

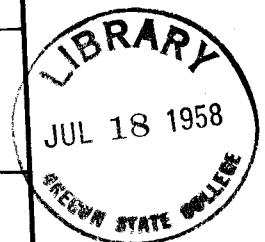
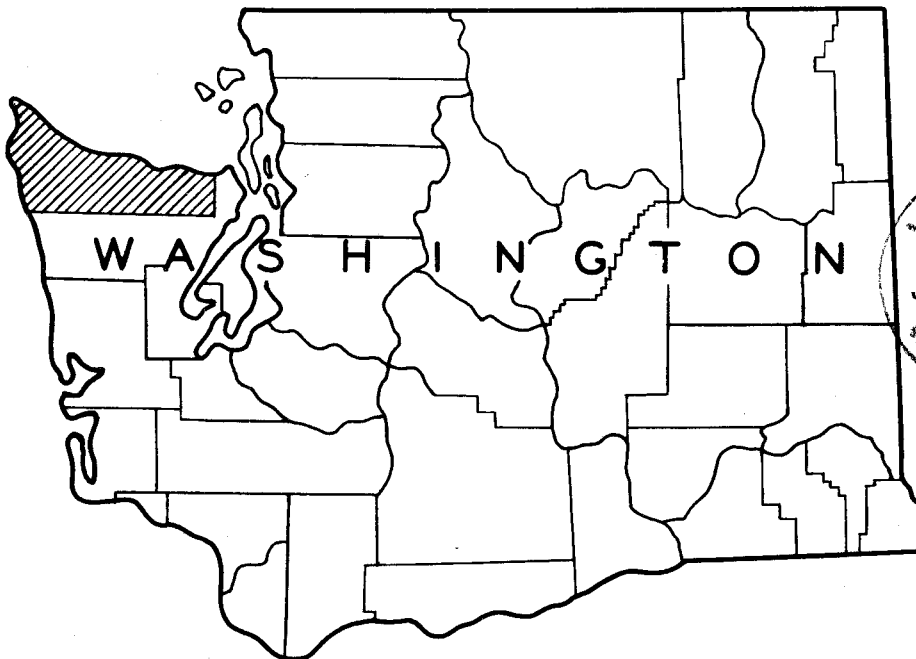
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FOREST STATISTICS FOR

CLALLAM COUNTY, WASHINGTON

FROM THE FOREST SURVEY INVENTORY REVISED IN 1939

(FOREST SURVEY REPORT) NO. 79



U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
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OCTOBER 15, 1940

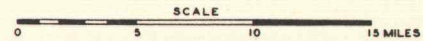
SCHOOL OF FORESTRY
OREGON STATE COLLEGE
CORVALLIS, OREGON

FIGURE I
 OUTLINE MAP





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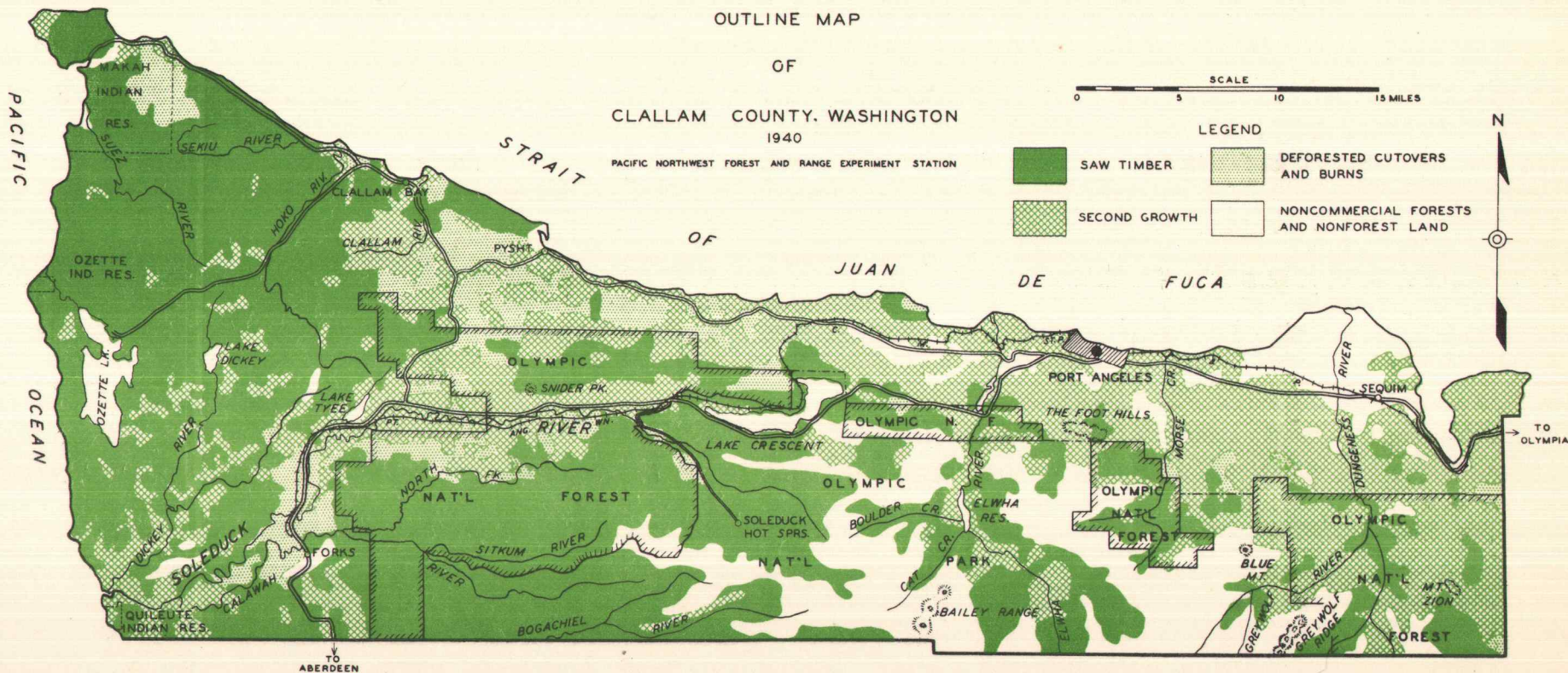
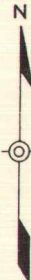
CLALLAM COUNTY, WASHINGTON
 1940

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION



LEGEND

-  SAW TIMBER
-  SECOND GROWTH
-  DEFORESTED CUTOVERS AND BURNS
-  NONCOMMERCIAL FORESTS AND NONFOREST LAND



FOREWORD

The forest survey, a Nation-wide project authorized by Congress in 1928, consists of a detailed investigation of the country's present and future forest resources in five major phases: (1) An inventory of existing forest resources in terms of areas occupied by forest-cover types and of timber volumes, by species, in board feet and cubic feet, and a study of conditions on cut-over and on burned-over forest lands; (2) a study of the depletion of the forest through cutting and through loss from fire, insects, disease, and other causes; (3) a determination of the current and potential growth on forest areas; (4) an investigation of present and prospective requirements of the United States for forest products; and (5) an analysis and correlation with other economic data of findings of these studies in order to make available to public and private agencies basic facts and guiding principles necessary to plan for sound management and use of forest resources.

The Pacific Northwest Forest and Range Experiment Station was designated to conduct the forest survey of Washington and Oregon and work was commenced in the Douglas-fir region of these States in 1930.* The inventory phase of the survey was conducted in Clallam County, Washington, in 1932, and a statistical report, "Forest Statistics for Clallam County, Washington", summarizing the results, was issued in 1934. In 1939 a reinventory of the county's forests was made to make adjustments in the forest statistics to comply with changes in forest type areas and timber volumes resulting from logging and fires, restocking of deforested cut-over and burned-over areas, and changes in land ownership since the original survey. The results of the reinventory are summarized in this report which supersedes the issue of 1934.

* Washington and Oregon were divided for survey purposes into two regions, (1) Douglas-fir region, consisting of that part of both States west of the Cascade Range summit, and (2) ponderosa pine region, that part of both States east of the Cascade Range summit. Regional reports will be issued which will present findings for each region as a whole. The regional reports will include an interpretation of the forest-survey data and a comprehensive economic analysis of the regional forest situation.

FOREST STATISTICS FOR CLALLAM COUNTY, WASHINGTON

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FOREST STATISTICS FOR CLALLAM COUNTY, WASHINGTON^{1/}

By M. J. Lauridsen^{2/}

The economic development of Clallam County has been closely associated with utilization of its forest resources, the county's principal source of wealth. Since the date of the first permanent colony the forest has been prominent in industrial growth and settlement, providing the foundation of the forest industries upon which the majority of the population is directly or indirectly dependent. After more than fifty years of lumbering, the forest, although greatly reduced in volume of timber, maintains its strategic position in the economy of the county and it is unlikely that any other resource will challenge this leadership.

Statistics included in this report are based upon data collected by the forest survey and indicate the recent trends in the forest situation from which conclusions relative to the position of the forest in the economic future of the county may be drawn.

The Place of the Forest in the County's Economic Development

Some of the earliest commercial logging and lumbering occurred on the present townsite of Port Angeles where a small sawmill, erected in 1888, furnished the local lumber needs. In 1893 a larger mill was built on the same site and for 20 years this was the principal industrial plant of the county.

Until the World War, when the demand for Sitka spruce for airplane production led to the construction of a railroad into the spruce stands of the western portion of the county, logging had been largely confined to the Douglas-fir stands of the northeastern part of the county where depletion progressed at a moderate rate. The railroad, however, in offering access to a great body of virgin timber, gave impetus to depletion and Clallam County soon became one of the leading log production centers of western Washington. By 1929 the county was second only to Grays Harbor County in log production and for the decade following 1926 ranked not lower than fourth among the western Washington counties. During the period approximately 10 percent of the log produc-

^{1/} Assistance in the compilation of the data contained in this report was furnished by the personnel of Work Projects Administration official project 65-2-94-144.

^{2/} The field and office work of the revised inventory of Clallam County, Washington, was done by M. J. Lauridsen, B. C. Baker, P. F. Liniger, E. D. Buell, Edna L. Hunt, T. J. Rowe, and W. E. Zeuthen.

tion of the Douglas-fir region of the State was cut from the forests of the county. In the past several years, however, relative inactivity in the log market and a diminishing supply of accessible Douglas-fir saw timber has caused the production to decline. Sawlog production figures for 1939 indicate that the volume of logs produced during the year was but 27 percent of that of 1929, the peak year.

Lumber production of the county was at its highest level after the World War when a sawmill designed to produce one million board feet of lumber daily was completed. This mill, however, was not operated at its full capacity and finally ceased operation in 1929. At present there are six or seven sawmills in part-time operation with a combined capacity of approximately 160 thousand board feet per 8-hour day, but they are primarily of local importance and the volume of export lumber manufactured in them is relatively small. There were a number of small shingle mills active in 1939 varying in size from 1 to 6 machines with a combined capacity of about 600 squares per day, and the recent addition of two more shingle mills of appreciable size in the western portion of the county will increase shingle production considerably.

Port Angeles, the county seat and principal city (fig. 1) is the site of three pulp and paper mills. The vast supply of pulpwood in the fog-belt forest to the west, the availability of ocean transportation, a plentiful supply of pure water, and the development of cheap electric power were factors in determining the location of these mills, which are the major wood-using plants of the county. Products from these plants include newsprint, dissolving pulp, bleached and unbleached paper pulp, boxboard, and groundwood pulp. During an average year, the aggregate production from these plants exceeds 225 thousand tons. Although the average consumption of pulpwood by the pulp industries is approximately equal to the entire volume of sawlogs produced in the county in 1939, about one-half of the log production is of species other than those used in the process of pulp manufacture, indicating that a large part of the consumption of the pulp mills is imported from neighboring localities.

In comparing the sawlog production and consumption figures it is revealed that about one-half of the log output is manufactured into wood products in the county and the remainder, which consists largely of Douglas-fir, is exported to be milled in other localities.

According to figures released by the Bureau of the Census for 1930, 38 percent of all persons gainfully employed in the county were directly engaged in the forest industries, and it is reasonable to assume that nearly a corresponding number are indirectly dependent upon these industries. Agriculture, the only other industry of importance, engages about 25 percent of the persons gainfully employed, a part of whom are, of course, indirectly dependent upon the forest industries.

The Forest

The total area of the county is approximately equally divided between the moderately broken lowlands that characterize the topography of the northern and western portions and the rough and mountainous terrain of the southeast and south-central portions. The rough and mountainous portion lies principally within the boundaries of the Olympic National Park and the Olympic National Forest. Of the county's total land area of 1,113,058 acres, 275,792 acres, or 25 percent, is within the boundaries of the national park, and 252,136 acres, or 22 percent, is within the national forest. Most of the timber on these lands is relatively inaccessible and has not been utilized. However, in the lower valleys inside the national forest some of the timber, both on public and privately owned lands, has been logged. This is particularly true in the Sol Duc River Valley. The remaining 53 percent of the county's area lies along the coast in the north and west portions and has furnished the major part of the log production.

The total area of forest land, as determined by the 1939 inventory, is 1,040,683 acres, or 94 percent of the total land area. Of this, 105,177 acres was classified as noncommercial forest land which consists of areas too steep and rocky to permit logging, areas at the upper altitudinal limits of tree growth, and a small area of lodgepole pine. Nonforest lands total 72,375 acres, 61 percent being classified as agricultural and consisting of areas of stump pasture as well as cultivated lands. The largest area of agricultural land is located in the vicinity of Sequim with the remainder existing in relatively small blocks over the more level areas of the lowlands. The other nonforest lands are largely barrens and meadows at the upper elevations of the mountains and urban settlements.

The area of all forest cover types, by ownership classes, is given in table 1, and in generalized form in table 2. Generalized cover types are graphically summarized in figure 2.

Saw-Timber Stands

Depletion by cutting, fire, and wind has reduced the area of saw-timber stands to 507 thousand acres, or approximately 55 percent of the total commercial conifer land. Nearly 75 percent of the area of these stands is found in the fog-belt of the western portion of the county where the annual rainfall varies from 100 to 140 inches. The luxuriant forest growth which is characteristic of the fog-belt consists of western hemlock, the balsam firs, western redcedar, Sitka spruce, and Douglas-fir.

Stands in which western hemlock is the predominating species cover 294 thousand acres, or 58 percent of the total area of saw-timber

types, and are principally located in the fog-belt. This type is widespread over the western portion of the county where it is intermingled with small areas of the redcedar and spruce types and with numerous areas of immature hemlock stands. In the southern portion of the county the type extends eastward until it gives way to Pacific silver fir stands on the upper slopes of the mountains. To the north Douglas-fir occupies the drier slopes although scattered areas of hemlock are found on moist sites.

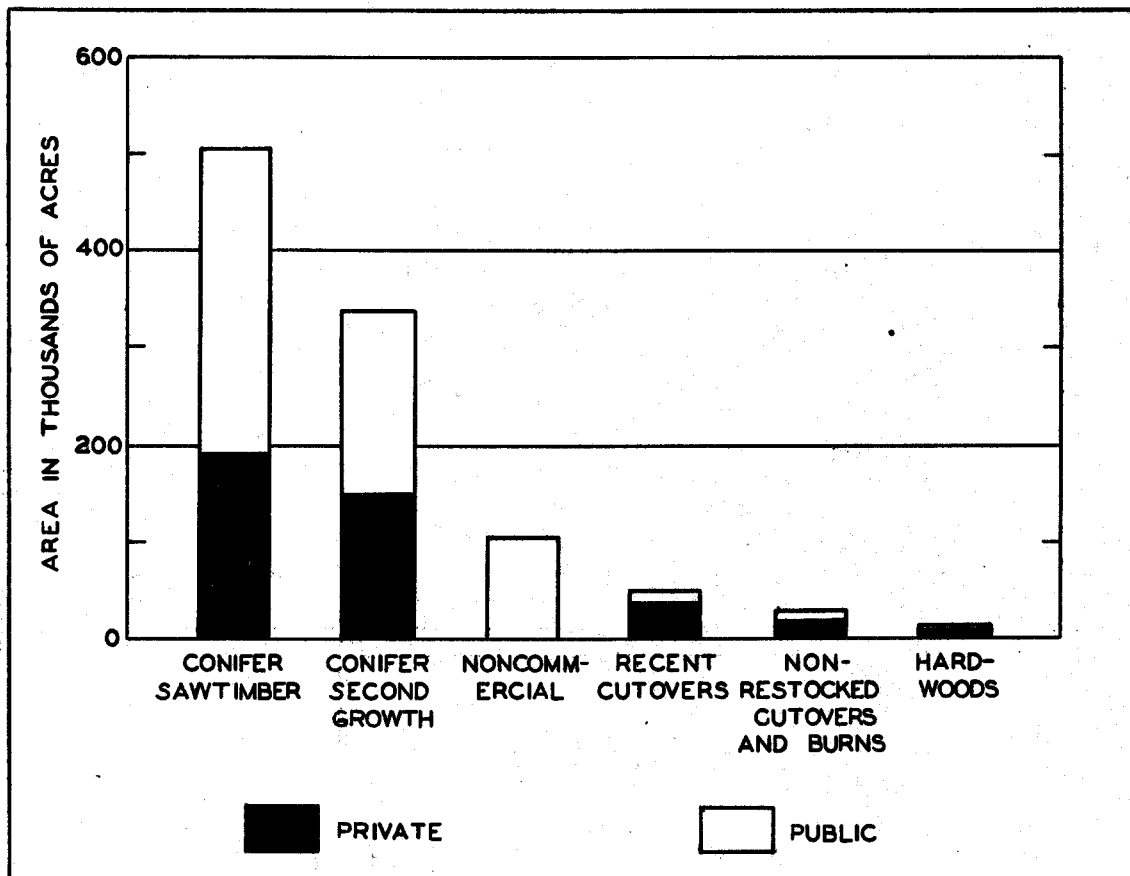


Figure 2. Generalized forest types by ownership class (from table 2).

Saw-timber stands consisting largely of silver fir are found on the upper slopes of the fog-belt occupying the ridges and low peaks of the northwestern corner of the county and the higher elevations of the western slopes of the mountains. This type occupies approximately 29 thousand acres or nearly 6 percent of the area of all saw-timber types.

The western hemlock and silver fir stands of the fog-belt of the county are the northern extension of the great pulpwood forest of the west coast of Washington and are important primarily as a source of raw materials for the pulp and paper mills of Port Angeles and the Puget Sound district.

Approximately 39 thousand acres, or 8 percent of the area of saw-timber stands, is occupied by western redcedar type. This type is found principally on the moist coastal flats and benches north and west of Lake Ozette although it also occurs in the scattered stands along the stream and river valleys over most of the county. Redcedar is also found as single trees or in small groups in practically all other saw-timber types in the county.

The saw-timber stands of the Sitka spruce type occupy 19 thousand acres, or about 4 percent of the total area of merchantable stands, and because of their exacting requirements are limited to the very moist sites of the fog-belt. They occur principally as stringers along the stream and river bottoms in association with hemlock and redcedar. Spruce is one of the important pulp species and is also of high value for construction where strength without weight is desirable.

The forests of almost the entire eastern half and the north-central portion are characteristically Douglas-fir in composition. The Douglas-fir stands of trees of merchantable size, which occupy 126 thousand acres or 25 percent of the total area of saw-timber types, are located in widely scattered blocks on the plateau and well-drained northern slopes of the mountains. The amount of annual precipitation varies widely in the zone occupied by this species. In the western portion of the zone it averages about 100 inches; toward the east it decreases rapidly until, in the sheltered areas of the northeastern corner of the county, it is less than 15 inches. In addition to the saw-timber stands of the Douglas-fir zone there are also scattered stands of the species in the fog-belt of the county where it occupies the well-drained sites.

Old-growth stands cover 108 thousand acres, or about 85 percent of the total area of Douglas-fir saw timber. However, on only 33 thousand acres is the majority of the merchantable volume contained in trees larger than 40 inches in diameter.

Immature Stands

Immature conifer stands in which the trees are less than 20 or 24 inches in diameter occupy 339 thousand acres or 33 percent of the total forest land area of the county. These stands are of great economic importance and, under adequate protection, those that will be available for cutting will furnish the basis of the future forest industries.

Although a large area in the county has been cut over, 70 percent of the area occupied by immature stands is comprised of lands depleted by fire and wind. Second-growth stands in which Douglas-fir is the predominating species occupy 221 thousand acres or nearly two-thirds of the total area of stands of this size class and, of this acreage, about 70 percent was originally deforested by fire. The areas of immature stands occupying old burns are principally located in the north-central and eastern parts of the county where devastating fires swept across the timbered slopes many years ago leaving only remnants of the original stand.

Fifty-two percent of the area of Douglas-fir stands in which the trees are of less than saw-timber size are composed of trees ranging from 6 to 20 inches in diameter.

Immature stands of western hemlock principally occur in the fog-belt of the west. Thirty percent of the area of these stands is on old cut-over lands, the remainder being largely on areas depleted by the Olympic Peninsula hurricane of 1921 which caused widespread damage to the spruce-hemlock stands of Clallam and Jefferson Counties. It is reported that 5 billion board feet of timber were blown down by the storm with the principal loss occurring in Clallam County. The hemlock seedlings and saplings that formed the understory of the original stand quickly responded to the release caused by the blowdown and now fully occupy these areas. About 70 percent of the area of immature western hemlock is stocked with trees less than 6 inches in diameter at breast height.

Second-growth stands of redcedar, spruce, silver fir, and grand fir also occur in the county but their aggregate area is less than 1 percent of the total area of all immature conifer stands.

As shown in table 3, which gives the area of the immature conifer types by age class and degree of stocking, the bulk of the immature stands are of the younger age classes and on the whole satisfactorily stocked. The stands on 237 thousand acres, or 70 percent of the total area occupied by immature types, are in the 10-, 20-, or 30-year age class.

Approximately 61 percent of the total acreage of immature conifer types is well stocked and on 30 percent the stands are of medium stocking.

Hardwoods

Hardwoods of commercial importance occurring in the county are red alder, northern black cottonwood, and bigleaf maple. These species usually occupy moist, fertile sites adjacent to streams although red alder and maple are frequently found in association with conifer growth on moist slopes. More than 12 thousand acres were classified by the

survey as being true hardwood sites supporting hardwood stands, largely of red alder which grows abundantly over the county in pure stands and in mixture with maple and cottonwood. Seven thousand acres, or 58 percent of the area of hardwood forests, is occupied by stands of merchantable size; the remainder supports immature stands ranging up to 30 years of age.

There has been little utilization of hardwoods in the county although small quantities have been used in the manufacture of paper spools.

Deforested Lands

Nonrestocked burned areas and areas that were logged prior to 1930 and have not restocked with conifer species were classified as deforested lands. Deforested cut-over lands were further classified as those logged prior to 1920 and those logged between 1920 and 1930. The survey statistics for 1939 reveal that a total of 27 thousand acres was classified as deforested, of which 81 percent was logged between 1920 and 1930, 12 percent was logged prior to 1920, and the remainder was old burns. These idle areas are principally located in the north-central portion of the county where repeated fires and the absence of a source of seed have resulted in this condition. A part of this acreage supports a temporary cover of red alder and willow which will occupy the site until conifer growth becomes established and assumes a dominant position, eventually forcing the hardwoods out of the stand.

During the interval between 1932 and 1939 a substantial improvement in the condition of the lands cut prior to 1920 has taken place, statistics indicating that there has been a 65-percent reduction in the area of deforested cut-over land. Recently increased fire protection on the idle lands in addition to the active planting program on State-owned lands may be expected to further reduce the area of unproductive land in the future.

The area of deforested burns within the county is relatively small with only 1,814 acres included in this classification. These areas are small and widely scattered and as they are largely surrounded by conifer stands of seed-bearing size they will undoubtedly become stocked through natural regeneration.

Recent Cut-Over Lands

Recent cut-over lands, or those clear cut between January 1, 1930, and the summer of 1939, total nearly 50 thousand acres. Lands partially cut were classified on the basis of the residual stand and are not included in this acreage.

Recent cut-over lands in the eastern portion of the county occur in small scattered blocks which form only a small fraction of the total

area of this type. The major part of the type is found to the west where the larger logging companies have been in operation for the past decade. Approximately 76 percent of the area of the recent cut-over lands is privately owned; 10 percent is in Indian ownership concentrated in a single block on the Makah Indian Reservation; and the remainder is principally in State and national forest ownership.

No examination of these lands was made to determine the degree of restocking because of the relatively short interval that has elapsed since logging.

Noncommercial Forest Lands

Noncommercial forest lands total 105 thousand acres or slightly more than 10 percent of the county's forest land area. These lands are almost entirely within the exterior boundaries of the national forest and the national park on the upper slopes of the mountains. Ninety percent of the area of noncommercial forest land is covered with sub-alpine forests growing at the upper limits of tree growth. These forests, which are usually comprised of poorly formed and unmerchantable trees of such species as mountain hemlock, western white pine, lodgepole pine, and Pacific silver fir, are primarily important because of their protective and esthetic values. Most of the remainder of the acreage of noncommercial forest land consists of areas within the limits of tree growth but are too steep and rocky to produce timber of merchantable character.

Productive Capacity of Forest Land

Determination of the site quality, or relative productive capacity, of the commercial forest land was made during the survey as a basis for the calculation of forest growth. Stands in which Sitka spruce, western hemlock, Pacific silver fir, or associated species were predominant were allocated to the spruce-hemlock site classification; stands of the Douglas-fir types were allocated to the site classification for this species. Deforested lands were classified on the basis of the type which originally occupied the area although this may not have been the climax type.

A comparison with the site quality of the remainder of the Douglas-fir region of Oregon and Washington indicates that Clallam County is of average productive capacity with 692 thousand acres, or 75 percent of the total area of commercial conifer forest land, of site quality class III or better. The major portion of the area of the highly productive sites, I and II, are located in the western and northwestern part of the county where the soil is fertile, the precipitation high, and the topography relatively gentle. Site quality III is of common occurrence in the northern part of the county occurring on the more fertile soils of the benches and river valleys. Con-

ditions on the benches of gravelly soil and on the rocky slopes are less favorable for the promotion of tree growth, the productive capacity of these areas being site quality IV. Site V, the lowest site class recognized, is found principally at the upper limits of commercial tree growth where the soil is characteristically shallow, the topography rugged, and the climatic conditions severe.

Table 4 shows the land areas, forest land areas, and commercial conifer areas by site quality class.

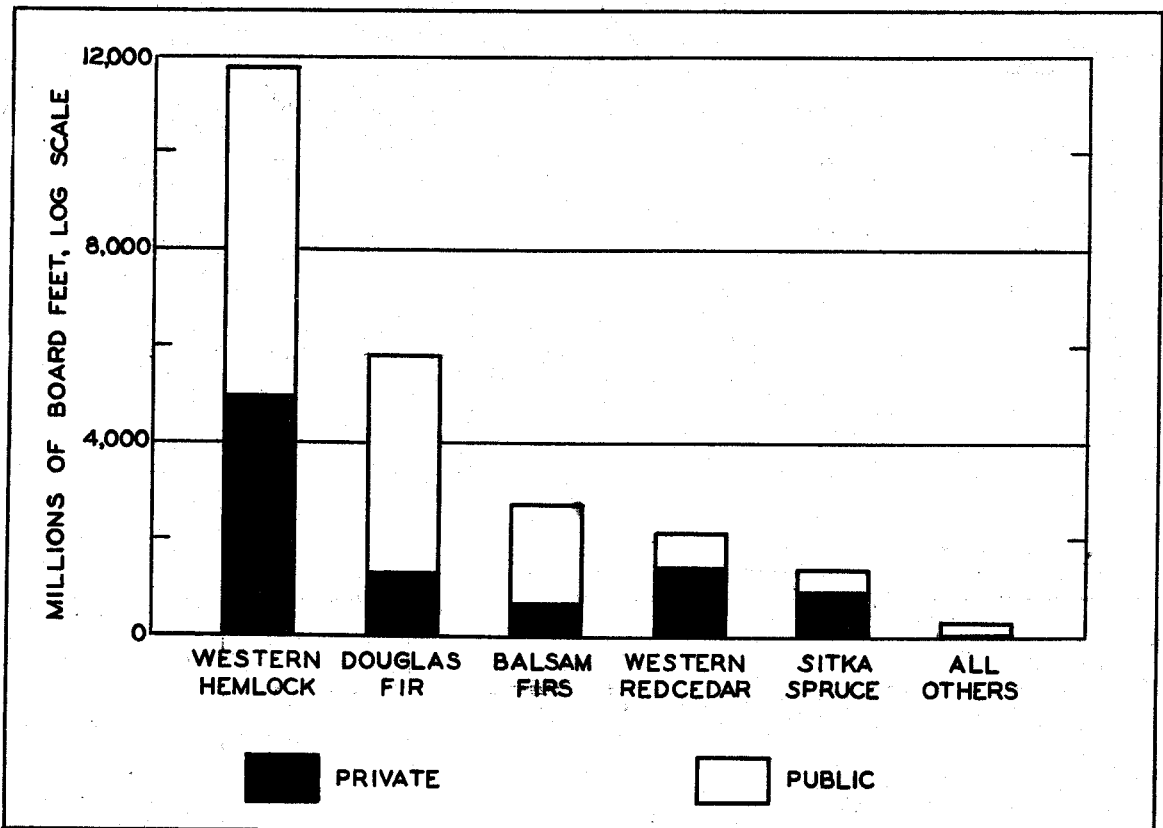


Figure 3. Distribution of saw-timber volume by species and ownership class (from table 5).

Saw-Timber Volume

The total saw-timber volume in the county, according to the 1939 inventory, was approximately 24.3 billion board feet, log scale, Scribner rule. Nearly one-half of the total volume is western hemlock; roughly one-fourth is Douglas-fir; and the remaining one-fourth is comprised principally of the balsam firs, western redcedar, and Sitka spruce. The aggregate volume of the other species such as western white pine,

Alaska yellow-cedar, mountain hemlock, lodgepole pine, and the hardwoods is insignificant. Table 5 summarizes the saw-timber volume by species and ownership class and figure 3 shows the distribution by species in both private and public ownership.

Of the 11.8 billion board feet of western hemlock in the county, 94 percent is in trees 20 inches or more in diameter at breast height. The quality of the hemlock is average at the lower elevations but improves on the higher ground where it attains diameters of over 40 inches and merchantable heights of from 8 to 9 sixteen-foot logs. On the poorer sites the stands are frequently light and the individual trees are likely to be of poor quality while on the more productive sites the stands are often dense and of good quality. The hemlock found in association with Douglas-fir is usually of better quality than that found in the spruce-hemlock stands of the fog-belt.

Of a total of nearly 5.9 billion board feet of Douglas fir, 4.9 billion board feet is in old-growth trees with about one-half of this occurring in trees 40 inches or more in diameter. A wide variety of site and conditions of stocking has resulted in considerable variation in the quality of the old-growth Douglas-fir in the county. Stands located in some parts of the fog-belt are open-grown, limby, and vigorous, producing a coarse-grained wood with an abundance of knots, thereby lowering the quality of the logs. There are, however, old-growth stands producing a relatively high percentage of surface clear logs although most of the wood is fairly coarse-grained and hard.

Pacific silver fir comprises all but about 1 percent of the total volume of the balsam firs in the county; grand fir occurs only in small quantities along the coast. Silver fir growing at the lower elevations in association with hemlock and redcedar is frequently of low quality and highly susceptible to disease. However, trees of this species occurring on the upper slopes and ridges are of better quality and attain dimensions comparable to those of hemlock on the better sites.

The total saw-timber volume of western redcedar, both live and dead, is 2.1 billion board feet, or 9 percent of the total saw-timber volume. This species is of fair quality throughout most of the county; the better grades occur on the lower slopes rather than in the poorly drained bottoms and swamps. Diameters in excess of 6 feet are not uncommon although many of the larger trees have been hollowed by decay.

Sitka spruce, the least abundant of the commercially important species, composes 6 percent of the total saw-timber volume, or 1.4 billion board feet. This volume is found chiefly in trees 24 inches or more in diameter in which the quality varies from very poor along the wind-swept shores of the west coast to excellent in the inland valleys of the fog-belt. The coast-line spruce is short and heavily limbed and of commercial value only for pulpwood. In the interior,

however, trees of this species often attain diameters of 100 inches or more, have long clear boles, and produce material of the highest quality, much of it suitable for airplane stock.

Two percent of the total saw-timber volume is of the hardwood species, largely red alder with a small amount of northern black cottonwood and bigleaf maple.

Ownership of Forest Resources

The character of the ownership of the forest resources is primarily important because it largely determines the forest-management policy that is to be applied to the forests of the county which, in turn, directly influences the yield that may be expected from them in the future.

Of the total of 923 thousand acres of forest land capable of producing conifer timber of commercial character and quality, 402 thousand acres, or about 44 percent, is privately owned. Approximately 178 thousand acres, or 19 percent, is in national forest ownership available for cutting; 159 thousand acres, or 17 percent, is in the Olympic National Park and reserved from cutting; 13 percent and 5 percent is State and county owned, respectively; and the remaining 2 percent is in Indian, municipal, or Federal other than national forest and national park ownership.

Thirty-eight percent of the 507 thousand acres of saw-timber types is privately owned, the title or control of these stands being held by relatively few companies. This consolidation of ownership of the merchantable timber increases the possibilities for the formation of sustained-yield units in which periodic yields of approximately equal volume can be harvested perpetually. The saw-timber stands on an additional area of 191 thousand acres of Indian and publicly owned land are available for cutting. Of this area, 109 thousand acres is in national forest ownership, 47 thousand acres is State owned, and 14 thousand acres is owned by the county. A total of 128 thousand acres of saw-timber stands is reserved from cutting in the Olympic National Park.

The ownership of saw-timber volume closely parallels that of the saw-timber stands. Thirty-nine percent is privately owned; 25 percent is in national park ownership; 22 percent is in national forest ownership; and the remainder is in State, Indian, and county ownerships.

Forest Depletion

Depletion of the saw-timber forests of the county during the interval between 1933 and the summer of 1939 has been almost entirely the result of cutting; there was only a small loss from fire and practically no loss from wind or insects.

The principal products removed from the forest stands are sawlogs, although small quantities of shingle bolts, posts and poles, fuel wood, ties, and other similar articles are also removed. The estimation of depletion is, therefore, based upon sawlog production statistics for the interval between 1933 and 1938 when production was relatively stable. The average annual output of sawlogs for the 5-year period was 386 million board feet, log scale, of which nearly one-half was of Douglas-fir. In 1938, however, production dropped to only a little over one-half of this 5-year average and in 1939 sustained a further drop.

Forest survey figures reveal that between 1933 and 1939 the saw-timber volume of the county was reduced 2.6 billion board feet or about 10 percent. Forty-seven percent of this volume was Douglas-fir and 32 percent western hemlock. Although only 17 percent of all Douglas-fir board-foot volume in the county as of 1932 was cut, it is significant that 30 percent of the volume of large old-growth Douglas-fir was removed during this period. This indicates the rate at which the supply of this desirable type of timber is vanishing. In contrast to this, the volume of old-growth western hemlock was reduced only 5 percent. Ten percent of the total volume cut during the period was of Sitka spruce, a reduction of 16 percent of the total volume of that species. The remaining 10 percent of the cut was chiefly composed of redcedar and silver fir.

Statistics pertaining to depletion by fire were obtained from reports of the Washington State Division of Forestry and the Forest Service. These statistics cover the interval between the original survey in 1932 and the revision of 1939. For the 7-year period a total of 4.8 million board feet was killed by fire, but this was almost entirely sustained in one year in a single fire within the national forest boundary and for 4 out of the 7 years there was no loss of saw-timber volume by fire reported.

During the period an average of approximately 1,400 acres was burned over annually, this acreage consisting principally of cut-over land. Some of these cut-over lands had been previously deforested by fire while others were supporting conifer second growth of varying degrees of stocking.

Forest Growth

The calculations of forest growth are based upon the data obtained in the original forest survey of 1932 when 300 thousand acres of conifer types and 9 thousand acres of hardwoods were classified as growing forests--those less than about 160 years in age.

The current annual board-foot increment of the conifer growing stock, or the board-foot increment for a specific year, was calculated for trees 15.6 inches or more in diameter at breast height. This in-

crement was determined to be 27 million board feet, of which 21 percent was on large second-growth Douglas-fir and 59 percent on small second growth of the same species. The remainder of the increment is principally accumulating in growing stands of western hemlock.

Growth determinations made on the basis of increment in cubic feet, in which all trees 3.6 inches or more in diameter at breast height were used, indicate that the current annual increment for the conifer growing stock was 24 million cubic feet.

Assuming that all commercial forest lands in the county were under intensive forest management, stocked with growing forests that were producing at a rate of 75 percent of their capacity, the potential annual growth is estimated to be 318 million board feet in trees 15.6 inches or more in diameter and 102 million cubic feet in trees 3.6 inches or more in diameter.

Trends

An analysis of the current trends in the forest situation as indicated by a comparison of the two forest survey inventories reveals several significant developments regarding changes in ownership status, the relation of growth to drain, and other important inclinations.

During the 7-year period between inventories a decrease of 53 thousand acres in the area of privately-owned lands has been accompanied by a corresponding increase in the area of State lands. This has been largely accomplished by foreclosure on tax-delinquent cut-over lands by the county which, in turn, transferred title to the State. Although the area of county-owned land was practically the same in 1939 as it was in 1932, the county has acquired much land during the interval but has deeded the land to the State. Some of these areas have been reforested by the State and are now in a productive condition. Although the acreage of federally-owned land in the county remained practically the same, a large area of forest land was transferred from an available-for-cutting status to a reserved-from-cutting status in the creation of the Olympic National Park. A total of 250 thousand acres of forest land and 6 billion board feet of saw timber were involved in the transfer in this county.

Calculations of growth and drain reveal that until 1938 logging was removing timber much faster than it could be grown under intensive forest management, a condition that will create an economic problem in the future.

Available old-growth Douglas-fir is a rapidly diminishing resource that has been the mainstay of most of the logging operators of the county. Future cutting in the virgin stands will be principally concentrated in the spruce-hemlock stands of the fog-belt where pulpwood species will comprise the majority of the log production.

Table 1.-Area, in acres, of all forest cover types, by ownership class
Data corrected to August 15, 1939

Survey type no.	Type definition	Private	State		County	Municipal	Indian	Federal					Total	
			Available	Reserved				National park	National forest		Other			
									Available	Reserved	Available	Reserved		
6	Douglas-fir Large old growth	12,220	2,100		90		15	10,036	8,627			105	10	33,203
7	Small old growth	6,145	3,120		1,340	5	70	41,654	22,094			70	20	74,518
8	Large second growth	5,042	2,185		920		30	4,415	5,992			60	55	18,699
9	Small second growth	50,939	20,015	85	9,775	200	110	9,528	21,654			2,510	170	114,986
10	Seedlings and saplings	27,352	16,940		5,495	5	255	18,417	37,075			215	20	105,774
11	Sitka spruce Old growth	12,665	2,880	15	615		1,090	1,443	256			185		19,149
12	Second growth	330					235							565
13	Seedlings and saplings	175	170											345
14	Western hemlock Old growth	115,655	33,350		9,525		16,655	50,444	67,202	264		205	685	293,985
15	Second growth	21,010	4,505	30	2,245		995	2,156	3,493			200		35,334
16	Seedlings and saplings	46,555	19,345	70	7,510		1,535	1,724	3,481			100	5	80,325
17	Western redcedar Old growth	33,710	2,385		1,465		720	234	667					39,181
19	Second growth	1,035			10									1,045
23	Fir-mountain hemlock Old growth	3,755	1,660		425			18,743	4,035					28,618
24	Second growth	105							479					584
26	Lodgepole pine Second growth							408						408
30	Grand fir Second growth	96												96
31.5	Hardwood Old growth	5,830	315	5	260		30	537	40			50		7,067
31	Second growth	3,863	670		395		130	61	10			15		5,144
33	Subalpine							82,911	10,076	1,593				94,580
35	Nonrestocked cutover Cut prior to 1920	1,700	1,595		65	5								3,365
35A	Cut from 1920-29, incl.	15,274	4,010		1,305	10	85	74	1,424					22,182
36	Recent cutover Cut since 1930	37,510	3,305		810		5,080	318	2,254			65	185	49,527
37	Deforested burn	631	135		90		5	12	916			25		1,811
38	Noncommercial rocky area	45	170		150		25	6,443	3,356					10,189
Total forest types		401,642	118,855	205	43,190	225	27,065	249,558	193,131	1,857	3,805	1,150		1,040,683
3	Nonforest land Cultivated	41,437	585		510		1,080		40			110	50	43,812
2	Other nonforest	5,464	150		95		520	20,014	1,980			280	60	28,563
Total		448,543	119,590	205	43,795	225	28,665	269,572	195,151	1,857	4,195	1,260		1,113,058

Table 2.-Area, in acres, of generalized forest types, by ownership class
Data corrected to August 15, 1939

Type definition	Private	Indian	Public						Total
			Available for cutting			Reserved from cutting			
			State	County	Federal	State	Municipal	Federal	
Conifer saw timber Types 6,7,8,11,14,17, and 23	189,192	18,580	47,680	14,380	109,498	15	5	128,003	507,353
Conifer second growth Types 9,12, and 15									
On cut-over areas	18,140	135	3,655	1,975	383	75	80	15	24,458
On old burns ^{1/}	54,139	1,205	20,865	10,745	27,474	40	120	11,839	126,427
Total	72,279	1,340	24,520	12,720	27,857	115	200	11,854	150,885
Conifer seedlings and saplings Types 10,13, and 16									
On cut-over areas	41,115	1,295	20,120	7,410	6,584		5	110	76,639
On old burns ^{1/}	32,967	495	16,335	5,595	34,287	70		20,056	109,805
Total	74,082	1,790	36,455	13,005	40,871	70	5	20,166	186,444
Other conifer second growth Types 19,24, and 30									
On cut-over areas	275								275
On old burns ^{1/}	961			10	479				1,450
Total	1,236			10	479				1,725
Recent cut-over areas Type 36	37,510	5,080	3,305	810	2,319			503	49,527
Nonrestocked cut-over and burned areas Types 35,35A, and 37	17,605	90	5,740	1,460	2,365		15	86	27,361
Hardwoods Types 31 and 31.5	9,693	160	985	655	115	5		598	12,211
Noncommercial areas Types 26,33, and 38	45	25	170	150	13,432			91,355	105,177
Total forest types	401,642	27,065	118,855	43,190	196,936	205	225	252,565	1,040,683
Nonforest land Types 2 and 3	46,901	1,600	735	605	2,410			20,124	72,375
Total	448,543	28,665	119,590	43,795	199,346	205	225	272,689	1,113,058

^{1/} Includes blow-down areas.

Table 3.-Area, in acres, of certain immature conifer forest types,
by age class and degree of stocking
Data corrected to August 15, 1939

Age class (years)	Degree of stocking	Type number and name				Total
		Douglas-fir second growth Types 9 and 10	Sitka spruce second growth Types 12 and 13	Western hemlock second growth Types 15 and 16	Other conifer second growth Types 19, 24, and 30	
10	Good	12,330		5,448	120	17,898
	Medium	23,138	305	14,430	125	37,998
	Poor	10,895	15	6,726	30	17,666
	Total	46,363	320	26,604	275	73,562
20	Good	44,842		49,501	121	94,464
	Medium	11,025		3,560		14,585
	Poor	3,260		670		3,930
	Total	59,127		53,731	121	112,979
30	Good	19,983	70	12,195	358	32,606
	Medium	12,126	240	3,790		16,156
	Poor	1,451	15	534		2,000
	Total	33,560	325	16,519	358	50,762
40	Good	17,381		9,807	875	28,063
	Medium	4,812	155	3,004		7,971
	Poor	987		755		1,742
	Total	23,180	155	13,566	875	37,776
50	Good	16,078		365		16,443
	Medium	1,275	40	318		1,633
	Poor	475				475
	Total	17,828	40	683		18,551
60	Good	7,206		1,094		8,300
	Medium	3,862	70	925		4,857
	Poor	456		415		871
	Total	11,524	70	2,434		14,028
70	Good	2,120		463		2,583
	Medium	1,210		258		1,468
	Poor	775		126		901
	Total	4,105		847		4,952
80	Good	2,390		915		3,305
	Medium	11,386				11,386
	Poor	2,490		360		2,850
	Total	16,266		1,275		17,541
90+	Good	1,940				1,940
	Medium	5,505				5,505
	Poor	1,362			96	1,458
	Total	8,807			96	8,903
Total all ages	Good	124,270	70	79,788	1,474	205,602
	Medium	74,339	810	26,285	125	101,559
	Poor	22,151	30	9,586	126	31,893
	Total	220,760	910	115,659	1,725	339,054

Table 4.-Land areas, forest land areas, and commercial conifer areas,
by site quality class^{1/}
Data corrected to August 15, 1939

Kind of forest and site quality class	Total area		Area in forest land	Area in commer- cial conifers
	<u>Acres</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
Commercial conifer				
Douglas fir				
Class I	312	0.03	0.03	0.03
Class II	41,523	3.73	3.99	4.50
Class III	178,334	16.02	17.14	19.32
Class IV	143,411	12.88	13.78	15.53
Class V	31,473	2.83	3.02	3.41
Total	395,053	35.49	37.96	42.79
Spruce-hemlock				
Class II	301,293	27.07	28.95	32.63
Class III	170,658	15.33	16.40	18.48
Class IV	30,348	2.73	2.92	3.29
Class V	25,943	2.33	2.49	2.81
Total	528,242	47.46	50.76	57.21
Total commercial conifer	923,295	82.95	88.72	100.00
Lodgepole pine	408	.04	.04	
Noncommercial rocky	10,189	.92	.98	
Subalpine	94,580	8.50	9.09	
Hardwood	12,211	1.09	1.17	
Total other than commercial conifer	117,388	10.55	11.28	
All forest types	1,040,683	93.50	100.00	
Nonforest types	72,375	6.50		
Grand total	1,113,058	100.00		

^{1/} Deforested areas, types 35, 36, and 37, were classified as to site on the basis of original type. The "site quality" of a forest area is its relative productive capacity, determined by climatic, soil, topographic, and other factors. The index of site quality is the average height of the dominant stand at the age of 100 years. Five site quality classes are recognized for both Douglas-fir and spruce-hemlock types, class I being the highest. In the survey Douglas-fir classifications were used not only for types in which this species is dominant, but also for other types for which no site quality classifications have been developed.

Table 5.-Volume of timber by species and ownership class
Data corrected to August 15, 1939

Trees 16" and more d.b.h.^{1/}
Thousands of board feet, log scale, Scribner rule

Survey symbol	Species	Private	State		County	Municipal	Indian	Federal				Total	
			Available	Reserved				National park	National forest		Other		
									Available	Reserved	Available		Reserved
DA	Douglas-fir Large old growth	896,092	156,788	28	15,705		2,667	672,198	676,792	460	6,684	104	2,427,518
DB	Small old growth	143,390	44,267	3	9,350		376	1,472,381	843,102	115	1,141	181	2,514,306
DC	Large second growth	117,830	25,106		6,632		98	119,287	247,767		381		517,101
DD	Small second growth	149,613	47,854	270	23,583	1,328	59	119,085	47,690		5,270	522	395,274
SA	Sitka spruce Old growth	932,393	169,608	231	51,277		95,214	106,606	47,376		9,059	2,555	1,414,319
SB	Second growth	849					775		2,427				4,051
HA	Western hemlock Old growth	4,603,963	1,082,602	1,630	378,451		410,566	2,248,794	2,412,497	5,060	13,008	13,399	11,169,970
HB	Second growth	390,031	90,803	186	30,403		57,663	51,226	27,189		1,110	1,007	649,618
MH	Mountain hemlock							117,939	4,721				122,660
C	Western redcedar Live	1,404,117	140,801	105	60,625		59,787	157,988	258,278	460	882	1,785	2,084,828
KC	Dead	29,174	2,224		1,807			40	4,612		337		38,194
YC	Alaska yellow-cedar							24,426	7,687				32,113
W	Western white pine	454	125		422			80,438	31,132				112,571
LP	Lodgepole pine							4,028	306				4,334
WF	Grand fir	7,904	52					9,327	60				17,343
A	Pacific silver fir	686,117	169,395	367	57,565		144,747	864,155	800,073	2,990		4,960	2,730,369
RA	Red alder	38,409	6,379	23	2,511	32	2,396	3,969	3,244		123	91	57,177
BC	Northern black cottonwood	2,680	108	9				62	750				3,609
OM	Bigleaf maple	333	37					172					542
	Total	9,403,349	1,936,149	2,852	638,331	1,360	774,348	6,052,121	5,415,703	9,085	37,995	24,604	24,295,897

^{1/} Trees of hardwood species taken from 12" and more d.b.h.