APPENDIX 4

THE LUMBER INDUSTRY IN WASHINGTON

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Raw Materials

IMPORTANCE OF FORESTS AND GENERAL EFFECTS

1. The forest resources have, since the earliest days of western Washington, formed this territory's principal source of revenue. From the first hand-sawn schooner load of lumber shipped to San Francisco by the earliest settlers in exchange for general merchandise, to the present production, which in the whole State reaches approximately $200,000,000 in value annually and furnishes 65 percent of the total industrial pay roll, the forests have, in a more marked degree than in any other State, influenced the character of development and the prosperity of this region.

2. The lumber industry in western Washington differs in its processes and effects from that of the Eastern States and of the South in several important respects. Because of the great dimensions of the trees, an entirely new system of logging with heavy machinery and tackle has been developed, followed by corresponding changes in the sawmills. Because of the dense stands, the large logs, and the concentration of tonnage to be transported, substantially constructed logging railroads with special rolling stock have been built, and on a far more extensive scale than in the pine regions. River driving has been practically unknown. The well-designed steam schooners, built of northwestern lumber for coastwise transportation of this lumber, and only within recent years partly replaced with steel hulls, are a distinctly northwestern type developed for this purpose; and the towing fleet, with many types of log rafts, occupies an important position in the coastwise traffic.

3. The heavy dimensions available have influenced methods of construction. Timbers 18 by 8 inches, 120 feet long, can be obtained, and beams with dimensions up to 24 by 38 inches, 40 feet long, have

been used on long spans instead of the steel beams which would have been erected in the Eastern States as a matter of course. A slow-burning, relatively fire-resistant, heavy "mill construction" has been largely developed in the Pacific Northwest, and general building construction shows marked influence of large local lumber supplies available at low cost. Piling, up to lengths of 120 feet, has been used in difficult foundations, and the easily available shorter piles have decidedly influenced construction methods of trestles, bridges, piers, etc.

4. Ports, harbor developments, foreign trade, and shipping have been to a considerable extent influenced by lumber, which forms such a large percentage of both domestic and export cargo movements.

5. Finally, the revenues of the State and of its subdivisions have so far been extensively based on taxes collected from the lumber industry, from timberland, sawmills, and allied activities.

6. While the State of Washington has during a number of years led all other States in lumber production, 85 percent of the standing timber and a corresponding portion of the activities are located west of the Cascades, a region climatically favored in a high degree and particularly as regards the growth of heavy stands of timber. This great lumber industry is based on a purely climatic natural resource, and the effects of even slight changes of the climate can be easily traced from the humid coast region to the higher slopes of the Cascades, until on crossing this range, which precipitates the moisture carried inland on the prevailing westerly and southerly winds, the drier eastern slope immediately shows a greatly differing growth of timber both as to species and yield of stands.

TIMBER REGIONS

7. *The fog belt.*—The humid western slope of the Olympic Mountains and such portions of the Coast Range as have similar climatic exposures receive the brunt of the moisture carried inland from the Pacific. Here the growth is very rapid and shows a distinct tendency to favor species which thrive under abundant moisture. In this group are western hemlock, western red cedar, and sitka spruce, forming over 60 percent of the stands, with douglas fir stands averaging less than 40 percent. As a rule, the greater the moisture and the altitude, the greater the percentage of hemlock in the stand.

8. Most of the timber of this type is in private ownership, and except for the western slope of the Olympic Peninsula, which is as yet untouched, it has been actively logged.

9. *The douglas fir belt.*—This area includes most of the great Puget Sound Basin, not as humid as the western slope of the Olympics; also the southerly extension of this basin toward Columbia River, forming a broad valley between the Olympic and the Cascade Ranges.

10. The dominating species here is douglas fir, comprising 60 percent or more of the stand.

11. This percentage of douglas fir decreases with increased moisture, with higher altitudes, and toward the north on the Canadian side. When approaching the warmer and drier climate in southern Oregon, the douglas fir gradually merges into yellow pine.

12. In this zone also occur hemlock, cedar, a small percentage of spruce, silver firs, western white pine, and other species of minor commercial importance.

13. This belt constitutes the most important of the three regions as it supports the largest stands of the primary commercial timber, douglas fir, in close proximity to the settled districts and under the most favorable climatic and logging conditions. Most of the logging and lumbering activities have so far been carried out in this zone, where the greater portion of the timber is privately owned.

14. *The upper slopes.*—This region includes the higher slopes of the Olympic and Cascade Ranges, largely within the boundaries of the national forests. As the altitude increases douglas fir gradually gives way to western hemlock and mountain hemlock, several species of balsam fir, Alaska or yellow cedar, Engelmann spruce, and varieties of minor importance. Because of their inaccessibility and the remaining large stands in the douglas fir zone the species on the upper slopes have as yet not been commercially exploited. However, they have a considerable potential value as a future reserve of timber. They are largely administered by the National Forest Service and are managed so as to produce continuous crops in the future on the "sustained yield" basis or logged in such manner as to balance the annual growth over the reserves as a whole.

USE OF SPECIES

15. *Douglas fir.*—Named after the Scotch botanist, David Douglas, this species is not a true fir. As the scientific name, *Pseudotsuga Taxifolia* (with foliage like the taxus), implies, it is more comparable to a "false hemlock." The true firs in western Washington are the species in the balsam fir group. Other common and trade names of douglas fir are red fir, yellow fir, Oregon pine, douglas spruce, Puget Sound pine, etc. Quoting United States Forest Service Bulletin No. 88:

> Douglas fir may, perhaps, be considered as the most important of American woods. Though in point of production it ranks second to southern yellow pine, its rapid growth in the Pacific coast forests, its comparatively wide distribution, and the great variety of uses to which the wood can be put, place it first. It is very extensively used in building trades; by the railroads in the form of ties, piling, car and bridge material; and by many of the manufacturing industries of the country. As a structural timber it is not surpassed, and probably it is most widely used and known in this capacity.

16. It may be noted that about two thirds of all the railroad ties in the western part of the United States are of douglas fir, and that this timber has no competition as material for piling.

17. Among additional uses may be mentioned wooden ships, boats, masts and spars, cooperage products, boxes, tanks, wooden stave pipe, paving blocks, sulphate pulp, furniture, plywood, flooring, sash and doors, finish, etc.

18. Trees over 9 feet in diameter and 275 feet high and more than 500 years old are rare. The following maximum growth is recorded in Bulletin No. 201, Branch of Research Forest Service:

> Maximum diameter 15.4 feet, with tree 1,020 years old. Maximum height, 330 feet. Maximum age, 1,400 years. Largest log, 12 feet at butt, 278 feet long, scaled 105,000 board feet, Scribner's scale.

19. *Hemlock.*—The western hemlock has only lately gained the recognition it has long deserved. For an extended period, handicapped by a name which in the eastern districts has been synonymous with lumber of far poorer quality, it has been low-priced, and often

considered as waste. Careful estimates by the Forest Service indicate that from 1,000 to 5,000 feet per acre have been left in the forests, but could have been taken out with other logs had a better market for hemlock existed.

20. The lumber is free from pitch, relatively hard, takes paints and stains even better than douglas fir, and makes excellent flooring and finish. It is an excellent wood for barrels, kegs, boxes, baskets, and fruit containers, since it is comparatively odorless and tasteless when dry. In late years an extensive business in hemlock box shooks has been developed, and it has gained increasing use as flooring. Lower in structural strength than douglas fir, hemlock has not been used in this field to any great extent, although it is suitable for all except the heaviest construction work.

21. The potential value of hemlock is greatly increased by its pulping properties, as it can be converted into a high grade of sulphite pulp, and with the increasing percentages of this timber found on the higher levels now being approached even small hemlock growths, tops, culls, etc., could, with increased demand, be salvaged as valuable material.

22. Unlike douglas fir, which is not very sensitive to shipping conditions and storage, hemlock must be well dried in order to reach eastern consumers in good condition.

23. The increasing content of hemlock in the timber is already noticeable; so is the production of hemlock lumber, growing from 100 million board feet in 1908 to 600 million in 1920, and 1,600 million in 1929, the last amount including pulpwood. The increase in production has been so rapid that market development and prices have as yet not kept step with the output, and hemlock lumber and logs have frequently been sold either close to or below the cost of production.

24. Since about 30 percent of the remaining stumpage consists of hemlock, its profitable disposal presents a problem of considerable economic importance for the future of the northwestern lumber industry. Initial steps toward this end have been taken by the West Coast Lumbermen's Association. (See West Coast Hemlock, Its Problems and Opportunities, by this association.)

25. *Western red cedar.*—Cedar resists decay in a higher degree than any other west coast wood, and it is because of this fact, used for a number of purposes where this quality is important. Its principal use is for shingles, which have for a long period of years been distributed from western Washington over a wide market throughout the United States. In general building work it is extensively used for siding and other exposed finishes.

26. It is relatively soft, but straight-grained, has a low shrinkage factor, takes a beautiful finish, and is successfully used for all purposes where not subject to hard wear or abrasion. Cedar is extensively used for boat lumber and cedar piling and poles. Being naturally durable, it finds a wide use in this field.

27. The largest dimension and the best quality have been found on the lowlands, and as these have been largely logged off in the douglas fir region, the future supplies of this quality are diminishing as the upper levels are approached.

28. Western red cedar has been so common, and it has been included with other lumber logged off in the past to such an extent, that the prices realized for this semiprecious lumber have not been in keeping with its actual value. Foreign countries appreciate the excellent qual-

ities of cedar, and it is, in the form of logs, exported to Japan, South America, China, Australia, and New Zealand in increasing quantities. The exports of cedar logs in 1930 greatly exceeded the exports of fir logs, the amounts being, respectively, 63,856,000 and 16,670,000 feet board measure. However, douglas fir sawed lumber exceeds all other lumber exports in a decisive manner, as will be noted by the export statistics in the following.

29. Cedar has, unfortunately, neither been conserved nor manufactured in a manner which would result in profiting by the latent value of this remarkable wood, partly because of general economic conditions and partly because of its abundance; but many possible uses can yet be developed, leading to as close and profitable utilization as in the redwood region of California.

30. *Sitka spruce.*—The lumber possesses characteristics which in a measure render it unique among American woods. In proportion to its weight, it is probably the stiffest softwood in the United States. It is also tough and straight-grained, which qualities, in combination with its lightness, have made it the favored lumber for airplanes.

31. It is odorless and tasteless, and therefore unsurpassed for shipments of butter, meats, and other food products. It is excellent for outside trim in building construction and advantageous in large doors for hangars, garages, etc., requiring strength and lightness. It possesses remarkable properties when used as a sounding board and is in demand for pianos, violins, etc. It can be converted into sulphite pulp of the highest grade, superior to the spruce pulp of the Northeastern States.

32. However, Sitka Spruce, except on the unlogged western slope of the Olympic Peninsula, is quite scarce and has during the past 10 years been contained in the cut merely to the extent of 2.6 percent (Puget Sound Log Scaling and Grading Bureau). Its use is limited to specialities and there is sufficient for the demand.

33. *Balsam Firs.*—Some confusion reigns in this classification, even among local lumbermen. The United States Forest Service includes in this group the noble fir, lowland white fir, alpine fir, silver fir, and white fir; local lumbermen use various names, as larch, gray fir, white fir, balsam, etc. There is no larch west of the Cascades and the classification of the United States Forest Service is being gradually accepted.

34. Except the lowland white fir, or balsam, which grows down to tidewater, all these species of the true fir occur on the higher levels and have as yet not reached commercial importance. Occurring in fairly large percentages among the high-level stumpage, and furnishing a generally good grade of lumber for a variety of purposes, they have a considerable potential value as a future timber reserve. All these species can be used for the production of pulp.

35. However, the percentage of clears included in the balsam firs is not as large as in the douglas fir, rendering the former group less useful for veneers, uppers, and other purposes requiring clear lumber. Balsam firs generally contain small spike knots for the full length of the trunk, even if hidden by the bark or the sapwood.

HARDWOODS

36. Hardwoods do not occur to the extent and in the varieties which mark the eastern hardwood regions, and with the exception of red

alder, they do not occur in commercial stands. As a product of the lowland and the river valleys, the Washington hardwoods have been the first to give way for land clearing and settlement; also for domestic use.

37. No survey of the Washington or Oregon hardwood has ever been made, and the only authentic information obtainable is contained in Bulletin No. 1437, United States Forest Service, red alder of the Pacific Northwest, 1926, with production data to 1923.

38. Red alder occurs in moist and protected locations throughout western Washington as pure stands of commercial-size timber, sometimes over fairly large areas, and scattered elsewhere as smaller trees in limited stands. Single stands containing as much as 500,000 board feet are not numerous; tracts containing 100,000 board feet are of frequent occurrence. The total alder stands of western Washington are estimated, in Bulletin No. 1437, at 360,000,000 feet, distributed in small groups over 30,000 acres, or at the average rate of 12,000 feet per acre.

39. Alder sometimes takes complete possession of burned-over lands not reforesting in conifers, but this growth is not always enduring. Alder grows very rapidly and annually contributes a large amount of decaying foilage and undergrowth as new topsoil. When overripe the alder gradually dies out, and the new enriched soil gives abundant nourishment and protection to a new conifer growth, which gradually takes full possession, thereby completing the rotation and a natural cycle of considerable interest and importance.

40. As second in abundance ranks black cottonwood in scattered stands along the lowland streams. This species is declining in importance because of its increasing scarcity.

41. Other hardwoods are bigleaf maple, Oregon ash, western birch, and Oregon white oak.

42. Bigleaf maple occurs scattered among alders and conifers; but where it has formed more extended stands it has largely been logged off, and most of the accessible present stands are formed by second growth.

43. Oregon ash follows the western slope of the Cascades north from its principal source, Oregon, but to such limited extent that it can be discounted among commercial hardwoods. This is also the case with oak, which grows in drier regions. It is of poor quality and quite limited as to distribution in the southern portion of the State.

44. Birch grows south from British Columbia along the northern border of western Washington to an extent estimated at two to three million feet, hence hardly reaching commercial importance.

45. It will therefore be noted that red alder forms the only commercial hardwood stand of any importance in western Washington; and while in the past it was considered to be of slight value even for fuel the rapidly increasing uses, especially for furniture, have during the last decade caused corresponding increases in stumpage values.

PRESENT STANDS OF TIMBER

46. Tables nos. 1 and 2, prepared by George S. Joy, forest supervisor, State of Washington, as of November 1928, give the total present stands in the western Washington counties, by species and by ownership.

TABLE No. 1.—*Estimate of timber stand, by species, in counties of western Washington*

[In 1,000 feet board measure]

County	Douglas fir	Cedar	Spruce	Hemlock and balsam fir, etc.	Total
Clallam	9,654,837	6,896,312	2,758,575	8,275,575	27,585,249
Clark	618,501	36,441		72,882	727,824
Cowlitz	10,110,152	1,444,307		2,888,615	14,443,074
Grays Harbor	9,629,316	3,501,568	1,750,784	2,626,176	17,507,844
Island	100,998	5,611		5,611	112,220
Jefferson	8,864,465	3,939,762	1,969,881	4,924,703	19,698,811
King	12,085,957	1,726,565		3,453,130	17,265,652
Kitsap	819,102	48,182		96,364	963,648
Lewis	19,401,809	2,771,687		5,543,374	27,716,870
Mason	5,546,684	693,335		693,335	6,933,354
Pacific	6,433,366	1,930,009	1,216,683		12,866,731
Pierce	8,335,535	595,395		2,976,977	11,907,907
San Juan	99,000	5,500		5,500	110,000
Skagit	9,746,592	3,248,864		3,248,864	16,244,320
Skamania	9,711,859	1,387,551		2,775,102	13,874,512
Snohomish	9,175,786	1,529,297		4,587,893	15,292,976
Thurston	2,578,800	368,400		736,800	3,684,000
Wahkiakum	1,242,153	552,068	138,017	828,102	2,760,340
Whatcom	4,733,405	1,893,362		2,840,043	9,466,810
Total	130,152,567	32,574,216	7,903,880	49,795,729	220,426,392

TABLE No. 2.—*Estimate of timber stand in counties of western Washington, segregated by ownerships*

[In 1,000 feet board measure]

County	Private	State public lands, Indian reservations, national parks	National forests	Total
Clallam	16,800,000	2,177,000	8,608,251	27,585,251
Clark	400,000	328,824		728,824
Cowlitz	11,400,000	2,504,880	538,195	14,443,075
Grays Harbor	9,053,944	3,693,038	4,760,862	17,507,844
Island	50,000	62,221		112,221
Jefferson	5,652,443	3,475,181	10,571,074	19,698,698
King	14,100,000	875,054	2,290,600	17,265,654
Kitsap	832,000	131,649		963,649
Lewis	21,000,000	2,555,480	4,161,396	27,716,876
Mason	3,880,000	500,874	2,552,480	6,933,354
Pacific	11,697,000	1,169,733		12,866,733
Pierce	8,500,000	1,736,678	1,671,230	11,907,908
San Juan	60,000	50,000		110,000
Skagit	10,800,000	1,300,000	4,144,321	16,244,321
Skamania	3,580,000	661,580	9,633,933	13,875,513
Snohomish	6,500,000	1,388,000	7,404,978	15,292,978
Thurston	3,420,000	264,000		3,684,000
Wahkiakum	2,180,000	580,340		2,760,340
Whatcom	3,000,000	825,854	5,640,956	9,466,810
Total	134,000,000	23,000,000	62,000,000	219,000,000

47. It will be noted that the total stand in western Washington in 1928 comprised 220,426,000,000 feet board measure, of which 59 percent is douglas fir, 22.6 percent hemlock and balsam fir, 14.8 percent cedar, and 3.6 percent spruce. This timber occupies an approximate area of 6,757,000 acres, hence showing an average stand of somewhat over 32,000 feet board measure per acre. If logged at the present approximate rate of 150,000 acres annually, the total stand would therefore be depleted in 45 years. This, however, will not take place, and a number of factors will govern the rate of future

logging, as will be shown in the following. The eastern Washington resources of standing timber are estimated at 36,518,965,000 feet, 74 percent consisting of yellow pine, the balance of white pine, small amounts of douglas fir, balsam fir, etc. The total stand of the State is, therefore, 257,178,109,000 feet board measure.

48. The total stand in Oregon is far more extensive, but the lumber production is considerably less.

DENSITY OF STAND AND RATE OF GROWTH

49. The timbered area of the fir region forms perhaps the most extensive known concentration of softwood stands of large dimensions and prolific growth. Originally covering some 28,000,000 acres in western Washington and Oregon, only somewhat over 4,000,000 acres have been logged to date, and there is apparently remaining an enormous acreage of virgin timber. However, this total acreage is not uniformly timbered with a commercial crop, and it is estimated that even before the arrival of the white man the whole region did not produce more than a third of the timber it was capable of producing under favorable conditions.

50. Great fires have since immemorial times ravaged the crop, and as a result, there is no uniformity of the stands, which range from overripe and poor quality stands partly reforesting, to healthy old growth running over 100,000 feet board measure per acre; through partly damaged stands, immature timber, young growth, saplings, and partly denuded areas, to sterile burns and large areas which, after the burns, have been reforested with hardwoods. It should also be noted that the 4,000,000 acres logged to date are located in the best and most accessible timber regions, and that as logging recedes from the coastal basins toward the upper slopes, the cost of production increases and the yield per acre, dimensions of trees, and quality of timber decrease.

51. As an average condition over the present timbered regions, a stand of 30,000 feet per acre is considered to express a fairly close approximation of the conditions; however, stands in whole watersheds run over 50,000 feet board measure per acre, and one watershed recently logged, the Sauk, shows a production of 70,000 feet per acre over several thousand acres. Smaller areas show a production of 100,000 feet per acre, which represents the theoretical yield which douglas fir timber should produce at an age of 80 years under best soil and exposure conditions. On areas as large as 2 square miles, near Port Angeles, 170,000 feet per acre have been recorded, and on smaller areas the production has been 200,000 feet per acre.

52. In comparison with these stands, the typical yellow pine districts on the eastern slope of the Cascades and in the Eastern States show stands averaging 15,000 feet per acre over extended regions with 25,000 feet under favorable conditions over more limited areas.

53. Table no. 3, shows the average yields of typical douglas fir stands under favorable, average, and poorer conditions of soil and exposure. This table was prepared after extended studies from northern Washington to southern Oregon, covering all conditions of growth, with stands of even age, fully stocked, without open spaces—in other words, under conditions of average full productivity, which are rarely realized except in limited areas.

TABLE NO. 3.—*Yields of typical stands of douglas fir from fully stocked areas*

Age, years	Yield per acre (feet, board measure, Scribner rule)			Diameter of average tree
	Excellent site	Medium site	Poorest site	Medium site
(1)	(2)	(3)	(4)	(5)
40	24,400	4,500		7.4
60	62,000	23,800	1,100	11.1
80	92,500	45,700	4,400	14.3
100	115,100	62,800	9,600	16.9
120	131,100	75,000	14,700	19.1
140	143,500	84,500	19,200	21.1
160	153,500	92,400	23,300	22.8

Columns 2, 3, and 5 taken from U.S. Department of Agriculture Bulletin No. 201.

54. It will be noted that the poor soil and exposure produces at an age of 160 years little more than the best site at 40 years. However, the low yield does not represent minimum possible growth or waste land; it represents commercial yields on areas not infrequently encountered during logging operations and still bought and sold as timberlands. After the age of 160 years, the douglas fir grows more slowly, and trees 400 years old have been not uncommon. However, the old trees occur not as extended continuous, unbroken stands, but mixed with hemlock and younger trees.

55. While trees below 16 inches are being already logged and will be logged in increasing amounts in the reforested areas, the mean annual growth over the standing timber regions as a whole cannot be based on this group. The growth under average conditions for trees from 100 to 120 years old gives a fair value, and allows for deterioration, fire, and other losses. An annual growth of 1 percent per year will therefore be used for the remaining standing timber in western Washington.

FOREST FIRES AND OTHER LOSSES

56. *Fires.*—The frequency of forest fires, the attendant losses and the menace to the remaining timber have led to organized methods of fire protection of private timber under the leadership of the Washington Forest Fire Association. The members of the association assess themselves for the purpose of maintaining lookout stations, telephone lines, and fire-fighting equipment, building trails, maintaining watchmen, and fighting fires without delay as soon as discovered.

57. Table no. 4 shows the records of this association for the past 5 years and discloses the following important facts:

First, the average annual loss of timber is relatively small, forming only one hundredth of 1 percent of the total stand and about 1 percent of the annual growth.

Second, the property and logging equipment loss is quite large, but not excessive when compared with the total investment involved. It reached $177,000 in 1929, and averages nearly $100,000 annually.

Third, the area annually burned over is extensive, nearly equaling the area logged off every year.

Fourth, while the total area protected remains fairly constant, the extent of the protected logged or reforesting area is increasing.

Fifth, of the total standing timber damaged, about 70 percent can be salvaged for commercial use if logged in time.

TABLE NO. 4.—*Annual destruction by fire in privately owned timberlands of western Washington*

[Compiled from annual reports of Washihgton Forest Fire Association, Seattle, Wash.]

	1926	1927	1928	1929	1930	Mean
Assessment per acre ..... cents	5	5	3	3½	4½	4.2
Acreage under protection	3,064,711	3,101,325	3,055,122	3,065,059	3,088,052	3,073,000
Percent logged and reforesting	25	28	28	50	50	--------
Area burned over ..... acres	104,981	58,142	89,084	287,541	131,475	134,244
Merchantable timber killed but usable M ft. b.m.	38,423	19,243	3,166	45,837	38,416	29,017
Merchantable timber destroyed, total loss ..... M feet b.m.	9,432	59	100	23,289	24,517	11,479
Cut logs destroyed ..... M feet b.m.	8,005	2,930	31,807	11,722	12,184	13,329
Logging equipment burned, value	$97,455	$38,860	$63,599	$138,622	$56,010	$78,909
Settlers' property destroyed, value	$14,024	$9,989	$25,413	$39,819	$5,122	$18,873

58. The outstanding record is formed by the extensive acreage annually burned over. The direct effect of this destruction is the annual postponement of reforestation on this area, where young growth is largely killed and the soil cover destroyed, in some cases requiring generations for renewal. This circumstance will have important economic effects in the future.

59. It should be noted that while the work of the Washington Forest Fire Association is commendable and efficient, the annual destruction having been greatly lessened and thousands of threatening fires checked, the essential activity of this organization is predicated upon the actual occurrence of fires, and no organization is as yet devoted to the management of young growth or to the fireproofing of old loggings. This activity would be synonymous with "reforestation and forestry management", which is yet to come with greater scarcity of timber and higher values.

60. As compared with the rest of the State, forest fires are of infrequent occurrence in the fog belt, because of the great humidity and the dense undergrowth, and the damage on the upper slopes is far less, with efficient protection by the United States Forest Service.

61. *Damage due to insects.*—The douglas fir region in western Washington has so far largely escaped ravages by insects and various types of blights which have in such marked degree damaged eastern stands. As an example, Bulletin No. 1241 of the United States Forest Service gives the damage caused by the spruce and bud worm in Maine alone in 1922 as equal to 40 percent of the total stand of pulpwood, the State's principal timber crop.

62. The principal insect pest known in the fir region of Washington is the Hemlock looper, now infesting 7,000 acres in Pacific County in the southwestern part of the State. This insect has been previously known in Oregon, Washington, and in British Columbia, but until recently, except in a few places, it has not infested the forests to any marked extent. State, Federal, and private agencies are now preparing plans for the eradication of this insect pest, a small caterpillar which defoliates the hemlock.

63. Until recent years, the douglas fir has not been affected to any serious extent, by any insect or disease, a fact of considerable

economic importance for the future reforestation program in the State. During the last 3 years, however, the douglas fir tussock moth has killed over 300 million board feet of douglas fir in northeastern Washington. In many places the entire stand has been killed.

64. In eastern Washington forests, however, the white pine blister rust and the mountain pine beetle spread and menace the whole white pine lumber industry. The former infests the timbered region of northeastern Washington, northern Idaho, and western Montana and menaces a timberland valued at $417,580,000. Federal, State, and private agencies have for 20 years ineffectively endeavored to eradicate this serious menace without success. The rust is particularly obnoxious because it attacks trees in all stages of growth and prevents either artificial or natural reforestation. The pest has spread to scattered white pines on the western slope of the Cascades, but as they do not form commercial stands, occurring sporadically among the fir and hemlock, and as the latter species are not attacked, the douglas fir region is not menaced. The mountain pine beetle is killing much of the mature lodge pole pine, white pine, and whitebark pine stands throughout Oregon and Washington.

65. *Damage due to winds.*—Until January 1921 western Washington escaped any marked damage due to high winds. Excepting that year, merely the usual percentage of old growth on exposed locations is annually blown down by high winds; but this damage is so slight that it is negligible and included in the natural causes which prevent the annual growth from exceeding the deterioration in old stands.

66. In January 1921 for the first time in the history of the State, a windstorm of exceptional extent and velocity damaged an area of 1,000 square miles on the western slope of the Olympic Peninsula, bringing down about 6 billion feet of standing timber, or 12⅓ percent of the total stand in the area affected, mostly a total loss because of inaccessibility. This storm, according to the United States Weather Bureau, was a freak and does not establish the probability of recurrence.

FOREST MANAGEMENT AND REFORESTATION

67. A casual observation of the logging methods practiced in western Washington would seem to indicate that the procedure was extremely wasteful, preventing either natural or artificial reforestation for all time to come, especially when comparing this practice with the logging methods used in the forested regions of northern Europe.

68. Under the present local method, most of the young growth is broken, the soil plowed up, the humus cover destroyed, and the logged-off land presents a picture of extreme desolation, forming a veritable fire trap when the debris left on the ground was dried.

69. In comparison with this procedure, the northern European forests still yielding at the same rate they did a hundred years ago, and presenting the same appearance, are logged by a method of judicious periodical thinning instead of by complete wrecking. The mature trees to be logged are selected and branded during the summer, necessary seed trees are left at regular intervals, and the logging is done with horses, during the winter, when the snow protects the soil cover. The trees are small, even smaller than in the yellow pine

belt, and the young growth is carefully protected. The following spring, all tops and branches are carefully piled and burned, and after one year, only the stumps show that logging has taken place. When the remaining young growth has reached maturity, the tract is logged again, and the process continues indefinitely. Stands which do not produce up to capacity are supplemented by planting.

70. Present conditions in the forests of western Washington are for the most part so radically different from those of the northern European forests that for several reasons logging cannot be carried on in this region to any great degree in the same manner as it is carried on there.

71. The douglas fir stands increase in growth and yield to an age of 300 years, but after 300 years they merely hold their own, natural deterioration and slower growth being about equal. At increased age, deterioration overbalances the growth, until the stand is overripe. In this condition, it is generally completely logged off. Furthermore, the extremely tall and heavy timbers of even normal age will, both in falling and high-speed removal, so break up the young growth and the soil that any effort at preserving forestry conditions would be both mechanically and economically impossible.

72. In addition, it is undeniable that the human factor enters to a considerable degree. Timber has in the past been so plentiful and of such comparatively slight value that the loggers have grown used to harvesting the best timber and wrecking the balance without any thought for tomorrow. That this attitude will change in the future is a reasonable assumption; but so far the values are too low to offer any inducement toward better conservation.

73. Reforestation can be either natural or artificial. Natural reforestation takes place with surprising regularity in this region of rapid growth if the conditions are even moderately favorable, and primarily if the young growth is protected from fire. United States Department of Agriculture, Bulletin No. 1493, Timber Growing and Logging Practice in the Douglas Fir Region, gives the reforesting area in logged-off land under private ownership as 60 percent and barren areas as 40 percent; but also points out the fact that the 60 percent now reforesting is not fully or uniformly stocked and is so exposed to fire that a large portion will sooner or later be damaged or destroyed.

74. The natural restocking which can be observed at this time is practically all taking place in old logging areas, carried out under much more favorable conditions. Cutting was not as close as today, a large number of seed trees were left standing, and the old bull-team, or low-power ground logging with small slow-speed donkey engine, did not destroy the young growth and the humus cover as extensively as is now the case. In the past, logging was carried out on the level bottom lands; today, it is largely conducted in the foothill country where the soil is poorer, breakage greater, and the opportunity for natural reforestation much more limited. If a future forest crop is to be maintained, artificial reforestation must be resorted to, in the beginning restricted to "minimum measures", and ultimately expanded to more intensive timber growing or actual forestry management. Summarized from Bulletin No. 1493, "minimum measures" require: First, guarding of the virgin forest through more extensive fire protection; second, protection during logging, through measures far more extensive than now practiced; third, fireproofing cut-over

lands. (Burning of slash is now required by law; but a more extensive effort must take the place of the present haphazard methods); fourth, protection and management of the new crop, from leaving necessary seed trees to full fire protection.

75. According to estimates given in Bulletin No. 1493, the cost of this method which leads to a reasonably continuous forest production, will amount to 1 cent per acre of protected forest land, plus 22 cents per thousand feet of logs cut in the region.

76. Under a more intensive method of forest management, all the above measures are increased, together with patrol, planting, and thinning measures, etc., added, as has been practiced in all the forest producing regions of Europe for some generations.

77. Some of the conclusions reached in Bulletin No. 1493 warrant quotation in full as illustrating the prevailing conditions and the present status of the reforestation program in western Washington, page 14:

> Logged-off lands are protected and fires fought thereon chiefly to keep fire from spreading to commercial timber or improvements, or to comply with State law. In short, up to the present time, the system of logging private lands in the douglas fir region, with but a few exceptions, provides no intentional measures to insure the reforestation of these lands. Whatever reproduction takes place does so, for the most part, in spite of present methods and not as a result of them.

78. That this circumstance cannot fail to influence seriously the future production is obvious. However, while private loggers have been accused of "wood mining" and of wrecking a natural resource without the slightest regard for the future, there are several mitigating circumstances, as will be shown under "Economic conditions" in the following.

79. Washington differs in one respect from all other forested States: Instead of proceeding through the first necessary step, "minimum measures" of forestry management, to the final step, "intensive forestry management", including planting, this final step has already been taken in a number of instances.

80. While the State has not yet completed the formulation of a definite forest policy, nor a systematic program of forest management, planting is already being carried out this year on a 300-acre State tract in the Hood Canal district, continuing similar work carried out in 1930.

81. One of the largest private lumber companies has also commenced a planting program on its logged-off lands. In the Olympic, Columbia, and Rainier National Forests, which are managed under a definite plan, several thousand acres have been planted during the past 10 years.

THE LOGGING INDUSTRIES

TOTAL TURNOVER AND STUMPAGE REMOVED

82. Plate no. 149 [2] shows the various sources of log supplies entering into the total turnover, the distribution, and the total stumpage removed from all causes. The year 1925 has been selected as being the only year for which any information can be obtained for the compilation of a complete diagram. While furnishing 65 percent of the total industrial pay roll in the State, and admittedly the most important basic industry and producer of wealth, it is notable that a

[2] Not printed.

flow sheet covering the whole industry has not been previously compiled and that no organization exists which collects and renders available all the scattered data required. A comprehensive study of the industry as a whole cannot be presented without this diagram.

83. It will be noted that four sources enter into the total log turnover: Imports, small truck loggers, the primary logging industry, and logs from other States, totaling 8,330,434,000 feet board measure.

84. Imports from British Columbia are duty free, and reach primarily the Puget Sound district. They consist principally of fir logs, and the total amount is sufficiently large to be detrimentally felt by the local loggers, 1,226,903,507 feet board measure having been brought in between 1923 and 1929.

85. The following amounts in feet, board measure, were imported from 1926 to 1929 [99]:

Year	Fir	Cedar	Hemlock	All others	Total
1926	67,491,283	39,234,010	19,372,627	11,321,746	137,419,666
1927	135,348,127	29,615,256	28,907,422	12,819,987	206,690,792
1928	95,277,449	28,144,808	15,839,625	5,864,187	145,126,069
1929	120,098,709	30,249,910	16,989,949	5,760,432	173,099,000

86. The British Columbia loggers have the advantage of lower taxes, lower stumpage costs, and cheaper labor. There is as yet nothing to indicate a decrease in this competition with the local loggers.

87. Logs from Oregon are brought in because of the proximity of the Columbia River mills on the Washington side of the river to Oregon supplies of timber, and logs from Idaho consist largely of white pine purchased by the match industries in the eastern part of the State.

88. The primary and secondary logging industries in Washington are treated separately in the following.

89. The logging in the fir region is unique in that it supports independent loggers, producing logs for the market only, without operating sawmills. While east of the Cascades 80 percent of the logs are produced by the mill companies themselves, on the west side in 1925 only 65 percent were so produced and 35 percent were cut by the independent loggers. This method is advantageous for the millmen, as it tends to stabilize the output and permits the mills to purchase in the open market such logs as they require but do not produce.

90. It also benefits a large number of the smaller operators who are not compelled to tie up their capital in stumpage. However, the independently produced logs increase the cost of the product in a material manner.

91. To the amount of stumpage removed by the primary and secondary logging industries must be added the other items as shown by the diagram. Mining timber, hewn ties, etc., are estimated as shown in a report on the Forests and the Wood-Using Industries of Washington by William H. Gibbons, of the United States Forest Service, Portland, Oreg.

92. The sound and usable timber left on the ground is included, according to a thorough survey made of the fir region by Allen H.

[99] Puget Sound imports only; data by the West Coast Lumbermen's Association.

Hodgson, associate forester, United States Forest Service, Portland, and covers western Washington only.

93. Fire losses as shown in the diagram are based on a 10-year average for Oregon and Washington as given in Forest Figures, Portland office of the Forest Service, 1929, for Washington, prorated in the proportion to the standing timber in the State. An average of 513 million feet for the two States is given by the Forest Service, leading to a loss of 213 million for Washington on the above basis. This figure has been reduced to 200 million because of the well-organized protection now in effect in the State, and the actual total loss is in all probability less than the prorated loss. An effort has been made to obtain more exact detail figures, without sufficiently representative results covering a long period.

94. Stumpage removed from all causes is about 50 percent greater than the cut by the primary logging operations, and equals 2.14 times the annual growth. This annual growth is based on the present stand of timber only, not on the young, reforesting areas, at the rate of 1 percent per year. This is contrary to the prevailing conception of the stumpage removal, placing the cut at about 2.7 percent of the growth, and evidently based on the lumber production only, without including the above items.

95. It appears necessary to include the logging waste as given by Mr. Hodgson, since it represents stumpage actually removed and left on the ground without use, in sound cordwood size and larger, but without including tops and branches. It includes a large percentage of log-size material, either broken, slightly undergrade, overlooked, or wasted in some other manner.

96. Later statistics covering the actual fire losses during the 5-year period, 1926–30, show that in the whole State 905,992,000 feet were fire killed, of which amount 231,928,000 feet was salvable, and that logs destroyed in addition totaled 79,276,000 feet, forming an average annual destruction of 197,053,600 feet. (Data supplied by Mr. George C. Joy, State supervisor of forestry.)

DEVELOPMENT

97. Briefly summarized, the logging industry in the Douglas fir region has progressed through the following stages:

98. Beginning with animal power, in combination with skidroads; progressing to light power logging in 1890; as the distances increased, adding "pole roads," or hauling tracks, built of round poles laid parallel, sometimes over a mile long; with further increases in distance, building light logging railways, with heavier logging engines and tackle for "ground lead" logging which continued until 1910, when the overhead cable methods of various types were introduced, constantly improved and increased in capacity until the present time, with a final introduction of the electric logging engine and supplemented by gasoline tractors for cleaning inaccessible corners or isolated stands which do not warrant a set-up of the overhead equipment.

99. The electric logging engine has so far been used by only a few operators. The gasoline tractor, with caterpillar tread and powerful motor, has been successful in supplementing the overhead logging equipment on more level ground. In smaller sizes it is used for prelogging cedar poles, pulpwood, piling, and light dimensions.

PRIMARY LOGGING OPERATIONS

100. The size of logging operations is gaged by the number of overhead logging engine set-ups or "sides" which are operated, each side requiring a field crew of 18 to 20 men, with an average present production of 70,000 feet, board measure, per day. However, some outstanding records have been made during recent years, as follows:

101. A maximum of 700,000 feet per side has been exceeded on several occasions, under favorable conditions, and it is reported that in June 1930 one side of the Bloedel-Donovan Lumber Co. operations in Clallam County yarded and loaded 86 carloads of logs, scaling 902,360 feet, board measure. This is believed to be the greatest single day's output by any side ever recorded on the west coast. The largest operator today uses 12 sides.

102. The daily output per side has steadily advanced from 40,000 feet under the old groundhead system, to the present records, in response to the loggers' efforts to reduce operating costs by increasing output. However, the increase in production has been accompanied by a heavy increase in the cost of equipment and of fixed charges. The investment required per side by the modern high-speed operations now ranges from $50,000 to $85,000, with a probable average of $60,000.

103. In addition, extensive railroad trackage and special rolling stock is required, the railroad mileage increasing as the logging recedes toward the foothills. The logging roads bring the product either to the loggers' own dumping ground at tidewater for rafting or to a point on the common-carrier systems. Standard gage and heavy rails are used on main lines, 52- to 65-pound rails on branches and spurs.

104. In 1925, according to The Forest and Wood-Using Industries of Washington, by William H. Gibbon, the primary logging operations of the whole State produced 7,934,581,000 feet of logs, requiring the following equipment, labor, and investment.

Logging statistics for 1925 for the whole State:

Railroad trackage	miles	1, 864
Locomotives		500
Logging cars		6, 000
Logging engines		2, 000
Capital invested exclusive of stumpage		$60, 000, 000
Annual pay roll		$43, 000, 000
Average daily wages		$5. 56
Men employed		29, 790
Days worked		261
Logs produced	M feet	7, 858, 581

TRUCK-LOGGERS

105. In addition to the above primary logging operations a considerable number of small independent "truck loggers" have entered the field. Originally hauling their logs to tidewater or to the common carrier railroads on slow speed, hard-tire trucks, they were limited to short distances, but the arrival of the air-tired high-speed trucks with the paved roads has greatly extended their operating radius. The highway administration rules them off the earth roads during the rainy season, but they can during the balance of the year, handle comparatively large amounts. During periods of high prices secured for logs, they may, in spite of their small percentage of the total output, influence the market to some extent because of the surplus of

small and no. 3 logs which they produce without adhering to fixed price schedules and with need of prompt conversion into cash. On the other hand, they fulfill an important function by logging and turning into value small or isolated stands, farm timber, piling, etc., which would not otherwise be salvaged.

106. As the second growth on tracts harvested in the past becomes ready for logging, a large amount of scattered and isolated timber and of timber not suitable for the large logging operations will no doubt be removed by the truck loggers. Furthermore, as stumpage values increase, or the value of small dimensions and of salvage becomes greater, and as pulp mills continue to expand, there will in the future grow an increased opportunity for the small logger, either as a contractor, a purchaser of second-growth stumpage, or on some basis of profit sharing. The last method has already been developed between some owners of stumpage and the truck loggers, the former collecting a fixed percentage of the price of the logs when sold, generally somewhat higher than the stumpage value, and the latter profiting because he is not compelled to use his small capital in payment for stumpage before the beginning of operations.

107. If the rapid increase in the number of pulp mills operating in western Washington since 1926 continues, it should in the future create numerous small loggers of pulpwood for the market. That this has not occurred as yet is due to other arrangements effected by the pulp mills for their present raw material supplies, and to some extent to the relatively low prices which have so far prevailed for pulpwood.

108. During 1923, a year of high log prices, the truck loggers produced 1,000,000 feet a day, or somewhat over 150,000,000 feet, board measure, for the season. Since that year, the average output has been approximately 60,000,000 feet, board measure, per season on the west side of the Cascades and probably not over 10,000,000 on the east side. In 1925, the probable output was approximately 100,000,000 feet in the whole State.

GRADES, PRICES, AND COSTS

109. The lumbering industries operate under a well organized system of classification, which grades all marketed logs as no. 1, no. 2, and no. 3, with prices ranging accordingly, and containing fixed percentages of respectively clear, merchantable, and common lumber, with additional requirements relative to diameters and lengths of logs, depending on the species.

110. The Puget Sound Log Scaling and Grading Bureau, classifying and scaling 75 percent of the Puget Sound output, issues an annual summary of each year's scale, showing the following variations in Douglas fir grades during the past 10 years:

	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
	Per-cent	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*
No. 1	15	16	16	14	14	13	13	13	11	10
No. 2	57	56	56	57	55	55	55	55	55	54
No. 3	28	28	28	29	31	32	32	32	34	36
Fir, percent of cut	62	63	64	64	62	64	62	60	63	62

111. The average size of the douglas fir logs in the three classes is shown by the following:

	1921	1924	1927	1930
	Feet, b.m.	*Feet, b.m.*	*Feet, b.m.*	*Feet, b.m.*
No. 1	2,502	2,812	2,619	2,555
No. 2	959	942	943	1,009
No. 3	495	444	412	420

112. The tabulation shows a decided shrinkage in the quantity of the no. 1 logs, a practically constant output of no. 2 logs, with a possible slight tendency toward reduction, and a decided increase in no. 3, or the poorest grade. No definite conclusion can as yet be reached relative to the change in the sizes of the logs.

113. The prices quoted on the Puget Sound market the first week in April 1931 are as follows:

Per thousand feet, board measure, Scribner's scale:

No. 1 Fir, $20/22; lumber cedar, $24.
No. 2 Fir, $15; shingle cedar, $12.
No. 3 Fir, $10; hemlock, $10/12.

114. However, cedar has been sold as low as $20 and $9.50. The 1930 prices were, respectively, $24, $16, and $12, for fir logs, somewhat low for no. 2, compared with the general run of prices which decreases $6 with each class. A price of $24, $18, and $12, has occurred several times since 1921; $25, $19, and $13, has occurred once, and the highest level was reached in 1920 with $32, $24, and $16, showing an abnormal advance for no. 1 logs.

115. If the decrease in contents of no. 1 logs between 1921 and 1931 is converted into a corresponding price for the average run, a decline in value due to the decreasing quality is quite apparent, as follows:

1921		1930	
15 percent at	$24.00	10 percent at	$24.00
57 percent at	18.00	54 percent at	18.00
28 percent at	12.00	36 percent at	12.00
100 percent at	17.22	100 percent at	16.44

116. A decline of 78 cents per thousand in a decade is hence due to decrease in no. 1 content alone, when comparing the contents on the same price basis.

117. The actual cost of production of logs by sawmill operators and the price of logs purchased on the open market from the logging companies, including stumpage cost, and based on mill delivery, is shown in table no. 5, furnished by the West Coast Lumbermen's Association:

TABLE NO. 5.—*Cost of logs produced and logs purchased, as reported to West Coast Lumbermen's Association*

Year	Number of operations	Cost of logs produced	Cost of logs purchased	Year	Number of operations	Cost of logs produced	Cost of logs purchased
1919	50	$13.48	$15.96	1925	62	$12.01	$16.01
1920	58	15.36	22.12	1926	50	11.67	15.39
1921	70	11.19	14.54	1927	41	11.42	14.93
1922	82	12.26	15.96	1928	36	11.17	15.09
1923	85	13.84	19.29	1929	35	11.33	15.67
1924	78	12.93	17.29	1930	26	10.29	14.00

118. The production cost has declined $0.72, and the average log price $2.01 since 1925. The 1930 low is $0.54 under 1921 low, with a further decline in 1931.

119. The West Coast Lumbermen's Association lists the production cost of logs by mills owning the stumpage; reports by 34 mills in five groups according to size form the basis of the cost analysis. The smallest and largest group and the average cost for the 34 mills are listed in table no. 6 for 1928.

TABLE No. 6.—*Logging cost per thousand, log scale*

Capacity	Stumpage	Administration and general	Depreciation	Labor and expense	Total cost, logs produced
Group A, 15,000,000–19,000,000 (4 mills)	$2.66	$0.73	$0.48	$8.42	$12.29
Group E, over 62,850,000 (5 mills)	2.41	.90	.42	7.00	10.73
Average of 34 mills	2.94	.85	.51	6.57	10.87

120. The 1928 costs do not form a basis for comparison between small and large mills. These costs vary from year to year, and in 1930 the small mills show lower labor and expense costs than the large mills.

121. The most notable item is the stumpage, carried at quite low average values, $2.94 in 1928 and $2.84 in 1930, against a mean present market value of approximately $4. Stumpage in the national forests could not be obtained at prices less than about $2.50 for fir and cedar during 1928 and 1930, and private sales are generally about $1 above national-forest sales, due to the greater accessibility of the private timber. If carried at full value, the cost of the product would be higher, so would be the annual losses.

122. The itemized logging costs for 1928 and 1930, from the same reports, are given in table no. 7.

TABLE No. 7.—*Logging costs during 1928 and 1930*

	1928	1930
Rigging ahead	$0.26	$0.23
Falling and bucking	1.42	1.15
Yarding and loading	2.44	2.19
Wire rope	.31	.25
Railroad costs	1.78	1.53
Logging spurs	.85	.73
Water haul	.32	.33
Booming and rafting	.34	.44
Boom stick return towing	.13	.17
Depreciation, logging, and transportation	.54	.58
Administration and general	.86	.84

123. These costs were reported by 2 to 15 mills, and they do not represent any single operation or the average for a definite group of mills. The water hauls are given by 2 to 4 mills only, and as a large group would not have the same average towing charges, the adding of the above items does not give the average total cost shown in the preceding table.

124. The tax paid on standing timber at this time ranges from 1.8 to 8.7 cents per thousand for fir, cedar, and spruce, averaging 3.9

cents per thousand, and the total tax on logging operations, including the stumpage tax, is 48 cents per thousand on the annual production of logs. (From 20 typical operations, collected by the West Coast Lumbermen's Association.)

125. The report produced by the Senate Committee on Reforestation in 1923 gives the average timberland tax per acre as ranging from $1.35 to $2.86, and increasing at the rate of 12½ percent annually.

126. The taxes are not carried as a separate expense item in the West Coast Lumbermen's Association statistics of production costs.

DISTRIBUTION

127. *Log-using industries.*—Plate no. 149[2] shows that of the total log turnover, 796,341,000 feet, board measure, or approximately 10 percent is absorbed by shipments from the State, by pulp mills and for poles and piling, the major portion being consumed by the "Log-using industries." Poles and piling are not classified under "Log-using industries" as this material is utilized in the condition it leaves the forests, without being converted into other products. Nor is pulpwood included under these industries, as it forms raw material for another group, pulp and paper, which is not included among the lumber industries. The above uses are part of the general log turnover and should be so classified in order that the total amount may be ascertained.

128. *Pulpwood.*—Plate no. 149[2] shows that 144,690 thousand feet of the log turnover, or 240,000 cords, were used in 1925 by pulp mills in Washington, exclusive of the mill waste. This material is either reduced to cordwood in the forest from smaller logs, or converted into pulpwood at the pulp mill after logging or purchase of poorer grade logs. While both methods are used, the latter is preferable in cases where the pulp mill is connected with sawmill and logging operations.

129. Since 1925, the pulp industry in Washington has expanded at a rapid rate, primarily due to the large supplies and the low cost of pulpwood, which have stimulated production to fill the shortages in the United States' requirements. In rough average figures, 1½ million tons of pulp, 1½ million tons of paper, and 1½ million cords of pulpwood have been annually imported for this purpose.

130. The diminishing eastern pulpwood supplies cannot stand increased cuttings, and the cost delivered at eastern pulp mills is far higher than in Washington. In 1926, the average price paid by 26 mills in Maine for rough pulpwood was $16.56 per cord, while the Washington price was approximately one half this amount. A local survey conducted in 1926 shows that if a Washington pulp mill operated in connection with and under the same ownership as a sawmill and a logging operation, small dimensions, tops, no. 3 logs, etc., could be charged to the pulp mill at the actual cost of $11 per thousand, or $6.60 a cord. If a pulp mill purchased cordwood in the open market, the price fluctuated from $7.50 to $8.50 a cord.

131. The water freight on pulp to the Atlantic coast is at the present time only $6 per ton, and under average market conditions for chemical pulp, the combined costs of Washington pulpwood and of water freight to the northeast Atlantic coast pulp-consuming mills is either equal to or less than the eastern pulpwood cost. That the advantage of Washington mills can be even greater than the above, is proven by the fact that numerous eastern mills in 1926 paid up to

[2] Not printed.

$20 for their pulpwood, and that if in Washington the use of mill waste is combined with the use of no. 3 and small logs, the cost can be brought down to $5 per cord or less. While the eastern pulpwood prices have lately shown a tendency to decline, they have not done so sufficiently to indicate any material change in the above facts.

132. The Washington consumption of pulpwood in cords increased from 1926 to 1928 as shown in table no. 8.

TABLE NO. 8.—*Consumption of pulpwood in Washington* [1] *(cords)*

[U.S. Department of Commerce, Bureau of the Census]

	1926	1927	1928
Spruce	40,796	33,435	43,663
Hemlock	140,077	151,975	213,261
White fir (balsam fir)	40,805	40,070	37,563
All others	29,366	38,196	40,104
Total	251,044	263,672	334,591

[1] This does not include mill waste, which during the same period increased in consumption from 54,743 to 317,066 cords.

133. However, exclusive reliance on mill waste, when purchased from other operators and not produced by the same owners who operate a pulp mill, is both technically and economically unsound. Constant quality cannot be secured when purchasing pulp chips or mill waste from several sources, and in case of shutdowns of the sawmills, due to depression of the general lumber industry or to other causes, the pulp mills are either compelled to shut down, to begin their own logging operations or to purchase logs in the open market. In this case, the pulp mill is compelled to add a cut-up plant for conversion of the log, and finds itself in the sawmill business.

134. Primary logging operations for pulpwood will hence always remain an important source of supply, regardless of the expansion in the use of mill waste. That these logging operations may be reduced to prelogging or relogging, or to salvaging logging waste, does not alter this economic basis for the pulp industry.

135. The northwest coast has the last remaining large stands of spruce, balsam fir, and hemlock, which form 78 percent of the country's pulpwood requirements. There were in 1925, in the eastern districts 537 paper mills purchasing all the pulp they consumed, and Washington chemical pulp can be laid down on the northeast Atlantic coast in competition with local and imported pulp.

136. In addition, the railroad freight rate of $12 to $13 per ton, from Puget Sound points to the large group of paper mills in Wisconsin, Michigan, and southeastern Indiana, has already enabled Washington pulp manufacturers to enter that territory, which they can also reach via New Orleans and the Warrior River Barge Line. The productive capacity of Washington is about 600,000 to 700,000 tons of chemical pulp a year, and every circumstance points toward a great future chemical pulp industry in the State.

137. Mechanical pulp cannot be economically produced and shipped to eastern points in spite of the low cost of pulpwood and the available water power. Mechanical pulp requires approximately 72 horsepower per ton of capacity in 24 hours, which increases the

cost too greatly for shipment to eastern consumers, while chemical pulp requires only 8 to 12 horsepower per ton.

138. A close analysis of the economic aspects of the pulp and paper industry in the United States as a whole, together with a study of the manufacturing conditions in Washington, leads to the possible conclusion that the State could perhaps to best advantage concentrate on the manufacture of pulp for the eastern mills now compelled to import such large amounts, and that production of paper is hardly warranted except for local consumption and export. Whe her this development will take place in the future, remains a matter of conjecture. It is, however, reasonable to assume that conditions which now may prevent this expansion cannot remain in effect for any length of time, and that economic laws will force a development along these lines.

139. As the pulpwood supplies in the spruce, balsam fir, hemlock group are limited to the douglas fir region, the major development has taken place in this district, and there is only one mill east of the Cascades at the present time.

140. *Exports and local shipments.*—While Japan is on plate no. 149[2] noted as the consumer of logs, this country absorbed the major portion only, and shipments were made to several other countries on a smaller scale.

141. The exports vary considerably from year to year, and in 1930, according to figures compiled from customs statistics by the United States Bureau of Foreign and Domestic Commerce, Seattle, are shown in table no. 9.

TABLE NO. 9.—*Exports for 1930*

	Thousand feet, board measure	Linear feet	Number	Value
Fir logs	19,670			$2,118,680
Cedar logs	63,856			
Other logs	50,418			
Piling		2,404,426		324,780
Poles			32,311	31,680
Total value				2,475,140

142. The fir logs were taken by Japan, Australia, China and even Germany as leaders; also by France, Netherlands, South Africa, Spain, and Argentina in smaller amounts.

143. Japan absorbed practically all the cedar logs, with small shipments also going to Peru, China, England, New Zealand, and Canada.

144. The total value of the products exported in this group, is relatively small in comparison with exports of lumber, which in value reached $14,103,134 in 1930.

145. The shipments to Oregon, shown on plate no. 149,[2] are due to the proximity of Oregon mills to Washington log supplies along the southern border.

146. *Poles and piling.*—Plate no. 149[2] shows that in 1925, 250,000,000 feet, board measure, log scale, were used for poles and piling, which are sold by the lineal foot, prices varying according to length and top diameter.

147. The major portion of piling is used on the Pacific coast for various construction purposes. Small amounts are exported as noted,

[2] Not printed.

and some shipments have been made to the Atlantic coast, among them a shipment of 5,000 fir piles, 100 feet long.

148. The freight rate is a governing factor, as it is quite high for both rail and water shipments. Long piling requires special handling on steamers and three railway cars for inland transportation.

149. Piles from the southern pine district are able to compete with Washington piles through a large eastern and middle and western territory, and except for special purposes, it is doubtful whether this market for the piles from the douglas fir region will ever be very extensive.

150. No data are available covering the production of poles and piling, no organization or association collects complete statistics covering this subject, and the Census of Manufactures does not include the item. The 1925 production, contained in Mr. Gibbon's article previously referred to, offers the only information available without inquiries from all the many producers.

151. An attempt has been made to ascertain the production of fir piling in the Puget Sound region during a 10-year period, and information has been collected covering from 35 to 50 percent of the total output. (See table no. 10.)

TABLE NO. 10.—*Production of fir piling in the Puget Sound region*

Year	Fir piling sold	Average price per lineal foot	Year	Fir piling sold	Average price per lineal foot
	Lineal feet	*Cents*		*Lineal feet*	*Cents*
1920	2,695,400	14.3	1926	3,609,100	12.7
1921	2,679,400	13.7	1927	3,740,100	10.1
1922	1,496,100	12.5	1928	3,376,700	11.8
1923	3,279,600	11.4	1929	3,898,300	13.1
1924	4,422,600	12.7	1930	1,897,600	12.0
1925	2,045,600	14.2			

152. The producers generally specialize in either fir piling or in cedar poles and piling, a large percentage of the former going to the creosoting plants, while cedar piles are used without treatment, or with butt treatment only, because of their durability.

153. Most of the cedar piling is produced on Puget Sound, while the Columbia River territory is perhaps a heavier producer of fir piling. Comparatively small amounts originate in the Grays Harbor district, which even has received fir-pile shipments from the Puget Sound region.

154. Piles above 80 feet are classed as "long piles", commanding a higher price, and they are only slightly more difficult to obtain than 10 years ago. The average dimension in the above list is 9-inch top, 14-inch butt, 55 foot length.

155. The price, per lineal foot, when converted to log scale, shows that the piles command a price about twice as high as a no. 2 log, or $10 above a no. 1 log. It will be noted that the price has fluctuated considerably since the 1920 maximum, reaching a low in 1927. The quantities sold have reached even greater fluctuations, from roughly 1,000,000 lineal feet in 1922 to a maximum of 4,000,000 feet in 1924, and reaching another low in 1930.

156. The total amounts of fir piling sold on the west coast is closely proportional to the tabulated amounts for each year.

157. Cedar poles and piling are higher priced and in demand through a smaller range of dimensions, including short telephone poles for secondary lines. They are, as a rule, logged out with light tractors previous to the main logging operation which would largely destroy them through breakage. Very large cedar poles are used for power lines and for carrying both high- and low-tension lines on two levels but their use has a tendency to decrease because of steel poles frequently being installed for high-tension lines.

158. Another decrease in the production of cedar poles is due to the underground system of conduits which is gaining increased use. A telephone line from Seattle to Everett laid underground is just being completed, and a transcontinental line underground is being constructed from New York to San Francisco.

159. Cedar poles and piling can still be obtained without difficulty as far as the raw material is concerned, the only difference being the necessity of going farther back for the supplies as logging recedes toward the foothills. As there is no logging as yet above the 2,000-foot level, the quality has not changed, and it will apparently remain good for some years to come.

160. The paved roads and the high-speed rubber-tired trucks have, to a large extent, eliminated the distance problems, as poles and piling can be hauled 40 miles at a trucking cost of only 2 cents a lineal foot.

161. At the present low water rates, a 40-foot cedar pole can be shipped to New York for a freight charge of $4.04, while the rail rate would be $7.20. As a rule, poles and piling must pay a water rate $3 per thousand feet higher than the lumber rate, but the coastwise steamers are reluctant to accept shipments even at the avanced rate. However, shipments are being made back to the Atlantic coast and to the Central States, and a trainload of 25 cars of cedar poles was shipped from Puget Sound to Minnesota Transfer within recent times.

162. Cedar poles with 8-inch tops, 40 feet long, forming 85 percent of the output, at the present depressed market, command a price of 12 cents a lineal foot against a normal of 14 and 16 cents which has been received during active periods.

163. The amount of cedar piling produced is comparatively small, and 95 percent of all piling consists of fir.

164. Both fir and cedar poles and piling are, as a rule, produced by small loggers and handled by brokers. The large logging companies prefer to cut the long timbers into standard logs, instead of marketing them separately as piling.

165. Except for the prevailing depression, producers have not observed any appreciable change in trend in the market during the past 10 years. While some of the uses have decreased, the general upbuilding of the west coast, with ever-expanding feeder lines for power and telephone systems, have largely compensated for the lost markets; and for the purpose of rough estimates, the 1925 statistics may therefore be accepted as approximately constant.

THE PRIMARY LOG-USING INDUSTRY

LUMBER

166. *Production.*—Plate no. 149[2] shows that in 1925, 7,027,325,000 feet board measure lumber was produced in Washington, of which amount 90 percent was manufactured west of the Cascades. The diagram also shows that this amount of lumber, while also producing

[2] Not printed.

some 4,900,000 cords, or 2,940,000,000 feet of mill waste, required only 6,475,000,000 feet of logs. This, because of the fact that the log generally produces more than its scale, is based on the average amount of lumber which can be sawed out, with rather liberal allowance for kerf and waste. This "overrun" varies greatly with the diameter, soundness, and material to be cut; it has reached 30 percent in some cases for small sound logs, and is being increased through the recent introduction of the Swedish gang saws with their low losses in kerf.

167. Scribner's lumber scale is used practically throughout the industry and by the United States Forest Service, while Brereton's log scale is used for solid log content in the export trade.

168. As an average for the fir region, the 8½ percent overrun is considered to closely represent actual conditions. The overrun is important, not only because of the difference in log scale and mill scale in statistical data, but because with the small margin of the millmen, the profit or the loss is often determined by the amount of the overrun in cases where logs are purchased on the open market.

169. In statistics covering the lumber industry, the sawmill cut is invariably used as representing the total lumber business, and even the total log cut, although this is not the case, as will be noted by the diagram. In 1925 the lumber production used 86 percent of the total raw material consumed by the log-using industries, 78 percent of the total log turnover, and only 54 percent of the total stumpage removed from all causes.

TABLE NO. 11.—*Lumber production in the of State Washington (in thousand feet board measure)*

[Source: Bureau of the Census, U.S. Department of Commerce]

Year	Douglas fir	Hemlock	Spruce	Cedar	Larch	White fir	Total
1899	1,152,672	201	82,699	83,670	3,970		1,323,215
1904	2,006,129	11,960	96,250	133,490	365		2,248,194
1905	3,125,325	84,773	179,864	252,174	23,385	20	3,665,541
1906	3,405,510	90,002	243,493	236,648	31,249	8,131	4,015,033
1907	3,107,114	58,307	167,493	127,719	40,233	6,370	3,507,236
1908	2,307,212	54,051	163,098	115,135	44,084	11,115	2,694,695
1909	3,060,983	103,268	165,331	183,952	39,795	7,491	3,560,820
1910	3,259,546	145,129	170,467	201,505	29,465	17,296	3,823,408
1911	3,361,120	126,594	133,499	195,335	30,223	8,876	3,855,647
1912	3,381,395	161,630	139,325	153,518	29,884	12,919	3,878,671
1913	3,615,430	209,184	214,843	233,443	39,277	1,323	4,313,500
1914	3,027,994	207,459	189,277	294,284	19,502	3,473	3,741,989
1915	2,754,179	306,570	196,203	201,561	21,477	6,783	3,486,773
1916	3,546,532	267,313	221,295	155,532	30,534	18,042	4,239,248
1917	3,320,044	317,243	198,271	135,820	34,242	23,736	4,029,356
1918	3,578,831	275,693	275,826	102,379	48,248	32,790	4,313,767
1919	3,876,631	286,854	229,145	205,393	63,870	17,979	4,679,872
1920	4,275,017	495,444	192,671	113,351	66,266	32,395	5,175,144
1921	2,889,543	347,940	151,845	120,765	25,648	7,980	3,543,721
1922	4,414,104	587,067	204,665	181,226	35,474	25,399	5,447,935
1923	5,047,712	775,220	146,122	225,503	40,093	26,966	6,261,616
1924	4,507,213	826,710	164,835	195,589	43,174	14,670	5,842,191
1925	4,912,204	1,097,425	207,927	226,664	33,666	14,395	6,492,281
1926	5,409,968	1,155,546	190,498	194,276	36,625	15,816	7,002,729
1927	5,219,045	1,265,634	152,293	170,107	38,437	16,724	6,862,240
1928	5,061,267	1,227,055	147,726	165,027	37,264	15,970	6,654,309
1929	5,101,356	1,252,888	161,030	167,667	38,258	28,400	6,749,608
1930[1]	3,969,913	680,839	155,140	[2] 112,156		14,328	4,940,775

[1] Source of 1930 figures, West Coast Lumbermen's Association.
[2] Of this amount, 33,103,000 feet represent Port Orford cedar.

TABLE NO. 12.—*Comparison of softwood lumber production of the United States as a whole with that of Oregon and Washington, and also with that of the douglas fir region of Oregon and Washington in units of 1,000 feet board measure*

Year	United States	Oregon and Washington	Percentage relation	Douglas fir region [1]	Percentage relation
1904	27,353,312	3,467,830	12.67	3,089,823	11.29
1905	24,914,618	5,171,217	20.76	4,833,441	19.40
1906	30,235,245	5,902,191	19.52	5,478,087	18.12
1907	31,001,225	5,405,758	17.44	4,997,977	16.12
1908	25,546,006	4,376,059	17.13	3,995,832	15.64
1909	33,896,959	5,757,087	16.98	5,278,784	15.57
1910	31,160,856	6,172,378	19.81	5,692,370	18.27
1911	28,902,388	5,857,245	20.27	5,461,047	18.89
1912	30,526,416	6,001,779	19.66	5,624,699	18.43
1913	30,302,549	6,680,729	22.05	6,182,172	20.40
1914	29,406,839	5,753,709	19.57	5,336,283	18.15
1915	29,484,763	5,230,870	17.74	4,801,391	16.28
1916	31,331,900	6,708,360	21.41	6,053,043	19.32
1917	29,174,122	6,783,850	23.25	6,031,251	20.68
1918	25,667,531	7,295,161	28.42	6,565,890	25.58
1919	27,407,130	7,535,523	27.49	6,768,788	24.69
1920	26,809,500	8,829,231	32.93	7,813,679	29.26
1921	22,185,504	5,849,977	26.36	5,250,321	23.66
1922	26,644,334	8,852,451	33.22	7,892,789	29.62
1923	30,903,981	10,633,277	34.41	9,390,834	30.39
1924	29,405,685	9,922,243	33.74	8,708,061	29.61
1925	31,710,478	11,233,741	35.42	9,672,411	30.50
1926	30,469,344	12,000,971	39.38	10,411,970	34.17
1927	28,442,522	11,318,714	39.79	9,987,562	35.11
1928	28,345,095	11,653,828	41.11	10,181,974	35.92
1929	29,813,345	12,086,072		10,377,196	
1930		[2] 8,783,186		[3] 7,637,553	

[1] Includes the species of western red cedar, douglas fir, west coast hemlock, Sitka spruce, larch and white fir, a small undetermined portion of which does not come strictly from the doulgas fir region.
[2] Estimated total softwoods equal 15 percent more footage than west coast survey species.
[3] Survey by West Coast Lumbermen's Association.

All totals, unless otherwise noted, are from Bureau of the Census reports, U.S. Department of Commerce. Compiled by the Industrial Facts Department, West Coast Lumbermen's Association.

TABLE NO. 13.—*Production of lumber, lath, and shingles in Washington by species and districts, 1928 (thousand feet board measure)*

[Source: United States Forest Service]

County	Number of active mills	Total cut	Douglas fir	Western hemlock	Western yellow pine	Western red cedar	Sitka spruce	Western white pine	Western larch	White fir [1]	Lodgepole pine	Total, hardwoods
Clallam	10	112,099	83,935	24,345		3,463	356					
Clark	17	129,584	50,726	75,000		3,803						[2] 55
Cowlitz	11	462,140	428,683	32,076		1,339				1		[2] 41
Grays Harbor	28	1,336,114	843,081	377,503	850	19,724	94,614				342	
Island	3	228	228									
Jefferson	1	170,483	154,227	16,256								
King	44	901,125	719,911	105,242	1,582	63,446	1,849	806				[3] 8,289
Kitsap	7	6,090	6,039	14		27		10				
Lewis	33	415,785	383,610	24,686		1,092	51			6,346		
Mason	5	118,244	54,190	64,054								
Pacific	11	217,448	191,365	15,524			10,559					
Pierce	38	983,189	831,500	141,893		2,846	1,805	1,000				[4] 3,145
San Juan	1	750	590	100		10				50		
Skagit	9	217,501	77,594	118,623		1,040	17,744		2,500			
Skamania	7	26,068	25,350	308		325		85				
Snohomish	32	978,400	703,818	226,079	1,095	34,988	954	275		11,154		[5] 37
Thurston	21	257,729	254,206	2,111		286	18					[6] 1,108
Whatcom	20	367,965	180,376	124,890		15,480	43,419		3,500			[7] 300
Total, west side	298	6,700,942	4,989,429	1,348,704	3,527	147,869	171,369	2,176	6,000	17,551	342	13,975
Percent		100.00	74.46	20.13	0.05	2.21	2.55	0.03	0.09	0.26	0.01	0.21

[1] Includes balsam fir and lowland white fir.
[2] Alder.
[3] Alder, 7,264 thousand; maple, 878 thousand; ash, 92 thousand; birch, 55 thousand.
[4] Alder, 615 thousand; maple, 1,660 thousand; birch, 300 thousand; cottonwood, 560 thousand; oak, 10 thousand.
[5] Maple.
[6] Alder, 479 thousand; maple, 629 thousand.
[7] Cottonwood.

170. These percentages are approximately correct for any year, with merely slight variations.

171. Table no. 11, prepared by the West Coast Lumbermen's Association, shows the lumber production west of the Cascades from 1899 to 1930. However, the table includes some larch, which should have been classified under the east side cut. (See table no. 13.)

172. Table no. 12 shows the total production in United States, in Oregon and Washington, and in the fir region, with percentage of the United States production.

173. Table no. 13 shows the production by species and counties in western Washington during 1928, and includes hardwood.

174. Except for a peak due to the boom in 1906, the production shows a fairly regular increase until 1920. The greatest fluctuation is shown between the depressions of 1921 and 1930, with variations between maximum in 1926 and minimum in 1921 of 50 percent.

175. The 1928 statistics by counties is representative of the present condition of distribution, and shows that fir and hemlock formed 94.6 percent of the whole production. The cedar included covers lumber only, and does not contain the shingle cedar as previously noted.

176. Tables nos. 11 and 12 show that in the normal year 1928, western Washington produced about 23 percent of the total lumber output in United States, while in 1910 the proportion was about 12 percent, and in 1920 about 19 percent.

177. Washington reached the lead in lumber production in 1905, and has maintained the position since that year with the exception of 1914, when Louisiana led in the output.

178. *Distribution.*—Plate no. 149 [2] shows that 70 percent of the lumber produced was shipped from the State in 1925 by rail and water and only 30 percent retained for manufacture or consumption in the State. In this year water shipments predominated, California leading in the consumption, with the Atlantic coast forming another important market.

179. The export shipments remained fairly constant during the 3-year period, as follows:

	Feet
1923	761, 000, 000
1924	778, 000, 000
1925	771, 000, 000

180. In 1926 the export increased to 1,011,000,000 feet, and in 1930 these shipments were 824,611,000 feet board measure.

181. However, the lumber export in 1930 formed only 71 percent of the total value of exported forest products, as shown by the following tabulation compiled from data assembled by the Seattle office of the United States Bureau of Foreign and Domestic Commerce from customs statistics.

182. Lumber products exported from Washington, in 1930:

Veneer	square feet	532, 837
Plywood	do	28, 943, 394
Doors	pieces	1, 198, 380
Ties, plain	do	126, 059
Ties, creosoted	do	24, 589
Lumber:		
Cedar, sawed timber		418, 000
Fir, sawed timber		178, 173, 000
Other softwood timber		12, 920, 000
Fir boards, rough		359, 695, 000

[2] Not printed.

Lumber—Continued.	
Fir boards, dressed	24, 080, 000
Cedar boards, dressed	540, 000
Spruce boards, dressed	7, 722, 000
Hemlock boards, dressed	98, 426, 000
Hemlock shooks	37, 817, 000
Total	819, 791, 000
Values:	
Lumber	$14, 103, 134
Veneers	11, 165
Ties	37, 623
Plywood	1, 128, 791
Doors	1, 954, 932
Total above	17, 235, 645

Total, all forest products, $19,700,772. (See Logging industry.)

183. The distribution of these exports is of considerable interest. China, England, Canada, and Chile took the ties. Douglas fir lumber was shipped to the principal lumber-producing countries of Europe, Sweden, Norway, Denmark, and practically every country of the European Continent. This lumber was taken by the South and Central Americas, by the Orient, and by Africa, by Iraq, Mozambique, and Miquelon, by Egypt, Iceland, and the Canary Islands. It has, indeed, a world wide distribution, going to 55 countries.

184. Germany was the leading importer of plywoods, with 10,566,816 square feet, followed by England, with 9,121,227 square feet and Belgium next in order with 2,274,088 square feet. The balance of the plywood was absorbed by 23 other countries.

185. The United Kingdom took a million doors, and 32 other countries received the balance.

186. The statistics covering rail shipments for 1930 are as yet not available, and the 1928 shipments are perhaps more representative than the shipments during the boom of 1929 and the depression of 1930. They were as follows:

Shipments from State of Washington in feet board measure:

Water:	
Domestic, United States and possessions	2, 355, 203, 400
Exports, including eastern Canada	1, 146, 116, 658
Total water shipments	3, 501, 320, 058
Rail: Shipped out of State	[1] 2, 217, 000, 000
Total, all shipments	[3] 5, 718, 320, 058

187. The total water shipments have varied as follows since 1921:

Year:	*Feet board measure*
1921	[4] 1, 111, 709, 279
1923	2, 620, 244, 349
1925	3, 055, 698, 341
1926	3, 552, 929, 599
1927	[5] 3, 605, 962, 606
1928	3, 501, 320, 157
1929	3, 317, 897, 332
1930	2, 544, 613, 272

[1] The rail shipments in 1928 were exceptionally heavy and formed a high point in the shipping records.
[3] 85 percent of production.
[4] Minimum.
[5] Maximum.

188. With the exception of the abnormal years of 1927 and 1930, showing a difference of 30 percent, the water shipments show a steadily increasing trend, largely illustrated by the governing years 1923, 1925, and 1929. (Figures from records of the Pacific Lumber Inspection Bureau and the West Coast Lumbermen's Association.)

189. *Sawmills.*—While in 1928 there were 298 active mills on the west side and 135 on the east side, their average production, based on the whole output, was, respectively, 22,500,000 and 4,335,000 feet board measure per mill, or, if reduced to daily cut, on a 260-day basis, respectively, 86,500 and 16,600 feet board measure.

190. As a matter of fact about 85 percent of the lumber produced on the west side is cut by mills having a daily capacity of 75,000 to 500,000 feet, with 100,000 to 200,000 feet per 8-hour shift predominating. The largest mill has a capacity of 1,000,000 feet board measure in 8 hours.

191. On the east side the mills are small, as indicated by the average output. In 1928 the west side cut 92 percent of the State's output of lumber, and it is, therefore, closely representative of the industry in the whole State.

192. Somewhat over 65 percent of the total cut was produced by mills owning their own stumpage and conducting logging operations, at least part of the time.

193. The large water shipments and the available log supplies on tidewater produced by the independent loggers have compelled tidewater locations for most of the large mills, many of them being modern plants, well equipped and diversified in operation, including lath mill, planing mill, box, factory, and, in a few cases, even veneer mill and sash and door factory. They are generally completely electrified, using mill waste for fuel with a battery of boilers, turbines, and generators. Some mills have been able to sell surplus current to the power companies.

194. However, these mills are exceptions, and a large number of mills produce lath and have planing mills for finishing lumber.

195. A large percentage consist of small mills cutting ties, common boards, and structural dimension timber.

196. The importance of the sawmill industry is shown by the following tabulation, covering the 1925 distribution, in the whole State:

Investment in timberlands, mills, and equipment, (approximate)	$400, 000, 000
Value of product	$160, 000, 000
Lumber produced ... feet	7, 027, 000, 000
Pay roll	$41, 840, 595
Laborers employed	35, 286
Time worked ... days	261
Average wage	$4. 54

197. In 1930, 95 percent of the mills west of the Cascades produced 4,685,486,278 feet board measure, operating 49.96 percent under their capacity. This would give a total capacity of 9,800,000,000 feet, or, roughly, 10,000,000,000, as the annual capacity of all the west-side mills under full production.

198. *Product.*—Douglas fir dominates the product of the mills and enters into a greater number of uses than any other American wood.

199. Lumber is produced in five grades, according to quality—grain, knots, and other defects, as shown in table no. 14.

TABLE NO. 14.—*Lumber grades in percent of total cut*

[Source: West Coast Lumbermen's Association]

GRADES	Percent
1. Clears or uppers:	
Flooring	8.71
Finish	5.70
Drop siding and rustic	5.37
Ceiling and partition	4.99
Car siding, lining, or roofing	3.75
Miscellaneous clears	6.27
Total	34.79
2. Intermediate grade: Select common and merchantable	5.33
3. No. 1, common timbers:	
Timbers	4.50
Railroad ties	3.03
Plank and small timbers	4.87
Miscellaneous	.85
Total	13.25
4. No. 1, common boards and dimensions:	
Boards	9.12
Dimensions	26.24
Miscellaneous	.10
Total	35.46
5. No. 2, common and poorer	11.17
Grand Total	100.00

200. The tabulation is, in the main, self-explanatory, with the exception of the intermediate grade. This class is especially introduced for the best type of construction lumber, as silo staves, special construction work, requiring dimensions, boards, etc., of better grade than no. 1 common, also car material, etc. It should be noted that while the log cut contains only 10 to 13 percent of no. 1 logs, the lumber cut produces about 35 percent clears due to the sorting and selection of additional clears from no. 2 logs. Of the clears one fourth is converted into flooring, 60 percent being vertical grain and the balance flat grain. Flooring forms an important item, both in local consumption and in shipments, and, together with other uppers, commands a relatively high price, which enables the sawmill to offset losses on poorer grades.

201. From 45 to 50 percent of the mill output is absorbed by general construction, 40 percent goes to planing mills and general millwork, 5 to 7 percent into car construction, and the balance goes into miscellaneous uses.

202. *Prices and costs.*—Plate no. 150 [2] shows the annual fluctuation of the average mill price per thousand feet of douglas fir and western yellow pine between 1921 and 1928. (From United States Department of Commerce, Statistical Abstract, 1930.) It will be noted that the fluctuation and the continuous decline since 1923 have been common for both fir and pine, except for a slight recovery of the yellow pine prices between 1927 and 1928, but a continued decline of fir prices. The relation between the average mill price, and the prices realized for the various items of the cut, is shown in table no. 15, giving prices f.o.b. mill.

[2] Not printed.

TABLE NO. 15. *Mill prices of douglas fir grades per thousand feet board measure for 1925*

Grade:	Price
Flooring, V.G., B clear, 1 by 4 inches	$42.50
Flooring, F.G., B or better, 1 by 4 inches	28.25
Ceiling, B and better, ⅝ by 4 inches	27.50
Drop siding, B and better, 1 by 6 inches	34.25
Boards and shiplap, No. 1 Com., 1 by 8 inches	16.75
Timbers, No. 1 Com., 6 by 6 inches and over	19.00
Boards and shiplap, No. 2 Com., 1 by 8 inches	11.00
Average price at mill 1925, whole output	20.94

203. Table no. 16 gives the cost of producing lumber, also the number of operators annually reporting these costs to the West Coast Lumbermen's Association.

TABLE NO. 16.—*Total cost of lumber manufacturing, as reported to West Coast Lumbermen's Association*

Year	Number of operations	Total cost of manufacturing [1]	Year	Number of operations	Total cost of manufacturing [1]
1919	50	10.21	1925	62	8.00
1920	58	12.47	1926	50	7.94
1921	70	8.61	1927	41	8.08
1922	82	8.14	1928	36	7.34
1923	85	8.91	1929	35	7.54
1924	78	8.47	1930	26	7.69

[1] Manufacturing costs:
Cost of administrative and general.
Cost of depreciation.
Cost of labor.
Cost of expense.
Administrative and general includes salaries of executives, superintendent, office employees, etc., and office expense, such as rent, light, stationery, telephones, furniture depreciation, etc., fire, boiler, and liability insurance, taxes, etc.
Depreciation includes depreciation on all manufacturing equipment and mill buildings.
Labor includes all labor in connection with mill pond, sawmills, sorting table, dry kiln, yard, sheds, planing mill, sizer, etc.
Expense includes all expense in connection with various units listed under "Labor", together with all supplies.

204. It will be noted that taxes are included under administrative and general costs. Because of their importance at this time an effort has been made to ascertain the amount of taxes paid per thousand feet board measure produced, but no results have been obtained which would be useful. The taxes differ in every county; there are several kinds of local and district assessments, and only an extensive survey could ascertain a rate per thousand which would be sufficiently representative of average conditions to warrant presentation.

205. The report of the West Coast Lumbermen's Association covers 16 separate items, all reduced to cost per thousand feet. The inclusion of taxes as an additional, separate item, would furnish information of considerable value, particularly since the costs are compiled from data covering 26 to 85 mills, as noted by table no. 16.

206. The following detail costs are extracted from the summary of the West Coast Lumbermen's Association for 1928, showing 5 groups of mills graded according to size of output. The mills in the smallest and largest groups and the general averages for 34 mills are included in table no. 17.

TABLE NO. 17.—*Manufacturing cost per thousand feet board measure for 1928*

	Administrative and general	Depreciation	Labor and expense	Total cost of manufacture	Shipping and selling expense	Total cost of products excluding inventories	Lumber returns
Group A, 4 mills with annual capacity of 15,000,000 to 19,150,000	$0.93	$0.49	$6.82	$8.24	$0.98	$20.83	$19.83
Group E, 5 mills with average capacity of over 62,850,000	1.40	.76	5.56	7.72	1.63	20.84	20.18
Average 34 mills	1.24	.72	5.38	7.34	1.39	20.36	20.01

207. The tabulations for several years generally show a lower manufacturing cost and a better price obtained by the larger mills. The administration cost varies; in 1930, the smaller mills charged $1.65 and the larger mills $1.43 to this item. The shipping and selling expense, however, appears to be consistently higher for the larger mills. Table no. 18 shows the cost, including logs, for tidewater mills only.

TABLE NO. 18. *Manufacturing costs 1927–30 (tidewater mills only)*

	1927	1928	1929	1930
Number of mills	12	11	11	10
Logs produced	$13.67	$13.14	$13.16	$11.38
Logs purchased	16.35	16.61	17.17	15.91
Logs sawn	13.35	13.39	13.61	12.57
Manufacturing	8.13	7.14	7.28	7.44
Shipping	.73	.72	.69	.69
Selling	.72	.55	.57	.58
Total cost, excluding inventories	22.93	21.80	22.15	21.28
Sales return	21.52	21.66	22.63	18.91
Profit			.48	
Loss	1.41	.14		2.37

Average 4-year production cost, sold and delivered, $20.04.
Average loss as above, $0.86.

208. It will be noted that the cost of logs is based on logs purchased or logs produced by the mill itself, according to the proportion consumed in manufacturing lumber. Under the heading "Logging", plate no. 149,[2] it was shown that in 1925, 65 percent of the logs were produced by the mills themselves and 35 percent by the independent loggers. However, this proportion does not prevail in the figures quoted above for the past 4 years, as the average percentages appear to be closer to 90 and 10 percent, respectively. More purchased logs were no doubt used prior to 1927.

209. Plate no. 150 [1] shows a comparison between the lumber price at the mill and the production price on the same basis for logs purchased and logs produced. It will be noted that since 1921 it has not been possible to produce lumber profitably from purchased logs during a single year, and that if the mills used their own logs, there were only two years with an appreciable profit, 1923 and 1929. As part of the logs were purchased in the open market, the result has been a loss during 5 years of 7.

[2] Not printed.

THE SECONDARY LOG-USING INDUSTRIES

210. As shown by plate no. 149,[2] lumber production consumes 86 percent of the logs used by these industries, followed by shingles and lath with, respectively, 9.5 and 2.5 percent; veneer consuming only 1.5 percent and cooperage and excelsior together using less than 1 percent.

211. While lath is produced in the lumber mills, it is not cut from lumber, but directly from the slab, and as it is generally grouped with shingles, it can be properly classified under the log-using industries.

212. *Lath.*—Table no. 19 shows the production in the State since 1923. (From Census of Manufactures: Lumber, Lath, and Shingles, for various years.)

TABLE NO. 19.—*Production of lath in Washington*

Year	Lath in thousands	In percent of United States production
1923	835,339	25
1925	766,591	24.3
1927	766,109	32.3
1928	584,403	30.7

213. In 1923, 117 mills were active in the whole State; in 1928, 86 mills. While separate statistics for eastern and western Washington are lacking, most of the lath is produced west of the Cascades. From a high value of $4.28 per thousand in 1923, the price declined to $3.40 in 1927, these prices expressing the average values at mills throughout the country. (Census figures.)

214. Washington is by far the heaviest producer of lath, outranking all other States. In 1928 Oregon followed Washington with 251,093,000 lath, other high producers being Mississippi and Louisiana, with 115,808,000 and 103,775,000, respectively.

215. The general consumption in the United States is declining, although at a slow rate, being influenced by substitutes like plaster board, etc. It is conceivable that even cheaper substitutes than plaster board may ultimately be produced from some waste material, in which case lath production may continue the decline at a more rapid rate.

216. Since some of the substitutes are also produced from the same waste material, as masonite, firtex, etc., the competition merely results in converting the waste products, slabs, edgings, etc., into more profitable material than lath, and the substitution is, therefore, not economically disadvantageous to the lumber industry.

217. *Shingles.*—The shingle industry occupies a prominent place among the State's lumber industries, in 1925 converting cedar logs, valued at $12,240,000 into shingles with a value of $19,829,280, distributing $5,252,599 in wages to 5,000 employees, and carrying an investment of $15,000,000, exclusive of timberlands.

218. Plate no. 149 [1] shows that 720,000,000 feet of logs were consumed, being converted into 6,196,650,000 shingles. Raw material is secured by logging or purchase of cedar logs delivered at the mill.

[2] Not printed.

219. Shingles are graded and sold on a classification introduced by the Washington and Oregon Shingle Association, which differs from the American Shingle Standards, but is more suitable for the local material. The association uses six grades, with price differences which in 1926 ranged from $2.10 for the lowest to $3.85 per thousand shingles for the highest grades. The present prices for the same grades are respectively $1 and $3.25 per thousand wholesale, with constant fluctuations. Shingles are packed in bundles of random width, and a thousand is in area equivalent to 1,000 shingles 4″ wide, forming five bundles. Competition with prepared roofing material which is sold by a "square" has caused the introduction of another unit, the equivalent in shingles which will roof 100 square feet or a "square."

220. Table no. 20 shows the Washington production of shingles for controlling years:

TABLE NO. 20. *Shingle production in western Washington*

[Statistical Abstract of the United States, 1930, and Census of Manufactures: Lumber, Lath, and Shingles]

Year	Shingles in thousands	Percent of United States production	Remarks
1909	8,879,467	59.56	Maximum output of Washington.
1916	6,739,388	71.91	
1918	4,238,714	74.49	Minimum output of Washington.
1922	6,664,876	81.97	
1925	6,196,650	84.30	168 mills.
1928	5,019,061	89.80	132 mills.

221. The maximum production in 1909 occurred simultaneously with the maximum United States output, which has steadily declined since that year. While the Washington production has also declined, the State's percentage of the United States output is steadily increasing.

222. The nearest competitor in shingle manufacture is Oregon, which produced 442,628,000 shingles in 1925, or about 7 percent of the Washington output.

223. A continued decline in shingle production is to be expected, caused partly by decreasing supplies of cedar, partly by the competition of other roofing materials, nationally advertised and aggressively sold even in the home territory of the shingle. However, the decline due to demand will not be abrupt, or result in cessation of the industry within a determinable period. The high quality, suitability, and durability of the western red cedar shingle apparently will always command a fair market in spite of competitive materials, and, unless radical innovations are introduced in the building industry, the present trend of shingle consumption, adjusted for evident stability of demand, indicates that at least 3,500,000,000 western Washington shingles could be marketed 20 years hence, requiring 410,000,000 feet of cedar logs.

224. However, the total remaining stand of cedar is only 32.5 billion feet, logged at the rate of about a billion feet a year for poles, export logs, shingles, and cedar lumber. The stumpage is also becoming poorer and more inaccessible, and it is possible that the decline

in the shingle production 20 years hence may be controlled more by the available supply of cedar than by the absorbing capacity of the market. With the decline in raw material, an increase in stumpage prices and in the cost of the product must follow, but in a competitive field, substitutes generally take possession of the market when the price of the original product advances beyond the competitive level.

225. With the slow growth of the western red cedar, the industry must largely depend upon the remaining old growth, and while a market for shingles would seem to exist above the supply of future raw material, it is not impossible that a more profitable and timber conserving future use may be found for this lumber, as finish, furniture, and fixtures, novelties, woodenware, etc.

226. In this connection the total consumption of cedar in Washington, dominated by consumption for shingles, is given for 1925. (See table no. 21.)

TABLE NO. 21.—*Consumption of red cedar in 1925*

[William H. Gibbons, The Forests and the Wood-Using Industries of Washington]

Industry	Quantity in feet, board measure	Percent
Exported logs	76,651,000	6.53
Poles and piling	150,000,000	12.78
Lumber	226,664,000	19.32
Shingles	720,000,000	61.37
Total	1,173,315,000	100.00

227. No data are available relative to shingles remaining in the State and those shipped to other States. However, it is known that shipments are made to every State, and that the heaviest consumers are the Central States, from Minnesota to Texas, taking about 50 percent of the total shipments.

228. On a basis of the per capita consumption in the United States, which in this case would not give accurate results, 98.5 percent would be shipped to other States and only 1.5 percent retained. The probable proportions are closer to 80 and 20 percent.

229. The British Columbia shingles, which enter duty free, form about one third of the western production. While they do compete with the local product on the eastern markets, with somewhat higher quality, the total effect of the competition is less apparent than the output would seem to indicate. (Red Cedar Shingle Bureau.)

230. *Veneer.*—While consuming only 1.5 percent of the logs used by the primary log using industries, and in its present development being of relatively recent origin, the veneer industry shows a more rapid and profitable growth than the others classified in this group.

231. The veneer industry existed in Washington on a small scale until 1909, consuming domestic cottonwood and spruce in amounts from five to seven million feet annually.

232. In 1909 the douglas-fir veneer and plywood panels were introduced, and the growth of the industry has since then been rapid, until in 1925, Washington led the United States with a production of 112,484,000 feet b.m. turned into veneer, North Carolina following

with 64,640,000 feet. (Census of Manufactures 1927.) Douglas fir now ranks third as a veneer wood, in the United States, being exceeded by red gum and tupelo, with relative productions of red gum 250,247,000 feet b.m., tupelo, 113,729, and Douglas fir 101,220.

233. Douglas fir formed 81.6 percent of the veneer produced in Washington in 1925, followed by sitka spruce with 16.3 percent, and small amounts of cottonwood, western birch, and others.

234. The veneer industry requires clear and sound fir logs, 30 inches and over in diameter, 8 feet long, commanding a premium above the ruling price, generally around $5 above the market for no. 1 logs. Because of the independent nature of the veneer mills, practically 85 percent of the logs are purchased in the open market, and the loggers are not warranted in breaking these high-grade logs out of the rafts except at the advanced price, partly because of the added expense and partly because their presence enhances the value of the whole raft.

235. In 1925 about 35 percent of the veneers produced in Washington were used by the door manufacturers, 45 percent converted into plywood panels, and 20 percent into baskets and fruit containers.

236. Veneer and plywood is finding increased use for a variety of purposes, and large amounts are exported. Among less known uses are partitions and paneling for steamships and motor vessels built in England, important portions of passenger car bodies, and if assembled with waterproof glue and built with protected seams, as bottoms and sides of motor boats in large sheets instead of the usual construction by the use of narrow boards fitted into place one at a time at high labor cost. Sandblasted ornamental panels for high-grade inside finish have lately gained prominence.

237. Veneer, or the single sheets, as they come from the veneer lathe, is principally used by the light container industry. Plywood, or several thicknesses of veneer glued together, is principally used as inside finish in buildings and for furniture, fixtures, cabinets, trunks, and allied lines.

238. Table no. 22 shows the Washington production of veneers, practically all by the west coast mills.

TABLE NO. 22.—*Timber consumed in manufacturing Washington veneer*

[Statistical abstract of the United States for 1930. Manufactures' Census of 1927, and Wm. H. Gibbons

Year	Feet board measure used	Veneer, in percent of United States production
1906	6,800,000	2.1
1909	5,419,000	1.2
1923	53,510,000	8.3
1925	112,484,000	15.3
1927	140,319,000	14.6

239. Statistics available for the study of the veneer industry are not as complete as for shingles and lath, and the 1927 Census of Manufactures does not give the value of the product.

240. Some apprehension has been expressed relative to the future supplies of veneer logs, in view of the fact that the fir stand is diminishing, the quality decreasing, and the veneer manufacturer is com-

pelled to rely on the independent loggers to the extent of 85 percent of his raw material. While there is some ground for this apprehension in regard to distant future supplies, it should be noted that the industry consumed in 1925 only 1.5 percent of the raw material converted by the log using industries, and that the principal species of the veneer industry is douglas fir, which now forms 59 percent of the stand, and which will supply suitable logs for a long time to come. On the other hand, it is quite probable that the veneer manufacturers will, in the near future, be compelled to use logs of lesser quality, diameter and length, for the more common products, reserving the high class large veneer logs for their select material.

241. On the whole, the veneer industry is on a solid basis, both as regards the market and the raw material, and no apprehension need be felt for its stable future and steady growth for an extended period to come. However, after the old growth is logged off, the second growth will never equal it in quality and content of veneer material, the second growth being practically similar to the present no. 3 grade. The present trend of the industry indicates that by that time there will be increased use of pressed wood fiber and wood flour board, with or without reinforcing inlay, in a large number of cases where plywood is used now.

242. *Cooperage.*—This is a minor industry, which employed 583 persons in 1923, and 675 persons in 1925, producing material valued in the former year at $1,921,196 (Census of Manufactures). The product consists of tight and slack staves, and headings for barrels, kegs, tubs, pails, etc. Under tight staves, the Census of Manufactures for 1927 reported Arkansas leading all States in production, with Washington included in a minor group under "Other States."

243. Under slack staves, Washington was also among the minor producers in 1927, with 13,786,000 of staves, Arkansas leading with 271,861,000 and Virginia following with 123,013,000. In 1927 Washington produced 1.4 percent of the United States output of slack staves.

244. This output reached a peak in 1909, with 2,029,548,000, decreasing to a minimum of 893,621,000 in 1921, and in 1927 reaching 961,782,000 of staves, the Washington production being influenced by the same factors governing the general decrease in consumption. This is due to competitive materials, largely a more extended use of steel drums and barrels, and to packing several products in boxes which in the past were shipped in barrels.

245. As raw material, the industry in Washington uses domestic woods, 60 percent fir, 27 percent spruce, 11 percent hemlock; the balance consisting of balsam fir and black cottonwood. This material is purchased from the independent loggers and converted by the cooperage plants, which do not own stumpage or conduct logging operations.

246. *Excelsior.*—This is the least of the log-using industries, and in 1923 produced material valued at only $80,000, or 1.5 percent of the United States' production. Only 25 percent is sold on the general market, the balance being used locally. Most of the excelsior is now produced by one factory in Seattle, the favored raw material being black cottonwood, generally purchased from the farmers in cord lots. Four grades are produced: Wood wool, ribbon, medium, and coarse.

247. The production has not materially changed from 1923 to 1926, and while the industry could be considerably expanded, it is doubtful whether it will ever be of any great importance, since it does not consume the common raw materials and wastes, but relies on the black cottonwood which is becoming scarce. Indiana and Illinois led in 1927 with 25 percent of the total output.

THE LUMBER-USING INDUSTRIES

LUMBER REQUIREMENTS

248. Plate no. 149[2] shows that the lumber-using industries consumed only 16 percent of the total lumber production in 1925, although forming about 35 percent of the total value of the product.

249. The percentages in the table for this group are based on the 1923 statistics, with lumber used by the group in 1925 proportioned to the total production of lumber for that year, no other statistics being available. The 1928 statistics have been recently published as preliminary releases, and are based on different groups as shown in table no. 23 from lumber Used in Manufacture, 1928, United States Forest Service and Bureau of the Census.

250. The tables are not comparable, since the 1928 statistics exclude matches and include planing-mill products as flooring, siding, and ceiling, in addition to numerous other differences.

TABLE NO. 23.—*Requirements of the wood-using industries in Washington, 1928*

	Consumption in M feet b.m.		Percent of total lumber consumption
	Total lumber used	Foreign lumber included	
Boxes and crates	456,037		22.51
Car construction and repairs	28,630	20	1.42
Caskets and coffins	3,641		.18
Chairs and chair stock	6,804	10	.34
Fixtures	1,262	101	.062
Furniture	8,386	422	.41
Patterns and flasks	206	9	.01
Planing-mill products	915,522		45.20
Pumps and wood pipe	5,686		.28
Refrigeration and kitchen cabinets	109		.005
Sash, doors, blinds, and general millwork	528,306	2,035	26.10
Ship and boat building	10,128	245	.50
Signs and supplies	50		.002
Trunks and valises	40		.002
Motor vehicles	4,228	1	.21
Woodenware and novelties	1,204		.06
All other industries	49,849		2.47
Total all industries	2,020,088	2,843	100.00

Boxes and crates, planing-mill products, and millwork, in percent of the foregoing group	93.81
Balance of group converted into finished products	6.2
Balance in percent of total lumber production, 1928	1.8

251. Under total lumber used in the 1928 statistics are also included all hardwoods and softwoods brought in from other States; however, the predominating raw material consisted of western Washington softwoods, amounting to 1,645,300,000 feet, or 81 percent of the total consumption.

[2] Not printed.

252. Both tabulations bring out the importance of sash, door, and millwork and boxes and crates. It should be noted that while a heavy consumer of lumber, the box industry converts it into a low-priced product, as will be noted by plate no. 149,[2] showing that this industry uses 36.2 percent of the total lumber, but produces only 15 percent of the total value in the group. The millwork industry shows a distinctly higher value.

253. The most striking fact brought out by the 1928 tabulation is the great consumption of lumber for boxes, planing and millwork, or 93.8 percent, rendering the balance of the consumption insignificant.

MILLWORK

254. The Census of Manufactures for 1923 and 1927 gives data on the millwork industry in Washington, as shown in table no. 24.

TABLE NO. 24.—*Planing-mill products*

	1923	1927	In percent of United States production, 1927
Number of establishments	92	120	2.6
Wage earners	2,602	3,070	
Wages	$3,361,105	$4,021,631	
Cost of materials	11,134,706	10,849,464	
Value of product	18,085,815	19,587,125	3.35
	Washington		United States
Conversion ratio, value of material to value of product	1-1.63	1-1.90	1-1.96
Value produced per capita	$12.80	$13.00	$4.95

This tabulation shows that the output of the State compared to the total production of the country is quite small, but that the average size of the Washington mills must be larger than the average of the United States. While the per capita production is not a true indication in this case, it shows that since the Washington production per capita is two and one-half times as great as for the rest of the country, and as the millwork industry is largely a local industry supplying home needs, there must be a surplus manufactured in Washington for shipment from the State. This is verified by the census statistics of unit production. The total United States production of doors in 1927 was 16,349,844 pieces, and Washington produced in the same year 8,506,762 pieces, or 52 percent of the whole country's output. Under lumber export it was shown that a large number of doors were exported, 1,000,000 going to England alone in 1930. The Washington production of doors has grown at a rapid rate, the 1925 output being 6,725,745 doors. The industry has been practically created by the introduction of the douglas fir plywood panels which are available in large sheets and high qualities, permitting an excellent finish.

255. Other major products of this industry are sash, window and door frames, mouldings and trim for buildings, and general customs millwork. The census includes under millwork, or planing-mill products, plywood, or the manufacture of laminated sheets from veneer; also portable houses, tanks, and vats.

[2] Not printed.

256. That the industry as a whole is organized on the same basis as the average for the United States is shown by the conversion ratio, which is identical in both cases, 1 to 1.9.

257. The millwork industry in Washington is on a stable basis, with a steady growth and an output which is as large as should be expected, since it is principally based on local requirements. However, it forms an outstanding exception from the same industries in other States in its heavy production of doors. This branch of the industry is as yet not saturated, and it will in all probability, owing to the available fir plywood, continue to expand in the future and to find a profitable outlet on both domestic and foreign markets.

258. No separate statistics covering the activities east and west of the Cascades are available. The general output is apparently closely related to the populations in the respective districts, and the special outputs, like doors, etc., are located on the west coast. Of the listed mills, 25 percent are located east of the Cascades, although their output is below this percentage.

BOXES AND CRATES

259. The data available are conflicting and apparently based on the difference between finished product and semifinished material or "box shooks."

260. In The Forests and the Wood-Using Industries of Washington, by William H. Gibbons, United States Forest Service, Portland, Oreg., the following data are submitted for 1923:

Total consumption, feet board measure	382, 881, 000
Value	$8, 143, 000
Value of products, shooks	$12, 000, 000
Persons employed	2, 238

261. On the other hand, the Census of Manufactures for 1923 and 1927 gives the following figures for boxes and crates:

	1923	1927
Number of establisments	21	15
Wage earners	649	377
Cost of materials	$2, 350, 273	$1, 137, 395
Value of product	3, 547, 696	1, 865, 506

262. The Portland office of the United States Forest Service shows three and one half times more employees and a product of two and three tenths times higher value than the census. The census figures would show a per capita production practically similar to the average of the United States. However, it is known that the State consumes more of this material than other States because of the heavy demand by the fruit, fish, and vegetable industries; also that it ships and exports large amounts. The data furnished by the Portland office of the United States Forest Service will be used as more in keeping with the known facts, although no figures for more recent years can be secured.

263. The industry has grown rapidly since 1912, when only 96,440,000 board feet were consumed; and the growth to and immediately after 1923 would indicate that the State was approaching the heaviest production of shooks in the United States. As the whole country consumes about 5½ billion feet annually in this industry; Washington in 1923 used 5 percent of the total consumption.

264. The State is a heavy consumer of boxes and crates for the following purposes: Fresh fruit, canned salmon, oil cases, vegetable crates, canned fruits and vegetables, cereals, cheese, clams, crabs, frozen fish, oysters, dried fruit, eggs, meat, milk and milk powder, etc., local products. The magnitude of the requirements may be illustrated by the fact that about 25,000,000 boxes are required for a season's crop of apples grown in the State.

265. The economic importance of the box industry lies not only in the value created, but in the following reciprocal circumstances:

(1) The box industry, using second-grade lumber, short lengths and culls, assists the sawmill industry in profitably disposing of a large amount of material otherwise going to waste.

(2) Manufacturing an abundant supply of relatively cheap products easily available, the box industry assists the local canning and packing industries by enabling them to pack their output in cheap and strong containers for all their shipments.

266. About 50 percent of the total output was used in the State during 1923, only 5 percent being shipped east of the Mississippi. Hawaii consumed 25 percent, closely followed by California, and exports go to South America, Australia, New Zealand, Europe, and the Orient.

267. The following amounts of lumber were consumed during 1923 and 1928, the latter figure from the Forest Service and census figures tabulated in the foregoing and showing an increase of 19 percent:

	Feet, board measure
Western hemlock	200, 783, 000
Western yellow pine	123, 550, 000
Sitka spruce	51, 055, 000
Douglas fir	6, 469, 000
Black cottonwood	1, 024, 000
Total, 1923	382, 881, 000
Total, 1928	456, 037, 000

All of this lumber was produced in the State, contrary to the procedure in the large eastern box manufacturing states, Illinois, Pennsylvania, and New York, which produce only a small part of the total raw material consumed. Most notable is the increase in the consumption of hemlock, from 13,808,000 feet in 1912 to 200,783,000 in 1923 and 195,395,000 in 1928.

268. The industry in Washington consumed 12½ percent of the total lumber used for the purpose in the United States during 1928, the State apparently leading in the output of box shooks.

269. In 1923, half of the box factories purchased their lumber from nearby sawmills, although forming only 20 percent of the total consumption. The largest producers are some of the sawmills themselves, with a box factory as part of the operations.

270. Contrary to most of the lumber industries in the State, 63 percent of the plants in 1923, producing 30 percent of the total output, were located east of the Cascades.

271. While in recent years the container market has undergone decided changes, cardboard materials of various kinds having successfully entered the field, and while the southern pine belt still has very large supplies suitable for box manufactures, the growth in Washington since 1923, and the increasing production of the box-consuming industries, together with the most extensive supply of

raw material in the country, warrant the conclusion that the economically very important box industry in the State will not decline for a long time to come. The growth may be less rapid than heretofore, but there is no evidence to indicate that it should decline, and there is some ground for the belief that shipments east of the Mississippi and for export can be increased.

BALANCE OF OUTPUT

272. Plate no. 149[2] shows that 75 percent of the whole lumber consumption in this group, producing 58 percent of the total value of the product, was used by the two industries headed "millwork" and "boxes and crates", and that the 25 percent consumed by the remainder produced 42 percent of the value. Among the latter were fixtures and cabinets, consuming only thirty-four hundredths of 1 percent of the raw material, but forming 3.5 percent of the value of the product; furniture and chairs, with, respectively, 1.4 and 6.8 percent; vehicles and parts, with, respectively, four-hundredths of 1 percent and 1.5 percent, etc.

273. The greatest relative values in the whole industry were created in this group. The lumber industry itself in 1925 converted logs valued at $16.01 per thousand into lumber valued at $20.94, showing a conversion ratio of 1 to 1.3. The lumber-using industries converted lumber valued at $34,200,000 into a product valued at $90,000,000 with a conversion ratio of 1 to 2.65. Furniture converted lumber valued at $329,956, together with other materials, into a product valued at $5,000,000, showing a conversion ratio of 1 to 15. Fixtures and cabinets, caskets and trunks, vehicles and parts, etc., although small consumers of lumber, all produced high values. As is the case in all industries, a high conversion ratio invariably permits a higher profit than the low ratios, provided that the manufacturing conditions are equal and favorable. In other words, it is generally not the semimanufactured product which is most profitable, it is the refined or finished article. Herein lies the fundamental importance of the wood-using industries in addition to their general creation of greater wealth. If they show a healthy and prosperous growth, even if their aggregate consumption of lumber is as yet rather insignificant, they indicate a future trend of great importance to the lumber industry of the State.

274. A comparison between the 1923 and 1928 consumption of lumber as listed by the census will show the extent of the growth. See table no. 25. As only a few items are common to both tabulations, a complete comparison can, unfortunately, not be carried out.

TABLE NO. 25.—*Growth from 1923 to 1928*

Product	Consumption of lumber		Product	Consumption of lumber	
	Increase	Decrease		Increase	Decrease
	Percent	*Percent*		*Percent*	*Percent*
Caskets and coffins	123		Cabinets		82
Chairs and chair stock	71		Ship and boat building	73	
Fixtures		58	Woodenware and novelties		40
Furniture		21	Vehicles and parts, 1923	870	
Patterns and flasks		51	Miscellaneous in 1923		41

[2] Not printed.

The tabulation would seem to indicate a general decline, but no positive statement relative to this change can be made in view of the variation in the census items from time to time.

275. Washington broom handles are shipped to all markets of the United States and exported. In 1923 this State furnished about 20 percent of the total consumption in the country. The handle industry consumed 5,460,000 feet of lumber, 97 percent consisting of douglas fir. The conversion ratio was 1 to 2.3 and a considerable value was therefore created, more or less from waste material.

276. The furniture industry had a rapid growth in Washington between 1918 and 1923, but since then it has grown more slowly. It consumed in 1923, 10,637 thousand feet of lumber, of which amount 37.7 percent was red alder and 34.7 percent fir. Of the whole consumption, only 459,000 feet consisted of wood from outside sources.

277. As an explanation of the relatively undeveloped state of the industry in Washington, there has been cited the fact that the State does not possess the necessary hardwood sources. The above statistics do not bear out this explanation, since only 4½ percent of outside lumber was required in 1923. Furthermore, California suffers under the same handicap relative to hardwood, with the results as shown by the figures for furniture production in 1927.

Principal Washington cities:	*Value of product*
Seattle	$2, 550, 461
Tacoma	2, 812, 149
Total	4, 362, 610
Los Angeles	23, 089, 070

That the furniture industry in Washington is far below its potential possibilities is undeniable. As a transformer of local lumber into a valuable and profitable product, it could occupy an outstanding position.

278. A recent listing by the Manufacturers Association of Seattle shows 67 furniture manufacturers in the State, all but 6 on the west side, but only a few with an output of any size; the balance produce chairs, kitchen furniture, parts, etc.

279. Another potentially important industry is woodenware and novelties. Insignificant in its use of lumber in the 1923 and 1928 statistics, with an apparent decline in consumption of raw material amounting to 40 percent between these years, it has a high conversion ratio and should, because of the large amounts of suitable raw material available, occupy a far more important position. Cheap raw material is as a matter of fact shipped to California points, returning to Washington as woodenware.

280. Fixtures occupy an intermediate position between millwork and furniture, consisting of counters, shelving, show-cases, cabinets, blackboards, wall cases, telephone booths, racks, partitions, etc. The use of glass and metal has affected the industry throughout, some Eastern States now producing only one half the amount of wood fixtures compared to earlier years. However, the industry has held its own in Washington, and being largely local, it can be developed no faster than the growth of the district unless special trade development steps are taken in order to enter eastern markets.

281. That wooden ships and boats used 7.3 percent more lumber in 1928 than in 1923 is of no particular significance, as variations occur

every year. While there exists a fairly steady demand for the building requirements of the fishing fleet, for towboats, trollers, purse seiners, halibut schooners, etc., and while even the demands of the California tuna fleet is met to some extent, the large vessels now being built are restricted to ferries, scows, barges, pile-drivers, and other floating equipment. As the latter are not built with any regularity and consume large amounts of lumber, they can easily influence the statistics.

282. The small-boat and motorboat industry has progressed to some extent since 1925, but by no means to the extent warranted by the excellent material available, the extensive coastline and the favorable climate and labor compared with the eastern regions. No local boat-building industry has achieved national distribution on the large scale reached by eastern builders, or even attempted it.

283. On the whole, the major portion of the important lumber-using industries in western Washington are not only far from their potential development but actually backward. Only 1.8 percent of the total production of lumber by the sawmills was converted into products of higher value in 1928, if millwork and box-factory output are deducted.

WASTE

284. The exceptionally large amounts and the economic disposal of the unutilized portion of the raw material presents one of the most pressing problems of the lumber industry. Plate no. 149 [2] shows that logging waste amounting to 1,870,000,000 feet is left in the forests, and that the sawmills produce 4,900,000 cords of mill waste. The total waste in 1 year's operation therefore amounts to 4,800,000,000 feet, or 8,000,000 cords. (One cord equals 600 feet.) This does not include material smaller than cordwood size, or tops, branches, crooked and knotty material, etc.; nor does it take into account a large amount of young growth destroyed. The logging waste for the whole State is based on 1,700,000,000 feet west of the Cascades, increased 10 percent for the cut in the eastern district. The mill waste is based on 70 cords per 100,000 feet lumber production, an average value established by experience.

LOGGING WASTE

285. Until recent times, the logging waste has been recognized as important, but its actual nature and amount has largely remained a matter of conjecture. However, the United States Forest Service, under the direction of Mr. Allen H. Hodgson, associate forester, office of forest products, Portland, Oreg., has, after a field study extending over 2½ years in 24 separate logging operations and 150 sample acre tracts of the fir region, completed an exhaustive and valuable report on the subject.

286. *Causes of logging waste.*—The following fundamental summary is based on the report mentioned in the preceding paragraph.

(1) Breakage resulting from felling the tall, heavy trees. This is due not only to unavoidable causes, but also to the loggers' tendency to place the trees pointing in a definite direction for easy haulage, regardless of the ground, and on general carelessness.

[2] Not printed.

(2) *Excessive stump heights.*—While stumps 15 to 20 feet high are no longer cut, considerable valuable material is still left in this portion of the tree.

(3) Losses in bucking, due to poor utilization, leaving too much of the top, cutting clear of crooked places with too great allowances, cutting too far from broken places, etc.; in short, cutting out the best part only.

(4) Breakage in rough ground due to careless bucking, with split or slabbed ends caused by springing or dropping of the logs when not underpinned or properly wedged.

(5) Leaving small and no. 3 logs in the woods in order to bring up the scale of the higher and more profitable grades.

(6) Leaving logs in the woods with rot or defects too slight to cause rejection of the whole log.

(7) Leaving small logs in the woods due to higher cost of bringing them out with the heavy equipment especially built for the largest sizes only.

(8) Breakage of logs during high-power yarding through careless handling.

(9) Overlooking or purposely leaving good logs in obscure or difficult places.

(10) Leaving logs piled up along a logging railroad right-of-way too long, causing deterioration by stain, fungus, insects, etc.

(11) Burying logs under logging railroad grades.

(12) Yarding logs several months after falling and bucking, causing deterioration.

(13) When hauled by common-carrier roads, avoiding freight payments on the poorer grades by leaving them in the woods.

(14) When rafted, avoiding crooked, short, small, and oversize logs in order to build a uniform raft for the easiest towing.

(15) Avoiding sinker logs, especially butt logs of hemlock which do not always float in the raft.

(16) Logging a few old-growth trees to the acre in a well reforesting stand of healthy young growth, and thereby destroying the entire stand, either through breakage or through the inevitable slash fire which follows.

(17) Contract method of falling, placing a premium on carelessness and faulty methods.

(18) Insufficient coordination between bucking, falling and yarding crews, lax supervision, faulty methods and practices, emphasis on volume only.

(19) Economic conditions, competition and market, causing independent loggers who have no manufacturing facilities to log out such timber only which they can profitably dispose of.

(20) The necessity of either prelogging or relogging in order to utilize the small dimensions of the present waste, and lack of capital, initiative, incentive, manufacturing facilities or market in order to effect such a system of double logging.

287. To these causes may be added inertia, or the tendency to follow old practices and traditions, brought down from the not very remote period when the forest wealth appeared inexhaustible, and merely the best portion was converted into lumber with a profitable result.

288. *Amount of waste.*—The report treats all these points in an exhaustive manner, showing the percentages wasted due to various causes. Some of the outstanding findings are as follows:

(1) The waste in the douglas fir region amounts to over 3,000,000,000 feet, log scale, or about one tenth of the annual lumber production in the United States.

(2) More than one third of the waste is hemlock, Sitka spruce and balsam fir, or woods producing a good chemical pulp. More than one half of the waste is douglas fir.

(3) More than one third of the waste was found in the Puget Sound region, due to the extensive logging, the size of the district, and the high percentage of hemlock.

289. Table no. 26 shows the amount of unutilized wood left after the logging operations in western Washington only, sound cordwood size and larger, in thousands of feet.

TABLE NO. 26.—*Waste left after logging operations, western Washington*

[1,000 feet b.m.]

District	Douglas fir	Hemlock	Balsam firs	Spruce	Red cedar	Other species	Total
Puget Sound	514,835	569,028	5,419	40,645	219,482	5,419	1,354,828
Grays Harbor	145,871	143,008	.....	11,733	15,855	634	317,101
Willapa Harbor	17,368	20,567	.....	3,457	1,815	.....	43,207
Total	678,074	732,603	5,419	55,835	237,152	6,053	1,715,136
Percent of total	39.5	42.7	0.3	3.3	13.8	0.4	100

290. Pulpwood content in the waste shown in table no. 26 is as follows:

Hemlock, balsam firs, spruce	feet	793,837,000
In cords at 600 feet	cords	1,300,000
In percent of total waste	percent	46.2

291. As was to be expected, the investigation proved that the independent logger left the greatest amount of waste in the woods; the logging sawmill operator, who was able to manufacture even smaller and poorer grades, left the least waste. Both operators left less waste in national-forest logging than in private timber, showing closer supervision.

292. The report shows that as a general average, 21,407 feet per acre of sound material, cordwood size and larger, was left on the ground, equal to about one fifth of the original standing timber. However, the extremes varied from 75,000 feet to a minimum of six to eight thousand feet. The average waste of 21,000 feet per acre would throughout the eastern pine region be considered a heavy stand of timber.

293. One of the most striking facts shown by the report is the large amount of sound sawlogs left in the woods. More than one third, or 1,062,529,000 feet, of which amount fully 90 percent would be equal to or better than a no. 3 log, Puget Sound log scaling and grading bureau classification, was left after logging in the fir region.

294. The report is quite important, not only because of the thorough study of the nature and the amount of the logging waste, but also because of the analysis made with a view of future prevention and closer utilization.

295. Neither the nature of the present logging operations nor the general economic condition of the whole industry warrant any statement except that the logging waste is not decreasing and will in all probability continue as at present for some time to come.

296. The exceptions to this rule, which are furnished by a few well-managed companies, are so insignificant in comparison with the whole operations that they do not influence the result.

297. *Utilization of logging waste.*—While no change appears evident in the heavy production of logging waste, there is a considerable improvement in the utilization.

298. Cedar stumps have been logged for shingle bolts for some years, and a portable shingle mill mounted on a truck has recently begun operations in old loggings in the Grays Harbor district.

299. In addition to prelogging, which has been practiced in the past for taking out cedar poles or shingle bolts previous to the main operations, "relogging" has been inaugurated within recent years, especially for pulp material.

300. After successively trying prelogging, logging light material with the standard heavy equipment, and relogging, one company selected the last method as the most practicable, and in a period of 4 months salvaged 4,000,000 feet of small hemlock logs and chunks from old loggings. The relogging was found to have salvaged 9,551 board-feet per acre, or an amount equal to 12 percent of the original stand. The major operation left 12,000 feet per acre; after relogging there was only 2,449 feet remaining.

301. The equipment consisted of a light, mobile, gasoline-driven yarder mounted on a caterpillar tractor, and it operated economically and efficiently with a small crew.

302. A field exists here for the small truck loggers, which with their light gasoline equipment and low cost of operation should be able to handle the relogging successfully on a contract basis or otherwise. There is no doubt that relogging will materially increase in the future.

303. It will be noted that the logging waste includes 55,835,000 feet, or 93,000 cords, of spruce, and that this content is approximately proportional to the spruce stand and the annual cut. On the other hand, on the Olympic Peninsula whole spruce logs are now being cut up into cordwood for the pulp mills. The practice is hardly defensible on economic grounds, as a far higher value can be realized by passing the log through a cut-up mill, segregating the high-grade lumber and converting the lower grades only into pulpwood, and as this valuable material from the whole log is largely converted into a cheap grade of news pulp, while it can produce the highest grade of chemical pulp, selling at a premium above other grades.

304. The spruce content in the timber stand is too low and the material too valuable for anything except the most complete utilization with conversion to the highest value.

MILL WASTE

305. *Amounts and causes.*—This waste has in the past been studied by several authorities in far greater detail than the logging waste. Since 1909, when the report of the National Conservation Commission was published, until recent times, the results of several investigations have been made available.

306. The Commission gives the following amounts of waste, in percent, of the total cubic content of the log:

	Percent
Bark	10–20
Kerf	13.5
Edgings and trimmings	8.7
Slabs	8.7
Loss due to standardized lengths and to carelessness in manufacture	4.5
Total loss	45.4–55.4

307. It should be noted that the present Scribner's log scale makes an allowance for waste so liberal that it underscales the lumber production about 8½ percent.

308. Prof. B. P. Kirkland, when with the College of Forestry, University of Washington, made a survey of sawmill waste in individual mills in the fir region, with the following conclusions:

	Percent
Wasted, "in percent of the cubic contents of wood"	63.4
Lumber, "in percent of the cubic contents of wood"	36.6

The foregoing percentages were based on net wood content, without the bark, and "each 100 cubic feet of douglas-fir wood is in addition accompanied by 10 cubic feet of bark." (Chemical Utilization of Wood in Washington, Bulletin 19, Engineering Experiment Station Series, University of Washington, 1923.)

309. Other data give 320 feet produced from each 1,000 feet of the tree standing in the forest, and "30 percent of the tree is turned into lumber" is perhaps the most frequently quoted and best-known local expression covering the subject. It will be noted that the last figures include the logging waste with the mill waste.

310. Part of the heavy mill waste is caused by the sawing methods used in the mills, the log carriage swiftly traveling back and forth past the headsaw, which slices off large slabs before beginning actual cutting, the heavy saws consuming a wide kerf. These slabs are used to make lath.

311. Four mills in the douglas fir region have recently installed Scandinavian gang-saws for their smaller logs with excellent results, not only in the reduction of mill waste but also in the uniformity of the product.

312. Mill waste is measured either in cords or in units, a unit being the content of a cord reduced to chips, or "hogged."

313. *Hogged fuel.*—The following standards are recorded for one unit of hogged fuel:

Cubic content	cubic feet	200
Weight, moist	pounds	3,800–5,000
Moisture content	percent	38–45
B.t.u. per unit, moist		12/13,500,000
B.t.u. per pound, dry		8,800
B.t.u. per pound, moist		5,000

The great variation in weight is due not only to the moisture content but to the density or graded amount of material which fills the void spaces, depending on whether or not the fines and the sawdust are included. As the consumer pays for B.t.u. content, which is constant per pound of dry weight, he is not assured of the full value when purchasing by volume.

314. The market for hogged fuel has within recent years grown considerably, doubling since 1925, and in 1930 reaching 650,000 units in

western Washington alone. It is used by small industrial plants, apartments, laundries, etc., and under normal conditions it furnishes a very economical fuel. It is also used as fuel by large generating stations, particularly in the vicinity of Portland.

315. It is interesting to note that hogged fuel is the only fuel which in its price fluctuates with crude oil. One unit of hogged fuel is in heat value approximately equivalent to two barrels of fuel-oil, and in order that hogged fuel may be purchased by the industry it must show a fuel economy which can only be reached by the proper price relative to oil. On long contracts with fairly large amounts involved hogged fuel is at the present time sold for $1 to $2 per unit, delivered; for small consumers or occasional users the price ranges up to $4.

316. *Sawdust.*—In addition to hogged fuel, a use has been found for sawdust since the development of the sawdust-burning furnaces for residential heating purposes. These furnaces use either straight sawdust or a mixture of sawdust and hogged fuel, and as an indication of the extent to which they have been installed, culminating in 1929, may be mentioned the fact that special machinery for converting mill waste or other logging waste into sawdust has been seriously considered in the Seattle district. While a sawdust shortage appeared imminent, the rapid increase in installations is no longer continuing, and no shortage is to be expected in the future. The price of this fuel to domestic users is now $6 per unit, sacked and delivered. In addition to the hogged fuel and the sawdust, slabs and edgings are still being disposed of to a considerable extent for domestic fuel.

317. *Total utilization.*—Plate no. 149[2] shows that the Washington sawmills in 1925 produced 4,900,000 cords of mill waste. This is usable mill waste, convertible to hogged fuel at the rate of 70 cords per 100,000 feet of lumber produced. The total amount of mill waste is larger, but the usual content of decayed wood, large knots, trash, wet bark strips, etc., which cannot profitably be turned into fuel is excluded. The hogged fuel which can be produced varies greatly, and the average figure of 70 cords per 100,000 feet produced, which is the result of a study made in 1926, gives a conservative expression of the average amount.

318. The 1928 production of mill waste convertible into hogged fuel reached 5,100,000 cords. Of this amount, approximately 520,000 cords was used for hogged fuel and 317,000 cords by the pulp industry. Of the total production, 16 percent was hence converted into value; of the remaining 84 percent the major portion became waste, the balance was used as fuel for the mills.

319. The problem of decreasing the amount produced and better utilization of the production hence remains partially unsolved and one of considerable importance to the lumber industry in Washington.

USE FOR PULP

320. *Use of logging waste.*—As noted under "logging waste", 46 percent, or 1,300,000 cords, consisted of material suitable for the production of pulp. Of this waste only a small percentage has so far been saved through relogging; the balance will no doubt be lost. At the usual rate of 2.2 cords per ton of chemical pulp, it would have supplied a year's raw material to 20 pulp mills of 100 tons daily capacity.

[2] Not printed.

321. *Use of mill waste.*—Since the expansion of the Washington pulp industry, mill waste has been utilized in a far more extensive degree.

322. With the present large content of pulp species and increased demand the mills have found it profitable to segregate bark, chip, and screen the slabs and edgings from this pulpwood, selling the product to the pulp mills. In a number of cases the pulp mills have installed their own barking and chipping plants in the sawmills, contracting only for the slabs and edgings. Several types of contracts and methods of production are in use, and the industry is as yet feeling its way toward the best method to follow. In addition, some pulp mills operate their own sawmills and segregate the usable waste for reduction in their own chipping plants.

323. While the pulp production in the State grew from 168,000 tons in 1925 to 651,657 tons in 1928, the consumption of mill waste grew as follows:

	Cords
1925	22,000
1926	54,743
1927	181,992
1928	317,066

This growth in the use of mill waste in Washington has been phenomenal. As the total United States consumption of mill waste in 1928 reached 455,000 cords, Washington alone accounted for 70 percent of all such waste material converted into pulp (U.S. census statistics). The West Coast Lumbermen's Association estimates the amount of usable pulp-mill material contained in the 1928 mill waste at 456,800 cords, or at the rate of 7 cords per 100,000 feet produced. Of this amount 317,000 cords were utilized, leaving a balance of only 139,800 cords as waste. This is a comparatively close utilization, which indicates a very promising trend in waste disposal. The 1929 statistics have as yet not been published, and while they may show some increase above the 1928 figures it is unlikely that there will henceforth be an increase similar to that between 1925 and 1928.

324. *Total utilization and general considerations.*—As shown under logging waste, 1,300,000 cords of pulp-mill material is left in the woods. To this amount is to be added 140,000 cords of unused mill waste, making a total of 1,440,000 cords, approximately equal to the annual United States imports of pulpwood, and, if converted into chemical pulp, producing 660,000 tons, or less than one half of the average annual pulp imports of the United States, and in value reaching $30,000,000.

325. One of the State's fundamental problems is connected with the salvage of this waste; but as it is more or less dependent upon the single and centrally controlled industry which can use the product as a raw material, and as the majority of the lumbermen are not directly affected, an early solution of the problem is hardly to be expected.

326. Individual efforts have been made and will no doubt continue. Among other notable solutions may be mentioned a chipping plant mounted on a logging car which is to enter the logging spurs, converting the hemlock waste into chips practically where the tree falls. Neither this method nor other similar proposals have as yet been put to practical use or economic tests.

USE FOR CHARCOAL

327. Plate no. 149 [2] shows that charcoal is one of the products using mill waste as raw material, although in 1925 the consumption was insignificant.

328. There have within recent years been numerous attempts to convert sawdust into charcoal; but at this time not a single attempt has succeeded. Three attempts have been made in Seattle, 1 plant has been sporadically operating in Tacoma, 1 at Raymond, 1 at Bellingham, and 1 at Montesano, all based on different applications of the same principle, a rotary cylinder, with external application of carbonizing heat, airtight feed and discharge, and an attempt at utilizing the by-products. All plants have been small, with a capacity fluctuating from 1 to 3 tons in 24 hours. The Bellingham plant was projected for a capacity of 36 tons in 24 hours, but did not progress beyond a pilot plant of 6 tons capacity.

329. All have been designed for continuous operation on sawdust or hogged fuel, and all have claimed a final solution of a problem which has for years engaged inventors throughout the country to the extent that some 500 patents in this field are on file in the United States Patent Office.

330. One plant operating on a small scale at Eatonville deserves special comment because of its departure from the general methods. It is somewhat similar to the kiln method used in the southern pine district, with the difference that the charged cars pass through a number of compartments, each under a different temperature, which permits the more valuable byproducts to be drawn off at the lower temperatures instead of being mixed with and contaminated by the high temperature tars and creosotes. This is a Swedish method which in theory shows some promise. The same problem has been solved by a Canadian inventor for a continuous process with the use of sawdust or hogged fuel. This method consists of a number of separated retorts in line, a single screw feeding the material through all the retorts, each one under a different temperature. No attempt has as yet been made to introduce the Canadian patent in Washington. The theory seems correct, and it may be possible to apply it to mill waste.

331. The fundamental reason for all these efforts has been the production of charcoal for use by the extensive poultry industry in the State and the fact that sawdust contains very nearly the correct proportions of coarse and fine material demanded by the industry. However, the practice has greatly changed in this respect, and while the poultry industry in the past used 50 percent of the total consumption, the Washington Cooperative Egg and Poultry Association alone using 500 tons annually, the consumption is now greatly reduced and the association no longer handles charcoal, leaving purchases to the individual members.

332. A survey concluded in 1926 placed the total 1925 consumption in Washington at 4,000 tons annually. Information collected from local distributors covering the present use is conflicting, but it indicates a consumption from 35 to 50 percent less than in 1925 and discloses the fact that a standard brand of eastern charcoal is handled in preference to the local product; also that a California corporation using peach pits as raw material is successfully competing with the eastern product in quality and price.

[2] Not printed.

333. The major portion of the local charcoal consumed in the past has been produced by a firm in Auburn using alder and maple as raw material, with the old beehive brick-kiln method. With several branches, the capacity of this firm has at times reached 140 tons a month.

334. The only notable effort at utilizing the mill waste for charcoal was made in 1922 under the auspices of individual members of the West Coast Lumbermen's Association. Competent engineers developed a method of briquetting charcoal, proving the method by commercial tests with the following results: With a plant of 60 tons daily capacity consuming 150 cords of hogged mill waste, charcoal briquets filling every necessary industrial and domestic requirement can be produced at a cost of $8 per ton including the material, while wasting all distillation products except a small part used for binder.

335. The result is important as indicating a potential use of the charcoal. The value of the briquets is demonstrated by their use for heating fruit shipments during the winter, and such briquets have at a high cost been secured for this purpose from the Ford industries. A charge of 30 pounds of charcoal briquets will heat a car for 38 hours, the fuel being odorless and very satisfactory.

336. As the heat value of charcoal is high, from 12,200 to 13,500 British thermal units per pound, and as the fuel is practically free from ash, smoke, soot and odor, briquets would furnish a very high grade of domestic fuel.

337. The greatest importance of charcoal to the lumber industry lies in its potential future industrial use for many purposes.

338. As an example, with the available supplies of lime rock and electric current at reasonable cost, charcoal would produce calcium carbide and cyanamide, which in turn could be used as a raw material for ammonia production. As a colloidal fuel, composed of ordinary fuel oil with 30 to 40 percent of finely pulverized charcoal suspended through a stabilizing chemical, the resultant mixture would be 50 percent more efficient than fuel oil. For equal bunker weight in steamships, the cruising radius would be increased 50 percent.

339. As a fuel for small gas producers furnishing power, cooking, and heating gas for isolated small communities, farms, or resorts, charcoal would be very efficient.

340. It could be used by stage lines and trucking companies with long continuous runs; a small gas producer 50 percent larger than the ordinary gasoline tank would from 1 pound of charcoal generate as much power as from 1 pint of gasoline, with a corresponding saving in fuel cost. These small producers, called "gasogenes" are extensively used in France for this purpose. However, the price of gasoline there is considerably higher, while charcoal is far cheaper than in the United States.

341. In addition, charcoal is extensively used in the metallurgical industry, in sugar refining, in candy and sirup manufacturing, in the production of glue, alcohol, lithophane, glucose, table oils, gelatine, etc.

342. While the apparent consumption at the present time in the State is insignificant, there are not only many potential uses, but, if steady supplies on a fairly large scale would be guaranteed, a surprisingly large market could be worked up without excessive effort or expenditure.

343. This eliminates all small plants and all promotions. The plant must be large, from 30 to 60 tons capacity in 24 hours; it must be operated in connection with one of the sawmills, with sufficient capital and with expert technical management; and the product must be uniform and of high grade. As tests have, beyond a doubt, demonstrated that charcoal of the high quality desired by the market can be produced from mill waste, it would appear reasonable to expect a local production of constant quality by a responsible concern at least in amounts which would render importations of eastern charcoal and California peach pits unnecessary.

CHEMICAL UTILIZATION

344. As noted under charcoal production, most of the efforts made have so far been connected with attempts to utilize the products formed during destructive distillation of the mill waste. However, wood distillation does not directly yield a single commercial liquid with constant and fixed characteristics, ready for the market without further distillation, refining, fractioning, and standardization. The products merge into each other imperceptibly, from some five fundamental groups of distillates, 50 to 80 separate fractions with varying characteristics can be separated, and the highest technical and commercial skill is required to produce and market these fractions. This circumstance, together with the low content of valuable products contained in the mill waste and the small and insufficiently planned and financed operations so far conducted, have prevented any successful development in this field.

345. Bulletin No. 19, University of Washington Engineering Experiment Station, 1923, gives the results of 21 semicommercial runs at 700° made at a special plant designed for this purpose. (See table no. 27.)

TABLE NO. 27.—*Summary of products secured from 1 cord of common fir mill waste*

Primary crudes:		
Charcoal	pounds	977
Light oils	gallons	3.4
Acid water	do	200–225
Crude tars	do	27.8
Gas	cubic feet	6,000
Fractions:		
In light oil:		
Turpentine	gallon	.6
Fir oil	do	2.8
In acid water:		
80 percent wood alcohol	do	3.7
80 percent acetate of lime	pounds	7.5
In crude tar:		
Light tar oil.		
Heavy tar oil.		
Creosote.		
Rosin.		
Rosin oil.		
Pitch.		
Wood tar.		

The acid water contains crude alcohol, pyroligneous acid, tar, and water. The pyroligneous acid contains the acetic acid. The commercial products consist primarily of turpentine, wood alcohol, and acetate of lime.

346. Southern pines produce from 7 to 10 gallons of turpentine per cord, select pitchy fir mill waste 3 to 6 gallons, and common mill waste only 0.6 gallon. It is therefore not profitable to use the mill waste as a raw material for production of turpentine.

347. Destructive distillation of eastern hardwoods yields 10 gallons of alcohol per cord. It is not profitable to recover the alcohol if the content is under 5 gallons per cord, and select fir mill waste yields only 3.7 gallons.

348. The eastern hardwoods also yield 200 pounds of acetate of lime per cord; the recovery is not profitable at less than 100 pounds, and select fir mill waste yields only 74 pounds per cord.

349. However, the utilization of the general distillate products and their fractions and derivatives has during the past 10 years made rapid strides. While in the past a market for these products in the Northwest was practically out of the question, charcoal being the only commercially profitable material, a number of the distillates can now be disposed of.

350. Fir oil, practically identical with pine oil, if produced in sufficient quantities in constant quality could find a good market as a solvent for gums, resins, and varnishes, in the rubber industry, in the manufacture of metal polishes, etc., and an inquiry for fairly large amounts of this fraction has already been received from a California rubber industry.

351. Various fractions of the crude tars and of the acid water are used as insecticides and weed killers, and a large amount of the tar can find a market as roofing tar.

352. As the ever expanding chemical industries develop in the Northwest, markets for other fractions are gradually created, and, as is the case with charcoal, a steady production on a fairly large scale under expert technical guidance would in a comparatively short time lead to profitable marketing of numerous products of wood distillation.

353. The pressing problem of economic utilization of the large amounts of available mill waste, together with the existing and latent opportunities for securing a profitable outlet, warrant the following conclusions: Destructive distillation of mill waste is already commercially justified if conducted in conjunction with charcoal production and a briquetting plant of not less than 30 tons capacity in 24 hours, provided that the plant operates in connection with one of the large tidewater sawmills under expert guidance and with ample finances to cover a necessary period of experimentation and market development.

MISCELLANEOUS USES

354. *Woodenware and toys.*—The small general production of woodenware and novelties has been indicated under "Lumber-using industries" and although large amounts of clear mill-ends, veneer cuttings, cedar and hardwood waste, etc., are available, they have as yet not been used except to a very insignificant extent. This is partly due to the fact that the mills do not segregate and deliver this material except at a cost which renders the mill waste practically equal in price to the lumber itself, which can be handled and stored more easily, and partly to the general nature of the lumber industry and the interests of the community, which so far have been identified with the large production of the semifinished material lumber.

355. There are no communities specializing in woodworking, as in some New England districts, the local market is relatively small owing to the limited population compared with the Atlantic coast consuming centers, and there exists no agency or central organization promoting the use of this raw material for various purposes.

356. *Insulation.*—The production of insulation board has in the last decade expanded to an appreciable extent throughout the United States. A number of the products use wood fiber of various types and methods of manufacture; and while no such material is as yet manufactured in Washington, there has been a plant in operation in the Douglas fir region so close to the state border that it warrants mention in this connection.

357. In conjunction with a large sawmill and pulp industry in Oregon, insulating board under the trade name of "Fir-Tex" has been manufactured from common fir mill waste, hogged and reduced to fibrous consistency. The plant has an annual capacity of 75,000,000 square feet of insulating board, estimating a production of 2,000 square feet of board with a sales price of $70, from one cord of common mill waste. It is particularly notable that it purchases all electric power from public-utility lines, finding it more profitable to convert the hogged fuel into a valuable product than to burn it under boilers. (Pacific Pulp and Paper Industry, May 1930.)

358. This industry offers an important and profitable outlet for the mill waste; and as the consumption of insulating board for general building and refrigeration purposes is annually increasing, one or more plants of this nature will no doubt in the future be operated in Washington.

359. *Minor uses.*—Sawdust is used as a filler in magnesia cement plasters, for artificial flooring, tile, etc., also in plaster wall board and blocks and for light-weight concrete blocks. Sawdust has also been used as the basis for an explosive invented by Prof. W. M. Dehn, of the University of Washington. It is not affected by temperature, it is odorless, and particularly suitable for stump blasting.

360. A wood-flour mill was operated in the Grays Harbor district for some time, but did not succeed. However, future industries using wood flour, as linoleum manufacturers, etc., may render such plants profitable.

361. There are several other minor industries using mill waste in amounts which as yet are not felt in the large quantities available, but their value lies in the indication of the general trend of industry, gradually converting increasing amounts of waste materials into valuable products. With the future industrial development in western Washington, some of these industries will doubtless use larger amounts of mill waste, and new uses for it will be discovered.

POWER CONSUMPTION

BASIC DATA AVAILABLE

362. The United States Census of Manufactures for 1927 gives the following data covering the power consumed by the whole lumber industry:

	Feet	Horsepower	Percent
Total production	34, 532, 420, 000		
Total horsepower		1, 781, 734	
Electric power included:			
Generated by mills		522, 624	29. 3
Purchased current		227, 748	12. 7
Total electr e.			42. 0

Reduced to daily capacity on an assumed 260-day basis, as in Washington, in order to ascertain the power required for 1,000 feet cut, the production per day is 133,000,000, and the power required per 1,000 feet cut in 8 hours is therefore 13.4 horsepower.

363. The corresponding census figures for Washington, covering the same year, are as follows:

Total production	feet	7, 325, 862, 000
Total horsepower		342, 771

Power required for 1,000 feet produced is, on the same basis, 12.1 horsepower. However, since the Washington mills operated at a considerably reduced capacity in 1927, the actual connected load per 1,000 feet cut at full capacity would be far less than 12.1 horsepower, which does not agree with the actual requirements as established by more specific local data. The census figures either omitted some of the power units or used another basis for compilation.

364. A complete study of the power consumption of all-electric mills has been made by the General Electric Co. for typical installations in the Oregon fir region, in power consumption identical with the Washington mills. Table no. 28 is a summary included in the General Electric study:

TABLE NO. 28.—*Power consumption of electrically operated mills*

Department	Number of motors	Total horse-power	Average kilowatt	Total 1,000 feet cut per day	Total daily kilowatt-hours	Kilowatt-hours per 1,000 feet [1]
Saw mill	125	2, 606. 3	860	198	6, 683	34
Planing mill, including timber sizer and blower	27	743. 0	450	184	3, 312	18
Lath mill, per 1,000 lath	4	107. 5	40	30	320	11
Miscellaneous	5	79. 3	50		800	
Total	161	3, 636. 1	1, 400		11, 115	

[1] Average kilowatt-hours per thousand feet, mill cut, whole operation, 56; average power factor 0.7 .

365. The Weyerhaeuser Timber Co., operating the most up-to-date all-electric mills in western Washington, by letter of March 27, 1931, submits power data for sawmill operation, including kiln-drying and planing part of the output, as follows:

Horsepower, connected load per 1,000 feet cut in 8 hours		25
Kilowatt-hours consumption, sawmill only, per 1,000 feet production		34
Kilowatt-hours consumption, all lumber finished, per 1,000 feet production		78. 5
Complete connected load per 1,000 feet cut, average operation	horsepower	35
Present Washington mills:		
Completely electrified	percent	60
Part electrified, part steam	do	30
Steam only	do	10

The General Electric and the Weyerhaeuser data are in substantial agreement relative to the total consumption of kilowatt-hours per thousand feet cut, and the following consumption limits can be established on a reliable basis:

	Kilowatt-hours
Sawmill, rough lumber only	34
Sawmill, with planing and lath mill	56
Industry finishing all lumber	78.5

PRESENT CONSUMPTION

366. The tables differ in the connected load, the General Electric figures show 3,636 horsepower for a daily cut of 198,000 feet, or 18 horsepower per 1,000; while the Weyerhaeuser data give 25 horsepower. However, the connected load is neither as important nor as reliable as the total power consumption, as individual mills vary greatly in their load factors and specific requirements.

367. If 20 horsepower per 1,000 feet cut in 8 hours under average mill conditions, including some planing, is assumed as an arbitrary connected load, the total power requirements of the west coast mills can probably be determined without too great an error. The total capacity as determined in paragraph 197 is 10,000,000,000 feet a year, or about 37,730,000 feet in 8 hours, requiring a connected load of 754,600 horsepower.

368. The 1928 cut in Washington was 6,654,309,000 feet, of which amount the census figures show approximately 2,000,000,000 to be finished by wood-using industries. No data exist covering the total amount planed in the mills and not included in the census figures; nor is any information available relative to the total cut by mills producing rough lumber only. To ascertain the total consumption of power in kilowatt-hour equivalents, including part steam and all steam, is therefore difficult; so is an estimate of actual current consumed, including generated at the mills and purchased. However, an approximation can be made under the following reasonable assumptions:

1. Rough-lumber production	feet	4,154,309,000
Finished and part finished	do	2,500,000,000
2. All-electric mills	percent	[6] 60
Mills 50 percent electrified	do	[6] 30
Total electric power	do	[6] 75

The tabulations previously quoted agree on a consumption of 34 kilowatt-hours per thousand for rough-lumber production. As to the final product, 60 kilowatt-hours per thousand may be conservatively used, since only a portion is "all finished", the balance being planed lumber, lath, etc. This will give the total kilowatt-hour equivalent for all power consumed, of which amount electric power is 75 percent.

Total power consumption, electric equivalent	kilowatt-hour	290,000,000
Included consumption of electric power	do	218,000,000
Yearly load factor, based on 365 days and 8 hours per day, connected load of 754,600 horsepower, and total power consumption of 290,000,000 kilowatt-hours	percent	17.8

Since the load factor is close to the value known to exist in the industry, the above figures appear to be sufficiently accurate for comparative purposes.

[6] Percent of mill output.

FUTURE CONSUMPTION

369. The future electric power consumption is governed by the rate at which the electrification of the mills is progressing and by the proportion of rough lumber to finished lumber.

370. The Weyerhaeuser Timber Co., in their letter of March 27, 1931, state that "within the next 30 years all mills of any size will be operated entirely by electric power."

371. The proportion between rough and finished lumber 30 years hence depends on a number of factors which do not lend themselves to a definite analysis except as to general trends, as shown under "Economic conditions" later in this appendix. Some of these factors are—

1. *Political.*—Taxes, legislation, tariffs, freight-rate regulations, forest policy.

2. *Economical.*—Consumers' demand, competition, production costs, labor, stumpage costs, exports, market for unfinished waste, development of waste-refining industries.

3. *Local.*—Rate of timber depletion and reforestation, consolidations and mergers, associations and trade extension work, recognition of the laws which govern all manufactures.

372. That lumber producers can continue to dispose of a surplus of rough or semifinished products to a reluctant market at or below cost of production is not a reasonable assumption. Even if not definitely recognized as a guiding policy at this time, economic laws will sooner or later force the lumbermen to finish a greater portion in the State instead of shipping large amounts in the rough.

373. Under "Economic conditions" it is shown that the total lumber production 30 years hence will be approximately two and a half billion feet. It is perhaps justifiable to assume that of this amount at least 35 percent may be rough lumber requiring 34 kilowatt-hours per thousand feet and 65 percent will be finished lumber requiring 70 kilowatt-hours.

374. Since the power 30 years hence will be all electric, the total consumption at that time should approach 144,000,000 kilowatt-hours per year. While lumber production may decline 62 percent in 30 years, electric power consumption during the same period appears to decline only 33½ percent. The decline in consumption of electric power would be even less if pulp is included among the products, in which case it is probable that the total consumption of electric current by the industries using forest products as raw material would remain fairly constant. In this respect, power would in stability follow the value of the product. While the total lumber production has declined, the value of the product has not done so, because of the increasing manufacture of pulp.

375. Accurate figures covering the total amount of purchased current are not obtainable. The Puget Sound Power & Light Co. in the western territory has a connected load of about 25,000 horsepower in use by the lumber industries. This territory reaches from the British Columbia border to Kelso, and two other power companies serve the Grays Harbor-Willapa Bay region. In the latter district the power companies have a relatively small output and purchase large amounts of current from the lumber companies. In the whole south-

western district it is estimated that probably not over 5,000 horsepower connected load is purchased from the power companies.

376. The total purchased current is therefore approximately 30,000 horsepower, with a probable load factor of 22 percent at the generating stations, resulting in an annual consumption of 19,300,000 kilowatt-hours, or about 9 percent of the total electric power consumed by the lumber industry, against 12.7 percent shown by the Census of Manufactures for the whole country.

377. There is a distinct tendency toward the purchase of current instead of generation at the mills, a circumstance requiring some analysis. The general reasons for electrification are as follows:

First. A considerable saving in power due to elimination of transmission machinery;

Second. A saving in maintenance and operation due to the same circumstance;

Third. Greater flexibility of operation and a decrease in time losses during breakdowns, changes, etc., due to individual drives, automatic starting equipment, etc.;

Fourth. An increase in the output of 20 to 25 percent without an increase in the pay roll, in addition to the above circumstances, caused by the independent drive on the headsaw. With steam, the power on all drives through the plant drops when a log hits the headsaw.

378. The generating plants of the mills are comparatively small, with a high initial cost, running from $150 to $200 per kilowatt. The annual load factor is quite low, from 15 to 20 percent, and the fixed charges alone are therefore very high, and unable to compete with purchased power. However, as long as sawmill waste is of no value, some justification for using it as fuel for generating electric power in the mills has existed, but as soon as the waste becomes valuable, the high fixed charges in combination with mill waste which can be profitably marketed render power production in the mills quite uneconomical.

379. As a general rule, it can therefore be stated that when a market for waste exists, it is profitable to purchase power. An example of this rule exists in Olympia, where all the veneer mills purchase their power and the sawmills purchase 60 to 70 percent, and in Everett where the sawmills purchase about 60 percent.

380. This general rule will apply in the future with even greater reason. The rate charged for industrial power by the power companies has not shown a tendency to increase, and with greater consumption, extension of the network, constantly improving load factor, and the declining tendency shown in the cost of steam production, it is reasonable to conclude that the cost of this power will not increase in the future, but may decline. On the other hand, the value of mill waste, used as fuel by the sawmills, shows a steady tendency to increase, with an equality pronounced reduction in the volume produced, caused by closer utilization.

381. However, under certain circumstances sawmill production of power will be profitable. If the industry is fully integrated, or if the sawmill serves merely as a "cut-up plant" for finishing mills, pulp mills, byproducts plants, etc., and if a bleeder turbine is used, with the drawn-off steam utilized as process steam, the remaining waste can be economically burned under high-pressure boilers. It will be noted that especially the addition of a chemical pulp mill, consuming from 8 to 12 horsepower per ton of output, so increases the total power con-

sumption and the load factor that economy results; and it is doubtful if in the future the lumber industries can economically produce their own power under any condition except full integration as stated.

382. Many mills now generating or purchasing part of their power are unable to change over to full electrification because the depressed industry cannot stand the investment required.

383. The new all-electric mills, erected within recent years or rebuilt, are owned by large, well-managed, and financed corporations, and show a distinct tendency toward diversification, closer utilization, and perhaps ultimate integration of the industry. The remaining 10 percent using all steam are small mills, largely survivals from the days when the millman's efforts were directed solely toward the production of large amounts of rough lumber, and a number of these mills will undoubtedly be among the first to discontinue operations for all time to come.

ECONOMIC ASPECTS AND FUTURE OF INDUSTRY

ORGANIZATIONS

384. *National organizations.*—There are a number of organizations at work on a general program for improving the conditions of the lumber industry in the whole country. This work affects Washington as well as other States, and some of them are locally represented.

385. The National Lumber Manufacturer's Association maintains headquarters in Washington, D.C., and has 10 independent regional associations, among them 1 in this State. See West Coast Lumbermen's Association below. This organization endeavors to secure voluntarily balanced supply and demand, new markets, cooperation in the industry and greater dissemination of public knowledge relative to lumber and its uses. Also affiliated with the national association are the Red Cedar Shingle Bureau, Seattle (see below), and the Western Pine Manufacturer's Association, Portland.

386. The National Committee on Wood Utilization, with headquarters in the Department of Commerce, is endeavoring to promote a wiser and more efficient use of wood and forest products.

387. The Federal Timber Conservation Board, appointed in November 1930, aims to develop an economic balance between production and consumption, and to formulate a definite plan of forest conservation.

388. The United States Forest Service, in addition to managing the national forests, conducts extensive surveys, studies, and investigations which benefit the lumbermen throughout the country, publishing the findings from time to time.

389. The National American Wholesale Lumber Association is a sales organization with a branch in Seattle.

LOCAL ORGANIZATIONS

390. West Coast Lumbermen's Association, Seattle. Quoting from the foreword of the association's "Service Book for 1930":

> The West Coast Lumbermen's Association represents and serves the lumber industry of the Douglas fir region. Its source is the individual membership of logging companies, sawmills, millwork plants, timber-treating plants and allied wood using industries. The association aims to serve all of the industrial group using west coast wood.
>
> From the members of the association are created its officers, board of trustees, and committees, who direct all of its undertakings.

391. This association, affiliated with the National Lumber Manufacturer's Association, is at the present time the most important local organization of its kind. In 1926, it absorbed the West Coast Lumber Trade Extension Bureau, created for the purpose of advancing the use of Northwest lumber in the Eastern markets, and advertising expenditures for this purpose were made to the extent of $150,000 in 1926, $125,000 in 1927, and $100,000 in 1928. Departments or committees are maintained for administration, market information, and trade practices, grades and inspection, industrial facts, information, trade extension, and field service and traffic. Numerous committees from the membership are at work on subjects of general interest, and biweekly reports on production are interchanged with 352 mills, representing 95 percent of the production in the Douglas fir region. General statistics and cost data are collected extensively, and publications of general interest are distributed.

392. Douglas Fir Exploitation and Export Co., Seattle. This is a corporation formed for the sole purpose of developing the foreign markets of west coast lumber under centralized control, price regulation, and standardization of grades and practices. An important step was taken in April 1931, through the signing up of 90 percent of the exporting mills in the Northwest as members of the corporation which will henceforth handle the whole output for the foreign field. This will greatly benefit the industry through elimination of price cutting, unwarranted fluctuations, and lack of concerted action. This export company was one of the first organizations of this nature made possible through the Export Trade act.

393. A Sales Corporation for Atlantic Coast Trade, Seattle. As yet in the process of organization, this corporation will in the future handle the sales on the Atlantic coast for lumber mills in western Washington which have previously disposed of their output through wholesalers and brokers.

394. A Sales Organization for Railroad Material, Seattle. About one half of the Washington mills belong to this organization, which handles the sales of car and other lumber to the railroads.

395. Red Cedar Shingle Bureau, Seattle. This organization, in existence since 1920, devotes its activities to trade extension principally.

396. Washington & Oregon Shingle Association, Seattle. An organization especially devoted to inspection and classification of red cedar shingles.

397. Douglas Fir Plywood Institute, Tacoma, is an organization for advancing the interests of the plywood manufacturers, and at the present time is undertaking an advertising campaign for the purpose of trade extension.

398. Northwest Furniture Manufacturer's Association, Tacoma. This comparatively recent association is devoted to the interests of the Washington manufacturers in this field.

399. *Millwork and woodenware.*—The millworking establishments and the manufacturers of woodenware have no separate organizations. The former operate under a subdivision of the West Coast Lumbermen's Association and the latter are generally members of the general manufacturer's associations in Seattle and in other localities.

400. Pacific Lumber Inspection Bureau, Seattle, is an organization for inspecting, grading, and certifying lumber for domestic and foreign

shipments. Practically the standard practice in foreign trade is for foreign buyers to specify "payments against Pacific Lumber Inspection Bureau certificate."

401. The names of the following additional organizations explain their various activities.

Western Door Manufacturer's Association, Tacoma.
American Export Door Co., Tacoma.
Sawmill Engineering Conference, Portland.
Western Retail Lumbermen's Association, Spokane.
Retail Lumbermen's Credit Association, Seattle.
Pacific Lumber Exporters' Association, Seattle.
Western Red Cedar Association, Spokane.

LOGGERS

402. Pacific Logging Congress, Portland, is an association devoted to the interests of the loggers in the fir region, exchanging information and determining policies, principally during annual meetings. Committees are at work during the year.

403. Loggers Information Association, Seattle, was originally organized for compiling and distributing information and statistics, and for functioning as a joint purchasing agency the latter activity has now been discontinued, but the organization still collects and distributes to members a monthly survey or inventory of the log supply.

404. Western Operators Association, Seattle, is an employment bureau for the loggers only.

405. Puget Sound Log Scaling Bureau, Seattle, is an organization for scaling, grading, and certifying logs, also for publishing statistics covering logs scaled.

406. Grays Harbor Log Scaling and Grading Bureau, Aberdeen, is an organization scaling and grading logs in the Grays Harbor region.

407. Columbia River Log Scaling and Grading Bureau, Portland, is an organization scaling and grading logs in the Columbia River region.

PULP AND PAPER

408. The Pacific Coast Association of Pulp and Paper Manufacturers is in the process of formation. Two meetings have been held, but the final organization has as yet not been effected.

GENERAL

409. Washington Forest Fire Association, Seattle, is an organization for fighting forest fires in private timber, supported through assessments levied on acreage basis. See Forest Fires and Other Losses.

410. Loyal Legion of Loggers and Lumbermen, Seattle, is a joint organization of employees and employers for the purpose of establishing and maintaining standards of wages, housing and working conditions, by mutual agreement. It also collects and publishes certain statistics of the lumber industry.

411. Western Forestry and Conservation Association, Portland, is an organization of lumbermen and forestry officials, promoting and studying conservation, protection, management, etc., of the forests.

412. Pacific Northwest Forest Experiment Station, Portland. This is the Research Branch of the United States Forest Service. Its activities embrace silvicultural, utilization, fire, taxation, insurance,

and other economic studies looking toward the growth, perpetuation, and utilization of the forest resources.

413. Forest Research Council, Portland. This council is made up of lumbermen, State forest officials, and representatives of timber and forest protection organizations, who act in an advisory capacity and as a liaison between the forest research agencies of the region and the industry.

414. State Forest Board, Olympia.

415. Washington State Forestry Conference, Seattle, is an organization composed of lumbermen, chamber of commerce officials, business men, etc., promoting forestry management and legislation. This group was able, during the 1930 session of the State legislature, to secure the passage of the first bill to recognize the importance of reforesting the logged-off land.

416. As a result, reforesting lands are now taxed at a valuation of only $1 per acre, west of the Cascades, and $0.50 east of the Cascades. The principal tax is the "yield tax" collected at the time of cutting only, at the rate of 12½ percent of the value of logged-off timber. This marks one of the first steps of genuine progress in reforestation, and it is expected to have a far-reaching effect on the future yields of reforesting timber.

417. *Consolidations.*—When the depression and the decline in the consumption and prices appeared to be more or less permanent after 1926, an effort was made to consolidate a large number of lumber companies in western Washington. Much preliminary work was done, inventories taken, maps of remaining timberlands prepared, etc., but the effort was finally abandoned because of lack of agreement and too conflicting interests.

418. In May 1931 the first important consolidation or merger was effected, covering four large lumber and logging companies in the Willapa Bay region, brought under the control of one of the two largest lumber companies in the country. The stumpage included, the total production, and the details of the merger are as yet not known. However, the new organization is important, not only because it welds into one body an extensive area of timber, containing a large percentage of spruce and pulpwood, but because it indicates the present trend and no doubt is the forerunner of several similar future mergers to follow.

419. *Summary.*—The above list indicates that the various interests of the lumber industry are cared for by over 30 existing organizations, both national and local.

420. *Economic conditions.*—The following quotation from the 1926 report of the West Coast Lumbermen's Association condenses into a brief statement the whole economic status of the industry and its relation to the economic structure of the Northwest.

> Lumber in 1926 contributed about $170,000,000 to Pacific Northwest prosperity in wages, purchasing of supplies and other expenditures incident to an estimated production of 10,429,000,000 feet for the douglas fir region in Washington and Oregon.
>
> As an industry, lumber did not participate in the prosperity it promoted. In producing 4 percent more lumber than in 1925, and approximately 20 percent more than the demand actually required, the business took a substantial loss, as it has for 3 years out of 5.

421. That the statement relative to the losses is correct is proven by plate no. 150[2] which shows the averages ales price of lumber at the mill, as given by the Census of Manufactures, and the average cost of

[2]Not printed.

lumber production, compiled from the logging cost and sawmill cost recorded by the West Coast Lumbermen's Association.

422. As noted under lumber, the operations from 1927 to 1930 showed an average loss of 86 cents per thousand for the 4-year period, and while the 1926 report shows a loss during 3 years of 5, the loss now occurs during 5 years of 7.

FUTURE TIMBER SUPPLY

423. *Timber for lumber production.*—Plate no. 151 [2] shows the average annual lumber production in western Washington, estimated ahead to 1970, also the true annual production from 1900 to 1930. The peak was reached in 1926, and it is probable that this production will not be equaled in the future. The 1930 depression exaggerates the decline, which would have been inevitable even under normal conditions.

424. The future production shows a sharp drop until about 1950, with a future slight decline until some time after 1960, when the minimum production is reached with somewhat less than 2.4 billion feet. Thereafter, a slight increase begins due to the increasing amounts of reforesting, to the stands reaching merchantable size, under the rapid climatic growth and to the improved conditions of forestry management which inevitably must be in practice at that time.

425. The future production is based on an analysis by Mr. W. G. Weigle, supervisor of the Snoqualmie National Forest, contained in the University of Washington Forest Club Quarterly of January 1924, and covering the private timber and the national forests. In order to ascertain the complete production, it has been necessary to add to Mr. Weigle's totals the reforested timber, or the second growth gradually reaching marketable dimension in the logged-off areas.

426. Mr. Weigle estimates the cut of private timber in 1940 at 3,000,000,000 feet, and in 1960 at 500,000,000. The 1940 cut appears somewhat underestimated, but Mr. Weigle has substantial ground for the belief that the figure will not be materially exceeded. The period from 1930 to 1940 will practically wind up the operations conducted by large numbers of small owners of stumpage, and when the present remaining stands of private timber in western Washington are analyzed, it is strikingly apparent that there is left only a comparatively small amount of this timber even now, the balance being held by operators on a larger scale, with more extensive resources for the future. See timber map prepared for the purpose of mill consolidation in 1929, also timber map prepared by Porteous & Co., logging engineers, Seattle, 1930.

427. As no more authoritative estimates of the future cut are available, and as Mr. Weigle, in 1924, very closely predicted the peak and the beginning of the decline, the use of his figure for the 1940 cut of private timber is justified. However, as has been the case in the southern pine district, after the apparent elimination of private timber recorded on maps, logs may continue to appear on the market from unexpected sources for a long period, considerably increasing the total production.

428. The 1960 estimate of 500,000,000 feet has, however, been increased to 750,000,000, since the latter figure appears to be more in

[2] Not printed.

accordance with similar rates of decline, occurring when the material diminishes. This rate invariably slows down considerably when approaching the end of the resource.

429. Relative to the national forests, Mr. Weigle bases his estimate on more substantial ground, being the cut in these forests on a sustained yield basis, by the United States Forest Service placed at 1 billion feet. Mr. Weigle states in his analysis that the cut "during the period 1940 to 1960, will be approximately 1 billion feet", and in plate no. 151[2] this cut has been gradually approached until it is reached in 1960.

430. In the report referred to, the total stand in the western Washington national forests is given as 66,851,919,000 feet board measure, and the sustained yield of 1,000,000,000 feet is hence equal to 1½ percent of the stand, not excessive under the rapid growth, the forestry conditions and the close supervision practiced by the United States Forest Service.

431. The national forests will, without a doubt, be entered at an increasing rate as the private timber is logged off, and plate no. 151[2] shows a reasonable presentation of this gradual utilization.

432. The reforested timber is already a factor, as logging in such timber has been carried out in several locations during a number of years. In 1926, the total amount reached 20,000,000 feet. In order to determine the logging of timber in this group during 1960, it is necessary to include only such stumpage as by that year has reached marketable dimensions. United States Forest Service Bulletin No. 201, The Yield of Douglas Fir in the Pacific Northwest, shows that under normal average conditions, there is little if any, commercial yield under an average of 50 years. No reforesting area cut later than 1910 can, therefore, be considered. Including only the areas reforesting prior to 1910, and using the acreages given in Mr. Weigle's report, together with basic data previously covered, leads to the following results:

	Acres
Private timber acreage logged to 1921	3, 500, 000
Less acreage logged 1910–20	1, 078, 000
Logged to 1910	2, 422, 000
Plus state and other miscellaneous private timber lands	300, 000
Total for 1960 crop	2, 722, 000
Actually restocking, 60 percent of above	1, 633, 000
Less allowance of 25 percent for uneven stands, for future fire damage, etc	408, 000
Balance, actually fully stocked	1, 225, 000

Of this area, for the purpose of this estimate, approximately

		Stand per acre
One third is 50 years old in 1960	feet board measure	12, 400
One third is 60 years old in 1960	do	23, 800
One third is 70 years old in 1960	do	35, 200
Average stand per acre in 1960	do	23, 800

Total stand on 1,225,000 acres at 23,800 feet, equals 29,200,000 thousand feet.

[2] Not printed.

Logged on 2.25 percent basis, the annual cut equals 650,000,000 feet.

433. The State and other miscellaneous private timber land, totalling 300,000 acres, added to the "Logged to 1910" area above, are derived in the following manner. In Mr. Weigle's analysis, the areas of timberland and logged-off land given as of 1920 are as follows:

		Acres
Privately owned, assessed as timberland		3, 635, 686
Ditto, not assessed as such	350, 000	
Unpatented land grant	85, 000	
State timberland	600, 000	
		1, 035, 000
Indian reservation timberland		275, 066
Unreserved public domain		15, 000
National forests		2, 475, 997
Total		7, 436, 749
Privately owned and cut-over and burned-over land		3, 500, 000

434. The 350,000 acres of private timberland, not assessed as such, the unpatented land grant, and the State land, total 1,035,000 acres, of which amount a considerable area has been logged. The private holdings represent timber on ranches, mining claims, etc., and for the purpose of this estimate, it is justifiable to add at least 300,000 acres of this total as reforesting area from the group, which exceeds 1 million acres.

435. The yields at 50, 60, and 70 years, are given in Technical Bulletin No. 201, previously referred to under, "Reforestation", and it was shown that about 60 percent of the logged-off area is restocking, although not fully so. The cut on a 2.25 percent basis is assumed, partly because the growth of young timber is far more rapid than that of ripe timber, partly because under private ownership, this timber will, without a doubt be logged closer than on an actual sustained yield basis. The percentage of growth in the principal groups is shown in the first chapter under "Density" and "Rate of Growth." However, should this reforested timber again be completely logged-off, the cut would be greatly increased.

436. The crop available in 1970 is far greater, partly because the 1910–24 area of 1,078,000 acres is beginning to produce, and partly because of the growth of the crop on which the 1960 cut is based. The following 10-year period, ending 1980, will show an even greater increase, the stands growing faster than the diminishing of the remaining private timber, and the total cut will therefore show a tendency to increase after 1970.

437. Provided reasonably efficient forestry methods are practiced, it should therefore be possible again to log approximately 3 billion feet a year in western Washington, perpetually, on a sustained yield basis. This figure appears to be somewhat lower than the estimate given by the United States Forest Service. In "Forest Figures" by the Portland office of the Service, the potential producing capacity of ultimate forest land in Washington and Oregon is placed at 10,000,000,000 feet board measure. In proportion to the stand of timber, Washington would, therefore, have a future capacity of 4,150,000,000 feet board measure, and if 14 percent is deducted for the region east of the Cascades, the western district would show a production of 3,570,000,000 feet, or 19 percent more than the maximum result indicated by continuing plate no. 151.[2]

[2] Not printed.

438. The Forest Service figures are no doubt carefully prepared, and they must be based on full forestry management and complete fire protection. However, it is believed that the more conservative figures arrived at through the analysis leading to plate no. 151,[2] represents results which may be possible to attain under less ideal and average conditions. The United States Forest Service figure supports plate no. 151[1] to some extent by indicating that since the future results do not show a substantial difference, the general trend of the production as shown between 1930 and 1970 should not err very materially, and the following conclusions are therefore indicated:

1. The final decline of the lumber production in western Washington has already begun, and the 1925-29 production will doubtless never be equalled.

2. The decline will be far more rapid than is commonly realized and it will reach a minimum during the decade 1960-70 with approximately 2.4 billion feet.

3. The production will increase after 1970, ultimately perhaps reaching 3,000,000,000 feet annually on sustained yield basis, and with full forestry measures, this figure may approach, but should not exceed 3½ billion feet in western Washington.

439. *Timber for pulp production.*—Plate no. 152[2] shows the amount of pulp timber contained in the annual cut, leading to a conclusion of considerable significance. While the cut declines sharply after 1930, the pulpwood content increases until 1940, and it is the same in 1958 as in 1926, the year of maximum lumber production. This is based on the fact that as the cut declines, it moves to higher levels, where the pulpwood content ultimately is 50 percent, as in the national forest.

440. Plate no. 151[2] shows the percentage of pulpwood contained in the separate groups, and it will be noted that in the reforested timber, this percentage is constant. This is based on the 1910 content of 15 percent and the assumption that the reforestation will show the same content. Although not always true, this is an assumption which is justifiable for lack of any accurate data. No survey has ever been made of the areas reforesting, and an up-to-date land classification in this connection is also lacking.

441. The amount of pulpwood actually available for pulp production is ascertained as follows for 1940 as an example:

Pulpwood contained in cut ..... feet board measure	1,220,000,000
Of this amount, more suitable for pulp than for lumber, 50 percent ..... feet board measure	610,000,000
In cords at 600 feet board measure ..... cords	1,017,000
Plus logging waste from 1,220,000,000 feet ..... do	428,000
Plus mill waste at 70 cords per 100,000 ..... do From millcut of 610,000,000 feet ..... do	427,000
Total	1,872,000

442. The percentage of timber more suitable for pulp than for lumber is based on the known quality of the stumpage at the high levels, containing only a small percentage of clears profitably convertible into lumber.

443. The logging waste is in the same proportion to the total cut as in Hodgson's report, previously referred to under Waste production, and the mill waste is based on experience as noted under that

[2] Not printed.

chapter. At the average rate of 2.2 cords per ton, this available material would, therefore, produce 850,000 tons of high-grade chemical pulp. In this raw material, douglas fir and cedar are not included. However, these species are already used at increasing rates for sulphate pulp, and several technical processes for utilizing douglas fir in a more extensive manner for chemical pulp are being perfected

444. That the remaining problems connected with the utilization of douglas fir for this purpose will be solved in the near future, is now accepted by the industry, and fir must, therefore, be included in the future pulp material. The total amount to be used remains a matter of conjecture, but even as low an estimate as 20 percent of the above pulpwood supplies would lead to a requirement of 375,000 cords, and a grand total of 2,298,000 cords of pulpwood which could be used in 1940. This would enable a production of 1,000,000 tons of chemical pulp against a 1928 production of 350,000 tons (statistical abstract of the United States, 1930).

445. *Conclusions.*—The following conclusions are therefore warranted:

1. While the available lumber supplies will decline 65 percent from 1926 to 1956, the pulpwood content does not decline during this period, even increasing during the next 10 years.
2. The productive capacity of western Washington during most of the future is 1,000,000 tons of chemical pulp.
3. While the lumber production must rapidly decline during the next 30 years, the value produced will not only be kept at a constant level, but will be increased, provided the course pointed out by the heavy future pulpwood content is followed by increasing the production of pulp to its required tonnage.

FUTURE DEVELOPMENT

446. The future development of the lumber industry in Washington is governed by:

1. General conditions affecting all United States industries.
2. The general consumption of lumber in the United States, and the increase in the use of substitutes and more permanent competing materials.
3. Federal legislation, tariffs, freight rate regulations, etc.
4. State legislation, taxation, etc.
5. The stumpage prices and supplies of raw material in Washington and in the balance of the United States.
6. The general policies of the lumbermen and their progressive or retrogressive attitude relative to techincal and economic problems and development of industry.

447. Relative to the general conditions affecting all industries in the United States, it can be stated as a fact requiring no detailed demonstration, that since the beginning of this development, there has not occurred a set-back of permanent nature in any fundamental phase of the country's industry and business; that the recessions have been and will no doubt continue to be temporary, and that the future growth can, with every reasonable assurance of correct results, be projected ahead past the present depression at or very near the previous rate of increase, with perhaps a slight reduction due to diminishing exports.

448. During the 1920-30 decade, the average curves of growth, neglecting the peaks and depressions, have been rising at the following approximate rates: Industrial production, 3.2 percent a year;

retail sales, 2.1 percent a year; steel production, 2.3 percent a year; number of employees in all occupations, 1.8 percent a year, etc. The industrial production and the retail sales are based on the Federal Reserve Index, the other figures on available census statistics.

449. This decade alone would not furnish a period sufficiently extended to prove the trend, but the lines of mean growth can be projected through previous decades with the same invariable result. A constant increase in production or value, with a constant rise in the rate of increase, in the case of "general production" and "bank deposits" as an example, show remarkably uninterrupted continuity at a uniform rate of increase since 1878. The future of the lumber industry should, therefore, be subject to the same laws, and this would occur except for the fact that the fundamental conditions governing the progress of all industries have not been met. The laws of industrial progress in the United States hold good only if these irrevocable conditions are followed. Overproduction, waste, failure to convert raw material into full value, lack of integration, adverse legislation, etc., are not conducive to continuous industrial progress as has been shown under economic conditions.

450. Another factor has detrimentally affected the industry, the gradual decline in the per-capita consumption of lumber. Plate no. 153 [1] shows how this consumption rose from 100 board feet in 1840 to 525 feet in 1906, declining to 290 in 1929. This decline since 1906 is generally attributed by the lumbermen to the increasing use of substitutes. However, there are substitutes of two kinds: Substitutes in fact, and substitutes by resentment, or so named when the market is lost to a new product better able to suit the purpose.

451. Lumber, as a matter of fact, gained its heavy per-capita consumption when there were no other more suitable materials. Plate no. 153 [2] illustrates this circumstance through the per-capita production curves of steel and of portland cement. They are based on the average line of growth through the period, eliminating peaks and depressions, according to figures given by Statistical Abstract of 1930.

452. When merely small amounts of these products were manufactured, and while the country was in the pioneer stage of development, lumber, which was available in practically unlimited quantities at very low cost, gained extensive use.

453. Since the production of steel and cement increased, the use of lumber has declined. It will be noted that since the beginning of the decline in lumber consumption, the per-capita production of steel has doubled and of cement increased 3.7 times. These are legitimate uses, and no real case of substitution exists. The sharp decline in lumber consumption has practically a uniform reversed equivalent in cement production since 1926. The per-capita consumption of lumber will doubtless decline in the future, but at a slower rate, possibly as indicated on plate no. 153.[2] It would be futile to combat this increased use of steel and cement; the economic laws which compel the large consumption of these materials are too relentless to be opposed by efforts to regain some of the lost ground to the use of lumber. Through the most logical and economic uses, competing materials invariably find their proper balance after a sufficiently extended period of com-

[2] Not printed.

parative trials, and there still remains an ample field for the use of lumber and its finished products.

454. The indicated decline in the future United States per-capita consumption of lumber is too slight to be of any material consequence. In this connection, it should be noted that the lumber-producing States still use much larger amounts, and the per-capitas consumption in the Douglas fir region has had an average value three times that of the United States. Even if the total consumption of lumber in the United States remains constant, the increase in population in 30 years would result in a per-capita consumption decreased by nearly 100 feet, board measure.

455. As to the industry in Washington, the decline in the United States per-capita consumption has in the past been more than offset by the decline in cutting by the other lumber-producing districts, with an attendant increase in the demands on the fir region as shown on plate no. 154.[2]

456. It will be noted that the cut in the Lakes States and in the Northeast, both leaders in production in the past, has diminished to the point where the end is in sight, and that in the Southern States which reached their maximum production in 1920, the decline has begun.

457. These four groups have produced an average of 73 percent of the country's lumber since 1870, but it is not justifiable to assume that the South and the North Pacific States will share this production in the future. The South still has a large supply of pine stumpage, 80 percent second growth, causing a much larger cut than predicted some years ago, and according to present estimates, permitting a perpetual production on sustained yield basis of between seven and eight billion feet in the future. The estimated cut is 7,000,000,000 feet in 1933, with a possible increase due to comparatively rapid reforestation.

458. The cut in the North Pacific States in percent of the whole production of the United States, in 1927, was apparently still maintaining an upward tendency. The future direction of this line depends on the entire cut in all the groups, the rate of decline in Washington and the future rate of production in Oregon, which State has a far more extensive stand and will not show a reduction in the cut for some years to come.

459. To extend the lines in plate no. 154 [2] would require an exhaustive survey, not only of the whole country's future lumber production and requirements, but of the South and of the North Pacific district and also of possible future supplies in all other districts due to reforestation, natural and artificial.

460. It is only possible to state at this time that any reliance on a great increase in the demands on the fir region due to the diminishing supplies in the South is not well founded, and that the South may have an ultimate capacity of production as great as the North Pacific States. In all probability, the curve for the latter group will turn approximately in the same manner as for the southern pine States, but the time and magnitude of this turn remains a matter of conjecture.

[2] Not printed.

461. The stumpage prices also enter as an important factor in the future consumption, and these prices are governed by a number of circumstances:

1. Rate of reduction in the private supply of stumpage.
2. Rate of conversion into more valuable products than lumber.
3. Stumpage prices of competing timber in other regions.
4. Rate of reduction in the old growth or percentage of the poorer second growth contained in the stumpage.

462. The price variations are shown in plate no. 155[2] projected ahead under the following assumptions:

1. That the timber supply declines as shown in plate no. 151.[2]
2. That the stumpage is converted into more valuable products than rough lumber.
3. That the fir stumpage is governed by approximately the same proportional price increases that controlled the white-pine stumpage.

463. Twenty years after the original old growth stands of white pine were logged off, the stumpage price had advanced to $12 to $15 per thousand, and even the poor grades now command a price of $10 to $12. There is, however, a definite limit to the price which stumpage can reach; if it exceeds this price, controlled by the economic and industrial conditions prevailing, competing materials and substitutes will rapidly gain increased use.

464. Douglas fir will not be as scarce as white pine, and the prices should not reach the same level for a considerable period, if at all. If the private timber supply does not decline as rapidly as shown in plate no. 151,[2] and if the stumpage is used predominatingly for lumber, no valid reason for increase in values will exist, and the price level would in that case be maintained on the present basis for a long future period.

465. As the old growth is logged off, a condition paralleling that in the southern pine region will be created; the new reforested growth will be of comparatively poor quality, never again equalling the present stand in content of no. 1 and no. 2 logs, and most of the new stumpage will be of no. 3 grade. This circumstance cannot fail to have some influence on the future stumpage prices. It should be noted that there is as yet no condition apparent which would tend to increase the prices of fir stumpage, and that the projected increase is due solely to the assumed development as above stated.

466. Federal and State legislation affecting the future of the industry have been treated under economic conditions.

467. As to the attitude of the lumbermen, the best illustration is afforded by quoting a Scandinavian lumberman who studied the production methods in the douglas fir region in 1926. Substantially, his comment was as follows:

> I cannot understand how any sawmill can exist as a detached industrial unit, with any hope of making a profit through the mere production of lumber, most of it rough. Were we to do this, we would be ruined in a short time; our profit comes from the material you waste. We use the sawmill merely as a cut-up plant, according to the fluctuating demands of the market, distributing the content of the log and the waste to pulp mill, veneer mill, sash and door plant, lumber yard, wood flour mill, box factory, charcoal plant, bobbin plant, wood-distillation plant, etc., from each one taking a small profit, generally quite satis-

[2] Not printed.

factory for the combined operation, all under the same general management and coordinated with a perpetual-timber supply under modern forestry practices.

468. This is a complete integration of the wood industry, such as is here practiced by the United States Steel Corporation, which under a single management, from the same raw material and its byproducts and wastes, manufactures all the products into which this raw material can be profitably converted.

469. In addition to conserving the raw material and producing a greater profit, the integration has the superior advantage of flexibility. Should the market for one product be stagnant, the raw material can be easily diverted to the manufacture of another product in better demand at the time. Herein lies the future of the lumber industry in the douglas fir region.

470. The economic history of all industries, in a large number of cases, shows nearly identical development, and the lumber industry is by no means alone in confronting a number of problems. Industrial history largely repeats itself, and after many false steps, many efforts to continue on a basis which has gradually become obsolete during the change of general conditions, and after a period of lagging, losses, elimination of the unfit, consolidations, and adjustment to the new conditions, the essential industries have generally survived and prospered.

471. It is, therefore, not presumptuous to state that the future of the lumber industry in western Washington will develop substantially as follows:

1. Continued losses, elimination of weak operators, survival of the fittest.
2. Consolidations, mergers, combinations, and reduction of output.
3. Increased interest in centralized organization, trade association, accurate market studies, and logical trade development, the beginning of more effective planning, cost analysis, equipment revision, electrification, waste prevention, etc.
4. Public support, more favorable taxation, legislation, and freight rates.
5. Decrease in production of rough lumber, with increase in the manufacture of finished products, realization of the possibilities offered by eastern consuming territories reached with low water rates, largely absorbed through savings in labor and material.
6. Revival of pulpmaking, realization of the fact that this is a key industry of equal and greater importance than lumber, and to be developed accordingly.
7. Increased development of fiber board, insulation board, plastics, and other products of present waste, development of wood distillation, and charcoal industries, greater utilization of all wastes and byproducts, technical and market research.
8. Final integration of the lumber industries, no detached sawmills operating as producers of lumber only, the industry reestablished and profitable.
9. Reforestation program gradually developing, realization of the fact that the forest resources are and will remain the backbone of Washington's industrial structure worth conserving and developing to their fullest extent, sustained yield program established.