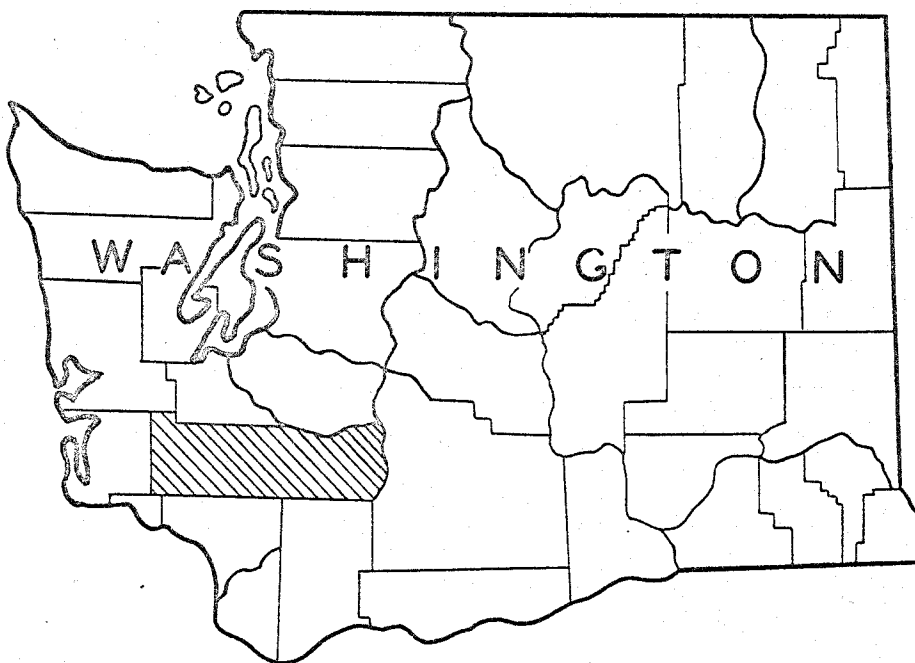


FOREST STATISTICS
FOR
LEWIS COUNTY, WASHINGTON

FROM THE FOREST SURVEY INVENTORY REVISED IN 1939

FOREST SURVEY REPORT NO. 81



U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
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


PORTLAND, OREGON

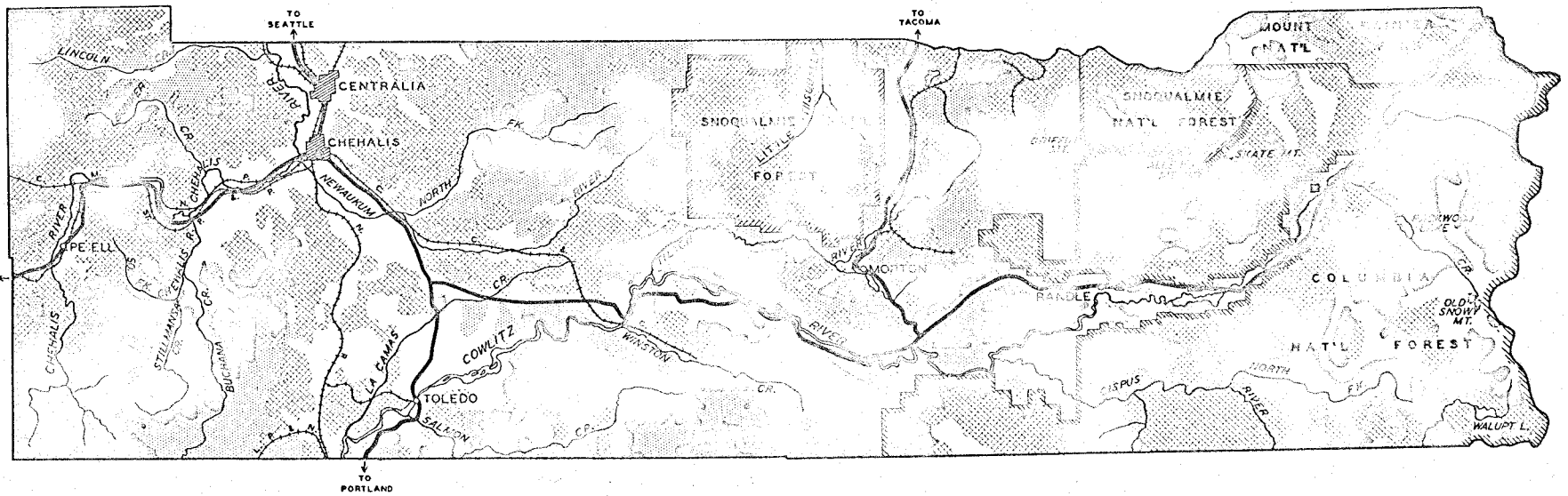
MARCH 1, 1941

FIGURE I
 OUTLINE MAP
 OF
 LEWIS COUNTY, WASHINGTON
 1940

SCALE
 0 10 15 MILES

LEGEND

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



FOREWORD

The forest survey, a Nation-wide project, consists of a detailed investigation in five major parts of present and future forest resources: (1) An inventory of the country's 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 forest lands; (2) a study of the depletion of the forests 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 basic facts and guiding principles necessary to plan for sound management and use of forest resources

The forest survey of Oregon and Washington, an activity of the Pacific Northwest Forest and Range Experiment Station, was conducted in the Douglas-fir region during the period 1930-33, inclusive.* In 1937 work of keeping the survey up to date was commenced in counties in which there had been extensive depletion since the original survey.

The forests of Lewis County, Washington, were first inventoried in 1931. Later, the inventory was brought up to date as of March 1, 1933, through adjustment for cutting depletion and in 1934 a report summarizing statistics on timber volume, forest type area, and site quality was issued. In the fall of 1939 the county's forests were reinventoried. This reinventory consisted of field examination of all cut-over lands logged prior to 1930 and all burned areas to determine the degree of regeneration, checking of location and extent of recent cut-over areas logged since January 1, 1930, as shown by cut-over records, obtaining additional data on productive capacity of the forest land, and recompilation of all statistical data. A new county cruise, made during the interval between inventories, was substituted wherever the old county cruise had been used in compiling volume estimates in the original inventory.

This report, which supersedes the one issued in 1934, gives results of the reinventory and briefly discusses the extent and character of the county's forests, their utilization and rate of depletion, and the rate at which they are being replenished through growth.

* Oregon and Washington 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 LEWIS COUNTY, WASHINGTON

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

By Edward D. Buell^{2/}

When Lewis County, the oldest in the State of Washington, was organized in 1845, it was practically an unbroken expanse of forest with less than 1 percent of its area nonforested. Fires occurring from time to time through the centuries had destroyed timber on some areas but these soon restocked with new stands. Each fire effected the establishment of an additional age class until the forest became one in which many age classes were represented by areas of even-aged stands. The volume of timber of saw-timber size probably totaled about 75 billion board feet.

The utilization of this vast natural resource has from the time of the first settlement to the present been one of the most important factors in the county's economic and social development. When the pioneers arrived they immediately began to clear land for agricultural use. Later, as the demand for lumber and other forest products increased, forest industries developed and timber was removed at an ever-increasing rate. At present, several major logging operations are active in the county.

During the first few decades of settlement most of the land denuded of forest was converted into farms. However, with the rapid growth of logging operations, land clearing fell far behind. Also, much of the more recent cut-over land is unlikely to be put to agricultural use because of such limiting physical factors as rugged topography, poor soil, and adverse climate. In certain portions of the county, however, there is still physical opportunity for agricultural expansion when economic conditions warrant.

The manner in which the remaining forests are utilized and the way in which the cut-over lands are managed is of paramount importance in the county's future development.

Physical Character of the County

Lewis County occupies the central portion of southwestern Washington, extending from the summit of the Cascade Range westward some 90 miles to the summit of the Coast Range (fig. 1). With a land area of 1,557,145 acres, it is the largest county in western Washington and the sixth largest in the State. Topographically, it is divided into three parts: the western

^{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 the county's forest was done by D. L. Lynch, Edward D. Buell, R. M. Ramstad, R. F. Goodall, P. F. Liniger, Edna L. Hunt, T. J. Rowe, and W. E. Zeuthen.

part dominated by the broken eastern slopes of the Coast Range; the central part consisting of broad nearly level valleys and rolling table lands; and the eastern part lying on the rugged western slopes of the Cascade Range. A large portion of the western half of the county is drained westward to Grays Harbor by the Chehalis River; a small area in the north-central portion drains northward into Puget Sound through the Deschutes and Nisqually Rivers; and the remainder of the county is drained southward to the Columbia River by the Cowlitz River.

The climate of Lewis County is similar to that of most of the inland section of the Douglas-fir region with wet winters, dry summers, and moderate temperatures except at the higher elevations. Climate, one of the principal factors determining the forest type on any specific area, is more favorable over most of the county to the growth of Douglas-fir than to any other species.

Character of the Forest

Although the virgin forest cover has been disturbed considerably through lumbering and land clearing operations, a total of 1,381 thousand acres or about 89 percent of the county's land area is still forest land as classified by the survey in the revised inventory. Table 1 shows the classification of the forest land by forest-cover types and table 2 the classification by 8 broad generalized groups.

Conifer Saw-Timber Types

Stands in which the timber is of saw-timber size (about 20 inches or more d.b.h.) occupy approximately 674 thousand acres, or nearly one-half of the forest land area.

Throughout the western and central portions of the county and at the lower elevations of the eastern portion, Douglas-fir comprises the bulk of the volume in the saw-timber stands. In many parts of the county this species finds sites favorable for optimum growth. Of the total of 481 thousand acres occupied by Douglas-fir saw-timber stands, 254 thousand acres is stocked with old-growth timber in which most of the volume is in trees from 40 to 100 inches in diameter breast height. Cruises show the average tree in these stands to be about 58 inches d.b.h., 13 sixteen-foot merchantable logs in height, and to contain a volume of 9 thousand board feet. These old-growth stands, which vary from 200 to about 700 years in age, are nearly all mature and many are decadent. They contain a large percentage of so-called "yellow fir" trees suitable for plywood or high-quality lumber.

Outstanding individual Douglas-fir trees found in the county include one that until recently stood near Mineral that measured 15 feet 4 inches d.b.h. and was estimated to be more than 1,000 years of age, and one near Buchanan Creek that was 330 feet in height.

Table 1.—Area, in acres, of all forest cover types, by ownership class
Data corrected to January 1, 1940

Survey type no.		Private	State		County	Indian	Federal			Total
			Available	Reserved			National forest		Other ^{1/}	
							Available	Reserved		
6	Douglas-fir									
	Large old growth	201,310	22,030	610						
7	Small old growth	9,835	605			485	25,255		4,250	253,940
8	Large second growth	120,890	16,340		120	205	13,565			24,005
9	Small second growth	111,735	6,140	30			62,785	325	2,075	202,740
10	Seedlings and saplings	170,920	25,410		570		61,980	90	3,520	183,495
	Western hemlock						57,010	705		254,615
14	Large	36,495	6,865							
15	Small	1,635	630				40,635	3,020	360	87,375
16	Seedlings and saplings	550	115				950	135	1,190	4,540
17	Western redcedar, large	1,205	105				930			1,595
	Fir-mountain hemlock						490			1,800
23	Large	9,885	1,280							
24	Small	435					73,790	9,430	9,600	103,985
26	Lodgepole pine, small	385					17,540	4,175	4,120	26,270
	Hardwood									385
31.5	Large	5,930	90							
31	Small	3,265	70				55			6,075
33	Subalpine	1,570								3,335
	Nonrestocked cutover						22,655	9,375	5,620	39,220
35	Cut prior to 1920	4,535	1,000							
35A	Cut from 1920-29, incl.	36,560	6,665		95		295			5,535
	Recent cutover									43,615
36	Cut since 1930	107,820	10,525							
37	Deforested burn	965	110		20	40	120		110	118,615
38	Noncommercial rocky area	1,195					3,695		2,775	7,565
	Total forest types	827,120	97,980	640	805	730	9,050	1,575	855	12,675
	Nonforest land						390,800	28,830	34,475	1,381,380
3	Cultivated	161,525	1,240	15	55	65				162,950
2	Other	4,625	20				50			
	Total	993,270	99,240	655	860	795	1,855	5,185	1,130	12,815
							392,705	34,015	35,605	1,557,145

^{1/} Includes 35,205 acres of Mount Rainier National Park, reserved from cutting.

Table 2.—Area, in acres, of generalized forest types, by ownership class
Data corrected to January 1, 1940

Type definition	Private	State		County	Indian	Federal			Total
		Available	Reserved			National forest		Other ^{1/}	
						Available	Reserved		
Conifer saw timber Types 6, 7, 8, 14, 17, and 23	379,620	47,225	610	120	690	216,520	12,775	16,285	673,845
Conifer second growth Types 9 and 15									
On cut-over areas	42,960	1,890	30						44,880
On old burns	70,410	4,880				62,930	225	4,710	143,155
Total	113,370	6,770	30			62,930	225	4,710	188,035
Conifer seedlings and saplings Types 10 and 16									
On cut-over areas	158,410	25,310		570		185			184,475
On old burns	13,060	215				57,755	705		71,735
Total	171,470	25,525		570		57,940	705		256,210
Conifer second growth Type 24									
On cut-over areas									
On old burns	435					17,540	4,175	4,120	26,270
Total	435					17,540	4,175	4,120	26,270
Deciduous cut-over areas Type 36	107,820	10,525			40	120		110	118,615
Deciduous restocked cut-over and burned as Types 35, 35A, and 37	42,060	7,775		115		3,990		2,775	56,715
Deciduous Types 31 and 31.5	9,195	160				55			9,410
Commercial areas Types 26, 33, and 38	3,150					31,705	10,950	6,475	52,280
Total forest types	827,120	97,980	640	805	730	390,800	28,830	34,475	1,381,380
Forest land Types 2 and 3	166,150	1,260	15	55	65	1,905	5,185	1,130	175,765
Total	993,270	99,240	655	860	795	392,705	34,015	35,605	1,557,145

^{1/} Includes 35,205 acres of Mount Rainier National Park, reserved from cutting.

Old-growth Douglas-fir stands in which the trees are from 20 to 40 inches d.b.h. stock an additional area of 24 thousand acres. Stands of this character are found principally in the mountainous eastern portion of the county.

Second-growth Douglas-fir of saw-timber size covers a total of 203 thousand acres. This acreage, which is comprised of several large bodies of thrifty even-aged timber from 60 to 200 years in age, lies principally in the Cowlitz River watershed.

Many of the Douglas-fir saw-timber stands are pure in composition; in those containing a mixture of species, western hemlock and western redcedar are the most common associates.

Saw-timber stands in which Douglas-fir is absent or comprises only a minor portion of the volume stock a total of 193 thousand acres. In most of these stands, which are found principally on the upper slopes and ridges of the mountainous section of the county, western hemlock or Pacific silver fir is the predominant tree. Both of these species form pure stands over considerable acreages but are usually in mixture with each other and such other associated species as mountain hemlock, noble fir, Alaska yellowcedar, western white pine, or western redcedar.

Although western redcedar comprises the bulk of the volume in saw-timber stands on less than 2 thousand acres, it occurs throughout all parts of the county.

The location and extent of the saw-timber stands is shown by the small generalized type map^{3/} in figure 1. Figure 2 shows the relation of their total acreage to that of the other generalized forest types.

Conifer Second-Growth Types

Conifer second-growth types in which the timber is less than saw-timber size occupy approximately 471 thousand acres or 34 percent of the county's forest land. Slightly more than half of this acreage, or 241 thousand acres, is restocked burns; the remainder is restocked clear-cut areas. The restocked cut-over areas are concentrated chiefly in the western one-third of the county, the scene of most of the logging operations. The restocked burns occur as smaller bodies of timber scattered throughout the county.

^{3/} Detailed 1-inch-to-the-mile county type maps and generalized $\frac{1}{4}$ -inch-to-the-mile lithographed State type maps showing the location and extent of the forest types have been prepared. For information on them, address Director, Pacific Northwest Forest and Range Experiment Station, 423 U. S. Court House, Portland, Oregon.

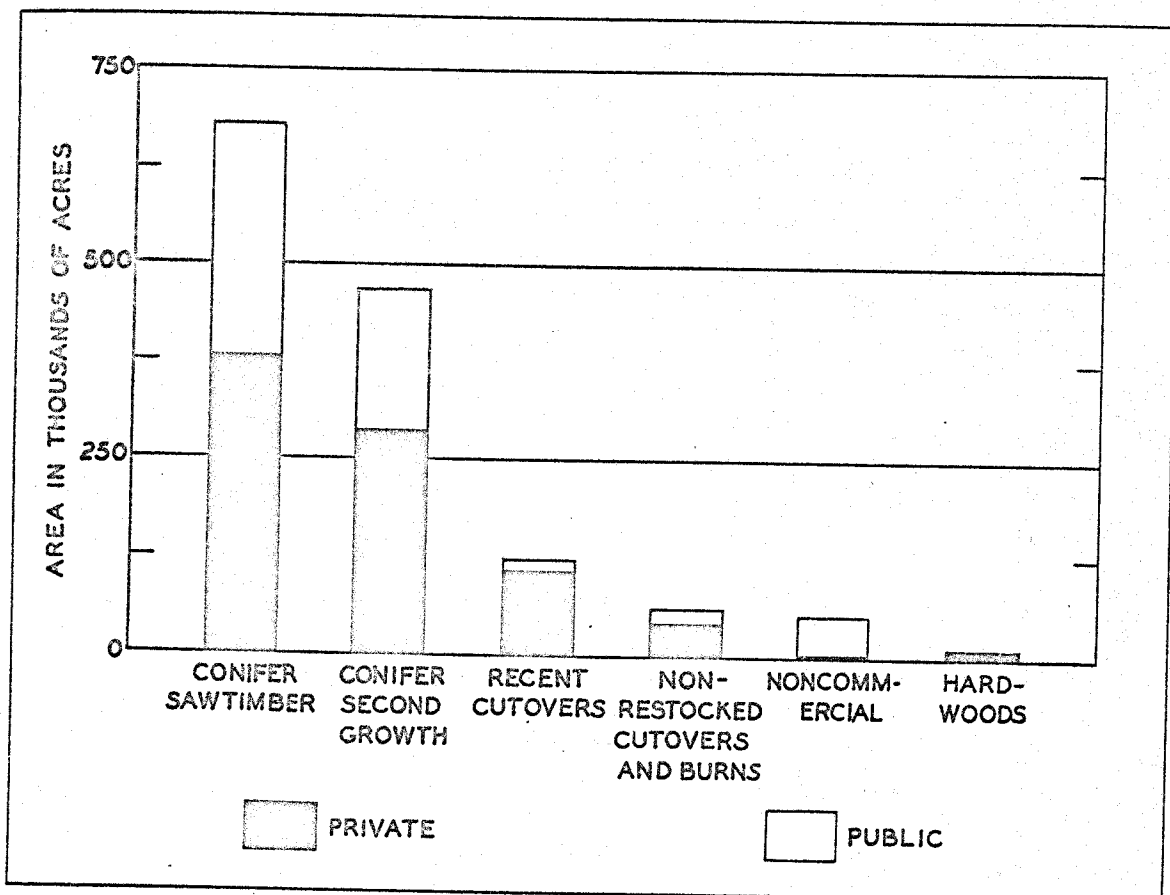


Figure 2. Generalized forest types by ownership class (from table 2).

Douglas-fir predominates in most of the second-growth stands. A total of 183 thousand acres is stocked with Douglas-fir of pole size (6 to 20 inches d.b.h.) and 255 thousand acres by seedling and sapling (0 to 6 inches d.b.h.) stands of this species. In table 3, which shows the area of the conifer second-growth types by age class and degree of stocking, it is seen that nearly half of the acreage of Douglas-fir pole stands is stocked with timber in the 60-year and 70-year age classes.

The degree of stocking of the second-growth stands in Lewis County is on the whole fairly satisfactory and considerably above the average for the Douglas-fir region. Fifty-eight percent of the total acreage is well stocked (70-100 percent), 30 percent is of medium stocking (40-69 percent), and only 12 percent is poorly stocked (10-39 percent).

Hardwood Types

Although red alder and bigleaf maple occur throughout most parts of the county, northern black cottonwood is found along some of the

Table 3.-Area, in acres, of certain immature conifer forest types,
by age class and degree of stocking
Data corrected to January 1, 1940

Age class (years)	Degree of stocking	Type number and name					Total
		10 Douglas- fir seedlings and saplings	16 Western hemlock seedlings and saplings	9 Douglas- fir small second growth	15 Western hemlock small second growth	24 Fir- mountain hemlock second growth	
10	Good	32,110					32,110
	Medium	57,065	1,000			4,005	62,070
	Poor	46,510				1,355	47,865
	Total	135,685	1,000			5,360	142,045
20	Good	66,245	420	3,530		515	70,710
	Medium	44,000	90	2,250		4,985	51,325
	Poor	5,490		675			6,165
	Total	115,735	510	6,455		5,500	128,200
30	Good	2,560	85	19,850	140		22,635
	Medium	635		4,040		2,605	7,280
	Poor			1,410			1,410
	Total	3,195	85	25,300	140	2,605	31,325
40	Good			27,875		4,090	31,965
	Medium			3,595	120	2,945	6,660
	Poor			2,565			2,565
	Total			34,035	120	7,035	41,190
50	Good			22,095	730	650	23,475
	Medium			4,215		290	4,505
	Poor			240			240
	Total			26,550	730	940	28,220
60	Good			47,755	1,050	2,000	50,805
	Medium			4,140	1,100	440	5,680
	Poor			435			435
	Total			52,330	2,150	2,440	56,920
70	Good			37,670	215		37,885
	Medium			165	100		265
	Poor			50			50
	Total			37,885	315		38,200
80	Good			930		2,390	3,320
	Medium						
	Poor						
	Total			930		2,390	3,320
90+	Good				140		140
	Medium			10	945		955
	Poor						
	Total			10	1,085		1,095
Total all ages	Good	100,915	505	159,705	2,275	9,645	273,045
	Medium	101,700	1,090	18,415	2,265	15,270	138,740
	Poor	52,000		5,375		1,355	58,730
	Total	254,615	1,595	183,495	4,540	26,270	470,515

larger stream courses, and Oregon ash occurs on the more swampy sites, none of these species form pure stands over areas of any extent; their occurrence is chiefly as understory trees. Stands on only about 9 thousand acres were classified as hardwood type. On approximately two-thirds of this acreage the stands were of saw-timber size (12 inches or more d.b.h.).

Deforested Lands

Deforested lands in the county that have not been put to agricultural use total 175 thousand acres or approximately 13 percent of the total forest land. These lands were classified by the survey into four categories: non-restocked cut-over lands logged prior to 1920, nonrestocked cut-over lands logged during the decade 1920-29, recent cut-over lands logged since January 1, 1930, and nonrestocked burned-over lands regardless of date of burn.

The area of lands logged prior to 1920 that are still nonrestocked is insignificant, totaling between 5 and 6 thousand acres. In 1931 at the time of the original inventory lands in this category totaled nearly twice this area. The total acreage is comprised of several small areas, the largest of which is about 1,500 acres in extent.

Nonrestocked cut-over lands logged during the decade 1920-29 total about 44 thousand acres. Analysis of data on cut-over areas obtained in the original survey indicates that approximately 150 thousand acres was logged during the decade. Thus, it appears that 106 thousand acres, or over 70 percent, of these lands became restocked by 1939, a condition considerably more favorable than that found in most of the other western Washington and western Oregon counties that have been reinventoried by the survey. However, some of these nonrestocked areas are of considerable extent and constitute a problem of land use.

The recent cut-over lands logged since January 1, 1930, which total 119 thousand acres, were not examined to determine the degree of regeneration. There are several large areas of land in this category and it is to be hoped that recurring fires can be kept from them since they constitute some of the most productive forest land in the county.

Nonrestocked burns total between 7 and 8 thousand acres. Most of this acreage is in two areas located in a region of inferior timber at high elevation in the Cascade Range.

Noncommercial Forest Lands

Approximately 52 thousand acres or 3.8 percent of the county's forest land was classified as noncommercial forest lands. These lands are practically all within the boundaries of the Snoqualmie and Columbia National Forests and the Mount Rainier National Park. Approximately 3 thousand acres is privately owned.

Subalpine forests at the upper limits of tree growth and composed of poorly-formed alpine fir, western white pine, mountain hemlock, lodgepole pine, Alaska yellow-cedar, or white-bark pine, cover 39 thousand acres. Rocky and sterile sites below the lower limits of subalpine forest growth comprise a total of about 13 thousand acres, and lodgepole pine stands stock a few hundred acres.

Although these noncommercial forests have no value for timber production, they do have considerable value as recreational and protection forests.

Productive Capacity of Forest Land

The relative productive capacity of the forest land, or site quality as it is called, was determined during the forest inventory primarily to compute forest growth and volume of second-growth stands. Land occupied by stands in which Douglas-fir and western redcedar predominate were graded according to the Douglas-fir classification; other commercial conifer lands by the spruce-hemlock classification.

The productivity of the forest lands of Lewis County is well above average for western Washington and the Douglas-fir region as a whole. More than half the Douglas-fir land is in sites I and II. The region averages about site III. The detailed site statistics for the county are given in table 4 which shows land areas, forest land areas, and commercial conifer land areas by site quality classes. Analysis of data clearly demonstrates the superior productivity of the county's forest land. However, realization of the full potentialities of the inherent capacity of the forest land depends upon the treatment given it. As a result of fire and cutting practice many acres of highly productive land is inadequately stocked or idle.

Saw-Timber Volume

Lewis County has more saw-timber volume by far than any other county in western Washington. Moreover, it has a greater proportion of Douglas-fir than most of the other counties. It has approximately one-fourth of the Douglas-fir remaining in western Washington. The revised inventory showed a total volume as of January 1, 1940, of 32.8 billion board feet. Approximately two-thirds of the total was Douglas-fir. Next in volume is western hemlock followed by Pacific silver fir. Saw-timber volume is given by species and ownership class in table 5 and distribution of the total volume by broad species and ownership groups is given in figure 3.

The total Douglas-fir volume is 21.1 billion board feet, of which 10.0 billion feet is in large old-growth trees (over 40 inches diameter); 3.3 billion is in small old-growth trees (16 to 40 inches diameter); 6.6 billion feet is in large second-growth trees (22-40 inches in diameter); and 1.2 billion board feet is in small second-growth trees (16-20 inches in diameter).

Table 4.-Land areas, forest land areas, and commercial conifer areas,
by site quality class^{1/}
Data corrected to January 1, 1940

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	56,382	3.6	4.1	4.3
Class II	636,254	40.9	46.1	48.2
Class III	366,449	23.5	26.5	27.8
Class IV	28,820	1.9	2.1	2.2
Class V	3,790	.2	.3	.3
Total	1,091,695	70.1	79.1	82.8
Spruce-hemlock				
Class II	12,100	0.8	0.9	0.9
Class III	85,980	5.5	6.2	6.5
Class IV	96,520	6.2	7.0	7.3
Class V	33,395	2.1	2.4	2.5
Total	227,995	14.6	16.5	17.2
Total commercial conifer	1,319,690	84.7	95.6	100.0
Lodgepole pine	385			
Noncommercial rocky	12,675	0.9	0.9	
Subalpine	39,220	2.5	2.8	
Hardwood	9,410	.6	.7	
Total other than commercial conifer	61,690	4.0	4.4	
All forest types	1,381,380	88.7	100.0	
Nonforest types	175,765	11.3		
Grand total	1,557,145	100.0		

^{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 January 1, 1940

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

Species	Private	State		County	Indian	Federal			Total
		Available	Reserved			National forest		Other ^{2/}	
						Available	Reserved		
Douglas-fir									
Large old growth	7,588,161	879,955	9,195		13,162	1,334,081		138,967	9,963,521
Small old growth	2,301,901	259,340	2,758		3,775	695,150	12,729	228	3,275,881
Large second growth	3,786,096	535,466	1,050	5,157	10,509	2,131,794	33,448	80,115	6,583,635
Small second growth	843,495	96,101	259		591	297,493		2,244	1,240,183
Sitka spruce									
Old growth	33,612	1,266				885			35,763
Second growth	7,610	168							7,778
Engelmann spruce						1,280			1,280
Western hemlock									
Old growth	2,898,995	555,436				1,777,539	112,029	171,031	5,515,030
Second growth	427,239	100,555				313,683	19,770	2,592	863,839
Mountain hemlock						150,125	22,417	30,780	203,322
Western redcedar									
Live	947,801	139,055	79		736	329,292	6,406	27,964	1,451,333
Dead	35,678	3,857				3,976			43,511
Alaska yellow-cedar	2,133					52,016	17,779	9,416	81,344
Western white pine	15,097	10,146				111,596	7,277	12,484	156,600
Lodgepole pine						157			157
Grand fir	60,289	10,816				3,116			74,221
Noble fir	226,404	72,524				314,862	30,329	17,036	661,155
Pacific silver fir	383,861	1,532				1,779,156	180,575	154,059	2,499,183
Alpine fir						32		1,008	1,040
Red alder	18,937	2,114	16		25	1,204		1	22,297
Northern black cottonwood	5,265				100	2,746			8,111
Singleleaf maple	74,747	5,926	47		71	380		2	81,173
Oregon ash	5,605								5,605
Total	19,662,926	2,674,257	13,404	5,157	28,969	9,300,563	442,759	647,927	32,775,962

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

^{2/} Includes a total of 645,313 thousand board feet in Mount Rainier National Park. reserved from cutting

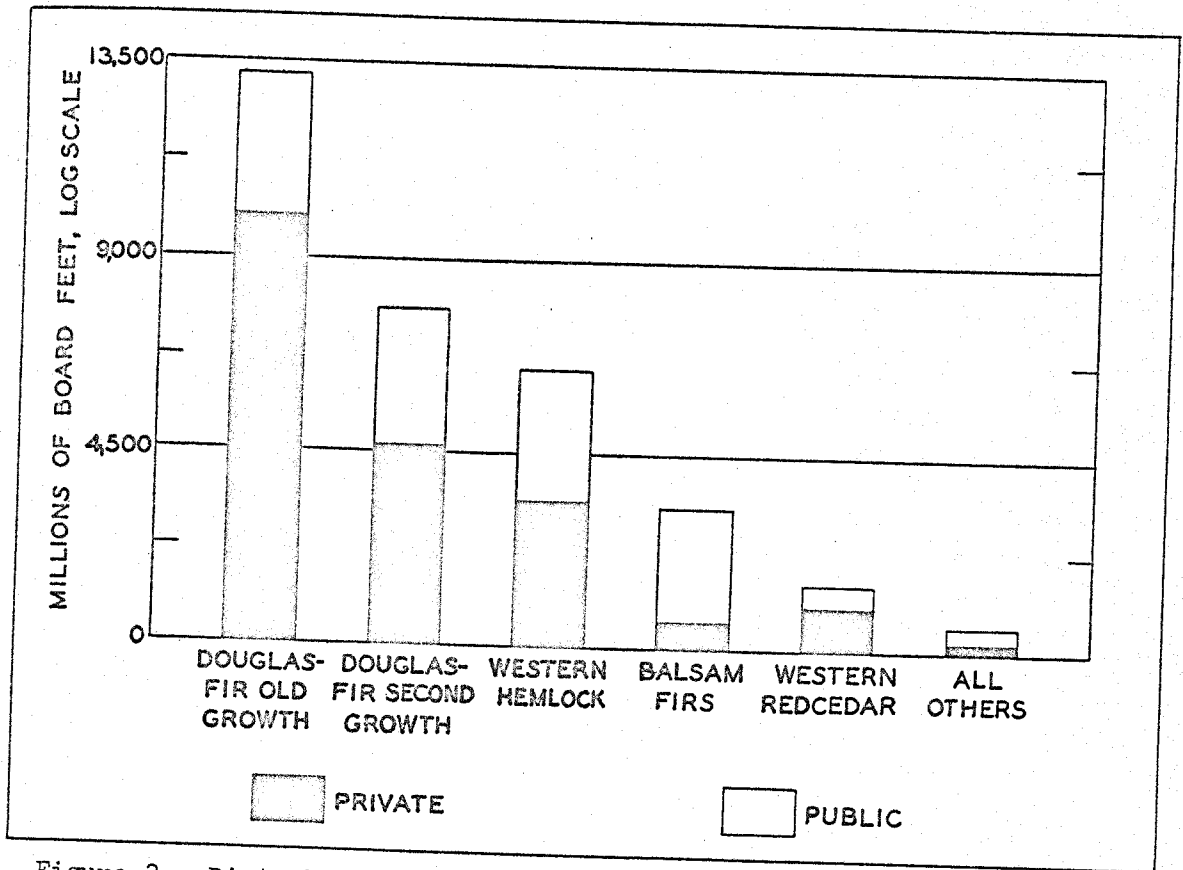


Figure 3. Distribution of saw-timber volume by species and ownership class (from table 5).

Western hemlock totals 6.4 billion board feet, of which 5.5 billion feet is in trees more than 20 inches in diameter. A large part of the hemlock volume is in trees growing as a minor component of the Douglas-fir types.

Western redcedar, the only other species of commercial importance at this time, has a total volume of about 1.5 billion board feet.

Ownership of Forest Resources

Approximately 60 percent each of the forest land area and saw-timber volume is in private ownership. Considering that 350 thousand acres or 42 percent of the private forest land has been cut over, it is significant that such a large percent of the saw-timber volume is still privately owned. This definitely indicates that the private-owned timber excelled the national-forest timber in size, quality, and density. Although the remaining private-owned old-growth forests do not measure up on the whole to those that have been cut over, they still are superior to those on the national forests. The State-owned timber is comparable to the private.

The decrease in private-owned forest land between the 1933 and 1940 inventories has been about 28 thousand acres. Some 9 or 10 thousand acres was the result of conversion of forest land to other use, chiefly agriculture; leaving about 18 thousand acres that passed into public ownership through tax foreclosures. Considering the large acreage of cut-over land in the county this is comparatively small, leading to the conclusion that forest-land ownership is comparatively stable here. Another factor that undoubtedly bears on this situation is that opportunities of converting cut-over land to farm and pasture are more favorable here than in most other western Washington counties.

The State of Washington owns nearly 100 thousand acres of forest land in Lewis County, of which 640 acres is in State parks reserved from cutting. The timber stand on State land totals 2.7 billion board feet, much of it high quality old-growth Douglas-fir. State holdings are scattered and no large compact blocks are owned. The State has increased its holdings by about 24 thousand acres during the past 7 years through the acquisition of cut-over land from the county. Much of this land is stocked with young conifer stands.

County-owned lands decreased from 3,400 acres in 1933 to less than 1,000 acres in 1940. During the intervening period, however, a large acreage was foreclosed and transferred to State ownership.

National-forest lands total about 427 thousand acres, of which 34 thousand acres is reserved from timber cutting. Of the 393 thousand acres of unreserved national-forest land about 355 thousand acres is commercial conifer forest land supporting 9.3 billion board feet. Although it is planned to manage these lands under sustained-yield principles, there has been little cutting. In a few places cutting on private land has reached the national-forest borders and increased activity in national-forest timber may be expected. National-forest land reserved from cutting consists of recreational and primitive areas.

Approximately 35 thousand acres of the Mount Rainier National Park extend into Lewis County and is reserved for recreational and educational purposes.

Forest Drain

Drain on Lewis County forests between 1933 and 1940 totaled about 4.5 billion board feet, log scale, according to a comparison of the two inventories. The decrease in private saw-timber volume was 3.9 billion board feet, and in public-owned saw timber 0.6 billion board feet. The national forests show a net loss of about 140 million feet during this period; however, this was the result of recalculation of the basic data and not actual drain. Part of the national forests are unsurveyed and new computations of area resulted in reductions in timber volume figures.

Douglas-fir suffered the greatest loss of volume totaling about 3 billion feet. Western hemlock was reduced about 0.6 billion feet and western redcedar about the same.

Cutting has been the principal factor causing this drain. It is estimated that more than 4 billion feet of sawlogs alone were removed from the woods during this period. Incomplete utilization of trees felled and destruction of other trees during logging and cutting of minor products such as fuel wood, poles, piling, etc. add to the cutting drain.

Approximately 5 thousand acres of thrifty second-growth stands of Douglas-fir have been cut over annually during the past decade. The timber in these stands is chiefly in the 60- to 80-year age class and, because of size, is well adapted for the manufacture of railroad ties and dimension lumber by small portable sawmills. However, their premature cutting constitutes a considerable loss in growing stock. With large volumes of mature and overmature timber in the county, the cutting of rapidly growing second-growth stands should be discontinued.

Fire losses of saw-timber volume were relatively small in this county during the past 7 years. Fire has been responsible for the destruction of many small second-growth stands, reduction in stocking in other young forests, and the delaying of regeneration of many acres of cut-over land. Reduction of forest growth and future saw-timber inventories are the result of fire.

Losses from insect epidemic, disease, or wind throw have been of minor significance in forest drain in this county.

Forest Growth

Calculations of forest growth are based on the 1933 inventory data when 596 thousand acres of conifer forests and 8 thousand acres of hardwood forests were classified as adding net growth. Although a complete analysis of current annual growth was not made on the basis of revised inventories, preliminary estimates indicate a decrease of approximately 5 percent in board-foot growth between 1933 and 1940. During this 8-year period the area of large second-growth Douglas-fir type was reduced from 236 thousand acres to 203 thousand acres; partly offsetting this was an increase in the area occupied by small second-growth Douglas-fir stands from 165 thousand acres to 183 thousand acres. These two types contributed practically all of the board-foot growth in 1933.

In 1933 the current annual board-foot growth calculated for trees 5.1 inches or more in diameter was 250 million feet. Current growth in cubic feet calculated for trees 5.1 inches or more in diameter amounted to 72 million in 1933.

The increase in area occupied by Douglas-fir seedling and saplings from 164 thousand acres to 255 thousand acres indicates an increase in

future growth provided these stands receive adequate protection and premature cutting of large second growth is checked.

Lewis County's commercial forest land could produce 552 million board feet annually under intensive forest management. This figure known as potential annual growth assumes that all commercial forest land would produce at 75 percent of capacity. In cubic feet potential annual growth is 162 million feet.

Forest Industries

Lewis County is the only county in western Washington that does not have access within its boundaries to the cheap transportation costs associated with water shipping; all other counties are on tidewater or the Columbia River. This lack of water-shipping facilities has greatly influenced the development of forest industries in the county. Another factor influencing this development is the ownership of much of the saw timber; a large portion of the remaining private saw timber is owned by several large companies who had built sawmills on Puget Sound or the Columbia River prior to cutting timber in Lewis County. As a result of these two factors, the growth of plants manufacturing forest products has not kept pace with the growth of the logging industry in the county. This is clearly indicated by an analysis of the trends of sawlog production and lumber production during the years 1925-38, inclusive, the period of greatest activity in forest industries in the county.

During this 14-year period the average annual sawlog production was approximately 450 million board feet, log scale. The cut was fairly uniform, except in 1932 when it dropped below 100 million board feet, until 1936 when it increased sharply, reaching an all-time high in 1937 of nearly double the 14-year average. In 1938 there was a small decrease but production statistics for 1939, while not yet available, will probably show a return to 1937 levels. If present trends persist, a production of a billion board feet in the near future is not unlikely.

The trend of lumber production in the county has been almost the reverse of sawlog production. The average annual lumber cut during the same period 1925-36 was roughly 225 million board feet, lumber tally. Considering that there is an over-run of from 10 to 15 percent in converting sawlogs to lumber, it appears that more than half of the sawlogs cut in the county was shipped elsewhere for manufacture. The peak in lumber production was reached in 1927; since then it has dropped rapidly and in 1938 was only about half the average for the period.

Sawmill and shingle mills are the only primary wood-using industries located in the county; there are no pulp mills or plywood plants. Although the cut of the so-called pulp species, western hemlock and the balsam firs, has been relatively small, a large volume of Douglas-fir sawlogs of the size and quality suitable for plywood manufacture has been cut in the past and will continue to be cut for many years in the future.

The character of the forest industries has greatly influenced the character of the cities and towns in the county. There is no concentration of mills at any one location as is usually found in the other western Washington counties and consequently there are no large sawmill towns. Also an unusually large percentage of the volume of lumber sawn is produced by small mills quite widely scattered throughout the county; in recent years approximately one-third of the total lumber production has been sawn by mills of less than 50-thousand-board-foot capacity. The principal cities, Centralia and Chehalis, are chiefly trading centers for a large number of loggers and the agricultural population of the Chehalis Valley.

Bureau of the Census statistics for 1930 show a total of 15 thousand people gainfully employed in the county. Of these 4 thousand were directly dependent on the forest industries and it is probable that at least as many more were indirectly dependent.

Conclusions

Liquidation of the county's timber resources has accelerated in the past decade and is rapidly approaching a climax. If properly controlled cutting could proceed at a substantial rate in the county for many years to come and eventually be sustained at past levels as young stands reach maturity. However, as timber immediately tributary to the highly industrialized Puget Sound and Columbia River areas approaches exhaustion, operating units are converging upon Lewis County which has the greatest remaining stand of old-growth Douglas-fir in western Washington. A fairly good distribution of age classes occurs in the second-growth forests but this balance is rapidly being disturbed by premature and excessive cutting of young forests.

Lewis County has rich agricultural lands and there is a possibility of some further expansion of this form of land use. Nevertheless, 89 percent of the county area is forest land and this will continue to be a major form of land use. Considering the inherent high productivity of the county's forest lands and the existing growing stock, a permanent forest industry could be maintained that would complement the agricultural industry. To do this, however, ungoverned forestry liquidation must be averted and an orderly system of forest management adopted.