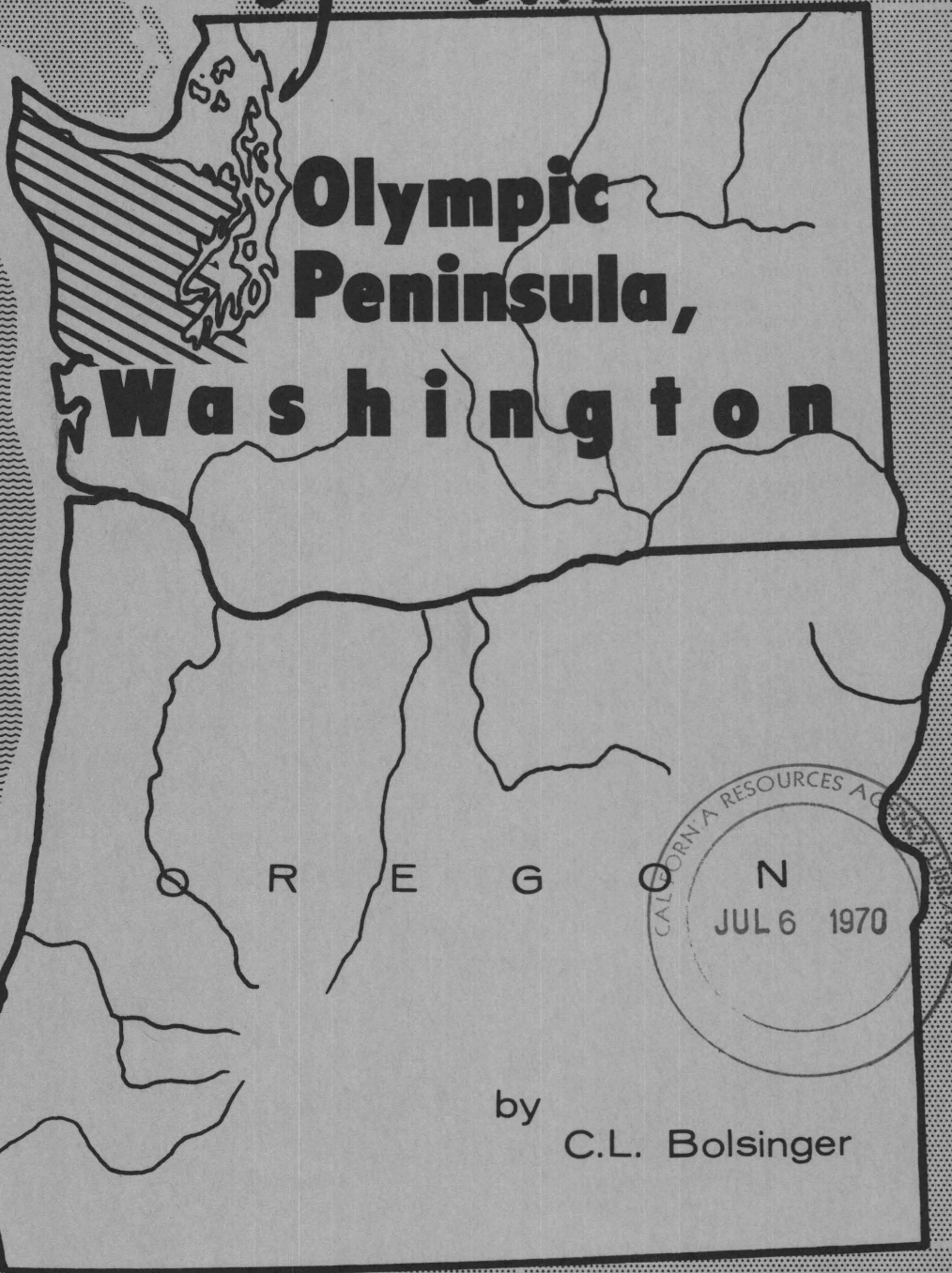


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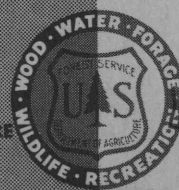
by
C.L. Bolsinger

PACIFIC NORTHWEST

FOREST AND RANGE EXPERIMENT STATION

FOREST SERVICE • U.S. DEPARTMENT OF AGRICULTURE

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**PREPARED BY
FOREST SURVEY PROJECT
Melvin E. Metcalf, Project Leader**

Field and Office Work by

**Charles L. Bolsinger, Field Supervisor
James D. Arney and James O. Howard, Assistant Field Supervisors**

Crewmen:

Dale R. Baer
Jerry Behm
Gary L. Carroll
David D. Chapman
Darrell D. DeVault
Barry L. Hilt
Jack Hoisington
David M. Jacobs

Loren K. Jones
Ronald P. Monk
Tharon O'Dell
John C. Rennie
Harold Riley
Marvin L. Schmeiser
Willard J. Schnurbusch
James L. Schuler

Michael J. Solomon
Roger C. Sparwasser
John L. Teply
Bruce A. Veneberg
William K. Vogt
Lothar F. Wildt
James L. Wilson

John M. Berger, Office Compilation Supervisor

Programmers:

David M. Jacobs
Mary Anne Mei

Statistical Clerks:

Patricia M. Fadner
Margaret C. O'Mara
Barbara C. Pearlman
Florence K. Ruderman
Marian E. Simons

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Preface

This report summarizes the findings of the fourth inventory of the forests in Clallam, Jefferson, Grays Harbor, Mason, and Thurston Counties in Washington. Fieldwork on lands outside the National Forests was completed during the summer of 1965. Fieldwork for the Olympic National Forest was completed in 1963, and for the Snoqualmie National Forest, a small portion of which lies in southeast Thurston County, in 1965. Previous inventories of these five counties were completed as follows:

County	First inventory	Second inventory	Third inventory
Clallam	1932	1939	1960
Grays Harbor	1932	1937	1951
Jefferson	1932	1939-40	1960
Mason	1932	1940	1951
Thurston	1932	1939	1954

This inventory was conducted by the Forest Survey, a nationwide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928 and subsequent amendments. The purposes of the Forest Survey are to obtain comprehensive information on timber resources, including the extent and condition of forest lands, the amount and kind of timber growing on these lands, the rate of forest growth and depletion, the amount of timber cut, and probable future trends in timber requirements, and to analyze and make available survey information needed to formulate forest policies and programs. Resurveys are made periodically to update basic information.

The Forest Survey is conducted in all nine forest regions of the United States by the USDA Forest Service Experiment Stations. The Pacific Northwest Forest and Range Experiment Station at Portland, Oregon, is responsible for the States of Washington, Oregon, California, Alaska, and Hawaii.

Summary

The fourth inventory of the timber resources of the Olympic Peninsula shows a total of 3,105,000 acres of commercial forest land and 81,464 million board feet (International 1/4-inch scale) of sawtimber volume. Total timber volume has remained about the same for the past 12 years, and cut and growth currently are nearly in balance.

Compared with the Douglas-fir region as a whole, less of the forest in the Olympic Peninsula is in a poorly stocked condition, and a greater proportion is in fast-growing young conifer timber. The generally good condition of the forest reflects the high growth potential of the forest land and the relative ease with which lands restock. Most of the present young sawtimber stands originated after logging or burning in the timber boom period of the late 1800's and early 1900's, or as a result of the February 1921 windstorm. Although most of these young-growth stands originated by chance, forest protection the past few decades has been important in their survival and development.

Although the forest is in generally good condition, there are some problems. Relatively large areas of high-site conifer lands are not producing as much as they could because of low stocking, overstocking, or predominance of low-quality trees. Several hundred thousand acres of forest land occupied by hardwoods could be growing more valuable conifer timber. A considerable volume of dead hemlock and Douglas-fir timber, much of which occurs in fairly heavy per-acre concentration, is being lost annually. Western redcedar, the basic resource for the important shake and shingle industry on the Peninsula, is diminishing and at the present rate of cutting will be gone in 25 years or less. A problem facing the timber industry is the loss of commercial forest land. A substantial area has been lost to roads and powerlines, urban and agricultural clearing, and recreational development. In the eastern part of the Peninsula, future losses due to recreational and real estate development may exceed 200,000 acres by the year 2000. Other areas may also be affected. If softwood timber production is to remain the same or be increased, more intensive management of remaining lands will be necessary.

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Introduction

The Olympic Peninsula is one of the outstanding tree-growing areas on the North American Continent, and timber has been a primary factor in its development. In the early 1850's, waterpowered sawmills were operating in what is now Jefferson and Mason Counties; and in 1853, the year Washington Territory was created, Pope and Talbot, an eastern concern, set up sawmill operations at Port Gamble on the east bank of Hood Canal. Demands created by the California gold rush and the growth and repeated burning of San Francisco sent lumber prices soaring; as a result, the great Douglas-fir stands in the lowlands of the Peninsula's east side fell at an

accelerated rate. Lumberjacks moved steadily inland from tidewater, first yarding the massive logs by ox team and later by steam donkey. A number of logging railroads began deep penetration into the woods. Among these were the Satsop, the Mason County Central, and the more successful Puget Sound and Grays Harbor Railroad, the latter managed by Sol Simpson primarily to supply Mason County logs to the Port Blakely Mill Company on Puget Sound (Simpson and Port Blakely are two names still prominent in the Olympic Peninsula). In the 1880's and 1890's, several hundred million board feet of timber were cut in Mason County, and in eastern

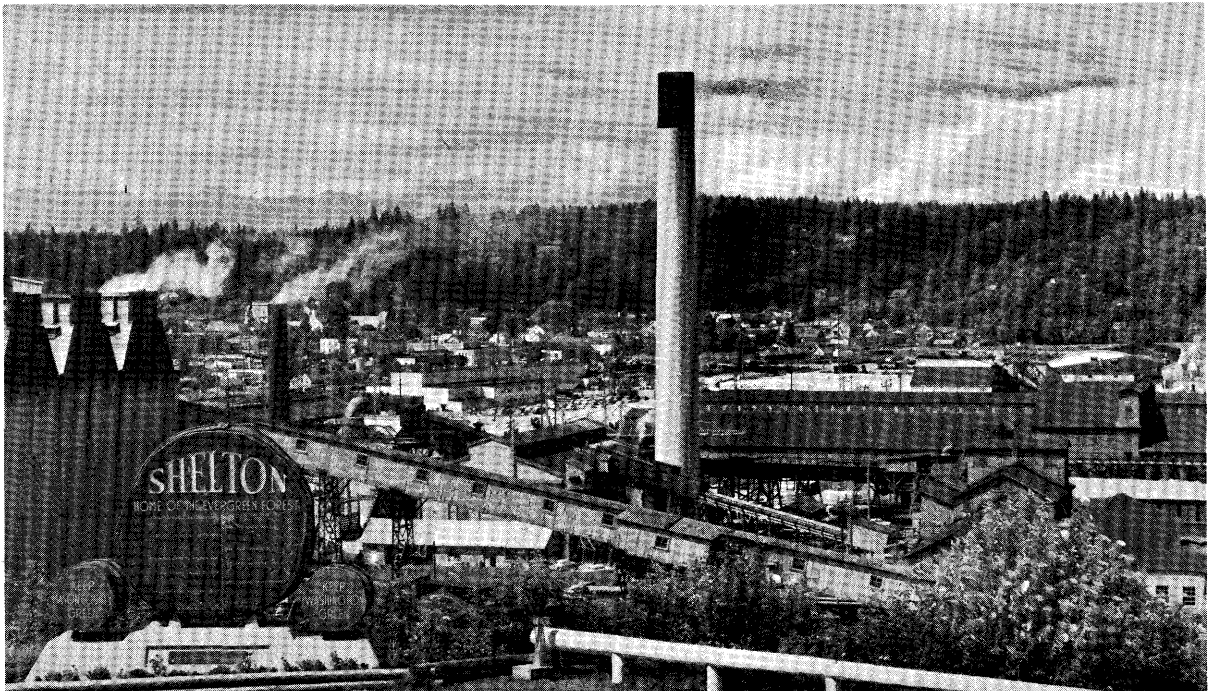


Figure 1. — The city of Shelton, in Mason County, is one of the oldest timber towns in the Northwest and is still an important forest industry center.

Clallam and Jefferson Counties near Discovery Bay, Port Townsend, and Port Ludlow.

The lumber boom intensified, reaching a peak shortly after the end of World War I. For three decades, logging was the dominant activity from Port Angeles to Shelton in eastern Clallam and Jefferson Counties and Mason County. By the late 1920's, the accessible old-growth Douglas-fir was nearly gone from eastern Clallam and Jefferson Counties, the loggers having cut back to the steep flanks of the mountains; and the lumber industry declined rapidly. In its shadow, however, grew the pulp and paper industry, still prominent today and one of the main supporting payrolls in Port Angeles and Port Townsend. Mason County also had its low period during the 1920's and 1930's, but today it is an important and stable timber supply area (fig. 1).

Thurston County, at the extreme southern tip of Puget Sound, was an important timber supply area in the past; it is less so today, but still contributes some to the total harvest. Of more importance are its mills and overseas harbor which handle logs and other forest products originating in many western Washington counties.

At Grays Harbor in the southwestern corner of the Peninsula, the first sawmills were built in the 1880's. The towns of Aberdeen and Hoquiam grew with the burgeoning lumber industry. Initially, Grays Harbor lumber was manufactured primarily for local use and to supply the southern California building boom. After the opening of the Panama Canal in 1914, Grays Harbor became an important world port in the lumber trade. From 1884 to 1924, over 20 billion board feet were cut from the forests of present Grays Harbor County. From 1924 to 1929, the cut exceeded a billion board feet per year, the primary species being Douglas-fir, Sitka spruce, and western redcedar, though even at this early period some hemlock lumber was being manufactured. The easily accessible old-growth Douglas-fir was becoming scarce when the Depression crippled the Nation and these two factors, combined with the related 1926-27 collapse of the California building boom — due in part to the rising postwar prices — caused Grays Harbor lumber production to

drop to one-quarter billion board feet in 1932. For years, lumber production never rose above one-half billion feet annually (in 1938, production was only 194 million), although the decline in lumbering was partly compensated for by the growth of the veneer and plywood and pulp and paper industries. For many years, Grays Harbor County was a semidepressed area, but now, as in the other Peninsula counties, economic activity is on the upswing. Though in part due to general regional and national economic well-being, Grays Harbor's recent growth is also a reflection of its productive forests and of the conversion of the forest industry from old-growth Douglas-fir lumber to a diversified industry using a greater range of sizes and species of trees in a variety of products.

After more than a century of logging, Olympic Peninsula timber is still of major importance to the local and State economy and to the Nation's paper-using and homebuilding industries (fig. 2). Employment by the forest industries is about 15,000 persons or 40 percent of total industrial employment reported in the five-county area (Employment Security Department 1966). In addition to reported employment, there are many nonreporting independent timber workers on the Peninsula including cedar cutters and many family operations. In addition to supporting the local economy, a substantial volume of Olympic Peninsula logs is hauled to mills on Puget Sound and in Lewis and Pacific Counties to the south and southeast, thus contributing to employment in these areas.

Compared with the Douglas-fir region as a whole, the Olympic Peninsula has had a rather long history of forest protection and management. In some areas, the present timber stands represent the third crop since settlement in the 1800's. The first private tree farm in the United States — the Clemons Tree Farm — was established at Montesano in Grays Harbor County in 1941, and two cooperative U. S. Forest Service-private industry experimental forests on private lands have been in existence for years to study the management of second-growth hemlock and Douglas-fir timber. At least two private timber companies and the State Department of

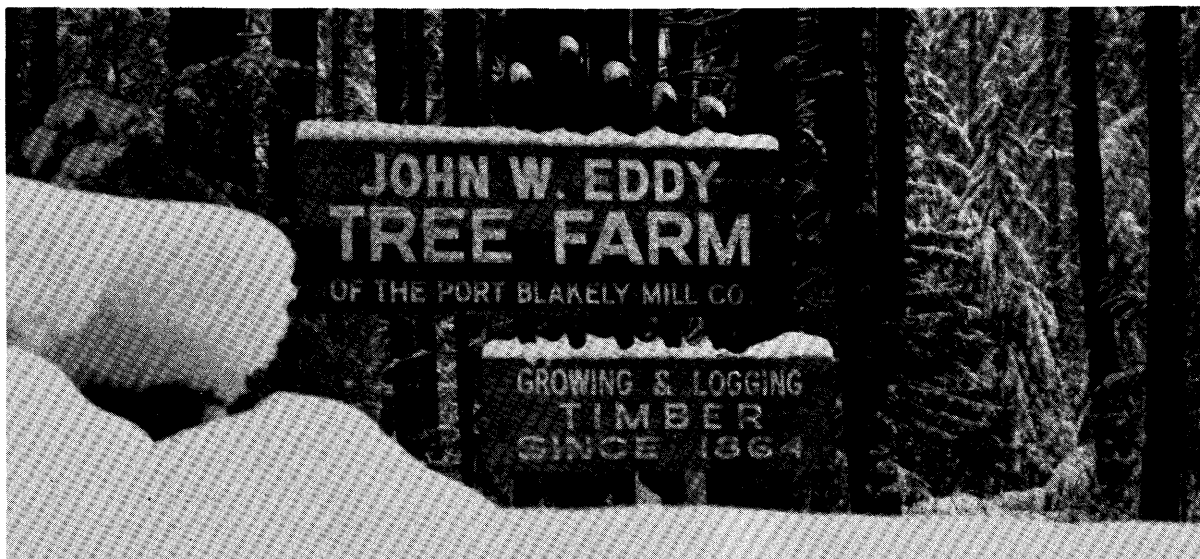


Figure 2. — The Olympic Peninsula has had a long and active logging and tree-growing history. This is one of many private tree farms on which continuous tree crops are being grown.

Natural Resources have fertilized second-growth timber stands, and experimental programs in tree genetics are currently being conducted.

Growth and cut are presently about equal on the Olympic Peninsula, a situation that exists in few areas in the Douglas-fir region and contrasts sharply with past conditions. In 1938, cut exceeded growth by over 800 percent on the Olympic Peninsula; yet the cut was only 41 percent greater than the current timber harvest (1.7 billion board feet in 1938 compared with 1.2 billion now). Although the cut-growth relationship has changed for the better, there has also been a change in the species distribution of the cut. From 1925 to 1933, over 60 percent of the timber harvest was Douglas-fir and less than 20 percent was hemlock. In 1965, 22 percent was Douglas-fir and about 47 percent of the cut was hemlock.

The increase in growth from about 189 million board feet a year in 1938 to 1,182 million now is the result of forest protection since 1938, replacing static old-growth stands with fast-growing young stands, and the restocking of large areas that were cut over and burned in the early logging days. In 1938, the area in old nonstocked burns and cutover areas totaled 356,000 acres. The current inventory shows only 45,000 acres of non-

stocked forest land, and this includes recently logged lands which were not included in the 1938 nonstocked acreage.¹

In spite of the small acreage of nonstocked forest, some areas are not producing as much as they could because of low stocking, or overstocking, or predominance of low-quality trees. Several hundred thousand acres of forest land, mostly in private ownership, now occupied by hardwoods, could be growing a greater volume of more valuable conifer timber.

Though an important timber area, the Olympic Peninsula is probably better known in other parts of the world for its superb scenery. The 897,000-acre Olympic National Park (fig. 3), parts of which lie in four of the five Peninsula counties, attracts campers, fishermen, hikers, mountain climbers, and sightseers from all over the United States and from many foreign countries. The annual number of visitors has increased from 92,000 in 1940 to over 2 million in 1968.

The Olympic National Forest nearly encircles the National Park. Though National Forest lands are managed for timber produc-

¹The exact differences in volume, growth, and area between these inventories cannot be determined because of differences in standards and definitions.

tion, they are also used for other purposes such as recreation, watershed, and game range. Many weekend visitors to the Olympic Peninsula camp in the National Forest or travel through it on their way to the Park. National Forest land managers take this into account in their timber management plans, in some

areas modifying the harvesting methods and volume of timber cut accordingly. Recreational use of the Olympic National Forest has been increasing — from about 18,000 visitors in 1940 to over 800,000 in 1968. Greater recreational use of all forest lands is predicted.

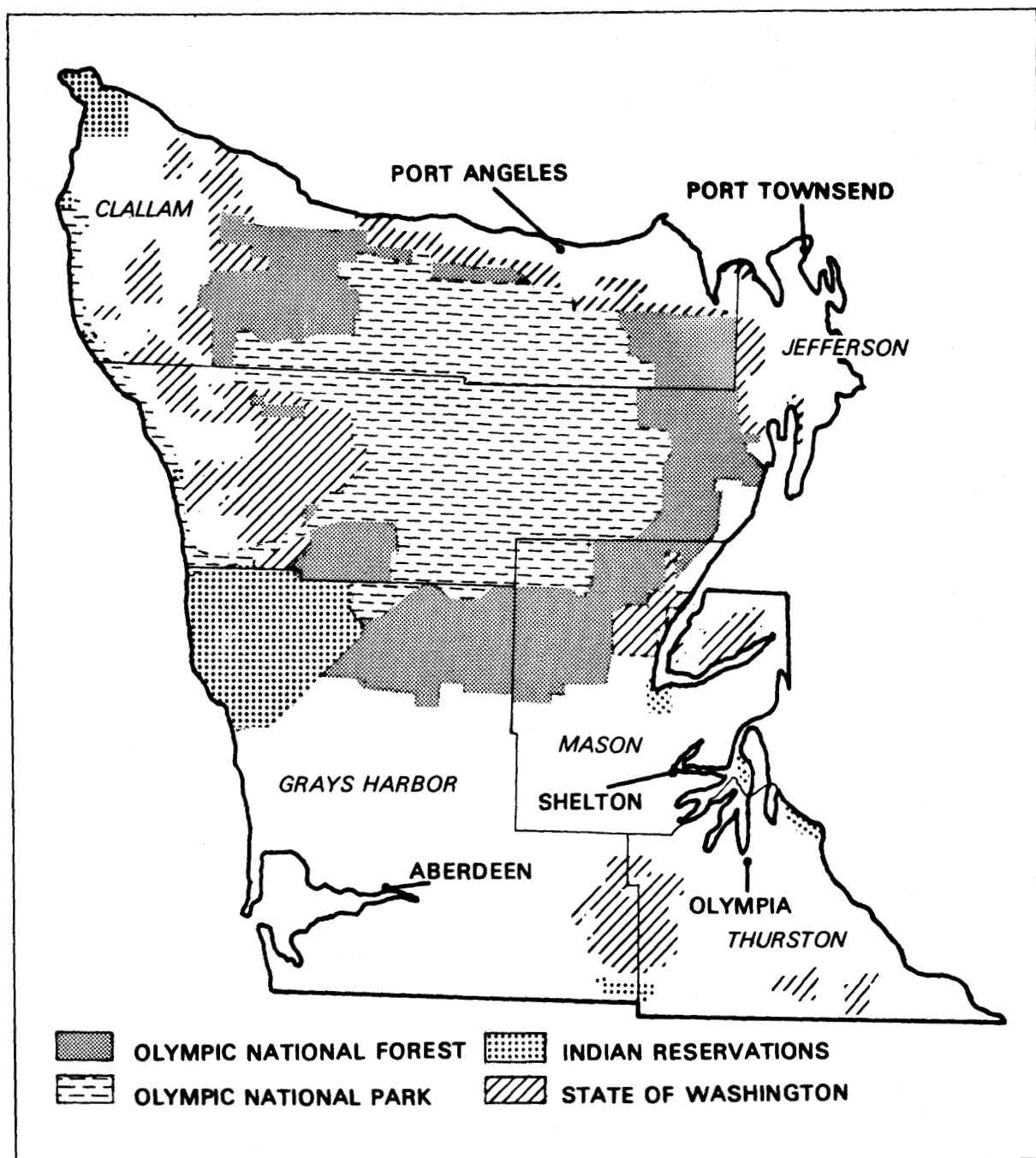


Figure 3. — Map of Olympic Peninsula showing generalized boundaries of public lands.

The Timber Resource

Commercial Forest Land Area Exceeds 3 Million Acres

The Olympic Peninsula has a total land area of 4,577,000 acres, of which 3,105,000 acres or 68 percent is commercial forest land. Another 518,000 acres of productive forest land are reserved in the Olympic National Park, in the Quinault Natural Area in the Olympic National Forest, and in a few small State and county parks. Christmas tree lands, also included as productive reserved, total 35,000 acres (fig. 4). Unproductive forest land totals 372,000 acres, and this includes subalpine and steep rocky areas, swampy

sites, and other areas incapable of producing timber crops.

Sawtimber Volume Exceeds 80 Billion Board Feet

Total sawtimber volume on commercial forest land is 81.5 billion board feet, International 1/4-inch scale; 77.9 billion or 96 percent of this is in softwood species and 3.6 billion or 4 percent is in hardwood species. Growing-stock volume totals 15.3 billion cubic feet; 14.0 billion or 92 percent of this is in softwood species and 1.3 billion or 8 percent is in hardwood species. Hardwood cubic-foot volume is proportionately greater than

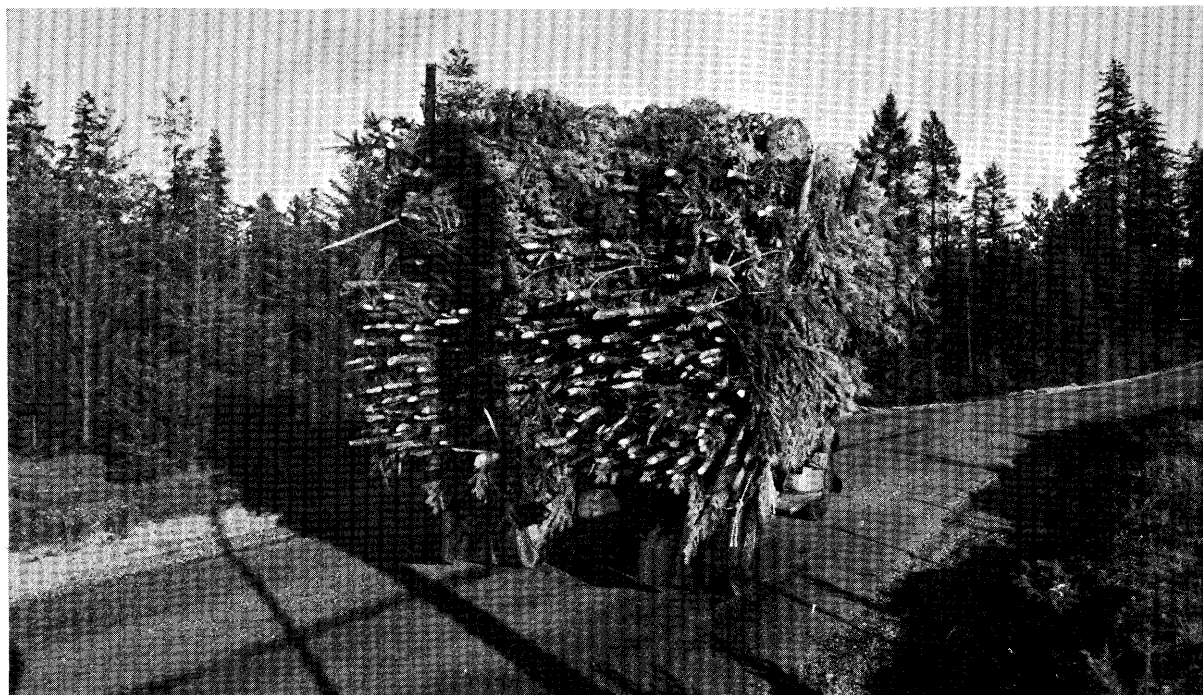


Figure 4. — This truckload of Mason County Christmas trees is enroute to a processing yard near Shelton. Christmas trees are being grown on 35,000 acres of forest land on the Olympic Peninsula.

hardwood board-foot volume because of the relatively large number of poletimber-size hardwood trees.

Commercial Forest Land Area Decreasing, but Volume Remaining the Same

Although the commercial forest land base shown by the current inventory cannot be compared precisely with previous inventories because of changing standards, there is no doubt that the commercial forest land base is decreasing. A special study was made in which given areas on 1951-53 aerial photographs were compared with 1962-64 photographs. The decrease of commercial forest land on the Olympic Peninsula was estimated to be about 3.1 percent for an annual rate of about 0.3 percent. For the most part, the loss has been

in the eastern portion of the Peninsula. The major losses are to: road and powerline building and widening, commercial and residential development, land clearing for agricultural purposes, and in Mason County, conversion of timberlands to Christmas tree production areas.

Despite the decrease in commercial forest land area, cubic-foot volume of growing stock has increased slightly since 1953. Most of the increase has been in hardwood trees; softwood volume has remained relatively static. These trends — shown in table 1 — were developed by projecting the current inventory backward in time to 1953 by use of stand projection models which took into account changes in commercial forest land area, historical cutting experience, and current growth and mortality rates.

Table 1. — Comparison of net volumes of growing stock and sawtimber on commercial forest land by softwoods and hardwoods, Olympic Peninsula, Washington, 1953, 1960, and 1965

Year	Growing stock			Sawtimber		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	----- Million cubic feet -----			----- Million board feet ¹ -----		
1953	14,452	13,848	604	82,591	80,910	1,681
1960	14,851	13,934	917	81,927	79,370	2,557
1965	15,254	13,964	1,290	81,464	77,881	3,583

¹ International 1/4-inch scale.

Since 1953, there has been an increase in numbers of softwood trees less than 24 inches in diameter and a decrease in numbers of softwood trees 24 inches and larger. Although detailed data on hardwood trends are not available, it appears the number of hardwood trees has about doubled in most diameter classes.

Eighty Percent of Commercial Forest Land Is in Public and Forest Industry Ownership

On the Olympic Peninsula, 1,342,000 acres or about 43 percent of the commercial forest

land is owned by Federal, State, and county governments. Much of this is in fairly large consolidated blocks, such as the Olympic National Forest, the Quinault Indian Reservation, and the State of Washington's Capitol Forest in eastern Grays Harbor and western Thurston Counties and Sustained-Yield Unit Number 1 in western Jefferson County (fig. 3).

Forest industry ownership totals 1,139,000 acres or 37 percent of the total commercial forest land area. Much of this is in large blocks, a pattern becoming even more prevalent as timber companies consolidate their holdings.

Miscellaneous private ownership totals 561,000 acres or 18 percent. A considerable area in this class is currently being managed for continuous timber production, although some acreage is owned by real estate and development companies and others who have no intention of managing their lands for timber production. Much of the miscellaneous privately owned land is in relatively large parcels, especially in the western part of the Peninsula.

Whether or not the miscellaneous private lands are kept in timber production will be important to the future of the timber industry on the Peninsula. A decade ago, these lands were considered to be suited only to timber production because the terrain is generally unsuitable for agriculture or grazing and much of the prime scenic land had already been set aside in the National Park. Now, however, with increased demands on the land from outdoor recreationists and commercial and residential developers and because these miscellaneous private owners do not have a commitment to support large investments in forest products mills, a substantial portion of the lands eventually may be diverted from timber production.

Farmers hold 63,000 acres or only 2 percent of the commercial forest land on the Olympic Peninsula. Most of these lands are located in northeast Clallam and eastern Jefferson Counties, along the Chehalis River in Grays Harbor County, and in the lower elevations throughout Thurston County. These lands are in relatively small parcels and are often in poorly stocked condition with hardwoods predominating. Though of little importance to the future of the forest industry, timber from these lands has been contributing to the total production. At least one timber company has offered forestry consulting advice to small-woodlot owners with the idea of getting them to increase production on their lands and thus informally assure the company's mills of a continuous supply of logs from this particular source.

A relatively large proportion of the Peninsula's commercial forest land is in large company and public ownership and a small proportion in farmer ownership. In the Douglas-fir region as a whole, forest industry owns

about 28 percent and farmers 10 percent of the commercial forest land (Pacific Northwest Forest and Range Experiment Station 1965) compared with 37 percent and 2 percent, respectively, on the Peninsula. The overall ownership pattern is significant in that large and corporate ownership is conducive to overall efficiency in terms of timber production per acre. The many large and well-established firms with modern mills and extensive acreages dedicated to timber production indicate a fairly stable timber industry.

Hemlock Is Most Extensive Forest Type; Douglas-fir Second

Western hemlock type occupies 1,211,000 acres or 39 percent of the commercial forest land area. The hemlock stands occur at all elevations in the western part of the Peninsula and on the upper slopes of the mountains in the eastern portion. Douglas-fir type covers 913,000 acres or 29 percent of the commercial forest area and is located mostly in the eastern parts of the Peninsula, though scattered stands may be found along the streams and on some of the drier ridges and benches on the west side. Douglas-fir type is almost entirely absent from the extensive old-growth forest in western Jefferson County, though occasional Douglas-fir trees up to 100 inches or more in diameter and small groups of these large trees occur in the hemlock stands.

Many stands of hemlock in the Aberdeen-Hoquiam area now occupy sites that once supported Douglas-fir. Hemlock, a tolerant species, has always been present as a codominant associate or as an understory component of the forest. The Douglas-fir stands which attracted the early timbermen probably originated following some catastrophic disturbance centuries ago. In the early days, when the Douglas-fir was cut, the hemlock was often left, thus accelerating the natural successional trend toward a climax hemlock forest. On many of these sites, either Douglas-fir or hemlock can be grown successfully; but in the "hemlock belt" along the Pacific Coast, more fiber per acre usually can be grown with hemlock than with Douglas-fir within the range of rotation ages planned by forest managers. Economics and landowner objectives may dictate one species over the other, and

future tree genetics work and fertilization could possibly change the comparative yields of these two species.

Currently, much of the commercial forest land on the west side of the Peninsula is being managed for hemlock production, though Douglas-fir and, in a few cases, true firs are being planted on many of the cutover areas, especially in the foothills and mountains away from the coast. In the eastern and less humid portions of the Peninsula, Douglas-fir is the primary species considered in forest management almost to the exclusion of any others.

Young-Growth Stands Occupy Three-Fourths of the Commercial Forest Land Area

Stands under 100 years of age occupy about 2,313,000 acres or three-fourths of the commercial forest land area (fig. 5). Stand age distribution is fairly even in the 0- to 50-year age groups, but from 50 years up there are gaps. About 37 percent of the area and 54 percent of the cubic-foot volume in even-aged stands under 100 years are in the 30- and 40-year age groups. A sizable portion of this is

in the western part of the Peninsula on lands where older stands were devastated by the February 1921 windstorm which blew down an estimated 4.5 billion board feet of timber. These young-growth stands are generally well stocked and in some areas make up the only stands, aside from seedling-sapling stands on recent cutovers, that are less than 200 years old. Some of these young stands contain as much net volume per acre as the defective old-growth stands in the same general area.

About 997,000 acres or 43 percent of the stands under 100 years of age is in forest industry ownership; and 571,000 acres or 25 percent is in the farmer and miscellaneous group. National Forest owns 203,000 acres or 9 percent of the young growth; 542,000 acres or 23 percent is in other public holdings.

Over 60 Percent of Sawtimber Volume Is on Public Lands

National Forest lands contain 25,410 million board feet (International 1/4-inch scale), or 31 percent of the total sawtimber volume on the Peninsula. Other public lands, including State, county, military, and Indian lands,

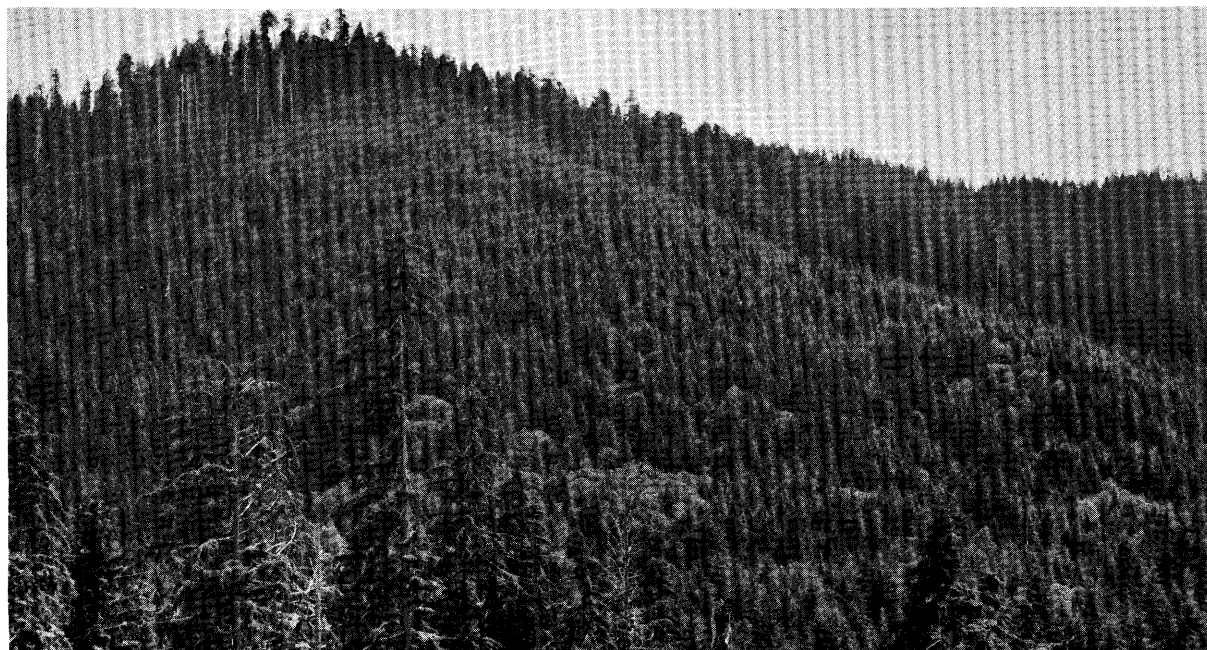


Figure 5. — Three-fourths of the commercial forest land in the Olympic Peninsula supports young-growth timber. This well-stocked hemlock stand occupies a clearcut patch on the Olympic National Forest in the Humptulips River drainage in Grays Harbor County.

contain 24,707 million board feet, or 30 percent of the total. Forest industry lands contain 22,553 million board feet or 28 percent of the total, and the farmer and miscellaneous lands contain 8,794 million board feet or 11 percent.

Nearly all the National Forest volume is in softwood species, whereas the sawtimber volume on private lands and to some extent on other public lands includes substantial amounts of hardwoods. The National Forest has little hardwood volume because its lands are on the higher slopes generally above the hardwood zone, and these lands have not had the long history of logging and burning characteristic of much of the private lands on the Peninsula. In the past, many stands of red alder have come in on conifer sites after logging and burning.

National Forest Holds Most of Large Douglas-fir Sawtimber

Although both Douglas-fir and hemlock types are well distributed across ownership classes, most of the old-growth Douglas-fir is in National Forest ownership. About half of the Douglas-fir volume in trees 21 inches and larger and three-fourths of the volume in trees 29 inches and larger are on National Forest land. Old-growth hemlock is fairly well distributed among National Forest, other public, and forest industry ownership.

Most private timber companies are planning to have liquidated their old-growth timber within a few years to a decade or two. Old-growth timber on other public lands will last somewhat longer. National Forest lands may someday be the primary source of old-growth timber.

Half of the Softwood Sawtimber Volume Is in Trees 29.0 Inches and Larger

For all softwood species, 55,442 million board feet (International 1/4-inch scale) or 71 percent is in trees 21.0 inches and larger; and 38,479 million or 49 percent is in trees 29.0 inches and larger; 21,312 million board feet or 27 percent is in trees 39.0 inches and larger. About 64 percent of total sawtimber volume is in stands 100 years old or older.



Figure 6. — This Douglas-fir log was cut in the upper Wynoochee Valley on the Olympic National Forest. Large logs will make up a significant portion of the Olympic Peninsula timber supply for years to come.

Size distribution is a significant factor in the overall forest industry picture. Although young-growth timber is contributing to the total timber supply at an increasing rate and is reducing the size of the average log handled, a substantial resource of large material still exists and will make up a large part of the log supply for years to come (fig. 6). This means that a diversity of equipment will be needed by the industry to handle both large and small size logs. Some smaller mills on the Peninsula have completely converted to handling second-growth timber, and in some areas where the old growth has been cut out for some time, an occasional load of large logs has to be hauled a long distance to reach a mill that can handle large material. The recent development of chipping-and-sawing and other rigs that process logs as small as 4 to 6 inches has resulted in a ready market for small logs in most areas, a reversal of the situation that prevailed a few years ago.

Growth and Cut

Net Annual Growth Is 1.6 Billion Board Feet

Net annual growth of sawtimber on commercial forest land on the Olympic Peninsula is 1,610 million board feet, International 1/4-inch scale, about 2.0 percent of current inventory volume. Average net annual growth per acre for all ownerships is 519 board feet. Forty-two percent of the growth is Douglas-fir and 35 percent is hemlock. Hardwoods make up about 16 percent of the total board-foot growth.

Net annual growth of growing-stock trees

is 349.6 million cubic feet or about 2.3 percent of inventory volume.

Growth Rates are High on Private Lands, Low on Public Lands

Although public sawtimber volume exceeds private sawtimber volume by 60 percent, net annual growth on private lands is nearly three times as much as on public lands—1,204 million board feet compared with 406 million.

Table 2 shows per-acre volume, growth, and mortality by the four main ownership groups.

Table 2. — Annual per-acre volume, growth, and mortality by ownership group

Ownership	Inventory volume per acre	Gross growth per acre	Mortality per acre	Annual mortality as percent of gross growth	Net annual growth per acre
	----- Board feet ¹ -----				Board feet ¹
National Forest	47,143	442	402	91	40
Other public	30,768	805	326	40	479
Forest industry	19,801	789	113	15	676
Farmer and miscellaneous private	14,093	739	43	6	696
All ownerships	26,236	723	204	28	519

¹International 1/4-inch scale.

The above figures are averages over all age groups and do not necessarily indicate growth potential or degree of forest management; nor do they take into consideration the various management objectives of the different owners.

The low net annual growth rates on National Forest and other public lands reflect

the higher proportions of these lands in old-growth stands, the impact of mortality in these stands, and the relatively small acreage in young-growth stands that are old enough to be putting on board-foot increment.

Only 76,000 acres or 14 percent of National Forest lands and 109,000 acres or 13 percent

cent of other public lands are stocked with stands 40 to 100 years old, the age span of maximum board-foot growth on most sites, whereas 234,000 acres or 21 percent of forest industry lands and 154,000 acres or 25 percent of farmer and miscellaneous private lands are stocked with 40 to 100-year-old stands. Growth rates on National Forest and other public lands will increase as the 484,000 acres of 1 to 40-year-old stands grow into the older age classes.

The farmer and miscellaneous private owner group has the highest annual growth rate,

but over 20 percent of the growth is on hardwoods. Forest industry and other public lands, although having the highest gross growth, have lower net growth rates than farmer and miscellaneous lands because of mortality. Forest industry and other public owners also have the highest growth potential. The following tabulation shows average cubic-foot-growth capacity in fully stocked stands and percent of area capable of growing 165 or more cubic feet per acre per year (roughly equal to hemlock site III (Barnes 1962) or better and Douglas-fir site II (McArdle 1961) or better) by ownership groups:

Ownership	Average cubic-foot-growth capacity	Percent of ownership area capable of growing 165 or more cubic feet per acre per year
National Forest	139	31
Other public	155	41
Forest industry	160	45
Farmer and miscellaneous private	103	24
All ownerships	144	37

Growth and Cut Almost Balance

The forests of the Olympic Peninsula are currently growing about as fast as they are being cut. The average annual cut of live trees reported for 1961-65 was 1,181 million board feet, Scribner scale (about 1,540 million, International 1/4-inch scale). Net annual growth for the year 1965 is estimated to be 1,182 million board feet, Scribner scale (1,610 million, International 1/4-inch scale).

Ownership	Net growth (Million board feet, Scribner scale)	Cut
Public	291	584
Private	891	597
Total	1,182	1,181

The imbalance of growth and cut on public lands is temporary, reflecting the large area of

slow-growing, old-growth timber on the lands from which the timber cut is coming. A similar situation existed on private lands in 1933 — cut was over eight times as great as growth in the Grays Harbor and Willapa Harbor Districts (Keezer 1941). Growth rates should increase in the future as old-growth stands are replaced with well-stocked young-growth stands.

The present rate of cutting on private lands is substantially less than growth with a resultant buildup of inventory. This situation exists because some stands are too small by today's standards for cutting; some are being withheld from harvest because of mounting pressure to use forest land for nontimber purposes; and some are held by owners who for many different reasons have little interest in timber production.

Mortality and Salvable Dead Timber

Mortality Averages 204 Board Feet Per Acre

Average annual mortality on the Olympic Peninsula is 633.5 million board feet (International 1/4-inch scale), about 204 board feet per acre.

The mortality rate for hemlock, the species having greatest total live volume, is 0.95 percent of hemlock inventory volume. Douglas-fir, the second-most-plentiful species, has a mortality rate of only 0.40 percent. One reason for this difference is that much of the live hemlock sawtimber is in old-growth stands, whereas a large part of the live Douglas-fir volume is in young-growth stands.

The annual mortality is not all lost. From 1961 to 1965 inclusive, the reported average annual harvest of dead timber was 120 million board feet, Scribner scale (about 156 million, International 1/4-inch scale).

Salvable Dead Volume Totals 3 Billion Board Feet

Total Scribner board-foot volume of salvable dead timber is 3,130 million, only about 27 percent greater than the 2,460 million board feet of timber estimated to have died during the period 1961 to 1965. This seems to indicate there is no substantial long-term buildup of dead material. Because a large proportion of the mortality volume is hemlock,

which deteriorates rapidly after death, rapid harvesting of this material is necessary if it is to be salvaged.

Tables 36 and 37 show net cubic- and Scribner board-foot volumes of salvable dead sawtimber by volume-per-acre and ownership classes and by volume-per-tree class and species group, respectively. Of the 3,130 million board feet of salvable dead timber, 1,257 million or 40 percent is in concentrations of 10,000 or more board feet per acre. About 509 million board feet or 16 percent is in concentrations of only 1 to 2,500 board feet per acre. The remaining 44 percent ranges in concentration from 2,500 to 10,000 board feet per acre.

About 55 percent of the salvable dead volume is outside the National Forest and 45 percent is on the National Forest. About 20 percent of the salvable dead volume outside the National Forest is in concentrations of 10,000 or more board feet per acre compared with 65 percent on the National Forest.

Hemlock accounts for about 41 percent of the salvable dead volume; Douglas-fir, 21 percent. Of the salvable dead volume, about 79 percent of the hemlock and 76 percent of the Douglas-fir are in trees which have a net volume of 500 or more board feet. About half of the salvable dead Douglas-fir is in trees having more than 2,500 board feet of salvable wood.

Condition of the Forest

Olympic Peninsula in Better Stocking Condition Than the Douglas-fir Region as a Whole

About 80 percent of the commercial forest land outside the National Forest on the Olympic Peninsula is 70 percent or more stocked with growing-stock trees, and only 7 percent is less than 40 percent stocked.² In the Douglas-fir region as a whole, only 57 percent of the commercial forest land is 70 percent or more stocked and the less-than-40-percent-stocked acreage totals 18 percent (Pacific Northwest Forest and Range Experiment Station 1965).

Nonstocked Areas Minimal

The total nonstocked area on all ownerships in the Olympic Peninsula is 45,000 acres or only 1.4 percent of the total commercial forest land area. This is only slightly more than the 36,000 acres that were clearcut in 1965, the year most of the field data were collected, indicating that logged areas are being restocked with a high degree of success.

Half of the Young-Growth Stands Contain 80 Percent or More of Yield Table Cubic-Foot Volume

Unthinned stands 30 to 100 years old were rated against normal yield table cubic-foot values for the appropriate species, site, and age (Barnes 1962; McArdle 1961; Worthington et al. 1960). About 350 plots were examined. The findings were:

1. One-third of the young-growth stands contain 100 percent or more of yield table cubic-foot volume.
2. One-half of these stands contain 80 percent or more of yield table cubic-foot volume.
3. Three-fourths contain 60 percent or

more of yield table cubic-foot volume.

In general, the 30- and 40-year-old stands are close to full yield table production, but older stands fall short. Forty-year-old stands, for example, average 86 percent of normal; 70-year-old stands average 58 percent. This may be partly the result of forest management and fire protection during the past three or four decades.

Within most age groups, the stands on poorer sites are closer to yield table production than stands on better sites, possibly because density of natural reproduction is usually greater on poorer sites. Another possible factor is brush competition, which is more of a problem on better sites in many areas than on poorer sites. These data indicate that some highly productive lands are currently producing less than their potential as defined in normal yield tables.

About 70 percent of the young-growth Douglas-fir stands contain 80 percent or more of the yield table value, but less than 50 percent of the hemlock stands are at this level of production.

All of these factors suggest that hemlock stands and high site land will yield the greatest increase in future fiber production.

Old-Growth Stands Average 10,800 Cubic Feet Per Acre

The average net volume in stands 100 years and older in the Olympic Peninsula is 10,800 cubic feet per acre. Most of these stands would have considerably more volume except for defective portions of merchantable trees and cull trees (fig. 7). In addition, considerable volume has been lost to mortality, and many stands have brush-choked areas where trees could be growing. Productivity in future rotations will undoubtedly be greater. For example, on Douglas-fir site 150 land, 10,550 cubic feet can be grown in 60 years in fully

²Data not available for National Forest lands.



Figure 7. — Old-growth stands on the Olympic Peninsula contain many defective trees. This hollow hemlock log was cut in the Wynoochee River drainage.

stocked unmanaged stands (McArdle 1961), and on hemlock site 150 land, 11,300 cubic feet can be grown in 70 years in fully stocked unmanaged stands (Barnes 1962).

430,000 Acres Now Stocked With Hardwoods Have Grown Conifer Timber in the Past

In the Olympic Peninsula there are 539,000 acres of hardwood type, primarily in private ownership, of which 467,000 acres or 87 percent is red alder. Of the total hardwood-type area, 430,000 acres or 80 percent has grown conifer timber in the past, but after logging or burning has restocked with alder (fig. 8). Many alder stands now have an understory component of conifer trees that will slowly take over the site as the short-lived alder dies out.

Present Cubic-Foot Yield in Hardwood Stands Is About Three-Fourths Conifer Potential; Future Production Loss Could Be Greater

Most of the merchantable hardwood stands on the Olympic Peninsula are in the 30- and 40-year age classes. At this stage in stand development, red alder produces about as much cubic-foot volume per acre as Douglas-fir according to the red alder and Douglas-fir yield tables. Present yield in hardwood is 78 percent of the Douglas-fir yield table values.³ As these hardwood stands grow older, the loss in fiber production will increase, since Douglas-

³ Douglas-fir site trees were present in many red alder stands; where Douglas-fir site trees were not available, we assumed that alder site 90 equals Douglas-fir site 140 on lands where Douglas-fir has grown in the past.



Figure 8. — Hardwoods such as this red alder stand occupy 430,000 acres that have grown conifer timber in the past.

fir stands produce more volume in the fourth and fifth decades than red alder stands. Also, with the current low market value of alder compared with that of Douglas-fir, the loss in income will be greater than the loss in fiber production.

In general, forest managers are converting hardwood types to conifers on sites where conifers have grown before. Where present hardwoods show promise of developing into merchantable stands, foresters usually wait for a harvest cut before converting to conifers. In the next decade or two, as present hardwoods grow, the hardwood volume will probably increase; but then as mature stands are cut and the land regenerated to conifers, the hardwood volume will decrease.

Production of hardwoods on the 109,000 acres of land not suited to conifers is only 65 percent of alder yield table value. On some of these sites, red alder is a minor component and other species such as Oregon ash, black cottonwood, bigleaf maple, and willow predominate. There is little likelihood that timber production will be increased on these hardwood sites. Maximum potential yields are low compared with conifer yields. The market value of these hardwoods is relatively low (currently less than half the dollar value per unit of Douglas-fir), and the canyon bottoms, streambanks, and valleys where these hardwoods grow are often the same lands demanded by recreationists, developers, roadbuilders, and farmers.

Western red cedar - a declining resource

Western redcedar has been the basis of an important timber industry on the Olympic Peninsula for many decades and still contributes to the local economy and the Nation's homebuilding industry. In 1963, there were over 70 shake and shingle mills in the Olympic Peninsula counties producing a total of over \$10 million worth of taper split and resawn cedar shakes, or about 39 percent of the total cedar shake production in Oregon and Washington.⁴ Since 1963, at least two large cedar mills have been built on the Peninsula. Shake production figures for the industry as a whole show an increase of about 400 percent from 1957 to 1964 and an increase of over 90 percent from 1964 to 1967.

The Olympic Peninsula has 8,339 million board feet (International 1/4-inch scale) of western redcedar, one-fourth of all the redcedar in Oregon and Washington. There is another 700 million board feet of usable volume in dead trees. In addition to the volume in live and salvable dead trees, there is an unknown but evidently substantial volume of redcedar wood in logs and chunks of trees not counted in the current inventory. These pieces are currently being salvaged by cedar splitters who, working with chain saw and the traditional mallet and froe, can use material of any size or shape, so long as it will yield a 24-inch long "shake board" or "blank" (Douglass 1965) (salvage volume makes up about 17 percent of the Olympic cedar shake output).

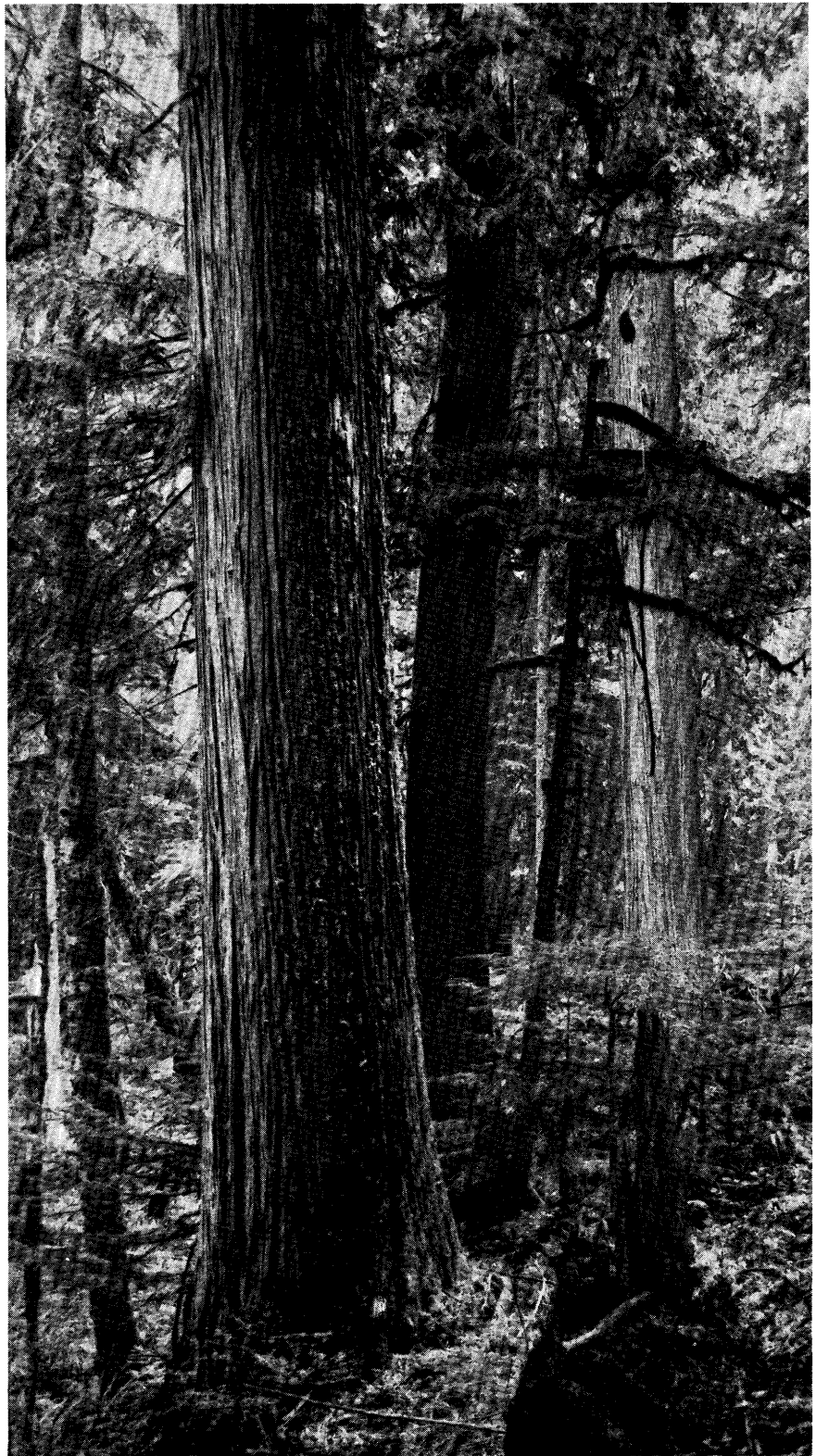
⁴Teshera, James M. *A survey of the handsplit shake industry of the Northwest. 1963. (Report of a survey conducted for the Handsplit Cedar Shake Association, Seattle.)*

Nearly 90 percent of the live redcedar volume is old growth, and about 55 percent is in trees 39 inches and larger. About 5,200 million board feet of the old-growth redcedar is concentrated along the Pacific Ocean in western Clallam, Jefferson, and Grays Harbor Counties with particularly heavy concentration in northwestern Grays Harbor County.

In 1967, 347 million board feet (International 1/4-inch scale) of live western redcedar were cut on the Olympic Peninsula. This is over half of the total redcedar cut in the State of Washington (State of Washington Department of Natural Resources [n.d.]). Current net annual growth of redcedar on the Olympic Peninsula is 66.3 million board feet. Less than half of this growth is in the coastal belt where the cedar volume and cedar industries are concentrated. Redcedar growth can probably be discounted anyway, because young-growth cedar is usually unsuitable for products now being made from cedar wood. Young-growth cedar contains a high percentage of sapwood, is relatively knotty, and often tends to be riddled with wormholes. Cedar is also slow growing, and timberland managers are not likely to hold stands long enough for trees to reach merchantable size and quality. For these reasons, no attempt is being made to regenerate cedar after logging (fig. 9). Once the current volume of old-growth cedar is harvested, the cedar shake and shingle industry on the Olympic Peninsula will be drastically reduced.

At the present rate of cutting, the live and salvable dead cedar could last about 25 years, but the concentrated reserves will probably be depleted much sooner, followed by a rapid decline in the cedar industry on the Peninsula.

*Figure 9. —
Old-growth western
redcedar timber is
required for the
products currently
made from redcedar.
Western redcedar stands
such as this, typical
of the coastal cedar belt,
cannot be grown on a
continuous yield basis.
Hemlock or Douglas-fir
will replace them in
the future.*



Future competition for forest land

The past few years have brought a tremendous increase in population and industrialization to the Puget Sound area which lies to the immediate east of the Olympic Peninsula. It is predicted that by 1990 there will be 2.7 million people in King, Kitsap, Pierce, and Snohomish Counties alone (Little 1964), a number nearly equal to Washington's entire 1960 population. The demand for outdoor recreation is increasing at four times the rate of population increase; the standard of living is rising; shorter workweeks are predicted. Already the Olympic Peninsula is feeling pressure from the Puget Sound area, as more and more people go to the woods and mountains to camp, hike, fish, and hunt, and to live.

A considerable area of forest land in the Olympic Peninsula outside the National Forest and National Park has already been taken out of timber production for permanent and summer homesites, commercial developments, and recreational use. Development has not been extensive in the western part of the Peninsula, being generally confined to a strip along the immediate coast and a few tracts near streams and lakes. In much of the eastern part of the Peninsula, however, development has been extensive and in the future may end timber production on a large area of forest land (fig. 10).

It is difficult to forecast how far and at what rate this development will spread. Various planning groups such as the Puget Sound Governmental Conference, county planning commissions, and the Washington State Department of Natural Resources have been studying the problems of urbanization and land use. Based on these studies and other information, it is estimated that by the year 2000 an urban-suburban area will have spread well into Mason and Thurston Counties (fig. 11).

There are other areas on the Peninsula where development may take forest lands out of timber production. These include the coastal area near Grays Harbor, the Port Angeles-Port Townsend area, and a strip along the west bank of Hood Canal.

At the present time, the projected urban-suburban area in Mason and Thurston Counties alone contains 235,000 acres of commercial forest land, representing 7.6 percent of the Olympic Peninsula's total. About 42 percent of this is owned by forest industries; 37 percent by farmer and miscellaneous private owners; and 21 percent by other public owners. Growing-stock volume in this area totals 539 million cubic feet with 403 million in softwoods and 136 million in hardwoods. Sawtimber volume is 1,900 million board feet (International 1/4-inch scale).

How much of this 1,900 million board feet will be harvested is impossible to say. Local timber operators are finding that some of the owners of small forest properties who have merchantable stands of timber are changing their minds about selling stumpage, figuring their lands will be worth more as real estate if they leave the large trees standing. On the other hand, in spite of rising land values and increasing land use competition, some timber companies are increasing and upgrading their timberland holdings. Most of these companies will probably sell some of their lands for real estate in the future or go into other lines of land development themselves. Some timber companies already have real estate divisions.

Much of this prospective urban-suburban area is of relatively low site quality, characterized by extensive glacial gravel flats with Douglas-fir site indexes of 120 and lower predominating. As urban developments move westward, however, they will encroach steadily upon the higher site forest land. Once out



Figure 10. — Real estate and recreational developments in the eastern part of the Olympic Peninsula are taking an increasing area of commercial forest land out of timber production.

of the glaciated country near the present urban area, they will take over the valleys and streambottoms first, and these are often the most productive lands.

The future of this “fringe forest” area is uncertain. Past and present trends indicate that timber production will become less and less important and possibly disappear entirely. The State of Washington plans not to invest money for long-range forest management purposes on much of their forest land within this area, and it has been predicted that the majority of small private ownerships in the fringe forest area of Puget Sound will go out of for-

estry use by 1985 (Parker 1966). These two ownerships control about a third of the commercial forest land in the prospective urban land use area. A substantial portion of this area is owned by investors, speculators, and developers who are steadily converting it to nontimber-growing uses. Though it appears this entire area will eventually be developed for nonforestry purposes, there is a possibility that strips and blocks will be kept in forest reserves as part of a broad plan for open space preservation. Under such a plan, management of some stands for timber production would still be possible.

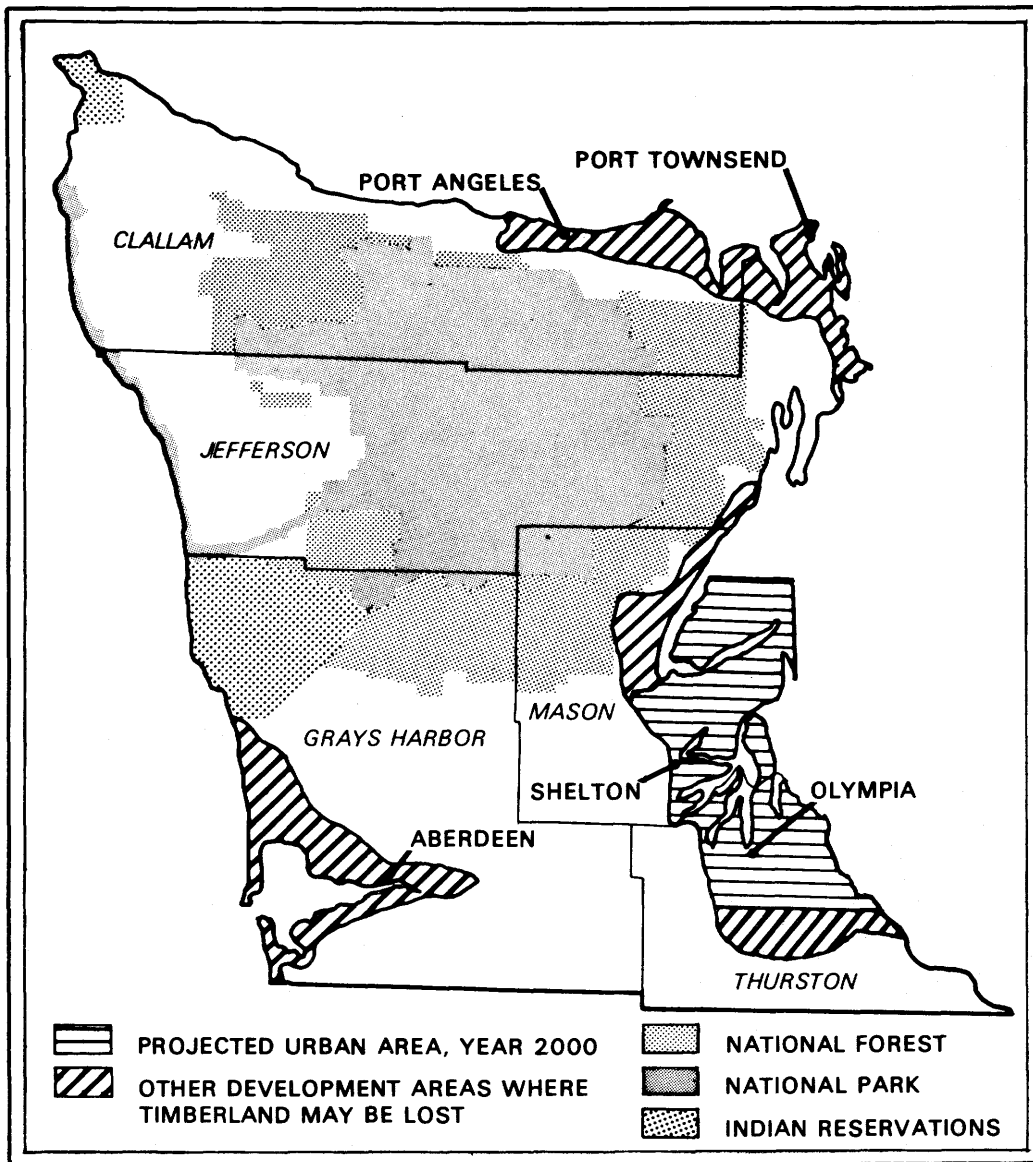


Figure 11. — Map of Olympic Peninsula showing projected urban area, year 2000, and other development areas where timberland may be lost.

For the future, it appears that much of this 235,000 acres and the timber on it will eventually be removed from the raw material base for the forest products industries. In addition, there will undoubtedly be forest land losses in other development areas on the Peninsula with concomitant losses of timber volume and annual growth. If softwood timber production is to remain the same or be increased, more intensive management of remaining

lands will be necessary. Such activities might include increased commercial and precommercial thinning, planting of superior genetic stock, more complete utilization of trees and stands, salvage of more of the annual mortality, conversion of hardwood stands to conifers, and possibly fertilization. Without intensification of management, the loss of forest land on the Peninsula would eventually lead to a reduction in the timber industry.

Table 3. — Area by land class and county, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Land class	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Forest land:						
Commercial	3,105	698	1,099	542	474	292
Productive reserved ¹	553	168	10	318	56	1
Unproductive	372	119	21	184	33	15
Total	4,030	985	1,130	1,044	563	308
Nonforest land ²	547	137	88	115	56	151
Total area ³	4,577	1,122	1,218	1,159	619	459

¹Includes 35,000 acres of land managed for Christmas tree production.

²Includes cropland, pasture and range, swampland, industrial and urban areas, powerline clearings, railroads and all improved roads and highways, and 20,000 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.

³Source: United States Bureau of the Census, Land and Water Area of the United States, 1960.

Table 4. — Area of commercial forest land by ownership class and county, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Ownership class	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Public:						
National Forest	539	180	131	123	105	(¹)
Other Federal						
Indian	165	26	133	2	3	1
Miscellaneous Federal	21	1	--	--	3	17
Total other Federal	186	27	133	2	6	18
State	549	160	83	192	56	58
County and municipal	68	--	52	13	3	--
Total public	1,342	367	399	330	170	76
Private:						
Forest industry	1,139	218	488	115	224	94
Farmer-owned	63	14	24	8	--	17
Miscellaneous private	561	99	188	89	80	105
Total private	1,763	331	700	212	304	216
All ownerships	3,105	698	1,099	542	474	292

¹Less than 500 acres of Snoqualmie National Forest.

Table 5. — Area of commercial forest land by stand-size and ownership classes, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:					
Old growth ¹	644	243	254	108	39
Young growth ²	1,284	132	261	568	323
Total	1,928	375	515	676	362
Poletimber stands	543	58	146	209	130
Sapling and seedling stands	589	86	139	246	118
Nonstocked areas	45	20	3	8	14
All classes	3,105	539	803	1,139	624

¹ Stands 140 years and older.

² Stands less than 140 years old.

Table 6. — Area of commercial forest land by stand volume and by ownership class, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Stand volume (board feet per acre ¹)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	692	119	162	255	156
1,500 to 4,999	404	32	91	178	103
5,000 to 9,999	353	30	97	107	119
10,000 to 19,999	429	41	99	181	108
20,000 to 29,999	229	36	37	112	44
30,000 to 39,999	249	45	42	120	42
40,000 to 49,999	158	43	41	53	21
50,000 or more	591	193	234	133	31
All classes	3,105	539	803	1,139	624

¹ Net volume, International 1/4-inch scale.

Table 7. — Area of commercial forest land by cubic-foot site and ownership classes, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Site class ¹ (cubic feet per acre)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
225 or more	370	41	98	181	50
165 to 224	793	128	235	333	97
120 to 164	916	152	240	345	179
85 to 119	540	106	143	147	144
50 to 84	453	100	78	126	149
20 to 49	33	12	9	7	5
Less than 20	--	--	--	--	--
All classes	3,105	539	803	1,139	624

¹A classification in terms of capacity for cubic-foot annual growth per acre at culmination of mean annual growth.

Table 8. — Area of commercial forest land by forest type and ownership class, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	913	187	203	332	191
Western hemlock	1,211	233	349	455	174
Mountain hemlock	3	3	--	--	--
Western redcedar	231	32	83	50	66
Alaska cedar	2	2	--	--	--
Pacific silver fir	77	52	25	--	--
Grand fir	1	1	--	--	--
Sitka spruce	45	2	9	31	3
Lodgepole pine	38	1	17	20	--
Red alder	467	4	105	208	150
Bigleaf maple	13	1	--	6	6
Other commercial hardwoods	15	1	--	14	--
Noncommercial hardwoods	44	--	9	15	20
Nonstocked	45	20	3	8	14
All types	3,105	539	803	1,139	624

Table 9. — Area of noncommercial forest land by forest type, Olympic Peninsula, Washington, January 1, 1966

(In thousand acres)

Forest type	All areas	Productive- reserved areas	Unproductive areas
Douglas-fir	203	203 ¹	--
Western hemlock	237	237	--
Western redcedar	(²)	(²)	--
Pacific silver fir	107	107	--
Sitka spruce	(²)	(²)	--
Lodgepole pine	1	1	--
Red alder	5	5	--
Noncommercial rocky	122	--	122
Noncommercial subalpine	223	--	223
Noncommercial other	27	--	27
All types	925	553	372

¹ Includes 35,000 acres of land managed for Christmas tree production.

² Less than 500 acres.

Table 10. — Volume of growing stock and sawtimber on commercial forest land by ownership class and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966

Ownership class	Average volume per acre	Total volume		
		All species	Softwoods	Hardwoods
<i>Cubic feet</i>		<i>----- Million cubic feet -----</i>		
All growing stock:				
National Forest	7,152	3,855	3,825	30
Other public	5,837	4,687	4,412	275
Forest industry	4,114	4,686	4,119	567
Farmer and miscellaneous private	3,247	2,026	1,608	418
All ownerships	4,913	15,254	13,964	1,290
<i>Board feet</i>		<i>----- Million board feet -----</i>		
Sawtimber (International 1/4-inch scale):				
National Forest	47,143	25,410	25,302	108
Other public	30,768	24,707	24,016	691
Forest industry	19,801	22,553	21,162	1,391
Farmer and miscellaneous private	14,093	8,794	7,401	1,393
All ownerships	26,236	81,464	77,881	3,583
Sawtimber (Scribner scale):				
National Forest	39,662	21,378	21,270	108
Other public	23,428	18,813	18,143	670
Forest industry	14,801	16,858	15,509	1,349
Farmer and miscellaneous private	10,715	6,686	5,334	1,352
All ownerships	20,527	63,735	60,256	3,479

Table 11. — Volume of growing stock and sawtimber on commercial forest land by county and ownership class, Olympic Peninsula, Washington, January 1, 1966

County	Average volume per acre	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Cubic feet ----- Million cubic feet -----						
Growing stock:						
Clallam	5,511	3,847	1,101	1,136	1,105	505
Grays Harbor	4,353	4,784	1,020	1,090	1,957	717
Jefferson	7,212	3,909	896	2,128	598	287
Mason	4,169	1,976	835	167	709	265
Thurston	2,527	738	3	166	317	252
All counties	4,913	15,254	3,855	4,687	4,686	2,026
Board feet ----- Million board feet -----						
Sawtimber (International 1/4-inch scale):						
Clallam	30,403	21,221	7,022	5,767	5,854	2,578
Grays Harbor	22,019	24,199	7,132	5,152	8,587	3,328
Jefferson	42,308	22,931	5,852	12,653	3,377	1,049
Mason	21,515	10,198	5,385	525	3,251	1,037
Thurston	9,983	2,915	19	610	1,484	802
All counties	26,236	81,464	25,410	24,707	22,553	8,794
Sawtimber (Scribner scale):						
Clallam	23,582	16,460	5,666	4,367	4,445	1,982
Grays Harbor	17,008	18,692	6,162	3,710	6,292	2,528
Jefferson	33,557	18,188	4,880	9,900	2,600	808
Mason	17,234	8,169	4,652	359	2,378	780
Thurston	7,623	2,226	18	477	1,143	588
All counties	20,527	63,735	21,378	18,813	16,858	6,686

Table 12. — Number of growing-stock trees on commercial forest land by diameter class and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966
(Thousands of trees)

Diameter class (inches b.h.)	All species	Softwoods	Hardwoods
5.0 - 6.9	144,737	111,430	33,307
7.0 - 8.9	107,023	77,032	29,991
9.0 - 10.9	68,654	51,754	16,900
11.0 - 12.9	45,269	36,229	9,040
13.0 - 14.9	29,794	24,517	5,277
15.0 - 16.9	20,356	17,414	2,942
17.0 - 18.9	14,000	12,708	1,292
19.0 - 20.9	9,969	9,559	410
21.0 - 28.9	21,278	20,516	762
29.0 - 38.9	9,761	9,677	84
39.0 and larger	5,373	5,352	21
All classes	476,214	376,188	100,026

Table 13. — Average number of growing-stock trees per acre on commercial forest land by diameter and ownership classes, Olympic Peninsula, Washington, January 1, 1966

Diameter class (inches b.h.)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
5.0 - 6.9	46.6	38.2	48.6	46.4	51.9
7.0 - 8.9	34.5	24.1	35.7	37.5	36.3
9.0 - 10.9	22.1	16.2	24.4	22.9	22.8
11.0 - 12.9	14.6	10.1	16.0	15.1	15.7
13.0 - 14.9	9.6	7.6	10.7	9.9	9.3
15.0 - 16.9	6.6	5.9	7.2	6.8	5.7
17.0 - 18.9	4.5	5.3	4.5	4.5	4.0
19.0 - 20.9	3.2	4.3	3.7	2.7	2.5
21.0 - 28.9	6.9	11.6	7.2	5.8	4.3
29.0 - 38.9	3.1	7.0	3.6	2.1	1.0
39.0 and larger	1.7	4.2	2.3	.8	.5
All classes	153.4	134.5	163.9	154.5	154.0

Table 14. — Number of growing-stock trees on commercial forest land by species and diameter class, Olympic Peninsula, Washington, January 1, 1966
(Thousand trees)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	120,665	34,775	28,054	17,759	11,621	7,729	5,367	4,307	2,704	5,606	1,800	943
Western hemlock	188,026	57,192	37,998	25,680	18,242	12,765	8,903	6,045	4,586	10,060	4,686	1,869
Mountain hemlock	417	69	42	30	38	20	42	25	28	86	31	6
Western redcedar	34,177	10,093	6,862	3,563	2,849	1,762	1,470	1,260	1,139	2,533	1,266	1,380
Alaska cedar	558	132	107	93	50	20	24	25	10	38	40	19
Pacific silver fir	18,546	4,267	2,437	1,869	2,052	1,262	999	698	800	1,731	1,550	881
Grand fir	774	172	37	160	146	8	12	113	26	70	23	7
Subalpine fir	52	--	13	13	8	11	--	3	--	4	--	--
Sitka spruce	7,308	2,794	993	1,141	730	213	351	144	154	312	241	235
Lodgepole pine	5,400	1,936	435	1,392	493	706	215	88	89	46	--	--
Western white pine	265	--	54	54	--	21	31	--	23	30	40	12
Total	376,188	111,430	77,032	51,754	36,229	24,517	17,414	12,708	9,559	20,516	9,677	5,352
Hardwoods:												
Red alder	84,348	27,486	26,311	13,959	7,919	4,564	2,381	892	252	545	39	--
Bigleaf maple	9,484	2,222	2,306	2,319	967	535	418	295	155	204	45	18
Black cottonwood	193	--	--	--	60	--	90	24	3	13	--	3
Pacific madrone	2,642	2,057	271	266	--	--	--	48	--	--	--	--
Other hardwoods ¹	3,359	1,542	1,103	356	94	178	53	33	--	--	--	--
Total	100,026	33,307	29,991	16,900	9,040	5,277	2,942	1,292	410	762	84	21
All species	476,214	144,737	107,023	68,654	45,269	29,794	20,356	14,000	9,969	21,278	9,761	5,373

¹ Primarily Oregon ash and Oregon white oak.

Table 15. — Volume of timber on commercial forest land by class of timber and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	12,342	11,809	533
Upper-stem portion	530	391	139
Total	12,872	12,200	672
Poletimber trees	2,382	1,764	618
All growing-stock trees	15,254	13,964	1,290
Sound cull trees	253	167	86
Rotten cull trees	261	253	8
Salvable dead sawtimber trees	579	570	9
Total, all timber	16,347	14,954	1,393

Table 16. — Volume of growing stock and sawtimber on commercial forest land by stand-size class and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966

Stand-size class	Average volume per acre	All species	Softwoods	Hardwoods
	<i>Cubic feet</i>	<i>----- Million cubic feet -----</i>		
All growing stock:				
Sawtimber stands	7,132	13,750	12,829	921
Poletimber stands	2,320	1,260	924	336
Sapling and seedling stands and nonstocked areas	385	244	211	33
All stands	4,913	15,254	13,964	1,290
	<i>Board feet</i>	<i>----- Million board feet -----</i>		
Sawtimber (International 1/4-inch scale):				
Sawtimber stands	40,706	78,482	75,224	3,258
Poletimber stands	4,006	2,175	1,935	240
Sapling and seedling stands and nonstocked areas	1,273	807	722	85
All stands	26,236	81,464	77,881	3,583
Sawtimber (Scribner scale):				
Sawtimber stands	31,963	61,625	58,466	3,159
Poletimber stands	2,779	1,509	1,273	236
Sapling and seedling stands and nonstocked areas	948	601	517	84
All stands	20,527	63,735	60,256	3,479

Table 17. — Volume of growing stock on commercial forest land by species and county, Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	3,555	679	770	506	1,165	435
Western hemlock	6,895	2,070	2,452	1,970	391	12
Mountain hemlock	22	--	11	1	10	--
Western redcedar	1,462	382	528	395	121	36
Alaska cedar	23	2	7	1	13	--
Pacific silver fir	1,486	316	294	823	53	--
Grand fir	34	9	1	2	19	3
Subalpine fir	1	--	--	1	(¹)	--
Sitka spruce	379	164	159	51	5	--
Lodgepole pine	79	(¹)	73	--	6	--
Western white pine	28	2	22	1	3	--
Total	13,964	3,624	4,317	3,751	1,786	486
Hardwoods:						
Red alder	1,095	189	428	142	142	194
Bigleaf maple	147	31	37	9	43	27
Black cottonwood	9	1	2	--	--	6
Pacific madrone	16	2	--	7	5	2
Other hardwoods ²	23	--	--	--	--	23
Total	1,290	223	467	158	190	252
All species	15,254	3,847	4,784	3,909	1,976	738

¹ Less than 500,000 cubic feet.

² Primarily Oregon ash and Oregon white oak.

Table 18. — Volume of sawtimber on commercial forest land by species and county, Olympic Peninsula, Washington, January 1, 1966 (International 1/4-inch scale)
(In million board feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	18,491	3,736	4,254	2,636	5,885	1,980
Western hemlock	38,026	11,356	12,445	11,850	2,305	70
Mountain hemlock	142	--	77	7	58	--
Western redcedar	8,339	2,272	2,869	2,367	692	139
Alaska cedar	149	12	50	3	84	--
Pacific silver fir	9,697	2,024	2,003	5,345	325	--
Grand fir	183	33	7	13	115	15
Subalpine fir	7	--	--	4	3	--
Sitka spruce	2,403	1,118	932	331	22	--
Lodgepole pine	272	--	272	--	--	--
Western white pine	172	10	136	9	17	--
Total	77,881	20,561	23,045	22,565	9,506	2,204
Hardwoods:						
Red alder	2,912	491	1,067	342	487	525
Bigleaf maple	562	161	77	22	191	111
Black cottonwood	51	8	10	2	--	31
Pacific madrone	14	--	--	--	14	--
Other hardwoods ¹	44	--	--	--	--	44
Total	3,583	660	1,154	366	692	711
All species	81,464	21,221	24,199	22,931	10,198	2,915

¹Primarily Oregon ash and Oregon white oak.

Table 19. — Volume of growing stock on commercial forest land by species and ownership class,
Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	3,555	1,212	581	1,165	597
Western hemlock	6,895	1,570	2,322	2,319	684
Mountain hemlock	22	22	--	--	--
Western redcedar	1,462	277	604	334	247
Alaska cedar	23	23	--	--	--
Pacific silver fir	1,486	656	698	122	10
Grand fir	34	9	6	3	16
Subalpine fir	1	1	--	--	--
Sitka spruce	379	43	142	142	52
Lodgepole pine	79	7	37	33	2
Western white pine	28	5	22	1	--
Total softwoods	13,964	3,825	4,412	4,119	1,608
Hardwoods:					
Red alder	1,095	20	260	477	338
Bigleaf maple	147	8	12	71	56
Black cottonwood	9	1	2	6	--
Pacific madrone	16	1	1	--	14
Other hardwoods ¹	23	(²)	--	13	10
Total hardwoods	1,290	30	275	567	418
All species	15,254	3,855	4,687	4,686	2,026

¹ Primarily Oregon ash and Oregon white oak.

² Less than 500,000 cubic feet.

Table 20. — Volume of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, January 1, 1966 (International 1/4-inch scale)
(In million board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	18,491	7,818	2,488	5,779	2,406
Western hemlock	38,026	10,384	12,438	11,988	3,216
Mountain hemlock	142	142	--	--	--
Western redcedar	8,339	1,961	3,360	1,683	1,335
Alaska cedar	149	149	--	--	--
Pacific silver fir	9,697	4,448	4,410	777	62
Grand fir	183	56	31	15	81
Subalpine fir	7	7	--	--	--
Sitka spruce	2,403	279	1,004	829	291
Lodgepole pine	272	29	150	83	10
Western white pine	172	29	135	8	--
Total softwoods	77,881	25,302	24,016	21,162	7,401
Hardwoods:					
Red alder	2,912	61	606	1,120	1,125
Bigleaf maple	562	38	70	215	239
Black cottonwood	51	9	11	31	--
Pacific madrone	14	--	4	--	10
Other hardwoods ¹	44	--	--	25	19
Total hardwoods	3,583	108	691	1,391	1,393
All species	81,464	25,410	24,707	22,553	8,794

¹ Primarily Oregon ash and Oregon white oak.

Table 21. — Volume of growing stock on commercial forest land by species and diameter class,
Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Species	Diameter class (inches at breast height)											
	All classes	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 28.9	29.0- 38.9	39.0 and larger
Softwoods:												
Douglas-fir	3,555	131	215	246	257	251	247	261	212	684	442	609
Western hemlock	6,895	228	316	396	451	466	455	419	399	1,428	1,322	1,015
Mountain hemlock	22	(¹)	(¹)	1	1	1	2	1	2	8	4	2
Western redcedar	1,462	30	40	37	45	40	48	54	61	219	218	670
Alaska cedar	23	(¹)	(¹)	1	1	1	1	1	(¹)	4	7	7
Pacific silver fir	1,486	15	17	27	45	44	48	46	67	238	439	500
Grand fir	34	1	(¹)	3	3	(¹)	1	7	2	9	5	3
Subalpine fir	1	--	(¹)	(¹)	(¹)	1	--	(¹)	--	(¹)	--	--
Sitka spruce	379	10	8	14	15	6	15	9	12	36	63	191
Lodgepole pine	79	6	4	18	11	20	8	5	5	2	--	--
Western white pine	28	--	(¹)	(¹)	--	1	1	--	2	5	11	8
Total softwoods	13,964	421	600	743	829	831	826	803	762	2,633	2,511	3,005
Hardwoods:												
Red alder	1,095	109	223	206	181	151	105	48	17	49	6	--
Bigleaf maple	147	9	17	26	16	14	15	13	9	14	9	5
Black cottonwood	9	(¹)	(¹)	--	2	--	3	1	--	2	--	1
Pacific madrone	16	8	2	4	--	--	--	2	--	--	--	--
Other hardwoods ²	23	4	6	4	2	4	1	2	--	--	--	--
Total hardwoods	1,290	130	248	240	201	169	124	66	26	65	15	6
All species	15,254	551	848	983	1,030	1,000	950	869	788	2,698	2,526	3,011

¹ Less than 500,000 cubic feet.

² Primarily Oregon ash and Oregon white oak.

Table 22. — Volume of sawtimber on commercial forest land by species and diameter class, Olympic Peninsula, Washington, January 1, 1966 (International 1/4-inch scale)
(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	18,491	1,266	1,314	1,361	1,498	1,267	4,289	3,019	4,477
Western hemlock	38,026	2,168	2,471	2,597	2,532	2,494	9,513	9,231	7,020
Mountain hemlock	142	5	3	8	6	12	50	37	21
Western redcedar	8,339	212	197	243	281	333	1,188	1,287	4,598
Alaska cedar	149	3	2	5	7	(¹)	28	50	54
Pacific silver fir	9,697	244	245	284	279	407	1,560	3,045	3,633
Grand fir	183	20	1	3	35	12	54	32	26
Subalpine fir	7	1	2	--	1	--	3	--	--
Sitka spruce	2,403	86	37	93	51	73	231	401	1,431
Lodgepole pine	272	55	107	43	22	28	17	--	--
Western white pine	172	--	5	8	--	12	30	65	52
Total softwoods	77,881	4,060	4,384	4,645	4,712	4,638	16,963	17,167	21,312
Hardwoods:									
Red alder	2,912	860	767	556	273	100	313	43	--
Bigleaf maple	562	72	74	79	68	48	94	73	54
Black cottonwood	51	6	--	19	8	11	--	--	7
Pacific madrone	14	--	--	--	14	--	--	--	--
Other hardwoods ²	44	8	20	6	10	--	--	--	--
Total hardwoods	3,583	946	861	660	373	159	407	116	61
All species	81,464	5,006	5,245	5,305	5,085	4,797	17,370	17,283	21,373

¹ Less than 500,000 board feet.

² Primarily Oregon ash and Oregon white oak.

Table 23. — Volume of sawtimber on commercial forest land by species and diameter class,
Olympic Peninsula, Washington, January 1, 1966 (Scribner scale)
(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	14,134	711	800	884	1,017	897	3,283	2,493	4,049
Western hemlock	29,341	1,266	1,558	1,736	1,761	1,809	7,307	7,625	6,279
Mountain hemlock	112	3	2	5	4	7	41	31	19
Western redcedar	6,377	116	113	147	174	203	815	945	3,864
Alaska cedar	109	2	1	2	5	2	18	38	41
Pacific silver fir	7,828	136	150	185	190	292	1,217	2,541	3,117
Grand fir	138	10	1	2	24	9	42	26	24
Subalpine fir	5	1	1	--	1	--	2	--	--
Sitka spruce	1,916	42	21	55	34	50	168	326	1,220
Lodgepole pine	158	31	61	26	12	17	11	--	--
Western white pine	138	--	3	5	--	9	25	54	42
Total softwoods	60,256	2,318	2,711	3,047	3,222	3,295	12,929	14,079	18,655
Hardwoods:									
Red alder	2,818	822	739	539	267	101	307	43	--
Bigleaf maple	554	69	72	77	66	45	95	75	55
Black cottonwood	50	5	--	18	8	1	10	--	8
Pacific madrone	14	--	--	--	14	--	--	--	--
Other hardwoods ¹	43	7	20	6	10	--	--	--	--
Total hardwoods	3,479	903	831	640	365	147	412	118	63
All species	63,735	3,221	3,542	3,687	3,587	3,442	13,341	14,197	18,718

¹ Primarily Oregon ash and Oregon white oak.

Table 24. — Area of commercial forest land and volume of growing stock and sawtimber by stand age and ownership classes, Olympic Peninsula, Washington, January 1, 1966

Stand age (years)	All ownerships			National Forest			Other public			Forest industry			Farmer and miscellaneous private		
	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber
		Million cubic feet	Million board feet ¹		Million cubic feet	Million board feet ¹		Million cubic feet	Million board feet ¹		Million cubic feet	Million board feet ¹		Million cubic feet	Million board feet ¹
Nonstocked: ²	45	--	--	20	--	--	3	--	--	8	--	--	14	--	--
0 - 9	362	125	517	35	2	--	90	29	137	156	59	292	81	35	88
10 - 19	232	182	341	32	5	17	49	43	121	109	101	105	42	33	98
20 - 29	397	828	2,060	23	30	116	98	190	344	181	408	1,134	95	200	466
30 - 39	416	1,492	4,966	3	4	11	154	589	1,896	164	591	1,994	95	308	1,065
40 - 49	321	1,476	5,893	38	94	257	66	412	1,734	137	658	2,687	80	312	1,215
50 - 59	117	656	3,076	2	4	11	10	61	311	61	377	1,820	44	214	934
60 - 69	85	448	2,192	20	81	286	7	70	391	31	190	1,050	27	107	465
70 - 79	26	149	777	5	18	80	18	92	454	--	--	--	3	39	243
80 - 89	17	91	411	9	45	200	5	25	88	3	21	123	--	--	--
90 - 99	7	60	357	2	15	95	3	29	177	2	16	85	--	--	--
100 - 109	22	199	1,229	10	68	397	--	--	--	12	131	832	--	--	--
110 - 119	6	47	252	2	17	115	4	30	137	--	--	--	--	--	--
120 - 129	10	78	478	7	41	251	--	--	--	3	37	227	--	--	--
130 - 159	21	210	1,277	17	154	908	--	--	--	4	56	369	--	--	--
160 - 199	24	264	1,620	20	215	1,313	--	--	--	4	49	307	--	--	--
Over 200	389	4,255	28,125	210	2,368	16,709	122	1,272	7,631	42	408	2,467	15	207	1,318
Uneven, under rotation age ²	333	1,697	8,929	34	63	464	42	313	1,726	153	962	5,192	104	359	1,547
Uneven, over rotation age ²	275	2,997	18,964	50	631	4,180	132	1,532	9,560	69	622	3,869	24	212	1,355
Total, all classes	3,105	15,254	81,464	539	3,855	25,410	803	4,687	24,707	1,139	4,686	22,553	624	2,026	8,794

¹ International 1/4-inch scale.

² See "Definition of Terms," page 55.

Table 25. — Net annual growth of growing stock on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1965
(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	127,890	3,700	31,660	57,400	35,130
Western hemlock	115,100	3,200	33,850	52,180	25,870
Western redcedar	14,730	1,200	3,990	4,750	4,790
Sitka spruce	9,510	800	2,260	4,690	1,760
True firs	820	- 400 ¹	- 1,560 ¹	2,000	780
Other conifers	- 670 ¹	- 1,300 ¹	1,110	940	- 80 ¹
Total softwoods	268,720	7,200	71,310	121,960	68,250
Hardwoods:					
Red alder	70,460	500	18,300	32,400	19,260
Other hardwoods ²	10,420	200	870	6,060	3,290
Total hardwoods	80,880	700	19,170	38,460	22,550
All species	349,600	7,900	90,480	160,420	90,800

¹ Negative growth is the result of annual mortality exceeding gross annual growth.

² Includes bigleaf maple, black cottonwood, Oregon ash, Oregon white oak, Pacific madrone, and quaking aspen.

Table 26. — Net annual growth of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1965 (International 1/4-inch scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	677,700	15,900	150,760	327,730	183,310
Western hemlock	561,590	-1,100 ¹	157,110	298,160	107,420
Western redcedar	66,290	8,000	17,720	11,130	29,440
Sitka spruce	56,350	5,200	16,430	22,690	12,030
True firs	3,510	-2,200 ¹	-12,990 ¹	13,550	5,150
Other conifers	-5,320 ¹	-9,300 ¹	2,190	2,320	-530 ¹
Total softwoods	1,360,120	16,500	331,220	675,580	336,820
Hardwoods:					
Red alder	211,670	3,100	46,690	71,860	90,020
Other hardwoods ²	38,390	1,800	6,640	22,380	7,570
Total hardwoods	250,060	4,900	53,330	94,240	97,590
All species	1,610,180	21,400	384,550	769,820	434,410

¹ Negative growth is the result of annual mortality exceeding gross annual growth.

² Includes bigleaf maple, black cottonwood, Oregon ash, and Pacific madrone.

Table 27. — Net annual growth of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1965 (Scribner scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	473,520	11,700	104,600	232,310	124,910
Western hemlock	391,790	-800 ¹	107,970	210,790	73,830
Western redcedar	40,420	5,900	11,310	4,910	18,300
Sitka spruce	39,590	3,800	11,550	15,970	8,270
True firs	-540 ¹	-1,600 ¹	-14,140 ¹	10,960	4,240
Other conifers	-4,350 ¹	-6,900 ¹	1,370	1,470	-290 ¹
Total softwoods	940,430	12,100	222,660	476,410	229,260
Hardwoods:					
Red alder	204,030	2,300	45,120	69,750	86,860
Other hardwoods ²	37,510	1,300	6,890	21,800	7,520
Total hardwoods	241,540	3,600	52,010	91,550	94,380
All species	1,181,970	15,700	274,670	567,960	323,640

¹ Negative growth is the result of annual mortality exceeding gross annual growth.

² Includes bigleaf maple, black cottonwood, Oregon ash, and Pacific madrone.

Table 28. — Net annual growth of growing stock on commercial forest land by species and county, Olympic Peninsula, Washington, 1965
(In thousand cubic feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	127,890	14,840	34,680	13,270	40,200	24,900
Western hemlock	115,100	41,060	59,860	10,180	3,670	330
Western redcedar	14,730	3,190	6,100	1,680	2,620	1,140
Sitka spruce	9,510	2,930	4,430	1,850	300	--
True firs	820	3,900	1,480	-5,390 ¹	660	170
Other conifers	670	-500 ¹	1,610	-390 ¹	-50 ¹	--
Total softwoods	268,720	65,420	108,160	21,200	47,400	26,540
Hardwoods:						
Red alder	70,460	7,630	31,400	6,940	7,560	16,930
Other hardwoods ²	10,420	1,610	2,570	1,040	2,460	2,740
Total hardwoods	80,880	9,240	33,970	7,980	10,020	19,670
All species	349,600	74,660	142,130	29,180	57,420	46,210

¹Negative growth is the result of annual mortality exceeding gross annual growth.

²Includes bigleaf maple, black cottonwood, Oregon ash, Oregon white oak, Pacific madrone, and quaking aspen.

Table 29. — Net annual growth of sawtimber on commercial forest land by species and county, Olympic Peninsula, Washington, 1965 (International 1/4-inch scale)
(In thousand board feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	677,700	82,940	193,860	77,280	210,860	112,760
Western hemlock	561,590	238,060	271,210	27,260	23,230	1,830
Western redcedar	66,290	11,470	29,680	3,620	11,890	9,630
Sitka spruce	56,350	17,930	26,480	10,820	1,120	--
True firs	3,510	19,250	12,750	-33,780 ¹	4,230	1,060
Other conifers	-5,320 ¹	-3,700 ¹	4,890	-2,710 ¹	-3,800 ¹	--
Total softwoods	1,360,120	365,950	538,870	82,490	247,530	125,280
Hardwoods:						
Red alder	211,670	18,820	77,670	24,630	45,090	45,460
Other hardwoods ²	38,390	10,580	10,780	1,700	8,190	7,140
Total hardwoods	250,060	29,400	88,450	26,330	53,280	52,600
All species	1,610,180	395,350	627,320	108,820	300,810	177,880

¹ Negative growth is the result of annual mortality exceeding gross annual growth.

² Includes bigleaf maple, black cottonwood, Oregon ash, and Pacific madrone.

Table 30. — Average annual mortality of growing stock on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1961-65, inclusive
(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	17,760	5,800	4,200	5,310	2,450
Western hemlock	62,550	14,200	24,140	20,510	3,700
Western redcedar	5,980	1,100	1,410	2,040	1,430
Sitka spruce	1,680	--	240	1,340	100
True firs	19,570	6,200	12,660	520	190
Other conifers	2,610	1,600	520	340	150
Total softwoods	110,150	28,900	43,170	30,060	8,020
Hardwoods:					
Red alder	5,750	200	290	3,490	1,770
Other hardwoods ¹	350	--	--	--	350
Total hardwoods	6,100	200	290	3,490	2,120
All species	116,250	29,100	43,460	33,550	10,140

¹ Primarily bigleaf maple.

Table 31. — Average annual mortality of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1961-65, inclusive (International 1/4-inch scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	74,050	39,100	16,860	12,960	5,130
Western hemlock	362,630	113,800	147,530	90,950	10,350
Western redcedar	29,470	6,300	7,790	10,050	5,330
Sitka spruce	8,720	--	990	7,730	--
True firs	132,230	46,300	83,570	2,360	--
Other conifers	15,360	10,800	3,780	--	780
Total softwoods	622,460	216,300	260,520	124,050	21,590
Hardwoods:					
Red alder	9,030	200	1,510	4,150	3,170
Other hardwoods ¹	2,010	--	--	--	2,010
Total hardwoods	11,040	200	1,510	4,150	5,180
All species	633,500	216,500	262,030	128,200	26,770

¹ Primarily bigleaf maple.

Table 32. — Average annual mortality of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1961-65, inclusive (Scribner scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	54,410	31,200	10,720	9,320	3,170
Western hemlock	280,960	90,800	114,950	67,780	7,430
Western redcedar	23,060	4,900	6,060	8,670	3,430
Sitka spruce	6,320	--	570	5,750	--
True firs	104,400	36,900	65,570	1,930	--
Other conifers	12,090	8,600	3,050	--	440
Total softwoods	481,240	172,400	200,920	93,450	14,470
Hardwoods:					
Red alder	8,720	200	1,460	3,990	3,070
Other hardwoods ¹	1,980	--	--	--	1,980
Total hardwoods	10,700	200	1,460	3,990	5,050
All species	491,940	172,600	202,380	97,440	19,520

¹ Primarily bigleaf maple.

Table 33. — Average annual mortality of growing stock on commercial forest land by species and county, Olympic Peninsula, Washington, 1961-65, inclusive
(In thousand cubic feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	17,760	4,420	3,680	2,410	4,280	2,970
Western hemlock	62,550	11,960	23,730	24,510	2,350	--
Western redcedar	5,980	1,290	2,110	1,980	190	410
Sitka spruce	1,680	--	1,680	--	--	--
True firs	19,570	2,550	2,000	14,520	500	--
Other conifers	2,610	600	910	400	700	--
Total softwoods	110,150	20,820	34,110	43,820	8,020	3,380
Hardwoods:						
Red alder	5,750	660	3,900	490	360	340
Other hardwoods ¹	350	--	--	--	350	--
Total hardwoods	6,100	660	3,900	490	710	340
All species	116,250	21,480	38,010	44,310	8,730	3,720

¹ Primarily bigleaf maple.

Table 34. — Average annual mortality of sawtimber on commercial forest land by species and county, Olympic Peninsula, Washington, 1961-65, inclusive (International 1/4-inch scale)

(In thousand board feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	74,050	20,740	13,490	10,570	20,440	8,810
Western hemlock	362,630	69,030	127,230	152,970	13,400	--
Western redcedar	29,470	6,570	9,560	11,170	1,090	1,080
Sitka spruce	8,720	--	8,720	--	--	--
True firs	132,230	17,440	14,400	95,690	4,700	--
Other conifers	15,360	3,800	4,260	2,800	4,500	--
Total softwoods	622,460	117,580	177,660	273,200	44,130	9,890
Hardwoods:						
Red alder	9,030	3,070	3,510	1,630	--	820
Other hardwoods ¹	2,010	--	--	--	2,010	--
Total hardwoods	11,040	3,070	3,510	1,630	2,010	820
All species	633,500	120,650	181,170	274,830	46,140	10,710

¹ Primarily bigleaf maple.

Table 35. — Average annual mortality of growing stock and sawtimber on commercial forest land by softwoods and hardwoods, and by cause of death, Olympic Peninsula, Washington, 1961-65, inclusive

Species	Cause of death					
	All causes	Fire	Insects	Disease	Other ¹	Miscellaneous and unknown
----- Thousand cubic feet -----						
Growing stock:						
Softwoods	110,150	300	2,050	3,460	80,470	23,870
Hardwoods	6,100	--	--	--	3,520	2,580
Total	116,250	300	2,050	3,460	83,990	26,450
----- Thousand board feet, International 1/4-inch scale -----						
Sawtimber:						
Softwoods	622,460	(²)	16,640	22,510	458,110	125,200
Hardwoods	11,040	--	--	--	6,060	4,980
Total	633,500	(²)	16,640	22,510	464,170	130,180
----- Thousand board feet, Scribner scale -----						
Sawtimber:						
Softwoods	481,240	(²)	13,180	17,710	353,060	97,290
Hardwoods	10,700	--	--	--	5,850	4,850
Total	491,940	(²)	13,180	17,710	358,910	102,140

¹ Largely weather killed, some of which had been predisposed to windthrow or windbreak by root rot and heart rot.

² Less than 5,000 board feet.

Table 36. — Net volume of salvable dead sawtimber on commercial forest land, by volume-per-acre and ownership classes, Olympic Peninsula, Washington, January 1, 1966

Volume per acre ¹	Total	National Forest ¹	All other owners ²
----- Million cubic feet -----			
Cubic feet:			
1 - 199	13.9	3.8	10.1
200 - 499	92.1	14.3	77.8
500 - 999	129.9	39.7	90.2
1,000 - 1,999	185.2	56.9	128.3
2,000 or more	158.3	82.0	76.3
Total	579.4	196.7	382.7
----- Million board feet, Scribner scale -----			
Board feet:			
1 - 499	18.3	5.5	12.8
500 - 999	82.5	15.6	66.9
1,000 - 2,499	408.5	54.6	353.9
2,500 - 4,999	510.3	116.4	393.9
5,000 - 9,999	853.0	300.1	552.9
10,000 or more	1,257.0	919.7	337.3
Total	3,129.6	1,411.9	1,717.7

¹Based on 1/5-acre plots.

²Based on 1-acre sample plots.

Table 37. — Net volume of salvable dead sawtimber on commercial forest land by volume-per-tree class and species group, Olympic Peninsula, Washington, January 1, 1966

Volume per tree	Total	Douglas-fir	Hemlock	Cedar	True firs	Other softwoods	Hardwoods
----- Million cubic feet -----							
Cubic feet:							
1 - 49	96.2	23.5	36.2	18.4	7.5	5.2	5.4
50 - 99	85.1	17.6	34.0	10.4	13.5	5.6	4.0
100 - 499	309.6	39.9	152.7	63.4	44.4	9.2	--
500 or more	88.5	18.7	17.4	25.7	20.7	6.0	--
Total	579.4	99.7	240.3	117.9	86.1	26.0	9.4
----- Million board feet, Scribner scale -----							
Board feet:							
1 - 149	237.9	69.1	81.5	45.2	13.9	16.7	11.5
150 - 499	481.5	85.7	192.5	70.2	68.2	27.5	37.4
500 - 2,499	1,471.3	179.7	800.6	245.6	197.6	47.8	--
2,500 or more	938.9	318.1	204.2	178.5	203.9	34.2	--
Total	3,129.6	652.6	1,278.8	539.5	483.6	126.2	48.9

Table 38. — Timber harvest by ownership class, Olympic Peninsula, Washington, 1950-67 (Scribner scale)

(In thousand board feet)

Year	All ownerships			Private ¹			State ¹			National Forest			Other public		
	Total	Live	Dead ²	Total	Live	Dead ²	Total	Live	Dead ²	Total	Live	Dead ²	Total	Live	Dead ²
1950	1,096,330	(³)	(³)				795,896	(³)	(³)	218,700	(³)	(³)	81,734	(³)	(³)
1951	1,085,622	(³)	(³)				743,922	(³)	(³)	241,700	(³)	(³)	100,000	(³)	(³)
1952	1,085,693	969,508	116,185				672,820	656,192	16,628	294,400	196,772	97,628	118,473	116,544	1,929
1953	939,105	(⁴)	(⁴)				448,606	394,752	53,854	369,100	(³)	(³)	121,399	121,048	351
1954	989,721	922,742	66,979				527,004	496,839	30,165	345,900	310,100	35,800	116,817	115,803	1,014
1955	1,143,691	983,314	160,377	576,067	543,519	32,548	140,332	138,276	2,056	250,179	124,406	125,773	177,113	177,113	--
1956	1,175,976	1,128,172	47,804	658,794	638,782	20,012	136,386	134,777	1,609	267,300	244,700	22,600	113,496	109,913	3,583
1957	926,230	883,079	43,151	543,957	524,756	19,201	71,944	69,507	2,437	249,964	228,451	21,513	60,365	60,365	--
1958	878,829	831,242	47,587	451,063	442,424	8,639	82,303	80,217	2,086	268,928	233,610	35,318	76,535	74,991	1,544
1959	1,177,402	1,124,926	52,476	662,073	636,682	25,391	81,765	80,872	893	322,299	297,691	24,608	111,265	109,681	1,584
1960	1,148,990	1,094,313	54,677	687,591	658,599	28,992	93,683	93,014	669	250,929	229,629	21,300	116,787	113,071	3,716
1961	1,049,286	1,001,146	48,140	607,680	577,843	29,837	100,071	97,649	2,422	219,890	206,368	13,522	121,645	119,286	2,359
1962	1,078,226	1,047,887	30,339	567,448	558,236	9,212	114,663	114,272	391	273,300	253,200	20,100	122,815	122,179	636
1963	1,298,262	1,179,190	119,072	655,428	548,961	106,467	147,093	142,947	4,146	361,400	357,500	3,900	134,341	129,782	4,559
1964	1,544,033	1,261,053	282,980	791,669	634,882	156,787	142,657	138,631	4,026	403,800	286,900	116,900	205,907	200,640	5,267
1965	1,539,236	1,420,863	118,373	715,757	664,961	50,796	250,409	249,807	602	369,800	308,400	61,400	203,270	197,695	5,575
1966	1,496,903	1,458,357	38,546	825,399	815,672	9,727	183,798	182,837	961	300,214	280,714	19,500	187,492	179,134	8,358
1967	1,440,086	1,422,100	17,986	720,139	715,807	4,332	225,482	223,380	2,102	291,500	281,749	9,751	202,965	201,164	1,801

¹ Data for private ownership combined with State ownership for 1950-54.

² Includes snags and down material existing prior to initial logging. Salvage of this material does not constitute drain on the volume of the forest inventory of live trees.

³ Data not available by live and dead.

⁴ Incomplete data.

Accuracy of the current inventory data

Forest Land Area and Timber Volume

The estimates of forest land area and timber volume in the Olympic Peninsula were derived by sampling and consequently have sampling errors. Sampling errors have been computed for the estimates of commercial forest land area, noncommercial forest land area, net cubic-foot volume of growing stock, and net board-foot volume (International 1/4-inch scale) of sawtimber. These are presented in table 39 as a percent of the estimated total at the 68-percent and 95-percent probability levels. They may be interpreted as meaning that the odds are two out of three for 68-percent probability or 19 out of 20 for 95-percent probability, that if a 100-percent inventory had been taken, using the same methods, the results would have been within the ranges shown. For example, the estimate of total

commercial forest land area from a 100-percent inventory would be expected to fall within plus or minus 1.0 percent of 3,105,000 acres, unless a one in three chance of sampling has occurred.

In addition to measurable sampling errors, there may be other nonsampling errors due to mistakes in judgment, measurement, and compilation. The magnitude of errors from these sources cannot be determined. However, such errors are kept to a minimum through training, supervision, field checking, and complete editing and machine verification in compiling the data.

The sampling error of any breakdown of these totals will be substantially greater than for the total. The smaller the breakdown, the larger the sampling error. An approximation of the increasing sampling error can be obtained from table 40, which shows the sampling error associated with smaller estimates.

Table 39. — Sampling errors of estimates of forest area and timber volume, Olympic Peninsula, Washington, January 1, 1966

Item	Estimated total	Sampling error in percent	
		68-percent probability	95-percent probability
Commercial forest land	3,105,000 acres	±1.0	±1.9
Noncommercial forest land	925,000 acres ¹	±11.6	±21.6
Volume:			
Growing stock	15,254 million cubic feet	±2.1	±4.1
Sawtimber (International 1/4-inch scale)	81,464 million board feet	±2.6	±5.2

¹ Of the estimated 925,000 acres of noncommercial forest land on the Olympic Peninsula, 775,000 were classified by type-mapping procedures, hence have no associated sampling error.

Table 40. — Approximate sampling error by size of estimate, Olympic Peninsula, Washington, January 1, 1966

Commercial forest land		Growing stock		Sawtimber	
Area	Sampling error ¹	Volume	Sampling error ¹	Volume	Sampling error ¹
<i>Thousand acres</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>	<i>Million board feet, International 1/4-inch scale</i>	<i>Percent</i>
3,105	1.0	15,254	2.1	81,464	2.6
776	2.0	7,474	3.0	61,189	3.0
345	3.0	4,204	4.0	34,419	4.0
194	4.0	2,691	5.0	22,028	5.0
124	5.0	673	10.0	5,507	10.0
31	10.0	299	15.0	2,448	15.0
14	15.0	168	20.0	1,377	20.0
8	20.0	108	25.0	881	25.0
5	25.0	75	30.0	612	30.0
3	30.0	42	40.0	344	40.0
		27	50.0	220	50.0
		7	100.0	55	100.0

¹ By random sampling formula; 68-percent probability.

Forest Survey procedures

This inventory of the forests of the Olympic Peninsula combines data from the Olympic National Forest inventory project, a very small parcel of the Snoqualmie National Forest in Thurston County (323 acres), and the Forest Survey project for all lands outside the National Forests. The National Forest lands were inventoried in 1963 and the outside National Forest lands in 1965. No updating was done to bring data to a common date.

National Forest Lands

Field plots were distributed on a systematic grid at 1.7-mile intervals on all National Forest lands, except the Shelton Working Circle where a double grid was used, placing plots at 0.85-mile intervals. Plots consisted of three 1/5-acre subplots. Estimates of area, volume, growth, and mortality were obtained from these plots.

Gross annual growth on National Forest land is for the period 1953 to 1963, as estimated from increment borings of a subsample of trees on each plot. Annual mortality is for the period 1958 to 1963, estimated by postdating time of death of dead trees on each plot. The Olympic National Forest was inventoried the year after the Columbus Day storm of 1962, and to avoid overestimating mortality, trees killed during that storm were identified on the plot tally and excluded from the mortality totals.

Outside National Forest Lands

A double sampling design was used for lands outside the National Forests. First, aerial photo sample plots were distributed systematically across the area. Photo plots were classified into one of three major land classes — commercial forest, noncommercial forest, and nonforest — and the commercial forest plots were further classified into stand volume classes. All photo plots were classified by kind of owner from public records. About 7,500

photo plots were examined. The second stage consisted of a basic systematic grid of field plots 3.4 miles apart with supplemental plots added. There were 589 field plots located at photo plot locations, each consisting of 10 sample points distributed systematically over an acre. The variable-radius plot sampling principle was used at each point to select the trees to be tallied. Where no trees were tallied, a ground cover class was recorded. Summations of the 10-point tally expressed the resources and conditions for that acre and were used with the photo sample to provide area, volume, growth, and mortality statistics. In Clallam and Jefferson Counties, in addition to the two-stage sample discussed above, previously established 1/5-acre plots were remeasured. Actual measured growth and mortality from these plots were used for these counties. For the remaining counties, increment core readings were taken for growth, and the time of death was postdated in estimating mortality.

Annual growth on lands outside National Forest is for the year 1965, estimated by regression equations. Variables included: d.b.h., d.b.h. minus average stand diameter, tree age, basal area per acre, site index, crown ratio, and several others. Diameter for 1 year ago was computed for all growing-stock trees, and net volume was computed for both present and past diameters. Gross growth was obtained by subtracting past from present net volume.

Annual mortality for lands outside National Forest is for the period 1961 to 1965. Mortality on these lands caused by the Columbus Day storm of 1962 is included because by 1965 it was not possible to differentiate trees killed in 1962 from trees killed before or after that date. Damage by the Columbus Day storm was generally light in the Olympic Peninsula, and for this reason, the growth and mortality figures are probably about the same as normal trends.

Definition of terms

Land Area

Total Land Area

Includes dry land and land temporarily or partially covered by water such as marshes, swamps, and river flood plains; streams, sloughs, and canals less than one-eighth mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

Forest Land Area

Land at least 10 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area of forest land recognized is 1 acre.

Nonforest Land Area

Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. Included are areas used for agricultural crops, improved pasture, residential areas, city parks, improved roads of any width and right-of-way clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and other nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

Forest Land Classes

Commercial Forest Land Area

Forest land which is producing or capable of producing industrial wood and not withdrawn from timber utilization.

Noncommercial Forest Land Area

Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Productive-reserved. Public forest land with-

drawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land. Also included are forest lands managed exclusively for Christmas tree production.

Unproductive. Forest land incapable of yielding crops of industrial wood products because of adverse site conditions such as sterile soil, poor drainage, high elevation, steepness, and rockiness.

Forest Types

Forest types are determined on the basis of species plurality of all live trees that contribute to stocking, considering both size and spacing.

Tree Classes

Growing-Stock Trees

Sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except cull trees.

Acceptable trees. Growing-stock trees of commercial species that meet specified standards of size and quality, but not qualifying as desirable trees.

Desirable trees. Growing-stock trees of commercial species (a) having no serious defects in quality limiting present or prospective use for timber products, (b) of relatively high vigor, and (c) containing no pathogens that may result in death or serious deterioration before rotation age.

Sawtimber trees (11.0 inches d.b.h. and larger). Live trees of commercial species. Softwood trees must contain at least one 12-foot saw log with a top diameter not less than 6 inches inside bark; hardwood trees must contain at least one 8-foot saw log with a top diameter not less than 8 inches inside bark. At least 25 percent of the board-foot volume in a tree must be free of defect for either softwoods or hardwoods.

Poletimber trees (5.0 to 10.9 inches d.b.h.).

Live trees of commercial species not less than 50 percent sound on a cubic-foot basis and with no disease, defects, or deformities which are likely to prevent them from becoming growing-stock sawtimber trees.

Sapling and seedling trees (less than 5.0 inches d.b.h.). Live trees of commercial species with no disease, defects, or deformities which are likely to prevent them from becoming growing-stock poletimber trees.

Nongrowing-Stock Trees

Cull trees. Trees of noncommercial species and trees of commercial species which are too defective or which are unlikely to become growing-stock trees due to deformity, disease, low vigor, etc.

Sound cull trees. Trees of noncommercial species, or with excessive defect due to form, roughness, etc.

Rotten cull trees. Trees with excessive defect due primarily to rot.

Mortality trees. Trees of commercial species which have died from natural causes within the past 5 years and which were not cull trees at the time of death.

Salvable dead trees. Standing or down dead trees of commercial species 11.0 inches or more in diameter that contain 25 percent or more of sound volume and at least one merchantable 16-foot log if a softwood or one merchantable 8-foot log if a hardwood.

Stand-Size Classes**Sawtimber Stand**

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with sawtimber stocking equal to or greater than poletimber stocking.

Large sawtimber stand. Stand in which the majority of the sawtimber stocking is in trees 21.0 inches d.b.h. and larger.

Small sawtimber stand. Stand in which the majority of the sawtimber stocking is in trees from 11.0 to 20.9 inches d.b.h.

Poletimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with poletimber stocking exceeding sawtimber stocking.

Sapling and Seedling Stand

Stand at least 16.7 percent stocked with growing-stock trees, with more than half of this stocking in saplings and/or seedlings.

Nonstocked Area

An area of commercial forest land less than 16.7 percent stocked with growing-stock trees.

Stocking

Stocking is an expression of the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Percent of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range which represents full site occupancy. This is called 100-percent stocking. The upper limit to full stocking has been set at 132 percent. Sites with less than 100-percent stocking represent understocking with less than full site occupancy. Overstocking is characterized by sites that have over 132-percent stocking.

Age

Stand age. Stand age is based upon growing-

stock stocking. In order for a stand to be even aged, a majority of the growing-stock stocking must be in two adjacent age classes. Stands that do not meet this criterion are classified as uneven aged, under or over rotation age.

Rotation age. The period of years between establishment of a stand of timber and the time when it is considered ready for cutting. Rotation age in softwood stands is 100 years; in hardwood stands, it is 50 years.

Old-growth sawtimber stand. Sawtimber stand in which 50 percent or more of the growing stock is in trees at least 140 years old.

Young-growth sawtimber stand. Sawtimber stand in which more than 50 percent of the growing stock is in trees less than 140 years old.

Timber Volume

Live Sawtimber Volume

Net volume in board feet of live sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner rule. The common board-foot log rule used in determining volume of sawtimber in Washington. Scribner volume in the Olympic Peninsula is measured in terms of 32-foot logs.

International 1/4-inch rule. The standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Growing-Stock Volume

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

All Timber Volume

Net volume in cubic feet of live and salvageable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top outside bark.

Industrial Wood

All roundwood products, except fuelwood.

Growth

Net Annual Growth

The increase in volume of a specified size class for a specific year. (Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to the year's end plus volume of trees reaching the size class during the year minus the volume of trees that died during the year minus the net volume of trees that became culls during the year.)

Ownership Classes

National Forest Lands

Federal lands which have been designated by Executive order or statute as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones title III lands.

Other Public Lands

Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies, and lands owned by States, counties, and local public agencies, or lands leased by these governmental units for more than 50 years.

Forest Industry Lands

Lands owned by companies or individuals operating wood-using plants.

Farmer-Owned Lands

Lands owned by operators of farms.

Miscellaneous Private Lands

Privately owned lands other than forest industry or farmer-owned lands.

Normal Yield Table

A normal yield table is a tabulation of the volume, basal area, number of trees, etc., per acre found in fully stocked stands on specified sites at specified ages.

Tree species

Principal tree species found on the commercial forest land on the Olympic Peninsula include:

Softwoods:

- Alaska cedar (*Chamaecyparis nootkatensis*)
- Douglas-fir (*Pseudotsuga menziesii*)
- Grand fir (*Abies grandis*)
- Lodgepole pine (*Pinus contorta*)
- Mountain hemlock (*Tsuga mertensiana*)
- Pacific silver fir (*Abies amabilis*)
- Sitka spruce (*Picea sitchensis*)
- Subalpine fir (*Abies lasiocarpa*)
- Western hemlock (*Tsuga heterophylla*)
- Western redcedar (*Thuja plicata*)
- Western white pine (*Pinus monticola*)

Hardwoods:

- Bigleaf maple (*Acer macrophyllum*)
- Black cottonwood (*Populus trichocarpa*)
- Oregon ash (*Fraxinus latifolia*)
- Oregon white oak (*Quercus garryana*)
- Pacific madrone (*Arbutus menziesii*)
- Red alder (*Alnus rubra*)
- Willow (*Salix* spp.)

References

- Andrews, H. J., and Cowlin, R. W.
1940. Forest resources of the Douglas-fir region. U. S. Dep. Agr. Misc. Pub. 389, 169 pp., illus.
- Barnes, George H.
1962. Yield of even-aged stands of western hemlock. U. S. Dep. Agr. Tech. Bull. 1273, 52 pp., illus.
- Douglass, Bernard S.
1965. Special forest products 1964 harvesting report, Oregon & Washington. USDA Forest Serv. Pacific Northwest Region. 39 pp., illus.
- Employment Security Department.
1966. Employment and payrolls in Washington State by county and by industry, fourth quarter 1965. State of Washington. Rep. 77, 128 pp.
- Forest Service, North Pacific Region.
1937. Forest facts, Olympic National Forest, Washington. U. S. Dep. Agr. 6 pp., illus.
1937. Industrial development of Olympic Peninsula counties. U. S. Dep. Agr. 9 pp., illus.
- Holbrook, Stewart Hall.
1945. Green commonwealth. 163 pp., illus. Seattle: F. McCaffrey Dogwood Press.
1945. A narrative of Schafer Bros. Logging Company's half century in the timber. 110 pp., illus. Seattle: F. McCaffrey.
- Keezer, Dexter M.
1941. The Douglas-fir lumber industry. Bur. Res. Statist. Adv. Comm. Council Nat. Def. 98 pp., illus.
- Kirk, Ruth.
1964. Exploring the Olympic Peninsula. 118 pp., illus. Seattle: Univ. Wash. Press. (Pub. in cooperation with the Olympic Natural History Ass.)
- Little, Arthur D., Inc.
1964. Economic growth of the Puget Sound region, a report to the Puget Sound Regional Transportation Study. 263 pp., illus. Seattle.
- McArdle, Richard E.
1961. The yield of Douglas fir in the Pacific Northwest. U. S. Dep. Agr. Tech. Bull. 201 (rev.), 74 pp., illus.
- Meany, Edmund S.
1924. History of the State of Washington. 412 pp., illus. New York: The Macmillan Co.
- Pacific Northwest Forest and Range Experiment Station.
1965. Timber resource statistics for the Pacific Northwest as of January 1, 1963. USDA Forest Serv. Resource Bull. PNW-9, 38 pp.
- Parker, Mervin W.
1966. Project open space, summary report. Puget Sound Governmental Conf., Puget Sound Reg. Planning Council. 118 pp., illus.
- Price, W. H., and Grogan, William W.
1941. The Clemons Tree Farm. West Coast Lumberman 68(7): 12-18, 69-70.
- State of Washington Department of Natural Resources.
[n.d.] 1967 Timber harvest report. 73 pp., illus.
- Steer, Henry B. (Comp.)
1948. Lumber production in the United States, 1799-1946. U. S. Dep. Agr. Misc. Pub. 669, 233 pp.
- Worthington, Norman P., Johnson, Floyd A., Staebler, George R., and Lloyd, William J.
1960. Normal yield tables for red alder. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 36, 3 pp. plus tables, illus.

CURRENT FOREST SURVEY PUBLICATIONS

Resource Bulletins:

PNW-30	1968 Washington Timber Harvest	1969
PNW-29	1968 Oregon Timber Harvest	1969
PNW-28	Animal Damage to Conifers on National Forests in the Pacific Northwest Region	1969
PNW-27	1967 Oregon Timber Harvest	1968
PNW-26	The Timber Resources of Humboldt County, California	1968
PNW-25	1967 Washington Timber Harvest	1968
PNW-24	Timber Resource Statistics for Central Oregon	1968
PNW-23	Preliminary Timber Resource Statistics for Humboldt County, California, January 1, 1967	1968
PNW-22	1966 Oregon Timber Harvest	1967
PNW-21	1966 Washington Timber Harvest	1967
PNW-18	1965 Washington Timber Harvest	1966
PNW-17	Forest Industries of Eastern Washington	1966
PNW-16	1965 Oregon Timber Harvest	1966
PNW-15	Timber Resource Statistics for Southwest Washington	1965
PNW-14	1964 Washington Timber Harvest	1965
PNW-13	1964 Oregon Log Production	1965
PNW-12	The Timber Situation and Outlook for Northwest Oregon	1965
PNW-11	Hardwood Timber Resources of the Douglas-fir Subregion	1965
PNW-10	Forest Statistics for West-Central Oregon	1965
PNW-9	Timber Resource Statistics for the Pacific Northwest	1965
PNW-8	Forest Statistics for Southwest Oregon	1964
PNW-7	Forest Statistics for Northwest Oregon	1964
PNW-6	1962 Washington Log Production	1963
PNW-5	Forest Statistics for Chelan and Douglas Counties, Washington	1963
PNW-4	Forest Statistics for Northeast Washington	1963
PNW-3	Toward Complete Use of Eastern Oregon's Forest Resources	1963
PNW-2	1962 Oregon Log Production	1963
PNW-1	1961 Washington Log Production	1963

Research Papers:

PNW-84	Projected Developments of the Timber Economy of the Columbia-North Pacific Region	1969
PNW-28	Manpower Use in the Wood-Products Industries of Oregon and Washington 1950-63	1965
PNW-5	Timber Trends in Western Oregon and Western Washington	1963

Available from: Pacific Northwest Forest & Range Experiment Station
Post Office Box 3141
Portland, Oregon 97208

Bolsinger, Charles L.

1969. The timber resources of the Olympic Peninsula, Washington. USDA Forest Serv. Resource Bull. PNW-31, 60 pp., illus. Pacific Northwest Forest & Range Experiment Station, Portland, Oregon.

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