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UTILIZATION of Oregon Hardwoods

By
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Oregon Forest Products Laboratory
OREGON STATE COLLEGE
Corvallis

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A Research Project of the Oregon Forest Products Laboratory,
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A preliminary report based on a field survey of the hardwood resources and industries of Oregon

SUMMARY

A field survey of Oregon's hardwood industry and resource was initiated by the Oregon Forest Products Laboratory during the summer of 1947. Current logging, milling, and remanufacturing practices were observed, and special problems were discussed with operators. Forestry agencies furnished certain hardwood resource data included in this report of the field study.

Present utilization of the native hardwood species is generally poor. A large volume of the hardwood tree is left in the woods, and a large portion of the log is wasted in milling operations. The quantity of hardwood timber destroyed in softwood logging operations greatly exceeds the amount of wood that is utilized commercially. Hardwood logging and milling operations are generally haphazard and inefficient because of poor equipment and inexperienced operators.

At the present time, the hardwood market in Oregon is extremely weak because of the general low quality of the material produced. Out-of-state buyers and some Portland firms have shifted from wartime use of red alder back to species from southern and eastern United States. Full utilization of Oregon's native hardwoods depends on the development of dependable and stable milling operations that can furnish a high quality product to the remanufacturer.

Information sorely needed by the industry includes:

1. Volume tables adapted to hardwood species.
2. Standard log grading rules for all species of native hardwoods.
3. Standard hardwood lumber grading rules.
4. Better air and dry-kiln seasoning practices for all species.
5. Ways and means of closer utilization from tree to the final product.
6. Uses for species hitherto classed as noncommercial.

Although Oregon's hardwood resource is small in comparison with the volume of coniferous species, there are several factors that favor increased use and a limited expansion in the hardwood industry.

1. Development of new logging roads into areas heretofore inaccessible will make additional hardwood timber available.
2. Coordinated logging plans will permit the harvesting of hardwoods as well as softwood species.

3. Information based on forthcoming research projects will increase the degree of utilization.
4. Relatively high cost hardwood lumber from southern and eastern United States, together with the prohibitive cost of imported species from South America and the Pacific Islands, should encourage demand for lower-cost hardwood lumber for certain uses.

Coordinated logging and milling operations are recommended as a means of producing highest quality stock possible. Such enterprises should be located reasonably close to hardwood timber stands and should have good transportation facilities to remanufacturing plants.

STUDY SCOPE AND PROCEDURE

In an effort to obtain basic information about the Oregon hardwood resource and industry, a field study was made in the summer of 1947. Specific objectives of the study included investigations into current practices, problems, quality of production, and degree of wood utilization, as well as the possible future development of hardwood logging, milling, and remanufacturing operations. Where appropriate, specific recommendations for improvement were to be included in the report covering the study.

To ascertain the data already available, all forestry agencies within the State were contacted for preliminary information. Existing hardwood stand data were obtained from the United States Forest Service and the Oregon & California Lands Administration. Forest inspectors of the State Board of Forestry furnished considerable information relative to the locations of current mills and logging operations. Previous spot studies by personnel of the Oregon Forest Products Laboratory furnished preliminary data about utilization and marketing problems.

Most of the operators of sawmills, logging operations, and manufacturing plants using hardwood species were personally contacted; current practices were observed, and problems were discussed with the operators.

As a result of this and future studies, it is hoped that the Oregon Forest Products Laboratory will be able to provide advisory service to all industries engaged in the utilization of hardwoods in Oregon. It should be emphasized that the following report of the field study applies to conditions existing in the hardwood industry during the summer of 1947, and it deals only with the native hardwood species yielding woods that are or may be of commercial importance.

THE HARDWOOD RESOURCE

Volume

The latest available estimates of hardwood timber volume appear in Table 1. These figures were taken from the Pacific Northwest Forest & Range Experiment Station mimeograph, *Sawtimber Volume Estimate for Oregon & Washington,* by F. L. Moravets, June 1944. According to these data, there are slightly more than $2\frac{1}{3}$ billion board feet of hardwood in Oregon. This total includes trees 11.1 inches and greater diameter breast high ($4\frac{1}{2}$ feet above ground), but it does not include such hardwood species as cherry, dogwood, or cascara. These latter species are of little importance in this state and, with the exception of cascara, seldom attain commercial size.

Location of stands

Figure 1 indicates commercial ranges of the important hardwood species. The boundaries of the different species are by no means limiting, but they do represent the general areas of commercial stand concentrations. It will be noted from the map that there are four broad regions, based on the type of hardwood stand.

1. THE NORTH AND CENTRAL COAST REGION contains the greater portion of the red alder stands. Bigleaf maple also occurs in this region in mixture with Douglas-fir and alder in the river valleys and creek drainages. Alder is found along these same waterways in pure stands or in mixture with Douglas-fir on the slopes and hillsides. Pure stands of alder on optimum sites average about 10 to 12 thousand board feet per acre at 60 years of age.

Most of the alder in this area is in either public or large private ownership; stands in the valleys are often owned by ranchers or logging operators.

2. THE SOUTH COAST REGION contains red alder, myrtle (California-laurel), tanoak, and maple. The alder and tanoak occur either in mixture or in pure stands. Maple and myrtle usually occur in damp sites along streams in mixture with Port Orford white-cedar or Douglas-fir. Tanoak is concentrated in the Coast Range and near the coast in Curry County.

These species occur on public lands or on lands owned by large logging companies. Myrtle and alder stands occur on farms and other small holdings.

3. THE UPPER UMPQUA-UPPER ROGUE RIVERS REGION supports California black oak, Pacific madrone, golden chinquapin, and Oregon white oak. These are typically dry site species: slow growing and fairly short, with low heavy limbs. Extensive

Table 1. HARDWOOD SAWTIMBER VOLUMES IN COUNTIES OF WESTERN OREGON*
(In thousands of board feet)

County	Red alder	Oregon ash	Golden chinquapin	Black cottonwood	Pacific madrone	Bigleaf maple	California black oak	Live oak	Oregon white oak	Tanoak	Myrtle (California laurel)	County hardwood volume
Benton	1,700	1,300	.....	1,300	.....	9,000	.....	.....	1,300	.....	.....	14,600
Clackamas	200	100	.....	400	.....	100	.....	.....	.....	.....	.....	800
Clatsop	39,000	.....	.....	.....	.....	14,400	.....	.....	.....	.....	.....	53,400
Columbia	4,000	.....	.....	15,000	.....	6,400	.....	.....	.....	.....	.....	25,400
Coos	174,000	.....	9,400	1,200	4,300	110,000	.....	.....	.....	.....	53,400	352,300
Curry	10,600	200	1,100	400	9,200	5,500	5,400	300	2,500	435,200	13,600	484,000
Douglas	178,000	1,700	58,000	300	231,000	86,500	31,000	.....	47,000	.....	.....	633,500
Hood River	.....	.....	.....	4,300	.....	.....	.....	.....	.....	.....	.....	4,300
Jackson	300	700	.....	3,500	3,100	200	9,200	.....	4,000	.....	.....	21,000
Josephine	.....	.....	700	200	2,800	.....	16,800	2,900	11,000	5,600	.....	40,000
Lane	100,000	3,400	.....	26,200	.....	161,600	.....	.....	3,200	.....	.....	294,400
Lincoln	131,300	.....	.....	.....	.....	3,100	.....	.....	.....	.....	.....	134,400†
Linn	18,200	2,600	.....	12,000	.....	74,400	.....	.....	1,400	.....	.....	108,600
Marion	5,600	7,500	.....	9,100	.....	5,600	.....	.....	2,700	.....	.....	30,500
Multnomah	100	100	.....	2,600	.....	100	.....	.....	.....	.....	.....	2,900
Polk	6,600	2,400	.....	700	.....	16,400	.....	.....	400	.....	.....	26,500
Tillamook	99,900	.....	.....	.....	.....	3,800	.....	.....	.....	.....	.....	103,700
Washington	3,300	2,800	.....	1,000	.....	2,400	.....	.....	500	.....	.....	10,000
Yamhill	7,500	8,600	.....	4,200	.....	12,700	.....	.....	5,800	.....	.....	38,800
TOTALS	780,300	31,400	69,200	82,400	250,400	512,200	62,400	3,200	79,800	440,800	67,000	2,379,100

* Trees less than 11.1 inches diameter breast high excluded. County hardwood volumes, as of January 1, 1943, are taken from Pacific Northwest Forest and Range Experiment Station, U. S. Forest Service, mimeograph, *Sawtimber Volume Estimates for Oregon and Washington*, by F. L. Moravets, June 1944. Breakdown by species has been estimated principally from Forest Survey reports on individual counties, issued between 1933 and 1942.

† Lincoln County alder sawtimber volume was revised, according to Forest Survey reports, from 599,591 thousand board feet in 1933 to 131,300 thousand board feet, as of September 1, 1942, a decrease of about 78 per cent. Since Lincoln County hardwood sawlog production, chiefly alder, averaged only about 250 thousand board feet annually from 1924 to 1942, alder volume for the county should have increased. It is estimated that the state 1933 alder volume should have increased approximately 14 per cent in the ten-year period, 1933-43.

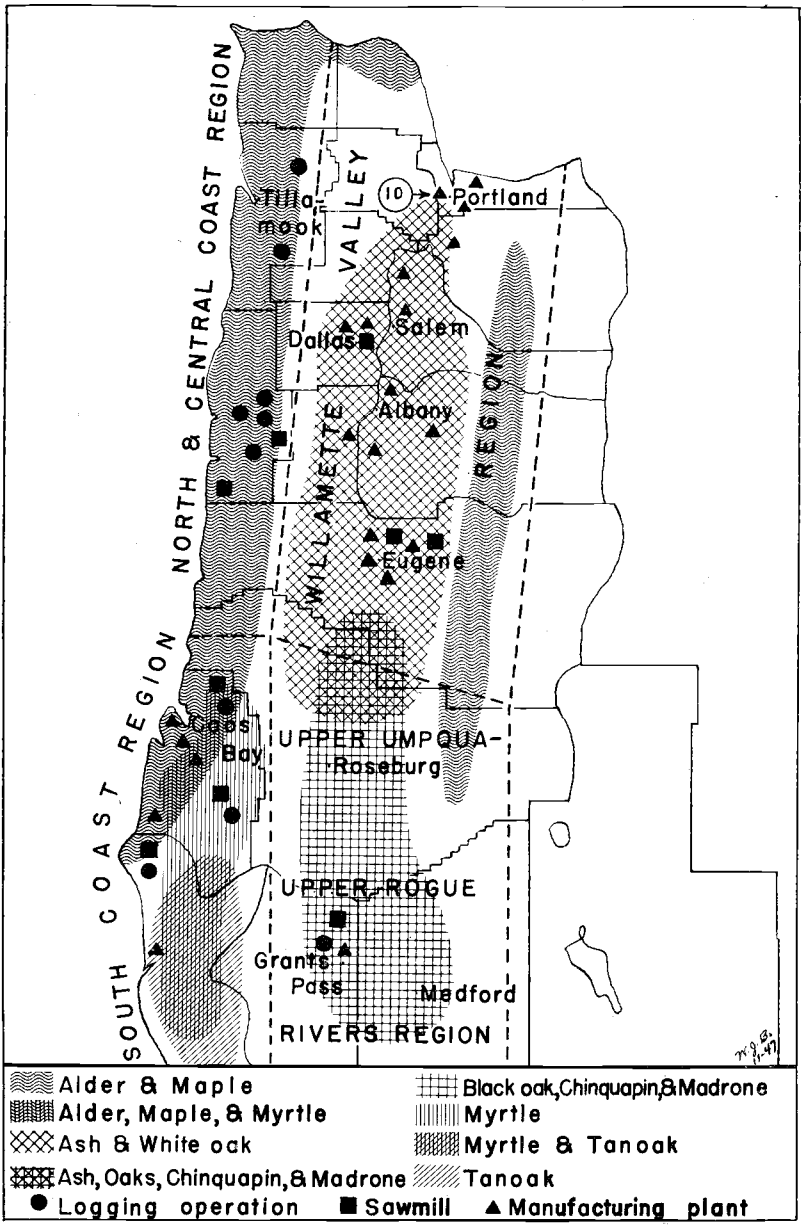

Figure 1. Hardwood regions, commercial timber areas, and principal hardwood operations of western Oregon.

pure stands of black oak, madrone, and white oak occur in this region. A limited supply of maple is found along creeks and in river valleys.

4. THE WILLAMETTE VALLEY REGION includes white oak, Oregon ash, maple, black cottonwood, alder, and a little black walnut. Walnut was introduced into the area by early settlers. White oak is a dry site species, usually occurring on south and east slopes throughout the valley. Ash, maple, alder, and cottonwood are usually streambank species in this area, although some alder and maple occur in limited pure stands on upper slopes in the west foothills of the Cascades. Cottonwood is often found in pure stands along the Willamette River from Eugene to Portland and also along the Columbia River between The Dalles and the coast.

Although most of the alder and maple in the foothills of the Cascades is in logging company ownership, most of the land on which hardwood species occur is in the form of small tracts owned by businessmen and farmers.

Forest management

Although most of the foregoing species have been commercially utilized in various quantities, very little attention has been directed toward any type of forest management. Stands located in valleys and farming areas are regarded as a deterrent to agricultural development. Much of the oak, ash, and maple used has come from these lands during clearing operations. Farm owners in the Willamette Valley have looked on their hardwood trees as a source of fuel, and, if offered any price by a buyer, they have usually sold the stumpage. Often the contract logger has taken only the choice logs; the remainder has been used as fuel by the owner or piled and burned to get it out of the way.

Accessible stands of hardwood in the Willamette Valley have thus been picked over by hardwood buyers, and, in general, the trees remaining are of low quality or are too small for present use. Ash is particularly difficult to obtain, as it has been a favorite species for handle stock for many years. At least two medium-sized hardwood plants in the Willamette Valley have changed to softwood lumber manufacture in the past year, because they could not obtain sufficient hardwood logs to maintain desired production.

Some of the alder stands in public or large private company holdings have received limited consideration in management plans. In the south coast region, some effort to save myrtle stands has been made by local Chambers of Commerce and other civic organizations.

This has been largely a preservation campaign and not a management plan for the species. Where these species occur in mixture with Douglas-fir, Port Orford white-cedar, and other softwoods, they are entirely ignored and largely destroyed when the softwood species are logged. The volume of myrtle and alder wasted in manufacture is comparatively small in relation to the amount broken and otherwise destroyed on the average softwood logging operation.

Silvicultural and forest management studies of Oregon hardwood stands are urgently required if the supply of these species is to be maintained. An accurate inventory of the resource is needed now; but, before such an inventory can be made, stand tables and volume tables should be developed for the important hardwood species in the state.

LOGGING PRACTICES

Hardwood logging operations in Oregon tend to be antiquated and poorly equipped in comparison with the average fir operation. Methods of operation and equipment depend to a large extent on the species and on the hauling distance from the woods to the mill. Several alder and a few myrtlewood operators in the south coast region of the state conduct logging and milling operations in the same area. These operations are usually located on small drainages at considerable distances from the public road transportation. Logging roads are typically poor and inaccessible for at least six months of each year.

Power saws are extensively used for felling and bucking operations. In many instances, the tree is felled, limbed, topped, and skidded to a rollway where it is bucked into 8-, 10-, or 12-foot log lengths with 10-inch minimum top diameters. Logs are then rolled onto the mill deck directly from the rollway. Large logs are bucked in the woods and skidded directly to the rollway by a medium-sized tractor.

When logs are to be transported to a distant mill or manufacturing plant, the operator yards the logs to the rollway where they are loaded onto trucks. Logs are generally cut into 8-foot lengths and loaded crosswise on the truck bed. Oak, maple, and ash logging operations vary somewhat from the alder shows. Most ash, maple, and oak logs are cut into 8-foot lengths, although some mill operators purchase 4-foot ash, oak, and cottonwood logs on a cord basis. In the past, much of the oak, ash, and maple has been cut by farmers and delivered to the buyer at the rollway or at the mill. Farm tractors or horses are used in the yarding and loading operations. In recent years, however, most buyers of these species prefer to buy

stumpage and cut their own logs so that they can be assured of obtaining the desired quality. The operators usually pay the owner for the amount of timber felled, taking only the best logs. The owner uses the remainder of the tree for fuel, or he piles and burns that portion of the tree left by the operator.

Stumpage prices for hardwood timber are extremely variable, even on sales from public lands. Minimum and maximum prices paid per thousand board feet for stumpage during 1947 follow:

Alder	$ 1.50 to $ 4.50
Ash	2.50 to 10.00
Cottonwood	1.50 to 3.00
Maple	2.00 to 8.00
Myrtle	10.00 to 25.00
Oak, white	5.00 to 10.00

Truck hauling distances vary from a few miles to a maximum of 100 miles. In some instances, the logs are unloaded from trucks onto railway cars for shipment to the manufacturing plant.

Log costs per thousand board feet

Few hardwood logging operators know their logging costs. Estimates from a few operators and U. S. Forest Service alder sales during 1946 and 1947 averaged per thousand board feet:

Felling and bucking	$ 4.50
Yarding and loading	6.00
Road construction and maintenance	1.50
Equipment repair	.75
Depreciation	.75
Social Security	1.00
Fire protection	.10
Total	$14.60

Adding the current price of $3.00 for stumpage gives a cost of $17.60 for logs on the truck. Hauling costs, of course, vary according to distances, the usual charge being between $5.00 and $10.00. Assuming that a hauling cost of $5.00 is added to the foregoing cost of logs, the cost of logs at the mill is approximately $22.60. Most mill operators are paying $20.00 for alder on the rollway or $25.00 to $28.00 delivered at the mill, depending on the length of haul. This means that the average profit to the alder logger approximates $2.50 to $5.00 per thousand board feet.

Ash, maple, and oak logs average between $35.00 and $40.00 per thousand board feet at the mill. Some buyers pay $25.00 to $30.00 per cord for these species delivered to the plant, but they demand straight, clear, butt logs. Cottonwood brings $15.00 per cord, delivered at the plant.

Myrtlewood logs command a much higher price because acceptable trees are scattered and must be felled and bucked with care to avoid breakage. Myrtlewood operators estimate that, for each thousand board feet, stumpage costs them between $10.00 and $25.00, felling and bucking $25.00, and yarding and loading $15.00 to $30.00. In most instances, myrtlewood novelty manufacturers select the trees and supervise the felling, bucking, and sawing operations in order to obtain the quality of stock they desire.

Experienced hardwood loggers maintain that it is necessary to get the logs from the woods to the mill in the shortest possible time; otherwise, excessive end checking and sap stain occur. Myrtlewood loggers cut logs in the early spring or late fall in order to minimize stain and seasoning degrade.

Poor utilization of hardwood species is typical in most logging operations. Approximately 50 per cent of the average hardwood tree is left in the woods because of defects and breakage or because the logs are too small.

Problems of hardwood logging operations

Problems of hardwood logging operations are:

1. Inadequate equipment necessitates an excessive amount of hand labor.
2. Excessive waste occurs in tops and in defective and small logs.
3. A relatively large number of pieces is necessary to make a thousand board feet. This means increased cost because of added time and labor in handling material.
4. Adverse weather conditions make the logging of certain species seasonal in nature. Since it is inadvisable to store hardwood logs for long periods of time, this means the average hardwood operator must either work in the dry summer season or move to another location to log other species.
5. Lack of hardwood log grading rules places the logger at the mercy of the buyer when logs are plentiful.
6. Inadequate information makes it difficult to determine the volume in any particular hardwood stand.

Recommendations for improving efficiency of hardwood logging operations

For improving the efficiency of hardwood logging operations the following recommendations are made:

1. Increase the use of power equipment (power saws and medium-sized tractors).

2. Where possible, yard the logs to the landing in tree lengths for bucking at the landing.
3. Use low-cost loading devices to reduce the amount of hand labor in loading logs from the rollway onto trucks.
4. Prevent excessive end checking in the woods and at the mill by end-coating logs with some type of material to retard end drying.
5. Develop hardwood log grading rules.
6. Where hardwood species are mixed with conifers, so plan the logging operation as to avoid excessive breakage of hardwood. In the south coast region, more alder and myrtle timber is broken and knocked down in fir logging operations than is utilized by the hardwood industries of that region. Prelogging studies may provide an answer to this problem.

LUMBER MANUFACTURE AND MARKETING

Hardwood milling practices are as varied as the number of mills in operation. Three general types of hardwood sawmills are found in the state:

1. Mills located adjacent to the stand of hardwood timber and operated currently with hardwood logging operations.
2. Mills operated in conjunction with small hardwood manufacturing plants.
3. Mills established as a unit of a large hardwood utilization plant, usually a furniture factory.

Mills located adjacent to a logging operation generally cut one or two species and often fill slack periods by cutting small second-growth fir. The plants are poorly equipped with secondhand or homemade machinery powered by 10- to 20-horsepower gasoline or diesel engines. Logs are cut by circular head saws into 1-, $1\frac{3}{4}$-, or $2\frac{1}{4}$-inch random-width lumber that is edged on the head saw. The lumber is usually stacked on the mill deck behind the head saw; when a few loads have accumulated, they are trucked to the delivery point. Trucking distances vary from a few miles up to 130 miles.

The mill is operated by two or three men who handle the logs and lumber almost entirely by hand. Because of this hand labor, the average production in these mills is usually between three and four thousand board feet per day.

Mills operated in conjunction with small hardwood manufacturing plants may cut one or several species, depending on the products manufactured. Most plants of this type are located in the Willamette Valley. They cut oak, ash, maple, some alder, and a limited amount of walnut. Logs are trucked to these mills by farmers and contract loggers within a radius of 50 to 60 miles.

Production in these mills ranges from 2 to 8 thousand board feet per day. The usual power units in these plants are 30- to 50-horsepower electric motors. Two or three men operate the mill for a few days and then are transferred to another job in the manufacturing plant until more stock is required. Some of the operators do custom sawing for individual buyers, but they seldom sell lumber to other manufacturing plants. Most of the lumber manufactured is recut into handle squares or other specialty stock for use in the manufacturing plant or for sale to California buyers.

These mills are somewhat more efficient than those located adjacent to logging operations, but excessive hand labor and insufficient power reduce production and increase milling costs.

Some furniture factories in the Portland area operate sawmills as units of their plants. These sawmills supply the requirements of the factories, and they are generally the most efficient hardwood mills in the state.

Some of these mills use 6-foot band saws with 8-inch blades. The alder or maple logs are cut on the head saw into 2-inch stock that goes to a vertical resaw. The lumber is dried in kilns, usually prior to edging. After it is dried, the lumber is transferred to the cut-up room for straight-line ripping and trimming.

Milling costs and utilization

Very few hardwood mill operators keep detailed records of milling costs. Operators contacted estimate per thousand board feet milling costs of $12.00 to $15.00 for alder, $25.00 to $30.00 for myrtle, and $15.00 to $20.00 for oak, maple, and ash. Operators estimate that, on a thousand board feet basis, hardwoods require two to three times greater sawing time than that required for softwoods. Smaller logs and longer sawing time per cut are the principal factors contributing to the increased time. Ash, oak, and maple logs purchased from farm owners frequently contain embedded nails, staples, and pieces of wire which dull saws and cause frequent delays while such objects are chopped from the logs.

From 30 to 50 per cent of the average hardwood log is wasted in the form of slabs, sawdust, trimmings, and defects. Sawyers claim that it is difficult to determine whether a hardwood log is sound or defective until it is opened up on the head saw. Rough logs are often sound, yielding good lumber, while straight smooth logs may be highly defective and of little value.

A relatively high percentage of defect in the form of rot, cat faces, loose knots, and checks necessitates much trimming to obtain the stock desired. Handle and furniture stock must be relatively clear for satisfactory service.

Most of the waste (in the form of slabs, edgings, sawdust, and trimmings) is burned at the mill for heating purposes, although a few plants sell slabs for fuel. Few such mills have refuse burners; the waste is burned in the open if not otherwise used.

Problems

The manufacturing problems are:

1. Inadequate power to operate the mill. Operators estimate that 60 to 75 horsepower should be the minimum used in a hardwood mill.
2. Large amount of hand labor involved in the milling operation.
3. Lowered prices for poorly sawed material. Inadequate power in the mill and poor maintenance of equipment cause inaccurate dimensions of the finished product.
4. Limited volume of logs, as a result of relatively long log-hauling distances and unreliable deliveries, preclude large-scale production of lumber and remanufactured stock.

Grading

Although the National Hardwood Lumber Association has published standard lumber grading rules for some Oregon hardwoods, these rules are not in general usage. Lumber and specialty stock produced at the mill are generally sold as clears or mill-run material. Alder is sometimes sold by grade, but some operators claim the system of grading is based on the opinion of the individual and not on standard specifications. Many operators and hardwood users believe native Oregon hardwoods are inferior in quality to species from the eastern United States. Several factors are responsible for this unfavorable attitude.

1. Most hardwood mills are inadequately powered and do not cut lumber to true dimensions. In some instances, the operators have had no experience in sawing hardwood species and do not understand the particular problems involved.
2. Buyers and manufacturers have attempted to utilize native hardwoods for purposes entirely unsuited to the species.
3. An unduly high percentage of degrade results from poor seasoning practices.

Seasoning practices

Seasoning techniques used in the hardwood industry vary with individual operators. Few operators have dry kilns suitable for acceptable seasoning of hardwood species.

Virtually all of the alder cut in Oregon is sold rough green or air-dried to manufacturers who dry the stock in their own kilns. Operators who sell air-dried alder stock pile the lumber under cover and allow approximately 4 to 6 months for drying. Air-dried stock usually requires 4 to 6 days in the kiln before it is manufactured into furniture. Green stock is placed in the kiln for 8 to 12 days before it is used. Temperature and humidity schedules are varied to suit the manufacturer's requirements. Kilns are generally of the natural-draft type, poorly-controlled, and in bad repair.

Myrtlewood users air-dry their stock from one to four years. Green lumber is stacked in a shed or warehouse to dry for at least one year. Using this air-dried stock, the manufacturer roughs out bowls, plates, and other novelty material and then stacks the pieces in an attic storeroom above the main shop. In some instances, the roughing-out operation merely consists of cutting the lumber into blanks of the approximate dimensions of the finished product. Some novelty manufacturers place the blanks on a lathe and turn them down to within an inch of the finished size before storing them for the final seasoning period. Experienced myrtlewood manufacturers assume a seasoning rate of one year per inch of stock thickness. For example, a piece 2 inches thick is seasoned 2 years; a piece 4 inches thick is seasoned 4 years. A few operators have constructed dry kilns that reduce the drying time of roughed-out stock to 6 to 8 months. Considerable warping and checking develop during the initial stages of drying. A typical kiln is usually nothing more than a small room equipped with hot water pipes or radiators around the walls and a ceiling ventilator equipped with a fan. No humidity controls are used, and the temperature is maintained at approximately 80° F.

Ash and oak are usually air-dried in the form of $1\frac{3}{4}$- or $2\frac{1}{4}$-inch handle squares. The squares are closely crib piled in the yard for about two months prior to shipment or manufacture into handles. Twenty to 40 days are required for kiln drying ash, oak, or maple lumber and squares of 1 to 2 inches in thickness. The long drying time is attributable to the fact that most kilns are of the natural-draft type.

Principal seasoning problems

The principal seasoning problems are:

1. Hardwood stock is generally subjected to severe conditions in the initial stages of drying, causing excessive end and surface checking. Proper seasoning schedules should eliminate much of the loss experienced with present drying practices.

2. Most dry kilns are antiquated and entirely inadequate for proper seasoning.
3. In many instances, the stock has not been sufficiently seasoned before it is manufactured into the final product. Checking and warping of the wood and blistering of the finish occur in the final product.
4. Operators tend to emphasize volume rather than quality in the manufactured product; they attempt to shorten the seasoning period in an effort to fill orders on hand.

Hardwood markets

Prices of hardwood lumber and specialty stock depend on species, dimensions desired, and general quality. The alder market was very inactive in 1947. Based on mill-run classification, the approximate free on board mill prices per thousand board feet for various items were: rough green alder lumber, $45.00 to $48.00; ash and oak 1¾- and 2¼-inch air-dried handle squares, $80.00 to $120.00; rough green oak timbers, $125.00; rough green 1-inch maple lumber, $70.00; green 2- to 4-inch myrtle lumber, $200.00; and seasoned 2- to 4-inch myrtle lumber, as high as $500.00.

Most Oregon hardwood lumber is marketed within the state. Some handle-square stock and a limited amount of alder lumber are sold to California and eastern markets. A small amount of maple lumber is sold on eastern markets by one large sawmill. The remainder of the hardwood cut in the state is manufactured into the final product before shipment to out-of-state buyers.

During the war, much of the alder lumber cut in Oregon was shipped to California buyers, but that market is no longer taking this species. Much of the alder shipped to California at that time was so highly priced and of such low quality that buyers turned to eastern United States hardwood species as soon as they became available again. Portland furniture manufacturers also are dissatisfied with the alder lumber cut by small sawmill operators. Buyers claim they cannot obtain the quality desired and that they cannot depend on delivery of orders. On the other hand, producers maintain that the buyers pay such low prices that the sawmill cannot realize a reasonable profit. Operators claim they cannot produce rough green alder lumber to sell for less than $45.00 per thousand board feet.

Only one operator contacted was optimistic about his alder business. This operator was trucking his rough green lumber for a distance of 110 miles and delivering it to the buyer in Portland for $58.00 per thousand board feet. An efficient mill, coupled with dependable delivery of orders, has assured this operator a continued stable market for all the alder lumber he can produce. Unfortunately,

there are very few alder producers in this category. The majority have an unfavorable reputation with Portland and out-of-state purchasers. One Portland furniture firm has partly solved its problem by purchasing a large acreage of alder timber and conducting the logging and milling operations to suit its own requirements. The manager of this firm feels he can obtain the product he wants at a lower price than would be possible through purchases of lumber on the open market.

Principal marketing problems

The principal marketing problems are:

1. Hardwood lumber producers cut poor quality material and cannot be depended on to deliver orders.
2. Lumber producers must operate on a widely fluctuating market with unstable prices and periods of high and low demand for their product. For this reason, the majority of hardwood operations are rather temporary and sporadic in nature. Many of the operators cut fir and other softwood species during periods of low hardwood lumber prices and then swing back to hardwood production when the demand increases.
3. Poor seasoning practices by local hardwood mills prohibit the accumulation of any sizable inventory of products; therefore, the producer must market his product within a relatively short time after it is cut or suffer considerable loss from degrade because of excessive checking and sap-staining.

Recommendations for improved market procedures

Recommendations for improving marketing procedures are:

1. The use of standard hardwood lumber grading rules would enable the buyer and seller to reach more satisfactory agreements on quality and price.
2. Establishment of concentration yards with good dry kilns should enable a number of producers to build up a large inventory of stock. All types of orders could then be filled from the accumulated supply.
3. Organization of the hardwood producers of the state into an association would enable them to establish milling and marketing practices that would place them on a dependable business basis.

Major products manufactured from Oregon hardwoods.

Some attempts have been made to produce veneer from alder, maple, myrtle, and white oak. While the maple veneer has been

satisfactory in some instances, the other species have not produced veneers of good quality. White oak sapwood veneer turns to a dirty green color. Myrtle veneer checks badly after a few years of use, and the grain tends to raise after finish is applied on the veneer surface. The principal products now made from Oregon hardwoods are listed below.

Species	*Products*
Alder, red	Furniture, paper roll cores, business machine cores, brush handles, fuel, wooden shoes, woodenware.
Ash, Oregon	Tool handles, ladder stock, farm implements.
Chinquapin, golden	Springboards, limited quantity for custom-built furniture.
Cottonwood, black	Paper, excelsior, furniture stock.
Madrone, Pacific	Fuel.
Maple, bigleaf	Flooring, panel stock, brush handles, wooden shoes, furniture, novelties, gun stocks, veneer.
Myrtle (California-laurel)	Novelties, panel stock, limited amount of veneer, gun stocks.
Oak, California black	Fuel, fence posts, mine timbers.
Oak, Oregon white	Tool handles, ladder stock, beams, fence posts, fuel, wedges, boat railings, saddle stirrups, pack-saddle trees.
Tanoak	Limited use for timbers and heavy structural beams in sawmill plants of southwest Oregon. Bark used for tanning.

FUTURE DEVELOPMENT OF THE HARDWOOD INDUSTRY

Oregon hardwoods have been a relatively unimportant resource when compared with the softwoods. The limited quantity of hardwood timber in the state prohibits any large industrial development using these species, but there are several factors that should be considered as favorable to a limited expansion of production. Locations of present hardwood sawmills and manufacturing plants are indicated in Figure 1.

There are two general areas of sawmill and manufacturing plant concentration: (a) Willamette Valley, including Portland, and (b) Coos County. Several north and central coast area mills that previously cut alder are now cutting softwoods. Some of these mills will doubtless return to alder production when the market for this species strengthens.

Communities in the upper Umpqua-upper Rogue rivers region are virtually devoid of hardwood operations, although a sizable volume of hardwood timber is available. Only one small mill, located between Roseburg and Medford, is now cutting hardwood species in this region. Relatively large volumes of black oak, madrone, and chinquapin occur in this area, but no intensive use has been made of these species. Tanoak grows in much of Curry County, but it has rarely been used commercially, although the trees attain rather large size. Hardwood mills and manufacturing plants are fairly well distributed throughout the other hardwood stands in the state.

In general, the existing hardwood industries of Oregon are favorably situated in relation to transportation and power facilities. The hardwood furniture industry is centered largely in Portland, which has ample power and labor and is situated on a main east-west, north-south transportation system. No insurmountable power problems exist in hardwood plants, because the plants are small and their power requirements are relatively low. Adequate truck, rail, or water transportation is readily available to all hardwood plants in western Oregon except in the south coast region. Remanufacturing plants that might be established in the future should be located in or near the larger towns of the state where adequate power, labor supply, and market outlets exist.

Factors affecting industry expansion

Following are the factors affecting expansion of the Oregon hardwood industry:

1. Diminishing supplies of commercial hardwoods in the eastern United States and the relatively high cost of imported hardwoods should permit continued use and limited substitution of Oregon species in certain products that are now made from foreign or eastern United States hardwoods.
2. Information based on results of forthcoming research projects pertaining to manufacturing, utilization, seasoning, and finishing of hardwood species will become available to sawmill operators and manufacturing concerns. Good practices will result in a product that can be manufactured into high-grade items.
3. Development of logging roads into areas heretofore inaccessible will make additional Oregon hardwood timber available.
4. Coordination of logging plans will permit harvesting all species of usable hardwoods and softwoods where they occur in mixture and will make available to manufacturing plants the volume of hardwood that, at present, is destroyed in

softwood logging operations. At least 75 per cent of the hardwood volume felled is wasted by the time the final product is manufactured. Broken and small logs, plus defects, account for the major loss of volume in the logging operation. In most instances, those hardwood species occurring in mixture with conifers are destroyed, from the standpoint of commercial use, in large softwood logging operations. Each year, a much greater volume of hardwood is thus broken and otherwise destroyed than is utilized by the entire hardwood industry in the state.

5. More intensive utilization of wood in manufacturing plants is necessary for economical operation. Many hardwood products must be produced from clear stock. Since the average hardwood log produces only a small amount of such material, waste is relatively high. The fact that many products can be cut from small-dimension short stock prevents greater loss. The most profitable operation demands the fullest utilization of all raw material brought into the manufacturing plant.

Tanoak: A special problem

The bark of tanoak contains a relatively high percentage of tannin, and it has been utilized at intervals for tanning purposes. Operators who have produced lumber from this species have experienced such difficulty that they have discontinued manufacture after short trial periods. In the opinions of these operators, the following factors have been deterrents to tanoak lumber production:

1. Logs are so heavy that large loads cannot be transported over the present road system in tanoak stands.
2. Logs are difficult to saw in a circular mill, and top and bottom circular saws must be refitted at frequent intervals.
3. Lumber is extremely heavy and difficult to handle in the normal manner by crews in a small mill.
4. Lumber warps badly as it comes off the head saw. Special piling is necessary to avoid loss from excessive warping.
5. Lumber rots very quickly, particularly under the stickers separating the individual courses in piled lumber.

While some research has been conducted on the seasoning of tanoak, the results have been inconclusive; additional research is contemplated. It is reported that several large timber operators are withholding tanoak stands from exploitation for tan bark, in expectation of the development of profitable uses for the wood.

Information most urgently needed by hardwood industries

Oregon hardwood industries urgently need information as follows:

1. Volume tables for hardwood species are essential before an accurate inventory of the hardwood resource can be made.
2. Log grades for all species of native hardwoods should be devised.
3. Standard hardwood lumber grading rules for all species are needed.
4. Better practices should be developed for air seasoning and kiln drying.
5. Information on new outlets for the currently used native hardwood species is needed so that small pieces now wasted may be utilized.
6. Utilization studies are needed for madrone, chinquapin, black oak, and tanoak.

When needed information becomes available to the operator, consideration might be given to the establishment of a few additional hardwood plants in the state. On the basis of observations of various types of Oregon hardwood mills and plants, it appears that somewhat larger and better equipped hardwood sawmills, coordinated with logging operations, are desirable if increased utilization and efficiency are to be obtained.

Recommended type of enterprise

In order to coordinate hardwood logging and milling, to secure the greatest utilization of hardwood timber, and to produce high-quality products that will retain favor in competitive markets, it is recommended that a few large, well-equipped, efficient sawmills be established within reasonable log-hauling distances from the larger hardwood stands, in strategic locations having good transportation facilities for the lumber produced.

Such sawmills should have daily capacities of at least 10 to 15 thousand board feet, and they should maintain adequate log inventories. Logs supplied by contract logging crews or purchased from independent loggers should be segregated at the mill by species and by log grades; mills would then be in position to supply remanufacturing plants with desirable products. Items, such as stock for flooring, interior trim, and furniture could be cut from the better grade logs; orders for stock that would be manufactured into small specialty items could be cut from lower grade logs and slabs. These

mills should have efficient kiln-drying facilities, since most remanufacturers do not have adequate drying equipment.

Enterprises of the kind recommended should be much more dependable and stable than the present mills that have incurred so much disfavor with hardwood remanufacturers. When markets have been established and buyers know that they can obtain material meeting their specifications, the limiting production factor would be log supply.

Dallas and Tillamook are suggested as possible locations for enterprises of this kind under present conditions. When uses for California black oak, madrone, and chinquapin are developed, Roseburg should be a logical location. Likewise, when methods of utilizing tanoak are forthcoming, it would probably be advantageous to establish a mill, confined largely to cutting this species, in Curry County.