

THESIS

HARDWOOD LOGGING IN THE
RIVER BOTTOMS OF WESTERN OREGON

Respectfully submitted in partial fulfillment
of the requirements for Bachelor of Science
degree in Forestry.

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HARDWOOD LOGGING IN THE RIVER BOTTOMS OF WESTERN OREGON

Description of Region

Location and Land Ownership

Hardwood logging in western Oregon is concentrated in the flood plain of the Willamette River. The area is small; covering the territory between Eugene and Portland, varying in width from 3 to 4 miles to just a margin along the river bank. Hardwoods are also taken from along the McKenzie River and from the region of the Coast and Middle forks of the Willamette River.

Nearly all of this region is in private ownership. Most of it consisting of a part of the farms bordering the above rivers. A small percentage is owned by local hardwood using industries located in the western part of the State. The counties control a few isolated areas which have been abandoned because of deterioration or loss of the agricultural soil due to the washing of the river.

Physiographic Features

The region is largely level, varying in elevation from about 500 feet at the upper end of the Willamette River, to nearly sea-level at the mouth of the Willamette River, or lower end of the valley. The region is criss-crossed with sloughs and old river channels. There are extended areas of river wash which is a nonagricultural class of material consisting of unassorted sands, gravels, and cobbles. It lies only a few feet above the normal flow of the river, ordinarily in open channels or as bars or low terraces along the banks. This

soil material is extensively developed along the Willamette and McKenzie Rivers. In general river wash supports no form of vegetation, but in a few protected areas willows have established a foothold. This land is overflowed annually, part of it remaining under for several months of the year.

For the most part the soils are of recent alluvial origin and are still in the process of accumulation. They are grouped in the Chehalis, Newberg, Camas, Wapato, and Core series.

Climatic Features

The climate is mild, without sudden or severe changes in temperature from day to day or from season to season. The coldest weather is generally experienced when the wind blows from the east or northeast over the snow-capped mountains of the Cascade range. Owing to the influence of warm ocean currents, winds from the west are warmer.

Throughout the Willamette Valley the precipitation is seasonal. Ninety-eight per cent of the annual precipitation, or 37.47 inches, falls between September 1 and June 30. Rains are generally accompanied by southwest winds. Severe winds in the Willamette Valley are of extremely rare occurrence, though gentle breezes blowing inland from the ocean are common in the afternoons throughout the summer. Hailstorms or thunderstorms are very infrequent.

Light snowfall occurs at rare intervals during the winter in this region, but it seldom remains on the ground for any length of time. The region is comparatively free from damaging

late spring or early fall frosts. The average date of the last killing frost is April 17 and that of the first October 31, giving an average frost-free season of 197 days.

Historical

Development of Lumbering

Lumbering in this region began with the first white settlers who used the local hardwoods for fencing and fuel and to a small extent for building purposes. Lumbering has never been developed to any extent except for local use. The valley hardwoods were not used to any extent in manufactured products until the turn of the century.

The joblike character of much of the hardwood lumber industry of the region is especially noticeable in logging. Many of the operators are ranchers who engage intermittently in the logging of hardwoods as a side line. The scattered occurrence of the timber and the small extent of pure stands preclude any extensive operations. A crew may consist of only three to five men, any one of whom may work at the different steps in the operation.

The timber is skidded with horses or tractors, generally direct to the mill, railroad, or towable water if the distance does not exceed one-half mile. For longer hauls wagons or autotrucks are resorted to, and then the skidding distance is not ordinarily more than 500 feet. The wagon or auto haul to mills located in the woods seldom exceeds one mile. Most of the mills, of course, are located long distances from the timber.

Because of the scattered character of the stand, the consequent small logging units, and the uncertainties in demand and price for both logs and lumber, the logging and milling of hardwoods by independent operators has been conducted on a small scale and in the main has not proved a steady or lucrative business. As would be expected under such conditions, most of the logging and some of the milling operations are marked by an absence of the specialization and high-class management that are found in the softwood industry of the State. The independent operators, moreover, are usually men of small means, and not infrequently they are relatively inexperienced. The sawmills of the secondary industries, although they are also in the main simple and often seemingly inadequate, produce lumber of satisfactory quality with comparatively little wood waste.

The Effect of Past Practices

When the first settlers entered this region they were primarily interested in agriculture and the growing of crops. Much of the richest land was along the rivers and covered with timber, which was in the way if crops were to be grown. Thus much of the hardwoods in this region were destroyed in land clearing by burning. At the present time much of the yearly production is from land clearing operations with little or no attention given to a continued production of such material. However there is considerable land in this region that can not be used for agriculture and is suited to the production of hardwoods. In such localities the marketable trees are logged

and the land left with the defective and unmarketable material to reproduce naturally.

Such areas are covered with slash and other debris and are soon grown up to brush and other undesirable vegetation. This undesirable vegetation, in some sections, consists of Canadian and bull thistles. In order to control the Canadian thistles, fires are set to destroy them which also destroys the remaining standing timber and the reproduction if present.

To sum up the effect of past practices in this region it may be said that they have been very harmful with little thought or consideration given to producing another crop. However some of the larger hardwood industries have taken better care of their holdings and have given consideration to future production by keeping out fire, protecting reproduction, and by planting areas where no natural reproduction has come in.

THE ECOLOGICAL FACTORS OF THE INDUSTRY

The following trees occur in this region: broadleaf maple (*Acer macrophyllum*), northern black cottonwood (*Populus trichocarpa*), and Oregon white oak (*Quercus garryana*). They are found in small pure stands and also in stands with a mixture of conifers and hardwoods.

Broadleaf Maple

Composition and Character of the Stand

Broadleaf maple reaches its best development in this region, attaining sufficient size and abundance to be of a real commercial importance. Although occasionally it forms pure stands of

small extent, broadleaf maple commonly occurs throughout its range as an incidental species, in small clumps or as scattered trees in mixture with other native trees.

Over most of its range it is a small tree, averaging about 50 feet in height and 18 inches in diameter. On good soils in competition with much taller species, it is sometimes 100 feet high and 40 inches or more in diameter. In the open the trees have short trunks and dense, round-topped crowns, while those in dense stands produce timber comparatively clear of branches from one-half to two-thirds of their height. Even then the bole is rarely without bad crooks, forks, burls, or other defects, which reduce to considerable extent the value of the species for commercial purposes. The tree is comparatively long-lived; occasionally reaching 150 to 200 years.

Stand Regeneration and Development

Advance Reproduction

Although broadleaf maple is fairly tolerant very little if advance reproduction will be found either in a pure stand or in a mixture with other native trees.

Broadleaf maple produces seed at a comparatively early age and continues to produce abundant seed every year. The seed germinates in the presence of sufficient moisture, but the seedlings seldom survive because of the heavy accumulation of leaves which keep the seedling from taking root in the soil. The seedlings soon die from the lack of sufficient moisture. The survival of seedlings is also small because of the damage done

to them by grazing animals. The young seedling's foliage and woody material are very palatable and are readily eaten by cattle, horses, and sheep. As most of the region is grazed at least part of the year the young seedlings do not have a very good chance to survive.

Subsequent Reproduction

Broadleaf maple sprouts well and most of the reproduction is from this source. Both young and old trees produce abundant sprouts when cut at stump height. The sprouts make rapid growth, 4 to 8 feet in a season.

The sprouts are also damaged considerably by grazing animals. If all of the sprouts are allowed to grow the material produced will not reach a very large size, however if they are all cut away but one or two, fairly large material may be produced. At present such practice has not been attempted to any extent in this region.

Effect of Competition

If broadleaf maple is grown in the open it will have a short trunk and a dense round-topped crown. But if the tree is grown in competition with other native trees of the region it will be comparatively clear of branches from one-half to two-thirds of its height. When grown in the open it will average about 50 feet in height but when grown in a dense stand may attain a height of 100 feet.

Disease and Insects

From its usual position in the understory of humid forests, broadleaf maple seems to be a favorite host for various vegetable epiphytes (and perhaps parasites), mosses, and lichens, and it is quite possible that its poor form is due partly to these plants. Trees of more than medium size, 18 inches in diameter, are very commonly affected with rot.

Windfall

Broadleaf maple has a well developed root system and therefore normally is not easily windthrown. The velocity of the wind in this region is not great which is also a favorable condition in regard to little windfall.

WHITE OAK

Composition and Character of the Stand

White oak or Oregon oak as it sometimes called will grow where the annual precipitation is a little as 15 or as much as 60 inches, and where the variation in temperature is from below zero to above 110° F. It therefore cannot be said to be fastidious as to climate. It does, however, make its best development in the climate of the Oregon valleys; here the annual precipitation is about 30 inches and the summers are almost rainless, the winters are not extremely cold, and the atmospheric humidity is low during the growing season.

It is most abundant in the border zone between forest and open country, and occupies areas not suited to the coniferous timber trees of the locality. The range of situations on which

it will grow is wide, from the sand islands in the Willamette River to ledgy ridges on the Cascades. It often forms pure stands over small areas, sometimes in dense groves, sometimes as scattered individuals.

White oak usually has a short, clear bole, often, crooked, and a large round, bushy crown, suggestive of that of an old apple tree. Its total height is usually 50 or 60 feet and its diameter 20 to 30 inches. Individuals sometimes attain a height of 90 feet and a diameter of 4 feet. An exceptionally large tree, growing in the open in Josephine County, Oregon, has a diameter of 9 feet at brestheight^A.

The root system is not particularly fibrous, but is made up of a number of large, strong roots, with a considerable lateral spread. Young trees have a prominent taproot.

This tree is not exacting in its soil and moisture requirements. It grows on sands, gravels, clays, or rocky soils, either deep or shallow, and either very dry or well-watered; it makes good growth, however, only on well-drained, rather light, deep soils, such as are found in river benches. Its growth on soils too shallow and poor for its usual associates does not mean that it actually prefers these soils, but indicates rather that in competition with other trees White Oak has been forced to the less favorable situations, where it is free from competition with more tolerant and more rapid-growing species.

Like most of the white oaks, Oregon White Oak is rather slow growing, and on poor soils the diameter growth is exceedingly

slow. It is long-lived and is known to live 250 years; probably there are occasional trees very much older. Usually, however, it is unsound after 150 years.

Stand Regeneration and Development

Advance Reproduction

Advance reproduction is often not abundant and may be entirely lacking in most stands. This deficiency in reproduction is due chiefly to the unfavorableness of the site in most stands. Fire and grazing by domestic livestock are the cause of the lack of seedling reproduction in many stands.

Subsequent Reproduction

Seed is produced abundantly during seed years, which occur every two or three years. In the intervening years almost no seed is produced. In a good seed year the acorns are so abundant that they form a large source of food for hogs pastured in the oak stand in this region. Seedlings, however, are not abundant, even where there are no hogs, probably because the sites on which the tree grows are unfavorable to the germination of the acorns, since the radicle can not readily penetrate the sod which is common in the oak woods.

The species sprouts vigorously from the stump, but the usual method of reproduction is by root suckers, which are abundant around large trees. These root suckers, locally called "oak grubs", form the small dense patches of pure Oregon White Oak saplings which are so characteristic of this species.

Effect of Competition

Abundant light, both from the side and the top, is a requisite for the life of this tree. In youth it will endure some shading, but on the whole it is less tolerant than any of its associates. Its great intolerance, combined with its small height, seriously handicaps it in competition with other species.

The growth and development of reproduction in oak stands varies with the origin of the reproduction, species composition, and the nature and intensity of competition. The growth of advance reproduction differs from that of subsequent reproduction. Origin has less effect on the growth of advance reproduction than that of subsequent reproduction. Of the subsequent reproduction, sprouts grow the fastest, followed in order by single seedling sprouts, multiple seedlings sprouts, and seedlings. With advanced age, the difference in growth rate of different growth forms is less noticeable. Since the sprout forms of subsequent reproduction grow more rapidly than any form of advance reproduction, the former gradually gain on the latter, with the consequence, that if competition is not too severe they will ultimately gain a dominant position in the stand.

Although shrubs are often abundant in the stand, they are not a serious menace to seedlings of tree species. Their growth is slower than that of the slowest growing tree species; consequently they are not likely to suppress tree reproduction.

Disease and Insects

Like most oaks, its foliage is attacked by a great number

of animal and vegetable parasites, none of which, however, do sufficient damage to kill the tree. Its twigs and branches are often profusely covered with mistletoe (*Phoradendron villosum*), particularly in this region. This parasite kills and deforms portions of the tree and undoubtedly lessens its vitality. Several species of fungi attack and seriously damage its roots and wood.

Windfall

It is windfirm as its root system, although not particularly fibrous, is made up of a number of large, strong roots, with a considerable lateral spread.

Black Cottonwood

Composition and Character of the Stand

The cottonwood is naturally a tall, straight tree and under favorable conditions may attain a height of 80 to 125 feet and a diameter of 3 to 4 feet. When grown in the open it develops a large wide-spreading crown and a short, heavy stem. In dense stands, however, the crowns become narrow and oblong and the stems long, slender, and free from branches.

The most favorable site for cottonwood is the alluvial soil along water courses, for the most important factor its growth and development is the available moisture in the soil and not the fertility. Stands of cottonwood require a situation in which the water table is within 10 to 15 feet of the surface. Individual trees, however, on account of their extensive root system,

can maintain themselves in drier situations. The root system is variable. Usually it has strong laterals, and a deep taproot, especially in moderately dry, porous soil.

The growth of cottonwood is rapid. In early life, under favorable conditions annual increases of 5 feet in height and one inch in diameter are common. A great many measurements taken under moderately favorable conditions indicate that an average height growth of from 2 to $3\frac{1}{2}$ feet per year, and a diameter growth of from $1/2$ to three-fourths of an inch may be expected for the first 25 or 30 years.

Like most of the poplars, the cottonwood is a short-lived tree; the growth falls off rapidly after 30 or 40 years, and a tree seldom lives to be more than 175 years old. The foliage is very thin and the shade underneath the typical open stands is so light that any but exceedingly intolerant species can endure it. It is therefore generally an advance growth preparing the way for a more permanent type of stand.

Stand Regeneration and Development

Advance Reproduction

Advance reproduction in the stand is very limited if present at all. This is due to the fact that cottonwood requires full sunlight for its development and therefore cannot stand the shading of the overhead stand and that of the growth of shrubs, and other vegetation found covering the forest floor in a stand of cottonwood.

Subsequent Reproduction

The cottonwood is dioecious, so that only the pistillate trees reproduce by seed. It is a prolific seeder. Along sand-bars reproduction from seed is often very dense, but throughout the region it is very slight except close to the streams in the river bottoms. Cuttings and suckers will both grow rapidly and make large trees. The sprouting capacity of young trees is very good.

Effect of Competition

From early youth to maturity cottonwood requires full light to develop properly. A dense growth, however, is beneficial if posts or lumber are desired, as the side shading reduces the excessive branchiness of the bole. Young seedlings in full, open sunlight will thrive if the soil moisture is sufficient.

Disease and Insects

Black cottonwood is seldom seriously damaged by fire because of the moist character of the situations in which it occurs. At intervals, within limited areas, the tree is defoliated by caterpillars of various species. Bark beetles and flat-headed borers kill individual trees. Round-headed borers damage living trees. The larger and older trees are often affected with butt and stem rot, particularly on the poorer sites. Branch gall kills individual branches. Leaf rust causes premature defoliation of considerable extent, but the effect is not lasting. The finding of the stain moth larvae on imported poplars in western Oregon

suggests a serious threat to the cottonwood in the Pacific Northwest.

Windfall

The root system is somewhat variable, but usually extensive with strong laterals, and a deep taproot, especially in moderately dry, porous soil. For this reason and also the fact that the greatest wind velocity in this region is low little damage as the result of windfall occurs in a black cottonwood stand.

THE ECONOMIC BASIS OF THE INDUSTRY

BIGLEAF MAPLE

Importance of the Species

Bigleaf maple (*Acer macrophyllum*), although available only locally and in comparatively small quantities, is yet one of the important commercial hardwoods of the Pacific Northwest. It owes its importance both to the intrinsic qualities of the wood and to the scant supply of other hardwoods throughout its range. Hardwoods suitable for the exposed parts of high-grade furniture, cabinets, panels, and similar products are not available in large commercial quantities anywhere west of the Rocky Mountains. For first-quality plywood, veneers, flooring, and the like, the Pacific Northwest must now go, in large measure, to manufacturers operating in the Central and Southern States. Hardwoods in the Pacific Northwest never were plentiful in the sense that they were in the East, and, except red alder, the better and more accessible have been materially reduced by logging and land clearing.

The wood of bigleaf maple enters into many of the different uses associated with the eastern maples; many of its properties, both mechanical and physical, compare favorably with those of the eastern species. Its excellent gluing and finishing qualities, workability, hardness, and strength make it very desirable for flat and turned parts of furniture, chairs, novelties, and the like. It is especially valuable for furniture and chairs when finished to imitate walnut and mahogany.

Bigleaf maple and such other local hardwoods are supplying wood-using industries in Oregon and Washington that otherwise

would be handicapped by the lack of raw material; and, in turn, the industries so supported afford additional means for the utilization within the region of the abundant supplies of soft-woods. It may, therefore, be said that only as steps are taken to conserve and to enlarge the supply of these few local hardwoods can the expectation of continued growth in the furniture, chair, and similar wood-using industries be realized.

Possibilities for growth in the furniture and chair industries seem to be particularly good. By 1927, the number of furniture and chair factories in Oregon and Washington reached 94, or an increase of about 50% since 1918, while the value of their output was valued at \$12,000,000, or more than double the 1918 value. Even so, more than half the furniture used on the Pacific coast is said to be shipped from the East, suggesting the possible expansion of the local industry, and a corresponding increase in the local demand for hardwoods, without invading outside markets.

Only a very general estimate of distribution and occurrence of bigleaf maple can be given. No one would be warranted in presenting even an approximate estimate of the marketable supply. Reliable data on the volume of this and other commercial hardwoods of the Pacific Northwest can be obtained only by a thorough-going survey, something that has never been attempted.

Annual Production and Consumption

As already implied, production and consumption of bigleaf maple lumber and veneer are largely confined to Oregon and Washington. Some of the larger users of bigleaf maple feel that

consumption has reached its peak and that a decline may be expected shortly. Such judgments doubtless are the outcome of an increasing difficulty in obtaining ample supplies of bigleaf maple logs at existing prices, which have shown no marked increase in the last decade or more. An advance in prices doubtless would have the effect of making marketable much timber that can not now be handled at a profit.

Such statistics as are available show that the consumption of bigleaf maple is increasing. Oregon and Washington used 3,400,000 board feet of bigleaf maple in 1910 and 4,900,000 board feet in 1923. A survey of their requirements for 1928 indicated that consumption rose in the next five years to about 8,040,000 board feet, of which Oregon consumed at least 5,170,000 board feet and Washington more than 2,860,000. These figures include 221,000 board feet of timber consumed for veneer (Oregon 211,000 board feet and Washington about 10,000). They do not include 400,000 board feet of lumber shipped to California and other States.

The cut of bigleaf maple in Oregon and Washington in 1928 amounted to 8,449,500 board feet, or less than 0.2 per cent of the cut of hardwood lumber in the United States. As some of the lumber produced in Washington was consumed in Oregon, California, and other States, and as some of the logs produced in Washington were sawed in Oregon, it is difficult to determine the 1928 production definitely as between the two States. It is estimated, however, that Oregon produced 3,598,800 board feet (lumber tally) of bigleaf maple logs (including veneer logs) and 3,822,800

feet of lumber. Oregon consumed a total of 211,000 feet of logs in veneer manufacture. In 1928 about 65% of the bigleaf maple logs cut were sawed by the wood-using factories, the remainder by small operators who sold their lumber output in the open market.

PROPERTIES OF BIGLEAF MAPLE WOOD

General Description

A cross section of the trunk of a bigleaf maple tree shows no plainly visible distinction between heartwood and the sapwood; both are nearly white and of high moisture content. When fully seasoned, the surface of the wood is light brown with a pale-red tint. This change in color is not undesirable, since the bulk of the wood as now used is stained to imitate walnut or mahogany. The rings of annual growth are fairly distinct, the summer wood appearing as a thin, dark line separating the growth of one year from that of the next.

Bigleaf maple has a straight grain as a rule and a fine uniform texture. Curly and bird's eye figures occur less frequently than in the eastern maples. Burls, which show a very distinctive figure in veneer, are quite common.

The wood is lighter in weight than that of any of the eastern species except silver maple (*Acer saccharinum*). Although by no means so strong or hard as sugar maple (*Acer saccharum*), it is superior to silver maple in all mechanical properties except shock resistance.

It turns and otherwise works well with tools, glues very satisfactorily, and takes a good polish. It also takes paint and enamel well and makes an excellent imitation mahogany or walnut when stained. If properly dried and cared for, bigleaf maple does not shrink, swell, check, or warp seriously in place.

Decay Resistance

When exposed to conditions that favor decay, wood in warm humid areas of the United States decays more rapidly than in cool or dry areas. The natural decay resistance of all common native species of wood is in the heartwood; the untreated sapwood of practically all species has low resistance under decay-producing conditions. The degree of decay resistance or durability of heartwood in service is greatly influenced by differences not only in the character of the wood but also in the attacking fungus and the conditions of exposure. Moisture and temperature are the principal factors which affect the rate of decay; they vary greatly with the local conditions surrounding the wood in service. Therefore wide differences in length of life may be noted in pieces of wood of the same species or even those cut from the same tree and used under apparently similar conditions.

In contact with the ground or under other conditions favorable to the attack of wood-destroying fungi, bigleaf maple is rather low in decay resistance. Logs left in damp situations during the warm months are likely to become infected within three or four weeks. The life of bigleaf maple fence posts will not ordinarily exceed three to five years; the wood is used for posts

only occasionally, the then only where more durable local woods, such as Douglas fir, or better, western red cedar, are not available.

General comparisons of the relative decay resistance of different species must be estimates; they can not be exact, and they may be very misleading. Experience, however, suggests that the heartwood of bigleaf maple when used under conditions that favor decay is only about one-third as durable as western red cedar. It is only about one-half as durable as Douglas fir and Oregon white oak, just about as durable as Oregon ash, and more durable than red alder, black cottonwood, and the true firs.

Utilization by Industries

The bigleaf maple cut in Oregon and Washington in 1928, excepting that used for fuel, was largely consumed by the secondary wood-using industries of these States in the form of logs, lumber, and veneer; about 400,000 board feet of lumber and a negligible quantity of veneer were shipped out of the two States, mostly to California.

The following table shows the relative demands made on bigleaf maple by the secondary wood-using industries of Oregon and Washington and by veneer manufacturers in 1910, 1923, and 1928. It will be noted that total consumption in these States has increased 65% since 1923 and 135% since 1910; also that a few industries which formerly used substantial quantities of bigleaf maple are now consuming greatly reduced quantities or none at all.

Summary of bigleaf maple used in secondary industries and by veneer manufacturers in Oregon and Washington, 1910, 1923, & 1928.

Industry	1910	1923	1928
	Board Feet	Board Feet	Board feet
Furniture.....	2,916,300	1,579,000	4,824,000
Chairs.....	.....	2,661,000	2,823,000
Handles.....	40,000	70,000	67,000
Fixtures.....	19,000	60,000	54,000
Vehicles and vehicle parts.....	.....	17,000	22,000
Boats.....	500	.....	10,000
Woodenware and novelties.....	.....	250,000	10,000
Saddles.....	6,000	.....	4,000
Miscellaneous.....	35,000	57,000	4,000
General millwork.....	370,000	134,000	.....
Pulleys.....	22,000	.....	.....
Baskets.....	5,000	5,000	.....
Total	3,414,600	4,833,000	7,818,500
Veneer	.....	50,000	221,000
Grand Total	3,414,600	4,883,000	8,039,500

The secondary wood-using industries in Washington and Oregon are not only consuming the bulk of the bigleaf maple lumber produced in these States but they are also continually increasing the proportion of the lumber which they themselves produce. In 1928 independent hardwood mills engaged solely in the production of hardwood lumber produced 2,953,500 board feet of bigleaf maple. The remainder, or 4,865,000 board feet, was produced by the secondary wood-using industries, almost entirely from purchased logs. The operation of hardwood sawmills by the secondary wood-using industries has certain advantages. Aside from possible economies, the practice assures an adequate and dependable supply of lumber. Then, too, it usually results in better lumber and closer utilization of the log.

Except that red alder is preferred for cores in built-up panels, bigleaf maple because of its properties already discussed is considered the most desirable of the local hardwoods for turned and other exposed parts, as well as hidden parts, in furniture and chair manufacture, especially of the better grades.

The largest demand for bigleaf maple on the part of the secondary industries, as shown on the preceeding table, is made by the furniture industry, which used in 1928 nearly 60% of the cut. Next in order is the chair industry, which used 35%. Veneer, practically all of which is consumed by the furniture industry, accounted for nearly 3%. The remainder was used for handles, fixtures, motor vehicles, boats, woodenware and novelties, saddles, and miscellaneous articles.

Furniture

The furniture industry of the Pacific Northwest is becoming increasingly important not only in the quantity of material used but also in the value of the products manufactured. In 1923 (year of latest available data) the total quantity of hardwoods and softwoods consumed by the industry in Oregon and Washington amounted in round numbers to 20,000,000 board feet. In 1928, it is estimated, the furniture industry of these two States consumed approximately 35,000,000 feet--an increase of 75% in the intervening 5-year period. Of the 4,824,000 board feet of bigleaf maple lumber consumed in 1928, 3,667,000 feet was produced by the industry itself from purchased logs. The remainder was purchased in the form of rough lumber, most of it in green condition.

Bigleaf maple is used chiefly for a medium-grade living-room, dining-room, and bedroom furniture of both plain and fancy designs, finished in walnut, mahogany, or enamel--ordinarily for cross-banding and backing in such built-up flat parts as tops, panels, and drawer ends. In living-room furniture finished in walnut or mahogany its use is mostly confined to such solid parts as legs, stretchers, rails, and slides of tables. Certain pieces of living-room furniture, however, such as bookcases, rockers, benches, stools, and radio tables, are made entirely of bigleaf maple. Living-room tables are occasionally so made also, except that the tops are of built-up construction and faced with walnut or mahogany veneer. In dining-room furniture finished in walnut or mahogany, bigleaf maple is used for legs, stretchers, and rails of tables; all parts of chairs, but especially legs, stretchers, back posts, and other turned parts; and the legs, stretchers, crowns, rails, and mirror frames of buffets. Small dining tables are sometimes made entirely of bigleaf maple, also enameled breakfast tables and tea wagons. Its particular use in bedroom furniture depends on the character of the finish. Finished in walnut or mahogany, it is used for legs, front rails, side rails, mirror posts, and mirror frames of dressers, chiffoniers, and dressing tables, also posts, side rails, and turned parts of bedsteads. Under enamel finish it is used for all exposed parts of chiffoniers, dressers, bureaus, and vanity tables, including the facing of panels; the posts, side rails, and turned parts of bedsteads; and the legs, stretchers, back posts, and seat frames of chairs. Sound-knotted stock is suitable for enamel

finish, except in parts requiring maximum strength. This grade of material can not be used in the exposed parts with other finishes.

Bigleaf maple is used but little in the manufacture of cheap furniture. A comparatively small quantity is made into kitchen tables, but its use is mostly confined to the legs, stretchers, banisters, and slats of chairs.

About one-tenth of the bigleaf maple consumed by the furniture industry enters into the production of overstuffed and upholstered articles, including davenports, davenport beds, benches, stool, and chairs. It is desired for the frames of overstuffed furniture, especially parts subject to strains, such as back frames, back posts, and legs; also for exposed parts, such as front rails, arms, and molding. In chairs with upholstered seats and backs the wood is used in all exposed parts, such as back posts, legs, stretchers, arms, arm posts, and seat frames.

Of the 4,824,000 board feet of bigleaf maple consumed by the furniture industry proper of Oregon and Washington in 1928, about 5% was used in the manufacture of wooden chairs. Furniture also includes some overstuffed chairs, but mostly as part of furniture sets. In general, the production of chairs is a specialized industry.

Chairs

The chair industry is here considered as separate from the furniture, and as consisting of factories that produce chairs exclusively. The chairs produced are mostly of standard design

and pattern and include living-room, dining-room, bedroom, library (public), office, lodge, kitchen, and nursery chairs, rockers, and stools.

In point of consumption bigleaf maple ranks first among the woods manufactured into chairs in Oregon and Washington. In addition to the 2,823,000 board feet, or about 45% of all the hardwoods consumed by the chair industry of these States in 1928, it is estimated that the furniture industry took an additional 240,000 feet for the production of chairs. The combined consumption of other local hardwoods for this purpose amounted to 3,121,700 board feet: Red alder 2,600,000, black cottonwood 441,000, Oregon white oak 50,000, Oregon ash 17,700, and western paper birch 13,000. The industry also used 275,000 feet of eastern oak and 60,000 feet of Japanese oak.

Bigleaf maple has proved an excellent wood for all the different grades of chairs manufactured by the local industry, including cheap wood-seat, medium-grade, and enameled chairs. As has been noted, it works easily, glues and holds screws well, and takes a satisfactory mahogany, walnut, or enamel finish. In strength it compares favorably with most woods used by the chair industry at large. Less wood waste, moreover, is considered to result from its use than from that of any other native hardwood.

In the manufacture of cheap or low-grade chairs, including wood-seat diners, rockers, and kitchen chairs, bigleaf maple is in demand for all parts except rims and pillars, but principally for legs, spindles, stretchers, slats, back posts, and banisters. In certain designs or patterns of this grade, it is

used for all parts except the seat, stretchers, and spindles; in cheap wood-seat rockers, only for the runners. Its particular use in different factories depends to a great extent on the opinion of operators. For example, one operator has turned from red alder to bigleaf maple for legs and stretchers, claiming that red alder lacks the necessary strength, while another is using red alder for this purpose, claiming that red alder gives very satisfactory results.

Bigleaf maple is used more generally in the manufacture of medium-grade chairs. In dining and living-room chairs of this grade, finished in walnut or mahogany, it is used for turned, square, and flat parts, including legs, stretchers, spindles, slats, banisters, seats, seat frames, posts, pillars, rims, crowns, arms, arm posts, and rails. It enters at one time or another into all parts of medium-grade rockers, but is generally limited to the runners, top slats, rails, arms, and arm posts. Many of the so-called mahogany chairs of the better grade are made entirely of this wood, as are also office and library chairs in various finishes and natural- finish tablet-arm chairs for schools and colleges.

Bedroom, dressing, and nursery chairs, finished in enamel, may be entirely of bigleaf maple, but in most instances its use is confined to arms, arm posts, back posts, banisters, rims, crowns, top slats, and rockers.

Bigleaf maple is used in both hidden and exposed parts of upholstered and overstuffed chairs. In overstuffed chairs it is used in all parts, especially for back frames, legs, rails, back

posts, arms, and rockers. In chairs with upholstered seats and backs, finished in walnut and mahogany, it is used for back posts, arm posts, arms, rails, top slats, and legs.

The general practice of the chair factories is to purchase their supply of bigleaf maple in the form of logs; in fact, more than 85% of the wood used is delivered in this form and converted into lumber by the factories themselves. With simple equipment, usually limited to a circular headsaw and carriage, the logs are sawed into 1 to 3 inch lumber.

Veneers

Little of the hardwood veneer made in the Pacific coast region can be substituted to fill the demand for such veneer woods as black walnut (*Juglans nigra*) and true mahogany (*Swietenia* spp.). The local veneer is rarely cut thinner than 1/16 of an inch, whereas face veneer, as used in the furniture industry, is almost entirely 1/28 to 1/30 of an inch in thickness. Consequently, most of the high-grade face veneers of both domestic and imported woods used by western industries are bought from factories in the central or southern part of the United States. For other uses in furniture manufacture, however, bigleaf maple veneer is in steady demand.

Consumption of bigleaf maple logs and burls in veneer manufacture, as shown on the preceding table, has increased more than fourfold in the 5-year period ended in 1928. Total consumption in Oregon and Washington in 1928 amounted to 231,000 board feet. The bulk of this veneer was used in these States--211,000 feet by the furniture industry and 10,000 feet by the general millwork

factories. The remainder, or the cut from 10,000 feet of logs, crotches, and burls, was shipped from Washington to eastern furniture factories. In addition, bigleaf maple burls valued at approximately \$50,000 were shipped to the Atlantic coast in 1928.

Two general classes of veneer, termed plain and figured, are produced from bigleaf maple. Other than this, there are no well-defined lines separating the different kinds. A relatively small quantity of highly figured veneer is cut by the stay-log process from burls, crotches, and stumps. Burls are particularly highly figured with eyelets and bird's-eye effects. The plain veneer, produced from logs by the straight rotary-cut method and used mostly for backing and cross-banding, has little or no distinctive figure; except where the logs contain curly wood, the figure is made by the growth rings, and since the cutting is done in the direction of these rings a veneer with a comparatively large figure usually results.

Most of the bigleaf maple veneer is consumed by the furniture industry in the production of built-up lumber, or plywood, largely in the cross-banding and backing of both 3 and 5 ply panels faced with more expensive hardwoods, and occasionally for facing low-grade panels. A small proportion of the total cut of plain veneer is used as a facing or cross-banding stock in door manufacture. The highly figured veneers, marketed almost entirely in the East, are used for facing, overlay, and inlay materials in the most expensive grades of furniture.

The rotary-cut method of producing veneer, which is used extensively with different woods, takes logs cut into length

suitable for the lathe, or from 4 to 6 feet. These sections or blocks are boiled in water for 12 to 36 hours, depending on their size, after which they are revolved rapidly against a fixed knife, which peels off a thin, continuous sheet. The knife is constantly advance, the advance for each revolution of the log corresponding the the thickness of the veneer. Sometimes an additional smaller lathe is used to peel the log down to a 4-inch core.

The stay-log process, a development of the rotary method, is used for cutting highly figured veneer from burls, crotches, stumps, or other curly wood. Although a slower and more expensive process, it is justified by the greater value of the product. To get the most out of a burl requires much care and experience. Usually the burl is first cut into several pieces, their number and shape depending on the size and form of the burl, the quality of the wood, and the kind of figure desired. In the stay-log process a plate, or stay log is attached off center to an ordinary veneer lathe, with the piece of burl to be cut bolted to the stay log in such a way that the desired face of the burl will come against the knife each time the stay log rotates. The stay log, as an attachment, is usually adjustable for the sweep or diameter of cuts to be made. This process not only makes possible the use of varying forms of timber and the production of different kinds of veneer, but much of the heartwood, which by the rotary-cut method is ordinarily thrown away in the core, may be utilized.

Manufacturers of rotary-cut veneer prefer bigleaf maple logs that are 18 inches and more in diameter at the small end and clear of defects. Most firms will, however, take logs that are at least

fairly clear and 16 inches and over in diameter, or even smaller ones down to 12 inches if they contain a high proportion of clear material. Some concerns do not buy veneer logs as such but rather limit their purchases to camp-run logs, from which material suitable for veneer is selected.

The price of plain veneer logs ranges from \$22 to \$26 per thousand board feet delivered at the local factory. Highly figured logs, such as butts and crotches, bring a price of \$40 to \$60 per thousand feet. The burls, due to their irregular form, are sold by the pound. Those of commercial size weigh from 200 to about 5,000 pounds and sell at 3 to 6 cents a pound delivered at the local factory or point of shipment to the East. The best sizes for cutting weigh from 600 to 1200 pounds. Sound specimens are rarely found in the largest sizes.

Handles

In past years bigleaf maple was the favorite wood for long handles, such as broom, mop, and window-brush handles, because of its moderate weight, moderate hardness, good qualities, and ability to take an excellent finish. At the present time, however, these articles in the Pacific Northwest are made almost entirely of Douglas fir, a much more abundant wood.

Most of the bigleaf maple reported for handles in 1928, about 55,000 board feet, was utilized in the production of brush backs and short brush handles, items for which red alder and western paper birch are also used. In addition, 7,000 feet were used in the manufacture of pick and shovel handles, and 5,000 feet in small-tool handles. The material for brush handles and backs is

purchased in the form of lumber 1 to 3 inches thick and usually green. To insure straight-grained stock, the pick and shovel blanks are sawed at the factories from purchased bolts.

Fixtures

Largely because of its finishing and wearing qualities, bigleaf maple is a desirable wood for fixtures. In this use, as in furniture and chairs, it is finished in walnut or mahogany or is enameled. The industry reported the use of 54,000 board feet of bigleaf maple in 1928, largely for counters (tops, framing, and rails), shelves, racks, cases, and drawers (sides and ends). That it is not more generally used in the production of fixtures is due to the scarcity of clear stock in long lengths and the difficulty of purchasing stock properly kiln dried.

Motor Vehicles

The use of bigleaf maple in motor-driven vehicles is limited mainly to auto-body companies in Oregon and Washington engaged in the repair of various types of truck, delivery, and passenger bodies, a large part of whose requirements are filled by wood shipped in from the East. The 22,500 feet of bigleaf maple reported in 1928 as used in this way went mostly for doorposts, top frames of inclosed bodies, filler and cross braces of commercial bodies, and sills and frames of cabs. More bigleaf maple doubtless would be used by this industry if properly kiln-dried stock could be purchased easily. Apparently the wood is better suited for the more important structural parts than for the relatively unimportant running boards, braces, seat risers, and the like, for which soft-

woods can as well be utilized. In ease of working, nail and screw-holding power, shock resistance, and strength in bending and compression, bigleaf maple compares favorably with the eastern maples, which are popular with auto-body manufacturers. Because of its smooth-wearing qualities and comparative freedom from splinters, it is desirable for the floors of delivery trucks.

Woodenware And Novelties

The classification woodenware and novelties ordinarily includes all kinds of serving utensils and other culinary articles, semiuseful and more ornamental articles, and many articles that can not be included under a distinctive heading. Then, too, establishments that make woodenware are frequently manufacturers of novelties as well as other articles, consuming similar stock and reporting their raw material together. The result is that it is not practical to make a definite statement as to the quantity of bigleaf maple consumed in the production of woodenware and novelties or the various articles included in this classification.

Bigleaf maple is or has been used in the production of floor lamps, candlesticks, smoke stands, table lamps, pedestals, umbrella stands, taborets, ferneries, sewing cabinets, hat racks, telephone stands and stools, footstools, coat hangers, towel racks, doorstops, tent stakes and toggles, dowels, ladder rungs, and reels; in these articles it is used for turned or other parts in much the same way and for the same purposes as in the case of furniture or chairs. It is or has been used for such woodenware as bread boards, meat boards, cloth boards, lapboards, cutting

boards, scoops, cooking spoons, rolling-pins, outing and wire-end dishes, etc. The 10,000 feet of bigleaf maple reported under this general classification in 1928 was used largely in the production of smoke stands, sewing cabinets, and cooking spoons; a single concern produced 1,000,000 spoons for a large eastern manufacturer.

Destructive Distillation

Results of distillation tests made at the Forest Products Laboratory suggest that bigleaf maple will yield a smaller quantity of crude alcohol and acetate of lime than beech (*Fagus grandifolia*), sweet birch (*Betula lenta*), and sugar maple, the chief hardwoods used by the distillation industry of the United States. On the basis of oven-dry weight of wood the acetic-acid yield of bigleaf maple is considerably lower than that of the three other species, and the alcohol yield about the same as that of birch and lower than that of beech and sugar maple. On a cord basis, the comparison is not so favorable, owing to the comparatively light weight of bigleaf maple. The low yields given by bigleaf maple indicate that it can not be used for distillation in direct competition with eastern hardwoods. Furthermore, practically no acetate of lime is used on the coast at present, and the consumption of wood alcohol approximates the output of a single good-sized plant.

Miscellaneous and Potential Uses

Boats.--The 10,000 feet of bigleaf maple reported under this classification in 1928 was used in the building of small commercial and pleasure boats, especially for decking, interior finish, ribs, and keel blocks.

General millwork.--Although earlier statistics show that the general millwork industry used bigleaf maple in considerable quantities, little or none of it was used by this industry in 1928. For practically all interior work, bigleaf maple is an excellent wood. The only limiting factor is supply.

Doors.--A small quantity of bigleaf maple veneer, both plain and figured, is used as a facing and cross-banding stock in the production of door panels.

Kitchen cabinets.--The bigleaf maple used in the production of kitchen cabinets, tables, and similar articles is reported under the heading Furniture.

Picture frames and molding.--As with kitchen cabinets, any bigleaf maple that may have been used in the production of mirror frames, mirror backs, picture molding, and picture backs is included under Furniture. Moderately light in weight, even in texture, working easily, carving readily, and taking an excellent mahogany, walnut, or enamel finish, it is a most desirable wood for such uses.

Shade and map rollers.--Bigleaf maple is well adapted for this general class of uses. It is especially suitable for curtain poles, because it turns well and because of the ease and permanence with which it takes stain and enamel.

Spools, reels, and bobbins.--The properties of bigleaf maple fit it for spools, reels, bobbins, and spindles. At present a certain quantity is used for reels.

Dowels and skewers.--Although bigleaf maple is well fitted for dowels, skewers, and similar rods or pins, very little of it has entered into this use.

Plumbers' woodwork.--Bigleaf maple is well adapted for toilet and medicine cases or cabinets, towel cabinets and racks, and other cabinet work for toilets, which may be finished to imitate the more expensive hardwoods, or enameled to match the tile work of the room.

Saddles.--The 4,000 board feet reported in 1928 was used in the production of pack saddles. Some bigleaf maple may also have been used in saddle trees; it has been used for this purpose in past years. Hardness and strength are requisite in both uses. Pack saddles, in addition, call for a wood that checks and warps but little under adverse conditions.

Toys.--That very little bigleaf maple is used in the manufacture of toys is largely due to the small size of the toy industry in the Pacific Northwest. The wood is admirably suited, entirely or in part, for practically all classes of toys, such as the following: Wagons, wheelbarrows, kiddie cars, buggies, coasters, scooters, hobbyhorses, toy animals of various kinds, doll houses, toy furniture, gunstocks, and blocks.

Musical instruments.--Choice selections of curly bigleaf maple are used for violin backs and necks. A violin-back cutting which is 1 by $8\frac{1}{2}$ by 18 inches in size and contains $1\frac{1}{16}$ board feet, sells for \$4.

Charcoal.--Only one small concern at present is producing charcoal from bigleaf maple in considerable quantity and that in mixture with red alder. This concern in 1928 consumed about 2,000 cords of bigleaf maple, most of which was in the form of slab wood purchased from near-by mills at \$2.75 per cord; one cord of

bigleaf maple will yield from 650 to 700 pounds of charcoal. Most of the bigleaf maple charcoal is consumed by the poultry industry, only small amounts entering into the manufacture of black powder and steel. It is produced in beehive kilns, more or less makeshift retorts having proved unsatisfactory both in the quantity and quality of charcoal produced.

Fuel.--Except for the slab wood, which some concerns sell at about \$5 per cord, and the relatively small amount of cordwood resulting from land clearing, very little bigleaf maple is used for fuel. It has a fuel value about 70% of that of Oregon white oak, 74% of eastern white oak, and 100% of Douglas fir.

Maple sugar.--The sap of bigleaf maple, like that of sugar maple, is sweet, and can be made into sirup. Where the climate is favorable the flow of sap is considerable, but as far as can be determined from the records available very little use has been made of it as a source of maple sirup.

Logging

Because of differences in the volume per acre, size of timber, character of ground, and hauling distances, also because reliable cost records are not available, little more than approximations of bigleaf maple logging costs can be given. For low and high costs per thousand feet board measure, these are:

Operation	Low	High
Felling and bucking.....	\$2.50	\$3.50
Skidding, not to exceed $\frac{1}{2}$ mile.....	2.00	4.00
Hauling, not to exceed 2 miles.....	2.50	4.00
	<u>7.00</u>	<u>11.50</u>

Utilization in the woods is fairly close. Most of the bigleaf maple cut runs from 16 to 24 inches in diameter at the stump, but 12-inch and 14-inch trees are taken. Tops are utilized up to an 8-inch diameter, size and frequency of the limbs permitting. The logs are usually cut in 8, 9, 10, and 12 foot lengths; the 8 and 9 foot logs, which include no trimming allowance, are produced for the sawmills operated by the secondary industries, whereas the longer logs are cut for the independent mills. When the timber is to be rafted and towed, it is occasionally logged in whole-tree lengths and later sawed into the desired log lengths at the sawmill. Veneer logs are sometimes cut 6 feet long.

Milling

Most of the mills sawing bigleaf lumber are small, having a daily capacity of 1,500 to 4,000 board feet. In no case does the daily capacity of the hardwood mills of the region exceed 10,000 feet. Some of the mills are located in or very near the timber; other and larger mills owned by independent manufacturers are located centrally in the bigleaf maple regions, but at some distance from the timber, so that their log supply has to be transported by railroad, water, or autotruck; those operated by the furniture and chair industries produce the bulk of bigleaf maple lumber and are usually at a considerable distance from the timber.

The equipment of the small independent mills, as well as that used by the chair factories, is of the simplest order, usually consisting of a circular head saw, a bolter carriage or a carriage with headblocks and setworks, track, and dead rolls. In the larger

mills this layout is supplemented by a cut-off saw, pony edger, and live rolls. In one case the logs which have been slabbed on two sides by the circular head saw are worked down by a bolter mill, and in another the cants are converted into small sizes by a gang mill. In only two instances, so far as known, are band head saws used. The circular head saws, 44 to 56 inches in diameter and of the inserted-tooth type, cut a 3/16 inch to 5/16 inch kerf. Many of the carriages will accommodate 24-foot logs, but the logs as a rule do not exceed 12 feet in length. Logs for bolter mills seldom exceed 8 feet.

Transportation

Bigleaf maple in the form of logs or lumber is transported rather long distances to the consuming factories, located largely in Seattle, Tacoma, and Portland. As a result, transportation costs, not including the first mile or so of haul in the woods, represent a considerable proportion of the total cost of the lumber to the consumer. Of the logs sawed by the furniture, chair, and other secondary wood-using factories, constituting about two-thirds of the cut, about 70% are transported by rail, 24% by water, and the remainder by autotruck. Of those sawed by the independent sawmills, representing some 35% of the cut, about 45% are transported by rail, 30% by water, and the remainder by autotruck. Practically all the bigleaf maple lumber produced by the independent mills is transported to the consuming point by common-carrier railroads.

By Water

The rafting and towing of bigleaf maple logs is limited to

Puget Sound and the Columbia and Willamette Rivers. Occasionally the rafts are made up entirely of bigleaf maple, but usually they consist of 20,000 to 60,000 board feet each of mixed hardwoods. They are constructed in various ways, but in all cases the logs are bound together; the logs ride low and tend to duck under the boom sticks and so to get away.

A common method of making up a raft is to bind the logs in a tier by means of a cable passed through an eyebolt driven in the middle of each log, the cable ends being fastened to the front and rear boom sticks. Sometimes the eyebolts are driven near the end of the log instead of the middle. Four tiers of about 40 logs each constitute a section, and five to six sections a raft or tow. When tree-length logs are towed they are fastened together in sections by means of a chain passed through a $2\frac{1}{4}$ inch hole bored through the small end of each log, a common method in assembling and towing piling.

No definite towage rates have been established by towing companies, doubtless because of the comparatively small quantity of hardwoods moved by water, the small size of the rafts, and the fact that hardwood rafts are usually made up at points off the regular towing routes. As a result, towage charges very considerably. In many cases a job price, based on the time required to make the round trip, is quoted, with little or no consideration given to the size of the tow. Rates quoted on a thousand-foot basis range from \$1.60 to \$2.50 for a 40 or 50 mile tow, with proportionately lower rates for shorter distances. So far as known, 125 miles is the maximum towing distance in the region, the rate amounting to about \$7 per thousand feet.

By Autotrucks

About 12% of the total cut of the bigleaf maple logs is transported by autotrucks to the mills, usually over distances of 10 or 12 miles and seldom more than 20 or 25 miles. Occasionally, high-priced veneer logs are trucked 60 to 75 miles. Many of the woods operators own trucks, some hire them by the day or trip, and a few contract the hauling on a footage basis. The cost of auto transportation averages \$4 to \$8 per thousand feet.

Only a very small quantity of bigleaf maple lumber is transported by autotrucks, and that largely from mills located near the consuming centers and on a job-rate basis.

By Railroad

The major portion of the cut of bigleaf maple is transported by common-carrier railroad, in the form of logs to the centrally located mills and wood-using factories, and in the form of lumber from both the woods and centrally located mills to the wood-using factories.

In Oregon and Washington freight charges on both logs and lumber are based on the weight of the shipment. Maple logs weigh from 9,000 to 12,000 pounds per M feet board measure, log scale; green lumber, 4,500 to 5,000 pounds per M; and kiln-dried lumber, with a moisture content of about 8%, 2,400 to 2,600 pounds per M. The small size of the timber precludes a large log scale per car, a load usually averaging from 7,000 to 9,000 board feet measure.

The largest portion of the logs shipped by rail originates in Washington. In Washington logs for rail shipment are cut in 8 and 9 foot lengths, in Oregon in 8-foot lengths. These are very

satisfactory lengths for lumber manufacture, as well as car loading. The Great Northern, Northern Pacific, Union Pacific, and the Chicago, Milwaukee, St. Paul, and Pacific railway companies have established the distance rates given in the following table. These rates apply only to carload lots of a minimum weight of 50,000 pounds. Point-to-point rates over the Southern Pacific lines in western Oregon are omitted.

Freight rates on 8 and 9 foot bigleaf maple logs, western Oregon and Washington, 1929

Distance	Rate per 100 lbs. (Cents)	Distance	Rate per 100 lbs. (Cents)
Not over 5 miles.....	2	Over 130, not over 150 m.....	6
Over 5, not over 30 m.....	3	Over 150, not over 170 m.....	6.5
Over 30, not over 50 m.....	3.5	Over 170, not over 190 m.....	7
Over 50, not over 70 m.....	4	Over 190, not over 220 m.....	7.5
Over 70, not over 90 m.....	4.5	Over 220, not over 250 m.....	8
Over 90, not over 110 m.....	5	Over 250, not over 280 m.....	8.5
Over 110, not over 130 m.....	5.5	Over 280, not over 290 m.....	9

Lumber Rates

Rates on bigleaf maple lumber are quoted both on a mileage and point-to-point basis by the Northern Pacific, Great Northern, and Chicago, Milwaukee, St. Paul, and Pacific railway companies.

Distance	Rate per 100 lbs. (Cents)	Distance	Rate per 100 lbs. (Cents)
Not over 5 miles.....	7	Over 90, not over 100 m.....	17
Over 5, not over 20 m.....	8.5	Over 100, not over 140 m.....	17.5
Over 20, not over 25 m.....	9	Over 140, not over 150 m.....	18.5
Over 25, not over 45 m.....	10.5	Over 150, not over 170 m.....	20
Over 45, not over 50 m.....	11	Over 170, not over 200 m.....	21.5
Over 50, not over 65 m.....	13	Over 200, not over 225 m.....	24.5
Over 65, not over 75 m.....	13.5	Over 225, not over 250 m.....	25
Over 75, not over 90 m.....	16	Over 250, not over 275 m.....	27

Stumpage, Log, and Lumber Values

Bigleaf maple stumpage in small, poorly located units with scattered timber may sell for as low as \$0.75 per M feet, but when stumpage contains a comparatively high percentage of logs suitable for veneer it may bring as much as \$5. Stumpage within a mile or two of existing transportation facilities, such as a good road, "towable" water, or a railroad, is ordinarily worth from \$1.50 to \$2.25 per M or, if good-sized and exceptionally well located, \$2.50 to \$3.50 per M.

Except for the small quantity of specially selected logs used in veneer manufacture, bigleaf maple logs are usually sold on a camp-run basis. Although the size and quality of the logs are taken into consideration, the location of the mill with reference to the timber and transportation facilities largely fixes the price. The following table gives average, high, and low prices paid for camp-run logs delivered to the different classes of mills.

Location of mill	Average	High	Low
In timber.....	\$8	\$10	\$7
On highway.....	16	18	15
On tidewater.....	20	22	16
On railroad.....	22	24	17

Veneer logs of a grade suitable for the manufacture of plain veneer sell for \$22 to \$26 per M feet b.m.; such logs are usually 18 inches and more in diameter and 6 to 8 feet in length, as well as straight, sound, surface, clear, well rounded, and with the minimum of taper. Veneer logs yielding highly figured stock sell for \$40 to \$60 per M.

Because of the relatively small quantity cut and the character of its use, lumber grades have not been established for bigleaf maple. Except for an occasional small sale of clear stock, the lumber is sold "mill run with culls out," culls being considered as lumber so defective as to contain little material of value.

The following table shows average, low, and high prices paid in 1928 for green bigleaf maple lumber delivered to the principal consuming centers. Prices paid for stock of different thicknesses are practically the same; the 3-inch and 4-inch stock, which represents but a small percentage of the cut, brings only \$2 to \$3 more per M than the thinner stock. Moreover, the price paid for partially air-seasoned lumber is substantially the same as that paid for green lumber. The partially seasoned stock occasionally brings \$2 to \$3 more per M. Of course, since the price of bigleaf maple lumber is generally quoted f.o.b. delivery point, the producer who ships by rail actually receives more for partially air-seasoned stock; the lumber is lighter in weight and so the cost of transportation is less.

Delivery point	Average	High	Low
Portland, Oregon.....	\$32	\$38	\$30
Tacoma, Washington.....	35	36	32
Seattle, Washington.....	35	38	32

The large users of bigleaf maple prefer to kiln-dry their own stock, with the result that the demand for kiln-dried bigleaf maple lumber is largely confined to small users. Prices paid for kiln-dried stock in 1928 ranged from \$45 to \$75 per M

feet b.m.; \$50 to \$75 in Seattle and Tacoma, and \$45 to \$60 in Portland. The wide range in these prices was due to the variation in the grade of the lumber, the stock bringing \$75 per M consisting mostly of clear lumber.

OREGON WHITE OAK

The wide range of this tree, the possibility of encouraging its growth on submarginal agricultural land, and the suitability of the wood for certain products make it worthy of consideration as one of the commercial hardwood species of the Pacific Northwest.

The wood of this tree is similar in appearance to that of eastern white oak, except for a somewhat lighter color. The wood rays, which produce the distinctive flecks in quartered oak, are numerous and conspicuous. The wood is heavy, hard, close-grained, tough and strong. It is heavier and harder than eastern white oak but the latter is stronger and more elastic. The wood shrinks less than that of most of the eastern oaks; this coupled with the hardness, suggests its suitability for flooring. In shock resistance, an important property in handle stock, Oregon white oak is exceeded by the eastern red and black oak. But many of these properties are dependent upon the growth of the tree. The wood from old-growth timber is inclined to be brash and flinty, hence difficult to work. That from second-growth timber is bendable, resilient, and more easily worked.

Oregon white oak about equals eastern white oak in decay resistance, and is about half as durable as black locust, which is rated as the most durable of the eastern hardwoods. Experience in this region suggests that the heartwood of Oregon white oak, when used under conditions that favor decay, is about half as durable as Pacific yew, three-fourths as durable as western red cedar and Port Orford cedar, but more durable than other species within its range. Thoroughly seasoned Oregon

Source

white oak posts will last for 20 years or more under average conditions.

Utilization

Oregon white oak has never been used extensively, and excepting for fuel, the demand has decreased markedly since 1910. The following table shows the amounts used, exclusive of fuel, in 1910 and 1928. It will be noted that industries formerly using substantial quantities are now consuming greatly reduced amounts or none at all.

Industry-	1910 (board feet)	1928 (board feet)
Handles	1,320,000	105,000
Chairs	457,000	90,000
Cooperage	200,000	.....
Saddle and stirrups	50,000	13,000
Boats	51,000	50,000
Fixtures	43,000	.....
Baskets	12,000	.....
Vehicles and parts	12,000	5,000
Interior work	10,000	.....
Misscellaneous	.....	3,000
Total	2,185,000	266,000

Fuel

Oregon white oak ranks second as a source of fuel in western Oregon, being exceeded only by Douglas fir. In 1930, 58,500 cords were used for this purpose. It is especially adapted to fireplace and furnace use as it does not emit sparks and burns slowly and steadily, with little smoke. A cord of air-dry Oregon white oak has 97 per cent of the fuel value of a ton of coal, and a 50 per cent greater value than Douglas fir.

Handles

The handle industry has always consumed the largest proportion of the cut of Oregon white oak. In 1910 approximately 1,320,000 board feet (60 per cent of the total consumption) were used for handles. By 1928 only 105,000 feet were required and in 1930 the amount probably did not exceed 15,000 feet.

Old-growth oak is brash, lacks resilience, and is hard to work, hence is not suitable for handles; heartwood has similar characteristics. Therefore all handle stock is cut from second-growth of "grub" oak. The usable portion of the tree is usually limited to the first four or eight-foot bolt above the butt swell. Bolts must be practically free from blemishes, straight grained, and have a limited amount of heartwood.

The handles made from Oregon white oak include axe, hammer, hatchet, peavy, mattock, pickaroon, pick, pruning shear and sledge. The principal markets are in California and Nevada, though small quantities are sold locally and in the middle western states. It is said that considerable quantities of oak handles manufactured in Virginia are marketed in South America. This suggests a possible extension of the outlets for Oregon-made handles.

Chairs

In the production of Oregon white oak small dimension stock for furniture and chairs, there is an estimated loss in volume of 40 to 50 per cent because of defect such as knots, rot, checks and cross-grain. Some producers claim that because of this loss the material recovered cost approximately the same as does a good

grade of eastern oak delivered at the factory. In some factories formerly using considerable quantities of this wood, it has been supplanted, entirely or in large degree, by eastern oak and other native hardwoods. Its use is now restricted almost exclusively to bow backs and braces, though formerly used for stretchers, legs, arms and other turned and square parts.

The introduction of other woods in place of Oregon white oak is evident in the decreased quantities reported as used. In 1910 the chair and furniture manufacturers used 457,000 board feet, in 1923 only 95,000 feet, and in 1928 approximately 90,000 feet.

With minor exceptions, chair manufacturers purchase their oak in log form, ranging from eight to nine feet in length, and 10 to 30 inches in diameter. The cost of such logs delivered at the factory is from \$40 to \$50 per thousand feet.

Cooperage

Oregon white oak, because it is impervious to liquids, is adapted for use in tight cooperage manufacture. Small quantities have been used for this purpose in the past, but because of the difficulty of obtaining material of sufficient clearness and the availability of equally suitable softwoods, the amount now used is negligible. The recently renewed demand for beer barrels, however, has revived interest in this wood, and inquiries as to the location of suitable stands of oak are being made.

One manufacturer has recently contracted for a small shipment of this wood in order to test its suitability for bungs.

This material was purchased in bolt form.

Boats

The use of Oregon white oak in boat construction and repairs is limited to such parts as stern posts, strakes, fenders, frames, raft logs, towing bitts, davits and hatch wedges, and in 1928 amounted to about 50,000 feet. Clear stock for these uses sells for \$100 to \$175 per thousand feet.

Miscellaneous Uses

A small amount of Oregon white oak is used in the repair or replacement of such vehicle parts as axles, bolaters, hounds, felloes, reaches, tongues, neckyokes, doubletrees, singletrees, plow beams and logging truck bunks.

It enters to some extent locally into such telephone equipment as insulator pins, brackets, tree pins and pole steps. Because of its greater durability, heartwood is preferred for these parts.

Small numbers of picker sticks for woolen mills, scutcheons for flax mills and screen frames for flour mills are made of Oregon white oak.

Because of the hardness, strength and ease of bending, this wood is superior to other native hardwoods for stirrups. It is also used for the sawbuck portion of pack saddles. In 1928, 13,000 feet were used for these products.

Other miscellaneous items for which Oregon white oak is adapted are housemoving rolls, mill rolls, machinery foundation

blocks and friction blocks for donkey engines. The sawdust is sometimes used for smoking meats.

Stumpage, Log, and Lumber Prices

Excepting for fuel, the amount of Oregon white oak stumpage purchased as such is negligible. With the use of the wood limited to special items the portion of the tree ordinarily utilized is so small that mills and factories purchase their oak in log or bolt form delivered at the plant. Stumpage for handle stock, usable portion of the tree only, ranged from \$5 to \$7 per thousand in 1928. In the case of fairly accessible timber of a size and quality yielding 12 to 16-foot sound logs suitable for the production of heavy plank and timbers, the price ranged from \$10 to \$20. In 1930 furlwood stumpage brought from 50 cents to \$2.50 per cord, depending on its size and accessibility.

Oregon white oak logs eight to nine feet long delivered to the chair factories bring from \$40 to \$50 per thousand feet. Sales of four-foot handle bolts range from \$10 to \$15 per cord. Logs 12 feet and longer comparatively clear, sound and of a size suitable for the production of plank and timbers at times sell for \$60 to \$75 per thousand at the mill.

Other than the lumber and small dimension stock sawed by chair and handle factories for their own uses, the amount of lumber produced is small. Most of the cut of the so-called independent mills is for special purposes, usually requiring an exceptionally high-grade product, for which they receive from \$100 to \$175

per thousand. When small dimension stock is produced, it brings about \$50 per thousand.

Management

These stands of oak should be so managed as to insure a permanent growth. Efforts should be directed toward producing the maximum amount of handle stock and fuelwood, favoring only the best trees for lumber production. Proper management requires absolute protection from fire, and the cutting of the trees so as to encourage vigorous sprouting. By proper management the owner of small tracts of this timber may expect cash returns from land it does not pay to cultivate, may provide an outlet for his labor during slack seasons, and may encourage the development of local wood-using industries assured of a permanent supply of raw materials.

Northern Black Cottonwood

The forest survey of western Washington and western Oregon recently completed by the Forest Service, shows that the stand of black cottonwood 12 inches and more in diameter breast high in this region, totals about 249,785 M feet, log scale, including 143,126 M feet in Washington and 106,659 M feet in Oregon. These figures are conservative, as it was manifestly impossible to obtain data on the many small clumps occurring throughout the agricultural areas. The stand by counties in western Oregon is shown in the following table.

Volume of black cottonwood 12 inches and over D. B. H.,
in the counties of western Oregon, in 1933.

County	Quantity M Bd. Ft.
Benton.....	1,500
Clackamas	12,951
Clatsop .....	.....
Columbia	19,660
Coos	510
Curry	400
Douglas	270
Hood River	8,311
Jackson	3,780
Josephine	275
Lane	17,019
Lincoln .....	.....
Linn	11,921
Marion	12,681
Multnomah	11,720
Polk	874
Tillamook .....	.....
Washington	1,000
Yamhill	3,787
Total.....	106,659

Black cottonwood is third among the hardwoods of the Pacific Northwest in quantity and value of lumber used, being surpassed

only by red alder and bigleaf maple. During the 20 years ending with 1930 the use of this wood in western Washington and western Oregon decreased nearly 50 per cent; consumption amounted in 1910 to 43,103 M feet, log scale, and in 1930 to 21,624 M feet. This decrease may be attributed directly to growing scarcity of supplies. Agricultural development and the demand made by certain industries have removed a great portion of the northern black cottonwood lands from forest production, and the latter has depleted the majority of the remaining readily accessible stands of merchantable size.

About two million feet of black cottonwood lumber is shipped out of the region annually. During the five years 1929-33 considerable quantities of the logs were shipped to the Orient for the manufacture of matches; these exports amounted to about 14,500 M feet, Brereton scale, in 1931 and 8,500 M feet in 1933.

Properties Of The Wood

The wood of northern black cottonwood can easily be distinguished from that other western hardwoods by its color which varies from grayish white to very light brown, and by its light weight when dry. It is very similar to the eastern cottonwood in appearance, but is softer and somewhat lighter in weight. The wide sapwood is not clearly defined but merges gradually into the heartwood, which is similar in color. There is no distinct line of demarcation between annual growth rings, the summer wood forming a very fine band visible only on a smoothly cut radial surface.

Black cottonwood is a diffuse porous wood, the pores being so small they can be seen without magnification only on a planed

longitudinal surface--and then only as fine grooves. They are fairly uniform in size and are evenly distributed throughout the annual growth ring. The fibres are short and are rather evenly distributed among the pores. The wood rays are one cell, or occasionally two cells, in width. The wood is heavy when green, but is light in weight when thoroughly seasoned. It is soft, uniform in texture, and fairly straight grained, and when dry is tough, odorless, and tasteless. In comparative shrinkage it is about equal to red alder. Although the comparative shrinkage is greater than that of chestnut, a standard corewood, it is not excessive. This, together with its low specific gravity suggests that the wood is suitable for use as a core stock. The wood turns and glues easily, holds nails and screws well and does not readily split. In seasoning it tends to warp badly but when properly and thoroughly dried does not shrink or swell appreciably under ordinary conditions of use.

Black cottonwood is low in bending and compressive strength, stiffness, and shock resistance. This, however, is of little importance, as the industrial uses to which the wood is put do not require these properties. The softness of the wood is a great advantage in working for excelsior, veneer, baskets, and turned products. Its nail-holding power is relatively low, but its comparative freedom from a tendency to split at the nails when dry more than compensates for this.

Black cottonwood is one of the least durable woods when placed in contact with the soil or exposed to the weather. Logs left in damp situations show signs of decay within a week or two. Although there is no record of a preservative treatment having been given this wood, presumably it would take preservatives readily.

Posts of eastern cottonwood (*Populus deltoides*) butt treated with creosote by the open tank method were sound after 17 years in the ground; being similar in character, black cottonwood should last equally long if given like treatment.

Utilization By Industries

The following table shows the quantities of black cottonwood consumed by various individual industries in Oregon and Washington in 1910, 1923 and 1930. The consumption shown covers practically the entire production of the two states with the exception of one to two million feet shipped out annually. It is notable that the quantity used in 1930 was only about half that of 1910, but almost a third greater than in 1923.

Many industries of this region that used considerable quantities of black cottonwood in the past have now turned to the softwoods or to other of the native hardwoods. This shift is due not to the unsuitability of the wood but to the increasing scantiness of dependable, readily available supplies. The pulp and paper industry of the Pacific Northwest is now importing considerable quantities of cottonwood from Canada and Idaho.

Industry	Quantity Consumed In (bd. ft.)		
	1910	1923	1930
Pulp and paper	13,139,000	12,000,000	12,660,000
Excelsior	10,740,000	1,400,000	2,700,000
Veneer-			
Furniture	4,500,000	627,000	1,425,000
Baskets and fruit pk.	655,000	567,000	1,530,000
Boxes and crates	12,169,000	1,024,000	976,000
Furniture	464,000	40,000	1,870,000
Chairs	.....	438,000	460,000
Vehicles & parts	22,000	14,000	3,000
Cooperage	1,133,000	45,000	.....
Paper plugs	.....	220,000	.....
Trunks	177,000	20,000	.....

Consumption of Black Cottonwood in Washington and Oregon in 1910, 1923 and 1930 cont.

Industry	1910	1923	1930
Caskets	50,000	....	....
Pulleys	40,000	....	....
Saddles	9,000	....	....
Fixtures	5,000	....	....
Cigar boxes	.....	10,000	....
Miscellaneous	.....	10,000	....
Total	43,103,000	16,415,000	21,624,000

Lumber

The production of black cottonwood lumber, which is utilized mainly by the furniture and box industries, has never been large and is subject to considerable fluctuation from year to year. Except in 1931, a much greater footage has been produced in Oregon than in Washington. During the 10 years ending with 1933 the annual cut of the two states has varied from one and one-half million to six million feet. The reported cut by years is as follows:

Lumber Produced		Lumber Produced	
Year	M Ft. B. M.	Year	M Ft. B. M.
1923	2,550	1929	3,143
1924	.....	1930	4,949
1925	1,102	1931	4,516
1926	2,119	1932	3,450
1927	1,556	1933	6,022
1928	2,417		

Pulp And Paper

Black cottonwood has always constituted a minor portion of the pulpwood consumed in Oregon and Washington. It composed 21,900 cords of the 140,000 cords consumed in 1910, and 21,090 cords of the 1,300,000 cords used in 1930. It is notable that

the consumption of this wood for pulp was practically the same for the two years, but that the proportion on the basis of total wood consumption had decreased from about 13 per cent to less than 2 per cent. The bulk of the wood requirements of this industry are now cut from the softwood species.

The softness, light color, and easy bleaching qualities of black cottonwood make it an excellent wood for certain types of pulp. About 85 per cent of the quantity used for pulp is reduced by the soda process. The sulphite and groundwood processes are also used. Because of the shortness of the fiber, paper made from cottonwood alone has little strength; hence, it is used in mixture with the softwoods Douglas fir (*Pseudotsuga taxifolia*) is blended with the soda pulp for the manufacture of the better grades of book, magazine, and tablet paper. The groundwood pulp is blended with Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*) in varying proportions in the production of carbonizing paper, book paper, and toweling.

Excelsior

In 1910 the excelsior industry of Oregon and Washington, which then consisted of six plants, consumed black cottonwood amounting to 17,900 cords, or about 10,740,000 feet, log scale. In 1930 this industry, reduced to four plants, used only 4,500 cords, or 2,700,000 feet. Excelsior, which was formerly used extensively by the furniture and packing industries, has been replaced to a large extent by cotton linters and shredded paper.

Black cottonwood is the standard excelsior wood of the Pacific Northwest. Excelsior produced from it is light in

weight, tough, straight-grained, resilient, free from resin, and of clean appearance--qualities essential for a good packing and stuffing material. Four grades of excelsior are produced: wood wool, ribbon, medium, and coarse. Wood wool is used for the upholstering of caskets, the ribbon and medium grades for overstuffed furniture and mattresses, and the coarse grade for general packing.

Cooperage

Black cottonwood has never formed a large proportion of the wood used in the Pacific Northwest for cooperage. In 1910, 1,133,000 feet, log scale, was so used, and in 1923, 45,000 feet. None of it has been used for cooperage in Oregon plants, and in cooperage plants of Washington it has made up not more than 1.5 per cent, and usually less, of the total wood consumed. There is no record of its use for cooperage in recent years.

In the past this wood entered into the containers of jelly, candy, lard, and pickles. Because it is odorless, tasteless, and nonresinous, it is particularly well adapted for such use.

Paper Plugs

In 1923 about 220,000 feet, log scale, of black cottonwood were used in the manufacture of paper plugs. Data are not available as to the quantities so used in previous and subsequent years. Although small quantities of this wood may have been consumed for paper plugs in recent years, red alder, which is more abundant and equally suitable, is now more generally used for this purpose.

Paper plugs are inserted in the ends of paper rolls to maintain their shape in handling and transportation and also to facilitate their handling. The plugs range in diameter from two to five and one-half inches at the large end and from one and one-half to four and one-half inches at the small end, and in length from one and one-half to four and three-quarters inches.

Fuelwood

The approximately 1,800,000 cords of fuelwood consumed in Washington and Oregon in 1930 included 450 cords of black cottonwood, used in the more arid sections where other woods were not readily available for fuel.

In some respects black cottonwood is a good fuel. When green it cuts and splits easily. It seasons rapidly, and when dry burns with a steady flame. Ton for ton, it gives about as much heat as any other nonresinous wood. A cord of dry black cottonwood has about two-thirds the heat value of a cord of dry Douglas fir, and about half that of a ton of coal.

Baskets and Fruit Packages

Black cottonwood is used in the form of veneer, $1/32$ to $3/16$ of an inch thick, for the manufacture of wireend dishes, berry baskets, berry hallocks, fruit packages, and egg crates. All the veneer for these purposes is rotary cut.

Light weight and toughness, as well as nearly white color and lack of odor and taste, especially adapt this wood for the manufacture of berry boxes and fruit packages. Its color, weight, and toughness favor its use, in the form of $3/16$ inch veneer, for the bottoms, sides and tops of egg crates. In the

past it it has been used in small quantities for the hoops of coffee and similar drums, and in some instances for the entire drum.

Because of its nail-holding power and freedom from splitting when dry it is used in considerable quantities in the form of 5/16 inch veneer for box cleats.

In 1931, a total of 1530 M feet, log scale, of black cottonwood was used for the items listed, a quantity more than double that so used in 1910 and nearly three times that so used in 1923. Although the quantity used has increased considerably, the proportion on the basis of all woods used has decreased since 1910 from about 16 per cent to less than one per cent.

Veneer

Black cottonwood in veneer form is used also in furniture manufacture. In panels to be faced with the more expensive of the hardwoods it is used for core stock, crossbanding, and backing. For core stock it is cut 1/8 to 3/16 of an inch thick, and for facing, crossbanding and backing 1/16 to 1/20 of an inch. When used, otherwise than as a glued-up stock, for drawer bottoms and ends its is cut 9/32 of an inch thick. All veneer for these uses is rotary cut. Except for a small quantity used by the plywood industry, this veneer is produced by the furniture manufacturers themselves.

Lack of a pronounced grain makes black cottonwood very desirable for crossbanding on panels to be faced with the more expensive of the hardwoods. If the grain of crossbanding is

too pronounced it shows through the face veneer, which is usually cut $1/28$ of an inch or less in thickness. Lack of grain, together with nearly white color, also makes it a pleasing wood for drawer bottoms and ends, and for back of panels.

The furniture industry of Oregon and Washington consumed 4,500 M feet, log scale, of black cottonwood in the production of veneer in 1910; 627 M feet in 1923; 1425 M feet in 1931; and 3013 M feet in 1933.

Although the plywood industry of this region, engaged primarily in the production of veneer and plywood from the softwood species, uses some northern black cottonwood each year, the quantity is usually negligible. In the first six months of 1934, however, this industry consumed nearly 1000 M feet of logs for veneer for facing, crossbanding, and core stock in three- and five-ply panels. The veneer was cut $3/16$, $1/8$, and $1/10$ of an inch thick. Except for a small quantity marketed locally and in California for furniture and store fixtures, these panels were exported to Europe, to be faced with hardwoods.

The furniture industry purchases woods-run logs eight to 16 feet long, selecting only the larger and better logs for veneer purposes. The plywood industry requires that the logs be at least 24 inches in diameter, surface clear, and free from defects. They are cut 80, 90 and 100 inches long.

As already stated, northern black cottonwood is used extensively by the furniture industry of the Pacific Northwest in veneer form. It is also used by this industry in sawed form, $3/4$ to 1 inch thick, mainly for the cores of thick panels, for cheap kitchen furniture, and in parts of frames not subject

to strain in the better grades of both solid and upholstered furniture.

This wood is recommended for core stock by its light weight, ability to stay in place, freedom from shrinking and swelling as atmospheric conditions change, lack of pronounced grain, and excellent gluing qualities.

Black cottonwood lumber used by the furniture industry amounted to about 150 M feet in 1910, 40 M in 1923, 1870 M in 1930, and 5017 M in 1933. Of the 1933 consumption, it is estimated that 75 percent was for core stock. In 1910 cottonwood constituted about 1 per cent of the total wood consumed by the furniture industry in the Pacific Northwest, in 1923 less than one-tenth of 1 per cent, and in 1933 about 8 per cent.

Chairs

The use of black cottonwood by factories in Washington and Oregon producing chairs only has not changed materially during the decade ending with 1933. It amounted in 1923 to 438 M feet and in 1930 to 460 M feet, or to about 8 and 5 per cent, respectively, of the total wood consumed. Aside from what is used in the chair factories proper a small quantity is used in furniture factories producing chairs as a part of their output. The wood is purchased largely in log form and sawed in the small mill that is an integral part of each chair plant in this region. A small quantity is purchased from independent hardwood mills.

This wood is well adapted to chair manufacture because it is tough, light in weight, easily turned, and straight and even grained, nails and takes screws readily without splitting,

and glues well. It is used principally for the seats of the cheaper grades of chairs.

Some concerns formerly using considerable quantities have turned to red alder, and bigleaf maple, on the basis that black cottonwood "wools-up" badly in working. It seems, however, that this objectionable feature can be obviated by sanding out the seats instead of turning them in a seat machine.

Miscellaneous

Vehicles.-A small quantity of black cottonwood is used in constructing and repairing automobile bodies, particularly truck bodies. Although not especially hard, because of its toughness it is desirable for the flooring of truck bodies. It is used also for seat frames and top slats, and as a filler in delivery-truck bodies. The quantity used for vehicles decreased from 22,000 feet in 1910 to 3,000 feet in 1930.

Pulleys.-In 1910, 40,000 feet of black cottonwood was used for built-up pulley rims. Sitka spruce and Douglas fir have now been substituted for this purpose.

Trunks.-Woods used for trunk boxes and trays should be strong, light in weight, stiff, odorless, and readily glued. Black cottonwood is entirely satisfactory for this purpose, but at present only a very small quantity is so used. Trunk manufacturers of the Pacific Northwest used 177,000 feet of this wood in 1910. Spruce and Douglas fir plywood have apparently replaced it in recent years.

Caskets.-In 1910 casket manufacturers used 50,000 feet of black cottonwood lumber, which was about 1 per cent of their

total requirements. In recent years they have used it in negligible quantities only.

Fixtures.-A very small quantity of black cottonwood is used for shelving and drawer bottoms in store fixtures.

Saddles.-Although since 1910 none has been reported as so used, black cottonwood formerly entered into the manufacture of pack saddles. Such use requires a wood that is strong and easily worked and that resists checking and warping under adverse conditions.

Cigar Boxes.-In 1923, 10,000 feet of this wood was reported as used in cigar-box manufacture. None has been so reported in recent years.

Matches.-Being nearly white in color, straight grained, and tough, northern black cottonwood is an excellent wood for match manufacture. During recent years considerable quantities of the logs have been shipped to the Orient for this purpose; these exports, which included a small quantity of aspen (*Populus tremuloides*) from eastern Washington, amounted to 600 M feet, Brereton scale, in 1929, 2000 M in 1930, 14,000 M in 1931, 2500 M in 1932, and 8500 M in 1933.

Toys.-A small quantity of cottonwood lumber is shipped to the Orient for the manufacture of toys. None has been reported as so used in the Pacific Northwest.

Lumbering

Most of the mills cutting black cottonwood are either parts of or subsidiary to the consuming plants. Independent mills, engaged primarily in sawing other hardwoods, do not cut more

than 15 per cent of the total cottonwood lumber produced in any one year.

It is notable that regardless of the many excellent qualities of the wood and the increasing scarcity of available supplies, black cottonwood stumpage, log, and lumber values have advanced but little during the past two decades. In fact, between 1910 and 1930 both log and lumber values diminished. There are several reasons for this situation. Fewer industries are now using this wood, hence the market is more restricted. Most of the readily available stumpage is owned by farmers having little knowledge of markets or values. In most cases such owners are glad to dispose of the timber at any price offered, especially since areas on which this tree grows are usually suitable for agriculture. During the past three years of subnormal economic conditions black cottonwood prices have decreased along with those of other species as would be expected. In certain industries the main reason for continued use of this wood is its availability at a price below those of native woods that could be substituted for it.

According to the available records of actual transactions, stumpage values per M averaged \$1.50 in 1929, \$1.62 in 1930, \$1.57 in 1931, \$1.60 in 1932, and \$1.50 in 1933. No data are available for earlier years. Stumpage value per M has always ranged from \$1 to \$2.50, depending on the accessibility, quantity, and size of the timber.

Records of actual transactions indicate that log prices averaged \$11.30 in 1929, \$12.92 in 1930, \$8.13 in 1931, \$7.15 in 1932, and about \$8 in 1933. There was a considerable range in the log prices of each year. Usually pulpwood logs sold between

\$4.50 and \$5.50 per M, lumber logs between \$7 and \$9, and veneer logs between \$10 and \$14. In general, log prices in Washington were from \$1.50 to \$2.50 per M higher than those in Oregon. In Washington a considerable proportion of the logs are cut expressly for veneer, hence must be of good quality, whereas in Oregon most purchases are on a woods-run basis.

Lumber prices per M averaged \$16.33 in 1910, \$23.80 in 1923, \$14.76 in 1930, \$12.51 in 1931, and \$11.07 in 1932. They ranged from \$19 to \$25.98 in 1923, and from \$10 to \$15 in 1932. It will be noted that lumber prices have followed about the same trend as log prices.

There have been no attempts to manage black cottonwood stands. In the past the major part of the production has come from lands being cleared for agriculture; future supplies from such areas will be negligible. There are, however, many sites unsuited to agriculture, especially the sandy soils of islands, bars, and shore lines subject to inundation on which this species should be encouraged, either by planting or management, to the exclusion of willows and other scrubby growth of non-commercial trees. Where black cottonwood occurs in mixture with other commercial species the management should aim to preserve it as an integral part of the stand. Because of the ease with which the tree reproduces and its rapid and persistent growth, the establishment and management of this species on favorable sites should offer no difficulty.

Several plantations of northern black cottonwood were established in past years by one of the pulp and paper companies of this region to provide a future supply for its own use.

These projects were abandoned when the company practically ceased using the species. Only partial yield data were obtainable on a single plantation established near Oregon City in 1905 and harvested in 1926 and 1927. The site of the plantation was good agricultural bottom land, which was plowed and summer fallowed for one year before the planting. The stock used was 1-year-old nursery-grown scions. The cost of field planting, with a spacing of 10 by 10 feet, was \$8.75 per 1000. During the first two years the rows were cultivated to check weed growth. The yield from 4.10 acres of the plantation after 21 years was 169 cords of four-foot peeled pulpwood and that from 4.15 acres after 22 years was 178 cords, an average of about two cords per acre per year. The yield was somewhat reduced by the cutting of the stumps three feet high to facilitate pulling. At the time of harvesting the average breast-height diameter of the trees was 10 inches and the average used length, to a four-inch top, was 50 feet. The maximum used length was 70 feet.

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Temporary living quarters of
Logging crew



Rafting pond + power boat used
in towing on Willamette River



Log raft in center-on McKenzie River



Maple rafts on McKenzie River



Logged Maple stand showing
Canadian thistles



Mixed hardwood stand
on Willamette R.



"Power" of the Willamette



Sheep grazing on cut over
cottonwood stand



Open area in mixed hardwoods
used for spring + summer
grazing



Stand of Ponderosa Pine
on McKenzie River



Maple coppice



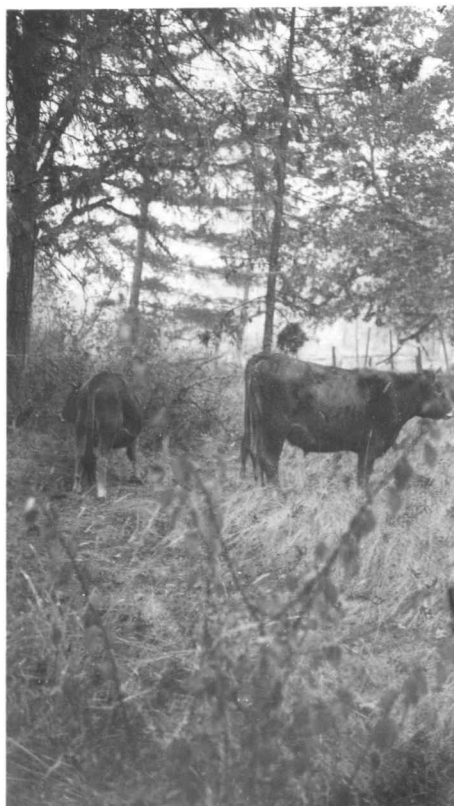
Logged maple stand burned
for Canadian thistle control



Cottonwood reproduction
on gravel bar



open stand of Oregon
white oak



Cattle grazing in mixed
Hardwoods + conifer.



Logs lost in high water (cottonwood)
and culled maple stand.



Ideal cottonwood