along with other logs. A dozen similar choice logs from as many different woodlots can be sent to a distant manufacturer at a price many times their lumber value.



Fig. 12.—A wasteful mine prop operation. Note the high stumps. Small trees if let grow for a few more years will produce poles and piling worth much more than mine props.—Courtesy Extension Forester.

The cooperative can fill large orders from wood manufacturers. Whereas the single wood grower is unknown, the progressive cooperative is well advertised. The lone shipper of logs or wood products finds transportation costs disproportionately high because of his small orders. Transportation costs per unit decline as the quantity increases; thus the net profits are greater on large, cooperatively shipped orders.

As the needs of the cooperative develop, manufacturing and wood-treating plants can be established. The farther the marketed product is along the manufacturing line, the greater will be the sale value and the income to the members of the organization. The advance-

ment of the cooperative into manufacturing will be limited chiefly by the ingenuity, progressiveness, and farsightedness of its members.

The organization of the cooperative is dependent upon the purpose and function for which it is formed. The simplest form is assumed when two or more farmers merely group their logs for shipping in order to reduce costs. Or, if a definite market for a certain quantity of a particular class of woods is known, a temporary cooperative agreement may be drawn up among the woodlot owners of the community. The order is filled and each member receives his proportionate share of the revenue, based upon the value of the logs he contributed. The cooperative may then be dissolved.

Missouri has two laws providing especially for the incorporation of cooperative associations. These, the Capital Stock Act of 1919 and the Non-Stock, Non-Profit Act of 1923, or general business corporation laws of the State can be used as a basis for the founding of permanent cooperatives. The permanent organization should be the goal of all cooperatives as a means of increasing the annual profits from the woodlot.

Another possibility of cooperation lies in existing organized cooperatives. Most such organizations deal in a wide variety of farm produce and the buying and selling of woodlot products could not only be added to the present list of commodities, but would benefit both its members and the industry at large.

Forest Products

The following list of forest products gives the more common uses made of timber in its various forms in Missouri.

After a careful study of this list the woodlot owner should be able to determine the products for which the material in his woodlot is best suited. These specifications are general. Before cutting material for any of these products he should get the exact requirements from the company which is in the market for the product.

If the material in the woodlot will meet specifications for several products, determine before cutting which product will bring the highest returns.

For a list of possible markets for wood products write the Extension Forester, University of Missouri, Columbia, Missouri.

Cooperage.—Cooperage may be classed as tight cooperage, such as barrels and casks for holding liquids, and slack cooperage, such as potato, sugar, and vegetable barrels.

Tight Cooperage.—Species used for staves: White oak and bur oak primarily and a small amount of post oak. Bourbon barrels require staves free from defects, and specifications for bolts are about as follows: "Straight, free from knots, rot, twisted grained, freshly cut from living trees". Most bourbon stave bolts are cut 39 inches long and are usually quartered. Before splitting the bolt should be at least 15 inches in diameter. This product requires

the highest quality material. Staves not meeting the bourbon standard are known as oil staves used for making barrels for vinegar, meat, and oil. White ash and red oak are used to some extent for this type of stave. Heading bolts have the same specifications except length.

To estimate the number of chord feet of 39-inch tight cooperage staves in a standing tree, the height of the tree is measured from stump height (1 to 1½ feet above ground) to a point on the trunk approximately 12 inches in diameter or to the first limbs or defect on the tree. Diameter is measured at a point 4½ feet above ground (D), and at the merchantable top (d). These two diameters are added together and divided by 2 to give the average diameter. This average diameter in inches is multiplied by the merchantable height in feet (ht.), and this result is multiplied by 0.072 to find the number of stave feet. Formula: $\frac{D + d}{2} \times \text{ht.} \times 0.072$.

Example: A tree measures 18 inches at a point 4½ feet above ground, its merchantable height is 33 feet to a 12 inch top. $\frac{18 + 12}{2} \times 33 \times 0.072 = 35.6$ chord feet of 39 inch stave bolts in the tree.

This formula is not 100 per cent correct and should be used to get an estimate only, rather than exact contents.

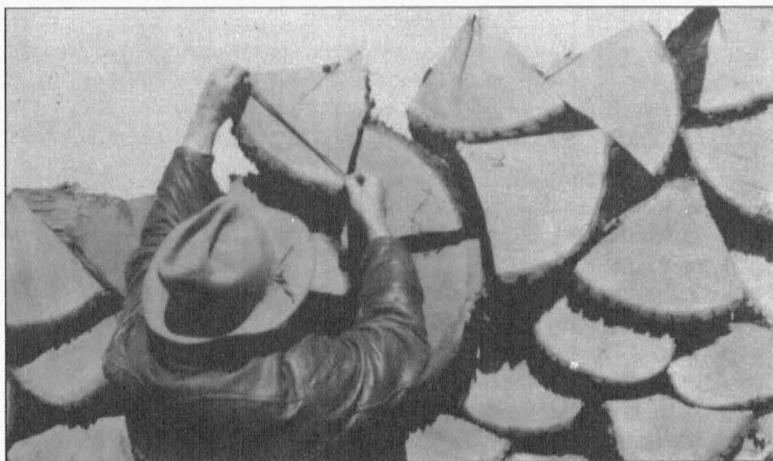


Fig. 13.—Measuring white oak stave bolts. Note that the sapwood is not scaled. This bolt, measuring 15 inches contains 1¼ chord feet. Bolts free of all defects bring the highest price.—Mill at Gainesville, Ozark County, Mo.

Slack Cooperage.—Species used: Red oak, elm, cottonwood, gum, maple, hackberry, sycamore, and others.

Specifications for bolts: Bolts are 10 inches in diameter and up, 32 inches long, freshly cut from living trees, not split, straight, free from rot, crook, and twisted grain.

Handles.—Species used: Hickory, white ash, white oak, and to a limited extent, sugar maple. Broom and similar low quality handles are being made to some extent from oak edgings from sawmills. Pignut hickory is not used.

Handle bolts are usually bought by the cord or rank when the length used is under 5 feet. When selling this material, be sure to ascertain whether the buyer is dealing in a standard cord, short or long cord. Some purchasers buying 40 inch bolts speak of a cord as 4 feet high, 8 feet long, and 40 inches wide; some 4' x 10' x 40"; others using 54 inch bolts speak of a cord as 4' x 8' x 54".

Handle stock bought in lengths 6 feet and over is usually bought by log scale; the Doyle rule being the log rule most commonly used in this section. Some mills buy bolts by the inch diameter of small end. Thus, if they are paying three cents per inch, an 18 inch bolt (small end) is worth 3 x 18 or 54c.

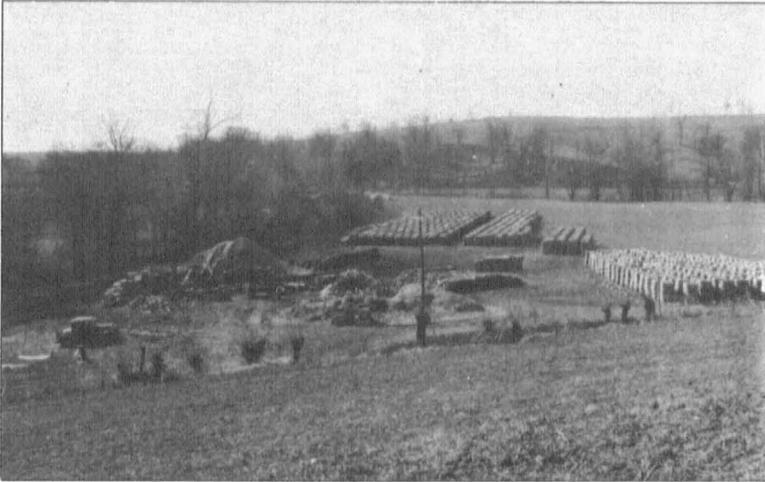


Fig. 14.—Small portable stave mill with cut staves stacked for drying.—Courtesy Extension Forester.

Bolts with hollow centers may be purchased by the handle, the price depending upon the number of clear 4" x 4" squares the bolt contains.

Bolts may also be bought by face foot. To determine the amount by this method the length of rank in feet is multiplied by height in feet to find the number of face feet in the rank.

Handle bolts cut in the spring should be delivered immediately after cutting to prevent sap stain and worm attack.

Specifications: Handle stock must be cut from live trees, be straight, free from knots, crook, twisted grain, and other defect. One or two small knots or small center rot is allowable in larger diameter pieces of otherwise good quality. Diameter must be 8 inches or over at the small end.

Shredded Wood.—This material is similar to shingle toe or excelsior and is used to a limited extent for packing trees and seedlings in nurseries for shipment. Soft woods with long fibers such as cottonwood, elm, soft maple, and willow are used for its manufacture. Pieces 4 feet long and 4 to 8 inches in diameter are used. Pieces above 8 inches are split. If near a nursery and an available supply of suitable woods the manufacture of this material may prove profitable as a side line.



Fig. 15.—High grade hickory handle bolts in front contain only a small amount of heart or red wood. Bolts in rear are low grade but can be used if there is 4 inches of sound white wood outside of defective center.

Sawdust.—Clean white oak sawdust is used extensively in the manufacture of certain brick. Sawdust from mixed species is now being used to a limited extent. Most sawdust for this use has come from stave mills.

Dry sawdust is used to a large extent in meat packing plants and large refrigeration plants.

The value of sawdust at the mill is very low, but if trucks are available they may be used profitably during slack periods for the delivery of this material.

Shingles.—There are two common types of wood shingles. Shakes, usually 32 to 36 inches long, either cut on a machine or hand split; and common sawed shingles 16 to 24 inches long.

Species used: The only species in this state available for shingle manufacture are pine, oak and to a limited extent cedar and cypress. Oak shingles and shakes, while harder to dry and lay, give good results when on the roof.

Billets used for making shingles should be straight, free from rot, shake, twisted grain, and have no knots within 4½ inches from either end. Knots between these points will be covered when laid.

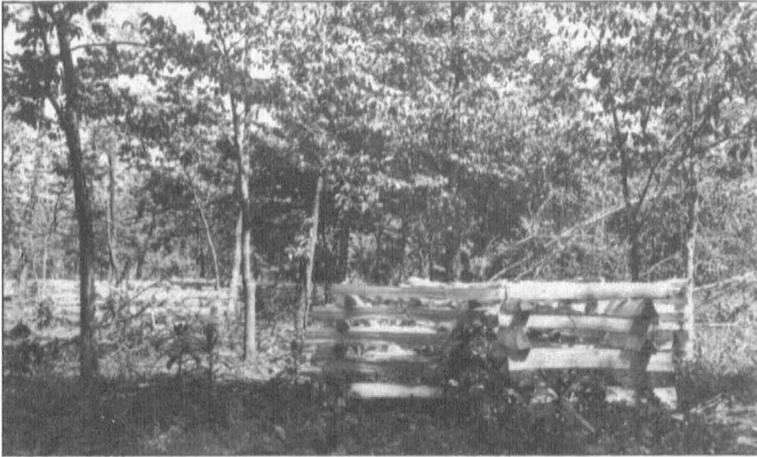


Fig. 16.—Cottonwood pulpwood bolts piled for rapid drying. Low stump shows good woods practice and allows trucks to be driven into the woods. A well stocked stand remains and another cutting can be made in a few years.

Shingles may be made on a shingle mill or both shingles and shakes may be made on some types of sawmill headsaws by using a special attachment. There is very little if any material in this state suitable for making shingles on a large commercial scale, but they can be made for home use and local sale.

Pulpwood.—This material is used for making paper. Recently the market for pulpwood has been extended to the eastern part of Missouri.

Species: Cottonwood, box elder, willow, and soft maple.

Specifications: Bolts 5 feet long and 4 inches minimum diameter are cut with a saw. Pieces over 10 inches are split so that no diameter is over 9 inches. They must be free of rot and excessive crook, and knots must be cut close to the stem. They should be air dried 60 to 90 days and the weight per 5 foot cord (4' x 8' x 5') should not exceed 3400 pounds at the time of shipping.

All wood must be sap peeled; that is, all bark including inner bark must be removed. Cottonwood will peel from approximately March 15 to September 1 or later. The other three species will peel for a slightly shorter period. For easiest peeling the wood should

be peeled as soon as the tree is felled. The trees may be felled, trimmed, peeled, and left to dry; and then bucked up during slack periods even several months later. Trees left this way should be raised off the ground to hasten drying and to prevent decay.

On a sawlog operation much of the top, otherwise wasted, can be peeled and used for pulpwood. On lowlands subjected to flooding and not suitable for cultivation or pasture, the above species, especially cottonwood, may be profitably raised for this purpose.



Fig. 17.—Cedar fence posts. Those with a large band of white or sapwood are not so durable as those with a narrow band. The pile should be off the ground to hasten drying and prevent decay.

Fence Posts.—A recent Soil Conservation Service survey shows that the average Missouri farm (excluding the Ozark region) uses over 100 posts per year. One of the first uses of a farm woodlot is to supply the farm with fence posts.

Species: Osage orange, black locust, red cedar, catalpa, mulberry, sassafras, and white oak are durable woods and may be used without any preservative treatment. Preservative treatment makes possible the economic use of less durable wood.

Specifications: The size of wood posts varies considerably with the strength and durability of the wood. Line posts of osage orange are sometimes as small as 2½ inches top diameter. With other woods, line posts are commonly 4, 5, or 6 inches, and corner posts and gate posts 8 to 12 inches. The least dimension for split posts is usually not less than 5 inches.

Posts generally are set 2½ feet into the ground (unless driven) and extend about 6 inches above the top wire. The overall length

then depends upon the height of the fence wire. Line posts are usually 7, 7½, or 8 feet, while gate and brace posts may be from 1 to 3 feet longer.

Poles.—Small poles 2 to 3 inches in diameter which can be obtained from thinnings can be used for many purposes on the farm. They may be used for temporary structures such as corn cribs, feeding troughs, corrals, fencing, etc. If stored off the ground under cover they will remain sound for several years. By using such material better material can be saved for sale or other uses. The use of any such material shows a saving since it has little or no sale value and replaces lumber of higher value.



Fig. 18.—Railroad ties in a tie yard along a railroad track. Over one million ties are made in Missouri each year.

Christmas Trees.—The use of Christmas trees, evergreen festoons for home and street decorations, and wreaths and sprays of natural foliage has been increasing every year. At present most of the trees and greenery used in Missouri are shipped in from other states. In some sections of the country the growing of Christmas trees from seed or seedlings has developed into a profitable business.

Mine Timbers.—Practically all coal mines require lumber and timber in several forms for such uses as tipples and chutes, props, ties, wooden rails, capping, lagging, etc.

The more durable species are best suited for this use but many of the small mines use most any species.

Wood rails are usually made from oak poles 3 to 4 inches in diameter, 8 to 12 feet long, and smoothed on opposite sides by hewing or sawing.

Props vary greatly in diameter and length depending on the part of the mine in which they will be used. Some are as short as 2½

to 3 feet. Most props shipped to larger mines are 4 to 5 inches in diameter and 7 to 9 feet long.

Props must be cut from living trees and must be free from rot, crook, and knots which will weaken the stick. They may be round or split. Usually the shorter props are bought by the cord, while longer lengths are bought by the piece.

Mine Ties.—Specifications for the larger mines: Any species of oak sawed or hewn on two sides. Outside use, 5" x 6" x 6' and 5" x 7" x 6'; room ties, 3" x 4" x 5½'.

Mine ties and props for shipment to larger mines are usually bought by the piece at a railroad.



Fig. 19.—Portable sawmills such as this are common in the wooded areas of Missouri. If properly set up and operated, such mills are capable of producing high grade rough lumber. Most lumber produced on these mills is used for general farm construction.—Courtesy Soil Conservation Service.

Fuel Wood.—Usually sold by the standard cord or by the rick or short cord. In a few sections cord wood is sold by weight, in which case 4200 pounds equals a standard cord for green oak or hickory.

The following are the most common specifications for the best grades of fuel wood for town and city markets and will bring the highest price: Oak and hickory, free from rot and dirt, air dried 4 to 6 months, 4-foot lengths, free from crook and large knots, 4 to 6 inches in diameter. Pieces over 6 inches in diameter to be split. For home use top wood and limbs are suitable. All fuelwood should be thoroughly air-dried before using.

The heat value of wood varies with the weight of dry wood. In general the heavier the dry wood, the greater the heat value. Roughly speaking, a cord of good fuel wood possesses about the same heating value as one ton of hard coal.

There is a fairly active demand for good fuel wood, especially for fireplace use. Near cities and larger towns it may be worthwhile to serve home owners with this type of fuel. Orders ought to be taken early enough so the wood can be properly seasoned before delivery.

Railroad Ties.—Most railroad ties in this State are bought by tie companies who in turn sell them to railroad companies. The tie companies have yards centrally located where their agents buy ties and many also have sawmills located throughout the State which buy timber and saw the ties.

Logs for ties are usually bought by the tie cut (a log that will make one tie) or in some cases by the board foot.

Specifications for ties vary but the most common are listed below. Ties may be square sawed or hewn. If hewn the bark must be removed from the sides. For hewn ties, the second dimension below refers to the hewn face.

- No. 1. 6" x 6" x 8'
- No. 2. 6" x 7" x 8'
- No. 3. 6" x 8" x 8'
- No. 4. 7" x 8" x 8½'
- No. 5. 7" x 9" x 8½'

The table below gives the amount of lumber in 1-inch boards in addition to one tie that can be cut from logs of various diameters at the small end.

APPROXIMATE NUMBER OF BOARD FEET OF LUMBER IN ADDITION TO ONE TIE, OF GRADE SHOWN, THAT CAN BE CUT FROM LOGS OF VARIOUS DIAMETERS.

Diameter small end (inches)	No. 1 Tie Bd. Ft.	No. 2 Tie Bd. Ft.	No. 3 Tie Bd. Ft.	No. 4 Tie Bd. Ft.	No. 5 Tie Bd. Ft.
12	10	5	0	0	0
14	25	20	15	10	5
16	45	40	35	30	25
18	65	60	55	50	45
20	90	85	80	75	70

Example: An 18-inch log will cut one No. 1 tie and 65 board feet of lumber or one No. 5 tie and 45 board feet of lumber.

With good equipment and proper sawing the above amounts of lumber can be increased.

Saw Timber.—Trees to be cut for sawlogs should be 15 inches and over at breast height (4½ feet above ground) and should be free of large limbs at least 16 feet from stump height. Cut the stump as close to the ground as possible as the best lumber is in the butt log.

Sawlogs are usually cut in even lengths from 8 to 16 feet, except for special uses. Logs should be cut 2 to 4 inches longer to allow for squaring the lumber. Sawlogs are bought and sold by the thousand board feet.



Fig. 20.—Charcoal wood and brick charcoal kiln with about 50 cords of wood capacity. Specifications for charcoal wood are very low and most wood unsuitable for other uses can be converted to charcoal.

Many mills buy logs by grade, the grade depending on diameter, length, defects such as knots, heart rot, fire scars, shake, worm holes, etc.

Charcoal.—Most species of hardwoods can be used for charcoal. Pieces from 2 to 6 inches in diameter are used round while larger pieces are split. The length should be 4 or 4½ feet. Both dead and green wood produce good charcoal, but the bolts must be sound.

Veneer Logs.—Species: Walnut, white oak, red gum, sycamore, soft maple, cottonwood, and elm.

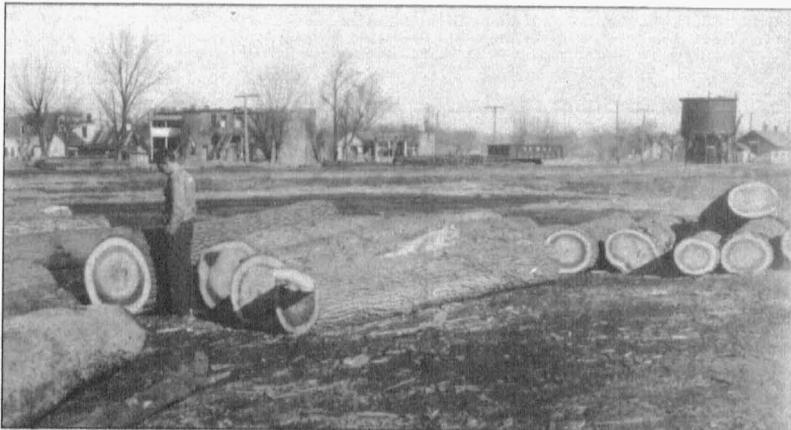


Fig. 21.—Cottonwood veneer logs to be used for making egg crate veneer. Sycamore and elm are also used. The largest log in the picture contains over 500 board feet. This is the proper use for logs of this size and quality.—Courtesy Missouri Veneer Company.

The first three species are usually used for furniture veneer and the remainder chiefly for basket and box stock.

Furniture veneer logs are of highest grade. Specifications vary greatly, depending on uses and the company buying them. Most specifications call for logs to be 14 inches and over in diameter and 8 feet or longer in length. Only the best grade logs can be sold as veneer logs. Grading varies with different species and grading rules should be obtained before selling.

Walnut.—Walnut logs are sold by log scale the same as other species but because of its high value it will be treated separately. It is valuable as lumber and veneer stock because of its excellent qualities for the manufacture of furniture, gun stocks, and special uses.

There is usually a good market for walnut trees and logs. The price per thousand board feet for logs varies greatly with size and grade.

The following prices quoted for January, 1941 by a walnut buying concern in Missouri will show difference in prices due to size and grade:

PRIME BUTT CUTS CLEAR OF ALL DEFECTS		
Diameter (Inches)	Length (Feet)	Price per M Ft. b.m. Doyle Scale
12 - 13	6 - 7	\$30.00
14 - 15	6 - 7	40.00
12	8 - 13	50.00
12 - 13	14 and up	60.00
14 - 15	8 - 13	60.00
14 - 15	14 and up	70.00
16 - 17	8 - 13	90.00
16 - 17	14 and up	100.00
18 - 19	.....	125.00
24 and up	.....	200.00
No. 2 Logs		
12 - 13	.....	25.00
20 and up	.....	50.00
Culls	.....	10.00
Stumps	.....	20 to 30 cents per foot

Healthy growing walnut trees should be considered as an investment, and bids should be obtained from several buyers before a sale is made.

A farmer in north Missouri had several walnut trees for sale. His first offer was \$1.00 each. After getting several bids he finally received \$10.00 per tree. The time spent in getting information about other markets was well spent.

Another example which didn't turn out so well for the seller was the case of the farmer who sold a walnut tree for \$5.00. The buyer had the tree cut and hauled to his yard for \$4.50 where the tree was sold for over \$60.00.

Unless the owner knows how to cut walnut logs to get the highest grade as well as the largest volume, it may be to his advantage to sell the trees on the stump. Then after the tree is sold it may be possible to have the buyer mark where the cuts should be made

and he take the job of cutting into logs and trucking them to the mill.

Before selling it will pay to find out what similar trees have sold for in the community and consult some disinterested person who has a knowledge of the value of such material. The County Agricultural Agent or State Extension Forester can help in this matter.

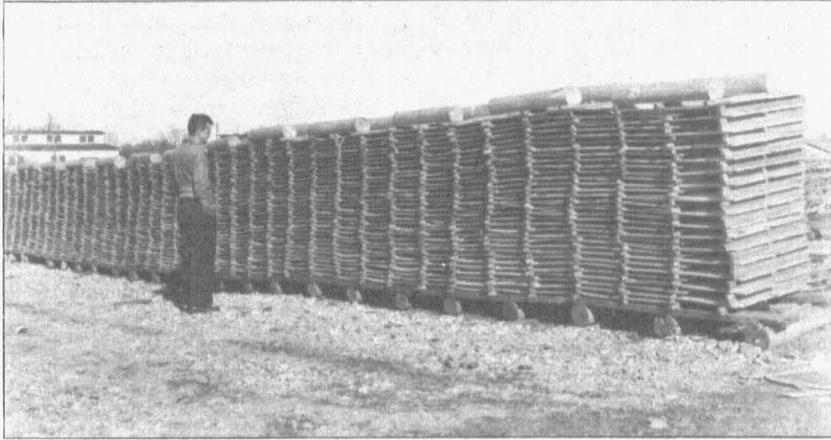


Fig. 22.—Method of drying egg crate veneer. Spacers between pieces of veneer allow for air circulation and reduce warping.—Courtesy Missouri Veneer Company.

American Walnut Manufacturing Association Specification for Walnut Logs

Prime Logs.—Butt logs only, freshly cut from live trees, sound, straight, and free from all defects and excessive sap. Logs to be 12 inches and larger at small end and run 8 feet or longer. Two-thirds of all logs 12 to 15 inches in diameter to be 10 feet and longer.

Select Logs.—a. Butt logs 16 inches and over, and 8 feet or longer; must have three clear faces; no unsound defects allowed.

b. Clear butt logs 6 or 7 feet long, 16 inches and larger.

c. Second cuts 16 inches and up, 8 feet and longer, clear of all defects.

d. Slight defect if otherwise prime.

On both prime and select logs 16 inches and larger, all sapwood in excess of $1\frac{1}{2}$ inches on each side of the heart shall be measured off in taking the diameter.

No. 2 Logs.—a. Logs 12 inches and up, 8 feet and longer; must run 65 per cent 10 feet and longer; must have two clear faces or better.

b. Clear butt logs 12 to 15 inches and 6 or 7 feet.

c. Any log 6 or 7 feet long, 16 inches and up, with three clear faces or better.

Culls.—All logs that will not meet the above specifications are cull logs.

Exceptions: Logs with ring shake, worm holes, bird peck, or ingrown bark have no classification.

Other Forest Products

Seed.—Several companies deal in tree and shrub seed and buy these seeds from individual collectors. At present there is considerable demand for seeds of shrubs suitable for game food and erosion control plantings. During good seed years the collection of seed may prove a profitable side line. Seeds must be collected at the proper time and properly dried and cared for or else they become worthless.

Food products.—Many of the native wild plants which are commonly found growing in Missouri woodlots are edible and nutritious. Some plants are pleasantly aromatic and when used wisely impart new and appetizing flavors to cooked foods. A few native herbs possess medicinal qualities, but their use should be limited to a doctor's prescription.

The common wild strawberries, blackberries, and dewberries are delicious fresh or canned as are many other wild fruits. If the woodlot is open and much of this fruit is available, it can almost always be sold at local markets. In some cases it may be profitable to plant berry producing shrubs and trees in the open areas adjoining the woodlot.

Walnuts, pecans, and hickory nuts usually find a ready market. Where hazel nuts are plentiful, they too can be sold. The kernels of all nuts when extracted bring a higher price when sold, but they must be treated with greater care and cleanliness.

Woodlots containing large sugar maple trees can produce some returns from maple sirup and sugar. The work necessary for this is done in the late winter before the busy season starts. There is always a broad demand for these products if they are clean and attractively marketed.

Marketable Wood Products by Counties

The following is an alphabetical list of counties showing Missouri woodland products used by manufacturers in the county at the time of writing. Markets for sawmill logs, railroad ties and tie logs exist in practically every county.

Where white oak can be found in suitable quantities, there is usually a stave mill which furnishes a market for stave bolts. Since these mills move so often the few markets shown for stave bolts may not be permanent.

1. AUDRAIN—Dry cherry, maple, and walnut lumber. Rough green cottonwood, elm, maple, willow, and oak lumber. Stave mill white oak sawdust.
2. BARRY—Hickory tool handle bolts. Stumpage.
3. BENTON—Walnut logs. Oak lumber. White oak stave bolts.
4. BOLLINGER—Mine timbers (oak props and ties). Logs. Stumpage.
5. BOONE—Lumber. Logs. Stave bolts. Hickory lumber. Osage orange bow wood.
6. BUCHANAN—Ash, elm, hackberry, and hickory bolts. Cottonwood, sycamore and maple logs. Cottonwood lumber. Walnut logs, stumps, and lumber.
7. BUTLER—Cottonwood, elm, hackberry, gum, sycamore, poplar, and water birch slack cooperage stave bolts. Hickory handle bolts and blanks, ash tool handle bolts and logs.
8. CALLAWAY—Cottonwood, elm and sycamore veneer logs. Stumpage.
9. CAMDEN—Stumpage. White oak stave bolts. Cedar lumber.
10. CAPE GIRARDEAU—Hickory logs. Logs and lumber of any species. White oak stave bolts.
11. CARTER—Hickory tool handle bolts and blanks, cedar and walnut lumber, white oak stave bolts.
12. CHRISTIAN—Cedar posts, railroad ties, lumber, and white oak stave bolts.
13. COLE—Walnut lumber. White oak stave bolts. Hickory handle bolts.
14. COOPER—Walnut logs and stumps.
15. CRAWFORD—White oak stave bolts, staves and heading. Charcoal cordwood.
16. DENT—White oak stave bolts. Pine lumber, logs and stumpage.
17. FRANKLIN—White oak stave and heading bolts, and white oak stumpage.
18. GASCONADE—White oak stave and heading bolts, and white oak stumpage.
19. GREENE—Walnut logs and lumber. Oak lumber. White oak stave and heading bolts.
20. GRUNDY—Walnut lumber.
21. IRON—Hickory tool handle bolts.
22. JACKSON—Walnut logs and stumps. Cottonwood lumber, logs and stumpage.
23. JASPER—Pine fence posts, poles, piling, oak bridge timbers.
24. JEFFERSON—Logs, white oak stave bolts, and pulpwood.
25. LACLEDE—White oak stave bolts. Oak logs and lumber.
26. LIVINGSTON—Walnut logs.
27. McDONALD—Stumpage, hickory handle bolts.
28. MARION—Walnut logs, white oak veneer logs. Cottonwood and sycamore logs.
29. MISSISSIPPI—Elm, sycamore, hackberry and gum slack cooperage stave bolts. Walnut, ash, hickory, elm, pecan, red and white oak bolts. Dry cottonwood and gum lumber.
30. MONTGOMERY—Cottonwood, soft maple, box elder and willow paper pulpwood.
31. MORGAN—White oak stave bolts. Bolts of any species of oak.
32. NEW MADRID—Slack cooperage stave bolts. Green and dry lumber any species. Logs and stumpage.
33. NEWTON—Sycamore, elm, cottonwood, and maple basket veneer logs and bolts.

34. OREGON—Hickory handle bolts.
35. OSAGE—Charcoal cordwood. White oak stave bolts.
36. OZARK—Cedar post. White oak stave bolts.
37. PEMISCOT—Slack cooperage stave bolts. Cottonwood and hardwood logs and lumber.
38. PERRY—Oak lumber. White oak stave bolts.
39. PIKE—Hickory and white oak handle bolts. Hickory poles 1½"-2½" diam., 4 ft. long. Cottonwood, elm, sycamore, hackberry, birch and maple basket veneer logs. Cottonwood, maple and box elder cordwood. Walnut logs.
40. PULASKI—Charcoal cordwood.
41. RAY—Mine props and ties.
42. REYNOLDS—Charcoal cordwood. Hickory handle bolts. White oak stave bolts, and tie logs.
43. RIPLEY—Hickory handle bolts.
44. ST. CHARLES—Paper pulpwood. White oak stave bolts.
45. ST. FRANCOIS—Oak lumber. Mine timbers.
46. ST. GENEVIEVE—White oak stave bolts, and pulpwood.
47. ST. LOUIS—(County and City)—Lumber all sizes and species. Veneer logs, barrel staves, slack and tight, pulpwood, and fuel wood.
48. SHANNON—White oak stave bolts, pine logs and lumber, oak lumber, white oak wagon hub stock.
49. STODDARD—Hickory and white oak handle bolts.
50. TANEY—Pine and cedar posts. Cedar lumber. Pine lumber. White oak heading bolts.
51. TEXAS—White oak stave bolts. Furniture lumber.
52. WASHINGTON—White oak stave bolts. Hickory handle bolts.
53. WARREN—Cottonwood logs and stumpage, maple and hickory bolts, and white oak stave bolts.
54. WAYNE—Hickory handle bolts. Mine props and ties.
55. WEBSTER—White oak stave bolts.
56. WRIGHT—White oak stave bolts.

Summary of Marketing Problems

The following items cover the problems most frequently met by the woodlot owner in Missouri. They are fundamental rules for the profitable marketing of woodlot products and are addressed to the owner who may already have met these problems or is certain to meet them as his woods grow in size and value.

1. Be certain you have something to sell. You have nothing to sell if by so doing you will have to buy similar timber products for farm use now or later.

2. Know what you have to sell. A few hours of careful inventory is certain to be time well spent.

3. Sell standing timber and logs by scale. Do not sell standing timber by the tract unless you have had an accurate estimate made by a reliable person.

4. Secure bids from several reliable sources before selling any forest products.
5. Have a contract properly drawn up before selling standing timber.
6. Sell or use material for highest use. Don't sell or use for fence posts a white oak log suitable for veneer or high grade lumber.
7. Don't sell small trees for lumber. A 10-inch tree with one 16-foot log is worth only about 18 cents when stumpage is \$5.00 per M bd. ft. by the Doyle Scale.
8. Keep a reserve growing stock of the best trees. They increase in value faster than low quality trees.
9. Study the possibilities of cooperative marketing of your woodlot products.
10. Treat your woodlot as a part of the farm which can produce a continuous supply of farm timber needs and not as an area to be cut over, burned and left in an unproductive condition.
11. Don't buy coal and let fuelwood rot in the woods.
12. Contact or write the Extension Forester, University of Missouri, Columbia, Missouri, about woodlot problems. He is in a position to give information and help, and furnish a list of possible markets for wood products.

Appendix

Table A

APPROXIMATE WEIGHT PER STANDARD CORD (4' x 4' x 8') OF
SEVERAL OF THE MORE COMMON WOODS BY DIAMETER CLASSES FOR GREEN
AND AIR DRY (12% MOISTURE) WOOD *

Species	Diam. Class 2" - 4"		Diam. Class 4" - 8"		Diam. Class 8" - 12"		Diam. Class 12" - 16"	
	Green - Dry		Green - Dry		Green - Dry		Green - Dry	
Cottonwood	3200	1700	3450	1800	3700	1900	3900	2050
E. Red Cedar	2600	2300	2800	2500	2950	2650	3150	2800
Sycamore	3650	2400	3900	2550	4150	2700	4400	2900
Soft Maple	3500	2650	3750	2850	4000	3050	4250	3250
Ash	3300	2900	3600	3100	3750	3300	4100	3500
Hard Maple	3900	3100	4200	3300	4500	3500	4750	3750
Birch	4000	3100	4300	3300	4600	3550	4850	3750
Red Oak	4500	3100	4800	3300	5100	3500	5450	3750
White Oak	4400	3300	4750	3550	5050	3750	5350	4000
Bl. Locust	4050	3350	4350	3600	4650	3850	4950	4100
Hickory	4400	3600	4750	3800	5000	4100	5400	4350

* Diameter class 2" - 4" based on 70 cu. ft. per cord; 4" - 8" - 75 cu. ft.;
8" - 12" - 80 cu. ft.; 12" - 16" - 85 cu. ft.

Table B

APPROXIMATE WEIGHT PER 1000 BD. FT. OF GREEN LOGS
BY DOYLE SCALE

Species	11"-16"	16"-20"	20"-28"
Poplar	8700	6000	5200
Basswood	9600	6500	5700
Black cherry	10400	7500	6300
Shortleaf pine	10500	7300	6000
Red gum	10500	7500	6200
Cottonwood	10600	7500	6200
Ash	11000	7600	6700
American elm	11200	8000	6600
Cypress	11700	8300	7000
Red maple	12000	8300	7000
Black walnut	12000	8400	7000
Sycamore	12000	8500	7000
Slippery elm	12500	8700	7500
Sugar maple	13000	9000	7500
Black locust	13500	9400	8000
White oak	14500	10000	8400
Hickory	14600	10400	8600
Red oak	14900	10300	8700

Note - For logs below 10" in diameter, add about 10% to weight of logs in 11"-16" class.

For logs over 16' in length, add about 10% to weights given above.

For logs that have been cut and dried for a period of 4-6 months, subtract 20-25%.

No accurate figures can be determined for weight of logs or cord wood since weight varies with diameter of log, length, species, length of time cut, and several other factors. Use these figures as an estimate only.

Table C

APPROXIMATE NUMBER OF LOGS PER 1000 BD. FT. DOYLE SCALE *

Diameter of Log in Inches	Length of Logs in Feet							
	6	8	10	12	14	16	18	20
8	166	125	100	83	71	62	55	50
9	111	77	62	53	45	40	36	32
10	71	55	43	39	31	27	24	22
11	55	40	32	27	23	20	18	16
12	41	31	25	21	18	16	14	13
14	34	20	16	14	11	10	9	8
16	19	14	11	9	8	7	6 1/4	5 1/2
18	13 3/4	10 1/4	8 1/4	7	5 3/4	5	4 1/2	4
20	10 1/2	8	6 1/4	5 1/4	4 1/2	4	3 1/2	3
22	8 3/4	6 1/4	5	4	3 1/2	3	2 3/4	2 1/2
24	6 3/4	5	4	3 1/4	2 3/4	2 1/2	2 1/4	2
26	5 1/2	4 1/4	3 1/4	2 3/4	2 1/2	2	1 3/4	1 3/4
28	4 3/4	3 1/2	2 3/4	2 1/4	2	1 3/4	1 1/2	1 1/2
30	4	3	2 1/2	2	1 3/4	1 1/2	1 1/4	1 1/4
32	3 1/4	2 1/2	2	1 3/4	1 1/2	1 1/4	1 1/4	1
34	3	2 1/4	1 3/4	1 1/2	1 1/4	1	1	1

* To nearest 1/4 log - Not accurate enough to be used for scaling or measuring logs for sale.

Table D

APPROXIMATE VOLUME OF DIFFERENT FOREST PRODUCTS
THAT CAN BE SHIPPED IN A 60,000 POUND CAPACITY
RAILROAD CAR

LUMBER

Rough	bd. ft. 15,000-18,000
Surfaced	" " 17,000-21,000

LOGS

Large (Log scale)	" " 5,000- 7,000
Small	" " 4,000- 5,000

TIGHT COOPERAGE

staves 1300-1500

CORDWOOD (4' lengths)

cords 15-18

POLES (piling)

pieces 25-40

TIES (7"x9"x8 1/2')
(6"x8"x8')" 300
" 350

MINE TIES (5"x6"x5 1/2')

" 1050

POSTS (4" top 7' long)
(6" " 8' ")" 800
" 500

SAWDUST

tons 12-18

Table E

APPROXIMATE NUMBER OF TREES OF VARIOUS DIAMETERS
REQUIRED TO PRODUCE 1 CORD OF WOOD

<u>Diam. of Tree in Inches</u> <u>4 1/2' above ground</u>	<u>No. Trees Required to Yield</u> <u>1 Cord of Wood*</u>	
	<u>Hardwoods</u>	<u>Pine</u>
5	35	
6	20	
7	15	20
8	11	13
9	8	10
10	6	8
11	5	7
12	4	6
13	3.5	4.5
14	3	3.7
15	2.5	3.0
16	2	2.5
17	1.7	2.1
18	1.5	1.9
19	1.3	1.6
20	1.2	1.5
21	1.0	1.4
22	.9	1.2
23	.8	1.1
24	.7	1.0

* Assumes all wood in tree and branches to a 3" diam. is used.

Table F

THE INTERNATIONAL LOG RULE
(Saw Kerf 1/4 inch)

Diameter* (inches)	Length of Log in Feet						
	8	10	12	14	16	18	20
	Contents (board feet)						
6	10	10	15	15	20	25	25
7	10	15	20	25	30	35	40
8	15	20	25	35	40	45	50
9	20	30	35	45	50	60	70
10	30	35	45	55	65	75	85
11	35	45	55	70	80	95	105
12	45	55	70	85	95	110	125
13	55	70	85	100	115	135	150
14	65	80	100	115	135	155	175
15	75	95	115	135	160	180	205
16	85	110	130	155	180	205	235
17	95	125	150	180	205	235	265
18	110	140	170	200	230	265	300
19	125	155	190	225	260	300	335
20	135	175	210	250	290	330	370
21	155	195	235	280	320	365	410
22	170	215	260	305	355	405	455
23	185	235	285	335	390	445	495
24	205	255	310	370	425	485	545
25	220	280	340	400	460	525	590
26	240	305	370	435	500	570	640
27	260	330	400	470	540	615	690
28	280	355	430	510	585	665	745
29	305	385	465	545	630	715	800
30	325	410	495	585	675	765	860
31	350	440	530	625	720	820	915
32	375	470	570	670	770	875	980
33	400	500	605	715	820	930	1045
34	425	535	645	760	875	990	1110
35	450	565	685	805	925	1050	1175
36	475	600	725	855	980	1115	1245
37	505	635	770	905	1040	1175	1315
38	535	670	810	955	1095	1245	1390
39	565	710	855	1005	1155	1310	1465
40	595	750	900	1060	1220	1380	1540

* Diameter measured at small end of log inside the bark.

Table G

SCRIBNER LOG RULE

Diameter* (inches)	Length of Log in Feet						
	8	10	12	14	16	18	20
	Contents (board feet)						
6	4	5	6	7	9	10	11
7	8	10	12	14	16	18	20
8	12	15	19	22	25	28	31
9	18	23	27	32	36	40	45
10	24	30	37	43	49	55	61
11	32	40	48	56	64	72	80
12	40	49	59	69	79	88	98
13	48	61	73	85	97	109	122
14	57	72	86	100	114	129	143
15	71	89	107	125	142	160	178
16	79	99	119	139	159	178	198
17	93	116	139	162	185	208	232
18	106	133	160	187	213	240	267
19	120	150	180	210	240	270	300
20	140	175	210	245	280	315	350
21	152	190	228	266	304	342	380
22	167	209	251	292	334	376	418
23	188	235	283	330	377	424	470
24	202	252	303	353	404	454	505
25	229	287	344	401	459	516	573
26	250	313	375	439	500	562	625
27	274	342	411	479	548	616	684
28	291	363	436	509	582	654	728
29	305	381	457	533	609	685	761
30	328	411	493	575	657	739	821
31	355	444	532	622	710	799	888
32	368	460	552	644	736	828	920
33	392	490	588	686	784	882	980
34	400	500	600	700	800	900	1000
35	438	547	657	766	876	985	1095
36	462	577	692	807	923	1039	1152

* Diameter measured at small end of log inside the bark.

Table H

DOYLE LOG RULE

Diameter* (inches)	Length of Log in Feet						
	6	8	10	12	14	16	18
	Contents (board feet)						
10	13	18	22	27	31	36	40
11	18	24	31	37	43	49	55
12	24	32	40	48	56	64	72
13	30	40	51	61	71	81	91
14	37	50	62	75	87	100	112
15	45	60	76	91	106	121	136
16	54	72	90	108	126	144	162
17	63	84	106	127	148	169	190
18	73	98	122	147	171	196	220
19	84	112	141	169	197	225	253
20	96	128	160	192	224	256	288
21	108	144	181	217	253	289	325
22	121	162	202	243	283	324	364
23	135	180	226	271	316	361	406
24	150	200	250	300	350	400	450
25	165	220	276	331	386	441	496
26	181	242	302	363	423	484	544
27	198	264	331	397	463	529	595
28	216	288	360	432	504	576	648
29	234	312	391	469	547	625	702
30	253	338	422	507	591	676	760
31	273	364	456	547	638	729	820
32	294	392	490	588	686	784	882
33	315	420	526	631	736	841	946
34	337	450	562	675	787	900	1012
35	360	480	601	721	841	961	1081
36	384	512	640	768	896	1024	1152
37	408	544	681	817	953	1089	1225
38	433	578	722	867	1011	1156	1300
39	459	612	766	919	1072	1225	1378
40	486	648	810	972	1134	1296	1458

* Diameter measured at small end of log inside the bark.

SAMPLE VOLUME TABLE - Table I

Black Walnut (<i>Juglans nigra</i>) Central States Region							
Volume in Board Feet							
L. F. Kellogg		1932			Scribner, 8" top.		
Diameter breast high (inches)	Total Height in Feet					Basis: No. of trees	
	40	50	60	70	80		90
Volume in Board Feet							
11	19	21	25	31	40	26	
12	25	31	42	52	62	29	
13	38	48	60	72	84	27	
14	54	65	78	92	105	16	
15	68	81	95	110	127	16	
16	83	96	112	130	150	13	
17		112	130	152	175	10	
18		129	150	174	201	6	
19		148	172	200	230	4	
20			195	227	261	2	
21			220	255	293	1	
22			245	284	325	1	
Basis: No. of trees		12	39	75	24	1	131

Volume above a stump height of 1.0 foot to a top diameter of 8 inches inside the bark. Logs have been scaled in 12-foot lengths with a trimming allowance of 0.3 foot.

Trees measured by Central States Forest Experiment Station in Kentucky, Indiana, Illinois, and Iowa. The block indicates the extent of basic data.

Sample Invitation to Bid

Mr., of (name) (address)
offers for sale to the highest acceptable bidder approximately ft. b.m.
of standing timber, consisting of the following: ft. b.m. (volume) ft. b.m. (species)

Material consists of trees 18 inches in diameter and up.
This timber may be inspected any time before bids are due.
Bids must be based on price per M ft. b.m. by
log rule for the different species. Logs to be scaled and paid for before removal from woods.
Bids must be received on or before 19.....
A contract agreeable to both parties will be drawn up and signed before any cutting begins.
The owner reserves the right to reject any or all bids.

(signature)

Sample Contract Form for Timber Sale

An agreement entered into this day of
between of hereinafter called
the seller, and of hereinafter
called the buyer.

1. The seller hereby agrees to sell to the buyer, subject to terms listed below, all the
timber specified below, on a certain tract owned by the seller, located in tp.
County of State of including all or parts of
quarter sections as described by
..... located of the farm house. This timber
shall be cut, removed, and paid for under the following terms:

2. Payment for timber stumpage shall be by at the rates
of per M for all (log rule)
\$..... for and
\$..... for all other species. No timber below on the stump will
be cut. Payment shall be made once per week for all logs removed from the property of
the seller during that week. A deposit of \$..... equivalent to approximately 10%
of estimated total value shall be deposited with the seller before cutting starts. At no time
shall timber values in excess of the deposit be removed before payment has been made.

3. The buyer agrees to abide strictly by all conditions set forth below:
a. All timber shall be cut, paid for, and removed from property of seller on or before
..... 19....., unless an extension of time is granted.

4. Sawlogs shall be scaled by the log rule, measured along
the average cross section of diameter of the small end of log inside bark. Scaling shall be
done in the presence of the seller or his representative and any dispute as to scale shall be
settled before logs are removed from land of owner.

5. Logs over 18' and under 23' shall be scaled as two logs, over 23' as 3 logs. Four (4")
inches additional length shall be allowed on all logs when cut. Logs overrunning this 4"
trimming allowance in length will be scaled to the next higher foot.

6. Stumps shall be cut so as to produce the least possible waste. Stump height shall
not exceed the diameter of the tree and will not exceed 18" for diameters of 18" and over.

7. No trees below in diameter at 4 1/2' above ground shall be cut, except
..... for bridges, loading poles, etc. These shall be paid
(species)

for at the rate of per pole. Dead timber under 10" may be used free for
such purposes.

8. All trees shall be utilized to a 7" top diameter unless decay or large limbs make this
impossible.

9. All merchantable logs cut shall be paid for at above rates whether utilized or not.
Red and white oak logs 7" and over in diameter and 6' and over in length shall be considered
merchantable if they will cut 40 per cent sound lumber; other species must cut 50 per cent
to be considered merchantable. Unmerchantable logs will remain in the woods for use by
the seller.

10. Small timber shall be protected from injury. Any trees severely damaged un-
avoidably shall be cut and utilized if possible. All property such as road and fences shall be
left in as good condition as found by buyer.

11. All possible care shall be exercised by the buyer and his woods crew against the
starting and spreading of fire, and he shall aid in putting out any fire in the woodlot
without charge.

12. It is further agreed and understood by both parties as follows:

a. All timber standing and cut shall remain the property of the seller until paid
for in full.

b. In case of dispute over any terms of this contract, final decision shall rest with a
reputable and qualified person mutually agreed upon by both buyer and seller, or by three
persons, one appointed by each, the buyer and the seller and the third to be the State
Forester or a representative appointed by him.

c. A final inspection of the area, roads, fences, etc., shall be made by buyer and
seller, and if all timber has been paid for and all conditions of this contract have been
fulfilled, the buyer shall receive a receipt and release from any further claims for damage.

d. The original deposit shall be applied on final payment when all conditions in this
contract have been met.

Witnessed, signed, and sealed on this day of 194.....

Seal