is dominated by the oat-producing areas in the Willamette Valley-Puget Sound region and eastern Idaho. These areas have a relatively long, moist growing season, favorable to the growth of oats, and practically the entire crop is threshed for grain.

195. Barley is favored in the rotation plan of irrigated farms. In terms of feeding value its yield is higher than that of any other grain grown on irrigated land in this region. In dry farming it requires less moisture than wheat. These facts have induced a few farmers to substitute barley for a portion of their wheat acreage. This movement is restricted, however, by the lack of markets and the low unit value as compared with transportation costs.

196. Rye and corn, table 16, have comparatively small acreages. However, the figures for corn represent only about one half the corn actually grown, the balance being cut for green feed or silage. The Willamette Valley and a few districts east of the Cascades are warm enough to ripen corn. Acclimated strains are being improved and expansion is keeping pace with the slow development of supplemental irrigation (par. 186), necessary during the dry summer months.[11] At present production in this region is far below consumption, the deficiency being filled by shipments from east of the Rocky Mountains.

197. *Potatoes.*—Potatoes are produced both in sections where rainfall is sufficient for normal requirements and in those having irrigation or natural subirrigation. Table 16 indicates the increasing importance of this crop. Plate 21[2] shows the principal producing areas. Production is decreasing in the humid Willamette Valley-Puget Sound area, whereas in the irrigated Yakima area it is increasing, due to a growing tendency away from fruit specialization. Irrigated tracts of southern Oregon and southern Idaho are expanding acreage.

198. Irrigation permits water to be applied at the right time and in the right amount. It is withheld during the ripening and digging periods. This means a measurable degree of control over time of ripening of the early crop and better condition of the late crop for storage and shipment. Yield per acre under irrigation averages over twice that from unirrigated interior land. The bulk of both the early and late crops of southern Idaho is marketed east of the Rocky Mountains.

199. In the Willamette Valley-Puget Sound area the early crop is produced similarly to, but earlier than, that of the Eastern States. The main crop is planted late enough to utilize the last of the spring moisture to start growth and to withhold blossoming and setting until the September rains induce rapid growth. Tardy fall rains, as in 1929, account for occasionally low yields of this main crop (pars. 182 and 196). The surplus goes to California markets.

200. In certain interior areas, certified seed potatoes are produced and sold under State supervision on what is known as "subirrigated land", i.e., foothills having natural subsurface summer drainage within reach of plant roots. Growers on irrigated farms of the Pacific Northwest, together with those in eastern and southern States, absorb the output. In the humid areas certified seed potatoes are raised as the first crop on cleared stump land. Their market is local and coastal (par. 211).

[2] Not printed.

[11] Powers, W. L. Supplemental Irrigation for the Willamette Valley. Oregon Agricultural College, Exper. Sta. Circ. 57, August 1921.

201. *Sugar beets.*—Sugar beets are grown under irrigation in rotation with other crops. Southern Idaho, with 5.4 percent of the national production of sugar beets in 1929, accounts for the bulk of this crop in the Pacific Northwest. Yield in sugar content is greatly influenced by slight variations in the factors affecting growth. For southern Idaho, good yields per acre, together with recent expansion, as shown in table 16, indicate adaptability to sugar manufacture. Several beet-sugar factories are operating in this area, usually contracting for the crop in advance of planting. The beet tops and beet pulp are valuable as farm animal feed.

202. *Beans, dry edible.*—Irrigated tracts of southern Idaho account for about two thirds of the reported production of the Great Northern variety, or about 10 percent of the total dry edible bean crop of the 14 States for which statistics are available. Production in that area is expanding, as indicated in table 16.

203. *Hops.*—Selected river-bottom lands in the humid areas west of the Cascades, particularly those periodically flooded, are well adapted to the growing of hops. As indicated in table 16, expansion in acreage here in the face of declining acreage in the East has accompanied a downward trend in prices. Violent fluctuations in unit prices, to be expected in a light-weight, high-value item produced on a world basis, have led to growers' contracts at specified prices over a period of years. Cooperative marketing is the subject of current discussion. Risks, noted above, plus the potential hazard from disease and the high production costs appear to operate against material immediate expansion, unless unexpected demands for new uses should develop.

204. *Flax.*—Flax fiber has been grown in the Pacific Northwest for over 50 years. West of the Cascades favorable climatic and soil conditions produce a long fiber of recognized quality. About 5,000 acres of land were devoted to flax in 1930. It is estimated that there are 270,000 acres in Oregon alone[12] and a large area in Washington which could be used for flax-fiber production. Two factories in Salem, Oreg., and one in Vancouver, Wash., are engaged in small-scale manufacture of the coarser forms of flax-fiber products.

205. Flaxseed yields linseed oil, used in making paint, linoleum, and other products. Flaxseed meal, a highly concentrated stock feed, is a byproduct. Two vegetable oil mills in Portland, Oreg., it is reported, are obtaining only 10 percent of their flaxseed locally. To supply part of this local deficiency, moderate production in the Pacific Northwest of flax for the seed itself is being urged. In selected areas east of the Cascades, this would be in rotation with wheat at possibly 5-year intervals. On the other hand, major producing areas of the United States have been increasing their acreage devoted to flaxseed.

206. *Seed crops, nursery stock, and bulbs.*—Seed and bulb production is particularly adapted to the Pacific Northwest. The climate and soil of the area west of the Cascades and of irrigated and subirrigated tracts in the interior are very favorable to producing hardy strains of many varieties of seeds and bulbs. Also, since such crops have a greater value per pound than most crops, the freight charges take a small proportion of the market price and they can be shipped profitably to distant markets. These advantages have been fostered by

[12] Marketing and manufacturing factors in Oregon's flax industry, by A. L. Lomax and Theodore Van Guilder, publication University of Oregon. Studies in Business No. 8. December 1930. p. 3.

State laws defining quality for certification, by measures for control of insect pests, and by the packing of seed in sealed containers.

207. Alfalfa seed, grown on irrigated tracts in relatively high altitudes, enjoys a wide-spread demand, particularly in the Northern States, because of its resistance to cold winters.

208. Clover seed while raised to some extent in the alfalfa-growing areas is more generally grown west of the Cascades in Oregon. Washington's production is negligible. Every year the United States has had to import large quantities of the various clover seeds, the quality of which is considerably inferior to the domestic product. Red and Alsike clover seed are particularly favored by Oregon and Idaho growers (par. 186) who now supply from 7½ to 19 percent of the Nation's production, while one observer predicts their future importance in Oregon as equal to that of wheat. These seeds are marketed not only in the South and Southwest but also in the Eastern States, where the red clover seed crop is usually incidental to the hay crop. Sweet clover seed is produced mostly for local use, while Ladino clover seed for national markets has successfully passed the experimental stage.

209. The vetches yield valuable seed crops which are shipped to California and other States, while Austrian field peas are grown for green feed or silage, or as a cover or green manure crop. Seed for the latter purpose is shipped to Southern States.

210. Several varieties of grass seed are grown, mostly west of the Cascades. Creeping bent grass, found growing wild along the Pacific coast, has come into national demand for golf courses and better lawns. Production of some 50 tons of this valuable seed was reported for 1930. Western rye grass is also favored as it makes an excellent temporary lawn in a few weeks, chokes weed growth, and serves as a nurse crop for more valuable grasses such as creeping bent. It is also shipped to the Southern States where it is sown each fall on Bermuda grass lawns to give winter greenness. Other grasses grown for seed in this region, include red top, orchard, and tall oat grass.

211. Vegetable seed production in this region is still largely in the experimental state, although sugar-beet, onion, and garden-pea seeds are grown commercially in Idaho, while cauliflower, cabbage, and turnip seed are grown in the Puget Sound area for the national market.

212. The growth of nursery stock—young fruit and ornamental trees and shrubs—is also favored by the climate of the Pacific Northwest, particularly west of the Cascades. Many cuttings which require winter shelter in other regions, grow readily in the open air. Sales of such products are mostly confined to this region. Some species, such as holly in the form of trees for planting, or branches for holiday decoration, reach a national market. The flower-bulb industry has had a rapid and steady growth west of the Cascades. As most of the bulbs used in the United States are now imported, the Pacific Northwest crop is marketed throughout the Nation. Among the principal bulbs are the narcissus, daffodil, tulip, gladiolus, dahlia, and peony. Eastern seed, nursery, and bulb houses capitalize on growing conditions here by sending out newly originated varieties to small local representative growers under contract. The increase is sent back for sale at prices commensurate with the scarcity of the novelty. The

value of nursery stock, including bulbs, produced in Oregon in 1929, is estimated at $2,750,000. No figures are available for Washington or Idaho.

213. From the foregoing, it is seen that specialty crops have a strong foothold in the Pacific Northwest. West of the Cascades, the mild climate, long, moist growing season, and good soil conditions favor their growth, and encourage experimentation by private individuals, as well as by agricultural colleges, to develop new strains or varieties or to introduce new crops from other regions. Such experimenters usually operate intensively, often only during leisure hours, on relatively small units but their frequent successes have made the business, on the whole, rather profitable to themselves and of material benefit to the region and to the Nation.

214. *c. Tree fruits and nuts—Apples.*—Apples are grown over a large portion of the United States but commercially in comparatively few districts. The commercial crop of Oregon, Washington, and Idaho, in the 4 years 1927 to 1930, accounted for nearly 40 percent of that of the entire country. Total production, commercial and noncommercial, is shown in table 17.

215. In this region there was general overplating of new orchards about 20 to 25 years ago. Much of it was ill-advised as to localities and varieties. At the present time new plantings here are but little greater than necessary to maintain present total bearing acreage. They are of the approved varieties and have the right soil, topographic, climatic, and marketing conditions. Plate 22 [2] shows the number and geographic location of apple trees in the Pacific Northwest. The leading commercial producing areas are Wenatchee, Yakima, and Spokane in Washington, and Hood River in Oregon.

216. In the United States as a whole, new plantings indicate a gradually increasing future production. Almost 25 percent of the commercial apple trees are not yet of bearing age or are producing little fruit, while 60 percent of the trees are under 20 years of age. Moreover, the eastern barreled apple districts are giving increased care to management and to selection of accepted varieties for new plantings. This increasing competition from other sections threatens to restrict the market for apples produced in this region.

217. However, in the Pacific Northwest, natural climatic conditions, regulation of moisture, and cultural requirements through irrigation, together with effective control of plant diseases and insect pests because of isolation from possible outside sources of infection, have combined to produce an apple with qualities appealing to the eye as well as to the taste. Furthermore, with the aid of agricultural colleges, and other State and Federal agencies, the cooperative associations have standardized on varieties; are grading as to size, quality, and appearance; and are giving attention to proper packing, storing, and timely shipping. These factors, together with aggressive sales policies, have enabled apple growers of this region to secure a strong hold on practically all domestic and a large number of foreign markets, notably in Great Britain.

[2] Not printed.

TABLE 17.—*Tree fruits and nuts—Number of trees, production and value, Oregon, Washington, and Idaho, 1914, 1919, 1924, and 1929*

[Compiled from statistics reported by U.S. Department of Agriculture and U.S. Bureau of the Census]

Product	Year	No. of trees	Production	Value
Apples	1914	(1)	13,602,000 bushels [2]	[3] $9,494,000
	1919	15,060,091	35,227,000 bushels	[4] 54,840,000
	1924	12,735,955	30,678,000 bushels	[4] 40,694,000
	1929	(1)	39,000,000 bushels	[4] 48,800,000
Pears	1914	(1)	1,142,000 bushels	977,500
	1919	2,087,938	3,949,000 bushels	6,606,200
	1924	2,861,401	3,035,000 bushels	5,069,000
	1929	(1)	6,203,000 bushels	8,530,000
Prunes	1914	(1)	(1)	(1)
	1919	6,148,759	102,693 tons [5]	(1)
	1924	7,887,924	101,900 tons [6]	3,876,000
	1929	(1)	248,440 tons [6]	9,785,000
Peaches	1914	(1)	993,000 bushels	1,013,000
	1919	1,347,268	3,173,000 bushels	5,275,000
	1924	1,162,106	711,000 bushels	1,496,000
	1929	(1)	1,770,000 bushels	2,471,000
Cherries	1914	(1)	(1)	(1)
	1919	1,030,181	18,009 tons [5]	(1)
	1924	(1)	15,900 tons	2,544,000
	1929	(1)	24,800	4,628,000
Walnuts [7]	1914	(1)	(1)	(1)
	1919	181,909	231 tons	(1)
	1924	(1)	400 tons	192,000
	1929	(1)	1,050 tons	315,000
Filberts [7]	1914	(1)	(1)	(1)
	1919	(1)	(1)	(1)
	1924	(1)	(1)	(1)
	1929	(1)	200 tons	56,000

[1] No data available.
[2] Converted to bushels from barrels, basis 3 bu. per bbl. See Year Book of Agriculture, 1930, p. 723, note 1.
[3] Basis, average between price Nov. 15 and Dec. 15.
[4] Basis, price Dec. 1.
[5] Converted to tons from bushels, basis 60 lbs. per bushel for prunes and 56 lbs. per bu. for cherries, as recommended by Mr. Kent, Assistant Statistician, Bureau of Agricultural Economics, Portland, Oreg.
[6] Dried prunes converted to fresh weight on basis of 3 lbs. fresh to 1 lb. dried, as recommended by Mr. Kent, Bureau of Agricultural Economics.
[7] Oregon data only. Data for Washington and Idaho not reported separately.

218. The almost complete failure of the 1930 apple crop in Europe, drought conditions east of the Rocky Mountains, and a New Zealand-Australian crop said to be only 40 percent of normal, contributed to the highly profitable disposal of the entire 1930 record commercial crop of the Pacific Northwest.

219. In this connection, it may be pointed out that this region's apple crop is produced on irrigated land, and is a hazardous undertaking for other than intelligent, well directed, and well financed specialists. In the first place, diversification is difficult because the apple orchards require constant attention. Secondly, production costs are high and margins of profit are usually small. Special studies indicate that yearly returns fluctuate four or five times as violently as do production costs. Consequently, it is likely that expansion of acreage will be conservatively adjusted to world demand.

220. *Pears.*—The Pacific Northwestern States probably produce a larger percentage of the pears of the United States than of any other important agricultural crop, and the unit value is comparatively high. Production in these three States is shown in table 17. Together with California, they accounted for nearly two thirds of the 1929 national crop of 22 million bushels. Plate 23 [2] shows the principal producing districts. The Yakima and Wenatchee areas in Washington and the

[2] Not printed.

Rogue River (Jackson County) and Hood River areas in Oregon are important.

221. While the total number of pear trees in United States has not changed greatly in recent years, more of them are now on the Pacific coast where measurably successful control of pear blight has been effected and commercial production fostered.

222. The Pacific Northwest in 1929 supplied about 22 percent of national exports of fresh pears. The bulk went to the United Kingdom and Canada, a market threatened by the growing Australian orchards. Meanwhile the Latin-American countries took 17 percent of the fresh-pear exports. About half the canned pack of the country is exported, the Pacific Northwest furnishing about 36 percent, the bulk going to the United Kingdom.

223. In view of extensive plantings below bearing age, here and abroad, overproduction, particularly of the canning variety, seems inevitable.

224. *Prunes.*—The three Pacific Northwestern States and California account for the entire reported commercial production of dried prunes in the United States. Over the period 1925 to 1929, California averaged 86.8 percent and the other three States 13.2 percent of the total domestic production, which, in turn, represents 83½ percent of the world's commercial output. Table 17 shows total production in the Pacific Northwest, which figure, however, varies greatly from year to year.

225. Plate 24[2] shows the prune and peach growing areas taken together. For prunes, the principal area includes the Willamette Va ley, Oreg., and Clark County, Wash. Other important areas are in northeastern Oregon; eastern Washington; the vicinity of Boise, Idaho, and northern Idaho.

226. Oregon, Washington, and Idaho prunes are nearly all of the Italian "tart-sweet" variety, which is larger and has more tartness than the California prune. About 34 percent of the Pacific Northwest production is shipped fresh to the East, and originates mostly in the area east of the Cascades. About 59 percent of the total is dried and 7 percent canned, those forms originating mostly west of the Cascades. The dried prune has difficulty in entering the domestic markets, but large quantities are taken by Europe and Canada.

227. In the Willamette Valley the Italian prune is interplanted with walnut trees and removed when the latter demand the additional space. This gives an interim crop and utilizes the artificial drying equipment needed for walnuts. Such incidental increase in number of prune trees is thought to contribute to the present apparent overproduction of dried prunes.

228. *Peaches.*—Peaches are a perishable crop grown over a large part of the United States. In most localities losses through diseases, insects, and winter-killing cause great variation in the crop from year to year, while quick growth readily adds to acreage. Sudden regional changes in production cause overlaps in marketing dates, thus occasionally glutting the market. Production is shown in table 17, but account must be taken of extreme year-to-year fluctuations.

229. In the Pacific Northwest, Washington is the only State contributing to other than regional markets. That State in 1929 furnished 15 percent of the national fresh-peach exports, mostly to

[2] Not printed.

Canada. Plate 24[4] shows the prune and peach producing areas taken together. In peach production, the Yakima area leads by a wide margin.

230. *Cherries.*—From 1926 to 1929, inclusive, Oregon, Washington, and Idaho averaged about 40 percent of the commercial cherry production of the United States. Leading producing areas are Salem and The Dalles, Oreg.; Wenatchee and Yakima in Washington; Lewiston, Idaho, and Clarkston, Wash.; and the Moscow and Coeur d'Alene districts in Idaho.

231. Cherries from these areas are noted for their large size, sweetness, and freedom from insect injury—control of insect pests is not difficult. In general, the dark red cherries are shipped fresh, while the lighter-colored varieties are sold to canneries, often under contract.

232. Evidences of the status of the industry are seen in the extensive new plantings, over 50 percent of the trees being below bearing age, while table 17 shows a 64 percent increase in production from 1924 to 1929. In the Wenatchee area, land in full-bearing cherries is valued higher than land in any other fruit crop in the district and, from the standpoint of returns, the higher value seems justified. There is some concern, at present, as to whether or not the extensive new planting may result in over production. However, two recent experiments promise to expand the market materially. The first is the successful development of a method of processing cherries for the maraschino trade, formerly supplied from abroad. In 1930, this region processed 10,000 barrels or 2,500,000 pounds of cherries in this manner, selling them profitably in eastern markets. The second is the reported shipment by airplane in 1931 of fresh cherries from Salem, Oreg., to Omaha and Denver. Precooling and refrigeration enroute, necessary in rail shipments, were omitted, and the cherries are said to have reached retail markets in excellent condition within 24 hours of picking.

233. *Walnuts.*—The commercial plantings of walnuts in the United States are confined almost entirely to the Pacific Coast and are practically all of the English, otherwise known as the Persian, variety. California has at least 95 percent of the nation's acreage, while Oregon, the only other state for which production estimates are available, has most of the balance. Western Washington has a small but increasing acreage. The Oregon production is increasing steadily, as shown in table 17. It is restricted mostly to the Willamette Valley, where the large size, high quality product indicates conditions probably as favorable as anywhere in the United States.

234. Walnut trees are susceptible to cold winters and to late spring or early fall frosts. Also, they require a deep, well drained and fertile soil, preferably on rolling foothills. These factors have prevented their growth in any but Pacific Coast States and, in the Pacific Northwest, have restricted plantings to especially favorable localities, mostly west of the Cascades. During the 10-year growing period before walnut trees return a profit, fruits or other crops, temporarily interplanted, supply an income. It is necessary to dry the walnuts artificially in this region, but this cost is held to be considerably less than the cost of irrigation, necessary in the drier regions.

[4] Not printed.

235. Rapid expansion of acreage on the Pacific coast has not kept pace with consumption in the United States. During 1929 imports were 16,768 tons, over half of which were shelled. It is thought that trees now growing, together with conservative additional plantings in favored locations, will supply most of this deficiency.

236. *Filberts.*—Until recently, the filbert has resisted all attempts to introduce its culture into the United States, climatic conditions, apparently, being the principal obstacle. The profusion of the wild hazelnut in western Oregon and Washington suggested the adaptability of this region to filberts, which are closely related to the hazelnuts. The experiments were so successful that the planting of filberts is now going on at a rapid pace. Soil requirements are similar to those of walnuts.

237. Production estimates are available only for Oregon and not earlier than 1929. As shown in table 17, the 1929 production was 200 tons. In 1930 it was estimated at 300 tons. Returns of as high as $250 per acre on a 6-year-old Oregon tract were reported in 1930. A regional cooperative association is marketing both walnuts and filberts, principally in the Eastern and Middle Western States.

238. Over the period 1926 to 1929, inclusive, the United States imported an annual average of over 8,500 tons of filberts, 35 percent of which were shelled. The quality is much inferior to that of the western Oregon and Washington product. Further expansion of acreage in selected localities has been recommended to supply this domestic market, in view of the fact that successful production elsewhere in the United States has not been reported.

239. *d. Small Fruits.*—This group includes strawberries, raspberries, loganberries, blackberries, gooseberries, currants, huckleberries, and cranberries. The bulk of these fruits are grown west of the Cascade Mountains, as shown by plate 25.[2] Most berries require the intensive, truck type of farming practice, a fertile soil, and a long, moist growing season, with little rain just at picking time. High yields are obtained in this area, particularly when the fertility and moisture content of the soil are supplemented by fertilization and irrigation.

240. Since 1919, the acreage devoted to small fruits in the Pacific Northwest has increased rapidly, as shown in table 18. This has been due largely to the stimulus of increased demand in the East for berries processed by the frozen-pack method. This method, developed in Oregon about 1911, and now practiced by most canners of this region, consists of packing the berries in barrels or smaller containers, with or without sugar or sirup, and then freezing quickly. Berries processed in this way may be kept for several months in cold storage, or shipped long distances under refrigeration without impairing their quality. Frozen packed berries are sold mostly to manufacturers of preserves and ice cream, hotels, restaurants, and the soda fountain trade.[13]

[2] Not printed.

[13] The Frozen-pack Method of Preserving Berries in the Pacific Northwest. U.S. Dept. of Agriculture, Tech. Bulletin No. 148. Jan. 1930.

TABLE 18.—*Small fruits and vegetables—Acreage, production, and value, Oregon, Washington, and Idaho, 1914, 1919, 1924, and 1929*

[Compiled from statistics reported by U.S. Department of Agriculture, U.S. Bureau of the Census, and by Oregon State College Agricultural Experiment Station]

Product	Year	Acreage	Production	Value
Strawberries	1914	(1)	(1)	(1)
	1919	6,368	11,031,386 qts.	[2] $2,909,000
	1924	[3] 7,580	12,916,000 qts.[3]	[3] 1,595,000
	1929	[3] 18,400	27,983,000 qts.[3]	[3] 3,206,000
Other berries [4]	1914	(1)	(1)	(1)
	1919	10,769	25,937,389 qts.	(1)
	1924	[3] 21,272	(1)	(1)
	1929	[3] 18,537	(1)	(1)
Truck crops [5]	1914	(1)	(1)	(1)
	1919	6,871	(1)	2,170,000
	1924	23,650	(1)	5,011,000
	1929	34,180	(1)	5,492,000

[1] No data available.
[2] Computed by multiplying production by unit price as shown in Year Book of Agriculture, 1925, p. 887.
[3] Data for Oregon and Washington only. Idaho data not separately reported.
[4] Includes raspberries, blackberries, loganberries, gooseberries, currants, cranberries, and huckleberries.
[5] Not including strawberries, potatoes, or dried beans.

Other producing regions are entering the frozen-pack field only to a limited extent. Their comparative nearness to markets has, so far, enabled them to get better prices for the fresh than for the frozen berries.

241. The canning of berries in the Pacific Northwest has shown a steady increase. In 1927 this region produced 74 percent, by value, of the national pack of canned berries, other than blueberries, whereas in 1909 it produced only 7 percent. In 1929 the ports of Oregon and Washington shipped 91 percent of the Nation's exports of canned berries, mostly to Canada.

242. Fresh shipments from this region have so far been relatively small and have consisted mainly of strawberries. However, they have widespread distribution in eastern markets, with some foreign shipments, particularly into Canada. Airplane shipments (par. 232) offer a possible expansion of markets for the fresh berries.

243. *Strawberries.*— Several varieties of strawberries are grown, but standardization is on selected varieties, some of which are especially adapted to freezing and others to canning. The total acreage in strawberries is about equal to that of all other berries combined, as shown in table 18. Strawberries have met with moderate success in fresh shipments and still more in canning, but have been particularly successful in the frozen form. Over twice as many are frozen as are canned. They now make up about two thirds of this region's pack of frozen berries of all kinds, while representing about 85 percent of the national pack of frozen strawberries. A conservative expansion of strawberry acreage in favored districts of the Pacific Northwest has been advised.

244. *Other berries.*—Next to strawberries, the most important small fruits in this region are raspberries, with about one fifth of the total small-fruit acreage. Both red and black raspberries are grown, but the red variety predominates. About equal amounts are canned and frozen, while fresh shipments are small. Acreage has been expanding steadily.

245. Loganberry production is confined principally to the Willamette Valley. In recent years the demand for this berry has fallen off because its naturally tart flavor is unpleasantly emphasized by the necessity of processing before completely ripe. The trend of acreage is stationary.

246. Blackberry acreage is chiefly in Washington, where yields are higher than in Oregon. Also, the abundances of wild blackberries in Oregon offers serious competition to the cultivated variety. Most of the blackberry crop is canned, being especially favored by bakers as an inexpensive pie filling.

247. Gooseberries, currants, and huckleberries are produced to a limited extent but are not commercially important. Production of cranberries, grown in the lowlands near the mouth of Columbia River, showed a steady increase until 1929. In that year and in 1930 production was greatly curtailed, due to lateness of the usual fall rains. For 1931 there is expansion of acreage.

248. *e. Vegetables.*—Arranged in order of value in 1930, this group includes onions, lettuce, green peas, celery, cauliflower, cantaloups, tomatoes, watermelons, turnips and rutabagas, spinach, asparagus, cabbage, carrots, and cucumbers. It also includes sweet corn, snap beans, beets, and pumpkins, but no estimates of their production in the three States are available. The acreage and value of all truck crops is shown in table 18.

249. Plate 26[2] locates the areas producing these vegetables. Besides the usual concentration near cities, there are shown several relatively isolated sections which have become important because especially favored from the standpoint of climate, soil, and topography. Outstanding among them are Yakima and Walla Walla Counties in Washington, which grow a wide variety of vegetables on irrigated lands. Onions in Walla Walla County are earlier than any others in the Pacific Northwest, and account for about one fourth of the total onion production in the three States. Lettuce is also important in Washington, while celery is an important crop in Oregon. Idaho has only a few areas producing a limited variety of vegetables, aside from those listed as field crops in paragraph 178, mostly onions, green peas, celery, and lettuce. Southwestern Oregon cans a large proportion of its vegetable crop, but also makes fresh shipments, especially to California markets.

250. Fresh shipments of vegetables from the Pacific Northwest is increasing, especially to eastern markets. The total car-lot movement of fresh vegetables from Oregon, Washington, and Idaho, for 1930, was 10,791 cars, including boat shipments reduced to car-lot equivalents. Apparently considerably more than half of this movement was to the States east of the Rockies, while the Pacific Coast States, Canada, and the Philippines took most of the balance. Onions, lettuce, green peas, celery, and cauliflower, accounted for over 74 percent of the total car-lot movement in 1930.

251. The canning of vegetables is increasing in importance, especially west of the Cascade Mountains, where canneries originally specializing in fruit have found that vegetables could be handled between fruit seasons, thus maintaining a steadier production. The most important canned vegetable is the pumpkin, particularly a new variety which originated here and has drawn national recognition because of its superior canning qualities.

[2] Not printed.

252. Pumpkins, string beans, beets, corn, carrots, tomatoes, and peas, accounted for 90 percent, by weight, of the 1930 pack of canned vegetables in Oregon, Washington, and Idaho. Here again, the Eastern States are important markets, while less than 10 percent goes into foreign trade, mostly to Canada.

253. *f. Livestock and livestock products—Dairying.*—Steady expansion of the dairy industry of the Pacific Northwest is evidenced in table 19. This growth has offset the decrease in beef cattle and horses, and has thus maintained production of the feed crops.

254. Plate 27 [2] shows the principal producing areas in Oregon, Washington, and Idaho. Concentration near the cities represents the areas marketing whole milk, the dairy product of highest value. Areas along the coast, favored by nearly 11 months of abundant pasture, produce cheese and butter. In the humid valleys west of the Cascades, but at some distance from urban centers, condensed milk and butter are produced. East of the Cascades there are irrigated areas with convenient pasture which produce butter, principally for the California trade. Other interior regions capitalize cheap milk and pasture by raising heifer calves secured from other dairying districts. This is done frequently under contract and also in their own interests for the purpose of enlarging or improving their own herds. These calves are from high-producing cows and bring a premium when matured. They are either retained or shipped to dairying centers often as far distant as California.

255. The importance of irrigation is becoming more and more apparent in the humid, as well as the semiarid regions, and applies fully as much to dairying as to general agricultural production (par. 196).

256. Eastern dairying methods have been gradually modified to fit conditions in this region. Comparatively little close housing, necessary in colder climates, is required here. Such shelter as is necessary is built at low cost, due to the supply of cheap lumber. As elsewhere, the financial position of producers is being strengthened by testing associations, eliminating unprofitable cows, and generally improving the breed. An increasing share of the manufacturing and marketing of dairy products is in the hands of cooperative associations. More efficient manufacturing has found wide uses for the various byproducts, the least valuable going into poultry feed.

[2] Not printed.

TABLE 19.—*Livestock and livestock products—Quantity and value, Oregon, Washington, and Idaho, 1914, 1919, 1924, and 1929*

[Compiled from statistics reported by U.S. Department of Agriculture and U.S. Bureau of the Census]

Livestock	Year	Quantity			Value		
		On farms at end of year indicated (number)	For slaughter (pounds, live weight)	Other products	On farms at end of year indicated	For slaughter	Other products
Milk cows	1914	[1] 583,000		*Milk—pounds* (2)	[1] $40,697,000		*Milk* (2)
	1919	563,000		2,144,924,547	48,190,000		$53,337,286
	1924	669,000		3,211,000,000	39,960,000		60,622,000
	1929	708,000		[3] 3,768,000,000	60,252,000		77,431,000
Beef cattle [4]	1914	[1] 1,097,000	(2)		[1] 41,605,000	(2)	
	1919	1,656,000	(2)		71,962,000	(2)	
	1924	1,363,000	427,635,000		33,296,000	$24,848,000	
	1929	1,198,000	403,245,000		50,462,000	36,827,000	
Sheep	1914	6,150,000	(2)	*Wool—pounds* (2)	28,448,000	(2)	*Wool* (2)
	1919	6,161,000	(2)	32,620,912	66,023,000	(2)	16,092,087
	1924	4,852,000	222,652,000	34,655,000	51,269,000	20,030,000	12,532,000
	1929	5,493,000	237,600,000	41,232,000	51,670,000	23,859,000	[5] 12,370,000
Goats	1914	(2)	(2)	*Mohair—pounds.* (2)	(2)	(2)	*Mohair* (2)
	1919	142,030	(2)	380,675	678,567	(2)	211,378
	1921	[6] 101,000	(2)	414,000	(2)	(2)	265,000
	1929	[6] 120,000	(2)	468,000	(2)	(2)	220,000
Hogs	1914	1,015,000	(2)		10,330,000	(2)	
	1919	792,000	(2)		16,261,000	(2)	
	1924	746,000	211,705,000		8,439,000	16,279,000	
	1929	632,000	173,540,000		7,572,000	17,325,000	
Horses and mules	1914	887,000			82,432,000		
	1919	875,000			74,776,000		
	1924	756,000			44,336,000		
	1929	598,000			35,329,000		
Chickens	1914	(2)	*Number* (2)	*Eggs—number* (2)	(2)	(2)	*Eggs* (2)
	1919	7,702,498	8,053,903	496,844,400	(2)	(7)	[8] 24,862,304
	1924	10,993,000	14,281,000	970,000,000	8,498,000	8,122,000	21,198,000
	1929	14,480,000	18,527,000	1,439,000,000	13,936,000	12,683,000	36,366,000
Bees	1914	*Number of hives* (2)		*Honey and wax—pounds* (2)	(2)		*Honey and wax* (2)
	1919	137,970		3,778,510	898,083		997,592
	1924	(2)		5,230,000	(2)		781,000
	1929	(2)		(2)	(2)		(2)

[1] Not comparable with later figures.
[2] No data available.
[3] Idaho data estimated on basis of 1928 production per cow.
[4] Also includes breeding and young dairy stock.
[5] Estimated, using farm value, Oregon, as basis.
[6] Goats clipped only, Oregon data only.
[7] Included with eggs, value.
[8] Includes both chickens for slaughter and eggs.

257. The surplus butter and cheese of Oregon, Washington, and Idaho, share, with production of other States west of Rocky Mountains, the market afforded by the growing cities in California. Most of the condensed milk is exported, principally to the Orient, while a beginning has been made in shipments of other dairy products to the Hawaiian Islands.

258. *Beef cattle.*—The beef-cattle industry of the Pacific Northwest exists because of the availability of cheap range land for summer grazing, together with the fact that there are numerous hay-producing

areas, irrigated or otherwise, on or near which the cattle are wintered. Pasture, if available, on or near the farm or ranch, is used during spring and fall months, and in most localities during mild winter weather.

259. Plate 28 [2] shows the wide distribution of beef cattle (deducting milch cows from all cattle) in Oregon, Washington, and Idaho. It is seen that beef production is more important east of the Cascades, and particularly where there is alfalfa produced under irrigation.

260. In the past marketing of cattle was entirely by shipment direct from the range to Middle Western distributing and slaughtering centers, whence some were taken to farms of the Middle West to be wintered on corn. However, recent expansion of slaughtering and packing plants in the Pacific coast cities, especially in Portland, Oreg., has shifted the movement westward. This region now produces but little more than its requirements, the small surplus now moving about equally eastward and to the rapidly growing cities of California. Finished on alfalfa, cattle are now shipped directly to the market for slaughter, and in a steadier stream, as demanded.

261. The decline in the eastward movement of feeder cattle from the ranges is partly equalized by the growing of young beef cattle on middle-western farms, using land formerly devoted to producing feed for horses and mules, now replaced by mechanization of farm and transportation power. This trend is emphasized by the present market demand for 2- or 3-year-old cattle against the 4- and 5-year-old heavier beef formerly wanted.

262. The Pacific Northwestern sheep and beef cattle industries are carried on in the same general areas. There has been much shifting of attention between the two as conditions favored one or the other. Recently, however, the sheep industry has seemed the more attractive. Further reasons for declining beef production are seen in the interrelation of the dairy and beef industries, as disclosed by table 19. The increase in the number of dairy cattle from 1919 to 1929 amounted to 26 percent, while the decrease in beef cattle during the decade amounted to 27 percent. Meanwhile, sheep, too, have declined in number, but to the extent of only 11 percent.

263. Figures, then, bear out the observation that beef has lost ground to milk. Not only are more dairy cows being raised, but progressive improvement of dairy herds is throwing the culls upon the market as low-priced beef. Improved home-cooking methods, together with the ready sale for canned meats in a variety of forms, have reduced the premium for steer beef in regional urban centers. The decline in the per-capita consumption of beef, while evident for the Nation as a whole, is said to have been felt to a somewhat lesser degree in this region, and recently to have turned into a slight increase.

264. *Sheep.*—The trend of the sheep industry in the Pacific Northwest has been towards greater production of meat and smaller production of wool, as shown in table 19. Meat now yields about 65 percent and wool about 35 percent of the total income from sheep. Plate 29 [2] indicates the areas important in sheep raising.

265. The meat phase of the industry is founded on early lambing in sheds, and is located mostly in northeastern Oregon and southwestern Idaho. These lambs are cross-bred stock of a type responding to good care, good early range, and special feeding. Both ewe

[2] Not printed.

and wether lambs are sent to the Chicago market in late June and July. At this time the parent stock is shifted to more distant range. Breeding stock is replenished from nearby areas not suited to market lamb production. Sheep are winter fed mostly on alfalfa produced on irrigated tracts. Late lambs come from the more remote districts. They are born on the range and are marketed in the fall after special feeding.

266. On general farms, small flocks graze the fence rows, ditch banks and other waste lands. In the Willamette Valley long-wooled sheep, adapted to the mild, humid climate, are used to keep down brush in pasture. For discussion of wool, see paragraph 377.

267. *Goats.*—Angora goats are utilized in the rougher logged-off areas, particularly in the coast range, to keep down the brush which grows rapidly in the mild, moist climate. Oregon's production of mohair is shown in table 19. It ranks fourth among the States in number of goats, and in the quantity of mohair produced. Yield of mohair per animal, as well as the quality, is high. Very few goats are raised in Washington and Idaho. With the country on an import basis, recommended expansion of the industry, in view of the large browsing area available, has met with only fractional response. (See also par. 378.)

268. A few milk goats are kept on small, isolated and partly cleared valley farms, where, due to the shortage of cleared land, they are better adapted than cows. The milk is used on the farm or sold for use of invalids and children.

269. *Hogs.*—In this area hogs are used for cleaning up grain fields, for the utilization of surplus or damaged fruit crops and generally to save waste on the farms. Plate 30[2] shows hog raising to be general over the region. Good profits of a decade and a half ago caused rapid expansion on a commercial basis, but the ensuing slump in profits resulted in wholesale reduction of stock, as evidenced by table 19. West of the Cascades recovery has been restricted to a few districts where corn growing is expanding with the help of better varieties or supplemental irrigation. East of the Cascades the industry shows promise in irrigated sections with the proper character of farm, equipment, and systematization, particularly where corn is grown to finish, for market, the hogs raised on cheap grain and alfalfa. In some districts where barley is produced cheaply hog raising has been and is profitable.

270. There are, however, other considerations. The sheep and beef cattle industries, as carried on here, are distinctly western institutions, developed to fit their environment and adapting themselves to changing economic conditions. Dairying, at first patterned after eastern practice, has gradually utilized specially favorable conditions peculiar to this section. Pork production and marketing in the Pacific Northwest has so far failed, except under irrigation, to develop its own standard technique to fit the various combinations of topographic, climatic, and economic conditions found in this area. Production in the Pacific Northwest is below consumption by probably 20 to 25 percent. With prices in regional markets above those prevailing in Chicago the shortage in pork is supplied by live hogs and pork products from east of the Rocky Mountains.

[2] Not printed.

271. *Horses and mules.*—Horses and mules on the farms of Oregon, Washington, and Idaho, declined nearly one third in number and over one half in value from 1919 to 1929, as seen in table 19. Numbers and value in the United States also decreased. The mechanization of agriculture by means of tractors, trucks, and automobiles, which, together with motorization in cities, accounts for this decrease, is most noticeable in the open areas where large-scale farming has developed.

272. Since the percentage reduction in draft animals is the same for the Pacific Northwest as for the country as a whole, the consequent release of crop acreage, as of 1928, to other uses, may be taken from estimates of the United States Department of Agriculture as about 20 percent. Plate 31 [2] shows the geographical apportionment of horses and mules on farms as of 1920. There is some evidence that the number of these draft animals is again increasing. Should this trend become pronounced the effect of their feed requirements is obvious.

273. *Poultry.*—The Pacific Northwest is well adapted to poultry raising. Conditions favorable to egg production are indicated by an estimated annual average for 1929 of 103.1 eggs per hen for this region as against 71.4 for the United States. Rapid growth of the industry is indicated in table 19.

274. Plate 32 [2] shows the principal centers of activity to be the Willamette and Lower Columbia Valleys and the Puget Sound, Spokane, and Boise areas. The bulk of the industry is based on egg production by means of improved strains of the egg type of fowl, while meat production is relatively incidental. While some eggs come from general farms the larger portion is produced on farms specializing in eggs. Present tendencies, however, are towards smaller units of several specialities, giving better division of labor and reducing the hazards of specialization.

275. Mild weather permits early pullet eggs from this region to reach the New York market during the season of high prices. These eggs supplement rather than compete with those from eastern specialty farms as the latter do not reach a large volume until later in the season. General farms of the Middle West produce the bulk of the country's eggs as a side line with very low feed costs but with comparatively little attention to marketing. Gradually, however, flocks and output per hen are increasing and quality is receiving more attention. Continuation of this trend may materially decrease the market for eggs from the Pacific Northwest.

276. An important phase of the poultry industry is the sale of hatching eggs and baby chicks, often shipped long distances. Breeding stock of high producing strains developed in this region has served as foundation flocks in numerous foreign countries.

277. The raising of quality turkeys for the eastern holiday trade is a thriving industry in especially adapted areas, particularly east of the Cascades and in southern Idaho. Cooperation and improved marketing facilities both physical and commercial have reduced hazards as well as broadened and steadied the demand.

278. *Bees.*—The raising of bees for honey and wax is principally a side line, fitting in well where alfalfa or clover hay is grown (see plate 33).[2] Many fruit growers keep several hives of bees to aid in

[2] Not printed.

pollination. Those on irrigated tracts surrounded by land unable to support bees often import swarms for the blossoming season. Most of the honey is used on the farm or sold within the region.

2 FISHERIES

279. Next to agriculture and stock raising, and the wood-using industries, fishing is the most important industry in the Pacific Northwest, having a total value of catch in 1928 of $10,187,127. About 73 percent of this was represented by the salmon fisheries. There were 12,889 fishermen engaged in Pacific Northwest fisheries in 1928. In addition, the fish canning industry of Oregon and Washington reported value of products in 1929 amounting to $16,523,323, most of which was canned salmon.

280. There are five varieties of salmon taken in these waters: Chinook, also known as king or spring; red, sockeye or blueback; silver or coho; pink or humpback; and chum or keta. Steelhead trout are classed with salmon, and some are canned. The chinook is the largest of the salmon, averaging about 23 pounds and sometimes weighing as much as 84 pounds. It is the principal variety caught in the Columbia and Oregon Coast fisheries. The Columbia River chinook has a higher reputation for quality and sells for a higher price, when canned, than salmon of any other species or than chinook from any other region.

281. Salmon fishing is usually concentrated at or near the mouths of rivers up which the salmon go to their spawning grounds, but some commercial fishing is done on the Columbia as far up as the Cascades. The spawning run extends through most of the year, but is especially heavy from the middle of February to the middle of May and again in August. The quality of the spring run is considerably better than that of late summer or fall runs.

282. Salmon are caught from boats operating trolls, purse seines, or gill nets; or by seines, set gill nets, traps, or wheels along the shore. Oregon has prohibited the fish wheel, but several are still operated in Washington waters. In Oregon a recent law closing Rogue River to commercial fishing probably will force the closing of two canneries at its mouth.

283. Fish canneries are located as closely as possible to the scene of fishing operations. Tenders, operated by the cannery, gather the day's catch from the fishermen. The fish are immediately put through the various operations of cleaning, canning, and cooking. These operations are now conducted almost entirely by machine.

284. There are five salmon canning districts in Oregon and Washington. The following tabulation shows the average yearly pack in each of these districts for the 10-year intervals since 1900, and for the year 1930: [14]

District	Average 1900–09, cases [1]	Average 1910–19, cases [1]	Average 1920–29, cases [1]	Year 1930, cases [1]
Puget Sound	743,071	1,173,522	458,424	572,606
North Washington Coast	24,800	55,985	25,541	28,907
Willapa Harbor	20,734	14,289	11,123	6,684
Columbia River	344,455	477,536	458,760	429,505
Oregon Coast	74,557	90,917	35,533	12,233
Total Pacific Northwest	1,207,617	1,812,249	989,371	1,049,935

[1] Reduced to common basis of 48 one-pound cans per case.

[14] Compiled from tabulation in "Pacific Fisherman", 29th Statistical Number, Jan. 1931, p. 85.

285. The Columbia River and Puget Sound districts are now about equal in amount canned, whereas, prior to 1920, the latter was far in the lead. As the tabulation shows, this was due to a considerable decrease in the Puget Sound pack, the Columbia River pack remaining comparatively stationary. The year-to-year fluctuations are also very slight in the Columbia River as compared with the Puget Sound district. The latter has a more or less violent 2-year cycle caused by the cyclical spawning habits of the pink salmon, which is one of the principal varieties taken there.

286. The total salmon pack of 1,049,935 cases in the Pacific Northwest in 1930 comprised 17.4 percent of the United States total and 10 percent of the total salmon pack of the world. In 1930 Oregon and Washington shipped $3,975,907 worth of canned salmon to foreign markets, most of the balance going to the Eastern States.

287. Besides the canning of salmon there is also a considerable amount sold fresh, frozen, or mild cured. In 1930 Oregon and Washington froze 17,265,290 pounds of fish, of which salmon accounted for 7,141,860 pounds and steelhead trout 1,380,983 pounds, the balance being mostly halibut and sablefish. These States also reported over 4½ million pounds of salmon mild cured, practically all of which is exported to Europe.

288. The Columbia River district is also dominant among the Pacific coast shad fisheries. The shad is either canned or sold fresh or frozen. In 1930 this district canned 11,645 cases of this fish.

289. Halibut fishing is an important industry in the open sea, most of the catch being landed at Seattle, or at ports in Alaska or Canada. Seattle reports 12,671,470 pounds of fresh halibut landed in 1930 as against total landings at all Pacific coast ports of 50,466,632 pounds. Most of the halibut catch is sold fresh or frozen. In this connection it might be pointed out that Alaska, ranking above any State in value of fishery products, is dependent upon Washington and Oregon ports for most of its supplies and marketing facilities.

290. Other sea foods taken commercially in Oregon and Washington are sablefish, cod, rockfish, flounders, herring, smelt, perch, sturgeon, octopus, crabs, clams, and oysters. The spring run of smelt up the Columbia and its tributaries is the signal for excursions of thousands of families. Men and women line the banks, scooping up smelt with small nets and make-shifts of all kinds. No license is required, and the run is so dense that nets dipped at random come up partly filled with smelt. Local commercial significance is confined chiefly to the adverse effect on the general market for sea foods while this run is in progress. No diminution in the supply through the years is noticeable. Clams are taken at points along the coast. Over 50,000 cases of razor and hard-shell clams were canned in Oregon and Washington in 1930. The recent transplanting of Japanese oysters to beds along the Washington and Oregon coast has proved successful and is being expanded. There are now about 10 companies marketing these so-called "Pacific" oysters, the principal center being Willapa Bay, Wash. These beds were, at one time, heavy producers of domestic oysters but were so depleted and efforts at restocking with domestic seed were so unsuccessful that most of them were abandoned until the discovery of the adaptability of Japanese oysters. As yet, they are sold for fresh consumption only.

291. Fish meal and fish oils are by-products of the fishing industry. In 1930 the Puget Sound and Columbia River districts produced 1,446 tons of fish meal and 177,285 gallons of fish oils.

292. The artificial propagation of salmon and trout has been conducted by the State fish commissions of Oregon, Washington, and Idaho for many years. Fish hatcheries, located on important spawning streams, catch and spawn the adult fish and care for the eggs and young fish until they are large enough to be liberated. They are then set free in the more depleted streams. The assurance of adequate fish ladders around falls and dams and the prevention of dumping of industrial wastes in rivers are other important phases of the work of these commissions, in which they are assisted by the United States Bureau of Fisheries.

293. Of particular interest in this connection is the provision made for the care of salmon at the new 185-foot Ariel Dam built by the Northwestern Electric Co. on Lewis River, Wash. During the spring run a specially constructed elevator lifts the fish from the water at the foot of the dam, where they are loaded into tank trucks and hauled a short distance downstream to a new fish hatchery. The system is operated by the State at the expense of the developing concern, which also bore the entire cost of construction.

3. MINING AND MINERAL RESOURCES

294. The following paragraphs are a summary of the mineral resources and the state of their development in the areas included in the Snake River drainage basin and in that of the Columbia below the mouth of the Snake. Plate 34 [2] indicates the approximate location of the known deposits in these areas. Appendix B contains a more detailed description of the mineral resources. A general outline of the geology of the Columbia River Basin below the mouth of Snake River is contained in paragraphs 24 to 38, inclusive.

295. The different products will be referred to in the order listed in the following columns, which are the equivalent of those shown on plate 34.[2]

Metals		*Nonmetals*	
Gold	Manganese	Coal	Salt
Silver	Cobalt and nickel	Phosphate clay	Limestone
Lead	Tungsten	Diatomite	Granite
Zinc	Molybdenum	Asbestos	Cinders
Copper	Platinum	Mica	Gas and oil
Iron	Vanadium	Feldspar	Mineral water
Mercury	Beryllium	Slate	Sulphur
Antimony	Tin	Gypsum	Building stone
Arsenic	Black sands	Barite	Sand and gravel
Chromium		Nitrate	

296. *Gold, silver, copper, lead, zinc.*—Placer gold occurs in the gravels of both the present and the ancient channels of many of the tributaries of Columbia River. It has been mined in western Oregon in Lane and Linn Counties, along streams tributary to Willamette River, and in eastern Oregon, in Crook, Wheeler, and Grant Counties in the watershed of John Day River.

297. The placers in Lane County were never very productive because the gulches in which they occur have been largely cleaned

[2] Not printed.

out by glaciation. The output from Linn County is unknown but was probably small, a few men at intermittent times making wages. Near Howard in Crook County, a million dollars or more came from placers between 1873 and 1900, the only known ground remaining to be worked being very lean or deeply buried. The Spanish Gulch district in Wheeler County once produced 10 to 20 thousand dollars a year. Its output is now reduced to but a few hundred, the placers that can be reached by available water being nearly worked out. The placers of Grant County were originally enormously rich and are estimated variously to have yielded 10 to 15 million dollars in gold. One dredge now produces about $50,000 a year. There are other smaller hand and hydraulic placer operations. It seems a justifiable prediction that, barring the possible discovery of new and now unsuspected fields, within a relatively short time placer mining anywhere in the lower Columbia drainage will have declined to a state of little importance.

298. On the Snake River side of the Blue Mountain region of northeastern Oregon, placer mining has been important in several localities, the heaviest past production having come from Burnt and Power Rivers and tributaries in the southwesterly part of Baker County. Of the more than $50,000,000 of total gold production from the eastern slopes of the Blue Mountain Range, a very large proportion has come from placer mining, though the amount now produced annually from this source is small.

299. In central and southern Idaho many millions of dollars have come from placer mining. There is still a steady production of gold from this source mainly in Valley, Boise, Custer, and Lemhi Counties, and in less amount from a dozen other southern Idaho localities. Some undeveloped dredging ground is known, but the volume of future production will probably depend largely on the development of methods for recovery of fine or flour gold, much of which is lost by present methods.

300. Lode gold occurs usually in association with one or more of the metals—silver, copper, lead, and zinc. It has been mined in Lane and Linn Counties of western Oregon, and in Washington, Jefferson, Wheeler, and Grant Counties of eastern Oregon, the last the principal gold-producing county in this State. Prospecting has been done in the State of Washington, but there has been as yet only experimental production in the Cascades in Skamania and Lewis Counties. The Bohemia and the Blue River districts of Lane County, Oreg., have produced more than three fourths of a million dollars in gold, though there are no regularly active gold mines west of Cascade Range at present. The main producing localities within the lower Columbia drainage in eastern Oregon are the Alama, Canyon, Granite, Quartzburg, and Susanville districts in eastern Grant County. Mining is more active in the Granite districts. Statistics for the years 1903 to 1928, inclusive, give a production of approximately $2,220,000 for Grant County.

301. As in the case of placer gold, the Snake River slopes of the Blue Mountains in Oregon have a long record of production of these metals from several localities, mostly in Baker and Grant Counties. The total output of gold is probably more than $50,000,000. A few properties were active intermittently in 1930.

302. To list the localities in Idaho which are producing or potentially productive of lode gold along with one or more of the metals usually associated with it, would be to name at least two thirds of the counties whose drainage is tributary to Snake River. Many well-known mines are within this area, and large stretches of comparatively inaccessible mountainous country are but partially, or not at all, prospected. While metal production has dwindled in some localities, the real potentialities of the Snake River region as a whole are probably far from fully known.

303. Production statistics for 1929 show as follows for the counties in Idaho tributary to Snake River. The figures indicate the relative importance of the several metals in the different counties:

County	Number of producers	Approximate value of 1929 production in dollars				
		Gold	Silver	Lead	Zinc	Copper
Ada	3	$370	$3			
Blaine	23	6,700	108,000	$254,500	$375,600	$2,500
Boise	22	267,000	5,000	300		275
Butte	4	430	30,000	269,800		27
Clark	2		130	2,170		
Clearwater	4	940	5			
Custer	17	53,000	137,300	345,400	62,200	531,400
Elmore	2	700	15			
Gem	2	1,200	300	300		20
Idaho	12	45,800	1,700	40		21
Lemhi	23	8,000	8,400	50,000		169,000
Owyhee	10	24,900	4,300			7
Valley	5	4,800	4,700	5,000	9,200	1,200

304. *Iron.*—Deposits of bog iron ore of limited extent have been prospected in Columbia County, Oreg., and iron was made formerly from a similar ore on Willamette River south of Portland in Clackamas County. Though iron ores are known within the Snake River watershed, there has been no production, and they have been given little attention owing to location and economic conditions.

305. *Mercury.*—Cinnabar, the ore of mercury, is now being mined in Lewis County, Wash., and in Lane, Clackamas, and Crook Counties in Oregon. Worthy prospects occur also in the John Day Basin in Wheeler and Grant Counties, Oreg. From two mines in the Washington locality 1,397 flasks were produced in 1929, valued at about $171,000; and from five Oregon mines, 3,657 flasks worth about $446,600. There has been a small but not definitely known production in Clearwater, Valley and Custer Counties tributary to Snake River in Idaho. The Oregon and Washington deposits give promise of the development of additional and probably large bodies of quicksilver ore of sufficient high grade to be merchantable under present conditions.

306. *Antimony and Arsenic.*—Antimony and arsenic minerals occur to a minor extent associated with the sulphide ores in the mining districts of both eastern and western Oregon. In Idaho, however, bodies of antimony are being prospected, or mined, usually in conjunction with gold, lead, and silver, in Valley and Custer Counties, and occurrences of varying significance are known in Idaho, Owyhee, Blaine, Butte, Lemhi, and in Adams, Washington, Boise, Elmore, and Camas Counties. Arsenic ore is not mined as such, the metal being recovered largely as a byproduct in the smelters.

307. *Chromium.*—Within the area under consideration chromite in prospectively commercial quantities is known only in the region of metamorphic rocks adjacent to John Day River in Grant County, Oreg. Production in 1917 was about 3,700 tons and in 1918 about 13,600 tons. There has been none since the World War. The ore in sight in 1918 was estimated by the United States Geological Survey to be about 4,000 tons running 40 percent or more of Cr_2O_3 (chromic oxide) and 25,000 tons running 30 to 40 percent. Partially prospected reserves of considerable volume are believed to exist in this region.

308. *Manganese.*—No commercial manganese deposits have been opened up within the limits of the lower Columbia and Snake River drainage areas. Occurrences have been reported in Lane and Marion Counties, Oreg., and in Washington, Bannock, Owyhee, Butte, and Lemhi Counties in Idaho, none of which has been sufficiently prospected to determine its actual importance.

309. *Cobalt and nickel.*—Cobalt occurs in one mine in Grant County, Oreg., and nickel ore is reported in Lewis County, Wash. Prospects for one or both of these metals were developed and some cobalt produced during 1918 in Lemhi County, Idaho.

310. *Tungsten and molybdenum.*—Tungsten ores have yielded a small production in Camas and Lemhi Counties, Idaho, from deposits which give promise of developing into important sources of metal. There are minor occurrences also in Idaho and Butte Counties. Molybdenum minerals are known in Idaho, Elmore, Custer, and Lemhi Counties, from the last of which a few hundred pounds of molybdenite have been produced. There is prospect of future development of importance as economic and transportation conditions become favorable.

311. *Platinum.*—Platinum is known to occur in places in the black sands along the Oregon coast line, on some of the streams entering the Columbia in western Washington, and those that come from central Oregon. It is rarely present in sufficient amounts to justify mining for this metal alone. A small quantity is recovered each year with gold in placer workings. No authenticated occurrences or production of platinum in the Snake River region are on record.

312. *Vanadium.*—This metal is recognized in the analysis of some of the phosphate rock in southeastern Idaho. The future importance of this possible source of vanadium remains to be proven.

313. *Beryllium.*—Large crystals of the mineral beryl, which is the source of this metal, occur in some of the pegmatite veins of Latah County, Idaho, where it has been developed to a small extent. The development of practicable electrolytic methods of extraction promise to bring beryllium (glucinum) into use as a desirable hard alloy metal of light weight.

314. *Tin.*—In the area under consideration the oxide of tin, cassiterit ("stream tin"), has been found only along some of the streams in the Salmon River mountains of central Lemhi County, Idaho. It has attracted little attention to date and its source is not known.

315. *Black Sands.*—Black sands containing varying amounts of a number of common metal-bearing minerals occur rather widespread along ocean beaches adjacent to the mouth of the Columbia, and on many of the streams tributary to the Snake and the Columbia throughout their entire length. Some gold and a little platinum are produced

from them annually. Efforts have been made to work the sands for iron and for chromium, but they have not to date become an established commercial source of either of these metals.

316. *Coal.*- Coal deposits are known within the Columbia Basin below the mouth of the Snake only in Clackamas County, Oreg., and in Cowlitz and Lewis Counties, Wash., to the west of the Cascade Range, and in Grant, Morrow, Wasco, and Wheeler Counties in the John Day drainage basin in eastern Oregon.

317. Both lignite and bituminous coals have been prospected and mined in the Washington localities, and anthracite also occurs in the higher slopes of the range. The latter is undeveloped and inaccessible at the present time. The coal resources here are large. In the Kelso-Castle Rock district of Cowlitz County are many prospects, from some of which there has been a small production in the past. The coal is lignite in sandstones and shales and runs in seams up to 8 feet thick. Near Morton in Lewis County bituminous coal has been opened up, also in the vicinity of Centralia, from which there is intermittent production. Of the total annual coal output for the State of Washington of about two and one half million tons, some 3 percent comes from Lewis County.

318. The eastern Oregon coals are impure lignite and bituminous seams associated with nonmarine and in part volcanic Tertiary rocks. They have been worked in places in a small way for local use, but offer little promise for future development.

319. Subbituminous coal is reported as occurring in five Idaho counties within the Snake River Basin; namely, Washington, Fremont, Clark, Teton, and Bonneville. It has been mined to an important extent only in the Horseshoe area in Teton County, where it is estimated there are 11,000,000 tons more or less of available high-grade coal. There has been some production here in past years.

320. Lignite is reported from Clearwater, Idaho, Boise, Washington, Owyhee, Custer, Lemhi, and Cassia Counties. None has been developed, nor has a sufficient amount of prospecting been done to determine the probable commercial importance of many of the deposits.

321. *Phosphate.*—Within the region under consideration commercial phosphate rock occurs as intermittent or continuous beds in the Phosphoria formation of Permian age in Madison, Teton, Bonneville, Bingham, Bannock, Caribou, and Bear Lake Counties of southeastern Idaho, and in adjacent parts of Wyoming, Montana, and Utah. The estimated total available tonnage is 5,831,327,000 long tons, or 93½ percent of the total available in the United States. Probably a little less than 5,000,000,000 lie within the drainage of Snake River.[15]

322. There has been production from mines in Bear Lake and Bannock Counties, outside of the Snake River Basin, the main operation within the area being that of the Anaconda Copper Co. at Conda in Bannock County, where a 7- to 10-foot bed of high-grade rock is being worked by coal-mining methods. It is estimated that 700,000 tons have been produced to date in the district as a whole, and that within the limits of 10 townships east and north of the Anaconda workings are a total of 3,068,041,000 long tons of high-grade phosphate rock. Distance from markets has heretofore been

[15] Geography, Geology, and Mineral Resources of part of Southeastern Idaho, Mansfield, U.S.G.S Prof. Paper No. 152, p. 292.

the important factor unfavorable to the rapid development of these deposits. However, there is a growing demand for use as agricultural fertilizer, particularly in the North Central States. This is being met by means of acid phosphate in highly concentrated form, with consequent saving in handling and in freight charges.

323. *Clay.*—Ordinary red-burning clays are of quite general distribution. Buff- to white-burning refractory clays of medium grade are being developed to a moderate extent in Cowlitz and Lewis Counties, Wash., and in Yamhill, Clark, and Lane Counties in western Oregon. The supply is abundant. Adjacent to the granite areas high-grade residual clays exist in large quantities in Latah County, Idaho. They range from pure kaoline to deposits of plastic and nonplastic refractory clays that have been transported varying distances. The later occurs also in Clearwater, Idaho, Lewis, Washington, Payette, and Power Counties, where they have been used in places to meet the local demands.

324. The latest figures available show a production in Idaho in 1929 of 616 short tons of fire clay valued at about $7,500, and in Oregon, 1,019 tons of fire clay and 300 tons of stoneware clay having a total value of about $2,200. These numbers do not include manufactured products. The quantities available are such that expansion of clay mining and manufacture in both these States is regarded as possible to any desired extent necessary to meet market demands.

325. *Diatomite.*—Diatomite (diatomaceous earth) of good quality occurs in abundance and is being worked at Lower Bridge on Deschutes River in Deschutes County, Oreg., and at Harper in northern Malheur County. At the Lower Bridge site several thousand tons of high-quality earth are produced each year from an ancient lake-bed deposit estimated to contain 7,000,000 tons of commercial grade. There is a small mill at this place. Diatomite is milled also on a small scale from the Harper deposit, which consists of a series of indefinitely extensive beds covering an area of several square miles. Undeveloped deposits are reported in Wheeler, Wasco, and Grant Counties, and extensive beds that have been rather thoroughly prospected exist in northeastern Harney County.

326. In the State of Idaho are large diatomite deposits in Idaho, Washington, Payette, Owyhee, Elmore, and Cassia Counties. There has been a small production in Elmore County, used for filtration purposes in the Idaho sugar factories. The potentialities of the Idaho deposits are not known.

327. *Asbestos.*—Asbestos occurs in the area of serpentinic rocks that border the upper John Day River Valley in Wheeler and Grant Counties, Oreg., though there has been no production. There are prospects in Clearwater County, Idaho, where intermittent production has been had from a large deposit of the mass-fiber type of amphibole near Kamiah. Car-lot shipments have been made from this place at intervals since 1909, though the total production has been small. A large quantity of this type of asbestos is available in this locality.

328. *Mica.*—Mica occurs in pegmatite veins in Latah County, Idaho, where there has been a small production. Occurrences are reported also in Clearwater and in Adams Counties. A possible source of small-flake muscovite is the residual and transported granite clays that are widely distributed in this part of Idaho.

329. *Feldspar.*—This mineral is a normal constituent of granite rocks and in the coarse-textured pegmatite veins of Latah and Adams Counties, Idaho, may prove of commercial importance in connection with development of the mica and beryl deposits. There is no record of production to date.

330. *Slate.*—But one occurrence of possible commercial slate in this part of the Columbia drainage is on record, that on Currant Creek in Wasco County, Oreg. There is no information as to the extent of the deposit or physical characteristics of this rock.

331. *Gypsum.*—Gypsum is reported from Crook, Grant, and Wheeler Counties in central Oregon, but none of the known occurrences has perhaps other than a local value. Gypsum was formerly mined on Snake River in Baker County, the deposit being apparently not extensive and changing to anhydrite with depth. A small output from this mine was maintained for several years, but owing to the indefiniteness of the deposit it is now abandoned. In Idaho, bodies of gypsum are reported in Washington, Owyhee, and Lemhi Counties, which have received little attention owing to remoteness and lack of demand.

332. *Barite.*—Barite is one of the gangue minerals in the sulphide ores of the Bohemia district in Lane County, Oreg., where it is probably of no commercial value. Deposits of this mineral occur in Blaine County, Idaho, which in the 1929 report of the Idaho State mine inspector are referred to as some of the largest of high grade found west of the Mississippi River. These have not been developed because of location and market conditions.

333. *Nitrate.*—Occurrences of nitrate have been studied in Owyhee, Camas, and Caribou Counties, Idaho, and in Malheur and Harney Counties, Oreg., all within the Snake River drainage basin. They are generally associated with one or more of a number of other soluble salts, and none has yet proved to be of commercial importance.

334. *Salt.*—Salt deposits of economic importance exist in Caribou County, Idaho, and adjacent parts of Wyoming, where there has been production from brine springs for many years. The United States Geological Survey estimates 5,000,000 tons of rock salt on Crow Creek, and indications of the possibility of still larger amounts on nearby branches of this stream. There has been no production for several years. Common salt was formerly produced in small quantity from a series of springs in Multnomah County, Oreg., the waters of which contain also a number of other soluble minerals.

335. *Limestone.*—Within the lower Columbia drainage basin in Oregon, occurrences of limestone are known in Clackamas, Linn, and Polk Counties in the Willamette Valley west of the Cascades; and in Crook, Gilliam, Jefferson, Grant, Sherman, and Wheeler Counties in the central and eastern parts of the State. Only one large deposit, a tuffaceous limestone near Dallas in Polk County, is being used. A large tonnage is taken each year for the manufacture of portland cement. The others are generally small, impure, or remote and at present of slight commercial importance. Oregon's total limestone production for 1929 was 23,800 short tons valued at about $58,400, of which a large part probably came from deposits outside of the Columbia Basin. To this should be added $40,400 sold as burned lime.

336. Within the watershed of Snake River are important beds of crystalline limestone or marble in Baker County and in the Wallowa

Range in southern Wallowa County. The quantity of good stone here is unlimited. It is being used for the burning of lime and for portland cement manufacture the comparatively small output being included in the figure given above.

337. In Idaho, high-grade limestone deposits are being worked in Clearwater, Idaho, Boise, and Bannock Counties, and beds of travertine in Custer and Caribou Counties. Undeveloped bodies of limestone or marble, some of them of large size, are reported as occurring in Nez Perce, Lewis, Boise, and in Washington, Payette, Gem, Ada, Owyhee, Cassia, Blaine, Butte, Lemhi, Teton, and other eastern Idaho counties. On account of location the total annual production from this State is small. It amounted in 1929 to 29,820 short tons valued at about $70,000, most of this coming from the Snake River Basin counties.

338. Summarily, it may be said that limestone suitable for all purposes exists, widely distributed, within those parts of Idaho and Oregon in the watershed of Snake River. Those that occur within the lower Columbia drainage, both east of the Cascade Range and between it and the Pacific Ocean, are in general much less extensive and of poorer grade. They are, however, contiguous to the broad agricultural Willamette Valley, whose acid soils are in notorious need of correction. Future demand for fertilizer may lead to the production of agricultural lime.

339. *Granite.*—Granite suitable for all purposes exists in abundance in the batholithic regions of central Idaho and of the Blue Mountains in northeastern Oregon. Granite was formerly quarried near Haines in Baker County, but, due to its distance from present markets it is practically an undeveloped resource.

340. *Volcanic cinders.*—Cinder cones formed by volcanic eruption exist scatteringly throughout the lava-covered areas of both the lower Columbia and Snake River drainage. The main deposits exploited thus far are near Bend in Deschutes County, and within the limits of the city of Portland. These afford locally abundant supplies of good material for temporary surfacing and for making light-weight concrete.

341. *Gas and oil.*—Commercial supplies of oil and gas are not known to exist within the drainage area of the Columbia below the mouth of the Snake, though traces of natural gas occur in a few places. Some drilling has been done and is now under way in the lower Willamette Valley of western Oregon, and in the John Day region of eastern Oregon. The prevalence of volcanic rocks over large areas and their more or less general presence even in the separated regions of marine sedimentary rocks, have made the area as a whole less attractive from the oil and gas standpoint.

342. In Payette County, Idaho, and adjacent portions of Malheur County in Oregon, gas is found in the Payette formation which is prevailingly lake-bed sediments of Tertiary age. Drilling is being done in this formation with some hope of establishing the existence of oil or gas in commercial amounts. Drilling is being carried on also in older rocks in the southeastern part of Idaho which in composition and structure are regarded by some geologists as favorable for the possible existence of oil.

343. *Mineral water.*—Both thermal and cold mineral springs occur widely in the lower Columbia and Snake River drainage areas. Their

development for recreational and curative purposes in a few localities may grow in importance, as density of population increases.

344. *Sulphur.*—Sulphur is reported as occurring in Lewis and Yakima Counties, Wash., and in Caribou County in Idaho. The latter are spring deposits said to be extensive. Some attempt at development was made during the war.

345. *Building stone.*—Sandstone and volcanic tuff suitable for building purposes occur in many places in Oregon and Washington, also the usual varieties of andesitic and basaltic lavas. The sandstone and volcanic tuff have been quarried extensively in the past. In the Snake River region, in both Oregon and Idaho, are unlimited quantities of these same rocks, also limestone, marble, and granite, none of which under present conditions is being at all actively developed.

346. *Gravel and crushed stone.*—Good sand and gravel are of widespread occurrence along practically all larger streams in both the lower Columbia and Snake River areas, and particularly on those tributaries that originate in the regions of the harder lavas or granitic rocks. Basalt suitable for crushing purposes is equally widespread and accessible, as many hundreds of square miles are covered by this type of volcanic rock.

347. The total production of sand and gravel in Oregon in 1928 was about one and one half million dollars, probably two thirds of which was in the Willamette Valley. In this same year Oregon produced a total of over $2,000,000 of stone, most of which was crushed for concrete and road-building purposes. Idaho's total output of stone from 21 producers in 1929 is given as about $336,000. The exact proportion of crushed stone, and the amount from within the Snake River Basin are not known, though probably the bulk of the output was used here. About 716,000 tons of sand and gravel valued at $326,000 were sold in Idaho in 1929, a large part being doubtless used on roads and in construction in the settled area within the Snake River Basin.

4. MANUFACTURES

348. *Wood-using industries.*—The wood-using industries, taken together, comprise the second most important industry in the Pacific Northwest. In Washington 65 percent and Oregon 47 percent of the industrial population is directly dependent upon them for a livelihood. These industries alone furnish transcontinental railroads in the State of Washington with 60 percent of their freight, while in Oregon and Washington, taken together, they are credited with creating business amounting to approximately $350,000,000 annually.[16]

349. Wood-using industries are classified naturally as primary or secondary. The former group takes the standing tree or the log as its raw material, while the latter utilizes the products of the primary group in further manufacture.

350. *Lumber-producing and lumber-using industries.*—In the primary group, the dominant industry is logging and lumber production, the two functions generally being performed by the same concern. In the Pacific Northwest, this industry is conducted by many operators, large and small. The present method of taxing standing timber,

[16] Greeley, W. B., Problems of the West Coast Lumber Industry, and Winkenwerder, Hugh, Reforestation Problems in the Pacific Coast Region, addressed before Eighth Western Division Meeting, Chamber of Commerce of the United States, Portland, Oreg., Dec. 9, 1930.

the ever-present fire and disease hazards, together with the fact that much of the virgin timber is overripe, encourage operation at a loss rather than idleness at greater loss. As a result the market is periodically oversupplied.

351. Selective logging, the removal of timber of commercial size with as little injury as possible to the younger growth, has been adopted by some of the largest operators in the pine regions east of the Cascades. In the denser stands of douglas fir and hemlock, less progress has been made, though this principle of sustained yield has been recognized in Government contracts involving the sale of timber.

352. Lumber substitutes originated in depleted forest areas. They have spread rapidly in numerous lines until they now cut deeply into the national lumber market. Transportation costs further restrict the market for lower-grade lumber. However, milling-in-transit rates enjoyed by mills located near the lower Columbia River, enable them to bring lumber from distant points in western Oregon and Washington for further manufacture and reshipment at but little more than the through rate.

353. The following tabulation shows the amount of lumber cut in Oregon, Washington, and Idaho for the years indicated, in comparison with the totals for the United States:

Lumber production [1]

[Millions of feet, board measure]

State or group	1899	1909	1919	1929
Oregon	735	1,899	2,578	4,784
Washington	1,429	3,863	4,961	7,302
Idaho	65	646	765	1,029
Total, 3 States	2,229	6,408	8,304	13,115
United States	35,084	[2] 44,510	34,852	36,425
Percent, 3 States of United States	6.4	14.4	24.0	36.0

[1] Source: U.S. Department of Agriculture, Forest Service.
[2] Abnormally high year; 3-year average 1908-10 was 39.2 billion feet. Next high, 40 billion feet in 1910.

354. In the secondary wood-using industries lumber still is the dominant factor. Other than the building trades, the principal lumber-using industries and their wood requirements are shown in table 20. Percentages which these figures bear to the national requirements, both by species and by industries, are also shown.

355. Chief among these lumber-using industries are the planing mills, usually operated by or in conjunction with sawmills and therefore integral parts of the lumber industry itself.

356. Sash and door factories and millwork plants are generally distinct units. As a rule their products are made to order, but a few have standardized, notably on doors, and are shipping to world markets.

357. Box and crate factories are usually operated in conjunction with sawmills and under the same ownership. Those of southern Oregon ship their box shooks largely to California fruit packers. The other box factories in this region sell to the Pacific Northwest fruit trade, while some shooks are shipped East and others exported.

TABLE 20.—*Wood requirements of lumber-using industries, 1928, Oregon, Washington, and Idaho, combined thousand feet, board measure* [1] [2]

Industry	Cedar, western	Fir, Douglas	Firs, other than Douglas	Hemlock	Larch	Pine, western yellow	Pine, white	Spruce	Other native softwoods	Total native softwoods	Native hardwoods	Foreign woods	Grand total all woods	Percent of United States total
Boxes and crates	16,113	27,370	6,245	251,276	2,977	353,384	68,279	95,295		820,939	6,432		827,371	17.5
Car construction and repair	5	46,360			206	842	30	93	3	47,539	1,143	26	48,708	4.8
Caskets and coffins	5,069			1,367		60	64	1,968	150	8,678			8,678	5.6
Fixtures	10	667		841		39	44	4,797	27	6,425	2,371	155	8,951	6.9
Furniture	135	4,202		50		235	4	1,033	205	5,864	23,986	542	30,392	2.3
Planing-mill products [3]	86,424	1,075,366	9,942	149,835	8,735	183,469	94,098	59,986	200	1,668,055	217		1,668,272	33.0
Sash, doors, blinds, and general millwork	6,015	558,724	2,186	45,409	632	214,360	53,138	16,532	15	897,011	1,323	2,525	900,859	37.2
Ship and boat building	392	10,539		6		4	3	65	4	11,013	409	262	11,684	9.1
Woodenware and novelties	2,108	1,050		312		25		12,412		15,907	253		16,160	11.4
Other industries [4]	19,727	51,178		3,874		54,036	16,300	7,891	113	153,119	8,120	46	161,285	
Total	135,998	1,775,456	18,373	452,970	12,550	806,454	231,960	200,072	717	3,634,550	44,254	3,556	3,682,360	19.7
Percent of United States total	66.4	69.7	25.3	78.8	36.2	38.2	16.5	39.8		28.7	7.4	3.4	19.7	

[1] Source: Lumber Used in Manufacture, 1928, U.S. Department of Agriculture, Forest Service, and U.S. Department of Commerce, Bureau of the Census.

[2] Mostly lumber, but includes 2 other classes of primary material, used directly; bolts and logs, and veneer and plywood; quantities converted into board feet.

[3] Includes products worked to pattern, such as flooring, ceiling and siding, but excludes lumber merely dressed.

[4] Includes agricultural implements; airplanes; baskets and fruit packages; brooms and carpet sweepers; brushes; cane and umbrella sticks; chairs and chair stock; cigar and tobacco boxes; dairymen's, poulterers', and apiarists' supplies; dowels; electrical machinery and apparatus; elevators; fixtures (Idaho); furniture (Idaho); handles; laundry appliances machine construction; matches; motion-picture and theatrical scenery; musical instruments; patterns and flasks; picture frames and molding; pulleys and conveyors; pumps and wood pipe; refrigerators and kitchen cabinets; saddles and harness; signs and supplies; sporting and athletic goods; tanks and silos; toys; trunks and valises; vehicles, motor and non-motor; and whips.

358. Railroad car shops are important locally and use a large amount of lumber. Furniture factories have expanded rapidly in this region during the last few years. They make mostly a popular-priced article which is shipped to points in the Western States, particularly to California. Chairs and chair stock, while related to furniture, are usually made in separate establishments. Several factories making store and office fixtures are also operating for Pacific-coast markets. Some of the native hardwoods of the Pacific Northwest are used by the furniture, chair, and fixture factories. Other important lumber-using industries include ship and boat building and manufacture of matches, wooden pipes, tanks, and silos. (See note (3) of table 20.)

359. *Pulp and paper.*—The second most important of the primary wood-using industries of the Pacific Northwest is pulp and paper production. The mills are located principally along the lower Columbia and Willamette Rivers, and along Puget Sound. New districts at the mouths of coast streams are opening up and the industry, as a whole, is growing. Pulpwood consumption and wood-pulp production, as shown in the following tabulation, have increased much faster here than in the United States as a whole:

Pulpwood consumption and wood-pulp production in the Pacific States as compared with the United States [1]

	Pulpwood consumption (thousands of cords)			Wood-pulp production (thousands of tons)		
	1923	1929	Percent gain	1923	1929	Percent gain
Pacific States [2]	397	1,125	183	300	625	108
United States	5,873	7,500	28	4,525	6,150	36
Pacific States of United States (percent)	6.8	15.0	-------	6.6	10.2	-------

[1] Source: Pacific Pulp and Paper Industry (trade journal), Mar. 31, 1931.
[2] Oregon, Washington, and California. California's portion is relatively small, and is reported statistically with Oregon to avoid disclosing individual operations.

360. On the Pacific coast the wood most used in making pulp is hemlock, obtained either as logs or as sawmill waste. Sitka spruce, occurring only in dense stands along the coast, takes second place, while Douglas fir, the most abundant wood, has come into limited use as a result of much study and experiment. An attempt has been made to salvage pulpwood from the waste left on the ground after logging for lumber, but that process was found uneconomical. At present prices, logs bought in the open market are more attractive. Newer operations, in general, are in connection with, or convenient to, sawmills, cutting out only the best of the lumber, the residue going into pulp.

361. Some pulp is shipped to Eastern and North Central States where paper mills, representing large capital investments, have depleted their nearby forests and must bring in their raw material from distant sources. Paper-making necessitates continuous day-and-night operation and requires an uninterrupted supply of pulp. Uncertainties in this respect, together with obsolescence of equipment, have resulted in the migration of several companies to the Pacific coast.

362. In Washington and Oregon the paper pulp is further manufactured either by paper mills or by paper converting plants into wrapping paper, newsprint, bond, bags, boxes and cartons, waxed paper, labels, envelops, fruit wrapping tissues, and other products.

363. Newsprint, bond and wrapping paper, as well as a small amount of other products are shipped mostly to the Atlantic and Gulf coast cities and to California, with also some movement to foreign countries, mostly the Orient. In 1928 intercoastal shipments easterly were balanced by an approximately equal volume of the higher grades of paper shipped to this coast. Gradual shifting from newsprint and other ordinary grades to the more valuable forms of paper, is shown by the fact that the value per ton of paper produced in the Pacific Northwest increased 15 percent between 1925 and 1927, whereas the value per ton in the United States decreased 7 percent in the same period. Modernized and new plants with large installations of expensive up-to-date equipment indicate the permanence of the industry here.

364. The manufacture of insulating board from wood pulp is generally included with the paper industry. Douglas fir is chiefly used for this purpose, offering a much needed market for previously unmarketable watse of logging and lumbering operations. This is a young industry in the Pacific Northwest and no data are available regarding its volume.

365. Recent developments indicate the possible perfection of a method of manufacturing cellulose and rayon from Douglas-fir pulp and the probable establishment of a tannic-acid plant in this region to utilize the hemlock waste of pulp mills.

366. *Other primary wood-using industries.*—A large quantity of poles, piling, bolts, and logs are sold as such, part of which goes to the Orient. Ninety percent of the national production of shingles in 1925 came from Oregon and Washington.[17] These two States, together with Idaho, also supplied nearly 40 percent of the national production of laths. The thicker veneers and plywoods are being produced in increasing quantities in this region, notably for battery separators, airplane stock, auto floor boards, and boxes. Tight and slack cooperage is made for a national market. A few excelsior plants are operated principally in conjunction with furniture or mattress factories. Several wood-preserving plants are handling an increasing business, mostly in railroad crossties and mine timbers. Wood distillation is till relatively unimportant in this region.

367. *Wood fuels.*—The various types of wood fuels, including hogged fuel and sawdust are mostly byproducts of the lumber industry. In 1929 there were 4,289,000 units of hogged wood and sawdust used in the area west of the Cascades in Oregon and Washington. Two hundred cubic feet of hogged fuel constitute one unit, equal in heating value to about 2¼ barrels of fuel oil.

368. The low price of wood fuels in this region has undoubtedly influenced the prices of other fuels with benefit to local industry, while the low cost of heating of residences with sawdust, burned by means of special attachments in standard furnaces, has called on the lumber industry for an appreciable amount of this material formerly

[17] Gibbons, Wm. H., The Forests and the Wood-using Industries of Washington. Reprint from the West Coast Lumberman, Seattle, Wash.

burned at the mill as waste or sold at low prices for electrical generation.

369. *Resources.*—The continued operation of the wood-using industries depends largely on the permanence of the timber resources of this region. Table 21 shows the latest estimates of timber stand for Oregon, Washington, and Idaho. California, with 200 billion and Montana with 50 billion feet, added to the above, bring the total stand for the five States to approximately 1,000 billion feet, or more than one half of the remaining timber stand in the United States.[18]

370. At the present time about 25 percent of the lumber cut in the Pacific Northwest is consumed within the region, the balance entering domestic and foreign commerce. Review of the tabulation in paragraph 353 shows that this region is supplying an increasing percentage of the Nation's lumber cut. This trend will undoubtedly continue with the depletion of timber resources elsewhere in the country.

371. However, the same table also shows a decrease in the Nation's lumber production. This has been due largely to the fact that, during the past 20 years, the total lumber consumption of the United States has declined about one fifth, while, on a per capita basis, it has declined about one third.[19]

[18] Bib. cit., also Idaho Forest and Timber Handbook. Bul. No. 28, University of Idaho, School of Forestry. F. G. Miller et al., in cooperation with U.S. Forest Service, August 1927.
Montana Forest and Timber Handbook. Bul. No. 273, University of Montana. R. N. Cunningham et al., in cooperation with U.S. Forest Service, C. N. Whitney.

[19] Peavy, Geo. W., Oregon's Commercial Forest. Bul. No. 2, Oregon State Board of Forestry. January 1929.

TABLE 21.—*Estimated timber stands by species, Oregon, Washington, Idaho*

[Compiled from statistics reported by U.S. Department of Agriculture, Forest Service, and State publications]

State	Acres in thousands	Millions of board feet									
		Douglas fir	Yellow pine	Western hemlock	Idaho or western white pine	Noble silver, and Shasta fir	Sitka spruce	Western red cedar	Western larch	Others	Total
Oregon [1]	23,372	237,781	73,028	22,118	1,453	12,218	2,062	5,748	4,414	25,106	383,928
Washington [1]	15,724	121,294	12,639	56,182	225	21,457	7,976	31,322	3,098	8,482	262,675
Idaho [2]	9,583	(3)	16,539	(4)	13,534			(4)	[5] 23,027	28,210	81,310
Total	48,679	[3] 359,075	102,206	78,300	15,212	33,675	10,038	37,070	[5] 30,539	61,798	727,913
Percent of total		[3] 49.3	14.0	10.8	2.1	4.6	1.4	5.1	[5] 4.2	8.5	100.0

[1] Estimate as of Jan. 1, 1926.
[2] Estimate as of 1924.
[3] Douglas fir for Idaho included with western larch.
[4] Included with "Others."
[5] Including Douglas fir for Idaho.

372. A large share of this decrease has been caused by lumber substitutes, and their use has been influenced to some extent by the national sentiment against depletion of our forest resources. However, depletion has been due to wasteful logging practices and insufficient attention to reforestation and control of fire and disease, rather than due to excessive use of forest products. Furthermore, wasteful logging is encouraged rather than discouraged by restricted markets, while reforestation tends to lag when prices are unfavorable.

373. The Pacific Northwest has large resources of virgin timber, most of which are valuable species such as Douglas fir, but some of which are now overripe and deteriorating. Proper conservation of this resource, therefore, must be predicated upon the selective logging of mature timber coupled with protection of younger growth.

374. Compared with other sections of the country, reforestation encounters little difficulty, particularly west of the Cascades, where douglas fir and hemlock grow rapidly and generally reforest themselves naturally where a few seed trees are left standing and when fire and disease are kept out. A few of the larger private interests are operating under a well-organized program of reforestation, while fire prevention is fairly well organized and is aided by State laws. There are now large stands of second growth of all ages. Some of this, being favorably located, is now being cut. Federal and State holdings offer a further assured reserve, but are mostly in thinner stands in the higher and less accessible locations.

375. It is generally realized in this region that, after the privately owned virgin timber has been cut, probably about 30 years hence, the wood-using industries and communities supported by them will be dependent largely upon second-growth timber. However, it is also understood that both the forest resources and the industries can be perpetuated without great difficulty. Computations by the United State Forest Service have revealed that, provided reasonable forestry control is exercised, the potential timberlands of Oregon, Washington, and Idaho, should sustain an annual cut of about 15,650 million board feet, or over one and one half billion feet more than their lumber production in 1929.

376. *b. Other industries—Textiles.*—The textile industry of the Pacific Northwest is still small in comparison with the eastern industry. It is growing, however, and has foundations for further growth. Wool, mohair, and fiber flax are produced here, rayon is a possibility, and silk from the Orient is more readily obtained than in any other region of the United States.

377. As previously indicated (table 19, par. 253), over 40 million pounds of wool are produced annually in this region. About 90 percent is shipped to the East for manufacture. The remainder is used by the regional woolen industry to be made into yarns, and then principally into knitted wear, blankets, and robes, although a growing manufacture of men's and ladies' garments also exists. A considerable part of the yarn and woolen cloth used is still brought from the East, due to the small size and limited selection of local mills. The knitted wear supplies an increasing world market, while distribution of the other products is restricted to the Pacific Coast States.

378. Mohair,[20] of which nearly half a million pounds are produced

[20] The Angora Goat and Mohair Industry. Misc. Circ. No. 50, U.S. Dept. of Agriculture, U.S. Dept. of Commerce cooperating, March 1929.

annually in Oregon, is practically all shipped east. However, the rapid growth of furniture manufacturing in this region may soon bring about a diversion of some mohair for local manufacture of upholstery cloth, possibly using the cheaper grades of flax fiber for upholstery tow. The Federal Government, in cooperation with manufacturers, recently established standards for mohair cloth. Another recent development is the chemical treatment [21] of the cloth at time of manufacture, rendering it permanently immune against moths. (See also par. 267.)

379. About 1,000 tons of flax fiber are produced annually in Oregon, the quality and length ranking among the best in the world. Some has been exported to Ireland but the bulk is now used by small local plants in the manufacturing of coarser linen products, such as fishing nets, hop and sack twine, shoe thread, and toweling. No attempt has been made as yet to produce the finer linens. (See also par. 204.)

380. Experiments on the use of Douglas-fir pulp in the manufacture of rayon are being conducted. Such an industry would be of great value to the lumber industry by providing a market for wood waste.

381. Textile manufacturers claim that the climatic and atmospheric conditions of western Oregon and Washington are highly favorable for the working of textiles. Present manufacturers have no difficulty in maintaining, at reasonable wages, a satisfied force made up of intelligent and efficient native labor. The principal drawbacks are the remoteness from large markets and the lack of related industries. Probably the development of an important textile industry will be predicated largely upon the growth of population in the Western States and upon the expansion of foreign trade in specialties.

382. *Foundries and machine shops.*—This industry has an important role in the Pacific Northwest, particularly in supplying the needs of the wood-using industries for machinery and replacement parts. Large-scale logging and sawmill operations demand heavy, special machinery, and quick deliveries. The same is even more true of the pulp and paper industry. As a result, foundry and machine-shop products are largely made to order. However, a strong tendency is shown to standardize products for volume production, and several such products of this region are being shipped to world markets.

383. The reason that this can be done in a region almost totally lacking in iron ore and in coal suitable for coke, is that the foreign trade of the Pacific States is largely one of exports as far as volume is concerned, and, therefore, such materials may be imported cheaply as ballast. Practically all of this section's coke is obtained in this way and a portion of its pig iron. The bulk of the pig iron now comes from mines in Utah, its low price being set largely by that of the foreign iron.

384. *Miscellaneous industries.*—Other branches of the metal-product industries which are well represented in the Pacific Northwest are copper, tin, and sheet iron; stoves, ranges, and warm-air furnaces; and structural and ornamental iron and steel work.

385. A few portland cement plants are in operation but find strong competition from California and foreign cement. Concrete products, including pipe for drainage and irrigation work, are made by several concerns. Brick and tile works are locally important, but their market is restricted by the low price of lumber.

[21] "Angora Journal", June 1931 and July 1931, Portland, Oreg.