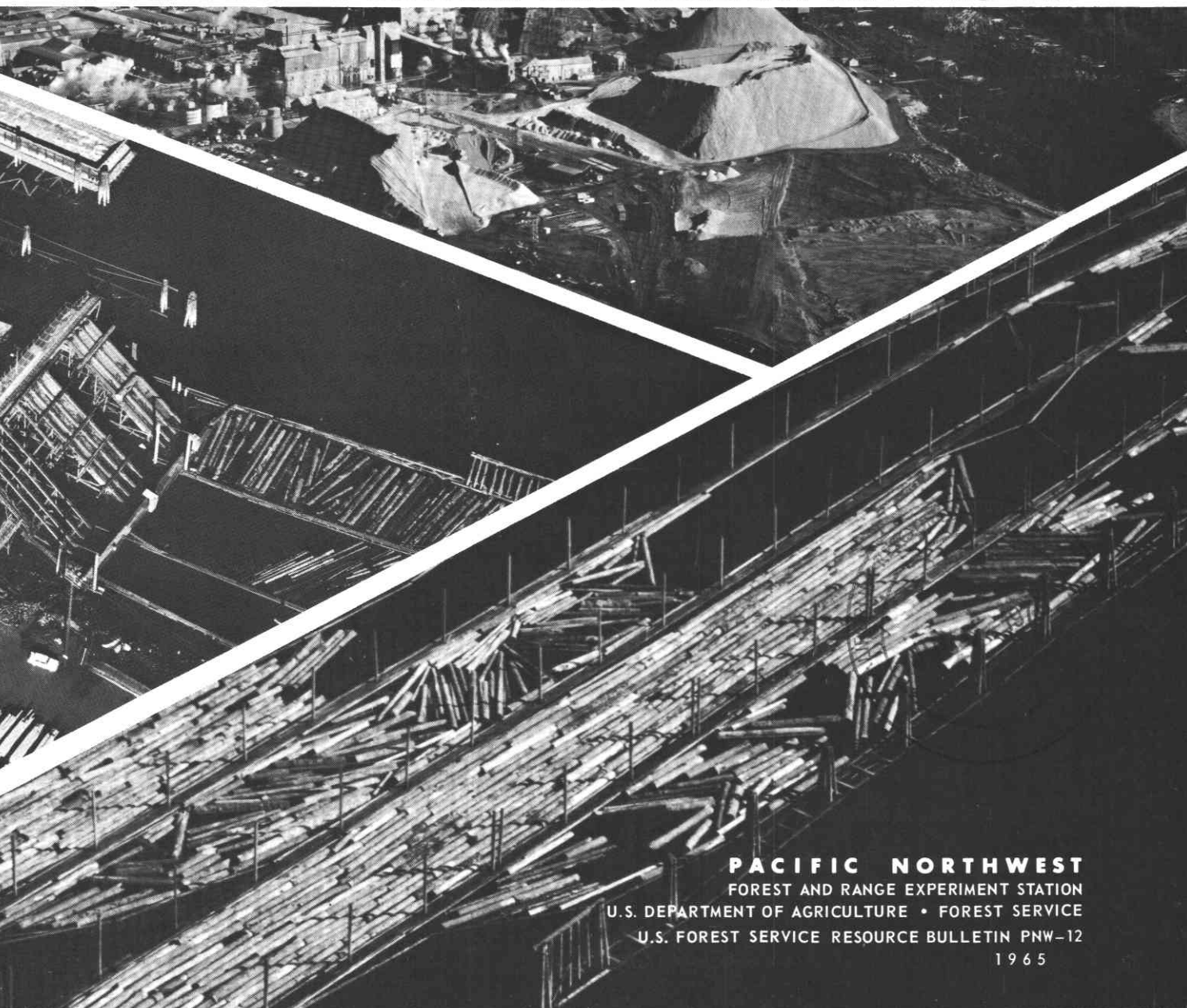


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The TIMBER SITUATION and OUTLOOK for Northwest Oregon

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This report was originally prepared for the Area Redevelopment Administration under the title "Forest Resources and Forest Industries of Northwest Oregon," with funds provided by that agency. Its purpose was to provide a basis for consideration of the possibilities of increased development of the forest industries as a part of a general study of ways and means to increase overall employment in the area and, particularly, in Columbia, Clatsop, Hood River, and Yamhill Counties. The resource data used are those contained in "Forest Statistics for Northwest Oregon," U.S. Forest Service Resource Bulletin PNW-7, 1964. This report, however, contains additional information on the forest products industry and additional interpretations and analysis of the industry, the resource, and their interrelationship.

Because the forest products industry is important to the economy of northwestern Oregon, this report will be of interest to many people throughout the Pacific Northwest. Therefore, it is being made available, with the approval of the Area Redevelopment Administration, through the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

CONTENTS

	<i>Page</i>
INTRODUCTION	1
TRANSPORTATION	4
LABOR FORCE	6
Clatsop County	7
Columbia County	7
Yamhill County	7
Hood River County	8
FOREST RESOURCE	9
Forest Land	10
Ownership of Forest Land	10
Condition of Forest Lands	11
Timber Volume	12
Timber Harvest	14
Forest Management	18
FOREST INDUSTRIES IN NORTHWEST OREGON	20
Sawmills	20
Planing Mills	22
Plywood and Veneer Plants	22
Pulp and Paper Mills	22
Wood Composition Board Plants	22
Shake and Shingle Mills	23

	<i>Page</i>
Posts, Poles, and Piling	23
Forest Industry and Raw Product Utilization	23
Forest Products Residues Developed in Northwest Oregon	23
Present Residue Use in Northwest Oregon	28
Forest Industry Capacity and Raw Material Consumed	29
OUTDOOR RECREATION IN NORTHWEST OREGON	31
INDUSTRIAL OPPORTUNITIES	33
Lumber Manufacture	35
Plywood Manufacture	38
Wood-Fiber Industries — Pulp, Paper, and Wood Composition Board	39
Poles and Piling	40
Secondary Wood-Using Industries	41
Christmas Tree Culture and Marketing	41
Recreation and Tourism	42
OUTLOOK FOR FOREST INDUSTRIES OF NORTHWEST OREGON	43
Raw Material Supply for Timber Industries	44
Transportation and Markets	47
Lumber	48
Plywood	50
Hardboard	50
Pulp and Paper	50
Logs	51
SUMMARY	52
CONCLUSIONS	54
LITERATURE CITED	55

LIST OF TABLES

	<i>Page</i>
1. Area by land classes, northwest Oregon, 1963	10
2. Area of commercial forest land, by county group and ownership class, northwest Oregon, 1963	10
3. Area of commercial forest land in northwest Oregon, by ownership class and stand-size class, 1963	11
4. Area of commercial forest land by forest type and ownership classes, northwest Oregon, 1963	12
5. Volume of sawtimber on commercial forest land, by species and species group and by county and county group, northwest Oregon, 1963	12
6. Volume of growing stock and sawtimber on commercial forest land, by diameter classes and species, northwest Oregon, 1963	13
7. Volume of sawtimber on commercial forest land, by ownership class and county group, northwest Oregon, 1963	14
8. Volume of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, northwest Oregon, 1963	14

	<i>Page</i>
9. Timber harvest, by county group and ownership class, northwest Oregon, 1960-62 (Scribner)	15
10. Periodic average annual growth, by growing stock and sawtimber on commercial forest land and by species group, northwest Oregon, 1952-61.....	16
11. Lumber production in northwest Oregon, by mill-size class and degree of manufacture, 1962	21
12. Equipment in northwest Oregon sawmills, by capacity class, 1962	22
13. Capacity and consumption of sawmills in northwest Oregon, 1962	24
14. Consumption of forest products industries, other than sawmills, in northwest Oregon, 1962	24
15. Sawmill location by capacity class in northwest Oregon, 1962	25
16. Total residue developed in northwest Oregon, 1962	25
17. Coarse residue developed in selected counties and all northwest Oregon, by species and type of plant, 1962	26
18. Shavings developed in selected counties and all northwest Oregon, by species and type of plant, 1962	27
19. Production and disposition of mill residue by sawmill capacity class and type of mill, northwest Oregon, 1962	28
20. Distribution of lumber rail shipments in United States from western Oregon and western Washington, 1962	49

INTRODUCTION

The 10 counties in northwest Oregon have a combined land area of 5.6 million acres, or about 8,760 square miles. These include Clatsop, Columbia, Tillamook, Washington, Multnomah, Hood River, Yamhill, Clackamas, Polk, and Marion Counties. Of this total, 4.0 million acres are commercial forest land and 1.6 million acres are nonforest land. In 1959, 1.7 million acres in northwest Oregon were in farms (U.S. Bureau of the Census 1961).¹ This total included 960,000 acres

of cropland, of which 691,000 acres were harvested; the remainder was either in pasture or fallow. Woodland on farms totaled 507,000 acres, more than half of which was pastured.

Northwest Oregon includes the largest metropolitan area in Oregon, with Portland as the hub. This area is the banking, trade, and manufacturing center of the State. Northwest Oregon had a population of 1,768,687 in 1960. Well over a third lived in Portland and suburbs, not including Vancouver, Wash., a city of nearly 100,000 people, immediately across the Columbia River and considered part of the Portland metropolitan area.

¹Names and dates in parentheses refer to Literature Cited, p. 55.

The rich forest resources and inland waterways giving access to ocean traffic were major factors in the economic growth of this area. For a century or more, lumber manufacture has been an important activity in northwest Oregon. More recently, pulp and paper, plywood, and other timber manufacturing industries have developed sizably. This has resulted in the formation and growth of an integrated manufacturing complex in this area centering on Portland. The Columbia River and its tributary, the Willamette, open the area's ports to world traffic and provide access to the interior of Oregon and Washington and their forest resources.

Northwest Oregon is divided geographically into three parts: the Coast Ranges, the Willamette Valley, and the foothills and mountains of the Cascade Range.

The Coast Ranges are a series of low, gently folded mountains forming long narrow ridges and valleys, the axes of which parallel the coast. The greatest relief is found near the coast, for as this range extends inland, it gradually drops into foothills which border the Willamette Valley basin. The elevation of these mountains usually ranges from 1,000 to 3,000 feet above sea level. The highest point is Saddle Mountain in Clatsop County with an elevation of 3,283 feet.

Within the Coast Ranges of northwest Oregon lie all of Clatsop, Columbia, and Tillamook Counties, and parts of Multnomah, Polk, Washington, and Yamhill Counties.

This portion of northwest Oregon has a mild mediterranean climate with cool, rainy winters and dry summers. Because of the rough topography, the rainfall varies widely with local terrain. The average annual rainfall in the Coast Ranges is 78.09 inches, but the extremes range from 130 inches annually at Glenora in Tillamook County to less than 40 inches annually in the rain shadow on the east slopes of the ranges.

The little agriculture that is practiced in this section is limited to the mountain valley floors, the river flood plains, and narrow coastal plains. Less than 6 percent of the total land area is classified as cropland, and more than 50 percent of that cropland is being used for pasture.

Approximately 88 percent of the land in this part of northwest Oregon is commercial forest land. Hemlock, spruce, and cedar grow along the coast and, further inland, Douglas-fir forms pure stands. These forests are the chief natural resource, and timber harvesting and manufacture of wood products are major factors in the economy of the area.

The Willamette Valley is a broad lowland trough lying between the Coast and Cascade Ranges. It is essentially an alluvial plain produced from sedimentary deposits eroded from the surrounding mountains. This valley, which is drained by the Willamette River and its tributaries, is approximately 30 miles wide and 130 miles long. Six northwest Oregon counties lie partially within the Willamette Valley. These counties are Clackamas, Marion, Multnomah, Polk, Washington, and Yamhill.

The Willamette Valley has a temperate maritime climate with dry, moderately warm summers and wet, mild winters. The average annual precipitation is about 40 inches, most of which falls during the late fall and winter months. Less than 2 inches of precipitation occurs during the 3 summer months. The mean annual temperature is 52° F.; snow and below-zero weather are very seldom experienced, giving the valley 200 frost-free days a year.

Approximately 70 percent of that portion of northwest Oregon which is in the Willamette Valley is mainly devoted to agriculture. The income derived directly from agriculture in the Willamette Valley in 1959 was estimated to be \$98.5 million (U.S. Department of Agriculture 1962).

Sixty-three percent of this came from the sale of agricultural crops and the rest from the sale of livestock.

Although the Willamette Valley is primarily agricultural, it is dotted with farm woodlots and surrounded by the extensive forests of the Coast and Cascade Ranges. Consequently, the economy of the area is greatly influenced by logging and the manufacture of wood products. Many sawmills and other forest products industries are located within the valley, drawing their raw products from the surrounding forested ranges.

The Cascade Range divides the humid marine-type climate of western Oregon from the semiarid climate found to the east. Elevations in the Cascade Range ascend from 100 feet along the Columbia River to 11,245 feet at the summit of Mount Hood. This range in elevation produces almost every gradation of climate, from warm and moist on the lower reaches of the western slopes of the Cascades,

through perpetually glacial on the high summits, to hot and semiarid in the rain shadow of the eastern slopes. Mean annual precipitation is equally as variable, ranging from less than 20 inches on the eastern slopes to more than 100 inches in some places on the western slopes. Temperatures range from an average of 50° F. near the Willamette Valley to below freezing in the snowfields of Mount Hood.

Except for some cultivated fertile valleys, the economy of this portion of northwest Oregon is based upon the harvest of timber and manufacture of wood products. Vast tracts of Douglas-fir cover the western slopes of the Cascade Range between the elevations of 1,000 and 4,000 feet. These forests supply much of the timber needs of northwest Oregon.

In northwest Oregon, all of Hood River County and portions of Clackamas, Marion, and Multnomah Counties lie within the Cascade Range and its foothills.

TRANSPORTATION

In spite of exceedingly rough terrain in some parts of northwest Oregon, transportation facilities are excellent throughout the entire area. Portland, the second largest city in the Pacific Northwest, lies at the junction of two navigable rivers: the Willamette and the Columbia. All main railroad lines in northwest Oregon pass through or originate in Portland, and several major east-west and north-south highways pass through it (fig. 1). As a population center, Portland creates markets; as an industrial center, it manufactures goods and services for local consumption and export; and through its strategic location, it is the transportation hub of northwest Oregon.

Four major north-south highways transect northwest Oregon. Recently completed Interstate 5 passes through Portland and continues south through Salem and Albany to the California border. U.S. 99E and U.S. 99W flank the new Inter-

state Highway as it progresses south from Portland through the Willamette Valley. U.S. 101, Oregon's picturesque coastal highway, follows the ocean shore from the mouth of the Columbia River to the California border and beyond. Three major east-west highways link the principal points in northwest Oregon. From Hood River, Interstate 80 proceeds west as a limited access highway to Portland, where it becomes U.S. 30 and follows the Columbia River to its mouth at Astoria. U.S. 26 proceeds north from Madras, swinging northwest where it joins State Highway 35, and continues through Portland to U.S. 101 just south of the coast city of Seaside. The last major east-west highway, State Highway 22, proceeds north from U.S. 20 to the Santiam River Valley, follows the valley west to Salem, and from there proceeds to the coast where it meets U.S. 101 at Hebo.

An extensive network of railroad lines unites all major points in northwest Ore-

gon. Portland is the termination of the Union Pacific line, which follows the south bank of the Columbia River from the east. The Spokane, Portland & Seattle Railway, following the north bank of the Columbia from Pasco, Wash., crosses the river at Vancouver to Portland and follows the south bank of the river west to Astoria. Two lines of the Southern Pacific originate in Portland. The first proceeds west from Portland to Nehalem and from there south to Tillamook. The second follows the Willamette River Valley south from Salem and continues into California. Branches and spurs of these lines give rail service to McMinnville, Dallas, Silverton, and other smaller communities throughout northwest Oregon.

The Columbia and Willamette Rivers

give northwest Oregon and neighboring southwest Washington the only fresh-water ocean ports of the Pacific Northwest. Portland has excellent port facilities for ocean-going vessels, and navigation of shallow draft vessels is possible beyond Pasco on the Columbia River and up as far as Harrisburg on the Willamette; as new dam construction proceeds, new navigable water will result. The Columbia River freight traffic over the past years has been increasing. Forest and agricultural products are shipped downstream, and the vessels return with petroleum products and nonwood building materials, such as cement. Rafted logs comprise the greatest portion of the cargo being transported in the upper reaches of the Willamette River.

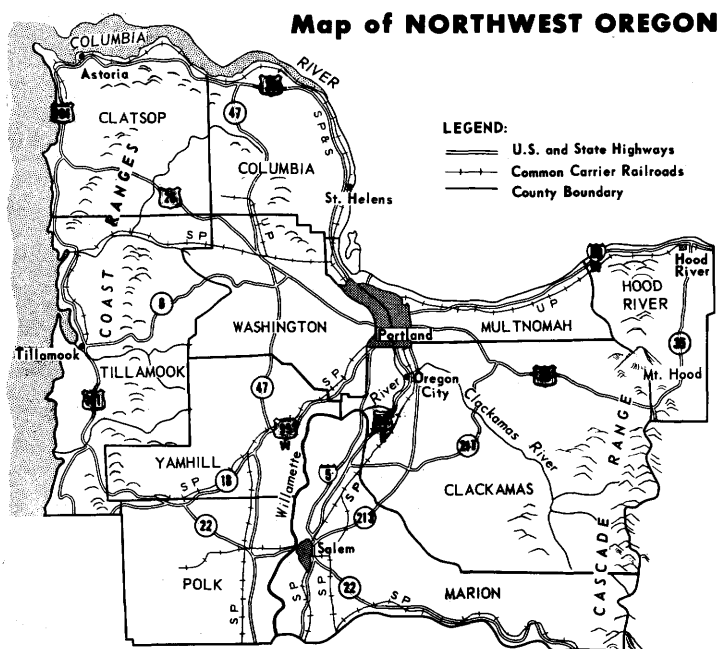


FIGURE 1. — Major political subdivisions and transportation routes in northwestern Oregon.

LABOR FORCE

Northwest Oregon has a labor force of 388,000, more than half of the State's 680,000 potential employees (U.S. Bureau of the Census 1962). The majority of this labor force is concentrated in or near the metropolitan area of Portland. Multnomah County has 214,000 potential workers, 55 percent of the labor force in northwest Oregon. Clackamas County, immediately south of Portland, has an additional labor force of 43,000, and Washington County, the boundary of which lies just 2 miles west of the City of Portland, has 34,000 able, willing workers.

Northwest Oregon plays a disproportionately large role in the State's agricultural and industrial endeavors because of its fertile land and strategic location.

Forty-eight percent of the State's manufacturing establishments are within northwest Oregon. These add 47 percent of the total value to manufactured products and pay 47 percent of the manufacturing wages earned in the State. Portland has an even larger share of the State's wholesale and retail trade. Fifty-four percent of the State's retail establishments are in northwest Oregon, making 58 percent of the State's retail sales and paying 61 percent of the State's total salaries to retail sales employees. Sixty-two percent of Oregon's wholesale establishments are in northwest Oregon. These establishments represent 79 percent of the State's wholesale trade and pay 79 percent of the salaries paid in the State to wholesale trade employees (U.S. Bureau of the Census 1962).

Despite the general prosperity of north-west Oregon, four of its counties have a high rate of chronic unemployment. These counties, Clatsop, Columbia, Hood River, and Yamhill, are of primary interest in this study.² It is significant that the economy of these counties is largely based on the harvest and processing of forest products.

CLATSOP COUNTY

Clatsop County is in the extreme north-west corner of Oregon and has a land area of 525,000 acres. It is bounded by the Pacific Ocean, the Columbia River, and Tillamook and Columbia Counties and lies entirely within the Coast Ranges. Astoria, the county seat, is the largest city. Due to rough terrain, agriculture is not a significant industry within the county. Although 55,000 acres of the county are classified as farmland, 29,500 acres are subclassified as woodland, of which 6,000 are pastured. Only 7,280 acres of this farmland yielded crops in 1959. Nearly 90 percent of the county's area, 465,000 acres, is classified as commercial forest land.

The population of Clatsop County in 1960 was 27,380, which is an 11-percent decrease from 1950 when the population was 30,776. The average annual labor force in 1962 was 9,150. The average annual employment was 8,450, which left 7.6 percent of the total labor force unemployed. This was an improvement over 1961 when 8.7 percent of the total labor force was unemployed. This improvement was the result of the out-migration of Clatsop County's workers. In 1962, there were 350 fewer jobs and 590 fewer persons in the labor force competing for the available employment, resulting in a net improvement in the unemployment percentage.

In 1962, of the 8,450 persons employed, 640 were engaged in agriculture; 2,500,

in manufacturing. Of those engaged in manufacturing, 1,320, or 53 percent, were employed in lumber or wood products firms. Thus, a large percentage of the employment and the county's economy is dependent upon forest products. Expansion of present firms or the development of new firms utilizing forest products would improve the economy of the county.

COLUMBIA COUNTY

Columbia County is bounded by the Columbia River and Clatsop, Multnomah, and Washington Counties. Except for narrow, alluvial plains along the Columbia River, this county is characteristic of the Coast Ranges. Columbia County has a land area of 413,000 acres, of which 25 percent is classified as farmland. One-fifth of the farmland is harvested cropland, half of which is grazed. Of the 413,000 acres in the county, 81 percent is commercial forest.

In 1960, Columbia County had a population of 22,379, an increase of 3 percent over the census of 1950. The average annual labor force of 1962 was 6,590. The average employment of that year was 6,180, leaving 6.2 percent of the labor force unemployed in 1962. This was an improvement over 1961 when 8.5 percent of the county's labor force was unemployed.

Of the 6,180 laborers employed in 1962, 5,020 were engaged in nonagricultural pursuits. Manufacturing employed 2,130; of these, 2,010 were employed by firms engaged in the manufacture of lumber, paper, and allied wood products. This is almost one-third the total employed working force of Columbia County. Thus, the prosperity of Columbia County is greatly influenced by the growth or decline of firms using forest products as a raw material.

YAMHILL COUNTY

About half of Yamhill County lies within the Coast Ranges and the remainder in the Willamette Valley. Its boundaries

²All labor figures for these counties were taken from tables published by Department of Employment, Research and Statistics, State of Oregon.

are Marion, Polk, Tillamook, and Washington Counties. The western half of the county, that in the Coast Ranges, has rolling foothills, becoming more mountainous toward the Tillamook border. The eastern half, lying within the Willamette Valley, is a relatively flat, fertile, alluvial plain, used primarily for production of agricultural crops. Of the 454,000 acres in Yamhill County, 57 percent is classified as farmland, a greater percentage of farmland than any other county in northwest Oregon. Of the 260,000 acres classified as farmland, 117,000 acres are cropland which produced a harvest in 1959. Only 83,000 acres of the land in farms is woodland, and more than two-thirds of this is pastured. Commercial forest land totals 258,000 acres in Yamhill County.

Yamhill County had a population in 1960 of 32,478, a decrease of 4 percent from the census figure of 1950. In 1962, the average labor force was 10,910. The average employment was 9,930. Thus, an average of 9 percent of the labor force was unemployed during the year of 1962. This was an improvement over 1961 when an average of 9.6 percent of the labor force was unemployed. The improvement was the result of a reduction in the labor force of 510 available workers, which more than compensated for the elimination of 420 jobs that existed the previous year.

Of the 9,930 employed in 1962, 2,500 were engaged in agriculture; 2,140, in manufacturing; and the remainder were in wholesale-retail, government, and miscellaneous occupations. More than one-third, or 850, of those in manufacturing pursuits were employed in firms producing lumber and wood products. Although it is not the largest single employer, the forest products industry plays a significant role in the economy of the county.

HOOD RIVER COUNTY

Hood River County, located in the northeast corner of the study area, lies entirely within the Cascade Range. Situated

directly east of Clackamas and Multnomah Counties, it is separated from the State of Washington by the Columbia River on the north and is bounded on the east and south by Wasco County in central Oregon. The terrain is extremely mountainous, giving the county a scenic splendor but leaving most of its land unsuited for agriculture. Of the 338,000 acres in the county, 37,000 are classified as farmland, only 16,000 of which yielded crops in 1959. There are 258,000 acres of commercial forest in Hood River County, of which 177,000 acres are in the Mount Hood National Forest and 26,000 acres are county-owned lands but managed by the Mount Hood National Forest. The Hood River Valley contains most of the county's farmland. This valley, about 8 miles wide, extends 20 miles south from the Columbia River almost to the foot of Mount Hood. Fruit is the chief agricultural crop and represents about 90 percent of the revenue from agriculture.

In 1960, Hood River had a population of 13,395. This was a 5-percent increase in population since 1950 and a 10-percent increase since 1940. The average annual labor force in 1962 was 5,140. The average employment throughout that year was 4,700. Thus, 8.6 percent of the total labor force was unable to find jobs in 1962. This was a net improvement over 1961, when an average of 9 percent of the total labor force was unemployed.

Of the 4,700 laborers employed in 1962, 1,000 were engaged in agriculture, 980 were employed by manufacturing firms, and 720 found their livelihood in the wholesale-retail trade. Lumber and wood products industries employed almost half of 980 employees engaged in manufacturing. Thus, forest-product-based industries play a significant part in the manufacturing sector of the county's economy, and their contribution to the total county income is considerable.

FOREST RESOURCE³

The early explorers, who came to the lower Columbia River by sea and over land, described northwest Oregon as a land of dense and magnificent forests and equable climate. First settlement was by fur traders of the British-owned Hudson's Bay Co. and the American-owned Pacific Fur Co., founded by John Jacob Astor. Missionaries and emigrants soon followed by wagon train, using trails blazed by Lewis and Clark and fur traders, and around Cape Horn by ship. Sawmills were first established in northwest Oregon to fill the needs of the swelling tide of set-

tlers and for limited ocean commerce with the Hawaiian Islands and China.

Not long after the turn of the century, the timber industries along the lower Columbia River developed on a large scale. However, at the time of the famous Tillamook conflagration in 1933, there were still great expanses of virgin forest a scant 40 miles from Portland.

³Detailed information, including definitions of terms used, has been published by the U.S. Forest Service (Metcalf and Hazard 1964).

After more than a century of settlement, northwest Oregon is still largely forested (table 1).

TABLE 1
Area by land classes, northwest Oregon, 1963
(In thousand acres)

Land class	Acres
Commercial forest	3,954
Unproductive forest	72
Productive-reserved forest	27
Total forest	4,053
Nonforest	1,554
All land	5,607

FOREST LAND

Practically all of the forest land in northwest Oregon is commercial in character. A small acreage of noncommercial forest land is on the slopes of Mount Hood above the commercial timberline, and some productive forest land is reserved from cutting in parks or other dedicated areas.

The present condition and potential productivity of the commercial forest land are basic factors in evaluating the capacity of the forest resource to maintain and expand the economy of northwest Oregon. This is particularly true in Clatsop and Columbia Counties, where forests overshadow other natural resources.

OWNERSHIP OF FOREST LAND

Nearly half of the commercial forest land is in public ownership (table 2). Slightly less than a quarter is in forest industry ownership, and the remainder is in farmer and miscellaneous private ownership.

Nearly all of the commercial forest land in public ownership is National Forest, Bureau of Land Management (chiefly O&C grant lands), and State of Oregon. Small acreages are owned by counties and municipalities. Practically all the public forest land is managed under sustained yield. Forest industry lands, totaling nearly a million acres, are an important factor in this area, particularly in Clatsop and Columbia Counties. These lands are generally managed by their owners for production of timber crops and are usually above the average in timber-growing capacity. In fact, 56, or nearly all, of the industrial owners have certified their holdings as tree farms. The acreage of industrial forest land in tree farms totals 911,000 acres, or 96 percent of the total in this category. There was considerable blocking and acquisition of small ownerships by industrial owners after World War II, a process which is continuing.

The "farmer and miscellaneous private" forest-land ownership is important because of the amount and nature of land in this class. It totals over a million acres

TABLE 2
Area of commercial forest land, by county group
and ownership class, northwest Oregon, 1963
(In thousand acres)

County	All ownerships	National Forest	Other public	Forest industries	Farmer and misc. private
Clatsop	465	—	144	221	100
Columbia	336	—	19	195	122
Hood River	258	177	43	23	15
Yamhill	258	23	43	90	102
Other counties	2,637	875	634	416	712
All counties	3,954	1,075	883	945	1,051

and is accessible and potentially highly productive. A significant part of the land in this category is managed for continuing timber crops, including Christmas trees. About 37,000 acres are in 77 certified tree farms sponsored by the Industrial Forestry Association, and additional holdings are pending certification. Another large part is in the urban fringe, held by the owners for appreciation of land values in their lifetime or for estate purposes. In other cases, the owners hold and manage the forests on their lands for esthetic reasons. All in all, this group can probably be characterized as above the average in sophistication and understanding of forestry and forest-land values. Many members of this group have plans for continued tenure and utilization of their forest lands.

Number and total acreage of tree farms certified by the Industrial Forestry Association substantiate the conclusion that a large part of the private forest lands in this area is headed for intensive management.

CONDITION OF FOREST LANDS

Information on distribution of commercial forest land by stand-size class, by stocking class, and by forest types, as well as ownership, is needed to analyze the forest resource and its potential as a supplier of industrial raw material.

Over 2 million acres, or better than half the commercial forest land in the area, is in sawtimber stands (table 3). As might be expected, the largest acreage of sawtimber is on the National Forests, where it comprises more than four-fifths of the total commercial forest land. A surprising amount of the privately owned forest land is in sawtimber; however, this sawtimber is largely young growth as contrasted to the mainly virgin timber of the National Forests.

There is an apparent deficiency of pole-timber stands which total a little more than half a million acres. On the other hand, well over a fourth of the 4.0 million acres of commercial forest land is in sapling and seedling stands. Very little of this stand-size class is on the National Forests where cutting has been more recent. About 200,000 acres are nonstocked; more than half of this land is in "other public" ownership, mostly State owned in the Tillamook Burn.

Generally speaking, commercial forest lands in northwest Oregon are satisfactorily stocked with trees, with only about 5 percent of the 4.0 million acres nonstocked. More than 2.2 million acres are classified as well stocked. Sawtimber and poletimber stands are in reasonably good condition, but the younger stands are in poorer condition. Roughly a third of the area in saplings and seedlings is well stocked; one-third, medium stocked; and

TABLE 3
Area of commercial forest land in northwest Oregon,
by ownership class and stand-size class, 1963
(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industries	Farmer and misc. private
Sawtimber	2,081	810	363	382	526
Poletimber	539	172	89	128	140
Saplings and seedlings	1,127	75	319	382	351
Nonstocked	207	18	112	43	34
Total	3,954	1,075	883	945	1,051

one-third, poorly stocked. It is anticipated that as these stands advance in age, stocking will improve. However, there are many hardwood trees, primarily red alder, intermixed with the conifers, contributing to the stocking but not generally considered as marketable as the conifers. This is especially true of the poletimber and younger stands in the coastal mountains.

Douglas-fir is the principal species and forms the forest type on 2.2 million acres (table 4). Second in rank is the hardwood type with 749,000 acres, a significant situation since this type presents difficult and often costly problems in management and utilization. Hemlock-Sitka spruce type follows closely in total acreage with 738,000 acres. This type occupies some of the better sites and is fast growing. The Douglas-fir and hemlock-Sitka spruce types are divided almost evenly between public and private ownership but nearly three-fourths of the hardwood type occurs on private lands.

TABLE 4
Area of commercial forest land by forest type and ownership classes, northwest Oregon, 1963
(In thousand acres)

Type	All ownerships	Public ownerships	Private ownerships
Douglas-fir	2,181	1,140	1,041
Hemlock-Sitka spruce	738	372	366
Spruce-fir	243	205	38
Lodgepole pine	28	28	—
Other conifers	15	15	—
Alder	470	146	324
Other hardwoods	279	52	227
Total	3,954	1,958	1,996

Forest site, or the capacity of the forest land to produce wood, is a criterion used in forecasting future timber crops. Northwest Oregon is unusually well endowed in forest land productivity. Forest sites are divided into four classes, determined by growing capacity in cubic feet per acre per year. Class A, 120 cubic feet or more per acre per year, is the highest of the four. Nearly two-thirds, 2.6 million acres, of this area's commercial forest land is in class A, compared with 200,000 acres, or about one-twentieth of the total, in class D, the lowest class — less than 50 cubic feet per acre per year.

TIMBER VOLUME

Northwest Oregon has a total sawtimber volume of 65.6 billion board feet (Scribner)⁴ and a total growing-stock volume of 15.8 billion cubic feet (tables 5 and 6).

This relatively small area has a sawtimber volume exceeding that of all the New England States or all the southern Rocky Mountain States (Arizona, Colorado, Nevada, New Mexico, and Utah). It contains about one-tenth of the sawtimber volume in the Pacific Northwest (Oregon and Washington).

⁴Sawtimber volume data are presented in board feet, Scribner rule, throughout the report. This method of measuring timber volume is the one currently in common use in this region for commercial purposes. Other volume data are presented in cubic feet.

TABLE 5
Volume of sawtimber on commercial forest land, by species and species group and by county and county group, northwest Oregon, 1963

County and county group	All species	Douglas-fir	Spruce-hemlock	True fir	Other conifers	Hardwoods
— — — — — Million board feet (Scribner) — — — — —						
Clatsop	7,789	969	5,697	15	263	845
Columbia	2,120	1,303	84	—	104	629
Hood River	4,817	2,367	803	1,146	466	35
Yamhill	3,146	2,395	39	16	—	696
Other counties	47,695	26,349	14,820	2,593	1,321	2,612
Total	65,567	33,383	21,443	3,770	2,154	4,817

TABLE 6
Volume of growing stock and sawtimber on commercial forest land,
by diameter classes and species, northwest Oregon, 1963

Species and class of material	Diameter class (inches at breast height)						
	All classes	5.0-10.9	11.0-14.9	15.0-18.9	19.0-28.9	29.0-38.9	39.0 and larger
— Million cubic feet —							
Growing stock:							
Douglas-fir	7,548	892	1,036	1,123	2,005	1,262	1,230
Pine	181	60	30	21	42	16	12
True fir	1,093	231	168	188	339	126	71
Hemlock	4,015	393	443	613	1,486	722	358
Spruce	917	112	108	150	220	129	198
Larch	36	2	4	5	15	6	4
Cedar	382	72	53	45	94	58	60
Alder	1,040	408	283	196	124	27	2
Other hardwoods	560	299	120	53	61	19	8
Total	15,772	2,469	2,245	2,394	4,356	2,365	1,943
— Million board feet (Scribner) —							
Sawtimber:							
Douglas-fir	33,383	—	2,840	4,279	10,074	7,629	8,561
Pine	528	—	73	77	214	93	71
True fir	3,770	—	523	699	1,432	691	425
Hemlock	18,534	—	1,375	2,530	7,704	4,258	2,667
Spruce	2,909	—	168	374	890	611	866
Larch	204	—	15	31	104	47	7
Cedar	1,422	—	152	151	415	311	393
Alder	3,366	—	1,259	1,088	811	193	15
Other hardwoods	1,451	—	526	306	413	143	63
Total	65,567	—	6,931	9,535	22,057	13,976	13,068

In analyzing the volume data and timber's availability as an industrial raw material, ownership, size of timber, species, and location must be considered in addition to quantity.

About 71 percent of the sawtimber volume and 66 percent of the growing-stock volume are publicly owned, compared with 29 percent and 34 percent, respectively, in private ownership (tables 7 and 8; fig. 2).

About two-fifths of the total sawtimber volume is in trees 29 inches in diameter and larger (table 6). About half the Douglas-fir volume is in trees 29 inches and larger.

Douglas-fir is the leading species, amounting to 33.4 billion board feet, or more than half the total, followed by hemlock with 18.5 billion board feet (fig. 3).

FIGURE 2. — Distribution of commercial forest land and sawtimber volume by owner group.

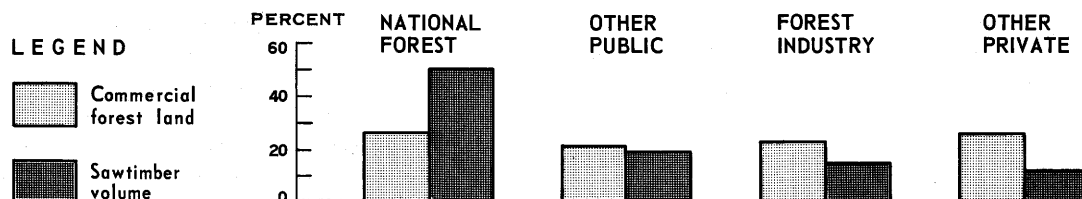


TABLE 7

Volume of sawtimber on commercial forest land,
by ownership class and county group, northwest Oregon, 1963

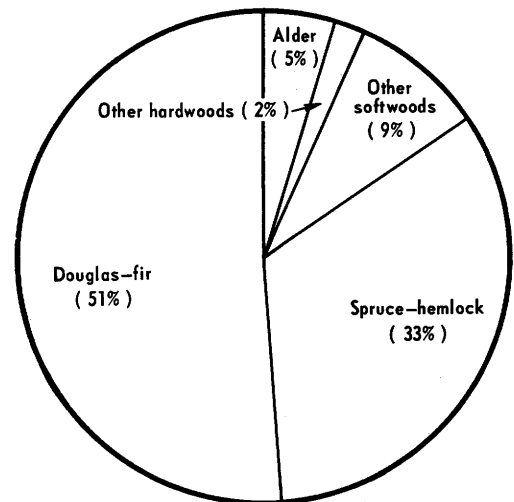
County	All ownerships	National Forest	Other public	Forest industries	Farmer and misc. private
<i>— Million board feet (Scribner) —</i>					
Clatsop	7,789	—	1,778	4,639	1,372
Columbia	2,120	—	61	1,118	941
Hood River	4,817	3,988	345	373	111
Yamhill	3,146	752	1,134	697	563
Other counties	47,695	29,123	9,607	3,661	5,304
Total	65,567	33,863	12,925	10,488	8,291

TABLE 8

Volume of growing stock and sawtimber on
commercial forest land, by ownership class and
by softwoods and hardwoods, northwest Oregon, 1963

Timber and ownership class	All species	Softwoods	Hardwoods
<i>— Million board feet (Scribner) —</i>			
Sawtimber:			
National Forest	33,863	33,065	798
Other public	12,925	12,082	843
Forest industry	10,488	9,777	711
Farmer and misc. private	8,291	5,826	2,465
All ownerships	65,567	60,750	4,817
<i>— Million cubic feet —</i>			
Growing stock:			
National Forest	7,287	7,070	217
Other public	3,047	2,753	294
Forest industry	2,901	2,637	264
Farmer and misc. private	2,537	1,712	825
All ownerships	15,772	14,172	1,600

FIGURE 3. — Distribution of sawtimber volume by species and species group, 1963.



TIMBER HARVEST

Although logging and lumbering have been conducted on a large scale in northwest Oregon for half a century, log harvest did not reach its peak until 1941. During that year, nearly 2 billion board feet of saw logs were cut in this area. Since that time, the trend has been generally downward with occasional rises. By 1961, timber harvest had declined to barely more than a billion feet, increasing

to 1.2 billion feet in 1962 (table 9). The average yearly harvest for 1958 through 1962 was 1.3 billion feet.

During the past several decades, heavy cutting has shifted eastward from Clatsop and Columbia Counties on the lower Columbia River to Clackamas County, essentially a Cascade Range county. Log harvest on private lands in northwest Oregon has been declining steadily in re-

TABLE 9
Timber harvest, by county group and ownership class,
northwest Oregon, 1960-62 (Scribner)¹

Ownership class and county	1960		1961		1962		Average 1958-62	
	Million bd. ft.	Per-cent	Million bd. ft.	Per-cent	Million bd. ft.	Per-cent	Million bd. ft.	Per-cent
Forest industry:								
Clatsop	—	—	—	—	206.1	40	—	—
Columbia	—	—	—	—	15.5	3	—	—
Hood River	—	—	—	—	15.1	3	—	—
Yamhill	—	—	—	—	6.0	1	—	—
Other counties	—	—	—	—	268.3	53	—	—
Total	—	—	—	—	511.0	100	—	—
Farmers, miscellaneous:								
Clatsop	—	—	—	—	6.0	7	—	—
Columbia	—	—	—	—	21.2	26	—	—
Hood River	—	—	—	—	4.2	5	—	—
Yamhill	—	—	—	—	1.1	1	—	—
Other counties	—	—	—	—	49.7	61	—	—
Total	—	—	—	—	82.2	100	—	—
All private:								
Clatsop	212.5	33	167.5	32	212.1	36	198.0	27
Columbia	93.6	15	34.6	7	36.7	6	63.5	9
Hood River	37.6	6	38.9	8	19.3	3	32.9	5
Yamhill	24.4	4	16.6	3	7.1	1	29.1	4
Other counties	412.8	42	260.7	50	318.1	54	398.7	55
Total	780.9	100	518.3	100	593.2	100	722.2	100
National Forest:								
Clatsop	—	—	—	—	—	—	—	—
Columbia	—	—	—	—	—	—	—	—
Hood River	35.2	11	32.1	9	54.0	14	46.6	13
Yamhill	5.2	2	—	—	—	—	1.0	—
Other counties	294.3	87	306.9	91	336.9	86	319.7	87
Total	334.7	100	339.0	100	390.9	100	367.3	100
Other public:								
Clatsop	40.6	18	44.9	21	24.3	10	29.3	13
Columbia	1.6	1	2.6	1	—	—	2.9	1
Hood River	—	—	—	—	—	—	—	—
Yamhill	11.0	5	21.1	10	26.1	10	16.0	8
Other counties	172.3	76	149.8	68	198.7	80	169.2	78
Total	225.5	100	218.4	100	249.1	100	217.4	100
All ownerships:								
Clatsop	253.1	19	212.4	20	236.4	19	227.3	17
Columbia	95.2	7	37.2	3	36.7	3	66.4	5
Hood River	72.8	5	71.0	7	73.3	6	79.5	6
Yamhill	40.6	3	37.7	4	33.2	3	46.1	4
Other counties	879.2	66	717.4	66	853.7	69	887.6	68
Total	1,341.1	100	1,075.7	100	1,233.2	100	1,306.9	100

¹Does not include poles and piling.

cent years, but these lands still furnish nearly half the saw logs harvested in the area. The bulk of these logs are cut from forest industry lands. The shifts in source of logs and decline in total log harvest have been accompanied by the virtual passing of the Columbia River open log market and the closing of several large sawmills on or near the Columbia River. These include the Eastern & Western Lumber Co., Inman-Poulsen Lumber Co., West Oregon Lumber Co., Jones Lumber Corp., and B. F. Johnson mills in Portland; the Clark & Wilson Lumber Co. mills at Linnton, the Oregon Lumber Co. at Prescott, the Oregon American Lumber Corp. mill at Vernonia, and the Cross-et-Western mill at Wauna. In contrast, across the Columbia River at Longview, Wash., a giant integrated timber industry complex has developed in the past four decades with the major growth occurring during the past two decades. The prominent enterprises in this complex are Weyerhaeuser, International Paper (formerly Long-Bell), and Longview Fibre Companies. These companies draw raw material, logs, bolts, and wood chips from both Oregon and Washington sources for their Longview plants and have extensive forest-land ownership in western Oregon and Washington.

Currently, the log harvest from National Forest lands in northwest Oregon averages about 367 million board feet annually, or about one-third of the total. Other public forest lands furnish about a quarter of a billion board feet annually.

Estimates of growth disclose an interesting situation, particularly when contrasted to log harvest. The average annual net growth in northwest Oregon for the period 1952-61 totals 327 million cubic feet, or 1,122 million board feet. This closely approaches current annual timber harvest. However, this comparison of totals is superficial, hiding internal imbalances among species which might lead to future problems. Growth by species (table 10) is not distributed the same as

the estimated log harvest by species. In addition, this growth estimate recognizes only the mortality occurring during the 10-year period.

TABLE 10

Periodic average annual growth, by growing stock and sawtimber on commercial forest land and by species group, northwest Oregon, 1952-61¹

Species group	Growing stock	Sawtimber (Scribner)
	Million cubic feet	Million board feet
Douglas-fir	165	568
Spruce-hemlock	72	277
Other softwoods	26	72
Total softwoods	263	917
Hardwoods	64	205
Total, all species	327	1,122

¹This should not be confused with estimates of current annual net growth which are based upon estimates of long-term mortality, including normal and catastrophic mortality. In northwest Oregon, impact of catastrophes over the past few decades — such as the 1962 blowdown, conflagrations, and hemlock looper epidemics — results in lower long-term growth figures.

Quantitative data on log harvest by species are not available. However, it is possible to make estimates for the principal species based upon log consumption data of northwest Oregon industrial plants. It is estimated that considerably more than half the volume of logs harvested in northwest Oregon is Douglas-fir, with western hemlock in second rank; it is also estimated that only about 20 to 25 million board feet of hardwood logs annually are being harvested in this area. Consumption of hardwood logs by northwest Oregon plants is less than 20 million board feet, nearly all by sawmills. Demand for red alder logs by pulpmills is leading to some exports to neighboring areas. With 127 million board feet or 18 percent of the estimated sawtimber growth in hardwoods, it is evident that there is an imbalance between total cut and growth. On the other hand, it must be remembered that over half of the total sawtimber inventory volume is Douglas-fir, much of it in old-growth forests which are producing only small amounts of net

growth. As cutting proceeds in these forests and the lands are converted to faster growing young forests, net growth of Douglas-fir should increase. Nevertheless, it is clear that critical and complex problems in forest management exist in this area. These must be reckoned with in considering future forest yields.

A critical and understandable measure of the magnitude of future forest crops of the area is the estimated annual allowable cut from its commercial forest land. Federal and State forest lands, which account for nearly all public forests, are being managed under sustained yield, and allowable cuts are determined and the findings published. Timber from these lands is sold by public bid under stipulated conditions.

Generally speaking, the forest industry lands in this area are also firmly held and are being managed with the objective of producing continued crops of timber. In determining annual harvest from these lands, owners may consider holdings in other areas or prospective timber supply from public lands as well as the growth and yield of their northwest Oregon holdings. Annual allowable cuts from industry lands, if calculated, are not released. However, a reasonable estimate of the prospective cut in the near future may be made for industry lands, based upon known forest inventory and growth information and past cutting experience. Although many of the private owners in the farmer and miscellaneous category hold their lands for production of forest crops, future yields for industrial utilization are uncertain. Estimating future cuts for these lands is more speculative.

A projection was made, based upon the current forest inventory, growth, and mortality data for the decade 1952-61, of the consequences of continuing the present level of cut on private forest lands for 20 years. Separate projections were made for industrial and nonindustrial ownership and for softwoods and hardwoods.

The projected 1983 sawtimber inventory on industrial forest lands is 6.6 billion board feet, a decrease of 3.2 billion board feet from the 1963 inventory. The hardwood sawtimber inventory, conversely, may increase from 711 million board feet in 1963 to 2.1 billion board feet in 1983. Based upon these projections, average annual net growth of softwoods would increase during the 20-year period from 329 million board feet to 369 million board feet. Hardwood growth would increase from 53 million feet to 97 million feet.

The situation on the nonindustrial forest lands would be considerably different. The sawtimber inventory of softwoods would increase from 5.8 billion board feet in 1963 to 11.1 billion board feet in 1983; hardwoods would increase from 2.5 billion board feet to 5.9 billion board feet. Average annual net growth on these forest lands would increase during the 20 years from 250 million board feet to 420 million board feet for softwoods, and from 136 million board feet to 255 million board feet for hardwoods.

For all private forest lands, an annual cut of 575 million board feet of softwoods would result in an increase in the softwood sawtimber inventory from 15.6 billion board feet in 1963 to 17.7 billion board feet in 1983. Average annual net growth of softwoods in 1983 would be 789 million board feet. The hardwood sawtimber inventory on all private forest lands would increase from 3.2 billion board feet in 1963 to 8.0 billion board feet in 1983. Average annual net growth of hardwoods in 1983 would be 352 million board feet.

An average annual cut of softwood timber from all commercial forest land in northwest Oregon of from 1.2 to 1.3 billion board feet is not unlikely. About 620 million board feet, or nearly half of this total, could be cut from public lands, divided as follows: National Forest, 368 million feet; Bureau of Land Management, 162 million feet; and State, 90 million feet. The other half would be taken from the private lands.

FOREST MANAGEMENT

Consequences of past forest management and use and natural forest catastrophes have had a dramatic effect on present and future timber harvests in north-west Oregon. Timber harvest commenced with bull team logging to the nearby waterways and high-grading of the seemingly endless virgin forests. Later, during the steam-donkey-railroad logging period, large, unbroken clearcut areas were left. Also during this period, the coastal forests were again high-graded for Sitka spruce needed to build World War I planes.

Interspersed with this sequence of events were several hemlock looper epidemics and large fires which deforested extensive areas in the Coast Ranges. Despite these inroads into the virgin forests, there were still extensive stands in the early thirties of high-quality old growth in Tillamook, Yamhill, and interior of Clatsop and Columbia Counties. These forests were nearly all privately owned. The climax came in 1933 when the greatest of modern forest fire catastrophes in the Pacific Northwest, the famous Tillamook fire, burned over a quarter of a million acres, destroying an estimated 10 billion board feet of valuable timber. Burning about the same time was the Wolf Creek fire, north of the Tillamook fire and joining it at times. Under ordinary circumstances, this fire would have been a "headliner" in its own right, but it was overshadowed by its neighbor.

In addition to these natural disasters, the country was in the great economic depression; salvage of any appreciable quantity of the burned timber seemed almost hopeless in view of anticipated deterioration from insects and disease and the weakened market. However, major owners commenced salvage operations promptly in 1934, some of them combining their efforts to make the salvage program more effective. Tax concessions were given by local governments faced with

prospect of total loss of revenue from these lands. Salvage proceeded slowly at first, aimed largely at cutting remnants of green timber. Advent of truck logging made salvage of the burned timber more feasible, since usable truck roads could be built quickly and relatively cheaply. This system of logging proved very flexible, allowing the cutting of scattered small tracts of timber.

During this period, little logging was taking place in the Cascade Range, where forest lands were nearly all publicly owned and road systems were underdeveloped.

Large expanses of snags in the Tillamook Burn created a severe fire hazard. At the time of the 1933 fires, most of this area was under protection of forest fire associations formed by the principal private owners. Only a small part of the Tillamook area was under Federal forest fire protection. By standards of fire control then in practice, protection was comparatively good. As new hazards were realized, protection efforts were intensified; however, these did not suffice, and this area was struck again and again by serious fires in 1939, 1945, and 1951. This increased the total area burned over by one or more of the fires to about 350,000 acres and timber killed to 13 billion board feet. Also, many areas of young forests were destroyed.

In spite of these recurring fires, salvaging proceeded apace, accelerating as economic conditions improved. The final tally of timber salvaged from the Burn approximates 7 billion board feet.

As the lands were cut over, or if salvage seemed unlikely, lands were allowed to revert to the counties through tax delinquency. The same phenomenon was also taking place in other areas of north-west Oregon, particularly in cutover lands and young forests. Later, this process was reversed and the young forests were reclaimed by forward-looking private owners. However, the Tillamook Burn was a

special situation. Costs of protecting and rehabilitating this area made it unattractive to private owners. The county, likewise, was not in a position to finance such a program, particularly since their tax base had been greatly reduced by the fires. Arrangements were made and these lands passed into State ownership. The succession of fires aroused public concern. Finally, a State bond issue was approved by the voters providing funds for rehabilitation, including snag falling, building of protection roads, and planting. Many obstacles, such as encroachment of brush and severe animal damage, have slowed progress in rehabilitating these lands; however, new reforestation techniques, planned game management, and new developments in forest rodent control are aiding restoration. All things considered, progress is notable, but much remains to be done before the area reaches full productivity.

Restocking of the older cutover areas, particularly those escaping repeated fires after slash burning, has been good. However, as discussed earlier, much of this land has been captured by red alder, which is faster growing than the conifers in the early years of their growth cycles.

This is especially true on the very productive sites at the lower elevations in the Coast Ranges. A large part of these sites will grow either conifers or hardwoods at unusually high rates.

If the hardwoods can be utilized economically, reestablishment of conifers is possible on best suited sites. Otherwise, the process of clearing the lands of hardwoods, planting conifers, and protecting them from further encroachment may be too costly for exclusive production of conifers. Limited amounts of alder have been used for lumber. Recent technological developments in woodpulp processes are opening up opportunities for greater use of alder in pulp manufacture. Columbia River kraft pulpmills are using alder logs in small quantities. Logs are bundled in even lengths. Also recently, one mill has commenced taking random lengths from 10 to 40 feet, which should stimulate harvest of alder.

Projection of effect of continuing present level of cut on future inventories, discussed earlier, illustrates the importance of hardwoods in management of private forest land and the great potential in these species for increasing the industrial raw material base.

FOREST INDUSTRIES IN NORTHWEST OREGON

Expansion of the forest-based industries could help relieve chronic unemployment in northwest Oregon. In order to evaluate specific proposals for new plants or industries, more information is needed on the current status of these industries and their raw material supply. The preceding chapter analyzed the forest resource. This chapter presents the results of a survey of the nature and size of the existing industry, the kind and volume of raw material used, the products manufactured, and the amount and kind of plant wood residues developed, used, and unused.

SAWMILLS

In 1962, there were approximately 109 sawmills operating in northwest Oregon (table 11). These mills ranged in size from an owner-operated, one-man, portable mill, capable of producing only 3,000 board feet per day, to a corporate, integrated operation with a capacity of 300,000 board feet in an 8-hour shift. Detailed information about the 1962 consumption of stumpage and production of finished products was obtained from each of these mills.

TABLE 11
Lumber production in northwest Oregon,
by mill-size class and degree of manufacture, 1962

Sawmill capacity per 8-hour shift (M bd. ft.)	Number of mills	Volume of production				
		Surfaced and seasoned	Surfaced green	Rough green	Rough seasoned	Total
— — — Million board feet, lumber tally — — —						
Up to 39	57	10.2	87.3	43.4	—	140.9
40-79	23	67.6	126.1	47.9	—	241.6
80-119	12	81.7	153.4	21.1	—	256.2
120+	17	269.7	366.3	34.6	3.9	674.5
All mills	109	429.2	733.1	147.0	3.9	1,313.2

Sawmills are divided into four classes according to their 8-hour-shift production capacity: the first class, up to 39,000 board feet; the second class, 40,000 to 79,000 board feet; the third class, 80,000 to 119,000 board feet; and the fourth class, 120,000 board feet or more. The most mills, 57, fall into the first class. The second class is represented by less than half that number, 23 mills, and the third and fourth classes contain 12 and 17 mills, respectively (fig. 4).

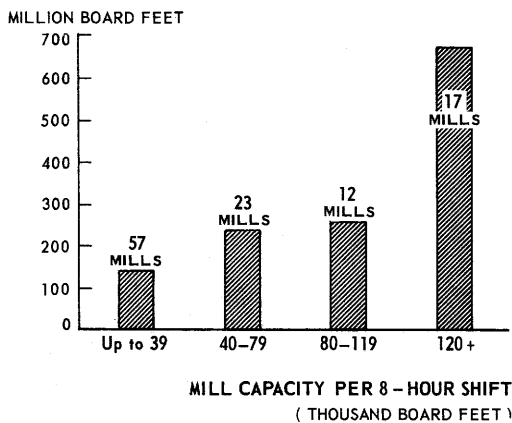


FIGURE 4. - Lumber production by mill-size class, 1962.

In 1962, the sawmills of northwest Oregon produced a total of 1.3 billion board feet of lumber. A little more than half of this volume, 733 million board feet, was shipped to the market surfaced but

not seasoned. An additional third was both surfaced and seasoned before shipment, and the remainder was shipped rough green.

The 17 mills in the largest class produced more than 50 percent of northwest Oregon's lumber. Almost 95 percent of this production was surfaced, 42 percent of which was both surfaced and seasoned. The second and third largest mill classes each supplied about 20 percent of the total lumber production of northwest Oregon, the smallest class producing the remainder. The smaller the mill, generally, the less refinement of the end product. Thus, although the mills in the smallest size class contributed only 11 percent to the total lumber production in northwest Oregon, they produced 30 percent of the total rough green lumber.

The tendency to have processing equipment other than a head saw increases with mill size (table 12). All mills in the two largest size classes have planers and most of them have dry kilns, barkers, and chippers. Three of the seven mills in these two classes not having dry kilns are stud mills with exceptionally high 8-hour capacities. Two of these stud mills cut only veneer cores and have no need for a barker, although each has a chipper to process its residues for marketing. Less than half of the mills in the smallest size class have planers, two have dry kilns, and only one has a chipper.

TABLE 12
Equipment in northwest Oregon sawmills,
by capacity class, 1962

Sawmill capacity per 8-hour shift (M bd. ft.)	Number of mills	Equipment other than head saw				
		Planer	Dry kiln	Barker	Chipper	Hog
Up to 39	57	27	2	0	1	1
40-79	23	19	8	10 ¹	12	1
80-119	12	12	9	9 ¹	11	—
120+	17	17	13	16 ¹	17	—
Total	109	75	32	35	41	2

¹One mill cuts veneer cores only, thus does not need a barker.

PLANING MILLS

There are 13 planing mills in northwest Oregon. Eight of these are located in Multnomah County and the remainder in Washington County. They range in size from 18,000- to 200,000-board-foot capacity in an 8-hour shift, the average being about 60,000 board feet. In 1962, these mills surfaced 70 million board feet, much of which was dried. All except two have dry kilns.

PLYWOOD AND VENEER PLANTS

In 1962, there were 26 firms manufacturing plywood or veneer within the study area. Six of these firms cut and sold veneer; 4 purchased veneer and manufactured plywood; and the remaining 16 cut veneer and manufactured plywood in single integrated units. These plants ranged in size from a small, single, cold press unit, capable of manufacturing 10,000 square feet of $\frac{3}{8}$ -inch plywood in an 8-hour shift, to firms with an 8-hour capacity of 270,000 square feet. In 1962, these firms manufactured the equivalent of 1,187 million square feet of $\frac{3}{8}$ -inch plywood. Those plants buying veneer used about 440 million square feet on a $\frac{1}{8}$ -inch basis. The plants manufacturing only veneer produced 380 million square feet on a $\frac{1}{8}$ -inch basis; thus, there was an apparent net import of 60 million square feet of veneer into the area.

PULP AND PAPER MILLS

There are five pulp and paper mills located in northwest Oregon. They range in capacity from 150 to 600 tons of pulp per 24-hour shift. The total capacity of all five mills is 685 tons of groundwood, 620 tons of sulfite pulp, and 375 tons of sulfate pulp in a 24-hour period (Lockwood Trade Journal Co., Inc. 1963). In 1963, about half a million tons of paper were produced by the pulp and paper mills in northwest Oregon.

WOOD COMPOSITION BOARD PLANTS

There are three wood composition board plants in northwest Oregon: two hardboard plants and one insulation board plant. Both hardboard plants are parts of integrated operations and obtain their entire raw material supply from their companion sawmills. These two plants, one located in Hood River County and one in Washington County, have a combined capacity of about 140 million square feet of $\frac{1}{8}$ -inch board annually and consume an estimated 40,000 tons of wood chips annually. In 1962, they produced at about 90 percent of rated capacity. The insulation board plant, located in Columbia County, has a rated annual capacity of 120 million square feet of $\frac{1}{2}$ -inch board. It purchases its entire supply of chips, although it has a wood mill and owns forest land. The wood mill has not operated for the past 5 or 6 years.

SHAKE AND SHINGLE MILLS

There are 14 shingle mills, 3 shake mills, and 6 firms producing both shakes and shingles in northwest Oregon, ranging in capacity from 20 squares to 120 squares per 6-hour shift. Most of these firms are located on the west side of the Coast Ranges, close to the supply of old-growth cedar growing there. In 1962, 294,000 squares of shingles and 31,000 squares of shakes were produced in northwest Oregon.

POSTS, POLES, AND PILING

Five pole and piling yards were included in the survey. Each has a barker, and four have pressure treatment plants. Besides poles, posts, and piling, these plants treat a limited amount of lumber. In 1962, 3.2 million lineal feet of poles and piling and almost 2 million feet of lumber were processed.

FOREST INDUSTRY AND RAW PRODUCT UTILIZATION

Of the 1,233 million board feet of sawtimber harvested in northwest Oregon in 1962, 380 million board feet, or about 31 percent, were harvested in the counties of primary consideration: Clatsop, Columbia, Hood River, and Yamhill. Within the 10-county area, the total log consumption of forest products industries was 1,733 million board feet (tables 13 and 14). About 20 percent, or 365 million board feet, was consumed within the four designated counties. Comparing consumption with production in these four counties shows a net export of about 25 million board feet of logs.

Of the 109 sawmills found in northwest Oregon, 29 are located in these four counties (table 15). In size-class distribution, these mills represent about one-fourth of the mills in each class. Also found within the boundaries of these four counties are two pulp and paper mills, two wood composition board plants, six

plywood plants, two pole and piling yards, five shingle mills, and a shake mill.

FOREST PRODUCTS RESIDUES DEVELOPED IN NORTHWEST OREGON

In the survey of timber industries, sawmill residues were divided into two categories, coarse and fine. Coarse residues include slabs, edgings, and trimmings. Sawdust and shavings are classified as fine residues.

The residue developed by sawmills was estimated by multiplying the production of lumber in each county by the factors developed by Corder and Gedney (1956).

The residue produced by veneer plants was determined by multiplying the production of plywood in each county by factors developed by Corder (1956) in his study on residue production in Oregon in 1953.

Shingle mill residue data were derived with the use of factors developed in an unpublished study by the Pacific Northwest Forest and Range Experiment Station.

In 1962, it was estimated that the forest products industries of northwest Oregon produced 886,000 tons of dry, coarse residue, 373,000 tons of dry sawdust, and 250,000 tons of dry shavings (table 16). In addition to the above residues, an estimated 159,000 tons of plywood dry-end trim were produced. This residue is considered separately from the rest because it is coated with glue which limits the possibilities of its utilization.

The majority of the residue developed in northwest Oregon was Douglas-fir. Sixty-seven percent of the coarse residue and 62 percent of the shavings consisted of this species (tables 17 and 18). Spruce and hemlock were second, accounting for 30 percent of the coarse residue and 35 percent of the shavings. All other species, including both softwoods and hardwoods, accounted for only 3 percent of both the coarse residue and shavings produced in the study area.

TABLE 13

Capacity and consumption of sawmills
in northwest Oregon, 1962

Size class (M bd. ft. per 8-hour shift)	Estimated capacity		1962 consumption	
	Per 8- hour shift	Annual ¹	Total	From north- west Oregon
	— M bd.ft., lumber tally —		— M bd.ft., Scribner —	
Up to 39	867	138,720	101,908	100,235
40-79	1,225	269,500	183,591	160,804
80-119	1,125	281,250	213,747	135,695
120+	2,745	768,600	514,494	387,706
All classes	5,962	1,458,070	1,013,740	784,440

¹Based on 160 days of operation for up to 39,000-board-foot-capacity classes, 220 days for 40,000- to 79,000-board-foot classes, 250 days for 80,000- to 119,000-board-foot classes, and 280 days for 120,000+-board-foot classes.

TABLE 14

Consumption of forest products industries, other than
sawmills, in northwest Oregon, 1962

Industry	1962 consumption	
	Total	From north- west Oregon
	— M bd. ft., Scribner —	
Shake and shingle ¹	34,187	24,987
Veneer and plywood (annual capacity, 1,367 MM sq. ft., 3/8 -inch)	458,209	360,778
Wood composition board (annual capacity, 260 MM sq. ft.)	42,500	30,000
Pulp and paper (capacity, 1,680 tons per 24 hours)	165,777	104,935
Posts, poles, piling ¹	18,212	17,746
Total	718,885	538,446

¹Capacity figures not available.

TABLE 15
Sawmill location by capacity class in northwest Oregon, 1962

Sawmill location	Sawmill capacity per 8-hour shift				Total
	Up to 39,000 board feet	40,000 to 79,000 board feet	80,000 to 119,000 board feet	120,000 + board feet	
	Number of mills				
Clackamas	14	6	—	4	24
Clatsop	3	—	1	1	5
Columbia	4	2	1	3	10
Hood River	—	—	2	2	4
Marion	7	4	3	1	15
Multnomah	1	4	1	1	7
Polk	5	2	1	2	10
Tillamook	4	1	—	3	8
Washington	14	1	1	—	16
Yamhill	5	3	2	—	10
Total	57	23	12	17	109

TABLE 16
Total residue developed in northwest Oregon, 1962

Type of plant	Coarse residue	Sawdust	Shavings
	Tons (dry)		
Sawmill capacity (per 8-hour shift):			
Up to 39,000 bd. ft.	55,811	35,785	17,194
40,000 to 79,000 bd. ft.	100,439	63,951	34,978
80,000 to 119,000 bd. ft.	132,319	78,231	52,996
120,000 + bd. ft.	279,159	177,924	131,482
Planing mills	—	—	13,833
Veneer mills	464,731 ¹	—	—
Shingle mills	12,493	17,333	—
Total	1,044,952	373,224	250,483

¹Includes 158,887 tons of veneer dry ends, utilization of which is limited by presence of glue.

TABLE 17

Coarse residue developed in selected counties and all
northwest Oregon, by species and type of plant, 1962

Species and type of plant	Clatsop	Columbia	Hood River	Yamhill	All north- west Oregon
— — — — — Tons (dry) — — — — —					
Douglas-fir:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	112	1,217	—	4,444	41,777
40,000 to 79,000 bd.ft.	—	3,029	—	11,405	59,521
80,000 to 119,000 bd.ft.	462	4,546	13,964	7,255	64,784
120,000+ bd. ft.	202	84,765	20,479	—	174,984
Veneer plants	13,567	23,397	—	11,740	253,875
Total	14,343	116,954	34,443	34,844	594,941
Hemlock-Sitka spruce:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	646	45	—	830	7,805
40,000 to 79,000 bd.ft.	—	1,739	—	9,474	34,236
80,000 to 119,000 bd.ft.	18,587	997	5,152	7,542	66,884
120,000+ bd.ft.	8,136	18,174	10,759	—	99,638
Veneer plants	1,507	13,161	—	2,935	51,969
Total	28,876	34,116	15,911	20,781	260,532
Other softwoods:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	184	30	—	10	1,116
40,000 to 79,000 bd.ft.	—	4,417	—	—	5,998
80,000 to 119,000 bd.ft.	—	248	—	—	248
120,000+ bd.ft.	—	—	600	—	4,537
Veneer plants	—	—	—	—	—
Shingle mills	3,059	388	—	—	12,493
Total	3,243	5,083	600	10	24,392
Hardwoods:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	775	—	—	—	5,113
40,000 to 79,000 bd.ft.	—	—	—	684	684
80,000 to 119,000 bd.ft.	—	—	—	—	403
120,000+ bd.ft.	—	—	—	—	—
Veneer plants	—	—	—	—	—
Total	775	—	—	684	6,200

TABLE 18
Shavings developed in selected counties and all
northwest Oregon, by species and type of plant, 1962

Species and type of plant	Clatsop	Columbia	Hood River	Yamhill	All north- west Oregon
— — — — — Tons (dry) — — — — —					
Douglas-fir:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	—	86	—	1,633	12,610
40,000 to 79,000 bd.ft.	—	50	—	4,862	20,612
80,000 to 119,000 bd.ft.	215	2,126	5,836	3,394	26,863
120,000+ bd.ft.	94	45,032	8,890	—	85,300
Planing mills	—	—	—	—	9,550
Total	309	47,294	14,726	9,889	154,935
Hemlock-Sitka spruce:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	—	18	—	387	2,792
40,000 to 79,000 bd. ft.	—	—	—	4,124	11,803
80,000 to 119,000 bd.ft.	8,664	465	2,305	3,515	25,857
120,000+ bd.ft.	3,793	8,472	4,721	—	44,403
Planing mills	—	—	—	—	3,423
Total	12,457	8,955	7,026	8,026	88,278
Other softwoods:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	—	—	—	12	277
40,000 to 79,000 bd.ft.	—	2,023	—	285	2,563
80,000 to 119,000 bd.ft.	—	116	—	—	276
120,000+ bd.ft.	—	—	243	—	1,716
Planing mills	—	—	—	—	258
Total	—	2,139	243	297	5,090
Hardwoods:					
Sawmills (capacity per 8-hour shift):					
Up to 39,000 bd.ft.	258	—	—	—	1,515
40,000 to 79,000 bd.ft.	—	—	—	—	—
80,000 to 119,000 bd.ft.	—	—	—	—	—
120,000+ bd.ft.	—	—	—	—	—
Planing mills	—	—	—	—	602
Total	258	—	—	—	2,117

PRESENT RESIDUE USE IN NORTHWEST OREGON

About two-tenths of the coarse residue and three-tenths of the fine residue developed in northwest Oregon is unused (table 19). All of the residue which is used should not, however, be considered totally unavailable for future expansion of forest products industries. Present uses, providing little or no return to the producer, can easily be diverted to industries willing and able to pay more for the residue. For example, coarse residue, given away for fuel, and shavings, given away for domestic animal bedding on a "pick-up" basis, are certainly available to any industry willing to pay a price for them.

In 1962, 520,000 tons of coarse residue were processed into chips at sawmills and plywood plants. This was 59 percent of all

the coarse residue developed in northwest Oregon. Since the average unit of chips weighs 1 ton, pulpmills within the area purchased or transferred 623,000 tons of chips. Therefore, all of the chips produced within the study area could supply only 83 percent of the chip consumption by pulpmills within this area. Board plants within the area consume an additional 90,000 tons of chips annually. To supply this combined demand from pulpmills and board plants, an estimated 193,000 tons of chips are imported into the study area annually.

Nearly 70 percent of the total volume of chips produced in northwest Oregon came from mills in the two largest size classes. Almost 90 percent of the coarse residues of the 17 mills in the largest size class and 83 percent of those of the mills in the second largest size class were con-

TABLE 19
Production and disposition of mill residue by sawmill capacity class
and type of mill, northwest Oregon, 1962

Residue and disposition	Sawmills (capacity per 8-hour shift)					Planing mills	Veneer and plywood plants	Shingle mills	Grand total	Percent of total
	Up to 39,000 bd. ft.	40,000-79,000 bd. ft.	80,000-119,000 bd. ft.	120,000+ bd. ft.	Total					
----- Tons (dry) -----										
Coarse residue:										
Pulp chips	6,095	43,649	110,049	248,928	408,721	—	111,787	—	520,508	59
Remanufacturing	3,412	—	—	—	3,412	—	—	—	3,412	(¹)
Fuel	14,472	40,160	15,484	8,234	78,620	—	102,457	963	182,040	21
Unused	31,562	16,630	6,786	21,997	76,975	—	91,600	11,530	180,105	20
Total	55,811	100,439	132,319	279,150	567,728	—	305,844	12,493	886,065	100
Fine residue:										
Sawdust:										
Agriculture and miscellaneous	3,122	8,738	11,993	8,643	32,496	—	—	1,771	34,267	9
Fuel	13,208	27,984	36,419	136,872	214,483	—	—	—	214,483	58
Unused	19,455	27,229	29,819	32,409	108,912	—	—	15,562	124,474	33
Total	35,785	63,951	78,231	177,924	355,891	—	—	17,333	373,224	100
Shavings:										
Agriculture and miscellaneous	4,406	9,999	9,751	21,950	46,106	7,397	—	—	53,503	21
Fuel	1,379	13,515	16,212	85,442	116,548	2,478	—	—	119,026	48
Unused	11,409	11,464	27,033	24,090	73,996	3,958	—	—	77,954	31
Total	17,194	34,978	52,996	131,482	236,650	13,833	—	—	250,483	100

¹Less than 1 percent.

verted to chips. The proportion of coarse residues converted to chips dropped in the smaller size classes to 43 percent in the third class and only 11 percent in the smallest class. It is in the smallest classes that the greatest percentage of unused residue occurs. Here, 56 percent of the coarse residue was burned or left to rot. As mill size increases, the percentage of unused residue is reduced. Only 17 percent of the coarse residue in the second smallest mill size class remained unused, and this figure was reduced to less than 10 percent in both of the largest mill size classes.

Veneer mills and plywood plants produced about one-third of the coarse residue developed in northwest Oregon. Their disposition of this residue was split almost evenly three ways: 37 percent reduced to chips, 33 percent burned as fuel, and 30 percent disposed of as waste.

Fifty-eight percent of the sawdust developed in northwest Oregon was consumed as fuel, 33 percent was burned or left unused, and most of the remainder was used for agricultural bedding. Residue usage is related to sawmill size. More than 75 percent of the sawdust produced by the largest size class was burned as fuel, but only 36 percent of the sawdust produced in the smallest size class was disposed of in this manner. Conversely, only 18 percent of the sawdust in the largest size class was left unused, compared with 54 percent in the smallest.

Forty-eight percent of the shavings produced was used as fuel, 21 percent was diverted to agriculture and miscellaneous uses, and the remainder was unused. Again, the percent of shavings used increased with the mill size. In the largest mills, 82 percent of the shavings was utilized in some way as compared with only 33 percent in the smallest size class.

Bark has long been used as a garden and orchard mulch, for cork, a source of tannin, and medicinal purposes. In recent years, many new uses have developed

through research. These include use as an additive or extender in adhesives, composition flooring and other products, insulating materials, lubricating flux for oil well drilling, and various chemical products. In northwest Oregon, the greatest volume of bark is used for garden mulch. Use for other products is expected to expand.

The processing and subsequent sale of residues have become an integral part of operations of large sawmills. The resultant revenue is often sufficient to become a profit factor in the operation. The expected revenue is taken into consideration in bidding for stumpage, so the producer who can exploit his residue is in an advantageous position compared with one who cannot.

The smaller the sawmill, the less likely that the residue will be profitably utilized. A considerable investment is involved in the installation of a barker and chipper, and this investment is more than a small mill can justify. The smaller the mill, the less likely it is to be located on a main transportation route or near the large industrial centers, and the transportation cost of residues may be prohibitive. The smaller the mill, the smaller the total amount of residue produced, and the volume produced may not be enough to give an attractive return on the investment in the processing and transportation equipment needed to utilize this residue. Thus, the small mill is at a disadvantage.

FOREST INDUSTRY CAPACITY AND RAW MATERIAL CONSUMED

The total capacity of all the sawmills included in this study is 5,962,000 board feet of lumber in an 8-hour shift. The single-shift capacity of the plywood plants is 2,500,000 square feet of $\frac{3}{8}$ -inch plywood. Shingle mills were rated on a 6-hour shift since that is normal for these plants, and for such a shift their capacity is 1,443 squares of shingles or shakes. The capacity of pole and piling yards is difficult to determine, for these firms treat

at the same time, in varying quantities, lineal feet of poles, cubic feet of posts, and board feet of lumber.

In 1962, the forest industries of northwest Oregon used 1,690 million board feet of sawtimber, pulp logs, bolts, and poles and piling (tables 13 and 14). Sixty percent of this volume was cut into lumber, 27 percent was manufactured into plywood, 10 percent was utilized by pulpmills, and the remainder was cut into shakes and shingles or treated and sold as posts, poles, or piling. The total timber volume consumed by sawmills in this area was 1,014 million board feet. More than half of this volume, 514 million board feet, was processed by the 17 mills in the largest size class. The mills in the second and third size classes consumed about

200 million board feet each, and the remainder was used by the 57 mills in the smallest size class. Plywood plants were the second largest consumer of logs in northwest Oregon. Their share, 27 percent of the total volume consumed, was 458 million board feet. Pulpmills used 166 million board feet of logs and bolts and supplemented their consumption with the purchase of 622,000 units of chips. Shake and shingle mills and pole and piling yards utilized the remainder, about 52 million board feet.

A little more than three-fourths of the timber consumed within northwest Oregon is cut within the boundaries of the study area. The remainder, 397 million, is imported from surrounding Oregon counties and the State of Washington.

OUTDOOR RECREATION IN NORTHWEST OREGON

Bordered on three sides by an ocean, a river, and snowcapped mountains, northwest Oregon has an abundance of diversified recreation sites centered around the forest resource. Through the efforts of cities, counties, the State, the Federal Government, and private landowners, many of these sites have been developed and opened to the public. The 10 counties within this area have established and maintained 46 parks with facilities for

picnicking, camping, hiking, and sports. The State has established 38 parks, varying in size from 1 to 8,000 acres. Most of these parks are on lakes, streams, or the seashore, offering facilities for every type of outdoor recreation. The State augments this park system with nine waysides where the motoring tourist can find rest and picnic sites. Some timber industries and public utilities also maintain forest recreation facilities.

The Federal Government has also developed numerous recreation sites on the land it manages. The Forest Service has established and maintains over 90 improved campgrounds and picnic areas, 5 winter-sports areas, and, for wilderness enthusiasts, the Mount Hood Wild Area, as well as numerous other areas dedicated to or managed primarily for recreation. A portion of the proposed Mount Jefferson Wild Area is in northwest Oregon. The Bureau of Land Management maintains six picnic and camp units and the Corps of Engineers has developed two land and water recreation sites, the combined area of which is almost 20,000 acres. Within northwest Oregon are two wildlife refuges and one national monument preserving the fort built by the Lewis and Clark Expedition in 1805.

Recreation in northwest Oregon is not only a service industry, providing the residents of this area with facilities for their leisure hours, but a basic industry, attracting tourists from bordering counties and States. The Portland metropolitan population makes abundant use of the

nearby superb natural resources for fishing, hunting, camping, hiking, picnicking, and water sports on the lakes, rivers, and seashore. In 1960, more than 6 million out-of-State tourists poured into Oregon. Most of them traveled one of three routes — the coast highway, through the Willamette Valley, or through the Columbia Gorge. Each of these routes passes through northwest Oregon. Fifty percent of these tourists spent nights in the motels and hotels of the area. More ate their meals in the local restaurants and all purchased gas, oil, and other travel necessities.

Due to a greater amount of leisure time, an increase in the amount of spendable income and the percentage allocated to recreation, and a vast improvement in transportation facilities, the predicted tourist flow in 1975 is 15 million people. It is also anticipated that the wealth of outdoor recreation facilities and equable climate will attract people to this area as residents. The impact this increase will have on the economy of northwest Oregon is considerable and should be taken into consideration in any economic proposals for the area.

INDUSTRIAL OPPORTUNITIES

Preceding sections of this report have described the forest resource as a raw material base for industry. Short-range projections of the stumpage supply, to determine if current level of industrial activity could be maintained or expanded, also have been presented.

Capacity and level of production of the timber industries was determined, including the quantities and disposition of mill residues. The present market situation of these industries was also studied.

Opportunities for expanding timber industries in northwest Oregon will depend not only upon the raw material supply but also upon future market prospects. Labor and capital are likewise needed to expand industry, but if raw material, industrial technology, and market prospects are favorable, labor can usually be found and capital obtained.

Several studies of future demand for timber products have been made during the past decade by public, quasi-public, and private agencies. The two most comprehensive and basic studies of this sort were made by the U.S. Forest Service (1958) and the Stanford Research Institute (1954). More recently, another was made by Guthrie and Armstrong (1961), which is more specific for the West. Generally, quantitative findings of such studies are carefully described as projections and based upon assumptions made of the elements which support demand and their future behavior, such as population, gross national product, price relationships, and other socioeconomic factors. Although such projections are disclaimed as forecasts, they are frequently used as such. For that reason, they may tend to be conservative; at least, the earlier ones are apparently proving to be underesti-

mates. One cause seems to be underestimation of rate of population increase.

The U.S. Forest Service has restudied the timber demand and supply situation, and preliminary results are available in a report entitled "Timber Trends in the United States" (1965). Based upon specified assumptions of economic and social conditions and use of wood in construction, projections were made of the outlook for timber demand in the year 2000. Prospective demand for lumber increases from 37.3 billion board feet in 1962 to 53.5 billion feet by 2000, of which 81 percent will be softwoods and 7 billion feet will be net imports. Prospective demand for plywood and veneer use rises from 12 billion square feet, $\frac{3}{8}$ -inch basis, in 1962 to 31.5 billion feet in 2000. Potential demand for paper and board is expected to nearly triple by 2000.

Translating the findings regarding the national situation to northwest Oregon has some speculative aspects, but some general conclusions can be drawn. In view of all the factors previously presented, regarding timber supply and demand for timber products in northwest Oregon as well as nationwide, a moderate decline in lumber production can be anticipated over the next two decades. This will be accompanied by a comparable increase in plywood production based upon logs shifted from lumber production. A substantial increase in pulp, paper, and wood composition board production is anticipated.

Clatsop, Columbia, Hood River, and Yamhill Counties, of major interest in this study, have many common features but they also have many dissimilarities and contrasts.

Each of the four counties has access to water transportation, but two of the counties, Hood River and Yamhill, are limited to some extent in this respect. Hood River County fronts on the Columbia River, but it is located upstream from the deepwater dredged channel and Bon-

neville Dam, and water traffic is limited to small boats, barges, and log rafts. The eastern boundary of Yamhill County is the Willamette River but, like Hood River County, traffic is limited to log rafts, small boats, and barges since it is upstream from the Oregon City falls and locks which will not pass large ships. The Yamhill River, flowing east through the county to join the Willamette near McMinnville, is used to some extent for rafting logs.

In contrast, Clatsop and Columbia Counties, bordering the lower Columbia River, have good facilities for docking and loading ocean-going vessels and are well located to receive log rafts from the interior of southwestern Washington and the Willamette Valley counties of Oregon.

In Hood River and Yamhill Counties, agriculture is more important than other industry. On the other hand, Clatsop and Columbia Counties are more highly industrialized, and agriculture is of minor importance. Forest industries are the mainstay of the economy of these two counties. Canning of seafood is another important activity in Clatsop County. Tourism and commercial and sport fishing are also exceedingly important to Clatsop County.

Probably the most significant difference between these counties is the relation of log harvest to log consumption. During 1962, log harvest from Clatsop County lands was 236 million board feet compared with log consumption of 119 million feet by Clatsop County industries. Neighboring Columbia County harvested 37 million feet of logs, and its industries consumed 248 million feet. Hood River, in its more isolated location, had a log harvest of 73 million feet and consumption of 95 million feet. Yamhill County harvested 33 million feet of logs and consumed 132 million feet. Each of these counties, Clatsop excepted, was drawing a large part of their industrial raw material from other areas.

As might be expected, relationship between wood chips produced and wood chips consumed also varies considerably from county to county. For example, Columbia County industries consumed more than twice the amount of wood chips its timber industries produced. Clatsop County, on the other hand, produced 41,000 tons of chips annually and consumed none. Hood River County produced about two and a half times the amount of chips consumed. Yamhill County produced only about one-fifth of its requirements for wood chips during 1962.

LUMBER MANUFACTURE

During the decade 1953-62, production of softwood lumber in the United States declined nearly 10.5 percent. Consumption declined, but at a much lesser rate, after imports of softwood lumber from

Canada increased from 2.5 billion feet to 4.6 billion feet. Thus, during the decade, U.S. consumption of softwood lumber was estimated at 32.0 billion feet in 1953 compared with 31.0 billion feet in 1962, a decline of about 3 percent. However, during the past 3 years, United States softwood lumber production has been fairly uniform, increasing slightly from 25.9 billion feet in 1961 to 26.8 billion feet in 1963. Imports of softwood lumber continued to increase during the past 3 years from about 4.0 billion feet in 1961 to 5.3 billion feet in 1963.

Lumber production in the Douglas-fir subregion during the past decade declined from a high of 10.4 billion feet in 1952 to 8.1 billion feet in 1962, or 22.1 percent compared with a decline in total U.S. softwood lumber production of 10.5 percent (fig. 5). This decline is probably due

LUMBER PRODUCTION

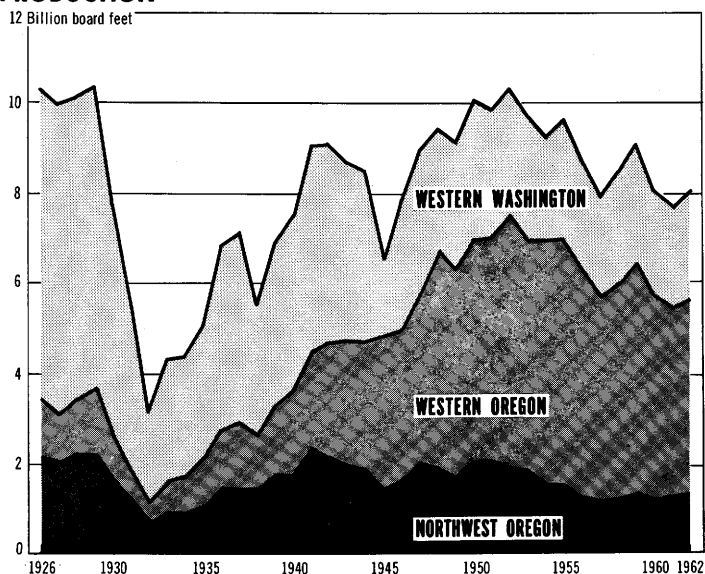


FIGURE 5. — Lumber production, Douglas-fir subregion, 1926-62.

to a combination of causes, including impact of softwood lumber imports, shifts of lumber production to other areas where stumpage is cheaper, and shifts to plywood production. During 1961-63, inclusive, however, lumber production of the Douglas-fir subregion has been somewhat stable at about 8 billion feet annually. Western Oregon production has declined relatively more than that of western Washington.

Northwest Oregon's share of the lumber production of the Douglas-fir subregion declined from 19 percent in 1953 to 17 percent in 1962. The bulk of the decline took place during the first 4 years of the decade, dropping from 1.8 billion feet in 1953 to 1.5 billion feet in 1954 and 1955 and to 1.3 billion feet in 1956. From 1956 to 1962, lumber production in northwest Oregon has been comparatively uniform at about 1.3 billion feet annually.

Movement southward of the center of production in the Douglas-fir subregion is shown by analysis of data available for the period 1926-61 (fig. 6). The first third of the period, center of production was near the south end of Puget Sound. Commencing in 1938, center of production moved swiftly southward in western Washington as production of the Puget Sound and Grays Harbor mills dropped off with declining supplies of old-growth timber. At the same time, southwestern Washington and western Oregon were increasing production of lumber. World War II demands for lumber increased and western Washington did not have stumpage supplies to meet this need. About 1945, the center of lumber production in the region crossed the Columbia River into Oregon. From then on, it moved southward toward the large, remaining supplies of old-growth Douglas-fir in southern Oregon and northern California.

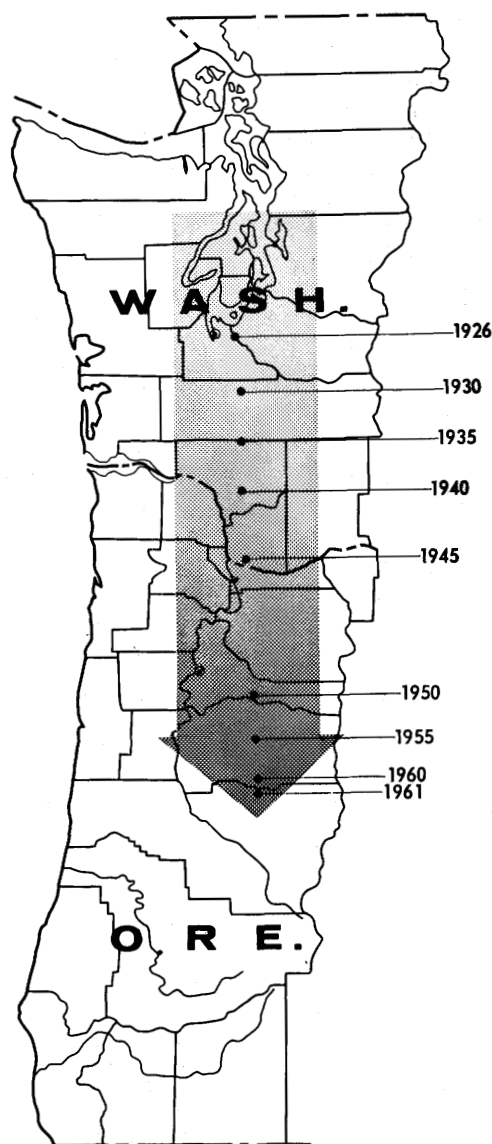


FIGURE 6. — Center of lumber production, Douglas-fir subregion, by periods, 1926-61.

During the postwar period, lumber production increased rapidly in California, largely fed by the previously unexploited "white woods"⁵ of northern California — particularly, the coast counties where large quantities of privately owned stumpage were available for cutting. Production of lumber in California reached its high point in 1959, dropping off slightly in the following years. Students of the situation there conclude that the period of expansion is over and timber supply does not warrant any further increases in production (Zivnuska et al. 1963). When all that is known regarding the timber supply situation in the Pacific Coast States is related to the migratory history of the industry and the present status of timber supply and sawmill installation in northwest Oregon, the conclusion is that no increase can be expected in softwood lumber production there. This conclusion is reinforced by the various projections of lumber demand which see no significant increase in national needs during the next decade that would exert strong forces on latent stumpage supplies.

Fedkiw (1964) determined that annual sawmill capacity in northwest Oregon peaked in 1951, and has been declining since then. In 1962, annual capacity of sawmills in northwest Oregon was about 1.46 billion board feet. However, this does not include idle mills. With both active and idle mills considered, unused capacity probably amounted to about 10 percent in 1962 when 1.36 billion board feet of lumber were produced by northwest Oregon mills. Fedkiw found that, for the entire Douglas-fir subregion, unused sawmill capacity averaged 14.5 percent annually during 1951 to 1960.

⁵A term used commonly in the redwood region of northern California forests to describe Douglas-fir and the true firs.

In view of the set of circumstances and conditions described above, there is no apparent justification for increasing overall sawmill capacity in northwest Oregon for manufacture of softwood lumber. Strategic advantages of much of this area, for obtaining logs and shipping lumber products by water as well as rail, are negated by the generally unfavorable outlook for increasing lumber production here. Unless the competitive situation with British Columbia changes through legislative or other governmental action, no increase can be expected in intercoastal or coastwise lumber shipments from Columbia or Willamette River ports. Outlook for foreign markets is believed to be better, since high-profit Douglas-fir clears are the principal items in this commerce and cargoes are handled for less freight cost in foreign bottoms. Northwest Oregon, in recent years, has been holding its own in this market and, as economic conditions improve in Latin America, Asia, and Africa, the market should expand. Australia has been another favored market for Douglas-fir producers.

It can be expected that new mills, designed for small logs, will be established as character of the area's stumpage resource changes to smaller timber and more young growth. Industry owning or controlling timber will be in the best position to construct new mills or modernize existing plants. Integrated operations, seeking to balance end product with raw material, may increase their sawmill capacity. Of the four counties with current high unemployment, Clatsop and Columbia on the lower Columbia River, seem to offer the best opportunity for establishing new sawmills.

The large volume of hardwoods growing in this area and the low rate of utilizing

them were pointed out earlier in this report. Currently, the quantity of hardwood lumber produced is relatively small. Nearly all hardwood lumber produced here is used in local or California furniture plants. These furniture manufacturers are market oriented, as are all of the secondary wood-using industries, and they are destined to expand with the growing population of the Pacific Coast and Southwest States. Opportunities for expanding the hardwood lumber industry are particularly good in Clatsop, Columbia, and Yamhill Counties.

PLYWOOD MANUFACTURE

Unlike the softwood lumber industry, the softwood plywood industry anticipates expanding markets as population increases and the national economy expands. The industry's large research and development program and aggressive marketing policies are opening new markets. A rapid expansion is taking place in the softwood plywood industry in the South, encouraged by expanding markets and available raw material. Some 19 new plants are already completed, or scheduled for completion by the end of 1965, with prospects of 6 to 10 more in 1966. The resulting expansion in total softwood plywood capacity is expected to be 1.6 billion square feet by the end of 1965, possibly reaching 2.8 billion by the end of 1966 (Anonymous 1965). This expansion will inevitably offer increased competition to Oregon plants.

Regardless of the favorable market outlook, raw material is a limiting factor to expansion of the industry in northwest Oregon. Although plywood logs can bear higher transportation costs under normal circumstances than sawmill logs, the industry must locate close to raw material sources to obtain weight reduction economies. History of the industry's growth illustrates this principle. Greatest expansion in recent years has been in southern

Oregon, northern California, Idaho, western Montana, and eastern Oregon. Records of plant closures, new plants, changes in ownership, and plants opening in 1964 (Sherman 1964) emphasize the above conclusions.

New plants added during 1963 were all located in southern Oregon, and plants scheduled to commence operation in 1964 are in Arkansas, Idaho, eastern Oregon, Texas, and Washington. Acquisitions during recent years by expanding integrated firms, such as Georgia-Pacific Corp. and U.S. Plywood Corp., generally have been of companies which either had substantial timber ownership or firm access to timber supplies. During 1963, four plants closed, three of them in northwest Oregon. Although the reasons for closure were not due entirely to timber supply problems, they probably were a contributing factor. Other reasons for closure were plant obsolescence, finances, and overall company policy regarding utilization of log supply and manufacturing facilities. One of the plants reopened in 1964 after extensive modernization. This plant has installed mechanized equipment which enables it to use smaller logs. However, it will employ about 40 percent fewer people than it did before modernization.

On the optimistic side, plants in northwest Oregon having access to water transportation, or within reasonable truck haul distance of National Forest timber, can anticipate continued supply of old-growth logs. In view of the competitive situation for plywood and sawmill logs, establishment of new plywood enterprises would face some raw material difficulties. At the least, before establishment, a thorough, detailed study should be made of raw material prospects and possible plant locations.

Again, existing firms having an assured timber supply may find it profitable to install or expand plywood capacity to obtain better product mix or other advantages of integration.

Products using plywood with facings of hardwood veneer, paper products, or light metals should offer advantages to plants in this area. Northwest Oregon is in a prime position to receive hardwood logs and veneer from abroad and hardwood veneer and other face material from United States sources by rail or water.

The expanding metropolitan area of northwest Oregon and southwest Washington offers local market outlets for such products. Population forecasters expect this area to grow at a higher rate than other parts of Oregon and at a rate more comparable to California and Washington growth, which is expected to be higher than the national average.

WOOD-FIBER INDUSTRIES — PULP, PAPER, AND WOOD COMPOSITION BOARD

The wood composition board industries (hardboard, particle board, and insulating board) have much in common with the pulp and paper industry in technology and raw material supply. Both employ continuous production processes, use wood residues for raw material, and require industrial water in considerable volume.

The combination of raw material availability and projected market demand is favorable to continued expansion of these industries in the Pacific Northwest. Like the sawmill and plywood industry, they are location-oriented toward raw material supply. Using wood residues for all or a major part of their raw material permits more flexibility in location as weight reduction advantages are partly obtained through use of chips rather than logs. In spite of this, history of the board industry in the Northwest has been generally one of integration with sawmills or plywood plants. Integration with sawmills and plywood plants is not as common in the pulp industry. Lower capital investment requirements for board plants are a probable factor influencing this type of integration. Many more lumber and plywood

firms can command capital for board plants than for pulp and paper plants. Market organizations and outlets are also more closely related between lumber, plywood, and fiberboard than between board and paper products.

The pulp and paper industry also differs from the board industry in the continued use of roundwood for part of its raw material. However, as was pointed out earlier, the great majority of pulp capacity installed during the past decade or more has been based upon availability and use of wood chips, byproducts of the sawmill and plywood industries.

Another point of difference is in the degree of processing needed to produce a completely manufactured commodity. The initial manufacturing process in board plants results in an end product, although all types of board can be and are used in secondary industries to a considerable extent; for example, use of hardboard and particle board in furniture manufacture.

Nevertheless, the major market for wood composition boards is for construction. There it competes with lumber and plywood. Woodpulp, on the other hand, must be made into paper or paperboard to reach end-product use. Paper is also converted to many other products, extending the degrees of vertical integration in the industry. It competes with lumber, plywood, and wood composition boards in limited markets only.

The two industries differ sufficiently, regardless of similarities, that blanket conclusions cannot be drawn regarding opportunities for expansion in northwest Oregon.

Pulp and paper industry. — Pulp and paper mills are a natural complement to the other primary timber industries in the Pacific Northwest. This industry can use wood residues from other primary manufacture, roundwood unsuitable or of marginal value for lumber, and hardwood

species having limited use for lumber or plywood manufacture.

The species composition in northwest Oregon forests makes possible the choice of several technical pulping processes, chemical, semichemical, and mechanical. Recent advances in technology have improved types of each of these three basic processes. This is giving greater flexibility in type of raw material needed, plant location, and magnitude of investment.

Stream and air pollution are being given greater attention by regulatory bodies. However, research and development are solving these problems.

Markets are expanding in volume of demand and type of products made from paper.

The great surge in expanding this industry has been in kraft mills. Although smaller mills have proved feasible, the industry seems to favor a minimum size of 300 to 400 tons capacity per 24 hours for establishing new kraft plants. An integrated pulp and paper mill of this size requires a capital investment of \$30 million to \$40 million. Such a plant would use about 210,000 to 280,000 tons of dry wood a year, based upon 350 operating days. Semichemical and mechanical pulpmills are commonly constructed with smaller capacities and lesser investment.

Recent research and development has made use of shavings and sawdust more feasible for pulping. The large volumes of red alder in northwest Oregon and the tremendous roundwood potential in mortality salvage thinnings and intermediate harvest cut from conifer young-growth stands in this area also add to the raw material base here. The Columbia River offers several choice pulpmill sites. No doubt other suitable sites could be found on the Willamette River system, depending upon type of pulping process and method of effluent disposal.

Raw material availability, plant sites, and market prospects combine to make northwest Oregon a likely area for expansion of the pulp and paper industry.

Wood composition board industries. — The board industries offer good prospects for expanding the timber-based economy in northwest Oregon. The outlook for markets is favorable, raw material is available, labor supply should present no problem, and this area has a number of feasible plant locations. Since this industry can use planer shavings as well as wood chips, expansion is not totally dependent upon importing chips from eastern and southern Oregon. Further, wood chips used do not have to be entirely bark free, strengthening ability of the industry to compete for supplies of this raw material. Roundwood and logging residues can also be used.

Plants of relatively small size are economical; a capital investment of about \$1 million to \$2 million, depending upon the type of board produced, is required for plants with a daily capacity of 50 to 70 tons of board. Annual raw material requirements are from 15,000 to 25,000 tons of dry wood material, depending upon days operated per year, size of plant, and type of product. Man-hours of labor required per ton of daily capacity were estimated at 7 to 10 in a study made in 1955 (Pacific Power & Light Company). Recent theoretical calculations, based upon reported output and labor employed at several typical west coast plants, give a slightly smaller figure, 6.5 to 8.6 man-hours per ton of daily capacity. Proposals for specific plant establishment should be preceded by intensive study of raw material supply, plant location, technical processes, plant and operating costs, and a market survey.

POLES AND PILING

This industry, including preservative treatment of lumber, has been active in this area for years, although it is small

in comparison with the other primary timber industries. About 1 percent of the logs and other roundwood processed in northwest Oregon is treated and marketed as poles and piling. Western pole producers have lost ground to southern pine producers since World War II. New developments in chemical wood preservatives and fire retardants lend encouragement to expanding this industry moderately in the future.

SECONDARY WOOD-USING INDUSTRIES

This industry group includes manufacturers of a wide range of products. These industries have two things in common: (1) They use as a principal raw material the products of sawmills, plywood and veneer plants, wood composition board plants, and pulp and paper mills; (2) these industries are market oriented, to a large degree, as far as plant location is concerned.

Related to these two factors is the tendency for these industries to cluster in and around metropolitan areas having concentrations of primary timber products industries. In the Douglas-fir sub-region, for example, concentrations are found in the Seattle-Puget Sound metropolitan area and the Portland metropolitan area. In this way, they remain near raw material supply and also are close to much or part of their market outlet.

In northwest Oregon, this group includes the following: planing mills; sash and door plants; furniture factories; plants making prefabricated products such as housing components, portable buildings, precut structures, laminated beams and trusses, and converted paper products plants. Other specialty products, such as ladders, garage doors, boats, panels, molded products, and wood flour, are produced in this area. In addition, plants sawing specialty products, custom sawing and drying, and slicing veneer might be included in this category.

Products of some of these industries — paper products, for example — may be marketed nationally, but mostly these industries depend upon western markets. The paper products are largely produced by the pulp and paper manufacturers at integrated plants or at subsidiaries. However, there are a number of relatively small independent producers of converted paper products in the area.

The other industries are largely made up of relatively small, independently owned plants, serving the local market. One or two exceptions — nationally known firms, such as Timber Structures — market products east to the Lake States or further.

Some items produced by these industries, cut stock for example, are also produced by sawmills in the area.

Nearly all of the plants in this category are located in Portland and its suburbs. However, there is no basic reason suitable locations cannot be found elsewhere in northwest Oregon, considering the network of transportation facilities available. As the economy and population of the Pacific coast and Southwest grow, these industries should expand. Usually, the key factors in success of the small firms characterizing these industries are creativity and technical competence in management. Unquestionably, there are opportunities in many places in northwest Oregon for these kinds of enterprises.

CHRISTMAS TREE CULTURE AND MARKETING

The combination of farm forests, industrial forests, and public forests within easy driving distance of a large metropolitan area encourages growing Christmas trees for the market. Although small compared with other forest industries, it is a profitable part-time business for many individuals. A few make it a full-time occupation. Some individuals buy the trees on the stump from public and

private forest-land owners and harvest and market them only.

Another occupation somewhat similar to the latter is the gathering and selling of forest greens and other minor forest products of this sort. There are a few firms in the Pacific Northwest that handle these miscellaneous products on a wholesale basis.

These minor forest industries will probably grow as population grows in the area.

RECREATION AND TOURISM

Northwest Oregon is well known for the quality and convenience of its outdoor recreation features and facilities. The combination of snowcapped mountains, rivers, lakes, forests, and seacoast in a comparatively small area presents many natural opportunities for all sorts of business enterprises. It is difficult to separate forest recreation from other out-

door recreation — presence of verdant forests enhances all outdoor recreation that uses the inland waters, the sea, the snow, or the beaches.

Improvement of the Federal highways, growth of air travel, greater leisure time, population explosion, and many other recent developments and phenomena are contributing to the great growth of this industry in northwest Oregon. The completion of the Columbia River bridge near Astoria will surely increase tourist travel along the northwest Oregon coast and probably along the Columbia River highway.

Opportunities in this industry are well known to local chambers of commerce and the communities of the area. No attempt was made in this study to single out certain forestry aspects of outdoor recreation and tourism and study them. That has been done by public agencies and commissions, and findings have been published.

OUTLOOK FOR FOREST INDUSTRIES OF NORTHWEST OREGON

Compared with most other timber manufacturing areas of the West, the timber industries of northwest Oregon are well diversified and highly developed. The Portland-lower Columbia timber industry concentration can be described as highly integrated, although it does not have a single corporate industrial plant complex to compare with the Weyerhaeuser Co. operation across the Columbia River at Longview.

In reaching this condition, the area has passed through several stages of industrial development. In northwest Oregon were located not only the pioneer sawmills but also the pioneer wood-using pulp and paper mills of the west coast. The softwood plywood industry commenced in Portland nearly 60 years ago. The area passed through the era of the large cargo mills which shipped most, if not all, of their lumber green by vessel coastwise

to California, intercoastal to the east coast, and across the seas to world markets. In contrast, this area was the scene of early intensive use of dry kilns in seasoning the common grades of Douglas-fir; for example, the Oregon-American Lumber Co. at Vernonia. The newer sawmills, replacing the cargo mills, are usually smaller in size, designed to maximize use of automated equipment and produce a more refined product through surfacing and seasoning.

Many secondary wood-using industries, established and expanded in this area, include cooperage manufacture, wood lamination and prefabrication, sawing and surfacing of specialty products, furniture manufacture, and manufacture of converted paper products.

In addition, a number of satellite industries, dependent upon the forest industries for all or a major part of their markets, have developed in or near Portland. These include manufacturers of dry kilns, logging equipment and machinery, lumber carriers, lift trucks, and industrial chemicals. Also located in this area are firms warehousing and distributing products used in the timber industries but manufactured elsewhere in the United States.

Portland is a financial and business center for a large part of the Northwest timber industry. It is the headquarters for many large timber industry firms. Wholesalers, brokers, commission men, and exporters handling lumber, plywood, and other timber products are located here. It is also the headquarters for the principal associations of western lumber manufacturers.

Northwest Oregon is serviced by private and public power utilities centering in Portland, and enjoys relatively low industrial and domestic electric power rates. The recent introduction of natural gas into the area provides another competitive source of industrial fuel. Supplies of water for industrial and domestic use are better than adequate for attracting and

holding timber industries dependent upon large quantities of water.

Earlier, the strategic physical location of northwest Oregon was described in detail. In brief, practically all of the industrial locations in the area have adequate access to excellent rail, highway, and water facilities for receiving raw material and shipping manufactured wood products.

Naturally, an area with the advantages described above would be a gathering place for labor. Adding the educational, cultural, social, and other living advantages makes this an attractive location for skilled, professional, clerical, and executive personnel experienced in the timber industries. Some economists consider that the natural amenities of an area may be an important factor in its economic growth.

With this background, it is evident that the crux of the problem for industrial expansion and job opportunity is in raw material supply and prospective market demand.

RAW MATERIAL SUPPLY FOR TIMBER INDUSTRIES

The log harvest from northwest Oregon forest lands of all ownerships was 1.2 billion board feet in 1962. In addition, unestimated but relatively small quantities of material in the form of poles, piling, cordwood, and bolts were cut and marketed commercially. Although this material is generally considered as non-sawtimber, it includes some that meets size specifications of small saw logs but brings greater returns when marketed as piling and poles, etc.

During 1962, the primary timber manufacturing plants consumed 1.6 billion board feet of logs. Thus, there was an apparent deficit of 400 million board feet in log supply which was satisfied by bringing logs from other parts of Oregon and Washington.

The other important form of raw material used by the primary timber manufacturing plants is chips produced from wood residues. Pulpmills and board plants of northwest Oregon used about 713,000 tons of wood chips from coarse wood residues. Apparently, 200,000 tons of chips were brought in to meet the demand.

Undoubtedly, some logs and chips produced in northwest Oregon are shipped to manufacturing plants out of the area. No attempt was made to determine these quantities. The important factor is the size of the net deficit of raw material needed to maintain northwest Oregon plants at current levels of activity and the dependability of imported chips as a source of supply. Also important are the potential sources of raw material which might be exploited to expand local industry.

Earlier in this report, it was demonstrated that an annual average cut of from 1.2 to 1.3 billion board feet of saw logs could be anticipated during the next decade or two from northwest Oregon commercial forest lands. This assumes continuation of current management practices on public and private lands. Although this amount is slightly higher than the 1962 log harvest on northwest Oregon lands, it is only about equal to the average annual harvest for the past 5 years.

Can the timber yield from northwest Oregon lands be increased without endangering future yields? There are several sources of additional log supply in northwest Oregon. First, there are close to 5 billion board feet of hardwood stumpage and a high growth potential from hardwood sites which have not been fully exploited. Second, there is a total of 5.8 billion board feet of softwood stumpage on private forest lands in the "farmer and miscellaneous" category. On the basis of past experience, current forest practices, and present knowledge of the owners' intent, it is not prudent to count upon any substantial increase in log harvest from these lands. However,

any significant change in management of these lands or transfer of ownership to industrial owners could result in safely increasing harvest from these lands without lowering future yields, as was demonstrated in the 20-year projections. A substantial increase in stumpage and log prices would doubtless result in increased cutting on these lands.

A third source of increased log harvest is the thinnings from the young-growth forests. There is a strong beginning, underway now, in closer utilization through prelogging and thinnings. Improved economic conditions in the lumber industry, exhaustion of the wood chip supply for pulpmills, and reduced cost of harvesting such material through technological changes would accelerate this trend.

Can northwest Oregon depend upon other areas in Oregon and Washington for logs to augment local raw material supplies? Physically, most northwest Oregon timber industries are well located to obtain logs from southwestern Washington and west-central Oregon. Additional transportation and log handling costs are minimized by the Columbia River and Willamette River systems of waterways.

The principal sources of logs in southwest Washington available to northwest Oregon are the Gifford Pinchot National Forest and the Crown Zellerbach lands in Wahkiakum and Pacific Counties. Logs from the Crown Zellerbach lands are obviously committed first to their plants in northwest Oregon and their Camas mill in southwest Washington. Logs will be sold when not needed or when procurement of other logs is advanced.

The annual allowable cut from the Gifford Pinchot was recently announced as 381 million board feet in the regulated cut and 29 million board feet in the unregulated cut.

The unregulated cut is merely an estimate of a potential annual cut and is not

now regulated nor scheduled for cutting. It is composed of material from thinnings, hard-to-log areas, and landscape management areas, economically marginal or sub-marginal owing to adverse costs, inadequate markets, or physical conditions.

It is obvious that western Washington timber industries will obtain a large portion of the stumpage from northern portions of the Gifford Pinchot National Forest. However, a large part of this Forest fronts on the Columbia River east of Portland, is drained by relatively short south-flowing streams like Wind River, or is in the Lewis River drainage which joins the Columbia opposite St. Helens, Oregon, and natural transportation routes are southward.

Currently, northwest Oregon plants are procuring significant quantities of logs from the Gifford Pinchot Forest and are in a competitive position to continue obtaining logs from this source since this stumpage is sold by public bid.

Logs procured from west-central Oregon by northwest Oregon timber industries may originate from both public and private lands. This area, consisting of Benton, Lane, Lincoln, and Linn Counties, produced a total of 2.8 billion board feet of logs during 1962. This log harvest was about equally divided between private and public lands. However, about 90 percent of the log harvest from private lands came from forest industry holdings. Except where these lands were owned by firms having plants in northwest Oregon, it is logical to assume that the logs would be allocated to west-central Oregon manufacturers. This would be as likely in the case of logs harvested from other private lands. While northwest Oregon can probably count upon procuring some logs from private forest lands in west-central Oregon, the most dependable source would seem to be the public forest lands. However, competition for public-owned stumpage has been severe in this area and will

probably continue so. Therefore, it is unlikely that northwest Oregon industries can expect any great increase in volume of logs procured from this area during the next decade, the ownership of private forest lands remaining as it is now.

Possibility of increasing the supply of wood chips, available for manufacture into pulp or wood composition boards, appears to be encouraging on the surface. Only about three-fifths of the coarse residue developing at northwest Oregon plants was converted to chips, despite the fact that local pulp mills and board plants imported nearly three-tenths of their chip requirements. The largest part of the coarse residues unused or used for fuel is developed at the smaller size sawmills and at the plywood and veneer mills. Cost of installing barkers and chippers is a limiting factor to the production of wood chips by the smaller sawmills. Approximately one-third of the coarse residue developing at the veneer and plywood plants was in the form of roundup, log trim, and spur ends. This material has disadvantages for chip production because of several factors, including physical shape and size, point in the plant where it develops, and cost. Pond "lilies" are not used and were not included as coarse residue in the survey.

Even at sawmills having barkers and chippers, a portion of the coarse residue is unsuited for processing into pulp chips because of adhering bark and other factors which make the operation uneconomical or infeasible. Some coarse residue is used for fuel which, under favorable economic conditions, could be converted to chips and marketed.

Analysis of available information and discussion with well-informed people show no market surplus of chips in this area currently. If more could be produced here at a price competitive with those shipped in from eastern and southern Oregon, there would be a ready market here and in western Washington.

Since northwest Oregon is both an exporter and importer of chips, appraisal of the overall situation and trends in use of chips and potential sources of supply is enlightening.

Volume of pulpwood in all forms, consumed by Oregon and Washington pulpmills, increased more than twofold from 3.4 million cords in 1947 to 7.2 million cords in 1962 (Northwest Pulp & Paper Association 1962). During that same period, use of chips and residue increased nearly fourteenfold from 290,000 cords to 4.0 million cords. Farmer wood increased from 283,000 cords to 729,000 cords, and consumption of logs decreased from 2.8 million cords to 2.5 million cords. Thus, the expansion of the pulp industry during this 15-year period was based almost entirely upon chips. In view of the pulp manufacturing capacity added in these two States during 1963 and that definitely planned for construction during 1964, a large part of which is in west-central and southwest Oregon, chips could become a critical raw material item.

The most recent overall analysis of pulpwood sources in the Pacific Northwest was made for 1957 by this Station (Grantham 1960). It showed that during 1957 chippable material developing at Oregon sawmill and plywood plants was 3.7 million cords and at Washington plants was 1.5 million cords, or a total of 5.2 million cords. During 1957, a total of 2.7 million cords of this material was used by pulpmills in the two States. Consumption has since increased to 4.0 million cords, or nearly 80 percent of the visible supply. This situation changes with volume of lumber and plywood production, but the diminishing margin between potential supply and consumption is a cautionary guidepost.

Other sources of raw material are available if chip prices become too high or the supply is actually exhausted. In the two States, these sources total 2.9 million cords of sawdust, 1.9 million cords of shavings,

1.6 million cords of logging residue, and 7.5 million cords of annual mortality. In Oregon alone, in 1957, there were 3.7 million cords of chippable manufacturing residue, 2.0 million cords of sawdust, 1.3 million cords of shavings, 1.2 million cords of logging residue, and 4.3 million cords of annual mortality.

Despite the mobility of log and chip supplies, there are local variations which require close analysis in evaluating the outlook for the timber industries in northwest Oregon. This is particularly true in the four subject counties: Clatsop, Columbia, Hood River, and Yamhill. The situation also varies by industry. Accordingly, each major industry will be discussed separately and raw material problems identified and described, following a general discussion of markets and transportation.

TRANSPORTATION AND MARKETS

The timber industries are commonly raw material oriented. On the other hand, the primary products of these industries are comparatively bulky and cost of shipping them to markets is a critical factor. Axiomatically, the greater the value added by manufacture to these products, the wider the markets open to them.

Sampson (1961), from a study of railroad shipments and rates from the Pacific Northwest, found that relatively few commodities, 14 out of 260, accounted for nearly half of the rail tonnage originating in the region. He also found that 13 of these 14 commodities were derived directly from forest or agricultural industries. Oregon was much more dependent upon these basic industries for extra-regional shipments than Washington. Sampson discovered that the principal markets for forest products are distant and concentrated geographically. He pointed out that the Pacific Northwest is greatly dependent upon adequate rail transportation and low freight rates because of the importance of distant markets for the region's comparatively high-

bulk, low-value commodities. He concluded that any adverse change in quality and cost of rail transportation would swiftly and directly affect the region's economy. A measure of importance of this rail traffic in Oregon is shown by the annual outgoing-freight bill,⁶ which amounted to \$248 million in 1958. Two commodity classes — lumber, including lath and shingles, and veneer and plywood — accounted for \$189 million. Other products manufactured from wood or wood fiber raise the total accounted for by the forest resource industries to \$200 million.

Northwest Oregon is physically well located with respect to transportation, having good world port facilities, direct rail connections with five transcontinental lines, and excellent highway access to principal routes east, north, and south. Only a comparatively small part of the total production of northwest Oregon's primary timber industries finds end use locally, and these industries are largely dependent upon national markets. Volume of lumber, plywood, and pulp and paper products shipped to foreign markets is sufficient to make this outlet important to some producers in this area. Generally, though, export markets are greatly overshadowed by domestic markets.

Although products of the northwest Oregon timber industries are marketed to some extent in every State of the Union, transportation costs and degree of competition from other United States timber-producing regions and from British Columbia and eastern Canada are restrictive factors in many States. Markets for wood-pulp are much more limited. No specific information was obtained regarding export markets for wood composition boards. However, it is believed that this industry is largely dependent upon nearby domestic markets because of the competition from

producers in the Southern and Lake States, eastern Canada, and the Scandinavian countries for eastern and world markets.

LUMBER

The authoritative source for recent lumber distribution statistics was a West Coast Lumbermen's Association compilation, published monthly, which covered about half the production of the Douglas-fir subregion and is believed indicative of total distribution (West Coast Lumbermen's Association 1962). During 1962, out of a total of 3,629 million feet of lumber shipped from the region, 2,113 million feet were shipped by rail, 922 million by vessel, and 594 million by truck and barge. Western Oregon alone shipped a total of 2,042 million feet: 1,270 million feet by rail, 488 million feet by ship, and 284 million feet by truck and barge. Distribution of rail shipments within the conterminous United States is given in table 20.

Table 20 does not include Alaska and Hawaii. In addition to the amounts in table 20, 15.8 million feet were shipped by rail to Canada and 0.1 million feet to Mexico.

Domestic cargo shipments of lumber from the Douglas-fir subregion during 1962 amounted to 744 million feet, distributed as follows:

	Western Oregon	Western Washington	Douglas-fir subregion
— — — — (million feet) — — — —			
DESTINATION:			
EAST COAST	332	178	510
WEST COAST	28	185	213
OFFSHORE	5	16	21
TOTAL	365	379	744

Export shipments of lumber during that year totaled 178 million feet, 70 million feet from western Washington and 108 million feet from western Oregon.

⁶Shipments out of the Pacific Northwest do not include intrastate shipments of logs, chips, and manufactured forest products.

TABLE 20
Distribution of lumber rail shipments in United States
from western Oregon and western Washington, 1962

Destination by region	Originating area					
	Western Oregon		Western Washington		Total	
	MM bd.ft.	Percent	MM bd.ft.	Percent	MM bd.ft.	Percent
Northeast and north						
Atlantic States	106	8.4	128	15.2	234	11.2
Southern States	317	25.2	165	19.7	482	23.0
Lake States	238	18.9	243	29.0	481	22.9
Prairie States	190	15.1	142	16.9	332	15.9
Mountain States	94	7.5	41	4.9	135	6.4
California	231	18.4	39	4.6	270	12.9
Oregon	51	4.0	19	2.3	70	3.3
Washington	31	2.5	62	7.4	93	4.4
Total	1,258	100.0	839	100.0	2,097	100.0

Truck and barge shipments of lumber are combined in the West Coast Lumbermen's Association tabulation. During 1962, they totaled 594 million feet; 310 million feet were shipped from western Washington plants and 284 million feet from western Oregon plants. However, in both States, a large part of the "truck and barge" shipments are intrastate, either to wholesale and retail outlets or for factory and plant use. In western Washington, these categories accounted for 288 million feet and in western Oregon, 213 million feet. In addition, there was some exchange between the two States. The net result is that the volume shipped to other States was small, with one exception; California was the destination of 54 million feet of truck shipments, practically all shipped from western Oregon. Each of the remaining eight Western States received small amounts of lumber by truck. Although no further geographical breakdown is available, it is believed that the larger part of truck shipments to California was shipped by west-central and southwest Oregon mills. Information on total volume of lumber shipped by truck is unobtainable so perhaps the above figures are not truly representative. Non-

member mills and nonrespondent mills to the WCLA canvass in western Oregon are believed to be the smaller mills and ones more likely to ship by truck.

Although complete lumber distribution data are not available for northwest Oregon, information is available on waterborne shipments. Generalizations can also be made upon the basis of data presented above. Obviously, a greater volume of lumber is shipped by rail. Major markets are the Southern States — principally Texas and Oklahoma — North Atlantic States, the Midwest, and California. Producers in western Oregon, from Glendale south, have a lower rate to California and southwest points than those in the remainder of the Douglas-fir subregion. Truck and waterborne shipments place California in first rank.

Waterborne shipments of lumber from northwest Oregon ports amounted to more than 250 million feet in 1962. Of this, nearly 105 million feet were shipped coastwise, California markets absorbing most, if not all of it. About 60 million feet were shipped to the east coast. Eighty million feet were exported, and the remainder went to Hawaii or Alaska.

PLYWOOD

During 1962, northwest Oregon accounted for more than one-tenth of the total softwood plywood production in the Nation. Nearly all of the total U.S. production of 9.5 billion square feet ($\frac{3}{8}$ -inch basis) was produced in the three Pacific Coast States. Producers in these three States have about the same competitive conditions in national and foreign markets. Therefore, it is reasonable to believe that industrywide distribution patterns will serve to describe the markets of northwest Oregon producers.

The Douglas Fir Plywood Association made a geographical analysis of 1962 shipments from member mills. This survey covered 6.5 billion square feet. Total production of all member mills was 7.3 billion square feet. Northeast and Middle Atlantic States received 18 percent of the total; Southern States, 27 percent; Lake States, 18 percent; Prairie States, 9 percent; Rocky Mountain States, 5 percent; California, 14 percent; Oregon, 3 percent; Washington, 5 percent; and Alaska, Hawaii, and foreign markets, 1 percent.

California producers have a preferential position in the California market. However, in spite of a rapid increase in plywood production in that State during recent years, it is not self-sufficient (Zivnuska et al. 1963). Since California producers ship much of their production out of the State, it remains an important market for Oregon producers.

Nearly all of the softwood plywood from northwest Oregon is shipped by rail and truck. Data on truck shipments are difficult to obtain, and such shipments are limited to the western continental States. Except for California, this market is relatively small — southern Oregon and northern California producers are in a better position than northwest Oregon producers to reach this market by truck. Logically, then, the great majority of northwest Oregon plywood moves to other markets by rail.

HARDBOARD

The principal domestic markets for hardboards were the North Central, New England, and Middle Atlantic States, according to a compilation made in 1954 by the U.S. Tariff Commission and covering the years 1950, 1953, and 1954 (Pacific Power & Light Co. 1955). During 1954, the 11 Western States probably consumed about one-sixth of the United States total.

The Northern and Eastern States are much more accessible to Eastern United States, Canadian, and foreign producers than to the western producers. The national market open to western producers is probably pretty well limited to the Midwest, Mountain, and Pacific Coast States.

Volume of all types of board shipped from northwest Oregon by water is minor.

PULP AND PAPER

The Pacific Northwest (Oregon and Washington) is an exporter of pulp, producing more than is used within the region for paper manufacture. During 1962, this region produced 4,576,000 tons⁷ of woodpulp, about one-sixth of the total U.S. production. Of the regional total, Washington produced 3,345,000 tons and Oregon 1,231,000 tons. By type of pulp, sulfate pulp leads, followed by sulfite, alpha and dissolving, groundwood, semichemical, and soda. Exact figures on some types are unavailable to avoid disclosure of production of an individual manufacturer. It has only been in recent years that sulfate pulp has been the leader. During 1962, this region produced 3,121,000 tons of paper and paperboard; Washington produced 1,894,000 tons and Oregon, 1,227,000 tons.

A total of about 1.4 million tons of woodpulp was shipped out of the region

⁷Includes production of one plant in Alaska which is combined with the Washington total.

during 1962. Although part of this went to "captive" paper plants, by far the major part of it was market pulp.

Figures on 1962 distribution of pulp are not available, but Guthrie and Iulo's study (1963) showed that in 1960 Oregon and Washington shipped 1,072,000 tons of pulp to other States, 971,000 tons by rail and over 100,000 tons by water and truck. About 85 percent of this amount was shipped to the Midwest and East. The rest was shipped to the Southern States and California. Market sales of pulp during this year amounted to about 900,000 tons.

During 1960, Pacific Northwest pulp producers exported 410,000 tons of wood-pulp. Again, this figure included the output of a dissolving pulpmill in Alaska, owned and operated by a Japanese firm. All of the output of this pulpmill is shipped to Japan.

The Western States as a whole do not produce all of their requirements for paper and paperboard. However, this is not true of Oregon, which produces in the aggregate more paper than it consumes.

All except one of the pulp and paper plants in northwest Oregon are integrated

and use all the pulp they make for paper manufacture. The one exception is a pulp plant at Newberg, which markets its entire output. Its capacity is rated at 150 tons per 24 hours of unbleached sulfite pulp (Lockwood Trade Journal, Inc. 1963). Total daily capacity of all pulpmills in northwest Oregon is 1,680 tons.

LOGS

Logs are becoming an important and controversial export commodity in the Pacific Northwest. Regardless of the impact they may have on stumpage supply to regional timber industries, they are a source of income to some timber industry firms and to labor. During 1961, the Pacific Northwest exported 336 million feet of logs; volume of this traffic dropped slightly to 311 million feet during 1962. Traffic in logs picked up considerably during 1963. During the first three quarters of the year, log exports totaled 595 million feet. Japan takes nearly all of the logs exported, small quantities going to Canada and South Korea.

During 1962, northwest Oregon ports shipped 16 million feet of logs to Japan. Small amounts of piling were shipped to Hawaii.

SUMMARY

1. Northwest Oregon has many natural advantages favoring the growth of timber industries. These include abundant forest resources, water transportation to the sea and interior, excellent rail and highway facilities, relatively cheap power, plentiful supplies of industrial and domestic water, and equable climate.

2. Population growth on the Pacific coast, development of other industries in

northwest Oregon, and overall economic growth of the area favor location of secondary wood-using industries here.

3. After more than a century of timber utilization and agricultural conversion of forest lands, 72 percent of the total land area of northwest Oregon is forest land. Forest land totals 4.1 million acres, of which 4.0 million acres are commercial forest land.

4. Northwest Oregon has a total sawtimber volume of 65.6 billion board feet. More than half of this volume is Douglas-fir. Hemlock-Sitka spruce type ranks second in softwood volume with 21.4 billion board feet. Hardwoods total 4.8 billion board feet, of which 3.4 billion is red alder.

5. Commercial forest land is about evenly divided between public and private ownership. More than half the sawtimber volume is on the Mount Hood National Forest. Combined public ownership accounts for seven-tenths of the timber volume.

6. A little less than half the private forest land is in industrial ownership, and the remainder is in farmer and miscellaneous private ownership, including a few large nonindustrial but forestry-oriented holding companies. Forest industry lands support 10.5 billion board feet of sawtimber compared with 8.3 billion feet on the nonindustrial private forest lands.

7. Net annual growth on all commercial forest lands during 1952-61 averaged 1.1 billion board feet, of which 917 million feet were in softwoods and 205 million feet in hardwoods.

8. During 1958-62, log harvest averaged 1.3 billion board feet. In 1962, it was 1.2 billion board feet.

9. The timber industry complex of northwest Oregon is highly developed, including sawmills, veneer and plywood plants, pulp and paper plants, wood composition board plants, and a variety of remanufacturing and secondary wood-using plants.

10. During 1962, the primary timber industries of northwest Oregon consumed 1.6 billion board feet of logs and 713,000 tons of wood chips processed from wood residues developed by sawmills and veneer and plywood plants. Northwest Ore-

gon plants produced 513,000 tons of wood chips.

11. Northwest Oregon currently imports a net volume of 400 million board feet of logs and 200,000 tons of wood chips from neighboring areas in Oregon and southwest Washington to supply its industries.

12. Based upon analysis of timber supply and anticipated demand for timber products, an average annual log harvest of about 1.2 billion board feet is expected during the next decade or two. This is about the same as the average harvest for the 1958-62 period. The current allowable cut from public forest lands totals 620 million board feet. With continuation of current trends in management of private forest lands, a cut of 600 million board feet could be harvested from these lands without serious adverse effect on future yields.

13. The diverse and unpredictable intentions of nonindustrial private forestland owners make it exceedingly difficult to predict future timber harvest from their lands. Furthermore, the comparatively large volume of hardwood growing stock and current growth, not now being utilized, creates forest management problems for all owners, but particularly for the nonindustrial private owners.

14. Lumber production has declined during the past decade, absolutely and relative to the total of the Douglas-fir subregion. Production declined from 1.8 billion board feet in 1953 to 1.3 billion board feet in 1956. During the past 5 years, production has stabilized at about 1.3 billion board feet annually.

15. Trends in production of plywood, pulp and paper, and wood composition board have been generally upward in northwest Oregon.

CONCLUSIONS

1. Based upon findings of a national analysis of demand for wood products in the framework of the timber supply situation, a moderate decline in lumber production is expected in northwest Oregon over the next several decades. During this period, a moderate increase in production of veneer and plywood and a substantial increase in production of pulp and paper and wood composition board is anticipated in this area.

2. During the next few years, some increase in hardwood lumber production is expected, but this will be limited by economic availability of logs and competition from pulpmills and existing hardwood lumber manufacturers for available logs.

3. Veneer and plywood production is expected to increase during the next few years in this area at the expense of lumber manufacture or through withdrawal of logs from other areas.

4. Pulp and paper manufacture will increase, but it will have to be based upon thinnings and other low-cost roundwood or on fine mill residues.

5. Secondary wood-using industries, manufacturing such products as wood specialties, laminated beams, trusses, etc., wood chemicals, and converted paper products, offer good possibilities for industrial expansion in northwest Oregon owing to locational advantages in this area and nearness to growing consumer markets.

LITERATURE

CITED

Anonymous.

1965. South moves fast into the softwood plywood industry. Forest Indus. 92(1):48, illus.

Corder, S. E.

1956. Oregon mill residues in 1953. Oreg. Forest Prod. Lab. Inform. Cir. 7, 32 pp, illus.

..... and Gedney, D. R.

1956. Mill residues in 3 Oregon counties. Oreg. Forest Prod. Lab. In-

form. Cir. 8, 34 pp., illus.

Fedkiw, John.

1964. Forest industry capacity, production, and available log supplies in the Douglas-fir subregion.*U.S. Forest Serv. Res. Paper PNW-11, 63 pp., illus.

Grantham, John B.

1960. Availability and use of wood for pulp in Pacific Northwest.* Pulp & Paper 34(13): 107-108, 111-112.

- Guthrie, John A., and Armstrong, George R.
1961. Western forestry industry, an economic outlook. 324 pp., illus. Baltimore: John Hopkins Press.
- and Iulo, William.
1963. Some economic aspects of the pulp and paper industry with particular references to Washington and Oregon. 106 pp., illus. [Wash. State Univ., Pullman.]
- Lockwood Trade Journal Co., Inc.
1963. Lockwood's directory of the paper, and allied trades. Ed. 88, 1,592 pp., illus. New York.
- Metcalf, Melvin E., and Hazard, John W.
1964. Forest statistics for northwest Oregon.* U.S. Forest Serv. Resource Bul. PNW-7, 38 pp.
- Northwest Pulp & Paper Association.
1962. Economic survey 1947-62. 10 pp. Seattle, Wash.
- Pacific Power & Light Co.
1955. Wood composition boards; general characteristics, uses and manufacturing processes. 43 pp. plus appendixes, illus. Portland, Ore.
- Sampson, Roy J.
1961. Railroad shipments and rates from the Pacific Northwest. Univ. Ore. Bur. Business Res., 64 pp., illus.
- Sherman, Dean F.
1964. The plywood industry; where it is — where it is going. Forest Indus. 91(1): 35-38, illus.
- Stanford Research Institute.
1954. America's demand for wood 1929-1975; summary of a report . . . to Weyerhaeuser Timber Co., Tacoma, Wash. 94 pp., illus.
- U.S. Bureau of the Census.
1961. United States census of agriculture, 1959. Washington counties. 225 pp.
- 1962. County and city data book; a statistical abstract supplement. 669 pp., illus.
- U.S. Department of Agriculture
1962. USDA report on water and related land resources, middle Willamette River basin, Oregon. 180 pp., illus.
- U.S. Forest Service.
1958. Timber resources for America's future. U.S. Dept. Agr. Forest Resource Rpt. 14, 713 pp., illus.
- 1965. Timber trends in the United States. U.S. Dept. Agr. Forest Resource Rpt. 17, 235 pp., illus.
- West Coast Lumbermen's Association.
1962. Distribution of lumber shipments. 4 pp. Portland, Ore.: Western Wood Products Association. [Published monthly.]
- Zivnuska, John A., Cox, Paul, Poli, A., and Pesonen, David.
1963. Economic development prospects for the commercial forest resources and forest products industries of California. Berkeley: University of California.
- *Address requests for copies to the Pacific Northwest Forest & Range Experiment Station.

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