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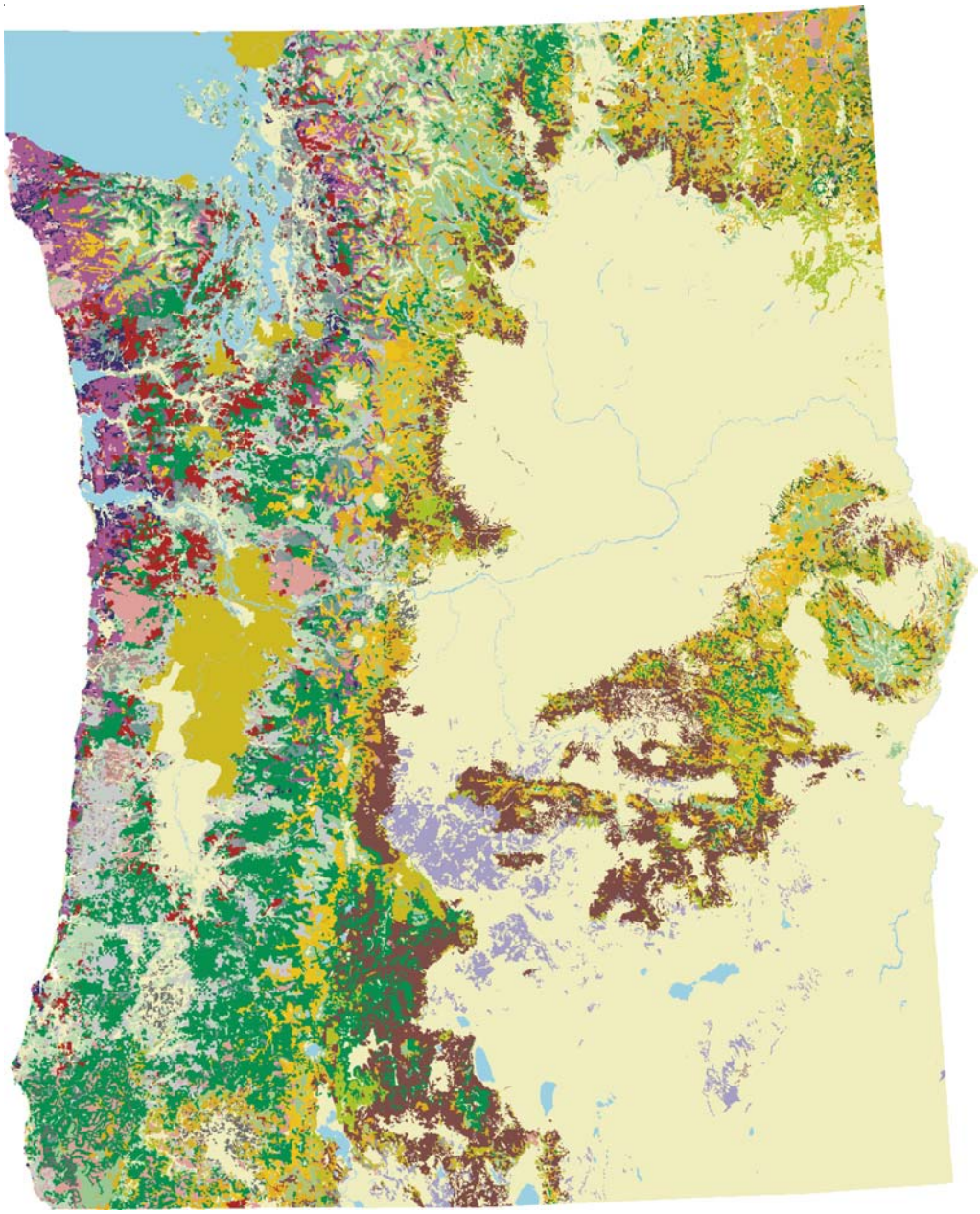
The 1930s Survey of Forest Resources in Washington and Oregon



Compiler

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The 1930s Survey of Forest Resources in Washington and Oregon

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U.S. Department of Agriculture, Forest Service
Pacific Northwest Research Station
Portland, Oregon
General Technical Report PNW-GTR-584
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Abstract

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Forest resources in Washington and Oregon were surveyed in the early 1930s by employees of the Pacific Northwest Forest Experiment Station (the original name of the current Pacific Northwest Research Station). This was the first of many periodic forest surveys conducted nationwide by the USDA Forest Service. Many publications and maps were produced from the Washington and Oregon 1930s survey data. Forest cover maps created from that data (at an original scale of 1:253,440) have recently become available in digital formats, but little documentation was provided with the electronic files, and the older publications are not readily available to most users. This report provides a brief overview of the survey and reprints excerpts from, or complete versions of, early publications that dealt with the planning, conduct, or results from the survey. A list of county-level maps, prepared at a scale of 1:63,360, that have been located is also included. A companion CD-ROM includes (1) the overview of the survey and the early publications in PDF format, (2) a link to the free Adobe Acrobat® Reader™ to enable users to read the PDF files, (3) the forest type maps in several geographic information system (GIS) or graphics formats (ArcView™ shape files, ArcExplorer™ project files, and .jpg, a graphics file format), and (4) a copy of ArcExplorer™ (to view and print the ArcExplorer™ files).

Keywords: Forest inventory, forest survey, 1930s, forest cover, forest type maps, Washington, Oregon, Douglas-fir region, ponderosa pine region.

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Introduction

Maps created from the first large-scale forest survey of the Pacific Northwest (PNW) in the early 1930s have recently become available in digital formats. Many people are unaware of this survey or have expressed interest in learning more about the methods used in the survey and the categories displayed on the maps. This report contains a brief overview of the survey; report appendixes include excerpts from, or complete copies of, old publications that dealt with the planning, conduct, or results from the survey. Most of the older publications have not been available for many years except in a few regional or national libraries. A companion CD-ROM is included that contains the text of this report (including the appendixes) in portable document format (PDF) format, the forest type maps in several formats (ArcView™ shape files, ArcExplorer™ project files, and .jpg, a graphics file format), and a copy of ArcExplorer™ (to view and print the ArcExplorer™ files).[1] The electronic version of this document contains hyper-links to the other documents and files present on the CD-ROM; thus, clicking on a citation with a blue font will take you directly to that document.

Background

The 1928 McSweeney-McNary Forestry Research Act (P.L. 70-466, 45 Stat. 699-702) authorized creation of a forestry research program and, among other items, directed the Secretary of Agriculture to "make and keep current a comprehensive inventory and analysis of the nation's forest resources." The Secretary of Agriculture, William M. Jardine, directed the Forest Service to conduct the survey (Andrews and Cowlin 1940 [app. D][2]). Early in 1929, Thornton T. Munger, then Station Director of the Pacific Northwest Forest Experiment Station[3] went to Washington, DC, to discuss this new project. The decision was made to begin the nationwide survey with the Douglas-fir region (Doig 1977 [app. F]) and shortly thereafter, to expand the survey to the other forested lands of Oregon and Washington. By late 1929, several foresters or economists had been hired for the survey (Cowlin 1988 [app. G]; USDA FS 1929a, 1929b [app. A]), and by 1930, the survey of the forest resources of Washington and Oregon was well underway (Cowlin 1988 [app. G], Munger 1955 [app. E]). The survey included an inventory of forest conditions on all ownerships in the region as well as estimates of forest growth; depletion from cutting, fire, or pests; and estimates of merchantable products.

Between 1930 and 1936, many people were hired to work on the PNW survey, including several foresters, economists, and mensurationists who became very well known in the region and elsewhere. The survey was initially directed by Horace J. Andrews;[4] others involved in the early survey included Warren H. Bolles, Philip A. Briegleb,[5] Edward D. Buell, Robert W. Cowlin, James W. Girard, A.W. Hodgman, Herman M. Johnson, Paul D. Kemp, Charles W. Kline, W.V.S. Litchfield, Donald N. Mathews, Walter H. Meyer, Floyd L. Moravets, W.E. Pelto, Percy N. Pratt, W.E. Sankela, Francis X. Shumacher, R.W. Taylor, William J. Wakeman, C.H. Willison, Jr., and Harry M. Wolfe (Andrews and

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[1] The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

[2] The appendixies are in chronological order of their original publication date.

[3] The Pacific Northwest Forest Experiment Station was later renamed the Pacific Northwest Forest and Range Experiment Station, and then the Pacific Northwest Research Station (current name).

[4] Andrews was later Regional Forester for the Pacific Northwest Region. His contributions to forestry research were acknowledged by having the H.J. Andrews Experimental Forest named after him.

[5] Both Cowlin and Briegleb later served as Directors of the Pacific Northwest Research Station.

Cowlin 1940, Cowlin 1988 [app. G], Cowlin and others 1942, Doig 1977 [app. F]). In those 6 years, all the forested portions of the two states were surveyed (33,000,000 acres or 13 360 000 ha). At that time, it was probably the largest survey in the world to be done at such an intensive scale (Munger 1955 [app. E]). More information on the history of the survey is available as part of both previously published and unpublished histories of the PNW Research Station (Cowlin 1988 [app. G], Doig 1977 [app. F]).

Survey Procedures

The inventory methods, sources of data, data compilation techniques, and analysis methods are described in the greatest detail in the appendix of Andrews and Cowlin (1940 [app. D]) for the Douglas-fir region of western Oregon and Washington, and in the appendix of Cowlin and others (1942) for the ponderosa pine region of eastern Oregon and Washington. The forest-cover and land-use types used in the survey were reported along with early results in Andrews and Cowlin (1934, 1940 [app. B and D]) and in USDA FS (1936a [app. A]). In brief, forest surveys for the Douglas-fir region[6] used three basic procedures depending on the information available and the land ownership. The national forests were cruised by using "the intensive reconnaissance methods…[which consisted of] mapping areas that are uniform as to type conditions and estimating the average volume per acre for each of these type areas." The initial type mapping was done from both field work and office analysis by using aerial photographs.[7] Approximately 30 percent of the land outside the national forests had recently been covered by intensive cruises (land owned by private timber companies, county cruises made for taxation purposes, cruises of state-owned land, Oregon and California Railroad revested grant lands, and Indian reservations); these lands were "adjustment cruised" to "adjust these data to survey standards." The remaining areas were type mapped (by driving roads and walking trails, using data from county records, and locating viewpoints to determine type boundaries) and then cruised to determine age class, species composition, stocking, and volume. Additional surveys were done for cutover or recently burned areas. Many "computers" (that is, people to summarize the data) were employed during the winter to summarize the data collected during the summer field season. (Andrews and Cowlin 1940, Munger 1955).

Early Survey Results

The first year's progress on the survey was reported in January 1931 by Cowlin (1931a [app. A]). In that year, information was compiled on over 13 million acres (5.3 million ha) of private and public land (this included cruises from over 3 million acres (1.2 million ha) supplied by private companies). At the end of the first year, the gathering of field data for the inventory phase was about 40 percent complete. This progress report states: "Through the cooperation of the State agencies an entirely new base map of both States is being prepared to use in presenting the forest types in colors. The Oregon map is about one-half complete." This was the first mention of the maps that were one of the major products of the early survey.

In August 1931 (USDA FS 1931, app. A), it was reported that "Good progress is being made in all phases of the field work. On the national forests field work is over 50 per cent complete…with twenty-one men on this work this summer. Six men, one to a county, are type mapping, and eight men are adjustment cruising on the lands outside the national forests." By December 1931, generalized type maps had been prepared for six counties in Oregon and Washington, and statistics were presented on the number of

[6] The forest-cover and land-use types in the survey of the ponderosa pine region were similar but slightly modified based on local conditions (USDA FS 1936a).

[7] Aerial photography was used for the areas where it was available, but many forest areas had not been photographed at the time of the survey. (See Cowlin 1988 [app. G] for more details on the early use of photography.)

acres in each county by broad land or forest type (Cowlin 1931b [app. A]). Conclusions were drawn on the relative economic importance of forest land in each county; these were based on the percentages of land in cultivated versus forest land.

Main Survey Results

In May 1933, the stocking classification of areas logged from 1920 to 1923 was reported for seven counties in Washington (Cowlin 1933 [app. A]). "These data do indicate very definitely that the lands clean cut in the past decade are in a condition far from satisfactory."

In July 1934, the first major product of the forest survey was issued–Forest Research Notes No. 13, *Forest Resources of the Douglas Fir Region: A Summary of the Forest Inventory of Western Oregon and Western Washington* (Andrews and Cowlin 1934 [app. B]). This 23-page note described the inventory process in fairly general terms, defined the forest cover types used in the inventory, and presented the results in 12 tables (2 general ones for the region and 5 for each state). The note described the map data in this way: "In addition, forest type maps of several different scales, showing the character of the forest cover, either have been or are being prepared. These maps consist of ½-inch-to-the-mile [1-cm-to-1267-m] generalized type maps of each county and 1-inch-to-the-mile [1-cm-to-634-m] detailed type maps of each county and each national forest in the region. The former have been prepared; the latter are nearly complete. Since these maps are hand-colored, they are not available for free distribution but may be copied or consulted at the Pacific Northwest Forest Experiment Station in Portland. Within a year, colored type maps of the region, scale ¼-inch-to-the-mile [1-cm-to-2534-m], will be lithographed and made available for public distribution."

In March 1936, the "News Items" section in Forest Research Notes No. 11 (USDA FS 1936b [app. A]) indicated that the first quarter-state map (for northwest Oregon) was available "for the nominal charge of $1.00 per sheet." The ¼-inch-to-the-mile [1:253,440] map showed "in colors the 26 most important forest cover types." Other news items indicated that forest statistics for all counties west of the Cascades had been prepared and distributed "some months ago" and that similar sets of statistics were available or would shortly be available for the eastern counties. The note also indicated that county forest type maps (1-inch-to-the-mile [1:63,360]) "showing in detail all the type data as mapped in the field" had been prepared. "Hundreds of these maps are now in use by lumber companies, pulp companies, and various public agencies. Uncolored blue-line print copies may be obtained from the Station for the cost of blueprinting."

Many other products were produced from the data collected in the early survey. For the Douglas-fir region, these include information on pulpwood resources (Andrews and others 1935), growth (Meyer and others 1936), and timber volumes and acres by timber types on the national forests in Washington and Oregon (Cowlin and others 1937). In 1940, much of this information, plus other results from the survey, was formally published as *Forest Resources of the Douglas-Fir Region* (Andrews and Cowlin 1940; portions of this publication are reprinted in app. D).

In February 1938, the first major publication from the ponderosa pine region was issued—Forest Research Notes No. 25, *Forest Statistics for Eastern Oregon and Eastern Washington* (Cowlin and Moravets 1938 [app. C]). This 26-page note presented inventory results for Oregon and Washington east of the summit of the Cascade Range. Results were portrayed in eight tables and two figures. A note on the distribution of sawtimber volume in the ponderosa pine region followed shortly (Briegleb and Dunford 1939), and in 1942, *Forest Resources of the Ponderosa Pine Region of Washington and Oregon* (Cowlin and others 1942) was issued, which summarized the survey results for eastern Washington and Oregon.

Publications were prepared for each state: *Forest Resources of Washington* (Cowlin and Moravets 1940) and *Forest Resources of Oregon* (Oregon State Board of Forestry and USDA FS 1942). These were shorter versions of the reports prepared for the Douglas-fir and ponderosa pine regions but covered the portion of both forested regions present in each state.

Quarter-State Maps and Available Map Formats

As mentioned above, the maps from the 1930s survey were distributed in several forms, including eight maps showing the distribution of forest cover by major species or species group and merchantability class. Each of the eight maps covered one quarter of Washington or Oregon. These "quarter-state" maps were 62 in wide by 38 in (Washington) or 44 in tall (Oregon) [156 by 97 or 111 cm tall] and beautifully colored. Information printed on the maps indicated the base maps had been prepared in the office of the Regional Forester, Portland, Oregon, and that the maps had been printed by the U.S. Geological Survey. (See Cowlin 1988 [app. G] for more details on map production).

The quarter-state maps were widely used for many years, but for most purposes they were eventually superceded by more recent surveys. In the early 1990s, it became evident that these maps could be very valuable for their documentation of the forest conditions in the early part of the 20th century. Other early surveys had been done, including those done prior to 1905 by the General Land Office (GLO) of the Department of the Interior (Bourdo 1956, Galatowitsch 1990), early surveys of the forest reserves and other forest lands by the U.S. Geological Survey (Gannett 1902a, 1902b; Leiberg 1900), and the "intensive reconnaissance" activities of the national forests begun in 1908 (Munger 1955). In general, these early surveys were limited in scope or area covered (the GLO survey was restricted to potentially farmable land and the reconnaissance survey to national forests only), they generally recorded less detail on forest conditions than the 1930 survey, or they used map attributes based on commercial factors (such as timber volume) rather than biological characteristics (species groups, forest types, etc.).

The Forest Inventory and Analysis Program of the Pacific Northwest Research Station realized the value in the old quarter-state maps and digitized them so they could be used in geographic information system (GIS) analyses and for other types of displays. These maps have been available electronically as ArcView™ shape files for several years, but their distribution to clients has been fairly limited, and supplemental information on the underlying data was not provided with the maps.

These maps are now available on the companion CD-ROM in three file formats: .shp, .aep, and .jpg. The first format (.shp) is an ArcView™ shape file for importing into GIS. Both the forest cover information and a county boundary file are included in shape files (additional information on the shape files is available in app. G). The second format—.aep—is included so the information can be viewed in ArcExplorer™. ArcExplorer™ is a free program that allows the files to be viewed without importing them into other GIS programs such as ArcView™ or ArcGIS™. ArcExplorer™ enables the user to use some GIS-software features such as displaying attributes of features, measuring distances, querying a theme, changing labels or colors, or zooming (instructions for installing ArcExplorer™ are included on the CD). The third format is a .jpg file; this type of file format can be opened by many file viewers or imported into a word processing or graphics program for printing or use as a graphics image. (Note, .jpg files lose resolution through repeated compressions, so if you create a new version of the project by zooming in or resizing, be sure to choose a compression option that will retain as much of the original file's resolution as possible.) The .aep and .jpg files are available in two versions—a "cover-size" file, which displays size classes for all forest cover types, and a "cover-type" file, which displays information only by forest cover type (has many fewer polygons).

County Maps and Reports

As mentioned above, 1-inch-to-the-mile (1:63,360) county maps showing the forest cover types from the 1930 survey were prepared as the surveys were completed for each county. The quarter-state maps for each portion of the state were published the year after the county maps were completed for each area. The county maps showed forest cover by tree size class, stocking in three classes, and age in 10-year classes for second-growth stands. The maps also delineated recent cutover and burned areas, indicated if burned areas had been cut, and if cutover or burned areas had been restocked. Also mapped were noncommercial rocky or swampy areas (with the forest type indicated), and nonforest land types (agricultural and nonagricultural). Owing to their larger scale, they included greater detail than was possible on the quarter-state maps. The maps were prepared for blueprinting machines, which did not take negatives over 42 in wide (108 cm); depending on the size and shape of the county, one to four maps were prepared (USDA FS 1935).

A February 1935 report (USDA FS 1935) on the status of the county maps indicated: "On request the Survey will furnish its negatives to any [Portland, OR] blueprinting firm and they will bill the party desiring the maps for the cost of blueprinting. As of December 1934 the code price for making blue line prints is 8 cents per square foot up to 50 square feet. Additional square footage over 51 feet is priced at 7 cents per square foot." The report included a table indicating the square footage in each map sheet.

The county map sheets were uncolored to keep the costs down. The uncolored maps contained all the same information "since all the type boundaries and type numbers are shown on the blue line prints." It was recognized, however, that colored maps are "much more useful…inasmuch as each different type then stands out and a picture of the timber situation in a county or portion of a county can be obtained at a glance." The survey provided printed legends to use with the county maps. The color-coded numbers for Dixon, Eagle, or Castell colored pencils were provided with the legend so that map users could hand color the maps with the same color scheme used in the quarter-state maps. Instructions were provided on how to fix the wax pencil color to the maps to result in a more even color that would not rub off when the maps were handled (USDA FS 1935).

Unfortunately only a few of the county-level maps are currently available in a digital format (table 1) and, in fact, I have not yet been able to locate original copies of several of the county maps (table 2). The counties not listed in either table 1 or 2 are ones for which the county maps have been located but not yet digitized. If anyone has paper copies of maps for the counties listed in table 2 or electronic versions of maps from counties other than those listed in table 1 and you would be willing to share, please contact me (at the address inside the front cover of this report) or Dale Weyermann at the address below. It would be very valuable to have all the county maps available digitally as they would provide more detail for watershed analysis and other midscale purposes.

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Table 1—Counties in Oregon and Washington with 1930 county-level forest survey maps available digitally

State	County	Year of map[a]
Oregon	Grant	1936
	Malheur	1935
	Morrow	1936
	Umatilla (north)	1936
	Union (north)	1936
	Wallowa	1936
Washington	Asotin	1935
	Chelan	1935
	Clallam	1939
	Columbia	1935
	Ferry	1936
	Garfield	1935
	Island	1932
	Pend Oreille	1936
	Spokane	1936
	Stevens	1938
	Walla Walla	1935

[a] Some county maps were reissued, so maps may exist with more than one date. This date corresponds to date on the map that was digitized.

Table 2—Counties in Oregon and Washington for which we have not located the 1930 county-level forest survey maps

State	County	Comments
Oregon	Columbia	
	Coos	
	Douglas	North sheet has been located.
	Gilliam	Very small area forested.
	Harney	Central sheet has been located.
	Hood River	
	Josephine	
	Klamath	
	Lane	
	Linn	
	Umatilla	North sheet has been located.
	Union	North sheet has been located.
	Wheeler	
	Yamhill	
Washington	Chelan	Central and South sheets have been located.
	Cowlitz	
	Jefferson	Northeast and West sheets have been located.
	Kittitas	
	Klickitat	
	Lewis	
	Lincoln	
	Pacific	
	Yakima	North sheet has been located.

Note: Counties with no forest shown on quarter-state map are Sherman in Oregon, and Adams, Benton, Franklin, and Grant in Washington; county maps were presumably not prepared for these counties.

Acknowledgments

Thanks to Dale Weyermann, Pacific Northwest Research Station, for sharing the digitized files from the quarter-state maps; to Rick Jordan, Olympic National Forest, for making the map files available in several formats and for suggesting the inclusion of the ArcExplorer™ software on the CD-ROM; to David Powell, Umatilla National Forest, for providing detailed information on the survey in the ponderosa pine region; to Grace Douglass for scanning or retyping the old research notes and reports; and to Robert McGaughey for providing the interface program for the CD-ROM.

Metric Equivalents

If you know:	Multiply by:	To find:
Acres (ac)	0.405	Hectares (ha)
Inches (in)	2.54	Centimeters (cm)
Miles (mi)	1609	Meters (m)

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Appendix A: Excerpts From Pacific Northwest Experiment Station Forest Research Notes Nos. 2, 3, 5, 7, 8, 11, and 18
(by R.W. Cowlin or author unknown)

U.S. Department of Agriculture, Forest Service. 1929. Station news items. In: Forest Research Notes No. 2. Portland, OR: Pacific Northwest Forest Experiment Station: 6.

STATION NEWS ITEMS

The national survey of forest resources and requirements, authorized by the McSweeney-McNary Act and for which Congress has now made an initial appropriation, will be begun in the Pacific Northwest this summer. This will be a systematic and adequate effort to find out exactly the amount and character of the present timber supplies and the present requirements for forest products and to forecast the probable future supplies and requirements.

U.S. Department of Agriculture, Forest Service. 1929. Station news items. In: Forest Research Notes No. 3. Portland, OR: Pacific Northwest Forest Experiment Station: 10-11.

STATION NEWS ITEMS

Several technical men are being added to the Station's force to conduct the Forest Resource Survey authorized by the McSweeney-McNary Forest Research Act, for which $30,000 is available to start this economic study in the Douglas fir region of Oregon and Washington. Already the following have been engaged: Associate Forest Economist R.W. Cowlin, Junior Forester F. L. Moravets, and Junior Forester P. A. Briegleb.

Cowlin, R.W. 1931. The year's progress in the forest survey of the Douglas fir region. In: Forest Research Notes No. 5. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest Experiment Station: 5-6.

THE YEAR'S PROGRESS IN THE FOREST SURVEY OF THE DOUGLAS FIR REGION

A review of the first year's work of the Forest Survey in the Douglas fir region indicates a satisfactory rate of progress. Information on over 8,250,000 acres of private and public land other than national forest, and approximately 5,000,000 acres of national forest land has been obtained. Reducing these figures to a percentage basis shows that the gathering of field data on the inventory phase of this project is about 40 percent complete.

Timber cruises covering over 3,000,000 acres of privately owned timberland have been secured from private owners and this phase of the work is practically completed. About 1,000,000 acres of the O and C revested land grant cruises have been transcribed. The condition of over 200,000 acres of land logged before 1920 has been determined from reports and maps of private operators. Approximately 1,000,000 acres of cutover land, burned areas, second growth stands, and farm land have been mapped in place by field examiners. Some 966,000 acres of mixed farm and forest land in the Willamette Valley have been covered by strip surveys using strips spaced three miles apart in order to get a statistical expression of the amount and character of woodland within the so-called agricultural zone. Approximately 63,000 acres of cut-over land have been covered by a strip survey using strips spaced two miles apart. The location of about 2,000,000 acres of land logged since 1920 has been fixed and recorded, but no attempt will be made by the Survey to determine the present unstable cover condition of these lands.

The work of adjusting the private and county cruise records by field examination for the purpose of bringing these estimates to a common standard has commenced and four counties have been completed. Work is now under way in three additional counties. The four counties completed involved the actual cruising of 11,000 acres with a 10 per cent cruise. In addition some studies of the utilization practice of private logging operators in the area check cruised were made. This work has been very much facilitated by the substantial help of the Forestry Department in both States.

Through the cooperation of State agencies an entirely new base map of both States is being prepared to use in presenting the forest types in colors. The Oregon map is about one-half completed.

All estimate assembly and type mapping is completed for the following counties in Oregon: Benton, Columbia, Clatsop, Marion, Polk, Tillamook, Yamhill, and Washington, and work is underway in Coos and Linn Counties, Oregon, and Cowlitz and Lewis Counties, Washington. Check cruising is completed in Clatsop and

Columbia Counties, Oregon, and Cowlitz, Wahkiakum and Lewis Counties, Washington and underway in Coos and Yamhill Counties, Oregon and Pacific County, Washington.

Compilation of adjusted timber volumes and type areas has been started for Columbia County and a technique has been developed for tabulating the field data for final presentation.

The fieldwork of the Survey on the national forest is about 46 per cent complete. The following table shows the status of the fieldwork on the individual forests:

Mt. Baker	30 per cent complete
Snoqualmie	Work not started
Rainier	100 per cent complete
Olympic	33-1/3 per cent complete
Columbia	53 per cent complete
Mt. Hood	32 per cent complete
Santiam	Work not started
Cascade	56 per cent complete
Siuslaw	5 per cent complete
Umpqua	60 per cent complete
Siskiyou	100 per cent complete
Crater	55 per cent complete

The above concerns only the inventory phase of this project. Work has been hardly begun on the other less time-consuming phases of this comprehensive economic study, namely, the growth phase, the depletion phase, and the requirements for forest products.

U.S. Department of Agriculture, Forest Service. 1931. Status of the inventory phase of the forest survey of the Douglas fir region. In: Forest Research Notes No. 7. Portland, OR: Pacific Northwest Forest Experiment Station: 9.

Status of the Inventory Phase of the Forest Survey of the Douglas Fir Region

Practically all available private and other cruise records have been transcribed, except for about one month's work copying O and C cruises. Good progress is being made in all phases of the field work. On the national forests field work is over 50 per cent complete; two forests, the Siskiyou and Rainier, are complete and work is in progress on the other ten west side forests with twenty-one men on this work this summer.

Six men, one to a county, are type mapping and eight men are adjustment cruising on the lands outside the national forests. The following table shows the status of this work:

Status of Field Work on Forest Survey Timber Inventory on Other Than National Forests

Oregon					Washington				
	Type Mapping		Adjustment Cruising			Type Mapping		Adjustment Cruising	
County	Comp.	In prog.	Comp.	In prog.	County	Comp.	In prog.	Comp.	In prog.
Benton	X	-	-	-	Cowlitz	X	-	X	-
Clatsop	X	-	X	-	Grays Harbor	-	X	-	X
Columbia	X	-	X	-	Lewis	X	-	X	-
Coos	-	X	X	-	Pacific	-	X	X	-
Lincoln		X	-	-	Wahkiakum	-	X	X	-
Linn	X	-	X	-	Whatcom	-	X	-	-
Marion	X	-	-	-					
Multnomah	X	-	-	-					
Polk	X	-	-	-					
Tillamook	X	-	-	X					
Yamhill	X	-	X	-					

X – indicates status Comp. = completed In prog. = In progress

Cowlin, R.W. 1931. Type areas in selected Oregon and Washington counties. In: Forest Research Notes No. 8. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest Experiment Station: 1-2.

TYPE AREAS IN SELECTED OREGON AND WASHINGTON COUNTIES

In connection with the forest survey of the Douglas fir region, a number of generalized type maps for several counties in Oregon and Washington have been prepared recently for use by the Agricultural Experiment Stations, who will assist in estimating the acreages likely to be withdrawn from forest areas for agricultural use within the next three decades. In the following table the broad type areas of six selected counties are given, showing some interesting conditions and variations.

Type Areas in Acres for Six Oregon and Washington Counties

	Oregon Counties			Washington Counties		
	Benton	Clatsop	Columbia	Clark	Cowlitz	Wahkiakum
Cultivated and pasture	206,618	30,992	84,400	238,303	85,599	17,395
Merch. timber over 20” d.b.h.	121,528	265,540	72,619	22,114	287,789	48,257
Second growth under 20” d.b.h.	70,803	100,414	119,232	37,127	225,804	65,456
Deforested burn	17,613	3,697	1,862	67,230	17,710	632
Nonrestocking cut over		6,725	30,218	19,761	23,613	13,124
Cut over since 1920	17,481	95,802	99,735	13,471	73,792	19,668
Hardwood	1,277	7,187	14,555	2,657	5,165	6,143
*Nonforest land	5,000	15,083	1,059	9,617	18,448	205
Total	440,320	525,440	423,680	405,760	737,920	170,880

*Includes barrens, brush, swamps, cities, industrial sites, etc.

The dependence of some counties upon the forests for their economic existence is evident upon inspection of the above table. Clatsop and Columbia Counties in Oregon and Cowlitz and Wahkiakum Counties in Washington all show less than 20 per cent of their area at present converted to agricultural use; by far the greatest area is in some sort of forest cover. It is reasonable to assume that in these four counties future conversion of forest land to farm land will be of little consequence, and that the economic future of these counties is dependent upon the continued productivity of their forest areas. On the other hand, Benton County in Oregon

Cowlin, R.W. 1933. The stocking classification of lands logged in 1920 to 1923 as shown by the forest survey. In: Forest Research Notes No. 11. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest Experiment Station: 6.

THE STOCKING CLASSIFICATION OF LANDS LOGGED IN 1920 TO 1923 AS SHOWN BY THE FOREST SURVEY

Field work on the inventory phase of the forest survey of the Douglas fir region is practically completed and compilation of the data is progressing rapidly. Statistics of timber volumes by species and ownership classes and cover type areas by ownership classes will be available for most of the 38 counties in this region sometime this fall.

In addition to timber volumes and type areas, interesting items of collateral information are being collected. For example, one of the types recognized by the Survey, “recent cut overs” was defined as lands clean cut since January, 1920. In order to obtain a statistical expression of the restocking condition on that portion of these areas which has been cut the longest, it was decided to make a linear survey, using the stocked quadrat method, of the areas logged from 1920 to 1923 inclusive. Transects were spaced at two-mile intervals and at one-chain intervals on these lines a set of four 13.2-foot quadrats was examined and each square recorded as stocked or nonstocked upon finding or failing to find one well-established, coniferous seedling within the confines of the square.

In seven counties in northwestern Washington 137 miles of strip line have been run and 43,856 quadrats examined. In analyzing these data, four-chain units or 16 quadrats were used and each four-chain interval was classified as either well stocked (70-100 per cent stocked) if 12-16 squares were stocked, medium stocked (40-70 per cent stocked) if 7-11 squares were stocked, poorly stocked (10-40 per cent stocked) if 2-6 squares were stocked, or nonstocked (0-10 per cent stocked) if 0-1 of squares were stocked. Six of the counties examined—King, Mason, Skagit, Snohomish, Thurston, and Whatcom—are in the Puget Sound region and are grouped together. The other county, Grays Harbor, which contains much of this type of land and has a different geographical situation, is listed separately. The following table gives the results of the analysis:

	Number of Four-chain Units by Classes of Stocking							
	Good		**Medium**		**Poor**		**Non**	
Degree of Stocking	No. units	Per cent	No. units	Per cent	No. units	Per cent	No. units	Per cent
Puget Sound Counties	278	13.8	338	16.7	583	29.0	816	40.5
Grays Harbor	l00	13.8	147	20.1	208	28.7	271	37.4
Total	378	13.8	485	17.7	791	28.9	1087	39.6

Results for individual counties of the Puget Sound group deviate somewhat from the average of the group, and it is probably partly coincidental that the Grays Harbor and Puget Sound results should agree so closely. These data do indicate very definitely that the lands clean cut in the past decade are in a condition far from satisfactory.

U.S. Department of Agriculture, Forest Service. 1936. News items. In: Forest Research Notes No. 18. Portland, OR: Pacific Northwest Experiment Station: 11.

NEWS ITEMS

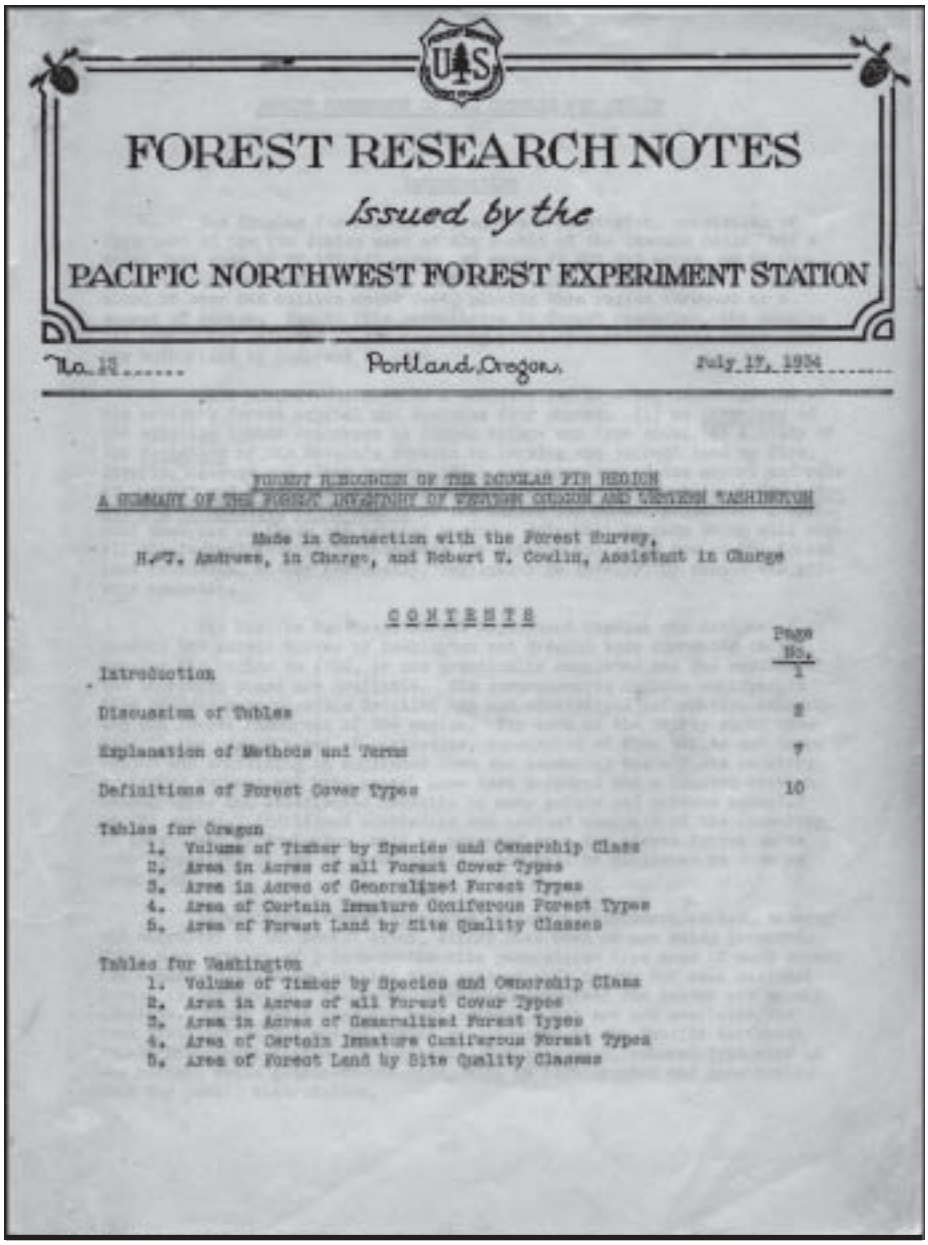
Lithographed Colored Type Map Available. One of the products of the Forest Survey of Oregon and Washington will be a ¼-inch-to-the-mile map showing in colors the 26 most important forest cover types. Each quarter of each State will be printed on a separate sheet. Copies are being distributed to the public for the nominal charge of $1.00 per sheet ($1.10 if by mail). The first of these sheets, namely, for the northwest quarter of Oregon, is now available and may be had by sending postal money order or certified check, made out to Treasurer of the United States, to the Pacific Northwest Forest Experiment Station, 424 U.S. Court House, Portland, Oreg.

Forest Statistics By Counties. Field work on the Forest Survey having been completed in eastern Washington, and in eastern Oregon, except the Blue Mountains, office compilation of the volume of timber by species and of the areas of the several types is progressing rapidly. A set of tables giving in detail the forest inventory of Klamath County, Oregon, has already been distributed in mimeograph form, and within the next two months it is expected that similar sets of statistics will be available for Wasco, Jefferson, Deschutes, and Lake Counties, Oreg., and for Okanogan, Chelan, Kittitas, Yakima, and Klickitat Counties, Wash.

Statistics for all counties west of the Cascades were prepared and distributed some months ago.

County Forest Type Maps Available. Copies of 1-inch-to-the-mile forest type maps showing in detail all the type data as mapped in the field have been prepared for all the above-mentioned counties and also for all counties west of the Cascades in both States. Hundreds of these maps are now in use by lumber companies, pulp companies, and various public agencies. Uncolored blue-line print copies may be obtained from the Station for the cost of blueprinting.

Appendix B: Pacific Northwest Experiment Station Forest Research Notes No. 13. (by H.J. Andrews and R.W. Cowlin)



FOREST RESEARCH NOTES

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FOREST RESOURCES OF THE DOUGLAS FIR REGION

A SUMMARY OF THE FOREST INVENTORY OF WESTERN OREGON AND WESTERN WASHINGTON

Made in Connection with the Forest Survey,
H. J. Andrews, in Charge, and Robert W. Cowlin, Assistant in Charge

CONTENTS

Andrews, H.J.; Cowlin, R.W. 1934. Forest resources of the Douglas fir region: a summary of the forest inventory of western Oregon and western Washington. Forest Research Notes No. 13. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest Experiment Station. 23 p.

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[1] This is a re-creation of the document. Page numbers in this document do not match those above on the original document. The page numbers on this page correspond to the location of the heading in this document.

FOREST RESOURCES OF THE DOUGLAS FIR REGION

Introduction

The Douglas fir region of Oregon and Washington, consisting of that part of the two states west of the summit of the Cascade Range, has a total land area of 35,127,449 acres, of which 29,001,910 acres, or 82 percent, is classed as forest land. This 29 million acres supports a timber stand of over 546 billion board feet, placing this region foremost as a source of timber. Due to this preeminence in forest resources, the Douglas fir region was selected as the beginning point of a nation-wide forest survey authorized by Congress in 1928.

This project consists of a complete and detailed investigation of the Nation's forest capital and includes four phases: (1) an inventory of the existing timber resources by timber volume and type area; (2) a study of the depletion of the Nation's forests by logging and through loss by fire, insects, disease and other causes; (3) a determination of the amount and rate of current and potential growth on forest areas; and (4) a study of the present and prospective requirements of the Nation for forest products. A critical analysis of these and related economic data will be made which will supply the factual foundation necessary for orderly and sound use of the forest land resources, either nationally, regionally or locally, by public and private agencies.

The Pacific Northwest Forest Experiment Station was designated to conduct the Forest Survey of Washington and Oregon; work commenced in the Douglas fir region in 1930, is now practically completed and the results of the inventory phase are available. The comprehensive methods employed in this project make possible detailed map and statistical information concerning the forest resources of the region. For each of the thirty-eight counties in the region a set of statistics, consisting of five tables and three graphs and containing in condensed form the essential basic facts relating to timber volumes and type areas, have been prepared and a limited edition mimeographed and distributed recently to many public and private agencies in the region. Additional statistics and textual analysis of the inventory, of growth and of depletion, will be prepared soon for eleven forest units each consisting of two or more counties, and will be published as soon as completed.

In addition, forest type maps of several different scales, showing the character of the forest cover, either have been or are being prepared. These maps consist of ½-inch-to-the-mile generalized type maps of each county and 1-inch-to-the-mile detailed type maps of each county and each national forest in the region. The former have been prepared; the latter are nearly complete. Since these maps are hand-colored, they are not available for free distribution but may be copied or consulted at the Pacific Northwest Forest Experiment Station in Portland. Within a year, colored type maps of the region, scale ¼-inch-to-the-mile, will be lithographed and made available for public distribution.

The data relating to volume of timber and acreage of forest cover types contained in the above-mentioned sets of county statistics have been assembled by states and a series of 5 tables prepared for each of the two states. These summary tables are presented herewith and some of their more significant data explained and discussed in the following pages. Explanation of the methods and terms used and definition of the types immediately precede the tables.

Discussion of Tables

Table 1 lists the volume of sawtimber by species and ownership classes in thousands of feet board measure, log scale, for the western portion of the two states. In this region volume was recorded for 25 coniferous species and 12 broadleaf species with the more important species further segregated into broad size and age classes; for example, Douglas fir is divided into four classes, western hemlock into two classes, and Sitka spruce and ponderosa pine likewise. On the contrary, certain species of similar dendrological and structural characteristics were combined; for example, noble fir and Shasta fir. Living trees only were included in the volume estimates except in the case of western red cedar and Port Orford cedar. Volume was recorded for dead trees of these two species but was segregated from the volume in living trees.

The most significant fact derived from table 1 is the total volume for the region, 546 billion board feet; approximately 301 billion feet, or 55 percent, being found in Oregon and 245 billion feet, or 45 percent, in Washington. Coniferous species preponderate; over 542 billion feet, or 99 percent of the total volume is in conifers and only 4 billion feet, or 1 percent, in hardwood species. As is to be expected, Douglas fir is the principal species, comprising over 77 percent of the stand in Oregon, about 40 percent in Washington and about 60 percent for the region as a whole. Of this species there is approximately 232 billion feet in Oregon, 99 billion feet in Washington, or a total of 331 billion feet. Western hemlock ranks next to Douglas fir with over 104 billion feet, or 19 percent of the regional total. Of this, nearly 80 percent, or about 80 billion feet, is in Washington contrasted to 24 billion feet in Oregon. Other important species in the region arranged according to their respective volumes are silver fir, western red cedar, Sitka spruce, noble and Shasta fir, mountain hemlock, and ponderosa and Jeffrey pine. Over a billion feet of Port Orford cedar was found. This species, the most valuable of all local conifers, is confined to southwestern Oregon. Here, too, is found redwood, the northern limit of its range extending a few miles into the extreme southwestern corner of Oregon. However, only 57 million feet was recorded for this species.

Slightly over half of the 4 billion feet of hardwoods is in red alder trees; bigleaf maple, tan oak, black cottonwood, and madrone follow in the order listed.

Recent estimates (page 174, vol. 1, of "A National Plan for American Forestry", the so-called Copeland Report) place the total sawtimber volume of continental United States, Alaska excluded, at 1,668 billion board feet, lumber tally. The figure for western Oregon and Washington of 546 billion feet is log scale and would be increased about 15 percent if reckoned on a lumber tally basis. This would amount to 628 billion feet, indicating that this region contains about 38 percent, or well over one third of the Nation's sawtimber volume. In view of these facts, any proposal or action leading to planned management of the country's forests must give careful consideration to the extent and character of the forest resources of this region containing as it does the "back log" of the Nation's existing sawtimber supply.

Equally important as the quantity of the sawtimber volume is the character of its ownership. Recent economic developments have focused attention on the subject of forest land ownership and for this reason the segregation of both type and volume data by ownership classes is of particular importance. The following table shows the quantities and proportion of standing timber in the Douglas fir region for broad ownership classes.

Sawtimber Volume by Ownership Classes

	Western Oregon		Western Washington		Total	
	Million feet B.M.	Percent	Million feet B.M.	Percent	Million feet B.M.	Percent
Private	137,043	46	123,678	50	260,721	48
National Forest	112,599	37	88,488	36	201,087	37
Other Public and Indian	51,151	17	33,089	14	84,240	15
Total	300,793	100	245,255	100	546,048	100

The ownership pattern in its broad aspects is practically identical between the two states. About half the timber in each state is privately owned and slightly over a third is in national forest ownership, the remainder being other public and Indian ownership. Of the 51,151 million board feet in the latter class in Oregon, 45,874 million feet, or practically 90 percent, is Revested Land Grants, consisting of the O. and C. and Coos Bay Wagon Road Grant lands revested in the federal government. There are no revested lands in western Washington; 23,154 million feet of the 33,089 million feet in other public and Indian ownership is owned by the State of Washington.

Of the 201,087 million feet in national forest ownership in the region, 5,899 million feet is reserved from cutting, either for protection or recreation. The bulk of this volume is in Oregon in the Bull Run Watershed, the recreational areas around Mt. Hood, and the Mt. Jefferson Primitive Area.

Table 2 gives the area in acres of all forest cover types by ownership classes for the two states separately. This table contains a mass of data and careful study will yield much valuable information. Over half of the 35 million acres in the region is in private ownership; slightly less than one third is in national forest ownership; the remainder being other classes of public and Indian ownership.

Of the 29 million acres of forest land in the region, 15 million acres, or over half, is now in Douglas fir type and the bulk of the 4 million odd acres shown as recent cutover, deforested burn or nonrestocked cutover was previously Douglas fir type. Collectively, the five Douglas fir types roughly follow about the same ratio of ownership as the total land area; one half private, one third national forest, and the remainder other public and Indian. Individually, a different relationship exists between the several Douglas fir types as illustrated by the following table.

Comparative Areas of Douglas Fir Types in Western Oregon and Washington

	Private		National Forest		Other Public and Indian		Total	
Type	Thousand acres	Per-cent	Thousand acres	Per-cent	Thousand acres	Per-cent	Thousand acres	Per-cent
Douglas fir over 40" DBH	2,157	26.3	651	14.4	491	19.2	3,299	21.5
Douglas fir old growth, 20-40" DBH	921	11.2	1,963	43.3	681	26.6	3,565	23.3
Douglas fir young growth, 20-40" DBH	1,425	17.4	730	16.1	486	19.0	2,641	17.3
Douglas fir, 6-20" DBH	2,416	29.4	624	13.8	652	25.4	3,692	24.1
Douglas fir, 0-6" DBH	1,291	15.7	568	12.4	252	9.8	2,111	13.8
Total	8,210	100.0	4,536	100.0	2,562	100.0	15,308	100.0

Although much of the large old growth has been cut there still remains over 3 million acres in the region, over 65 percent of which is in private ownership. One of the most striking facts in the above table is the heavy concentration of the old growth Douglas fir of the 20 to 40-inch type in national forest ownership and the scarcity of this type in private ownership. This type occurs principally in locations where the growing conditions aren't as favorable as those occupied by the old growth type over 40 inches in diameter, the higher altitudes and poorer soils for example. On the national forests, due partly to lack of cutting, there is a relatively small area of younger types as contrasted with privately owned lands. Nearly 70 percent of the youngest type is in Washington (Table 2, Oregon and Washington), evidence of the heavier cutting in this state.

The third pair of tables lists the area of generalized forest types by ownership classes for each state, condensing the information in table 2. Table 3 separates the young growth types occurring on old burns from those on cutover lands. In Washington there are about 3,500,000 acres of young growth, slightly over half of which is found on cutover land and the remainder on old burns. Oregon has about the same total area but over three quarters of it is on old burns with the remaining quarter on cutover. The obvious deduction, considering also the disparity in acreage of deforested burn between the two states (Type 37, Table 2), is that Oregon has had a worse fire history than Washington. Another noteworthy fact is the heavy preponderance in Oregon of types ranging from 6 to 20 inches DBH as contrasted with Washington where the area of second growth from 6 to 20 inches DBH is only slightly greater than that from 0 to 6 inches DBH. More detailed information concerning the young growth types can be found in the next set of tables (Table 4).

Since January 1920, twice as much acreage of timberland has been logged in Washington as in Oregon; indicative of the accelerated rate of logging in Washington. Sample strip surveys show that much of this "recent cutover" land is either nonrestocked or poorly stocked with young trees, and owing largely to recurring fires, in an unstable condition. There are about 2,160,000 acres of this type in the two states, and adding to it the 2,200,000 acres of deforested burns and older nonstocked cutover, makes a total acreage of 4,360,000 acres of idle forest land in the Douglas fir region of Oregon and Washington. Some idea of the magnitude of this area can be obtained by comparing it with the total agricultural area in the region, which is about 4,670,000 acres, or only a few hundred thousand acres larger than the idle forest land acreage.

Table 4, area of certain immature coniferous forest types, segregates the types under 20 inches in diameter (the bulk of the immature coniferous types), into 10-year age classes and three degrees of stocking as defined on page 9 [6]. In these two tables all ownership classes are combined. Comparing the data contained in the two tables, a striking dissimilarity in the distribution of age classes between the two states is observed. In Oregon the largest acreage occurs in the 40-year age class, followed closely by the 30-year age class, with the 10-year, 20-year, 50-year and 60-year age classes following in that order and the last four named having nearly the same acreage. The obvious assumption is that the 10 and 20-year age classes should lead, since it has only been in the last two decades that logging has been on a large-scale basis in Oregon. These data refute this assumption, but this apparent anomaly can be explained by the fact that the acreage of nonrestocked cutover (Type 35, Table 2, Oregon) accounts for much of the area logged prior to 1920, and all lands logged since 1920 are thrown into one category and not classified (Type 36, Table 2, Oregon). Some of the latter class of lands are reproducing and if classified would swell the total of the 10-year age class. In spite of this, the large acreage of the 30, 40, 50 and 60-year age classes is a significant fact that merits further analysis. Referring to tables 2 and 3 for Oregon, it appears that the stands making up these classes largely occur on old burns and not on cutover areas. It is interesting to note that the period of establishment of these stands (1870-1900) is coincidental with the era of intensive land settlement and the development of rail transportation that followed the Civil War. However, the apparent dearth of the 80, 90 and 100-year classes can be attributed partly to the exclusion of types 8 and 14 from table 4, which contain some acreage in these age classes.

The distribution by degrees of stocking is in the aggregate practically identical in the two states, with Washington having a slightly higher percentage of well stocked stands and slightly less medium stocked area compared to Oregon; the comparative percentages being for Oregon, well stocked 38 percent, medium stocked 49 percent, and poorly stocked 13 percent; for Washington, well stocked 44 percent, medium stocked 42 percent, poorly stocked 14 percent.

The distribution by age classes in Washington varies widely from that in Oregon, the ten-year age class having over twice the acreage of any other class and forming nearly one third of the total. The 30 and 20-year classes, nearly equal in acreage, are next in order, followed by the 40-year class not far behind in acreage. The other classes are considerably less and taper off to the older classes as do the Oregon data. The majority of the acreage in the 10-year age class is cutover land. The Washington data are more easily explained than the Oregon and reflect the steady increase in cutting through the decades.

Table 5, the final pair of tables in this series, gives the area of forest land by site quality classes for Oregon and for Washington. As explained in a footnote in the tables, site quality denotes the forest productive capacity of an area and is a reflection of the composite effect of all climatic and soil conditions. In general, the two states are very similar in productive capacity and although Washington has a very slightly higher percentage of the two best sites, Site I and Site II, the average weighted site for the western portion of the two states is practically the same, both centering around Site III with Washington about a tenth of a site class higher than Oregon.

Washington has considerable more subalpine forest areas than Oregon, owing to the lowering of the altitudinal limits of tree growth to the northward and also to the more rocky, rugged character of the mountainous areas. Western Oregon shows a higher percentage of nonforest land than western Washington, which is accounted for by the fact that Oregon has more than twice the amount of agricultural land. However, both states have a high percentage of forest land, 80 percent of western Oregon and 85 percent of western Washington being forest land of some description, and about 75 percent of the western part of each state being commercial coniferous forest land. These few figures emphasize the importance of the forest resource in the economy of this region.

Summarizing, this series of tables contains the fundamental information concerning the extent, condition and character of the forest resources of the Douglas fir region. These data, and those later to be made available on growth and depletion will furnish much of the foundation for state-wide plans and policies of forest land use. Used in conjunction with the regional type maps soon to be printed, they will give a complete picture of the forest resources of this timber region. As data from other regions become available, they can be used in

determining and studying the policies and problems that transcend regions and become nation-wide in character. The county tables recently published coupled with the county type maps, both detailed and generalized, allow the localization of the data for specific reference and study of local problems.

Only a few of the interesting facts and comparisons that can be obtained from these tables have been recited in the preceding pages; they are intended to be suggestive, not final. The data contained in previous publications, this report, and companion reports to be published later, have great possibilities for use by the many public and private agencies and individuals concerned with forests and their products.

Robert W. Cowlin

EXPLANATION OF METHODS AND TERMS

SOURCES OF DATA - In this project all existing information on the distribution of forest types and estimates of volume of timber, as well as existing maps and timber estimates of public agencies, including county cruises, was used as far as possible. Timber estimates of private lands were furnished by the owners, with the condition that they be published only in combination with the cruises of other owners and for large areas. This cooperation of timber owners was a very material aid to the project. Estimates obtained in this manner were thoroughly checked in the field by a corps of timber experts who determined adjustment factors by which to raise or lower these estimates to the standard adopted by the forest survey. Some 165,000 acres in western Oregon and western Washington were intensively check-cruised to adjust the cruise on areas for which usable data existed. Volumes of merchantable timber outside the boundaries of the national forests were obtained largely by this method. Inside the boundaries of the national forests sufficiently detailed volume and type data were available for only a small proportion of the merchantable timber area.

Where no usable data existed, either inside or outside the national forests, the field personnel carried on type mapping and estimating, thus giving a complete coverage of the forest area of the region. Where there were large blocks of farm land sprinkled with forest areas too small to map in place, the field examiner ran strips at stated intervals to arrive at a statistical evaluation of the proportion of the several forest types in the farm area and the timber volume thereon.

TIMBER ESTIMATING STANDARDS - The timber estimates in the following tables are expressed in board feet, log scale, according to the Scribner rule. All survey cruising, whether for adjustment purposes or for areas not covered by existing estimates, was done to include all trees of the following minimum specifications: all coniferous trees which would make one 32-foot log 12 inches in diameter inside bark at the small end and all hardwood trees which would make one 8-foot log 10 inches in diameter inside bark at the small end.

Allowance has been made in these estimates for decay, defects, and such breakage as is inevitable in logging. In other words, the estimates are for the net volume usable in saw timber operations practicing intensive utilization. The standards of utilization employed in the survey are probably slightly more intensive for the more valuable species and considerably so for the less valuable species than the average utilization practice of the present day sawtimber operator, owing largely to the inclusion of trees down to 16 inches DBH.

Differences between present estimates and previous estimates do not necessarily indicate increases or decreases in the volume of known timber in the region. Such differences may be due largely to differences in standards between the present and previous cruises and to variation in the completeness of the cruise. The present estimates cover all forest trees of the above specifications, outside of municipalities, whether in small farm woodlots or in extensive forest areas.

The estimates as herein given make no distinction with regard to accessibility or availability to market, although it is recognized that in certain localities some of the timber is utterly remote and some readily accessible. Neither is there any differentiation by classes of forest products, the whole volume above the stated limits being expressed in board feet of sawtimber. In the statistical and textual analyses of the units larger than a county, these further subdivisions of the estimates will be considered.

OWNERSHIP CLASSES - The volume of timber and the acreage of forest types have been compiled by ownership classes from the best public records available. It is of course recognized that ownership is constantly changing. The totals of each ownership class will in many cases not coincide with statistics from other sources; nor in fact will the total area of the region always agree with hitherto accepted total areas. The statistics herein presented are believed to be the most accurate obtainable at the date of record. The following ownership classes were used:

Private - all privately owned forest property, including farm woodlots.

State, available for cutting - includes any state owned forest property which is not reserved from cutting.

State, reserved from cutting - includes parks, National Guard camp grounds, etc.

County - includes forest property deeded to the county. Tax delinquent land not deeded to the county is classified as "private".

Municipal - includes all municipally owned forest property outside the platted limits of municipalities, such as city watershed, etc.

Indian - includes both tribal and trust allotments.

Revested land grants - includes O and C and other land grants which have reverted to federal ownership, whether classified as "timber", "agricultural", or "power withdrawals".

Federal other than national forest, Indian and revested land grants - includes national parks, military reservations, vacant lands not revested, and miscellaneous.

National forest, available for cutting.

National forest, reserved from cutting.

The term "reserved from cutting" as applied to state or national forest land denotes that the area, because of statute, proclamation, or policy, is not available for cutting, the land usually being officially dedicated to park, watershed or other uses to the exclusion of timber cutting. The term "available for cutting", in contrast to the above, means that there is no legal or formal prohibition on timber cutting; this does not necessarily imply that lands so classified now carry timber suitable for cutting or any timber at all.

AGE CLASSES AND DEGREES OF STOCKING - In addition to typing according to composition and size, the important immature forest types—those where most of the dominant trees are under 20 inches in diameter (or 24 inches in the case of cedar and spruce)—were classified according to age in 10-year classes and according to their density in three degrees of stocking. The age and stocking classification for these immature stands is shown in table 4. If a forest of seedlings, saplings, or small "second growth" is dense enough to cover 70 to 100 percent of the area (as measured by the stocked-quadrat method), it is classified as "well stocked"; if 40 to 70 percent is covered, it is called "medium stocked"; if 10 to 40 percent, it is "poorly stocked". Areas that show less than 10 percent stocked are considered as "nonrestocking".

The type "recent cutover" (No. 36) makes no distinction between stocked and nonstocked land, because it was not practicable to classify and type map the degree of regeneration on land cut so recently as 1920 and later. However, some of the areas cut between 1920 and 1923 (inclusive) have been examined and a statistical expression of their degree of stocking obtained, which will be used in the description and analyses of the forest units.

TREE SPECIES - Timber estimates have been kept separately for all the tree species that usually reach sawtimber size and character. The absence of volume estimates for any species in table 1 does not necessarily mean that the species does not occur in the state in question; a species may be present but not have been found in significant quantity or in trees of commercial size, or it may be confined to the noncommercial types. This is particularly true of such species as yew and the hardwoods that often do not attain sawtimber specifications. The common names employed by the Forest Service (U.S.D.A. Misc. Cir. 92) have been used throughout.

DEFINITION OF TERMS - The abbreviation "DBH" signifies the diameter at breast height (4½ feet above ground) outside the bark.

In describing Douglas fir timber the terms “old growth” and “second growth” should be regarded as relative descriptive terms to distinguish the older, more mature timber from the younger and more rapidly growing timber. There is no sharp line of demarcation between the two. Likewise the terms “large” and “small” are relative and are used to divide the large, older Sitka spruce, hemlock, etc., from the smaller and younger timber of these types of species.

DEFINITION OF FOREST COVER TYPES

The forest cover types recognized by the forest survey in the Douglas fir region of western Oregon and western Washington are defined below. Not all of these thirty-eight types are found in any one county.

Nonforest Types

2. **BARRENS**: an area too rocky, too deficient in soil, or too exposed to support a vegetative cover of either trees, shrubs, or herbs.

   GRASS, SAGEBRUSH, AND BRUSH: areas whose principal present vegetation is either grass, herbs, brush, shrubs, or sagebrush (where not part of operating farm units).

   CITIES, TOWNS, AND UNMEANDERED WATER SURFACE.

3. **CULTIVATED:** an area cleared and/or cultivated for agricultural use, including pasture.

   STUMP PASTURE: logged-off or burned-off land, part of operating farm units, now chiefly devoted to grazing and from which the stumps or snags have not been removed. Usually some attempt has been made to propagate forage plants by seeding or repeated burning.

WOODLAND TYPES

4. **OAK-MADRONE**: a forest composed of approximately 60 percent or more of any species of oaks (including tan oak) or madrone or any combination of these. No separation of age classes.

5. **JUNIPER:** a forest composed of 80 percent or more of any species of juniper.

5 ½. **PONDEROSA PINE WOODLAND**: areas in which ponderosa pine predominates, with the trees scattered, either singly or in clumps, forming a very thin stand—individual trees may or may not be of merchantable size and form.

TIMBERLAND TYPES

DOUGLAS FIR: a forest containing approximately 60 percent or more by volume of Douglas fir—the characteristic forest west of the Cascades. The type will be divided into size classes as follows:

6. **DOUGLAS FIR, LARGE OLD GROWTH:** forests where the major part of the volume is in trees over 40 inches DBH.

7. **DOUGLAS FIR, SMALL OLD GROWTH:** forests where the major part of the volume is in trees 20 to 40 inches DBH.

8. **DOUGLAS FIR, LARGE SECOND GROWTH:** forests where the majority of the volume is in trees 20 to 40 inches DBH. Young growth, coarse grained timber that will cut only a small percent of the upper grades of lumber.

9. **DOUGLAS FIR, SMALL SECOND GROWTH:** forests in which most of the volume is in trees 6 to 20 inches DBH.

10. **DOUGLAS FIR, SEEDLINGS AND SAPLINGS:** forests in which most of the trees are 6 inches and under in diameter.

SITKA SPRUCE: a forest containing 50 percent or more by volume of Sitka spruce, rarely in pure stands, usually in mixture with Douglas fir, western hemlock, or western red cedar. Three size classes will be recognized:

11. **SITKA SPRUCE, LARGE:** forests of sawtimber size in which most of the volume is in trees over 24 inches DBH.

12. **SITKA SPRUCE, SMALL:** forests in which most of the volume is in trees from 6 to 24 inches DBH.

13. **SITKA SPRUCE, SEEDLINGS AND SAPLINGS:** forests in which most of the dominant trees are under 6 inches DBH.

WESTERN HEMLOCK: a forest in which 50 percent or more of the volume is western hemlock with a variable amount of Douglas fir, western red cedar, silver fir, and Sitka spruce. Three size classes will be recognized:

14. **WESTERN HEMLOCK, LARGE:** a forest of sawtimber size in which most of the volume is in trees over 20 inches DBH.

15. **WESTERN HEMLOCK, SMALL:** forests in which most of the volume is in trees from 6 to 20 inches DBH.

16. **WESTERN HEMLOCK, SEEDLINGS AND SAPLINGS:** forests in which most of the dominant trees are under 6 inches DBH.

17. **WESTERN RED CEDAR, LARGE:** a forest of sawtimber size containing approximately 40 percent or more by volume of western red cedar, in which most of the volume is in trees over 24 inches DBH.

18. **PORT ORFORD CEDAR, LARGE:** forests of sawtimber size in which 20 percent or more of the volume is in Port Orford cedar trees over 30 inches DBH with a variable amount of Douglas fir, white fir, Sitka spruce, western red cedar and hardwoods.

19. **CEDAR, SMALL:** forests where small or immature western red cedar 24 inches DBH or under or Port Orford cedar 30 inches DBH or under together or either one of them comprise 40 percent or more of the dominant stand by volume. May include considerable western hemlock or Sitka spruce.

PONDEROSA PINE: a forest containing approximately 50 percent or more by volume of ponderosa pine, sugar pine, or Jeffrey pine, or all of them in combination. This type is divided into three size classes:

20. **PONDEROSA PINE, LARGE:** forests where the predominating trees are over about 22 inches DBH (over about 150 or 200 years old) so-called “yellow pine”, and where no material amount of the stand has ever been cut.

20a. **SUGAR PINE, LARGE:** a forest containing 20 percent or more by volume of sugar pine, never in pure stands, usually in mixture with Douglas fir, ponderosa pine or white fir in which most of the volume is in trees over 22 inches DBH. This type was mapped only outside the boundaries of national forests.

21. **PONDEROSA PINE, SMALL:** forests where the majority of the trees are under about 22 inches in diameter (under 150 or 200 years of age, so-called bull pine) either on old burns or on areas which have been selectively cut, and where the volume in trees 12 inches and over is ordinarily at least 1,000 bd. ft. per acre.

22. **PONDEROSA PINE, SEEDLINGS, SAPLINGS, AND POLES:** forests on old burns or heavily cut logged-off land where the majority of the trees are under 12 inches in diameter and the stand of larger trees, if any, amounts to less than 1,000 bd. ft. of sawtimber per acre.

FIR-MT. HEMLOCK: Forests, characteristic of the upper slopes of the Cascade Range, the Coast Mountains in Oregon and the Olympics in Washington, in which either noble fir, silver fir, Shasta red fir, or mountain hemlock, or any combination of these species comprise at least 50 percent of the volume of the stand. Two size classes will be recognized:

23. **FIR-MT. HEMLOCK, LARGE:** forests where a majority of the dominant trees are 16 inches in diameter or larger and physically suitable for sawtimber. (Mature stands not suitable for sawtimber will ordinarily be included in the subalpine type.)

24. **FIR-MT. HEMLOCK, SMALL:** forests where most of the dominant trees are under 16 inches in diameter, usually young trees on old burns or cuttings.

LODGEPOLE PINE: A forest containing at least 50 percent by volume of lodgepole or knobcone pine, often almost pure. This type will be divided into two size classes:

25. **LODGEPOLE PINE, LARGE:** forests where 50 percent or more of the dominant trees are 12 inches or over in diameter.

26. **LODGEPOLE PINE, SMALL:** forests in which less than 50 percent of the dominant trees are as large as 12 inches in diameter.

WHITE FIR-LARCH-DOUGLAS FIR: A mixed forest limited to the range of western larch consisting of western larch, white fir, Douglas fir, ponderosa pine, and lodgepole pine in which ponderosa pine constitutes not more than 40 percent of the stand. The composition of this type varies greatly. Prevalent on the north and other cool slopes within the ponderosa pine zone. Two size classes will be recognized:

27. **WHITE FIR-LARCH-DOUGLAS FIR, LARGE:** forest where the majority of the volume is in dominant trees about 20 inches and over DBH (over about 150 years old).

28. **WHITE FIR-LARCH-DOUGLAS FIR, SMALL:** forests where the majority of the dominant trees are under about 20 inches DBH (under about 150 years old).

WHITE FIR: usually a mixed forest found in the range of ponderosa pine and sugar pine, consisting of 50 percent or more of *Abies grandis* or *concolor*.

29. **WHITE FIR, LARGE:** forests where most of the dominant trees are over about 20 inches DBH (over about 150 years old).

30. **WHITE FIR, SMALL:** forests where most of the dominant trees are under about 20 inches DBH (under about 150 years old).

31. **HARDWOOD:** a forest in which alder, maple, ash, cottonwood, myrtle, etc., predominate; pure or in mixture (does not include any oaks or madrone).

32. **REDWOOD:** a forest containing approximately 80 percent or more of redwood, usually with some Douglas fir, madrone, tan oak and other, small hardwoods.

33. **SUBALPINE:** forests at upper limits of tree growth, and usually unmerchantable because of poor form and small size. Its principal components, besides alpine fir, are mountain hemlock, Shasta red fir, lodgepole pine, whitebark pine, western white pine, and alpine larch.

35. **NONRESTOCKED CUTOVERS:** clean-cut areas cut prior to 1920 which are not restocking and which are not put to other use.

36. **RECENT CUTOVERS:** clean-cut areas cut since January 1920, regardless of the status of regeneration.

37. **DEFORESTED BURNS:** lands not cut over on which the stand has been killed by fire, and which are not satisfactorily restocking. (Areas not restocking have less than 10 percent of the 13.2' x 13.2' squares stocked).

38. **NONCOMMERCIAL ROCKY AREAS:** areas within the range of commercial timber and below the limits of the subalpine type which are too rocky, too steep, or too sterile to produce a stand of commercial size, density, and quality. The timber may consist of any species, but is not, and is not likely to be, of commercial value because of difficult logging conditions, low quality, poor form, and low volume. Ordinarily the stand will average under 5,000 to 10,000 board feet per acre. No volume should be recorded for this type. This type does not include the upper portion of valleys or the higher slopes of potentially loggable timber now inaccessible.

FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 1. VOLUME OF TIMBER BY SPECIES FOR EACH OWNERSHIP CLASS IN THOUSANDS OF BOARD FEET, LOG SCALE, SCRIBNER RULE

Survey Symbol	Species	Private ownership	PUBLIC OWNERSHIPS									Total
			State, available for cutting	State, reserved from cutting	County	Municipal	Indian, tribal and trust allotments	Revested land grants 0 & C etc.	Federal, other than nat. for., Indian and revested land grants	National forest, available for cutting	National forest, reserved from cutting	
DA	Old growth Douglas fir, trees over 40" DBH	54,719,796	79,654	12,509	697,977	135,835	89,715	15,813,388	318,519	16,168,510	1,852,489	89,888,392
DB	Old growth Douglas fir, trees 20-40" DBH	22,156,727	61,494	8,283	416,159	37,044	14,880	11,028,765	181,963	46,967,359	525,685	81,398,359
DC	Second growth Douglas fir, trees 20-40" DBH	22,920,380	233,738	4,619	534,848	29,103	82,004	9,740,758	290,368	15,128,517	72,319	49,036,654
DD	Second growth Douglas fir, trees 16-20" DBH	6,735,260	229,799	7,692	204,682	19,463	26,190	2,290,758	214,074	1,767,069	3,300	11,498,287
SA	Large Sitka spruce, trees over 24" DBH	4,100,641	14,703	7,152	71,027	3,552	6,352	50	89,013	328,081	-	4,620,571
SB	Small Sitka spruce, trees 16-24" DBH	278,861	411	360	10,671	171	1,137	-	7,552	37,146	-	336,309
ES	Engelmann spruce, trees over 16" DBH	3,856	-	-	-	-	-	-	-	147,892	37,247	188,995
HA	Large western hemlock, trees over 20" DBH	12,519,005	12,830	12,753	216,926	35,716	15,354	1,135,426	198,532	6,858,196	927,455	21,932,193
HB	Small western hemlock, trees 16-20" DBH	1,348,012	1,037	680	29,558	5,565	5,600	125,398	22,083	964,346	152,718	2,654,997
MH	Mountain hemlock, trees over 16" DBH	18,960	-	-	1,253	-	-	130	-	3,707,663	268,931	3,996,937
C	Western red cedar, live, trees over 16" DBH	2,484,669	4,092	2,249	37,375	3,604	6,465	518,088	19,161	1,235,671	255,819	4,567,193
PC	Port Orford cedar, live, trees over 16" DBH	789,379	1,628	265	5,893	160	1,367	186,061	1,593	187,602	100	1,174,048
YC	Alaska cedar, live, trees over 16" DBH	120	-	-	-	-	-	-	-	11,692	399	12,211
IC	Incense cedar, trees over 16" DBH	758,685	520	10	23,429	600	816	458,408	6,309	539,106	5	1,787,888
KC	Dead cedar, trees over 16" DBH	44,333	7	-	890	-	-	10,230	591	38,280	1,441	95,772
KPC	Port Orford cedar, dead, trees over 16" DBH	22,208	-	-	40	-	-	1,956	-	640	-	24,844
YA	Large ponderosa (&Jeffrey) pine, trees over 22" DBH	1,613,502	7,938	98	77,921	5,979	-	1,749,522	57,603	879,826	1,129	4,393,518
YB	Small ponderosa (& Jeffrey) pine, trees 12-22" DBH	194,913	1,350	7	15,479	816	-	144,272	12,026	76,702	-	445,565
SP	Sugar pine, trees over 12" DBH	1,001,391	4,285	25	42,917	632	30	1,066,086	23,221	1,414,467	40	3,553,094
W	Western white (& whitebark) pine, trees over 16" DBH	85,072	-	-	236	12	-	18,043	-	1,178,725	39,716	1,321,804
LP	Lodgepole (& knobcone) pine, trees over 16" DBH	3,235	-	150	10	-	-	-	-	69,446	2,740	75,581
WF	White fir and lowland white fir, trees over 16" DBH	1,567,540	5,395	96	26,513	1,923	2,069	1,016,476	8,270	2,874,961	14,844	5,518,087
NF	Noble and Shasta fir, trees over 16" DBH	1,057,893	-	-	12,895	-	1	179,430	758	4,279,170	387,229	5,917,376
A	Silver fir, trees over 16" DBH	1,044,333	2,725	7,725	12,425	1,087	-	2,103	9,788	1,543,477	417,588	3,041,251
AF	Alpine fir, trees over 16" DBH	200	-	-	-	-	-	-	-	34,348	30,893	65,441
WL	Western larch, trees over 16" DBH	643	-	-	10	-	-	-	165	81,916	17,428	100,162
R	Redwood, trees over 16" DBH	15,980	-	-	-	-	-	-	-	41,400	-	57,380
RA	Red alder, trees over 12" DBH	635,336	10,733	193	35,657	523	1,467	102,605	22,090	683,369	4,370	1,496,343
OO	Oregon white oak, trees over 12" DBH	69,965	680	3	1,214	61	130	9,469	2,292	4,507	-	88,321
CO	California black oak, trees over 12" DBH	35,969	446	-	1,076	71	80	13,008	1,546	11,439		63,635
CLO	Canyon live oak, trees over 12" DBH	530	120	-	-	-	-	15	-	2,679	-	3,344
TO	Tan oak, trees over 12" DBH	135,985	625	255	3,827	-	1,380	1,630	5,292	290,471	-	439,465
BC	Black cottonwood (and aspen), trees over 12" DBH	93,175	-	-	4,314	20	-	20	163	4,771	4,196	106,659
OM	Bigleaf maple, trees over 12" DBH	341,879	1,122	128	5,424	601	174	122,088	2,700	13,831	378	486,325
MAD	Madrone, trees over 12" DBH	134,470	986	12	5,443	3	26	98,015	2,196	5,741	-	247,127
ASH	Oregon ash, trees over 12" DBH	29,756	-	-	27	3	I	1,033	27	4	-	30,851
MY	California laurel, trees over 12" DBH	41,822	418	25	1,004	20	105	14,347	547	475	-	58,763
CH	Chinquapin, trees over 12" DBH	37,541	280	2	1,339	4	60	26,611	512	503	-	66,852
	Total	137,042,022	677,016	65,291	2,498,459	282,568	255,638	45,874,189	1,498,954	107,579,998	5,018,459	300,792,594

FOREST STATISTICS FOR THE STATE OF OREGON WEST OF THE CASCADE RANGE **OREGON 2**
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 2. AREA IN ACRES OF ALL FOREST COVER TYPES, BY OWNERSHIP CLASSES

Survey type no.	Definition of types	Private ownership	PUBLIC OWNERSHIPS									Total
			State, available for cutting	State, reserved from cutting	County	Municipal	Indian, tribal and trust allotments	Revested land grants O & C etc.	Federal, other than nat. for., Indian and revested land grants	National forest, available for cutting	National forest, reserved from cutting	
2	Nonforest land other than agricultural	254,384	1,542	110	8,289	3,650	305	39,105	24,534	87,941	26,617	446,477
3	Agricultural: cultivated, and cleared pastures on operated farms	3,217,628	2,848	210	13,691	1,252	2,363	11,990	3,612	1,637	-	3,255,231
4	Oak-madrone: a forest containing over 60% oaks or madrone	222,303	1,253	55	6,396	840	360	46,231	15,962	67,896	-	361,296
5 ½	Ponderosa pine woodland: scattered and largely unmerchantable stands of ponderosa pine on unfavorable sites	21,835	15	-	3,852	175	-	21,370	7,162	-	-	54,409
	DOUGLAS FIR: a forest containing over 60% Douglas fir											
6	Douglas fir, large old growth, over 40" DBH	1,257,219	1,430,	480	20,957	2,355	4,275	313,545	9,917	378,001	32,908	2,021,087
7	Douglas fir, small old growth, 20-40" DBH	785,585	4,174	625	31,595	2,463	520	589,924	18,266	1,700,343	9,404	3,142,899
8	Douglas fir, large second growth: 20-40" DBH	984,779	12,882	80	34,541	1,570	3,960	339,305	21,620	510,323	1,719	1,910,779
9	Douglas fir, small second growth, 6-20" DBH	1,349,736	64,749	1,725	68,845	4,285	3,370	243,400	95,122	374,016	19,210	2,224,458
10	Douglas fir, seedlings and saplings, 0-6" DBH	372,645	1,522	205	19,883	1,325	185	57,781	15,689	262,246	33,502	764,983
	SITKA SPRUCE: a forest containing over 50% Sitka spruce											
11	Sitka spruce, large, over 24" DBH	78,182	537	145	2,191	80	85	-	2,848	7,449	-	91,517
12	Sitka spruce, small, 6-24" DBH	28,264	30	90	2,062	40	360	-	523	2,194	-	33,563
13	Sitka spruce, seedlings and saplings, 0-6" DBH	9,200	-	-	585	10	5	-	31	881	-	10,712
	WESTERN HEMLOCK: a forest containing over 50% western hemlock											
14	Western hemlock, large, over 20" DBH	192,467	165	160	8,707	855	685	4,325	5,226	114,797	13,492	340,879
15	Western hemlock, small, 6-20" DBH	75,058	145	-	6,895	655	-	545	5,503	10,418	2,451	101,670
16	Western hemlock, seedlings and saplings, 0-6" DBH	23,974	-	-	5,204	160	-	520	700	855	270	31,683
17	Western red cedar, large: a forest containing over 40% western red cedar, and over 24" DBH	8,028	-	-	214	110	340	515	25	1,460	1,912	12,604
18	Port Orford cedar, large: a forest containing 20% Port Orford cedar, and over 30" DBH	27,365	115	-	100	-	-	5,575	5	5,520	-	38,680
19	Cedar, small: a forest containing 40% or more of either western red or Port Orford cedar, and under 24" or 30" DBH respectively	5,929	60	80	220	-	-	65	-	494	-	6,848
	PONDEROSA PINE: a forest containing over 50% ponderosa pine											
20	Ponderosa pine, large, over 22" DBH	92,567	1,511	40	6,483	169	-	100,474	7,193	80,086	-	288,523
20A	Sugar pine, large: a forest of 20% or more sugar pine, over 22" DBH, mapped only outside national forests	51,238	-	-	5,865	-	-	36,260	4,390	-	-	97,753
21	Ponderosa pine, small, 12-22" DBH	42,161	135	-	5,232	130	-	17,521	2,868	10,272	-	78,319
22	Ponderosa pine, seedlings, saplings, and poles, 0-12" DBH	88,625	868	-	10,565	736	-	36,515	8,382	7,475	-	153,166
	FIR-MOUNTAIN HEMLOCK: a forest containing over 50% of either noble, silver, or Shasta fir and/or mountain hemlock											
23	Fir-mountain hemlock, large, over 16" DBH	26,974	-	505	762	-	-	8,036	205	530,366	49,163	616,011
24	Fir-mountain hemlock, small, under 16" DBH	6,048	-	-	520	100	-	3,519	365	80,291	29,769	120,612
	LODGEPOLE PINE: a forest containing over 50% lodgepole pine											
25	Lodgepole pine, large, over 12" DBH	1,305	-	-	-	-	15	-	25	1,596	-	2,941
26	Lodgepole pine, small, under 12" DBH	26,057	90	150	1,454	30	-	332	1,487	210,037	3,691	243,328
	WHITE FIR-LARCH-DOUGLAS FIR: a mixed forest of western larch, white fir, Douglas fir, ponderosa pine, or lodgepole pine											
27	White fir-larch-Douglas fir, large, over 20" DBH	55	-	-	-	-	-	-	60	15,529	7,033	22,677
28	White fir-larch-Douglas fir, small, under 20" DBH	2,165	-	-	220	-	-	-	-	12,794	5,811	20,990
	WHITE FIR: a forest containing over 50% white fir											
29	White fir, large, over 20" DBH	19,338	145	-	690	-	-	16,201	475	30,719	-	67,568
30	White fir, small, under 20" DBH	5,392	-	-	80	-	-	3,807	230	3,895	-	13,404
31	Hardwoods: alder, maple, ash, and/or cottonwood predominating	264,503	7,882	20	21,932	400	972	12,869	10,496	80,686	339	400,099
32	Redwood: a forest containing over 80% redwood	440	-	-	-	-	-	120	-	1,057	-	1,617
33	Subalpine: unmerchantable forests at upper limits of tree growth	1,837	-	-	595	-	-	2,460	330	50,910	14,889	70,991
35	Old cutovers, not restocked: clear cut prior to 1920	118,793	265	-	8,096	1,595	-	6,990	55	3,904	-	139,698
36	Recent cutovers: clear cut since January 1920	582,580	3,087	1,370	34,021	2,470	686	70,598	7,102	17,082	46	719,042
37	Deforested burns: any nonrestocked burn, not cut over	505,072	5,623	270	67,922	215	1,230	168,892	40,080	373,318	6,228	1,168,850
38	Noncommercial rocky areas	6,716	795	490	667	-	-	7,168	729	180,819	5,412	202,796
	Total	10,756,447	111,868	6,810	399,331	25,670	19,716	2,165,928	311,217	5,217,307	263,866	19,278,160

FOREST STATISTICS FOR THE STATE OF OREGON WEST OF THE CASCADE RANGE FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 3. AREA IN ACRES OF GENERALIZED FOREST TYPES, BY OWNERSHIP CLASSES

Definition of types		Private ownership	PUBLIC OWNERSHIPS									TOTAL
			State, available for cutting	State, reserved from cutting	County	Municipal	Indian, tribal and trust allotments	Revested land grants O & C etc.	Federal, other than nat. for., Indian and revested land grants	National forest, available for cutting	National forest, reserved from cutting	
Nonforest land type survey types 2 and 3		3,472,012	4,390	320	21,980	4,902	2,668	51,095	28,146	89,578	26,617	3,701,708
Hardwoods: alder, maple, ash, and/or cottonwood predominating survey type 31		264,503	7,882	20	21,932	400	972	12,869	10,496	80,686	339	400,099
Coniferous timber types over about 20" DBH survey types, 5½ , 6, 7, 8, 11, 14, 17, 18, 20, 23, 27, 29, and 32		3,544,282	20,974	2,035	115,517	7,777	9,865	1,433,585	75,177	3,375,650	115,631	8,700,493
Coniferous timber types from 6-20", 24" or 12-22" DBH survey types 9, 12, 15, and 21	on cutover areas	319,360	1,473	155	15,304	1,070	90	8,645	1,879	-	-	347,976
	on old burns	1,175,894	63,631	1,660	67,730	4,040	3,640	252,821	102,137	396,900	21,661	2,090,114
	Total	1,495,254	65,104	1,815	83,034	5,110	3,730	261,466	104,016	396,900	21,661	2,438,090
Coniferous timber types from 0-6" or 12" DBH survey types 10,13, 16, and 22	on cutover areas	275,075	820	15	15,905	751	15	8,329	960	18,580	1,458	321,908
	on old burns	219,369	1,570	190	20,332	1,480	175	86,487	23,842	252,877	32,314	638,636
	Total	494,444	2,390	205	36,237	2,231	190	94,816	24,802	271,457	33,772	960,544
Coniferous timber types from 0-16", 20" or 24" DBH survey types 19, 24, 28, and 30	on cutover areas	4,778	15	-	145	-	-	80	-	527	445	5,990
	on old burns	14,721	-	80	895	100	-	7,311	595	96,947	35,135	155,784
	Total	19,499	15	80	1,040	100	-	7,391	595	97,474	35,580	161,774
Noncommercial types survey types 4, 25, 26, 33, and 38		260,008	2,138	695	9,552	870	375	58,226	20,748	511,258	23,992	887,862
Recent cutovers: clear cut since January 1920 survey type 36		582,580	3,087	1,370	34,021	2,470	686	70,598	7,102	17,082	46	719,042
Old cutovers nonrestocked, and deforested burns survey types 35 and 37		623,865	5,888	270	76,018	1,810	1,230	175,882	40,135	377,222	6,228	1,308,548
Total		10,756,447	111,868	6,810	399,331	25,670	19,716	2,165,928	311,217	5,217,307	263,866	19,278,160

FOREST STATISTICS FOR THE STATE OF OREGON WEST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 4. AREA OF CERTAIN IMMATURE CONIFEROUS FOREST TYPES SUBDIVIDED INTO AGE AND STOCKING CLASSES

		TYPE NUMBER AND NAME												
		10	13	16	9	12	15	19	24	28	30	22	21	
Age class	Degree of stocking	Douglas fir seedlings & saplings 0"-6" DBH	Sitka spruce seedlings & saplings 0"-6" DBH	Western hemlock seedlings & saplings 0"-6" DBH	Douglas fir small second growth 6"-20" DBH	Sitka spruce second growth 6"-24" DBH	Western hemlock second growth 6"-20" DBH	Cedar small 0"-24" DBH	Fir-mt. hemlock small 0"-16" DBH	White fir-larch-Douglas fir small 0"-20" DBH	White fir small 0"-20" DBH	Ponderosa pine seedlings & saplings 0"-12" DBH	Ponderosa pine small 12"-22" DBH	Total
		Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
10	Good	112,051	325	6,288	-	-	-	45	10,932	-	1,323	135	-	131,099
Year	Medium	214,874	2,566	14,207	-	-	-	953	8,728	1,091	301	1,898	-	244,618
	Poor	115,761	2,899	2,200	-	-	-	465	1,630	-	422	1,029	-	124,406
	Total	442,686	5,790	22,695	-	-	-	1,463	21,290		2,046	3,062	-	500,123
20	Good	136,936	550	5,403	27,222	976	8,154	55	32,028	2,406	340	2,731	-	216,801
Year	Medium	115,244	3,465	1,735	52,852	2,105	3,501	325	20,706	4,014	345	9,930	-	214,222
	Poor	25,152	130	-	17,022	-	45	425	1,738	1,230	85	5,341	54	51,222
	Total	277,332	4,145	7,138	97,096	3,081	11,700	805	54,472	7,650	770	18,002	54	482,245
30	Good	35,725	65	1,690	183,015	2,709	28,804	265	16,242	5,195	245	2,840	130	276,915
Year	Medium	5,556	712	160	235,370	4,100	11,077	165	10,624	1,234	820	18,729	357	288,905
	Poor	2,005	-	-	48,133	50	1,655	35	80	-	-	5,331	-	57,289
	Total	43,286	777	1,850	466,518	6,859	41,536	466	26,946	6,419	1,065	26,900	487	623,109
40	Good	1,418	-	-	212,445	5,134	18,694	920	3,962	1,397	58	12,357	1,217	257,602
Year	Medium	-	-	-	268,280	4,208	3,240	284	77	-	1,672	46,520	2,434	326,715
	Poor	-	-	-	63,860	130	31	65	-	-	69	13,288	2,896	80,339
	Total	1,418	-	-	544,585	9,472	21,965	1,269	4,039	1,397	1,799	72,165	6,547	664,656
50	Good	261	-	-	181,524	333	6,261	400	5,062	4,393	245	2,164	1,948	202,591
Year	Medium	-	-	-	198,756	210	2,511	635	775	-	1,470	4,294	3,597	212,248
	Poor	-	-	-	48,635	-	96	340	-	-	540	3,395	2,043	55,049
	Total	261	-	-	428,915	543	8,868	1,375	5,837	4,393	2,255	9,853	7,588	469,888
60	Good	-	-	-	110,472	5,939	4,155	-	335	40	1,320	4,923	3,351	130,535
Year	Medium	-	-	-	206,140	5,693	4,471	135	-	-	1,323	14,989	24,279	257,030
	Poor	-	-	-	40,359	525	630	35	288	-	-	2,822	12,290	56,949
	Total	-	-	-	356,971	12,157	9,256	170	623	40	2,643	22,734	39,920	444,514
70	Good	-	-	-	105,261	-	145	-	317	-	330	-	1,175	107,228
Year	Medium	-	-	-	154,802	25	350	35	-	-	140	-	10,217	165,569
	Poor	-	-	-	14,349	170	1,370	-	-	-	135	-	5,230	21,254
	Total		-	-	274,412	195	1,865	35	317	-	605	-	16,622	294,051
80	Good	-	-	-	9,765	35	233	-	-	-	-	240	1,627	11,900
Year	Medium	-	-	-	16,462	921	120	-	3,902	-	480	80	2,463	24,428
	Poor	-	-	-	5,113	-	-	-	-	-	-	130	1,016	6,259
	Total	-	-	-	31,340	956	353	-	3,902	-	480	450	5,106	42,587
90	Good	-	-	-	21,321	-	-	-	282	-	-	-	255	21,858
Year	Medium	-	-	-	2,878	300	-	-	-	-	-	-	640	3,818
	Poor	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	24,199	300	-	-	282	-	-	-	895	25,676
100	Good	-	-	-	422	-	4,260	494	467	-	416	-	-	6,059
Year	Medium	-	-	-	-	-	1,867	771	2,437	-	1,325	-	-	6,400
and	Poor	-	-	-	-	-	-	-	-	-	-	-	1,100	1,100
over	Total	-	-	-	422	-	6,127	1,265	2,904	-	1,741	-	1,100	13,559
Total	Good	286,391	940	13,381	851,447	15,126	70,706	2,179	69,627	13,421	4,277	25,390	9,703	1,362,588
All	Medium	335,674	6,743	16,102	135,540	17,562	27,137	3,304	47,249	6,339	7,876	96,440	43,987	1,743,953
ages	Poor	142,918	3,029	2,200	237,471	875	3,827	1,365	3,736	1,230	1,251	31,336	24,629	453,867
	Total	764,983	10,712	31,683	2,224,458	33,563	101,670	6,848	120,612	20,990	13,404	153,166	78,319	3,560,408
	Total	764,983	10,712	31,683	2,224,458	33,563	101,670	6,848	120,612	20,990	13,404	153,166	78,319	3,560,408

Note – In addition to the immature types recognized above there are other types in which net growth is taking place, but which were not subdivided into age and stocking classes.

FOREST STATISTICS FOR THE STATE OF OREGON WEST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 5. AREA OF FOREST LAND BY SITE QUALITY CLASSES

Site classification						
Type of land		Site quality class	Area in acres	Percent of commercial coniferous forest land	Percent of total forest land	Percent of total area of region
Coniferous forest land exclusive of lodgepole type, subalpine, noncommercial rocky areas and pine woodland	Douglas fir classification	I	179,008	1.2	1.1	0.9
		II	3,371,259	23.5	21.6	17.5
		III	6,555,012	45.6	42.2	33.9
		IV	2,851,214	19.9	18.3	14.8
		V	658,724	4.6	4.2	3.4
	Ponderosa pine classification	I	23,602	0.2	0.2	0.I
		II	159,781	1.1	1.0	0.8
		III	377,186	2.6	2.4	2.0
		IV	169,111	1.2	1.1	0.9
		V	14,657	0.I	0.1	0.1
		VI	2,217			
Total coniferous forest sites (commercial)			14,361,771	100.0		
Lodgepole pine land			246,269		1.6	1.3
Noncommercial rocky areas			202,796		1.3	1.1
Subalpine forest areas			70,991		0.5	0.4
Oak-madrone land			361,296		2.3	1.9
Hardwood land			327,449		2.1	1.7
Pine woodland			6,510			
Total			1,215,311			
Total forest land in region			15,577,082		100.0	
Nonforest land			3,701,078	3,701,078		19.2
Total area of region			19,278,160	19,278,160		100.0

Note - The term “site quality” denotes the forest productive capacity of an area and is a reflection of the composite effect of all climatic and soil conditions.

The term “site quality” followed by roman numerals I to V for Douglas fir and I to VI for ponderosa pine designates the relative productive capacity, “site quality I” being the best and “site quality V” for Douglas fir and VI for ponderosa pine the poorest site qualities recognized. The height of the trees at a given age is used as a standard of classification.

The site quality classification designed for the Douglas fir type has been employed for that and all other types in the region except ponderosa pine, lodgepole pine, subalpine, oak-madrone, hardwoods and noncommercial rocky areas. The ponderosa pine classification has been used for ponderosa pine types except for pine woodland. There has been no differentiation into site quality classes for lodgepole pine, subalpine, oak-madrone, hardwoods, noncommercial rocky areas and pine woodland.

FOREST STATISTICS FOR THE STATE OF WASHINGTON WEST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE I. VOLUME OF TIMBER BY SPECIES FOR EACH OWNERSHIP CLASS
IN THOUSANDS OF BOARD FEET, LOG SCALE, SCRIBNER RULE

Survey symbol	Species	Private ownership	PUBLIC OWNERSHIPS									Total
			State, available for cutting	State, reserved from cutting	County	Municipal	Indian, tribal and trust allotments	Federal, other than nat. for., Indian and revested land grants	National forest, available for cutting	National forest, reserved from cutting	National forest, state selection	
DA	Old growth Douglas fir, trees over 40" DBH	35,506,212	4,697,191	29,495	129,998	106,908	165,733	690,165	13,155,154	59,900	19,592	54,560,348
DB	Old growth Douglas fir, trees 20-40'' DBH	9,040,762	1,197,598	4,634	58,347	209,901	16,204	51,183	9,334,205	38,251	851	19,951,936
DC	Second growth Douglas fir, trees 20-40" DBH	11,350,148	l, 300,199	30,568	166,500	2,359	25,531	114,984	6,111,042	8,800	639	19,170, 770
DD	Second growth Douglas fir, trees 16-20" DBH	4,248,512	510,589	6,929	105,093	7,183	16,923	33,317	790,955	-	212	5,719,713
SA	Large Sitka spruce, trees over 24" DBH	3,833,498	737,413	3,049	27,610	5,215	455,614	18,452	1,090,l53	36,980	156	6,208,145
SB	Small Sitka spruce, trees 16-24" DBH	423,447	30,611	480	4,760	48	54,553	1,055	5,677	-	-	520,631
ES	Engelmann spruce, trees over 16" DBH	63	-	-	-	-	-	-	33,946	-	-	34,009
HA	Large western hemlock, trees over 20" DBH	32,821,398	7,469,248	8,034	396,302	342,869	1,370,412	1,109,911	25,894,509	286,685	20,081	69,719,449
HB	Small western hemlock, trees 16-20" DBH	5,442,272	1,025,605	1,767	82,648	10,503	117,253	141,131	3,397,064	32,679	2,231	10,253,153
MH	Mountain hemlock, trees over 16" DBH	182,698	20,675	-	170	210	-	47,325	1,123,837	17,397	1,080	1,393,392
C	Western red cedar, live, trees over 16" DBH	10,441,536	2,334,980	6,409	133,721	62,275	1,176,830	114,777	5,724,556	83,342	13,654	20,092,080
YC	Alaska cedar, live, trees over 16" DBH	89,589	5,207	-	164	126	-	60,130	371,006	7,887	1,388	535,497
KC	Dead cedar, trees over 16" DBH	378,716	118,812	-	3,626	2,234	197,858	285	262,713	2,525	2,219	968,988
YA	Large ponderosa pine, trees over 22" DBH	-	-	-	-	-	-	-	98,415	-	-	98,415
YB	Small ponderosa pine, trees 12-22" DBH	-	-	-	-	-	-	2,320	-	-	-	2,320
W	Western white (& white bark) pine, trees over 16" DBH	238,851	97,019	-	3,348	15,128	28,001	72,122	1,031,859	10,957	452	1,497,737
LP	Lodgepole pine, trees over 16" DBH	845	-	-	-	-	-	2	4,870	-	-	5,717
WF	White fir and lowland white fir, trees over 16" DBH	672,282	55,186	196	391	-	4,819	600	131,330	536	-	865,340
NF	Noble fir, trees over 16" DBH	1,024,798	179,603	-	2,557	59,702	-	123,228	1,368,718	600	-	2,759,206
A	Silver fir, trees over 16" DBH	7,231,644	3,147,993:	2,843	111,378	272,552	446,919	871,703	17,492,394	291,919	13,869	29,893,214
AF	Alpine fir, trees over 16" DBH	11,504	-	-	51	-	-	4,732	17,229	-	-	33,516
WL	Western (and alpine) larch, trees over 16" DBH	-	-	-	-	-	-	-	26,515	-	-	26,515
RA	Red alder, trees over 12" DBH	423,441	43,260	528	7,534	378	51,385	649	25,512	933	83	553,704
BC	Black cottonwood (and aspen), trees over 12" DBH	97,365	4,527	50	1,688	6	4,514	2,900	31,576	500	-	143,126
OM	Bigleaf maple, trees over 12" DBH	207,971	22,998	139	1,591	243	4,846	737	7,332	274	188	246,319
ASH	Oregon ash, trees over 12" DBH	11,048	298	-	3	-	-	255	-	-	-	11,604
WPB	Western paper birch, trees over 12" DBH	-	-	-	-	-	-	-	202	-	-	202
	Total	123,678,600	23,059,012	95,121	1,237,480	1,097,840	4,137,396	3,461,963	87,530,774	880,165	76,695	245,255,046

FOREST STATISTICS FOR THE STATE OF WASHINGTON WEST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 2. AREA IN ACRES OF ALL FOREST COVER TYPES, BY OWNERSHIP CLASSES

Survey type no.	Definition of types	Private ownership	PUBLIC OWNERSHIPS									Total
			State, available for cutting	State, reserved from cutting	County	Municipal	Indian, tribal and trust allotment	Federal, other than nat. for., Indian and revested land grants	National forest, available for cutting	National forest, reserved from cutting	National forest, state selection	
2	Nonforest land other than agricultural	292,546	12,345	470	1,590	6,560	3,815	77,303	472,996	136,672	4,270	1,008,567
3	Agricultural: cultivated, and cleared pastures on operated farms	1,393,849	9,450	1,670	3,466	494	3,468	2,625	242	-	-	1,415,264
4	Oak-madrone: a forest containing over 60% oaks or madrone	2,398	-	-	5	-	-	600	-	-	-	3,003
	DOUGLAS FIR: a forest containing over 60% Douglas fir											
6	Douglas fir, large old growth, over 40" DBH	900,225	114,067	938	4,318	2,909	3,555	12,232	237,674	2,094	280	1,278,292
7	Douglas fir, small old growth, 20-40" DBH	136,046	18,377	85	4,367	4,507	285	5,680	252,583	474	-	422,404
8	Douglas fir, large second growth: 20-40" DBH	440,632	45,032	1,105	10,790	85	3,892	11,050	218,214	-	-	730,800
9	Douglas fir, small second growth, 6-20" DBH	1,066,517	62,828	3,244	52,302	4,279	12,233	35,621	229,907	883	-	1,467,814
10	Douglas fir, seedlings and saplings, 0-6" DBH	918,628	59,751	320	51,391	24,466	5,248	13,838	269,792	2,111	-	1,345,545
	SITKA SPRUCE: a forest containing over 50% Sitka spruce											
11	Sitka spruce, large, over 24" DBH	57,420	9,972	255	340	80	9,678	1,029	18,899	599	-	98,272
12	Sitka spruce, small, 6-24" DBH	12,943	496	-	453	-	25	80	30	-	-	14,027
13	Sitka spruce, seedlings and saplings, 0-6" DBH	990	315	-	-	-	-	-	-	-	-	1,305
	WESTERN HEMLOCK: a forest containing over 50% western hemlock											
14	Western hemlock, large, over 20" DBH	783,644	212,575	215	13,790	9,957	50,856	20,773	799,096	14,184	1,210	1,906,300
15	Western hemlock, small, 6-20" DBH	209,370	13,785	-	7,160	3,770	1,005	2,230	27,018	-	-	264,338
16	Western hemlock, seedlings and saplings, 0-6" DBH	155,809	27,378	70	9,658	1,845	605	275	15,690	272	-	211,602
	Western red cedar, large: a forest containing over 40% western red cedar											
17	Western red cedar, large, over 24" DBH	184,535	49,370	45	3,690	700	62,196	300	74,202	620	475	376,133
19	Western red cedar, small, under 24" DBH	17,439	430	235	640	30	-	-	150	-	-	18,924
	PONDEROSA PINE: a forest containing over 50% ponderosa pine											
20	Ponderosa pine, large, over 22" DBH	-	-	-	-	-	-	-	4,946	-	-	4,946
21	Ponderosa pine, small, 12-22" DBH	-	-	-	-	-	-	780	-	-	-	780
	FIR-MOUNTAIN HEMLOCK: a forest containing over 50% of either noble, silver, or Shasta fir and/or mountain hemlock											
23	Fir-mountain hemlock, large, over 16" DBH	179,506	65,993	-	2,335	8,744	5,510	49,751	658,073	20,290	390	990,592
24	Fir-mountain hemlock, small, under 16" DBH	16,811	-	-	260	-	-	1,987	133,076	1,127	-	153,261
	LODGEPOLE PINE: a forest containing over 50% lodgepole pine											
25	Lodgepole pine, large, over 12" DBH	165	-	-	-	-	-	-	-	-	-	165
26	Lodgepole pine, small, under 12" DBH	6,998	940	295	20	-	-	25	18,285	67	-	26,630
	WHITE FIR-LARCH-DOUGLAS FIR: a mixed forest of western larch, white fir, Douglas fir, ponderosa pine, or lodgepole pine											
27	White fir-larch-Douglas fir, large, over 20" DBH	-	-	-	-	-	-	-	14,874	-	-	14,874
28	White fir-larch-Douglas fir, small, under 20" DBH	-	-	-	-	-	-	-	9,922	-	-	9,922
	WHITE FIR: a forest containing over 50% white fir											
29	White fir, large, over 20" DBH	3,060	1,480	-	-	-	90	-	74	-	-	4,704
30	White fir, small, under 20" DBH	1,553	-	-	25	-	-	-	-	-	-	1,578
31	Hardwoods: alder, maple, ash, and/or cottonwood predominating	319,645	8,155	165	5,390	2,363	9,768	1,374	5,773	535	-	353,168
33	Subalpine: unmerchantable forests at upper limits of tree growth	65,634	7,396	-	776	289	-	71,791	821,164	123,201	1,640	1,091,891
35	Old cutovers, not restocked: clear cut prior to 1920	457,450	24,315	110	16,586	10,424	11,445	3,825	1,662	-	-	525,817
36	Recent cutovers: clear cut since January 1920	1,241,635	90,934	30	38,449	5,136	26,762	1,043	37,007	-	-	1,440,996
37	Deforested burns: any nonrestocked burn, not cut over	121,414	24,665	160	27,990	10	-	24,713	161,693	5,171	-	365,816
38	Noncommercial rocky areas	69,012	5,297	2,470	1,907	536	40,212	8,655	160,739	12,246	485	301,559
	Total	9,055,874	865,346	11,882	257,698	87,184	250,648	347,580	4,643,781	320,546	8,750	15,849,289

FOREST STATISTICS FOR THE STATE OF WASHINGTON WEST OF THE CASCADE RANGE FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 3. AREA IN ACRES OF GENERALIZED FOREST TYPES, BY OWNERSHIP CLASSES

Definition of types		Private, ownership	PUBLIC OWNERSHIPS									Total
			State, available for cutting	State, reserved from cutting	County	Municipal	Indian tribal and trust allotments	Federal, other than nat. for., Indian and revested land grants	National forest, available for cutting	National forest, reserved from cutting	National forest state selection	
Nonforest land type, survey types 2 and 3		1,686,395	21,795	2,140	5,056	7,054	7,283	79,928	473,238	136,672	4,270	2,423,831
Hardwoods: alder, maple, ash, and/or cottonwood predominating survey type 31		319,645	8,155	165	5,390	2,363	9,768	1,374	5,773	535	-	353,168
Coniferous timber types over about 20" DBH survey types, 6, 7, 8, 11, 14, 17, 20, 23, 27, and 29		2,685,068	516,866	2,643	39,630	26,982	136,062	100,815	2,278,635	38,261	2,355	5,827,317
Coniferous timber types from 6-20", 24" or 12-22" DBH survey types 9, 12, 15, and 21	on cutover areas	701,058	21,518	914	24,475	7,194	10,160	5,728	-	-	-	771,047
	on old burns	588,572	55,591	2,330	35,440	855	3,103	32,983	256,955	883	-	976,712
	Total	1,289,630	77,109	3,244	59,915	8,049	13,263	38,711	256,955	883	-	1,747,759
Coniferous timber types from 0-6" or 12" DBH survey types 10, 13, 16, and 22	on cutover areas	915,569	52,244	320	50,520	25,876	5,543	8,905	6,887	20	-	1,065,884
	on old burns	159,858	35,200	70	10,529	435	310	5,208	278,595	2,363	-	492,569
	Total	1,075,427	87,444	390	61,049	26,311	5,853	14,113	285,482	2,383	-	1,558,452
Coniferous timber types from 0-16", 20" or 24" DBH survey types 19, 24, 28, and 30	on cutover areas	15,685	340	235	550	-	-	-	232	-	-	17,042
	on old burns	19,318	90	-	375	30	-	1,987	142,916	1,127	-	165,843
	Total	35,003	430	235	925	30	-	1,987	143,148	1,127	-	182,885
Noncommercial types survey types 4, 25, 26, 33, and 38		144,207	13,633	2,765	2,708	825	40,212	81,071	1,000,188	135,514	2,125	1,423,248
Recent cutovers: clear cut since January 1920 survey type 36		1,241,635	90,934	30	38,449	5,136	26,762	1,043	37,007	-	-	1,440,996
Old cutovers nonrestocked, and deforested burns survey types 35 and 37		578,864	48,980	270	44,576	10,434	11,445	28,538	163,355	5,171	-	891,633
Total		9,055,874	865,346	11,882	257,698	87,184	250,648	347,580	4,643,781	320,546	8,750	15,849,289

FOREST STATISTICS FOR THE STATE OF WASHINGTON WEST OF THE CASCADE RANGE FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 4. AREA OF CERTAIN IMMATURE CONIFEROUS FOREST TYPES SUBDIVIDED INTO AGE AND STOCKING CLASSES

		TYPE NUMBER AND NAME										
		10	13	16	9	12	15	19	24	28	30	
Age class	Degree of stocking	Douglas fir seedlings & saplings 0"-6" DBH	Sitka spruce seedlings & saplings 0"- 6" DBH	Western hemlock seedlings & saplings 0"- 6" DBH	Douglas fir small second growth 6"-20" DBH	Sitka spruce second growth 6"-24" DBH	Western hemlock second growth 6"-20" DBH	Cedars small 0"-24" DBH	Fir-mt. hemlock small 0"-16" DBH	White fir-larch-Douglas fir small 0"-20" DBH	White fir small 0"-20" DBH	Total
		Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
10	Good	280,189	335	122,274	-	-	-	2,655	402	-	-	405,855
Year	Medium	371,776	115	43,559	-	-	-	1,690	5,158	-	-	422,298
	Poor	247,761	855	19,011	-	-	-	5,607	32,443	-	-	305,677
	Total	899,726	1,305	184,844	-	-	-	9,952	38,003	-	-	1,133,830
20	Good	154,275	-	10,240	33,706	-	6,150	2,865	13,135	-	-	220,371
Year	Medium	168,526	-	8,736	35,850	245	5,767	1,3592	5,352	-	-	245,835
	Poor	38,290	-	725	7,595	-	275	350	7,372	-	-	54,607
	Total	61,091	-	19,701	77,151	245	12,192	4,574	45,859	-	-	520,813
30	Good	45,352	-	3,307	165,889	2,445	31,557	490	9,368	444	691	259,543
Year	Medium	35,546	-	900	149,879	1,070	32,938	355	5,317	2,864	-	228,889
	Poor	3,270	-	-	24,682	220	2,670	190	3,225	-	-	34,257
	Total	84,168	-	4,207	340,450	3,735	67,165	1,035	17,910	3,328	691	522,689
40	Good	280	-	1,269	182,900	2,455	32,507	1,462	10,136	-	75	231,084
Year	Medium	129	-	400	156,273	1,060	25,066	570	1,940	-	-	185,438
	Poor	-	-	-	21,600	135	2,262	125	1,812	-	-	25,934
	Total	409	-	1,669	360,773	3,650	59,835	2,157	13,888	-	75	442,456
50	Good	-	-	412	95,822	145	10,250	165	2,326	2,832	80	112,032
Year	Medium	151	-	145	74,697	105	9,081	385	150	-	-	84,714
	Poor	-	-	-	14,536	110	856	230	85	-	-	15,817
	Total	151	-	557	185,055	360	20,187	780	2,561	2,832	80	212,563
60	Good	-	-	40	95,972	125	10,845	-	834	3,762	-	111,578
Year	Medium	-	-	-	106,237	235	12,315	124	6,769	-	-	125,680
	Poor	-	-	365	18,031	730	2,159	-	617	-		21,902
	Total	-	-	405	220,240	1,090	25,319	124	8,220	3,762	-	259,160
70	Good	-	-	50	85,343	-	21,051	-	6,683	-	370	113,497
Year	Medium	-	-	169	43,999	-	13,530	-	-	-	-	57,698
	Poor	-	-	-	10,475	-	3,805	-	-	-	-	14,280
	Total	-	-	219	139,817	-	38,386	-	6,683	-	370	185,475
80	Good	-	-	-	33,231	875	5,236	173	8,367	-	-	47,882
Year	Medium	-	-	-	40,965	360	7,095	50	943	-	266	49,679
	Poor	-	-	-	15,362	3,192	3,112	29	-	-	-	21,695
	Total	-	-	-	89,558	4,427	15,443	252	9,310	-	266	119,256
90	Good	-	-	-	3,485	-	785	-	-	-	-	4,270
Year	Medium	-	-	-	15,892	-	1,135	-	-	-	-	17,027
	Poor	-	-	-	1,210	-	210	-	-	-	96	1,516
	Total	-	-	-	20,587	-	2,130	-	-	-	96	22,813
100	Good	-	-	-	9,680	-	1,470	-	500	-	-	11,650
Year	Medium	-	-	-	19,136	480	21,268	50	10,327	-	-	51,261
and	Poor	-	-	-	5,367	40	943	-	-	-	-	6,350
over	Total	-	-	-	34,183	520	23,681	50	10,827	-	-	69,261
Total	Good	480,096	335	137,592	706,028	6,045	119,851	7,810	51,751	7,038	1,216	1,517,762
All	Medium	576,128	115	53,909	642,928	3,555	128,195	4,583	55,9562	2,884	266	1,468,519
ages	Poor	289,321	855	20,101	118,858	4,427	16,292	6,531	45,554	-	96	502,035
	Total	1,345,545	1,305	211,602	1,467,814	14,027	264,338	18,924	153,261	9,922	1,578	3,488,316
	Total	1,345,545	1,305	211,602	1,467,814	14,027	264,338	18,924	153,261	9,922	1,578	3,488,316

Note – In addition to the immature types recognized above there are other types in which net growth is taking place, but which were not subdivided into age and stocking classes.

FOREST STATISTICS FOR THE STATE OF WASHINGTON WEST OF THE CASCADE RANGE FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 5. AREA OF FOREST LAND BY SITE QUALITY CLASSES

Site classification Type of land	Site quality class	Area in acres		Percent of commercial coniferous forest land	Percent of total forest land	Percent of total area of region
Coniferous forest land exclusive of lodgepole type, subalpine, noncommercial rocky areas and pine woodland	I	320,292		2.8	2.4	2.0
	II	3,794,999		32.6	28.3	23.9
	III	4,542,091		39.0	33.9	28.7
	IV	2,567,905		22.0	19.1	16.2
	V	423,755		3.6	3.2	2.7
Total coniferous forest sites (commercial)			11,649,042	100.0		
Lodgepole pine land		26,795			0.2	0.2
Noncommercial rocky areas		301,559			2.2	1.9
Subalpine forest areas		1,091,891			8.1	6.9
Oak-madrone land		3,003				
Hardwood land		353,168			2.6	2.2
Total			1,776,416			
Total forest land in region			13,425,458		100.0	
Nonforest land		2,423,831	2,423,831			15.3
Total area of region		15,849,289	15,849,289			100.0

Note - The term “site quality” denotes the forest productive capacity of an area and is a reflection of the composite effect of all climatic and soil conditions.

The term “site quality” followed by roman numerals I to V designates the relative productive capacity, “site quality I” being the best and “site quality V” the poorest site quality recognized. The height of the trees at a given age is used as a standard of classification.

The site quality classification designed for the Douglas fir type has been employed for that and all other types in the region except lodgepole pine, subalpine, oak-madrone, hardwoods and noncommercial rocky areas, for which there has been no differentiation into site quality classes.

Appendix C: Pacific Northwest Experiment Station Forest Research Notes No. 25 (by R.W. Cowlin and F.L. Moravets)

FOREST RESEARCH NOTES

NUMBER 25

FOREST STATISTICS
FOR
EASTERN OREGON AND EASTERN WASHINGTON

FROM INVENTORY PHASE OF FOREST SURVEY

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION

U.S. COURT HOUSE PORTLAND, OREGON

Publication of the
Pacific Northwest Forest and Range Experiment Station
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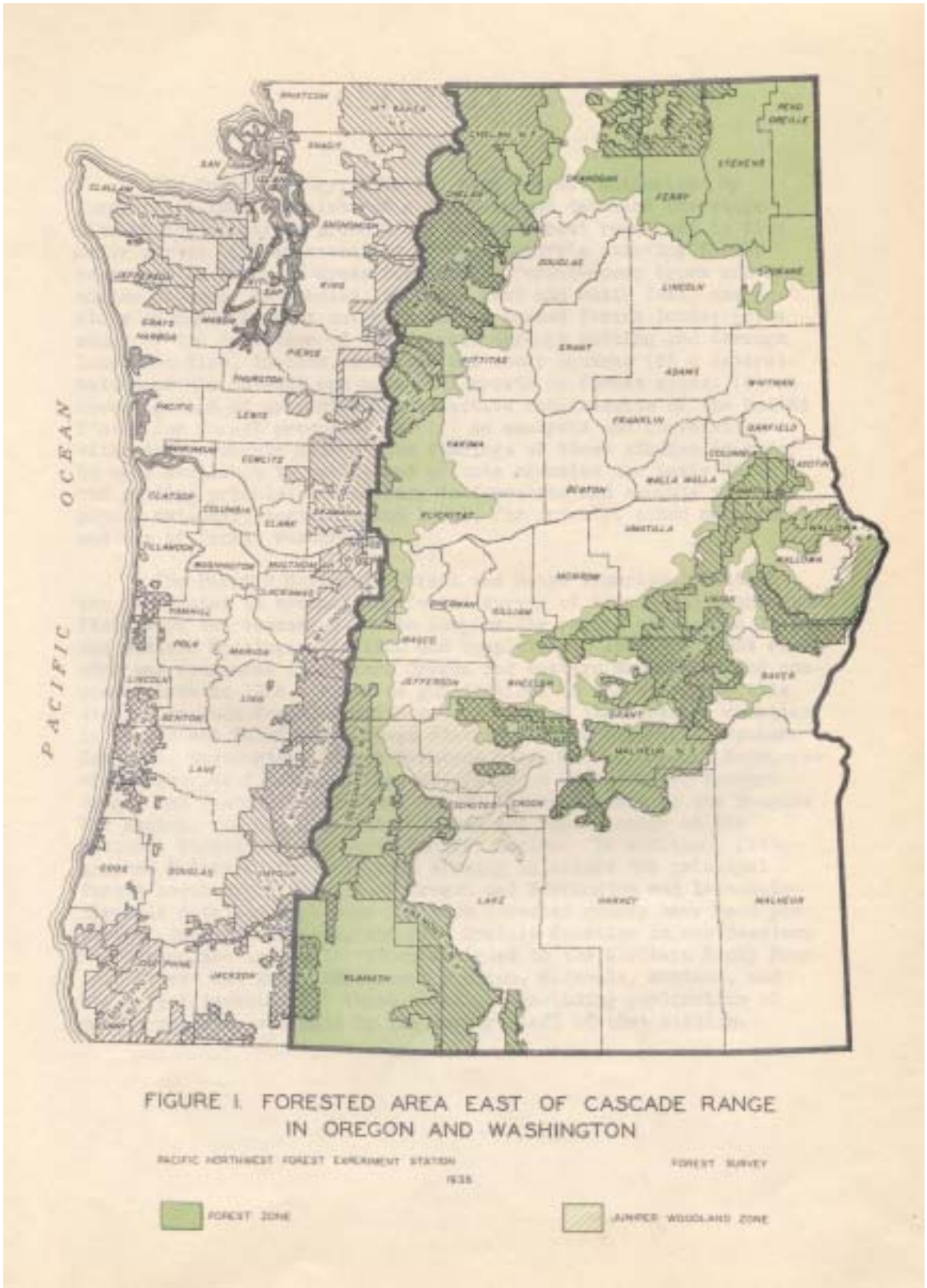


FIGURE 1. FORESTED AREA EAST OF CASCADE RANGE IN OREGON AND WASHINGTON

PACIFIC NORTHWEST FOREST EXPERIMENT STATION — FOREST SURVEY

1935

FOREWORD

The forest survey, a Nation-wide project authorized by Congress in 1928, consists of a complete and detailed investigation of the country's present and future forest resources in five major parts: (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 the findings of these studies in order to make available to public and private agencies the basic facts and guiding principles necessary to formulate and execute rational plans, national, regional, and local, for orderly, sound management and use of forest resources.

The Pacific Northwest Forest and Range Experiment Station was designated to conduct the forest survey of Oregon and Washington. Field work was commenced in the Douglas fir region of western Oregon and western Washington in 1930 and completed in 1933. In 1934 field work was commenced in eastern Oregon and eastern Washington and completed late in 1936. Previous publications on the survey by this station include forest statistics for each of the forested counties in Oregon and Washington except Stevens, Pend Oreille, and Spokane Counties, Washington; Forest Research Notes No. 13, *Forest Resources of the Douglas Fir Region*, No. 17, *Pulpwood Resources of Western Oregon and Western Washington*, No. 20, *Forest Growth in the Douglas Fir Region*, and No. 22, *Timber Volume and Type Acreage on the National Forests of the North Pacific Region*. In addition, lithographed ¼-inch-to-the-mile maps showing in colors the principal forest cover types for all Oregon and Washington and 1-inch-to-the-mile detailed type maps for each forested county have been prepared. Spokane, Stevens, and Pend Oreille Counties in northeastern Washington are in the territory assigned to the Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana, and the forest inventory of these counties, including publication of county reports, was made by the survey staff of that station.

FOREST RESOURCES OF EASTERN OREGON AND EASTERN WASHINGTON

By R. W. Cowlin and F. L. Moravets[1/]

INTRODUCTION

Oregon and Washington are divided by the Cascade Range into two geographic regions, which vary greatly in character of forest cover. Forest conditions in the region west of the summit, the Douglas fir region, were described in previous publications of the forest survey. This report presents basic forest inventory data for that part of the two States[2/] east of the Cascade Range (fig. 1). The combined area of eastern Oregon and eastern Washington is 67 million acres, amounting to roughly two-thirds the total area of the two States. In western Oregon and western Washington more than 80 percent of the area is forest land and the larger part of the land now classified as agricultural was originally forested; only above timber line in the Cascade Range and Olympic Mountains is tree growth limited by climatic conditions. In eastern Oregon and eastern Washington meager precipitation limits tree growth over extensive areas and only about 35 percent of the total area is forest land. The treeless area consists of river valleys, plateaus, deserts, rolling hills, and in southeastern Oregon scattered buttes and mountains. One extensive mountain range in southeastern Oregon, the Steens Mountain, is practically nonforested.

The principal industry of eastern Oregon and eastern Washington is agriculture and the Bureau of the Census report for 1930 shows nearly 24 million acres in farms, which lacks only about a million acres of equaling the forest land area. The principal agricultural products are wheat, livestock, hay, apples, dairy products, and potatoes. Of the total farm area 8.5 million acres was classified as crop land, 14 million acres as pasture land, and 200 thousand acres as woodland not pastured. Approximately 2 million acres of the pasture land was also classified as woodland.

1/ IN ADDITION TO THE REGULAR FOREST SURVEY STAFF, THE FOLLOWING WERE EMPLOYED UNDER EMERGENCY CONSERVATION WORK FUNDS, ON THE FIELD WORK, MAP PREPARATION, AND OFFICE COMPILATION: G. N. ALLMAN, GLENN BAILEY, MARION BECQUET, R. W. COX, R. H. EDDY, N. R. EDMONDSON, E. A. ERICKSON, GRACE FREDRICKSEN, G. W. FROST, F. HARLESS, V. HARLESS, A. W. HODGMAN, L. W. HUNTINGTON, W. IRWIN, G. H. JACKSON, CLAUDE KERR, M. J. LAURIDSEN, W. V. LITCHFIELD, D. L. LYNCH, H. E. MILLER, W. E. PLETO, R. W. TAYLOR, A. D. THRANE, L. E. TUCKER, W. E. SANKELA, C. S. SMITH, H. M. WOLFE, AND J. WOOD.

2/ ALL THAT PORTION OF OREGON AND WASHINGTON EAST OF THE SUMMIT OF THE CASCADE RANGE, INCLUDING KLICKITAT COUNTY, WASHINGTON, BUT EXCLUDING HOOD RIVER AND JACKSON COUNTIES, OREGON.

Grazing is not restricted to pasture land and large areas of forest land not classified as woodland pasture are used to range stock, particularly during the summer.

The forest industries rank next to agriculture among the basic industries. Out of a total (1930) population in this region of 634 thousand persons 260 thousand were gainfully employed. Approximately 32 percent of the gainful workers were employed in agriculture and 8 percent in the forest industries.

In addition to furnishing raw material for industry, fuel for domestic use, and forage for stock, forests contribute to economic enterprise in this region by providing recreation facilities and favorably influencing stream flow. Although dry farming predominates, the irrigated areas are the most productive and the source of water supply for all these areas is in the forest zone.

According to the Bureau of the Census the area of irrigated land in eastern Oregon and eastern Washington was 1.3 million acres in 1929, which is about 15 percent of the total crop land. The value of land and buildings of irrigated farms was 42 percent of the value of land and buildings of all farms in 1930. In the heavily forested counties the value and acreage of irrigated farms is very much greater in proportion to the value and acreage of all farms than in the nonforested and lightly forested counties.

During the 12-year period from 1925-36, inclusive, lumber production in this region averaged 1,435 million board feet annually. It is significant to note that the only year during this period when production dropped below a billion board feet was 1932, in the depth of the depression. The strength of the industry was shown by the quick recovery from this low, and in 1935 production climbed to a billion and a half feet and in 1936 it reached 1,857 million feet exceeding 1929 production, the previous high year of the period, by 33 million feet.

A brief discussion of the statistical data follows: Explanation of the methods and terms used immediately precedes the tables.

Saw-Timber Volume

The volume of saw timber by species and ownership is given for eastern Oregon in table 1 and for eastern Washington in table 5 and is shown graphically for the two States combined in figure 2. In all, 18 conifers and 3 hardwoods were considered to have saw-timber volume. Owing to the similarity of dendrological and structural characteristics white fir was combined with lowland white fir and Shasta red fir with noble fir.

Eastern Oregon and eastern Washington combined have a total timber volume of 132 billion board feet. Ponderosa pine is the most important species and forms more than 50 percent of the stand on 11.6 million acres, which amounts to 47 percent of the total forest land in the region. This species is the most widely distributed conifer in the United States and occurs commonly throughout the forest portions of the western United States. It ranks second to Douglas fir in saw-timber volume among the Nation's commercial timber species. This region has 83 billion board feet, log scale, of ponderosa pine saw-timber which is approximately 36 percent of the national total volume of this valuable species. During the period 1925-36, inclusive, 82 percent of the lumber cut in eastern Oregon and eastern Washington was ponderosa pine.

Eastern Oregon has a total timber volume of 87.7 billion board feet, of which 75 percent, 65.4 billion board feet, is ponderosa pine and 9 percent, 7.8 billion board feet, is Douglas fir. Eastern Washington has a total timber volume of 44.5 billion board feet, only about half as much as eastern Oregon. In this State ponderosa pine forms 40 percent of the total with 17.9 billion board feet and Douglas fir amounts to 27 percent with 11.9 billion board feet.

Approximately 30 percent of the saw-timber volume in this region is privately owned compared to nearly 50 percent in the Douglas fir region. Indian ownership[3/] is much more important here, amounting to 15 percent of the total volume. The national forests have 42 percent of the total volume and the remaining 13 percent is in other forms of public ownership.

The situation is slightly different with respect to ponderosa pine volume, 34 percent is privately owned, 18 percent is owned by Indians, and 43 percent is on the national forests, leaving very little in other public ownership.

In addition to the species for which saw-timber volume was shown in the tables, cordwood volume was estimated for western juniper, Oregon white oak, and mountain mahogany trees 4 inches or more in diameter 1 foot above the ground. In eastern Oregon there were 3,564 thousand cords of juniper, 40 thousand cords of white oak, and 27 thousand cords of mountain mahogany; in eastern Washington there were 92 thousand cords of white oak and a very small amount of juniper. These species are chiefly valuable for fuel and fence posts. Cordwood volume was also estimated for aspen, northern black cottonwood, and red alder trees less than saw-timber size, amounting to 30 thousand, 23 thousand, and 1 thousand cords, respectively, in the two States combined.

[3/] LANDS OWNED BY INDIANS, EITHER TRIBAL LANDS OR TRUST ALLOTMENTS, ARE MANAGED BY THE FEDERAL GOVERNMENT BUT ARE NOT CONSIDERED AS FEDERAL LAND.

Forest Land

The area of all cover types by ownership class is given in table 2 for eastern Oregon and table 6 for eastern Washington.

Of the combined total of 24,729,995 acres of forest land in eastern Oregon and eastern Washington, 45 percent is in national forest ownership, 32 percent is privately owned, 11 percent is in Indian ownership, and the remaining 12 percent is in the various public ownership classes other than national forest. Figure 3 shows graphically the ownership of forest land.

A little more than a third of eastern Oregon is forested. As shown in figure 1, the forest land in this portion of the State occurs in two separate zones.[4/] One zone parallels the Cascade Range, extending from the Columbia River on the north to the California line on the south and eastward from the summit of the Range a distance of from 20 to 115 miles. Ponderosa pine types predominate in this zone, except in a narrow belt along the summit occupied by fir-mountain hemlock, lodgepole pine, upper-slope mixture, and subalpine types. The pure ponderosa pine type, large, type 20.5, occupies approximately a third of the total area of the zone and the other mature and immature ponderosa pine types occupy most of the remainder of the area. Ponderosa pine in this zone reaches good development and is of good quality; stands usually average from 8 to 15 M board feet per acre, and on the best sites greatly exceed these figures.

The other zone in eastern Oregon lies in the northeastern portion of the State and occupies the main range and spurs of the Blue Mountains and the Wallowa Mountains. Ponderosa pine types, pure or nearly so in composition, occur throughout nearly all of the southern half of this zone. In the northern half the upper-slope mixture and lodgepole pine types predominate on much of the area. Here the ponderosa pine types are limited principally to the lower slopes. There is a considerable acreage of subalpine type and barren land along the higher ridges and slopes of the Wallowa Mountains.

In the central part of the State and lying between the two areas of forest land is the juniper woodland zone. Although western juniper is found throughout most of eastern Oregon, it is here that it reaches its best development and forms almost continuous stands.

4/ FOREST TYPES ARE SHOWN IN MUCH GREATER DETAIL ON THE INCH-TO-THE-MILE COUNTY MAPS AND ¼-INCH LITHOGRAPHED STATE MAPS. COPIES OF THESE MAPS MAY BE PROCURED FROM THE PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION.

About two-fifths of eastern Washington is forested and, as in eastern Oregon, there are two large forest zones. One lying along the Cascade Range reaches eastward from the summit a distance of from 20 to 50 miles and consists of two quite distinct parallel belts of forest land. One belt adjacent to the summit of the Cascade Range, and occupying the higher slopes and ridges, is composed of fir-mountain hemlock, Douglas fir, upper-slope mixture, lodgepole pine, barren, and subalpine types. Although much of the timber in this belt is of value principally for watershed protection, some good timber is found in the Douglas fir types, particularly in Kittitas and Klickitat Counties. The other belt occupying the lower slopes and extending down to the "dry" timber line is composed of ponderosa pine types. The best timber in this belt is found in southwestern Yakima and northwestern Klickitat Counties where ponderosa pine forms excellent stands of high-quality timber.

The second zone in eastern Washington is located in the northeastern part of the State and is dominated by the Colville Mountains. It may be considered an extension of the Inland Empire forest region of Idaho and Montana. Ponderosa pine types predominate in the southern half of the zone, while the majority of the area in the northern half is occupied by upper-slope mixture types composed of various combinations of western larch, Douglas fir, white pine, and lodgepole pine.

In addition to the two large forest zones in eastern Washington, there is a forested area of a few hundred thousand acres in the southeastern corner of the State. This area is an extension of the Blue Mountain forested area of northeastern Oregon and is about equally divided among the ponderosa pine, upper-slope mixture, and subalpine types.

The generalized types by ownership class for eastern Oregon are shown in table 3 and for eastern Washington in table 7. The distribution of generalized types for both States combined is shown graphically in figure 4. Ponderosa pine types of saw-timber size occupy more than half of the forested area in eastern Oregon and more than a third in eastern Washington. In the two States combined there is more than 10 million acres of ponderosa pine saw timber. Other coniferous saw-timber types, not including lodgepole pine, total 3.3 million acres. Of the second-growth types less than saw-timber size, ponderosa pine types occupy 1.9 million acres and other coniferous types 1.8 million acres. The area of ponderosa pine saw timber is more than 5 times that of ponderosa pine second growth, a highly significant fact. Lodgepole pine types which are of little commercial value occupy 2.2 million acres; a slightly larger area was classified as noncommercial forest land. In the two States deforested cut-over and burned areas amount to only 534 thousand acres. Considering the adaptability of ponderosa pine stands to selective cutting, the large acreage of saw-timber types, the comparatively small area of idle commercial forest land, the stability of ownership, and the secondary income obtainable from grazing, the possibilities of region-wide sustained yield are very encouraging.

Productive Capacity of Forest Land

Tables 4 and 8 give the area of forest land by site quality classes for eastern Oregon and eastern Washington, respectively. 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. Six site quality classes are recognized for ponderosa pine and five for Douglas fir, class I being in each case the highest. In the survey the ponderosa pine classification was used for the pure ponderosa pine, ponderosa pine mixture, and white fir and lowland white fir types; the Douglas fir classification was used for the Douglas fir, upper-slope mixture, and fir-mountain hemlock types.

The deforested areas, cut-over land and burns, were classified on the basis of the original type. Approximately 151,000 acres of lodgepole pine types, occurring on areas formerly occupied by either ponderosa pine or upper-slope mixture types, was classified as to site, but the remainder of the area of lodgepole pine types was not classified. Likewise no classification was given to the juniper, noncommercial rocky, subalpine, oak, and hardwood types, all of which are of little or no value for timber production.

The forest land occupied by the types given the ponderosa pine site classification in eastern Oregon average higher in productive capacity than those in eastern Washington. Approximately 77 percent of the area so classified in eastern Oregon is of Site Class IV or better, whereas in eastern Washington 67 percent is of Site Class IV or better. The reverse is true of the forest lands occupied by the types given the Douglas fir classification; eastern Washington has a greater percentage of its area of such lands in Site Class IV or better than has eastern Oregon.

EXPLANATION OF METHODS AND TERMS

SOURCES OF DATA – IN THE SURVEY OF OREGON AND WASHINGTON USE WAS MADE, SO FAR AS POSSIBLE, OF ALL EXISTING INFORMATION ON DISTRIBUTION OF FOREST TYPES AND ALL AVAILABLE ESTIMATES OF TIMBER VOLUME, INCLUDING COUNTY CRUISES AND MAPS AND TIMBER ESTIMATES MADE BY OTHER PUBLIC AGENCIES. TIMBER ESTIMATES OF PRIVATE LANDS WERE FURNISHED BY THE OWNERS WITH THE UNDERSTANDING THAT THEY WOULD BE PUBLISHED ONLY IN COMBINATION WITH CRUISES OF OTHER OWNERS AND FOR LARGE AREAS. THIS COOPERATION OF TIMBER OWNERS WAS A VERY MATERIAL AID TO THE PROJECT. TIMBER EXPERTS THOROUGHLY CHECKED IN THE FIELD SUCH EXISTING ESTIMATES AS WERE AVAILABLE AND DETERMINED ADJUSTMENT FACTORS BY WHICH TO RECONCILE THEM TO THE STANDARD ADOPTED BY THE FOREST SURVEY. SOME 113,000 ACRES IN EASTERN OREGON AND EASTERN WASHINGTON WERE INTENSIVELY CRUISED TO ADJUST THE CRUISE ON AREAS FOR WHICH THERE WERE EXISTING USABLE DATA. THE SURVEY FIELD PERSONNEL MADE TYPE MAPS AND TIMBER ESTIMATES OF ALL FOREST AREAS IN THE REGION FOR WHICH NO USABLE DATA EXISTED.

TIMBER ESTIMATING STANDARDS – THE TIMBER ESTIMATES, SUMMARIZED IN THE FOLLOWING TABLES WERE MADE IN BOARD FEET, LOG SCALE, SCRIBNER RULE. ALL CRUISING, WHETHER FOR ADJUSTMENT PURPOSES OR FOR AREAS NOT COVERED BY EXISTING ESTIMATES, WAS SO DONE AS TO INCLUDE ALL LIVING CONIFEROUS TREES (EXCEPT JUNIPER) THAT WOULD MAKE AT LEAST ONE 16-FOOT LOG 3 INCHES IN DIAMETER INSIDE BARK AT THE SMALL END AND ALL HARDWOOD TREES THAT WOULD MAKE AT LEAST ONE 8-FOOT LOG 10 INCHES IN DIAMETER INSIDE BARK AT THE SMALL END.

ALLOWANCE HAS BEEN MADE IN THESE ESTIMATES FOR DECAY, DEFECTS, AND SUCH BREAKAGE AS IS INEVITABLE IN EXPLOITATION; IN OTHER WORDS, THE ESTIMATES ARE FOR NET VOLUME USABLE IN SAW-TIMBER OPERATIONS PRACTICING INTENSIVE UTILIZATION. THE STANDARDS OF UTILIZATION EMPLOYED IN THE SURVEY ARE PROBABLY SLIGHTLY MORE INTENSIVE FOR THE MORE VALUABLE SPECIES AND CONSIDERABLY SO FOR THE LESS VALUABLE SPECIES THAN THOSE OBSERVED BY THE AVERAGE PRESENT-DAY SAW-TIMBER OPERATOR, OWING LARGELY TO THE INCLUSION OF TREES AS SMALL AS 12 INCHES D.B.H.

DIFFERENCES BETWEEN PRESENT AND PREVIOUS ESTIMATES DO NOT NECESSARILY INDICATE INCREASES OR DECREASES IN VOLUME OF TIMBER. SUCH DIFFERENCES MAY BE DUE IN LARGE MEASURE TO DIFFERENCES BETWEEN THE PRESENT AND PREVIOUS CRUISES IN STANDARDS AND IN COMPLETENESS. THE PRESENT ESTIMATES COVER ALL FOREST TREES OF THE ABOVE SPECIFICATIONS OUTSIDE OF MUNICIPALITIES, WHETHER IN SMALL FARM WOODS OR ON EXTENSIVE FOREST AREAS.

THE ESTIMATES HEREIN GIVEN MAKE NO DISTINCTION WITH REGARD TO ACCESSIBILITY OR AVAILABILITY TO MARKET, ALTHOUGH IT IS RECOGNIZED THAT SOME OF THE TIMBER IS READILY ACCESSIBLE AND SOME UTTERLY REMOTE. NEITHER DO THEY DIFFERENTIATE AMONG CLASSES OF FOREST PRODUCTS, THE WHOLE VOLUME ABOVE THE STATED LIMITS BEING EXPESSED IN BOARD FEET OF SAW TIMBER.

OWNERSHIP CLASSES – TIMBER VOLUME AND FOREST-TYPE ACREAGES HAVE BEEN COMPILED BY OWNERSHIP CLASSES. INFORMATION ON OWNERSHIP WAS TAKEN FROM THE BEST PUBLIC RECORDS AVAILABLE. IT IS OF COURSE RECOGNIZED THAT OWNERSHIP IS CONSTANTLY CHANGING. THE TOTALS FOR OWNERSHIP CLASSES WILL IN MANY CASES NOT COINCIDE WITH STATISTICS FROM OTHER SOURCES; NOR IN FACT WILL FIGURES FOR TOTAL AREA OF THE STATES ALWAYS AGREE WITH FIGURES HITHERTO ACCEPTED. THE FOLLOWING OWNERSHIP CLASSES WERE CONSIDERED:

PRIVATE. ALL PRIVATELY OWNED FOREST PROPERTY, INCLUDING FARM WOODS.

STATE, AVAILABLE FOR CONVERSION. INCLUDES ANY STATE-OWNED FOREST PROPERTY NOT RESERVED FROM CUTTING.

STATE, RESERVED FOR ANY PURPOSE. INCLUDES STATE-OWNED FOREST PROPERTY USED FOR PARKS, NATIONAL-GUARD CAMPGROUNDS, ETC.

COUNTY. INCLUDES FOREST PROPERTY DEEDED TO THE COUNTY. TAX-DELINQUENT LAND NOT DEEDED TO THE COUNTY IS CLASSIFIED AS “PRIVATE.”

MUNICIPAL. INCLUDES ALL MUNICIPALLY OWNED FOREST PROPERTY OUTSIDE THE PLATTED LIMITS OF MUNICIPALITIES, SUCH AS CITY WATERSHEDS.

INDIAN. INCLUDES BOTH TRIBAL LANDS AND TRUST ALLOTMENTS.

REVESTED LAND GRANTS. INCLUDES O AND C AND OTHER LAND GRANTS THAT HAVE REVERTED TO FEDERAL OWNERSHIP, WHETHER CLASSIFIED AS “TIMBER”, “AGRICULTURAL”, OR “POWER WITHDRAWALS.”

FEDERAL OTHER THAN NATIONAL FORESTS AND REVESTED LAND GRANTS, AVAILABLE FOR CUTTING. INCLUDES PUBLIC DOMAIN, ETC.

FEDERAL OTHER THAN NATIONAL FORESTS AND REVESTED LAND GRANTS, RESERVED FROM CUTTING. INCLUDES NATIONAL PARKS, WILD-LIFE REFUGES, MILITARY RESERVATIONS, ETC.

NATIONAL FOREST, AVAILABLE FOR CUTTING.

NATIONAL FOREST, RESERVED FROM CUTTING.

RAILROAD SELECTION PENDING. FEDERAL LANDS DESIGNATED FOR SELECTION AS RAILROAD GRANTS BUT NOT YET DEEDED.

THE TERM "RESERVED FROM CUTTING" AS APPLIED TO STATE LAND AND TO NATIONAL-FOREST OR OTHER FEDERAL LAND DENOTES THAT THE TIMBER IS UNAVAILABLE FOR CUTTING BECAUSE OF STATUTE, PROCLAMATION, OR POLICY, THE LAND USUALLY BEING OFFICIALLY DEDICATED TO PARK, WATERSHED OR OTHER USES TO THE EXCLUSION OF TIMBER CUTTING. THE TERM "AVAILABLE FOR CUTTING", IN CONTRAST TO THE ABOVE, MEANS THAT THERE IS NO LEGAL OR FORMAL PROHIBITION ON TIMBER CUTTING.

AGE CLASSES AND DEGREE OF STOCKING – IN ADDITION TO TYPE MAPPING ACCORDING TO COMPOSITION AND SIZE, THE EVEN-AGED IMMATURE FOREST STANDS, THOSE IN WHICH MOST OF THE DOMINANT TREES ARE UNDER 22 INCHES IN DIAMETER, WERE CLASSIFIED ACCORDING TO AGE IN 10-YEAR CLASSES AND ACCORDING TO THEIR DENSITY IN THREE DEGREES OF STOCKING. IF A FOREST OF SEEDLINGS, SAPLINGS, OR SMALL "SECOND GROWTH" IS DENSE ENOUGH TO COVER 70 TO 100 PERCENT OF THE AREA (AS MEASURED BY THE STOCKED-QUADRAT METHOD), IT IS CLASSIFIED AS "WELL STOCKED"; IF 40 TO 69 PERCENT IS COVERED, IT IS CALLED "MEDIUM STOCKED"; IF 10 TO 39 PERCENT, IT IS "POORLY STOCKED." AREAS LESS THAN 10 PERCENT STOCKED ARE CONSIDERED AS "NONRESTOCKING." IF UNEVEN AGED THE STANDS WERE CLASSIFIED ON THE BASIS OF THE STOCKING OF POLES AND REPRODUCTION COMBINED.

TREE SPECIES – THE TIMBER ESTIMATES HAVE BEEN KEPT SEPARATELY FOR ALL THE TREE SPECIES THAT USUALLY REACH SAW-TIMBER SIZE AND CHARACTER. THE ABSENCE OF VOLUME ESTIMATES FOR ANY SPECIES IN TABLES 1 AND 5 DOES NOT NECESSARILY MEAN THAT THE SPECIES DOES NOT OCCUR IN THE STATE IN QUESTION; A SPECIES MAY BE PRESENT BUT NOT HAVE BEEN FOUND IN SIGNIFICANT QUANTITY OR IN TREES OF COMMERCIAL SIZE, OR IT MAY BE CONFINED TO THE NONCOMMERCIAL TYPES. THIS IS PARTICULARLY TRUE OF SUCH SPECIES AS JUNIPER AND THE HARDWOODS THAT OFTEN DO NOT ATTAIN SAW-TIMBER SPECIFICATIONS. THE COMMON NAMES EMPLOYED BY THE FOREST SERVICE (U.S.D.A. MISC. CIR. 02) HAVE BEEN USED THROUGHOUT.

DEFINITION OF TERMS – THE ABBREVIATION "DBH" SIGNIFIES THE DIAMETER AT BREAST HEIGHT (4 ½ FEET ABOVE GROUND) OUTSIDE THE BARK.

IN DESCRIBING DOUGLAS FIR TIMBER THE TERMS "OLD GROWTH" AND "SECOND GROWTH" SHOULD BE REGARDED AS RELATIVE DESCRIPTIVE TERMS TO DISTINGUISH THE OLDER, MORE MATURE TIMBER FROM THE YOUNGER AND MORE RAPID GROWING TIMBER. THERE IS NO SHARP LINE OF DEMARCATION BETWEEN THE TWO. LIKEWISE THE TERMS "LARGE" AND "SMALL" APPLIED TO OTHER SPECIES ARE RELATIVE.

DEFINITIONS OF TYPES

THE FOREST COVER AND LAND USE TYPES RECOGNIZED BY THE FOREST SURVEY OF EASTERN OREGON AND EASTERN WASHINGTON ARE DEFINED BELOW. NOT ALL OF THESE TYPES OCCUR IN ANY ONE STATE.

NONFOREST LAND TYPES

1. BARRENS: AREAS TOO ROCKY, OR TOO SOILLESS, OR TOO EXPOSED TO SUPPORT A REAL VEGETATIVE COVER OF EITHER TREES, SHRUBS, HERBS, OR GRASS. ALSO INCLUDES CITIES, TOWNS, AND UNMEANDERED WATER SURFACE.

2. CULTIVATED, GRASS, GRASS SWAMP, SAGEBRUSH, OR BRUSH: INCLUDES AREAS NOW IN AGRICULTURAL USE OR LYING FALLOW AND AREAS WHOSE PRINCIPAL PRESENT VEGETATION IS EITHER GRASS, SAGEBRUSH, OR BRUSH, INCLUDING MARSHY, SWAMPY AREAS NOT CONSIDERED LAKES. DOES NOT INCLUDE "FOREST LAND", I.E., LAND WHICH FROM ALL EVIDENCE HAS BEEN

FORESTED IN RECENT DECADES. NO DIFFERENTIATION IS MADE BETWEEN CULTIVATED LAND, NATURAL PASTURES, AND RANGE LANDS.

WOODLAND TYPES

4. OAK: A STAND CONTAINING APPROXIMATELY 60 PERCENT OR MORE OF ONE OR MORE SPECIES OF OAK. NO SEPARATION OF AGE CLASSES.

JUNIPER: A STAND COMPOSED PRINCIPALLY OF JUNIPER, OFTEN WITH MORE OR LESS MOUNTAIN MAHOGANY. LAND WHERE THE TREES ARE SO SCATTERED THAT THEY OCCUPY LESS THAN ABOUT 5 PERCENT OF THE GROUND SURFACE IS NOT CLASSIFIED AS JUNIPER WOODLAND.

5A. DENSE JUNIPER: A STAND IN WHICH THE JUNIPER TREES ARE SO LARGE OR NUMEROUS THAT THEY OCCUPY 10 PERCENT OR MORE OF THE LAND AREA.

5B. SCATTERED JUNIPER: A STAND IN WHICH THE JUNIPER TREES ARE SO SMALL OR SCATTERED THAT THEY OCCUPY LESS THAN 10 PERCENT OF THE LAND AREA, ALTHOUGH ABOUT 5 PERCENT OR MORE.

5½. PONDEROSA PINE WOODLAND: AN AREA WITH SOLITARY TREES, OR GROUPS OF TREES TOO SMALL TO MAP SEPARATELY, IN WHICH MATURE PONDEROSA PINE IS THE PREDOMINATING TREE. A BORDERLINE ZONE, CHARACTERISTIC OF THE FRINGES OF THE DESERT AND OF THE BREAKS BETWEEN TIMBERED PLATEAUS AND TREELESS CANYONS, WHERE THE AREA OF GRASS OR SAGEBRUSH MAY BE AS GREAT OR GREATER THAN THE AREA OF TIMBER. THIS TYPE USUALLY MERGES AT ITS UPPER BOUNDARY WITH TIMBERLAND TYPES AND AT ITS LOWER LIMIT WITH OPEN LAND. FOR THE ZONE AS A WHOLE THE VOLUME PER ACRE IS ORDINARILY LESS THAN 3,000 FEET. THE TREES ARE NOT NECESSARILY NONCOMMERCIAL. IMMATURE TYPES ARE NOT INCLUDED.

TIMBERLAND TYPES

DOUGLAS FIR: FORESTS CONTAINING APPROXIMATELY 60 PERCENT OR MORE, BY VOLUME, OF DOUGLAS FIR. THE FOLLOWING SIZE CLASSES ARE RECOGNIZED:

6. DOUGLAS FIR, LARGE OLD GROWTH: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES MORE THAN 40 INCHES IN DBH.

7. DOUGLAS FIR, SMALL OLD GROWTH: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES 22 TO 40 INCHES IN DBH.

8. DOUGLAS FIR, LARGE SECOND GROWTH: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES 22 TO 40 INCHES IN DBH. COARSE-GRAINED TIMBER THAT WILL CUT ONLY A SMALL PERCENTAGE OF THE UPPER GRADES OF LUMBER.

9A. DOUGLAS FIR, 12-20 INCHES DBH: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES 12 TO 20 INCHES IN DBH.

9B. DOUGLAS FIR, 6-10 INCHES DBH: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE FROM 6 TO 10 INCHES IN DBH.

10. DOUGLAS FIR, LESS THAN 6 INCHES DBH: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE LESS THAN 6 INCHES IN DBH.

WESTERN RED CEDAR: FORESTS CONTAINING APPROXIMATELY 40 PERCENT OR MORE, BY VOLUME, OF WESTERN RED CEDAR. LARGELY CONFINED TO SWAMPS AND STREAM MARGINS ON THE NATIONAL FORESTS OF EASTERN WASHINGTON.

17. WESTERN RED CEDAR, MORE THAN 24 INCHES DBH: FORESTS OF SAW-TIMBER SIZE IN WHICH MOST OF THE VOLUME IS IN TREES MORE THAN 24 INCHES IN DBH.

19A. WESTERN RED CEDAR, 12-24 INCHES DBH: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES FROM 12 TO 24 INCHES IN DBH.

19B. WESTERN RED CEDAR, LESS THAN 12 INCHES DBH: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE LESS THAN 12 INCHES IN DBH.

PONDEROSA PINE: FORESTS CONTAINING APPROXIMATELY 50 PERCENT OR MORE, BY VOLUME, OF PONDEROSA PINE, SUGAR PINE, OR JEFFREY PINE, OR ANY COMBINATION OF THESE SPECIES,

EXCEPT THOSE IN WHICH SUGAR PINE IS THE KEY TREE, IN WHICH THE STANDS ARE CONTINUOUS IN CONTRAST TO THE MORE OPEN PONDEROSA PINE WOODLAND TYPE. THREE SIZE CLASSES ARE RECOGNIZED.

20. PONDEROSA PINE, LARGE: FORESTS IN WHICH THE DOMINANT STAND AVERAGES MORE THAN 22 INCHES IN DBH, SO-CALLED "YELLOW PINE" (MORE THAN ABOUT 150 OR 200 YEARS OLD), NO MATERIAL PART OF WHICH HAS BEEN CUT. INCLUDES OCCASIONAL STANDS OF MATURE OR OVERMATURE PONDEROSA PINE THAT AVERAGE SMALLER THAN 22 INCHES IN DBH.

20.5 PURE PONDEROSA PINE, LARGE: FORESTS CONTAINING APPROXIMATELY 80 PERCENT OR MORE, BY VOLUME, OF PONDEROSA PINE OR JEFFREY PINE.

20A. PONDEROSA PINE-SUGAR PINE MIXTURE, LARGE: FORESTS WITH MORE THAN 50 PERCENT PONDEROSA PINE, BY VOLUME, AND 20 PERCENT OR MORE OF SUGAR PINE, IN WHICH MOST OF THE VOLUME IS IN TREES MORE THAN 22 INCHES IN DBH.

20B. SUGAR PINE MIXTURE, LARGE: FORESTS CONTAINING 20 PERCENT OR MORE, BY VOLUME, OF SUGAR PINE AND LESS THAN 50 PERCENT OF PONDEROSA PINE, USUALLY IN MIXTURE WITH DOUGLAS FIR, PONDEROSA PINE, OR WHITE FIR, IN WHICH MOST OF THE VOLUME IS IN TREES MORE THAN 22 INCHES IN DBH.

21. PONDEROSA PINE, SMALL: EITHER (A) SELECTIVELY CUT STANDS OF ANY AGE IN WHICH THE VOLUME OF PONDEROSA PINE TREES 12" OR MORE IN DBH IS 1,000 BOARD FEET OR MORE PER ACRE, OR (B) IMMATURE STANDS, SO-CALLED "BULL PINE" (LESS THAN 150 TO 200 YEARS OLD), OF 1,000 BOARD FEET OR MORE PER ACRE, USUALLY WITH THE GREATER PART OF VOLUME IN PONDEROSA PINE TREES FROM 12 TO 22 INCHES IN DBH BUT INCLUDING THE OCCASIONAL IMMATURE STANDS IN WHICH THE TREES EXCEED 22 INCHES IN DBH.

22. PONDEROSA PINE, SEEDLINGS, SAPLINGS, AND POLES: FORESTS ON OLD BURNS OR HEAVILY CUT-OVER LAND IN WHICH MOST OF THE TREES ARE LESS THAN 12 INCHES IN DBH AND THE STAND OF SAW TIMBER, IF ANY, AMOUNTS TO LESS THAN 1,000 BOARD FEET PER ACRE.

FIR-HEMLOCK: FORESTS IN WHICH EITHER NOBLE FIR, SILVER FIR, ALPINE FIR, SHASTA RED FIR, WHITE FIR, MOUNTAIN HEMLOCK (OR, OCCASIONALLY, WESTERN HEMLOCK), OR ANY COMBINATION OF THESE SPECIES COMPOSES AT LEAST 50 PERCENT OF THE VOLUME OF THE STAND. THIS TYPE IS CHARACTERISTIC OF THE UPPER SLOPES OF THE CASCADE RANGE. TWO SIZE CLASSES ARE RECOGNIZED.

23. FIR-HEMLOCK, LARGE: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES 12 INCHES OR MORE IN DBH AND PHYSICALLY SUITABLE FOR SAWLOGS. (MATURE STANDS NOT SUITABLE FOR SAWLOGS ARE ORDINARILY INCLUDED IN THE SUBALPINE TYPE.)

24. FIR-HEMLOCK, SMALL: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE LESS THAN 12 INCHES IN DBH, USUALLY YOUNG TREES ON OLD BURNS.

LODGEPOLE PINE: FORESTS CONTAINING AT LEAST 50 PERCENT, BY VOLUME, OF LODGEPOLE PINE, OFTEN ALMOST PURE. THREE SIZE CLASSES ARE RECOGNIZED.

25. LODGEPOLE PINE, 12 INCHES ARE LARGER DBH: FORESTS IN WHICH 50 PERCENT OR MORE OF THE DOMINANT TREES ARE 12 INCHES OR MORE IN DBH.

26. LODGEPOLE PINE, 6-10 INCHES DBH: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE FROM 6 TO 10 INCHES IN DBH.

26A. LODGEPOLE PINE, LESS THAN 6 INCHES DBH: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE LESS THAN 6 INCHES IN DBH.

PINE MIXTURE: MIXED FORESTS OF WHICH PONDEROSA PINE CONSTITUTES ABOUT 20 TO 50 PERCENT, BY VOLUME, WITH A VARIABLE QUANTITY OF WESTERN LARCH, WHITE FIR, DOUGLAS FIR, LODGEPOLE PINE, WHITE PINE, OR OTHER SPECIES OR OF ANY COMBINATION OF THESE SPECIES. CHARACTERISTIC OF NORTH SLOPES AND COOLER BASINS. TWO SIZE CLASSES ARE RECOGNIZED.

27. PINE MIXTURE, LARGE: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES 12 INCHES OR MORE IN DBH AND IN WHICH NO MATERIAL QUANTITY OF CUTTING HAS BEEN DONE.

28. PINE MIXTURE, SMALL: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE LESS THAN 12 INCHES IN DBH.

UPPER-SLOPE MIXTURE: MIXED FORESTS ORDINARILY ABOVE THE PONDEROSA PINE ZONE, NEVER CONTAINING MORE THAN A NEGLIGIBLE QUANTITY OF THAT SPECIES. CHARACTERISTIC OF THE COLDER, MOISTER SITES. CONTAINS VARIABLE PROPORTIONS OF LARCH, WHITE FIR, ALPINE FIR, DOUGLAS FIR, ENGELMANN SPRUCE, LODGEPOLE PINE, WHITE PINE, AND OCCASIONALLY OTHER SPECIES. WHERE ENGELMANN SPRUCE, WHITE PINE, OR LARCH FORMS 50 PERCENT OR MORE OF THE STAND, BY VOLUME, MAPPED AS A SEPARATE SUBTYPE AND DESIGNATED BY ADDING SPECIES SYMBOL TO TYPE NUMBER, E.G., 27.5 ES. TWO SIZE CLASSES ARE RECOGNIZED.

27.5 UPPER-SLOPE MIXTURE, LARGE: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES 12 INCHES OR MORE IN DBH.

28.5 UPPER-SLOPE MIXTURE, SMALL: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE LESS THAN 12 INCHES IN DBH.

WHITE FIR: FORESTS CONTAINING 50 PERCENT OR MORE, BY VOLUME, OF ABIES GRANDIS OR A. CONCOLOR. USUALLY OCCUR WITHIN THE RANGE OF PONDEROSA PINE.

29. WHITE FIR, LARGE: FORESTS IN WHICH MOST OF THE VOLUME IS IN TREES 12 INCHES OR MORE IN DBH (MORE THAN ABOUT 150 YEARS OLD).

30. WHITE FIR, SMALL: FORESTS IN WHICH MOST OF THE DOMINANT TREES ARE LESS THAN 12 INCHES IN DBH (UNDER ABOUT 150 YEARS OLD).

HARDWOOD: FORESTS IN WHICH MAPLE, ASPEN, COTTONWOOD, ETC. PREDOMINATE; PURE OR IN MIXTURE. (DOES NOT TAKE PRECEDENCE OVER OAK WOODLAND.)

31. HARDWOOD: FORESTS IN WHICH MOST OF THE TREES ARE LESS THAN 12 INCHES IN DBH.

31.5 HARDWOOD: FORESTS IN WHICH MOST OF THE TREES ARE 12 INCHES OR MORE IN DBH.

33. SUBALPINE: FORESTS AT UPPER LIMITS OF TREE GROWTH, USUALLY UNMERCHANTABLE BECAUSE OF POOR FORM AND SMALL SIZE. PRINCIPAL COMPONENTS ARE ALPINE FIR, MOUNTAIN HEMLOCK, SHASTA RED FIR, LODGEPOLE PINE, WHITEBARK PINE, WESTERN WHITE PINE, AND ALPINE LARCH. USUALLY INTERSPERSED WITH MEADOWS AND GLADES. NO VOLUME IS RECORDED FOR THIS TYPE.

NONRESTOCKED CUTOVER: LOGGED AREAS THAT HAVE NOT SATISFACTORILY RESTOCKED (ARE LESS THAN 10 PERCENT STOCKED) OR THAT DO NOT SUPPORT A RESIDUAL STAND OF 1,000 BOARD FEET PER ACRE, AND THAT ARE NOT PUT TO OTHER USE.

35A. AREAS CUT SINCE BEGINNING OF 1920.

35B. AREAS AS CUT BEFORE 1920.

37. DEFORESTED BURNS: LANDS NOT CUT OVER ON WHICH THE STAND HAS BEEN KILLED BY FIRE, AND THAT HAVE NOT RESTOCKED. THE REMAINING GREEN TIMBER, IF ANY, IS NOT LOGGABLE. AREAS DEFORESTED BY INSECTS ARE DESIGNATED BY 37B; AREAS DEFORESTED BY WIND THROW ARE DESIGNATED BY 37W.

38. NONCOMMERCIAL ROCKY AREAS: AREAS WITHIN THE RANGE OF COMMERCIAL TIMBER BELOW THE LIMITS OF THE SUBALPINE TYPE THAT ARE TOO ROCKY, TOO STEEP, OR TOO STERILE TO PRODUCE A STAND OF COMMERCIAL SIZE, DENSITY, AND QUALITY. THE TIMBER MAY BE OF ANY SPECIES; IT IS NOT, AND IS NOT LIKELY TO BE, OF COMMERCIAL VALUE, BECAUSE OF DIFFICULT LOGGING CONDITIONS, LOW QUALITY, POOR FORM, AND LOW VOLUME. ORDINARILY THE STAND AVERAGES LESS THAN 5,000 BOARD FEET PER ACRE UNLESS OF PONDEROSA PINE, IN WHICH CASE IT AVERAGES LESS THAN 2,000 BOARD FEET PER ACRE. NO VOLUME IS RECORDED FOR THIS TYPE. THIS TYPE DOES NOT INCLUDE UPPER PORTIONS OF VALLEYS OR HIGHER SLOPES THAT ARE NOW INACCESSIBLE BUT ARE POTENTIALLY LOGGABLE.

PLATE I

TYPE 20, PONDEROSA PINE, LARGE, CONTAINING SOME WESTERN LARCH AND DOUGLAS FIR

TYPE 21, PONDEROSA PINE, SMALL

TYPE 22, PONDEROSA PINE, SEEDLINGS, SAPLINGS, AND POLES ON CUT-OVER LAND

PLATE 2

TYPE 27½, UPPER-SLOPE MIXTURE, LARGE, COMPOSED OF WESTERN LARCH, DOUGLAS FIR, AND LOWLAND WHITE FIR

TYPE 28½, UPPER-SLOPE MIXTURE, SMALL, COMPOSED OF WESTERN LARCH, DOUGLAS FIR, AND LODGEPOLE PINE

TYPE 26, LODGEPOLE PINE, MEDIUM

TYPE 5A, DENSE JUNIPER

FOREST STATISTICS FOR THE STATE OF OREGON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 1.—VOLUME OF SAW TIMBER,[1/] BY SPECIES AND BY OWNERSHIP CLASS
THOUSANDS OF BOARD FEET, LOG SCALE, SCRIBNER RULE

SURVEY SYMBOL	SPECIES	PRIVATE	STATE		COUNTY	MUNICIPAL	INDIAN, TRIBAL AND TRUST ALLOTMENTS	FEDERAL						TOTAL
			AVAILABLE FOR CUTTING	RESERVED FROM CUTTING				REVESTED O. AND C. LAND GRANT	PUBLIC DOMAIN, AVAILABLE FOR CUTTING	RAILROAD SELECTION PENDING	RESERVED FROM CUTTING[2/]	NATIONAL FOREST AVAILABLE FOR CUTTING	NATIONAL FOREST RESERVED FROM CUTTING	
Y	PONDEROSA PINE	23,230,582	129,534	320	286,086	7,601	9,670,196	143,410	636,193	150,317	168,248	30,839,716	172,820	65,435,023
SP	SUGAR PINE	386,047	5,810				179,793	34,838	260		492	128,660	629	736,529
W	WESTERN WHITE PINE	13,379	208		35		10,464	7,050	14		6,629	297,571	24,408	359,758
LP	LODGEPOLE PINE	79,431	1,301		787	4	6,464	450	2,749	20	30,834	538,890	30,288	691,218
DF	DOUGLAS FIR	1,853,267	18,933		37,862	7,398	534,605	60,973	40,101		4,197	5,117,666	92,704	7,767,706
C	WESTERN RED CEDAR	128					57					5,238	3	5,426
YC	ALASKA CEDAR	8										434		442
IC	INCENSE CEDAR	120,305	1,125		299		47,353	972	689		552	49,640	651	221,586
H	WESTERN HEMLOCK	696					6,624				5,070	208,285	4,502	225,177
MH	MOUNTAIN HEMLOCK	7,080			1,925		92,473				166,722	1,282,452	164,629	1,715,281
WF	WHITE AND LOWLAND WHITE FIR	1,563,545	11,292		19,082	3,902	417,337	45,012	13,778	58	22,078	3,149,452	61,842	5,307,378
NF	NOBLE AND SHASTA RED FIR	73,375					47,682	69,029	3,330		198,590	735,612	123,058	1,250,676
A	SILVER FIR						591					13,546	16,750	30,887
AF	ALPINE FIR	11,158			116	665	947		9			147,899	8,212	169,006
WL	WESTERN LARCH	615,257	4,095		22,947	1,547	23,631		16,481			2,465,525	30,658	3,180,141
ES	ENGELMANN SPRUCE	70,964	480		1,633	834	12,119		1,592		97	448,135	29,076	564,930
BC	NORTHERN BLACK COTTONWOOD	11,516	10		15	15	2,952		146			2,317		16,971
ASP	ASPEN	1,715										40		1,755
	TOTAL	28,038,453	172,788	320	370,787	21,966	11,053,288	361,734	715,342	150,395	603,509	45,431,078	760,230	87,679,890

1/ TREES 12 INCHES AND MORE IN D.B.H. 2/ CRATER LAKE NATIONAL PARK

FOREST STATISTICS FOR THE STATE OF OREGON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 2.—AREA, IN ACRES, OF ALL FOREST COVER TYPES, BY OWNERSHIP CLASS

SURVEY TYPE NO.	TYPE DEFINITION	PRIVATE	STATE		COUNTY	MUNICIPAL	INDIAN, TRIBAL AND TRUST ALLOTMENTS	FEDERAL						TOTAL
			AVAILABLE FOR CUTTING	RESERVED FROM CUTTING				REVESTED O. AND C. LAND GRANT	PUBLIC DOMAIN, AVAILABLE FOR CUTTING	RAILROAD SELECTION PENDING	RESERVED FROM CUTTING[1]	NATIONAL FOREST AVAILABLE FOR CUTTING	NATIONAL FOREST RESERVED FROM CUTTING	
	WOODLAND:													
4	OAK: FOREST CONTAINING 60% OR MORE OF OAK	28,880	1,990		1,040	545		400	1,215			2,125		36,195
5A	DENSE JUNIPER: JUNIPER (OR MOUNTAIN MAHOGANY) FOREST OCCUPYING 10% OR MORE OF THE AREA	127,110	8,270	40	30,830	50	1,000		247,065			4,775		419,140
5B	SCATTERED JUNIPER: JUNIPER (OR MOUNTAIN MAHOGANY) FOREST OCCUPYING 5 TO 10% OF THE AREA	438,210	30,005	70	47,410	210	17,870	520	521,210	155		61,340		1,117,000
5 ½	PONDEROSA PINE WOODLAND: SCATTERED STANDS OF PONDEROSA PINE ON UNFAVORABLE SITES	192,720	4,480	20	6,740	70	48,675	1,480	56,265	295		174,800		485,545
	PONDEROSA PINE: FOREST CONTAINING 50% OR MORE OF PONDEROSA PINE													
20	PONDEROSA PINE, LARGE: FOREST CONTAINING 50 TO 80% OF PONDEROSA PINE, MORE THAN 22" D.B.H.	232,130	1,800		5,755	115	79,725	6,085	7,220		1,505	508,515	3,710	846,640
20.5	PURE PONDEROSA PINE, LARGE: FOREST CONTAINING 80% OR MORE OF PONDEROSA PINE, MORE THAN 22" D.B.H.	1,773,320	11,120	50	26,760	395	588,900	4,505	71,770	11,300	5,645	2,289,795	9,605	4,793,165
20A	PONDEROSA PINE-SUGAR PINE MIXTURE, LARGE: FOREST CONTAINING 50% OR MORE OF PONDEROSA PINE AND 20% OR MORE OF SUGAR PINE, MORE THAN 22" D.B.H.	11,745					9,750	875				7,760		30,130
21	PONDEROSA PINE, SMALL: 12 TO 22" D.B.H.	257,485	2,055	35	8,910		150,455	435	8,325	1,110	260	250,750	195	680,015
22	PONDEROSA PINE SEEDLINGS, SAPLINGS, AND POLES: LESS THAN 12" D.B.H.	519,610	4,615	10	11,305	860	4,050	4,050	15,765	185	100	231,705	260	792,560
	PINE MIXTURE: MIXED FOREST CONTAINING 20 TO 50% OF PONDEROSA PINE													
20B	SUGAR PINE MIXTURE, LARGE: FOREST CONTAINING 20% OR MORE OF SUGAR PINE AND LESS THAN 50% OF PONDEROSA PINE, MORE THAN 22" D.B.H.	23,555	625				190	4,595			25	6,665		35,655
27	PINE MIXTURE, LARGE: 12" OR MORE D.B.H.	107,695	810		2,985	630	22,565	3,825	3,205		1,480	302,210	4,215	449,620
28	PINE MIXTURE, SMALL: LESS THAN 12" D.B.H.	97,865	1,180		1,635	535	6,905		1,695			36,605	575	146,995
	DOUGLAS FIR: FOREST CONTAINING 60% OR MORE OF DOUGLAS FIR													
6	DOUGLAS FIR, LARGE OLD GROWTH: MORE THAN 40" D.B.H.	775	30					595				3,095	1,210	5,705
7	DOUGLAS FIR, SMALL OLD GROWTH: 22 TO 40" D.B.H.	9,340			230		6,260	3,720	55		65	38,580	1,860	60,110
8	DOUGLAS FIR, LARGE SECOND GROWTH: 22 TO 40" D.B.H.	5,460			160				190			10,910	190	16,910
9A	DOUGLAS FIR, LARGE POLES: 12 TO 20" D.B.H.	4,325	100		65		100		140			28,895	35	33,660
9B	DOUGLAS FIR, SMALL POLES: 6 TO 10" D.B.H.	6,610	145		90		120		1,140			27,940	100	36,145
10	DOUGLAS FIR SEEDLINGS AND SAPLINGS: LESS THAN 6" D.B.H.	3,725			5		295	20	55		40	2,980		7,120
	WESTERN RED CEDAR: FOREST CONTAINING 40% OR MORE OF WESTERN RED CEDAR													
17	WESTERN RED CEDAR, LARGE: 24" OR MORE D.B.H.											180		180
	FIR-MOUNTAIN HEMLOCK: FOREST CONTAINING 50% OR MORE OF NOBLE FIR, SHASTA RED FIR, SILVER FIR, ALPINE FIR, OR MOUNTAIN HEMLOCK, OR OF ANY COMBINATION OF THESE SPECIES													
23	FIR-MOUNTAIN HEMLOCK, LARGE: 12" OR MORE D.B.H.	5,070			275		13,440	5,470	215		43,710	239,195	42,780	350,155
24	FIR-MOUNTAIN HEMLOCK, SMALL: LESS THAN 12" D.B.H.	165					6,225	900	105		1,010	18,585	3,010	30,000
	UPPER-SLOPE MIXTURE: MIXED FOREST OF VARIOUS COMBINATIONS OF WESTERN LARCH, DOUGLAS FIR, ENGELMANN SPRUCE, THE BALSAM FIRS, MOUNTAIN HEMLOCK, LODGEPOLE PINE, WESTERN WHITE PINE, AND OCCASIONALLY OTHER SPECIES													
27½	UPPER-SLOPE MIXTURE, LARGE: 12" OR MORE D.B.H.	107,650	965		4,325	640	5,195		72,330			608,990	7,925	808,020
28½	UPPER-SLOPE MIXTURE, SMALL: LESS THAN 12" D.B.H.	74,720	385		1,065	185	10,170		1,335			147,585	10,075	245,520
	WHITE FIR OR LOWLAND WHITE FIR: FOREST CONTAINING 50% OR MORE OF WHITE FIR OR LOWLAND WHITE FIR													
29	WHITE FIR OR LOWLAND WHITE FIR, LARGE: 12" OR MORE D.B.H.	23,180	195		810		1,590	1,195	500		675	75,960	255	104,360
30	WHITE FIR OR LOWLAND WHITE FIR, SMALL: LESS THAN 12" D.B.H.	1,140			150				45		45	2,075		3,455
	LODGEPOLE PINE: FOREST CONTAINING 50% OR MORE OF LODGEPOLE PINE													
25	LODGEPOLE PINE, LARGE: 12" OR MORE D.B.H.	3,530			160		235		165		4,795	48,075	595	57,555
26	LOOGEPOLE PINE, MEDIUM: 6 TO 10" D.B.H.	187,560	1,905		6,550	80	160,985	1,905	53,115	30	45,005	840,700	27,065	1,324,900
26A	LODGEPOLE PINE, SMALL: LESS THAN 6" D.B.H.	34,660	210		1,260	40	22,685		4,795		3,010	167,360	7,065	241,085
	HARDWOODS: FOREST CONTAINING 50% OR MORE OF HARDWOODS													
31.5	HARDWOODS, LARGE: 12" OR MORE D.B.H.	5,945	10				755		135			20		6,865
31	HARDWOODS, SMALL: LESS THAN 12" D.B.H.	5,935	55		30		35		2,750	5		5,270		14,080
33	SUBALPINE: FOREST AT UPPER LIMITS OF TREE GROWTH, USUALLY UNMERCHANTABLE	10,105			175	140	12,015		3,740		24,435	229,445	135,300	415,355
	NONRESTOCKED CUTOVER: LOGGED AREA NOT SATISFACTORILY RESTOCKED AND NOT CARRYING A RESIDUAL STAND OF 1 M OR MORE PER ACRE													
35A	CUT SINCE BEGINNING OF 1920	46,150	280		1,210		50	2,380	795			6,620	40	57,525
35B	CUT BEFORE 1920	6,105			25				175			1,465		7,770
	DEFORESTED AREA: NONRESTOCKED AREA DEFORESTED OTHERWISE THAN BY CUTTING													
37	DEFORESTED BURN	19,505	360		1,400		9,410	1,985	6,060		1,115	40,740	2,550	83,125
37B	AREA ON WHICH STAND WAS KILLED BY INSECTS	150			115				130			640		1,035
38	NONCOMMERCIAL ROCKY AREA	40,895	2,385		1,375	125	2,050	2,555	35,375		1,145	242,140	13,955	342,000
	TOTAL FOREST TYPES	4,413,025	73,975	225	162,845	4,620	1,181,745	47,495	1,117,080	13,080	134,145	6,664,490	272,570	14,085,295
1,1B, and 2	NONFOREST LAND: CULTIVATED, GRASS, SAGEBRUSH, BARRENS, URBAN AREAS, AND UNMEANDERED WATER SURFACES		26,743,105 ACRES OF NONFOREST LAND UNCLASSIFIED BY OWNERSHIP						2,090			1,088,805	53,405	[2]27,887,405
	TOTAL								15,170			7,753,295	325,975	41,972,700

[1] Crater Lake National Park and Upper Klamath Wildlife Refuge. [2] For four counties, and for national forests in all counties, data on area of nonforest land were obtained in the forest survey. For nonforest land outside national forests in the other counties totals were computed by subtracting forest-survey area figures from county area figures issued by the Bureau of the Census.

FOREST STATISTICS FOR THE STATE OF OREGON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 3.—AREA, IN ACRES, OF GENERALIZED FOREST TYPES, BY OWNERSHIP CLASS

TYPE DEFINITION		PRIVATE	STATE		COUNTY	MUNICIPAL	FEDERAL							TOTAL
			AVAILABLE FOR CUTTING	RESERVED FROM CUTTING			INDIAN, TRIBAL AND TRUST ALLOTMENTS	REVESTED O. AND C. LAND GRANT	PUBLIC DOMAIN, AVAILABLE FOR CUTTING	RAILROAD SELECTION PENDING	RESERVED FROM CUTTING[1/]	NATIONAL FOREST AVAILABLE FOR CUTTING	NATIONAL FOREST RESERVED FROM CUTTING	
WOODLAND: OAK AND JUNIPER														
SURVEY TYPES 4, 5A, AND 5B		594,200	40,265	110	79,280	805	18,870	920	769,490	155		68,240		1,572,335
HARDWOODS: COTTONWOOD, ASPEN, AND RED ALDER														
SURVEY TYPES 31 AND 31.5		11,880	65		30		790		2,885	5		5,290		20,945
PONDEROSA PINE AND SUGAR PINE 12" OR MORE D.B.H.														
SURVEY TYPES 5½, 20, 20.5, 20A, 20B, 21 AND 27		2,598,650	20,890	105	51,150	1,210	900,260	21,800	146,785	12,705	8,995	3,540,495	17,725	7,320,770
PONDEROSA PINE AND SUGAR PINE LESS THAN	ON CUTOVER AREAS	560,135	4,385	10	10,960	680	3,210	4,040	9,275			171,440	15	764,150
12" D.B.H.	ON OLD BURNS	57,340	1,410		1,980	715	7,790	10	8,185	185	100	96,870	820	175,405
SURVEY TYPES 22 AND 28	TOTAL	617,475	5,795	10	12,940	1,395	11,000	4,050	17,460	185	100	268,310	835	939,555
CONIFERS 12" OR MORE D.B.H. OTHER THAN PONDEROSA PINE,														
SUGAR PINE, AND LODGEPOLE PINE														
SURVEY TYPES 6, 7, 8, 9A, 17, 23, 27½, AND 29		155,800	1,290		5,865	640	26,585	10,980	73,430		44,450	1,005,805	54,255	1,379,100
CONIFERS LESS THAN 12" D.B.H. OTHER THAN	ON CUTOVER AREAS	60,100	225		940		60		835		20	6,765		68,945
PONDEROSA PINE, SUGAR PINE, AND LODOEPOLE PINE	ON OLD BURNS	26,260	305		370	185	16,750	920	1,845		1,075	192,400	13,185	253,295
SURVEY TYPES 9B, 10, 24, 28½, AND 30	TOTAL	86,360	530		1,310	185	16,810	920	2,680		1,095	199,165	13,185	322,240
LODGEPOLE PINE 12" OR MORE D.B.H.														
SURVEY TYPE 25		3,530			160		235		165		4,795	48,075	595	57,555
LODGEPOLE PINE LESS THAN 12" D.B.H.														
SURVEY TYPES 26 AND 26A		222,220	2,115		7,810	120	183,670	1,905	57,910	30	48,015	1,008,060	34,130	1,565,985
NONCOMMERCIAL AREAS														
SURVEY TYPES 33 AND 38		51,000	2,385		1,550	265	14,065	2,555	39,115		25,580	471,585	149,255	757,355
NONRESTOCKED CUT-OVER AREAS, DEFORESTED BURNS, AND AREAS ON														
WHICH STANDS HAVE BEEN KILLED BY INSECTS														
SURVEY TYPES 35A, 35B, 37, AND 37B		71,910	640		2,750		9,460	4,365	7,160		1,115	49,465	2,590	149,455
TOTAL FOREST TYPES		4,413,025	73,975	225	162,845	4,620	1,181,745	47,495	1,117,080	13,080	134,145	6,664,490	272,570	14,085,295
NONFOREST LAND														
SURVEY TYPES 1, 1B, AND 2					26,743,105 ACRES OF NONFOREST LAND UNCLASSIFIED BY OWNERSHIP					2,090		1,088,805	53,405	[2/] 27,387,405
TOTAL										15,170		7,753,295	325,975	41,972,700

[1/] Crater Lake National Park and Upper Klamath Wildlife Refuge. [2/] For four counties, and for national forests in all counties, data on area of nonforest land were obtained in the forest survey. For nonforest land outside national forests in the other counties, totals were computed by subtracting forest-survey area figures from county area figures issued by the Bureau of the Census.

FOREST STATISTICS FOR THE STATE OF OREGON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 4.-AREA OF FOREST LAND, BY SITE QUALITY

SITE CLASSIFICATION				AREA IN PERCENTAGE OF—		
TYPE [1/]	SITE QUALITY CLASS		AREA IN ACRES	COMMERCIAL CONIFEROUS FOREST LAND	TOTAL FOREST LAND	TOTAL AREA
COMMERCIAL CONIFEROUS		II	8,913	0.1	0.1	
		III	504,928	5.0	3.6	1.2
	PONDEROSA PINE	IV	5,987,808	58.9	42.5	14.3
		V	1,787,921	17.5	12.7	4.3
		VI	136,477	1.3	0.9	0.3
		TOTAL	8,426,047	82.8	59.8	20.1
		III	35,245	0.3	0.3	0.1
		IV	283,543	2.8	2.0	0.7
	DOUGLAS FIR	V	1,433,520	14.1	10.2	3.4
		TOTAL	1,752,308	17.2	12.5	4.2
TOTAL COMMERCIAL CONIFEROUS			10,178,355	100.0	72.3	24.3
LODGEPOLE PINE[2/]			1,554,860		11.0	3.7
JUNIPER AND MOUNTAIN MAHOGANY			1,537,455		10.9	3.7
NONCOMMERCIAL ROCKY			342,030		2.4	0.8
SUBALPINE			415,455		3.0	1.0
OAK			36,195		0.3	
HARDWOOD			20,945		0.1	0.1
TOTAL OTHER THAN COMMERCIAL CONIFEROUS			3,906,940		27.7	9.3
ALL FOREST TYPES			14,085,295		100.0	33.6
NONFOREST TYPES			[3/]27,887,405			66.4
GRAND TOTAL			41,972,700			100.0

[1/] DEFORESTED AREAS, TYPES 35A, 35B, 37, AND 37B, WERE CLASSIFIED AS TO SITE ON THE BASIS OF ORIGINAL TYPE.

[2/] EXCLUDES 72,420 ACRES OF LODGEPOLE PINE TYPES CLASSIFIED AS COMMERCIAL CONIFEROUS.

[3/] FOR FOUR COUNTIES, AND FOR NATIONAL FORESTS IN ALL COUNTIES, DATA ON AREA OF NONFOREST LAND WERE OBTAINED IN THE FOREST SURVEY. FOR NONFOREST LAND OUTSIDE NATIONAL FORESTS IN THE OTHER COUNTIES, TOTALS WERE COMPUTED BY SUBTRACTING FOREST-SURVEY AREA FIGURES FROM COUNTY AREA FIGURES ISSUED BY THE BUREAU OF THE CENSUS.

FOREST STATISTICS FOR THE STATE OF WASHINGTON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 5.—VOLUME OF SAW TIMBER, [1] BY SPECIES AND BY OWNERSHIP CLASS
THOUSANDS OF BOARD FEET, LOG SCALE, SCRIBNER RULE

SURVEY SYMBOL	SPECIES	STATE					FEDERAL						
										NATIONAL FOREST			
		PRIVATE	AVAILABLE FOR CUTTING	RESERVED FROM CUTTING	COUNTY	MUNICIPAL	INDIAN, TRIBAL AND TRUST ALLOTMENTS	PUBLIC DOMAIN, AVAILABLE FOR CUTTING	RAILROAD SELECTION PENDING	RESERVED FROM CUTTING[2]	AVAILABLE FOR CUTTING	RESERVED FROM CUTTING	TOTAL
Y	PONDEROSA PINE	5,282,183	1,640,338	11	197,275	141	5,500,946	186,578	194,956	2,433	4,820,401	106,998	17, 932,260
W	WESTERN WHITE PINE	405,902	32,348	150	5,826		37,534	4,349	31,994		482,153	34,450	1,034,706
LP	LODGEPOLE PINE	79,325	23,936		4,094		26,635	5,630	10,866		250,981	74,282	475,749
DF	DOUGLAS FIR	3,439,150	777,011	18	244,713		1,512,128	187,748	262,014	190	5,197,042	307,187	11,927,201
C	WESTERN RED CEDAR	92,295	4,108	7	1,914		13,269	1,476	18,055		296,641	12,044	439,809
YC	ALASKA CEDAR	204	89				827		1,902		23,258	3,255	29,535
H	WESTERN HEMLOCK	323,035	10,041	27	5,920		762	2,658	66,468		634,092	80,801	1,123,804
MH	MOUNTAIN HEMLOCK	78,424	2,459				115,379		102,186		665,663	58,115	1,022,226
WF	WHITE AND LOWLAND WHITE FIR	391,229	49,657	81	4,674		198,809	4,401	26, 269		492,052	30,362	1,197,534
NF	NOBLE FIR	11,525	888						6,140		17,042	35	35,630
A	SILVER FIR	373,986	9,063		80			45	217,574		1,615,648	259,385	2,475,781
AF	ALPINE FIR	27,334	5,790				114,227	5	20,757		254,098	107,025	529,236
WL	WESTERN LARCH	1,063,719	314,652	18	134,356		688,346	152,581	46,714		2,021,221	83,757	4,505,364
ES	ENGELMANN SPRUCE	81,288	42,635		4,521		83,912	1,527	38,973		955,337	671,247	1,879,440
RA	RED ALDER	76						25					101
OM	BIGLEAF MAPLE	5									16		21
BC	NORTHERN BLACK COTTONWOOD	32,164	737		47		11,332	330	745		15,910	2,396	63,661
ASP	ASPEN	577									90		667
	TOTAL	11,682,421	2,913,752	312	603,420	141	8,304,106	547,353	1,045,613	2,623	17,741,645	1,831,339	44,672,725

[1] Trees 12 inches and more in d.b.h. [2] Fort George Wright, Spokane County

FOREST STATISTICS FOR THE STATE OF WASHINGTON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY

TABLE 6.—AREA, IN ACRES, OF ALL FOREST COVER TYPES, BY OWNERSHIP CLASS

SURVEY SYMBOL	TYPE DEFINITION	STATE					FEDERAL					TOTAL
										NATIONAL FOREST		
		PRIVATE	AVAILABLE FOR CUTTING	RESERVED FROM CUTTING	COUNTY	MUNICIPAL	INDIAN, TRIBAL AND TRUST ALLOTMENTS	PUBLIC DOMAIN, AVAILABLE FOR CUTTING	RAILROAD SELECTION PENDING	RESERVED FROM CUTTING[1]	AVAILABLE FOR CUTTING	RESERVED FROM CUTTING	
	WOODLAND:												
4	OAK: FOREST CONTAINING 80% OR MORE OF OAK	21,990	1,280		1,025		4,055	1,835					30,185
5B	SCATTERED JUNIPER: JUNIPER (OR MOUNTAIN MAHOGANY) FOREST OCCUPYING 5 TO 10% OF THE AREA	185	60										245
5½	PONDEROSA PINE WOODLAND: SCATTERED STANDS OF PONDEROSA PINE ON UNFAVORABLE SITES	143,730	22,095		6,525	25	87,440	24,200	665		49,910	60	334,650
	PONDEROSA PINE: FOREST CONTAINING 50% OR MORE OF PONDEROSA PINE												
20	PONDEROSA PINE, LARGE: FOREST CONTAINING 50 TO 80% OF PONDEROSA PINE, MORE THAN 22" D.B.H.	153,950	45,975		9,685		241,040	9,715	12,650		224,860	7,875	705,750
20.5	PURE PONDEROSA PINE, LARGE: FOREST CONTAINING 80% OR MORE OF PONDEROSA PINE, MORE THAN 22" D.B.H.	354,225	128,165		7,885	10	424,695	12,715	12,970		321,580	2,715	1,264,960
21	PONDEROSA PINE, SMALL: 12 TO 22" D.B.H.	600,180	59,710		39,215	60	182,180	16,255	340	2,230	64,355	110	964,635
22	PONDEROSA PINE SEEDLINGS, SAPLINGS, AND POLES: LESS THAN 12" D.B.H.	560,075	42,420		42,445	85	49,100	15,685	385	455	22,415	150	733,215
	PINE MIXTURE: MIXED FOREST CONTAINING 20 TO 50% CF PONDEROSA PINE												
27	PINE MIXTURE, LARGE: 12" OR MORE D.B H.	108,610	18,880		9,270		117,150	6,185	4,930		154,015	6,160	425,200
28	PINE MIXTURE, SMALL: LESS THAN 12" D.B.H.	154,010	12,665		14,520		24,460	6,775	740		22,000	130	235,300
	DOUGLAS FIR: FOREST CONTAINING 60% OR MORE OF DOUGLAS FIR												
6	DOUGLAS FIR, LARGE OLD GROWTH: MORE THAN 40" D.B.H.	330							100		470	90	990
7	DOUGLAS FIR, SMALL OLD GROWTH: 22 TO 40" D.B.H.	84,255	19,640		4,560		14,840	4,830	8,570		159,965	9,305	305,965
8	DOUGLAS FIR, LARGE SECOND GROWTH: 22 TO 40" D.B.H	53,320	19,205		8,710		16,985	6,925	2,405		49,810	600	157,960
9A	DOUGLAS FIR, LARGE POLES: 12 TO 20" D.B.H.	32,410	3,580		6,230		4,255	3,065	1,455		65,475	305	116,775
9B	DOUGLAS FIR, SMALL POLES: 6 TO 10" D.B.H.	35,785	4,110		3,380		2,000	6,630	2,605		51,465	385	106,360
10	DOUGLAS FIR SEEDLINGS AND SAPLINGS: LESS THAN 6" D.B.H.	33,860	6,320		5,055		1,065	4,700	2,560		24,380	1,130	79,070
	WESTERN RED CEDAR: FOREST CONTAINING 40% OR MORE OF WESTERN RED CEDAR												
17	WESTERN RED CEDAR, LARGE: MORE THAN 24" D.B.H.	2,415	50				290	10	125		10,595	210	13,695
19A	WESTERN RED CEDAR POLES: 12 TO 24" D.B.H.	1,155	175					125			1,785		3,240
19B	WESTERN RED CEDAR SEEDLINGS AND SAPLINGS: LESS THAN 12" D.B.H.	440			105			130			650		1,325
	FIR-MOUNTAIN HEMLOCK: FOREST CONTAINING 50% OR MORE OF NOBLE FIR, SHASTA RED FIR, SILVER FIR, ALPINE FIR, OR MOUNTAIN HEMLOCK, OR OF ANY COMBINATION OF THESE SPECIES												
23	FIR-MOUNTAIN HEMLOCK, LARGE: 12" OR MORE D.B.H.	35,680	1,105				17,475		25,035		163,660	18,065	261,020
24	FIR-MOUNTAIN HEMLOCK, SMALL: LESS THAN 12" D.B.H.	11,980	65				5,430		6,260		46,715	3,860	74,310
	UPPER-SLOPE MIXTURE: MIXED FOREST OF VARIOUS COMBINATIONS OF WESTERN LARCH, DOUGLAS FIR, ENGELMANN SPRUCE, THE BALSAM FIRS, MOUNTAIN HEMIOCK, LODGEPOLE PINE, WESTERN WHITE PINE, AND OCCASIONALLY OTHER SPECIES												
27½	UPPER-SLOPE MIXTURE, LARGE: LESS THAN 12" OR MORE D.B.H.	189,510	55,845	15	23,045		104,695	25,580	14,540		511,170	86,730	1,011,130
28½	UPPER-SLOPE MIXTURE, SMALL: LESS THAN 12" D.B.H.	455,635	52,610	805	102,970		62,585	80,600	7,845		406,260	22,255	1,191,565
	WHITE FIR OR LOWLAND WHITE FIR: FOREST CONTAINING 50% OR MORE OF WHITE FIR OR LOWLAND WHITE FIR												
29	WHITE FIR OR LOWLAND WHITE FIR, LARGE: 12" OR MORE D.B.H.	3,730	5		65		1,895	50	450		8,650	30	14,875
30	WHITE FIR OR LOWLAND WHITE FIR, SMALL: LESS THAN 12" D.B.H.	1,890	880		380			60			690		3,900
	LODGEPOLE PINE: FOREST CONTAINING 50% OR MORE OF LODGEPOLE PINE												
25	LODGEPOLE PINE, LARGE: 12" OR MORE D.B.H.	4,095	1,715		15		3,825	330	715		14,960	3,500	29,155
26	LODGEPOLE PINE, MEDIUM: 6 TO 10" D.B.H.	21,275	36,060		1,450		23,010	2,420	1,885		181,765	20,095	287,960
26A	LODGEPOLE PINE, SMALL: LESS THAN 6" D.B.H.	54,110	13,070	160	7,865		28,945	4,260	1,370		146,900	37,590	294,270
	HARDWOODS: FOREST CONTAINING 50% OR MORE OF HARDWOODS												
31.5	HARDWOODS, LARGE: 12" OR MORE D.B.H.	8,300	70		15		2,445	115	25		835		11,805
31	HARDWOODS, SMALL: LESS THAN 12" D.B.H.	5,300	215		15		1,050	10	75		645		7,310
33	SUBALPINE: FOREST AT UPPER LIMITS OF TREE GROWTH, USUALLY UNMERCHANTABLE	36,105	10,160	700	945		14,320	4,040	49,940		567,850	181,405	865,465
	NONRESTOCKED CUTOVER: LOGGED AREA NOT SATISFACTORILY RESTOCKED ANO NOT CARRYING A RESIDUAL STAND OF 1 M OR MORE PER ACRE												
35A	CUT SINCE BEGINNING OF 1920	67,220	9,935		14,620		1,170	5,435	195		7,370		105,945
35B	CUT BEFORE 1920	31,935	1,140		3,905		55	345			220		37,600
	DEFORESTED AREA: NONRESTOCKED AREA DEFORESTED OTHERWISE THAN BY CUTTING												
37	DEFORESTED BURN	75,700	16,635		26,380		17,655	31,145	4,045		64,320	5,205	241,085
38	NONCOMMERCIAL ROCKY AREA	89,340	34,070		7,500	35	62,380	35,670	27,805		419,640	51,345	727,785
	TOTAL FOREST TYPES	3,432,730	617,910	1,680	347,780	215	1,516,490	309,840	190,685	2,685	3,765,380	459,305	10,644,700
1,1B, AND 2	NONFOREST LAND: CULTIVATED, GRASS, SAGEBRUSH, BARRENS, URBAN AREAS, AND UNMEANDERED WATER SURFACES			16,096,930	ACRES OF NONFOREST LAND UNCLASSIFIED BY OWNERSHIP						277,495	95,545	16,469,970
	TOTAL										4,042,875	554,850	27,114,670

[1] FORT GEORGE WRIGHT, SPOKANE COUNTY.

FOREST STATISTICS FOR THE STATE OF WASHINGTON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 7. —AREA, IN ACRES, OF GENERALIZED FOREST TYPES, BY OWNERSHIP CLASS

TYPE DEFINITION		PRIVATE	STATE		COUNTY	MUNICIPAL	INDIAN, TRIBAL AND TRUST ALLOTMENT	FEDERAL					TOTAL
			AVAILABLE FOR CUTTING	RESERVED FROM CUTTING				PUBLIC DOMAIN, AVAILABLE FOR CUTTING	RAILROAD SELECTION PENDING	RESERVED FROM CUTTING[1]	NATIONAL FOREST: AVAILABLE FOR CUTTING	NATIONAL FOREST: RESERVED FROM CUTTING	
WOODLAND: OAK AND JUNIPER SURVEY TYPES 4 AND 5B		22,175	1,340		1,025		4,055	1,835					30,430
HARDWOODS: COTTONWOOD, RED ALDER, AND ASPEN SURVEY TYPES 31 AND 31.5		13,600	285		30		3,495	125	100		1,480		19,115
PONDEROSA PINE 12" OR MORE D.B.H. SURVEY TYPES 5½, 20, 20.5, 21, AND 27		1,360,695	274,825		72,580	95	1,052,505	69,070	31,555	2,230	814,720	16,920	3,695,195
PONDEROSA PINE LESS THAN 12" D.B.H. SURVEY TYPES 22 AND 28	ON CUTOVER AREAS	585,900	43,750		45,355	85	44,330	12,875	300	455	18,815	110	751,975
	ON OLD BURNS	128,185	11,335		11,610		29,230	9,585	825		25,600	170	216,540
	TOTAL	714,085	55,085		56,965	85	73,560	22,460	1,125	455	44,415	280	968,515
CONIFERS 12" OR MORE IN D.B.H. OTHER THAN PONDEROSA PINE AND LODGEPOLE PINE SURVEY TYPES 6, 7, 8, 9A, 17, 19A, 23, 27½, AND 29		402,805	99,605	15	42,610		160,435	40,585	52,680		971,815	115,335	1,885,885
CONIFERS LESS THAN 12" D.B.H. OTHER THAN PONDEROSA PINE AND LODGEPOLE PINE SURVEY TYPES 9B, 10, 19B, 24, 28½, AND 30	ON CUTOVER AREAS	259,545	23,995		40,045		1,985	14,085			23,065		362,720
	ON OLD BURNS	280,045	39,990	805	71,845		69,095	78,035	19,270		506,860	27,630	1,093,575
	TOTAL	539,590	63,985	805	111,890		71,080	92,120	19,270		529,925	27,630	1,456,295
LODGEPOLE PINE 12" OR MORE IN D.B.H. SURVEY TYPE 25		4,095	1,715		15		3,825	330	715		14,960	3,500	29,155
LODGEPOLE PINE LESS THAN 12" D.B.H. SURVEY TYPES 26 AND 26A		75,385	49,130	160	9,315		51,955	6,680	3,255		328,665	57,685	582,230
NONCOMMERCIAL AREAS SURVEY TYPES 33 AND 38		125,445	44,230	700	8,445	35	76,700	39,710	77,745		987,490	232,750	1,593,250
NONRESTOCKED CUT-OVER AREAS AND DEFORESTED BURNS SURVEY TYPES 35A, 35B, AND 37		174,855	27,710		44,905		18,880	36,925	4,240		71,910	5,205	384,630
TOTAL FOREST TYPES		3,432,730	617,910	1,680	347,780	215	1,516,490	309,840	190,685	2,685	3,765,380	459,305	10,644,700
NONFOREST LAND SURVEY TYPES 1, 18, AND 2		16,096,930 ACRES OF NONFOREST LAND UNCLASSIFIED BY OWNERSHIP CLASS									277,495	95,545	16,469,970
TOTAL											4,042,875	554,850	27,114,670

[1] Fort George Wright, Spokane County.

FOREST STATISTICS FOR THE STATE OF WASHINGTON EAST OF THE CASCADE RANGE
FROM INVENTORY PHASE OF FOREST SURVEY
TABLE 8–AREA OF FOREST LAND, BY SITE QUALITY

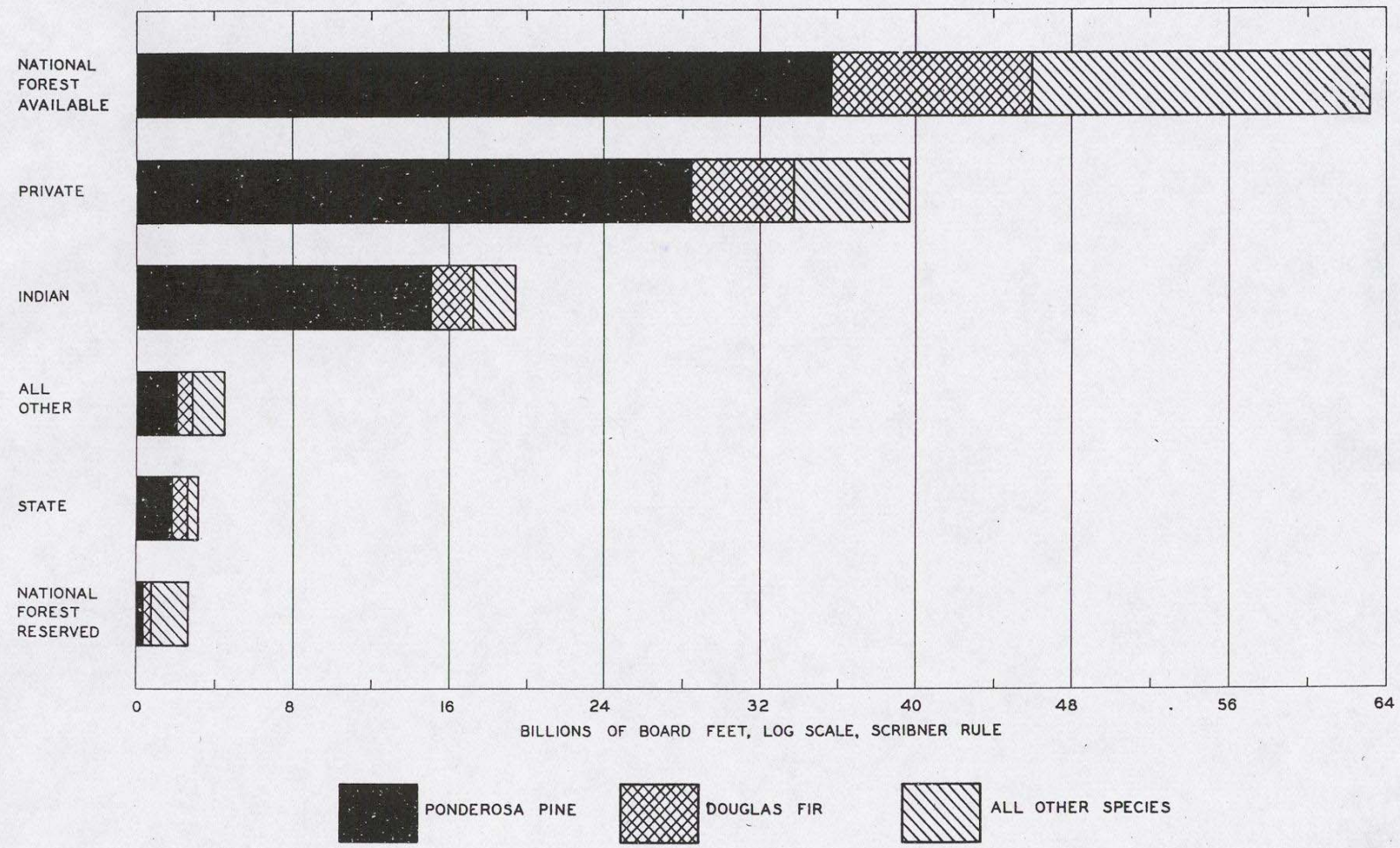
SITE CLASSIFICATION				AREA IN PERCENTAGE OF—		
TYPE [1/]	SITE QUALITY CLASS		AREA IN ACRES	COMMERCIAL CONIFEROUS FOREST LAND	TOTAL FOREST LAND	TOTAL AREA
COMMERCIAL CONIFEROUS		I	560			
	PONDEROSA PINE	II	32,220	0.4	0.3	0.1
		III	493,095	5.8	4.6	1.8
		IV	2,677,420	31.7	25.1	9.9
		V	1,436,140	17.0	13.5	5.3
		VI	134,570	1.6	1.3	0.5
		TOTAL	4,774,005	56.5	44.8	17.6
	DOUGLAS FIR	II	320			
		III	125,160	1.5	1.2	0.5
		IV	1,323,685	15.7	12.4	4.9
		V	2,221,765	26.3	20.9	8.2
		TOTAL	3,670,930	43.5	34.5	13.6
TOTAL COMMERCIAL CONIFEROUS			8,444,935	100.0	79.3	31.2
LODGEPOLE PINE[2/]			546,905		5.1	2.0
JUNIPER			245			
NONCOMMERCIAL ROCKY			727,785		6.9	2.7
SUBALPINE			875,530		8.2	3.2
OAK			30,185		0.3	0.1
HARDWOOD			19,115		0.2	0.1
TOTAL OTHER THAN COMMERCIAL CONIFEROUS			2,199,765		20.7	8.1
ALL FOREST TYPES			10,644,700		100.0	39.3
NONFOREST TYPES			[3/]16,469,970			60.7
GRAND TOTAL			27,114,670			100.0

[1/] DEFORESTED AREAS, TYPES 35A, 35B, AND 37, WERE CLASSIFIED AS TO SITE ON THE BASIS OF ORIGINAL TYPE.
[2/] EXCLUDES 78,830 ACRES OF LODGEPOLE PINE TYPES CLASSIFIED AS COMMERCIAL CONIFEROUS.
[3/] FOR FERRY COUNTY, AND FOR NATIONAL FORESTS IN ALL COUNTIES, DATA ON AREA OF NONFOREST LAND WERE OBTAINED IN THE FOREST SURVEY. FOR NONFOREST LAND OUTSIDE NATIONAL FORESTS IN THE OTHER COUNTIES, TOTALS WERE COMPUTED BY SUBTRACTING FOREST-SURVEY AREA FIGURES FROM COUNTY AREA FIGURES ISSUED BY THE BUREAU OF THE CENSUS.

FOREST STATISTICS FOR EASTERN OREGON AND EASTERN WASHINGTON

FROM INVENTORY PHASE OF FOREST SURVEY

FIGURE 2. SAW-TIMBER VOLUME BY SPECIES AND BY OWNERSHIP CLASS (FROM TABLES 1 & 5)



FOREST STATISTICS FOR EASTERN OREGON AND EASTERN WASHINGTON

FROM INVENTORY PHASE OF FOREST SURVEY

FIGURE 3. OWNERSHIP OF FOREST LAND (FROM TABLES 2 & 6)

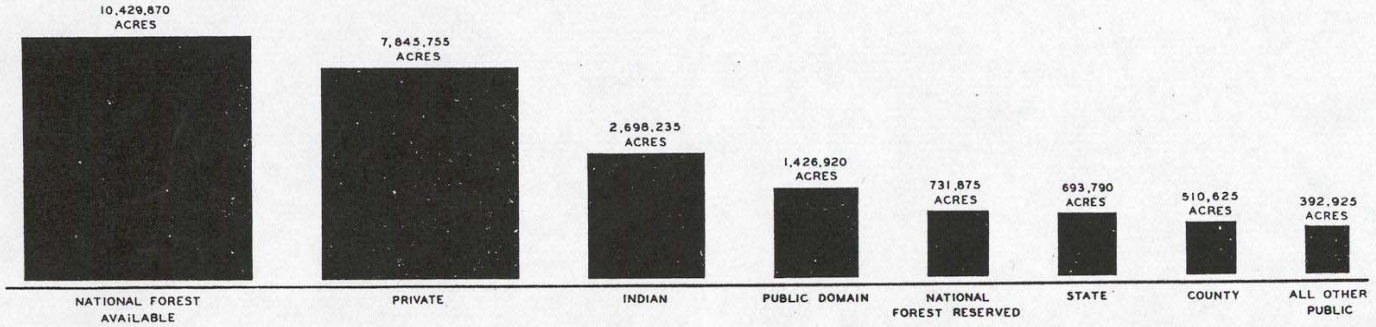
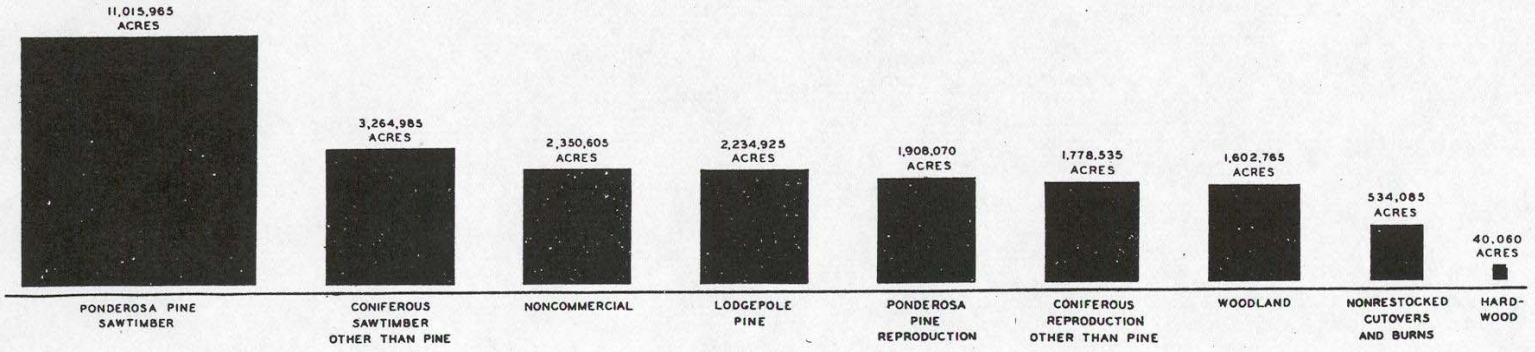
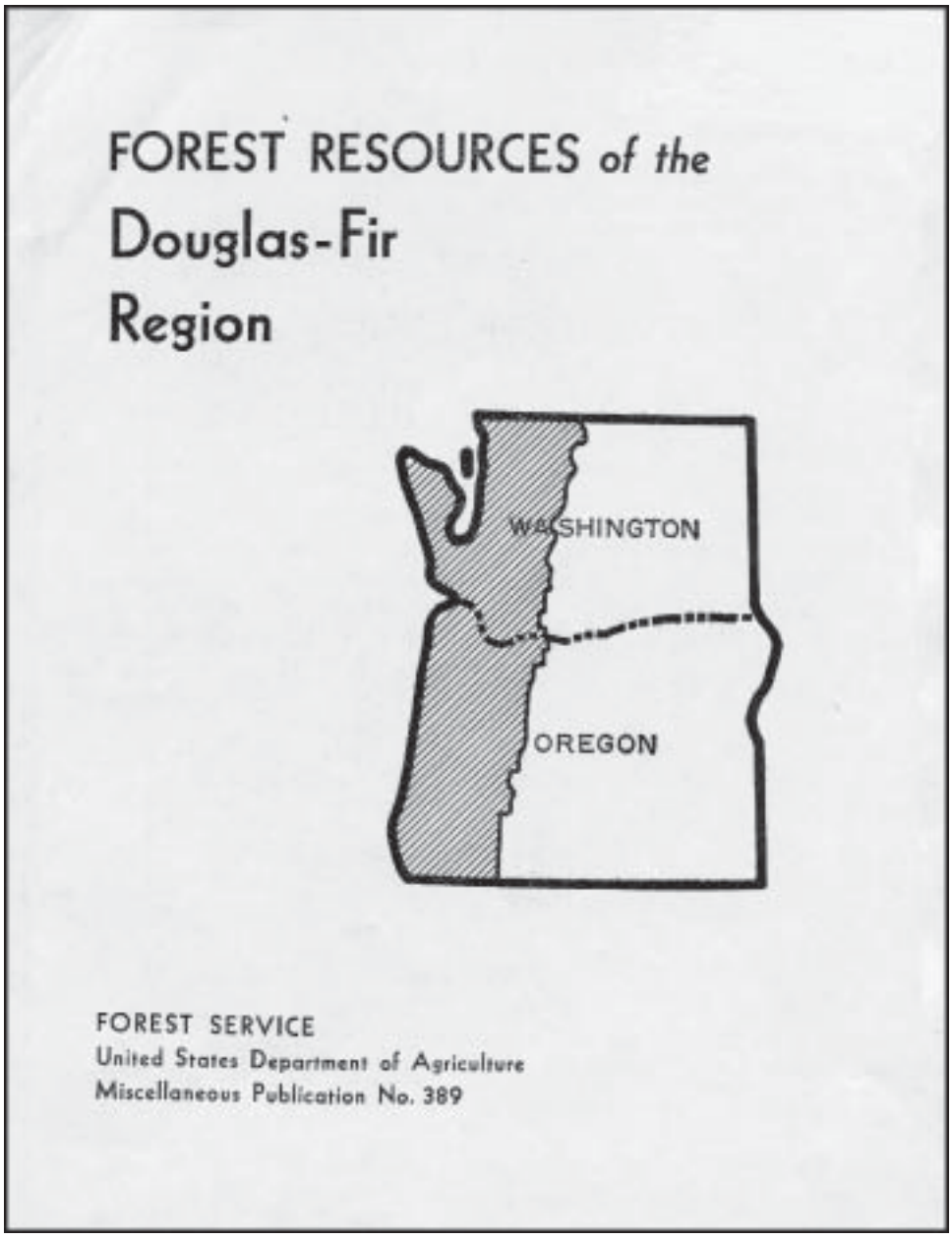


FIGURE 4. DISTRIBUTION OF FOREST LAND BY GENERALIZED TYPES, ALL OWNERSHIP CLASSES (FROM TABLES 3 & 7)



Appendix D: Selected portions of *Forest Resources of the Douglas-Fir Region*. Misc. Publ. 389 (by H.J. Andrews and R.W. Cowlin)



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UNITED STATES DEPARTMENT OF AGRICULTURE

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Forest Resources of the Douglas-Fir Region

by H. J. ANDREWS *and*

R. W. COWLIN, *senior forest economists*

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

FOREST SERVICE

UNITED STATES GOVERNMENT PRINTING OFFICE • WASHINGTON - 1940

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The Forest Survey

EFFECTIVE rehabilitation and constructive management of this country's forest resources require not only protection against neglect and destruction but, with equal urgency, provision for permanent and wise use. Intelligent forest land use planning must be based upon reliable facts as to location, area, and condition of existing and prospective forest land, supply of timber and other forest products, forest depletion and forest growth, and production and consumption of forest products. This necessity for dependable and comprehensive data is now being translated into action through the provisions of the McSweeney-McNary Forest Research Act of 1928, authorizing a Nationwide forest survey. The Forest Service was directed by the Secretary of Agriculture to conduct the survey.

The fivefold purpose of the Forest Survey is: (1) To make an inventory of the extent and condition of forest lands and of the present supply of timber and other forest products on these lands; (2) to ascertain the rate at which this supply is being increased through growth, and the potential growth on forest areas; (3) to determine the extent of depletion of the forests through cutting and through loss from fire, insects, disease, wind throw, and other causes; (4) to determine the present consumption and the probable future trend in requirements for timber and other forest products; and (5) to analyze and correlate these findings with other economic data, as an aid in the formulation of private and public policies for most effective and rational use of land suitable for forest production.

These investigations are conducted in each forest region of the United States by the regional forest experiment station of the Forest Service. In Oregon and Washington they are conducted by the Pacific Northwest Forest and Range Experiment Station, with headquarters at Portland, Oreg.

It is planned to publish the results of this investigation, as they become available, in a series of reports applying to large forest areas such as districts, regions, and States. It is expected that the information presented in these reports for large geographic units will facilitate more intensive studies of small areas.

Contents

Survey Findings in Brief

THE highest service that forests of the Douglas-fir region can render is in support and stabilization of communities dependent on them. Included are, not only the people and investments in forest industries, but also those in farms, stores, banks, garages, schools, transportation, and various industries. Forests support in one way or another about half the population of the region. To redeem this enormous responsibility for service, forests must furnish a permanent annual harvest of material equal at least to present production. This will require sustained-yield forest practice, including acceptance of the responsibilities of permanent ownership.

The major problem therefore is to bring about promptly the adoption of a system of managing old-growth and second-growth forests for the continuous production of high-quality material while there is yet sufficient growing stock to do so without calamitous dislocation of people and industry.

A factual resume of the findings of the Forest Survey, as presented in detail in subsequent pages of this publication, is as follows: [1]

1. The forest is an integral part of the farm economy of the Douglas-fir region. Forests furnish fuel, fence posts, and other products essential to farm management and rural life. Forest products are important crops to many farmers. Forest industries afford part-time employment to many farmers and support, directly and indirectly, approximately half the population of the region.

2. The Douglas-fir region produces 30 percent of the lumber, 90 percent of the shingles, and 23 percent of the wood pulp produced in the United States, depending chiefly upon outside markets.

3. The major forest problem in the Douglas-fir region is the necessity for instituting a system of managing old-growth forests for continuous production. This means that clear cutting over vast areas, which has resulted in large areas of nonstocked cut-over land, must be halted.

4. The Douglas-fir region has 29 million acres of forest land, amounting to 82.6 percent of its total land area. Of this, 26.1 million acres, or 90 percent, was classified in the forest survey as commercial conifer.

5. Conifer types of saw-timber size occupy more than 14.5 million acres, of which 11.6 million is old growth and 2.9 million second growth. Second-growth conifer types less than saw-timber size occupy 7 million acres. Deforested burns, old nonrestocked cut-overs, and recent cut-overs total 4.4 million acres.

[1] Forest survey progress releases on the Douglas-fir region issued by the Pacific Northwest Forest and Range Experiment Station previous to the publication of this major report are: (1) Forest statistics in separate form for Clallam, Clark, Cowlitz, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, San Juan, Skagit, Skamania, Snohomish, Thurston, Wahkiakum, and Whatcom Counties, Wash., and for Benton, Clackamas, Clatsop, Columbia, Coos, Curry, Douglas, Hood River, Jackson, Josephine, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill Counties, Oregon. 1934. [Mimeographed.] (2) Forest Resources of the Douglas-Fir Region. Forest Res. Notes No. l3. 1934. [Mimeographed.] (3) Pulpwood Resources of Western Oregon and Western Washington. Forest Res. Notes No. 17. 1935. [Mimeographed.] (4) Forest Growth in the Douglas-Fir Region. Forest Res. Notes No. 20. 1936. [Mimeographed.] (5) Timber Volume and Type Acreage on the National Forests of the North Pacific Region. Forest Res. Notes No. 22. 1937. [Mimeographed.] (6) Detailed forest type maps of each of the above listed 38 counties. Scale 1 inch equals 1 mile. Blue line print form. 1934. (7) State type maps—Douglas-fir region covered by four sheets, NW Washington, SW Washington, NW Oregon, SW Oregon. Scale ¼ inch = 1 mile. 1936. [Lithographed.] The Pacific Northwest Station has also cooperated with the State of Washington in the following recent publication: Cowlin, R. M. [W.], and Morets [Moravets], F. L., Forest Resources of Washington. Wash. Dept. of Conserv. and Development, Olympia. 44 pp., illus.

6. More than 3 million acres of forest land in the Douglas-fir region was cut over prior to 1920 and in 1933 had not been put to other use; of this total, in 1933, 28 percent was well stocked with second-growth trees, 36 percent was medium stocked, 15 percent was poorly stocked, and 21 percent was nonstocked. In the period 1920-33 more than 2 million acres was cut over, of which at the end of the period 12 percent was well stocked with reproduction, 17 percent was medium stocked, 29 percent was poorly stocked, and 42 percent was nonstocked. Of the total area of cut-over land in the region, 50 percent is satisfactorily restocked and 50 percent is either nonstocked or only poorly stocked.

7. The region's saw-timber stand totals 546 billion board feet, log scale, all but 4 billion of which is conifers. Douglas-fir, the leading species, totals 331 billion feet, and is followed by western hemlock with 105 billion board feet. Other important species are western redcedar, Sitka spruce, and silver fir.

8. It was estimated that only a little more than half the saw-timber volume could profitably be logged under the conditions that prevailed during the period 1925-29.

9. The regional total of cubic volume in trees 6 inches and larger in breast-height diameter is 129 billion cubic feet; species eminently suitable for pulp manufacture make up 39 billion cubic feet, or 30 percent.

10. More than 53 percent of the commercial forest land and approximately 48 percent of the saw-timber volume in the Douglas-fir region are privately owned, and 30 percent of the commercial forest land and 37 percent of the saw-timber volume are within the national forests. The remaining 17 percent of the land and 15 percent of the volume are in other forms of public ownership or owned by Indians.

11. Current annual depletion of saw timber from all causes is estimated to total about 8.3 billion board feet, of which 7.9 billion board feet is cutting depletion.

12. Sawlog production in the Douglas-fir region during 1925—33 averaged 7.4 billion board feet, of which 5.4 billion feet was Douglas-fir, 1 billion feet western hemlock, 0.6 billion feet western redcedar, 0.3 Sitka spruce, and 0.1 billion other species.

13. Current losses of saw timber by fire, excluding catastrophes such as the Tillamook fire of 1933, amount to a quarter of a billion board feet annually. The area burned over annually averages more than 250,000 acres, including large areas of second growth. Killing of second growth seriously endangers future saw-timber supplies.

14. Current annual growth in the Douglas-fir region totals approximately 2.4 billion board feet. Potential annual growth under intensive forest practice is approximately 8.2 billion board feet.

15. The supply of old-growth Douglas-fir within economically feasible transportation distance of the Puget Sound and Grays Harbor districts will be practically exhausted within two decades if the present rate of depletion continues.

16. The supply of pulp timber is sufficient to maintain the existing rate of wood-pulp production indefinitely if reasonable forest practice is observed and if the volume of pulp species used in lumber manufacture is not increased.

17. In order to stabilize economic life in this region sustained-yield forest management should be instituted as soon as possible. The ultimate sustained-yield capacity of the region under reasonably intensive forest management is estimated at 8 billion board feet per year; during the transition period, under optimum conditions, a cut of about 6 ½ billion per year is allowable.

18. In the Puget Sound, Grays Harbor, and Columbia River districts the annual cuts allowable under a sustained-yield budget were exceeded during 1933, a year of comparatively low production. Progressive overcutting of the southern districts will bring about conditions similar to those in the north.

19. Most of the forest land that should be used for continuous production could, through concerted action by industry and government, be put under sustained-yield management within 25 to 50 years.

20. With an enlarging acreage of cut-over land and a growing use of the forests by the public for recreation, the Douglas-fir region is facing an increasingly difficult problem of forest-fire protection.

The Douglas-Fir Region

THE Douglas-fir region, which includes those parts of Oregon and Washington west of the summit of the Cascade Range, was selected as the place to begin the Nation-wide forest survey (fig. 2). Extending 480 miles from north to south and varying in width from 100 to about 150 miles, this region has an area of more than 35 million acres, of which 29 million acres, or 83 percent, is forest land. Its long littoral exposure subjects most of it to humid westerly winds; its climate is characterized by equable temperatures, except in the high mountains, and moderate to heavy precipitation. Climatic conditions are particularly favorable to conifer forest growth, and the region is noted for the luxuriance and density of its forest vegetation.

The forests of this region are almost exclusively conifer, and Douglas-fir *(Pseudotsuga taxifolia)* is the predominating tree, forming 60 percent or more of the stand on more than half the forest land (fig. 1). Important species commonly associated with Douglas-fir are western hemlock *(Tsuga heterophylla),* western redcedar *(Thuja plicata),* Sitka spruce *(Picea sitchensis),* Pacific silver fir *(Abies amabilis),* and noble fir (*A. nobilis).* Exceptions to the predominance of Douglas-fir are found in the forests on the cool, humid western slopes of the Coast Ranges and the Olympic Mountains known as the fog belt, where western hemlock and Sitka spruce are the outstanding species and Douglas-fir is occasionally entirely lacking. Again, on the higher slopes of the Cascade Range and the Olympic Mountains and occasionally on those of the Coast Ranges, the stands are made up principally of western hemlock, Pacific silver fir, noble fir, mountain hemlock *(Tsuga mertensiana),* and western white pine *(Pinus monticola).* Latitudinally also, toward the cooler, northern extreme of the region, Douglas-fir forms a smaller percentage of the stand, western hemlock and other species increasing in frequency; and on the dry exposures of the interior valleys and foothills of southern Oregon Douglas-fir gives way to ponderosa pine *(P. ponderosa).*

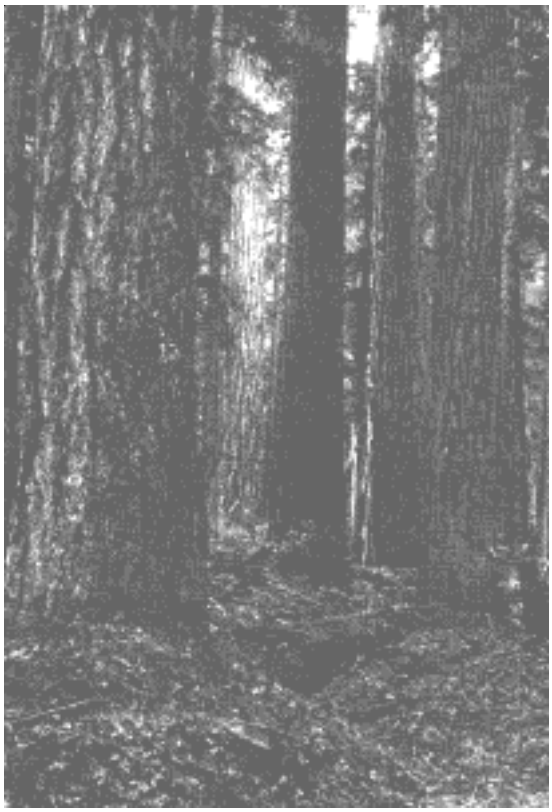

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FIGURE 1.—Saw-timber stand of old-growth Douglas-fir near the Columbia River in western Washington averaging more than 40 inches in diameter and having a gross volume of about 125,000 board feet per acre. The trees in the picture measure from 5 to 6 feet in diameter.

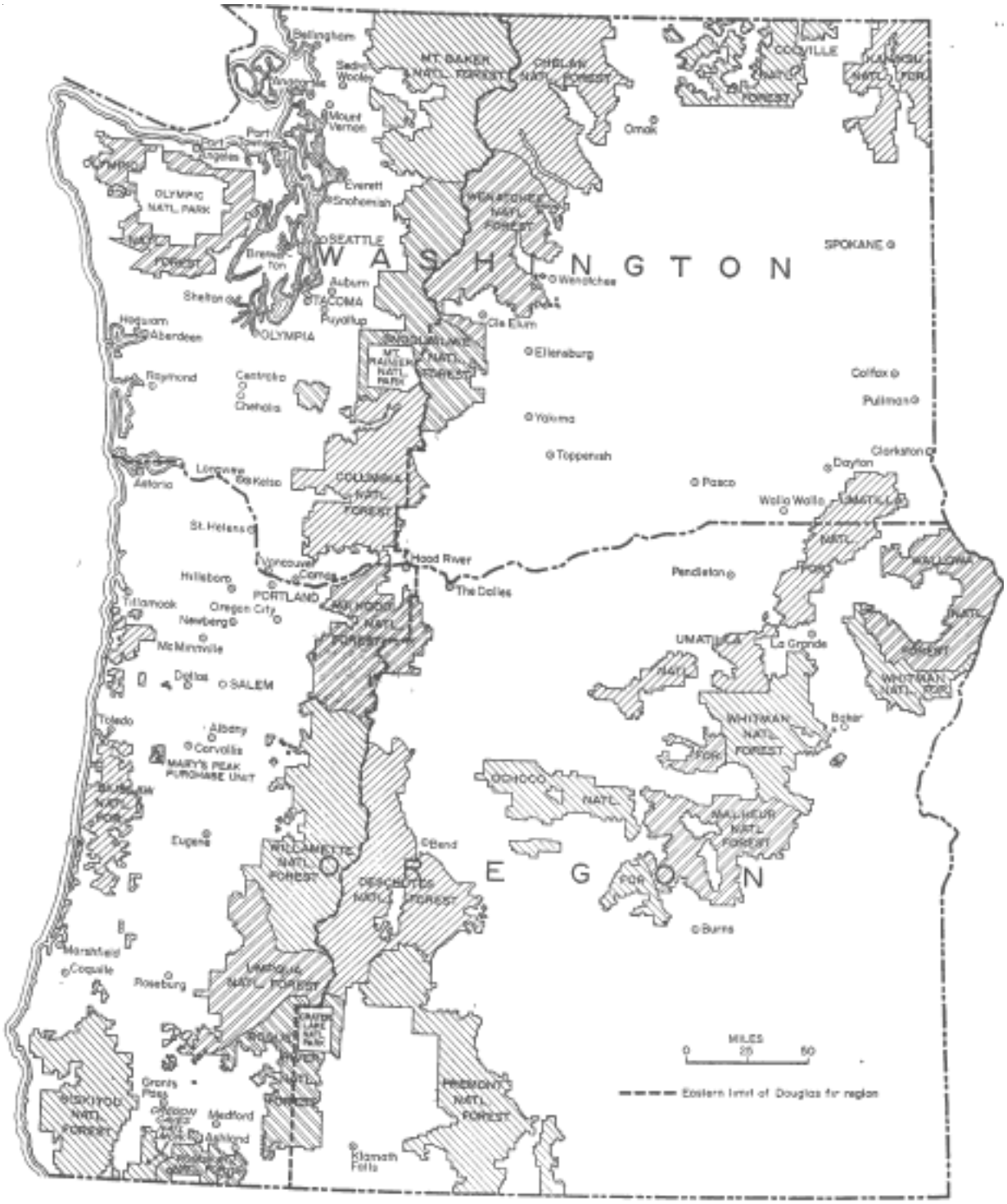

FIGURE 2.—*Map of Oregon and Washington showing Douglas-fir region, national forests, parks, monuments, and principal cities.*

Major Phases of Survey

THE major phases of the Douglas-fir survey were four—the inventory phase, the study of forest depletion, estimates of forest growth, and a determination of present and future timber requirements. An analysis of this information for the purpose of developing principles and policies to make the forests contribute most in services regionally and nationally leads inevitably into a consideration of land use planning, future supplies of timber in relation to industrial development and requirements, and forest management. Although the requirements phase is discussed here only for the region, the subject is much broader than this; it is planned to integrate it with similar information from other regions for publication later as a report on forest-products requirements for the whole country.

The inventory phase of the forest survey was undertaken first in the spring of 1930. Its principal purposes were to obtain:

1. Volume of the present timber stands, by species and by ownership class.
2. Areas of the several types, by ownership class.
3. Areas of the immature-conifer types by age class and degree of stocking.
4. Maps showing location of each of the forest types.
5. A classification of timber stands according to economic availability for logging.
6. A classification of forest area according to site quality.

The existence of considerable information, particularly on the merchantable timber areas which comprise about half of the 29 million acres in the Douglas-fir region, made it practicable to rely on checking and compiling the information already available from public or private cruises, maps, and reports. This was supplemented with field examinations of all remaining areas.

The work of the inventory phase was conducted in four steps: (1) Collection of all existing information, (2) checking and adjusting to a common standard all usable existing timber estimates, (3) field examination of areas not covered by usable information, (4) compilation of data collected. [2]

The immediate object of the depletion phase of the forest survey was to determine the quantity and kind of timber annually removed by cutting or killed by fire, wind throw, insects, disease, and all other causes; in short, the extent and character of the drain on the forest capital. The ultimate object was to obtain data needed for an analysis that would determine the trends of depletion and growth, present and potential, and the net result of the two trends.

Depletion as considered in this study does not include ordinary endemic losses due to such causes as diseases, surface fires, wind throw, and insects. Such normal losses have been allowed for in the construction of the yield tables used in calculating growth. Depletion as here considered involves only timber killed or removed by logging, by fires that kill entire stands, by windstorms of major intensity, and by insect epidemics.

To estimate the rate and quantity of current and potential growth in the forests of this region would be simple if rates of growth were constant for all conditions. Instead, they vary among individual trees according to species, age, and dominance; among individual forest stands according to type, site, average age, and stocking; and among aggregates of stands according to the growth characteristics of individual stands. Stands more than 160 years of age were considered as a whole to have no present net growth. Although some stands above this age are increasing in merchantable volume, others are actually losing in merchantable volume; thus in these older

[2] The organization of the field work and the detailed procedure involved in each of these four steps are described in the Appendix, p. 146.

stands losses due to mortality and to decay approximately balance growth. Stands not more than 160 years of age were classed as growing stands. For all these stands growth computations were made.

Four conceptions of rate of growth were considered: Current annual growth, realizable mean annual growth, potential annual growth, and periodic growth. These terms as used in this report are defined as follows:

Current annual growth is the volume increase that took place in 1933.

Realizable mean annual growth is (1) mean annual growth from 1933 to 2032 of existing stands, or to dates earlier than 2032 for those areas which it is assumed will be depleted before that date, plus (2) mean annual growth on portions of areas now deforested or to be deforested that presumably will restock before 1952. These calculations were made for each of the three decades from 1933 to 1962.

Potential annual growth is the average quantity of timber that can be grown annually if all the commercial conifer forest land produces 75 percent of full capacity.

Periodic growth is growth within a given period—in this study, 10 years. It was estimated for each of the three decades from 1933 to 1962. On the basis of these estimates and of assumptions as to future depletion, future inventories at 10-year intervals during that period were estimated.

The requirements phase of the forest survey consisted of a determination of present and prospective requirements for wood products of the Douglas-fir region. Estimates of the quantities of these products needed in the future cannot be made solely on the basis of needs within the region. Interchange of products between regions necessitates determination of future requirements on a national basis.

Obviously, this region with its enormous forest resources and comparatively sparse population can supply its requirements for practically all kinds of forest products indefinitely. The only wood products consumed in this region that must be imported are small amounts of hardwood material such as flooring and interior finish, and articles manufactured of woods not grown in this region, such as certain kinds of furniture and implement handles. The principal sources of these items are eastern and southern United States, the Philippine Islands, South America, and Central America.

Methods and Specifications

Standards of Measurement

IT WAS necessary to fix standards of measurement of the volume of standing timber, so that estimates would be stable and could be correlated with estimates for other regions and adjusted to meet changing economic conditions. Standards were defined that conformed as far as practical with generally accepted concepts of utilization practices appropriate to current conditions. Inventory, growth, and depletion data are given in board feet, log scale in the body of this report. Lumber-tally equivalents are found in the appendix.

Timber-volume estimates were made in board feet, log scale, according to the Scribner Decimal C rule, and in cubic feet. The board-foot estimates included only the stems of living trees that would make at least one log meeting the following specifications: Conifers other than ponderosa pine and sugar pine, 32 feet long, 12 inches in diameter inside bark at the small end; ponderosa pine and sugar pine, 16 feet long, 10 inches in diameter inside bark at the small end; hardwoods, 8 feet long, 10 inches in diameter inside bark at the small end. Practically, this amounts to making the minimum specification for conifers other than these two pines the 16-inch diameter class (15.1 to 17.0 inches d. b. h.)[3] and that for ponderosa pine, sugar pine, and hardwoods the 12-inch diameter class (11.1 to 13.0 inches d. b. h.)

Allowance was made in the volume estimates for decay, defects, and such breakage as is inevitable in logging. In other words, the estimates are for the net volume usable in sawtimber operations under good utilization practices.

[3] "D. b. h." signifies diameter at breast height (4 ½ feet above average ground level) outside bark.

Probably the standards of utilization employed in the survey estimates are slightly more intensive for the more valuable species, and considerably so for the less valuable species, than the average utilization standards of present-day sawtimber operators, owing chieftly to the inclusion of trees as small as 16-inches diameter class.

Cubic-foot volume was computed for the sound wood of stems only, from stump to 4-inch tip inside bark, limb wood and bark excluded, of all trees of or above the 6-inch (5.1 to 7.0 inches) diameter class.

The estimates cover all timber areas, including farm woods, outside the platted limits of municipalities.

In order to obtain satisfactory estimates of volume of standing timber it was necessary to have for each of the commercial saw-timber species an accurate volume table that could be applied throughout the region. Investigation and check of the existing tables showed that some of them could be used as they were and others could be made usable by adjustment and extension to include larger trees, but that for some species new tables would have to be made. Volume tables used for the principal species are described in the appendix.

Species and Tree-Size Classification

An estimate of total volume of living timber was made and recorded separately for every species that usually attains sawtimber size and character and that was present in commercial types in quantity measurable according to survey standards. Also, an estimate of total volume of dead timber was made and recorded for Port Orford white-cedar *(Chamaecyparis lawsoniana),* western redcedar, and Alaska yellow-cedar *(C. nootkatensis).* (Owing to their durability and resistance to decay, dead trees of these species have commercial value and

are logged.) In some cases, separate estimates were made for certain size and age classes of timber of a single species; in some, estimates were combined for pairs of species having similar dendrological and structural characteristics.

Species that usually do not attain saw-timber size in the Douglas-fir region include Pacific yew *(Taxus brevifolia)* and some hardwoods.

Table 1 lists the species (21),[4] classes, and diameter ranges for which volume was recorded, with the symbols adopted for convenience in referring to them. As applied to Douglas-fir here and elsewhere in this report, "old growth" and "second growth" are relative terms distinguishing between the older timber and the younger, more rapid-growing timber. Likewise, "large" and "small" are used here as relative terms distinguishing between larger and smaller timber of a given type or species.

Type Definitions and Type Mapping

In primitive forests of the Douglas-fir region certain fairly definite major species associations and innumerable minor associations may be observed. Fire, cutting, and land settlement have added to the complexity of forest-cover conditions, and consequently to the difficulty of defining types. Each forest type recognized in this survey had to have some significance in forest management. Types had to be within practical limits in number, and type definitions had to be such that types could be determined from office records, such as timber cruises, and could easily be recognized in the field and indicated on field maps. A type scheme that had already been adopted by the Forest Service for intensive surveys partly fulfilled the requirements. On this foundation a scheme was finally evolved that stood the test of 4 years' field use with few changes.

The forest-cover and land-use types recognized in the forest survey of the Douglas-fir region[5] follow:

Nonforest Types

No. 2. Nonforest land other than agricultural, including (*1*) barren areas too rocky, deficient in soil, or exposed to support a cover of either trees, shrubs, or herbs;

[4] Italic numbers in parentheses refer to Literature Cited, p.145.

[5] Numbers preceding types relate to series of types listed for the entire Northwest.

TABLE 1.—*Species and diameter classes for which volume as recorded*

Name and class	Symbol	Breast-height diameter range
CONIFERS		
Douglas-fir (*Pseudotsuga taxifolia):*		*Inches*
Large old growth	DA	40+
Small old growth	DB	22-40
Large second growth	DC	22-40
Small second growth	DD	18-20
Sitka spruce *(Picea sitchensis):*		
Large	SA	24+
Small	SB	16-24
Engelmann spruce *(P. engelmannii)*	ES	16+
Western hemlock *(Tsuga heterophylla):*		
Large	HA	20+
Small	HB	16-20
Mountain hemlock (*T. mertensiana)*	MH	16+
Western redcedar *(Thuja plicata):*		
Live	C	16+
Dead	KC	16+
Port Orford white-cedar *(Chamaecyparis lawsoniana):*		
Live	PC	16+
Dead	KPC	16+
Alaska yellow-cedar *(C. nootkatensis):*		
Live	YC	16+
California incense-cedar *(Libocedrus decurrens*)	IC	16+
Ponderosa pine *(Pinus ponderosa)* and Jeffrey pine *(P. jeffreyi):*		
Large	YA	22+
Small	YB	12-22
Sugar pine *(P. lambertiana)*	SP	12+
Western white pine *(P. monticola)* and whitebark pine *(P albicaulis)*	W	16+
Lodgepole pine *(P. contorta latifolia),* shore pine *(P. contorta),* and knobcone pine *(P. attenuata)*	LP	16+
White fir *(Abies concolor)* and grand fir *(A. grandis)*	WF	16+
Noble fir *(A. nobilis)* and Shasta red fir *(A. magnifica shastensis)*	NF	16+
Pacific silver fir *(A. amabilis)*	A	16+
Alpine fir (*A. lasiocarpa)*	AF	16+
Western larch *(Larix occidentalis)* and alpine larch (*L. lyallii*)	WL	16+
Redwood *(Sequoia sempervirens)*	R	16+
BROADLEAF TREES		
Red alder (*Alnus rubra)*	RA	12+
Oregon white oak *(Quercus garryana)*	OO	12+
Canyon live oak (Q. *chrysolepis)*	CLO	12+
California black oak *(Q. kelloggii)*	CO	12+
Tanoak *(Lithocarpus densiflora)*	TO	12+
Northern black cottonwood *(Populus trichocarpa hastata)* and quaking aspen *(P. tremuloides)*	BC	12+
Bigleaf maple *(Acer macrophyllum)*	OM	12+
Pacific madrone *(Arbutus menziesii)*	MAD	12+
Oregon ash (*Fraxinus oregona)*	ASH	12+
California laurel *(Umbellularia californica*)	MY	12+
Golden chinquapin *(Castanopsis chrysophylla)*	CH	12+
Western paper birch *(Betula papyrifera occidentalis)* and northwestern paperbirch *(B. papyrifera subcordata)*	WPB	12+

(*2*) grass, sagebrush, and brush areas on which the principal present vegetation is either grass, herbs, brush, shrubs, or sagebrush; and (*3*) cities, towns, and unmeandered water surfaces.[6]

No. 3. Agricultural land, including (*1*) areas cleared or cultivated for agricultural use, including pasture; and (*2*) stump pasture, logged-off or burned-off land from which stumps or snags have not been removed, now part of an operating farm unit and devoted chiefly to grazing. Usually, on such an area some attempt has been made to propagate forage plants by seeding or repeated burning.

Woodland Types

No. 4. Oak-madrone woodland, consisting of approximately 60 percent or more of any species of oaks (including tanoak) or madrone or any combination of these.

No. 5½. Ponderosa pine woodland, in which ponderosa pine predominates and on which the trees are scattered, singly or in clumps, and form a very thin stand. Individual trees may or may not be of merchantable size and form.

Timberland Types

Nos. 6, 7, 8, 9, and 10. Douglas fir: A forest containing approximately 60 percent or more, by volume, of Douglas-fir—the characteristic forest west of the summit of the Cascade Range. The five Douglas-fir types, differentiated by the sizes into which most of the volume falls, are (6) large old growth, 42 inches d. b. h. and more; (7) small old growth, 22 to 40 inches; (8) large second growth, 22 to 40 inches (coarse-grained timber yielding only a small percentage of the upper grades of lumber); (9) small second growth, 6 to 20 inches; (10) seedlings and saplings, mostly less than 6 inches.

Nos. 11, 12, and 13. Sitka spruce: A forest containing 50 percent or more, by volume, of Sitka spruce, rarely in pure stands, usually in mixture with Douglas-fir, western hemlock, and western redcedar. The three Sitka spruce types are (11) large, 26 inches d. b. h. and more; (12) small, 6 to 24 inches; (13) seedlings and saplings, mostly less than 6 inches.

Nos. 14, 15, and 16. Western hemlock: A forest containing 50 percent or more, by volume, of western hemlock with varying quantities of Douglas-fir, western redcedar, Pacific silver fir, and Sitka spruce. The three western hemlock types are (14) large, 20 inches d. b. h. and more; (15) small, 6 to 20 inches; (16) seedlings and saplings, mostly less than 6 inches.

No. 17. Western redcedar, large: A forest containing approximately 40 percent or more, by volume, of western redcedar, in which most of the volume is in trees more than 24 inches d. b. h.

No. 18. Port Orford white-cedar, large: A forest in which 20 percent or more of the volume is in Port Orford white-cedar trees more than 30 inches d. b. h., with varying quantities of Douglas-fir white fir, western redcedar, western hemlock, Sitka spruce, and hardwoods.

No. 19. "Cedar," small: A forest in which western redcedar 24 inches or less in d. b. h. or Port Orford white-cedar 30 inches d. b. h. or less, or both, compose 40 percent or more, by volume, of the dominant stand, with some or considerable quantities of western hemlock, Sitka spruce, or Douglas-fir, or of two or all three of these species.

Nos. 20, 20A, 21, and 22. Ponderosa and sugar pine. The four types are (20) large ponderosa pine, in which the predominating trees are the so-called yellow pine, about 22 inches d. b. h. or more (about 150 or 200 years old or older), in which no material part of the stand has been cut; (20A) large sugar pine, containing 20 percent or more, by volume of sugar pine, never in pure stands, usually in mixture with Douglas-fir, ponderosa pine, or white fir, in which most of the volume is in trees 22 inches d. b. h. or more. (This type was mapped only outside the boundaries of national forests.) (21) Small ponderosa pine in which most of the trees are less than about 22 inches in diameter (less than 150 or 200 years old), either on an old burn or on an area that has been selectively cut, and in which the volume in trees 12 inches d. b. h. or more is ordinarily at least 1,000 board feet per acre; (22) ponderosa pine seedlings, saplings, and poles, on an old burn or on heavily cut-over land, most of the trees being less than 12 inches d. b. h. and the stand of larger trees, if any, amounting to less than 1,000 board feet of saw timber per acre.

Nos. 23 and 24. Fir-mountain hemlock: The two fir-mountain hemlock types are (23) large, in which most of the dominant trees are 16 inches d. b. h. or more and of saw-timber character (mature stands not of this character are ordinarily included in the subalpine type); (24) small, most dominants less than 16 inches d. b. h., usually a young stand on an old burn.

[6] Bodies of water that have not been surveyed by the General Land Office and that consequently are included in the official totals of land area.

Nos. 25 and 26. Lodgepole pine: A forest containing at least 50 percent, by volume, of lodgepole pine or knobcone pine, often pure. The two types are determined by the size of 50 percent or more of the dominant trees: (25) Large, 12 inches d. b. h. and more; (26) small, less than 12 inches.

Nos. 27 and 28. White fir-larch-Douglas-fir: A mixed forest of greatly varied composition, consisting of two or more of the five species western larch, white fir, Douglas-fir, ponderosa pine, and lodgepole pine, in which ponderosa pine constitutes not more than 40 percent of the stand; limited to the range of western larch and prevalent on north and other cool slopes within the ponderosa pine zone. The two types are determined by the size of the trees representing most of the volume: (27) Large, 20 inches d. b. h. and more; (28) small, less than 20 inches.

Nos. 29 and 30. White fir: Usually a mixed forest within the range of ponderosa pine and sugarpine, containing 50 percent or more, by volume, of grand fir or white fir. The two types are determined by the size of most of the dominant trees: (29) Large, more than 20 inches d. b. h. or 150 years in age; (30) small, less than 20 inches or 150 years.

No. 31. Hardwood: A hardwood forest, either pure or mixed, consisting predominately of one or more species other than oaks or madrone.

No. 32. Redwood: A forest containing approximately 80 percent or more, by volume, of redwood, usually with some Douglas-fir and some Pacific madrone, tanoak, and other hardwoods.

No. 33. Subalpine: A forest at the upper limits of tree growth, usually unmerchantable because of poor form and small size, the principal components being alpine fir, mountain hemlock, Shasta red fir, lodgepole pine, whitebark pine, western white pine, and alpine larch.

Miscellaneous Types

No. 34. This number was used as a prefix to type numbers to denote areas clean cut prior to 1920 or selectively cut at any time.

No. 35. Nonrestocked cut-over: An area cleancut prior to 1920 on which less than 10 percent of the 13.2-foot squares are stocked, not put to other than forest use.

No. 36. Recent cut-over: An area clean-cut since the beginning of 1920, regardless of the status of regeneration.

No. 37. Deforested burn: Land not cut over on which the stand has been killed by fire and that is less than 10 percent restocked.

No. 38. Noncommercial rocky: An area of any species of timber within the range of commercial timber and below the range of the subalpine type that is too rocky, too steep, or too sterile to produce a stand of commercial size, density, and quality; ordinarily the stand averages less than 5,000 board feet per acre.

The scale decided on for type mapping was 1 inch to the mile. A larger scale would have led to excessive detail and made the cost more than was contemplated; a smaller one would not have provided sufficient space for the field examiner to record data of the desired completeness. Obviously, areas only a few acres in extent could not be mapped on the adopted scale. It was decided that all 40-acre or larger areas of commercial forest land—that is, land now bearing or capable of producing forests of commercial character—and agricultural land should be mapped, but that for non-commercial-forest land, barrens, etc., the minimum should be several hundred acres. Hardwood types, owing to their infrequent occurrence, usually as "shoestrings" along creek and river bottoms, were mapped if occupying areas as large as 20 acres. These limits are fixed not absolutely but merely as a guide. In all cases the field examiner was allowed to exercise his judgment. If he could conveniently map a farm or a patch of conifer timber as small as 20 or 30 acres without slowing down the work he was at liberty to do so; if he was mapping an area low in values and difficult of access he was allowed to generalize more than if mapping an area of high values and easy access.

Classifications

Ownership Classes

Separation of forest type and volume data according to ownership was considered particularly important because of the high timber values involved and the large quantities of timberland in various classes of public ownership. Its usefulness has been emphasized by economic developments since

the inception of this project. The subject of forest-land ownership is being carefully studied by economists, foresters, legislators, public officials, and the lumber industry. The breakdown in private forest-land ownership (22) is a cause of particular concern and the subject of many studies.

Ownership statistics were taken from the best public records available. It is recognized that ownership is constantly changing and that the totals given for individual ownership classes probably fail in many cases to coincide with statistics from other sources. Both forest land and intermingled nonforest land were classified as to ownership. No distinctions were attempted as to the ownership of large bodies of agricultural land; they were all arbitrarily classified as privately owned. As applied to forest land, the ownership classification was as follows:

Private. All privately owned forest property, including farm woods.

State, available for cutting.

State, reserved from cutting.

County. Forest property deeded to the county. (Tax-delinquent land not deeded to the county is classified as private.)

Municipal. Includes all municipally owned forest property outside the platted limits of municipalities.

Indian. Includes both tribal lands and trust allotments.

Revested land grant. Includes Oregon & California Railroad and other land grants that have reverted to Federal ownership whether classified as timber, agricultural, or power withdrawals.

Federal other than national forest and revested land grant. Includes national parks, military reservations, unappropriated public domain and miscellaneous.

National forest, available for cutting.

National forest, reserved from cutting.

National forest, State selection.

The term "reserved from cutting" as applied to State or national-forest land denotes areas unavailable for cutting because of statute, proclamation, or policy. Most land so classed had been officially dedicated to watershed protection, to recreational use, or as national-forest primitive areas on which primitive conditions are to be maintained so far as possible for recreational purposes. The term "available for cutting" means that there was no legal or formal prohibition on timber cutting; it does not imply the presence of timber ready for cutting or, in fact, of any timber at all.

National-forest areas designated as State selection areas are lands in the north Puget Sound unit that have been designated for exchange with the State of Washington in order to enable the State to consolidate scattered land holdings.

Other Classifications

For convenience and facility of analysis and discussion, the region was arbitrarily divided into 11 units (figs. 3 and 4). So far as was practical, the units were compact areas homogeneous as to economic influences and industrial

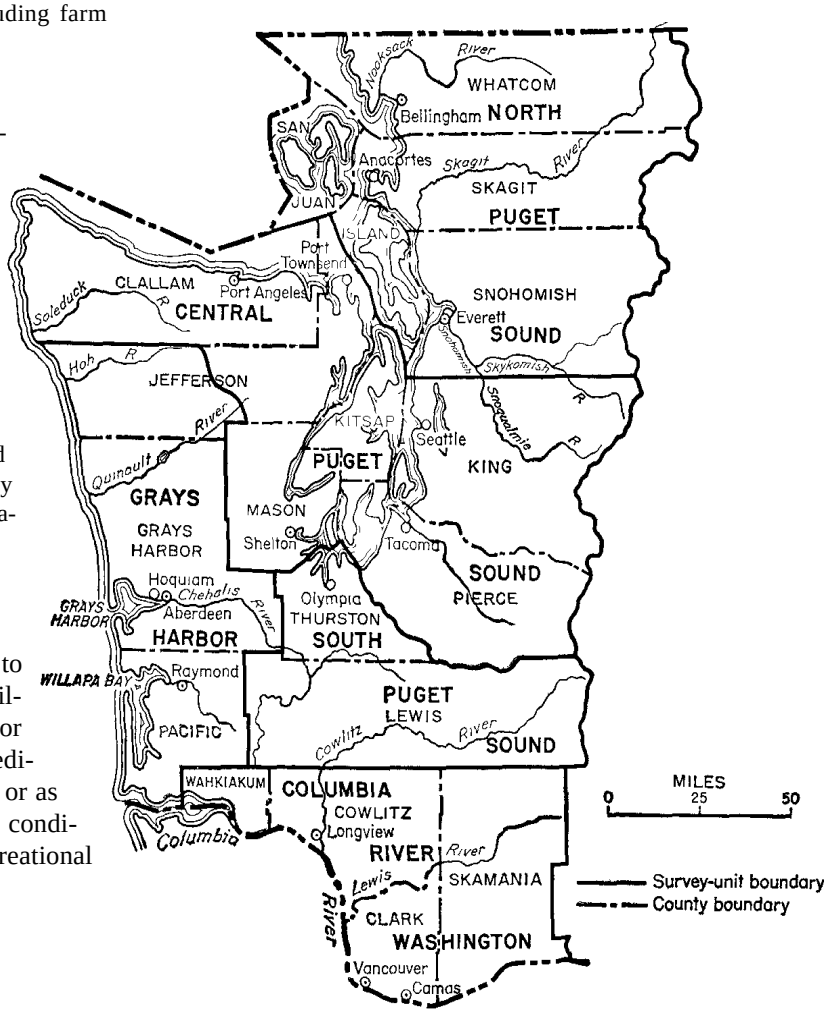

FIGURE 3—*Map of Western Washington showing survey units, counties, and important drainages.*

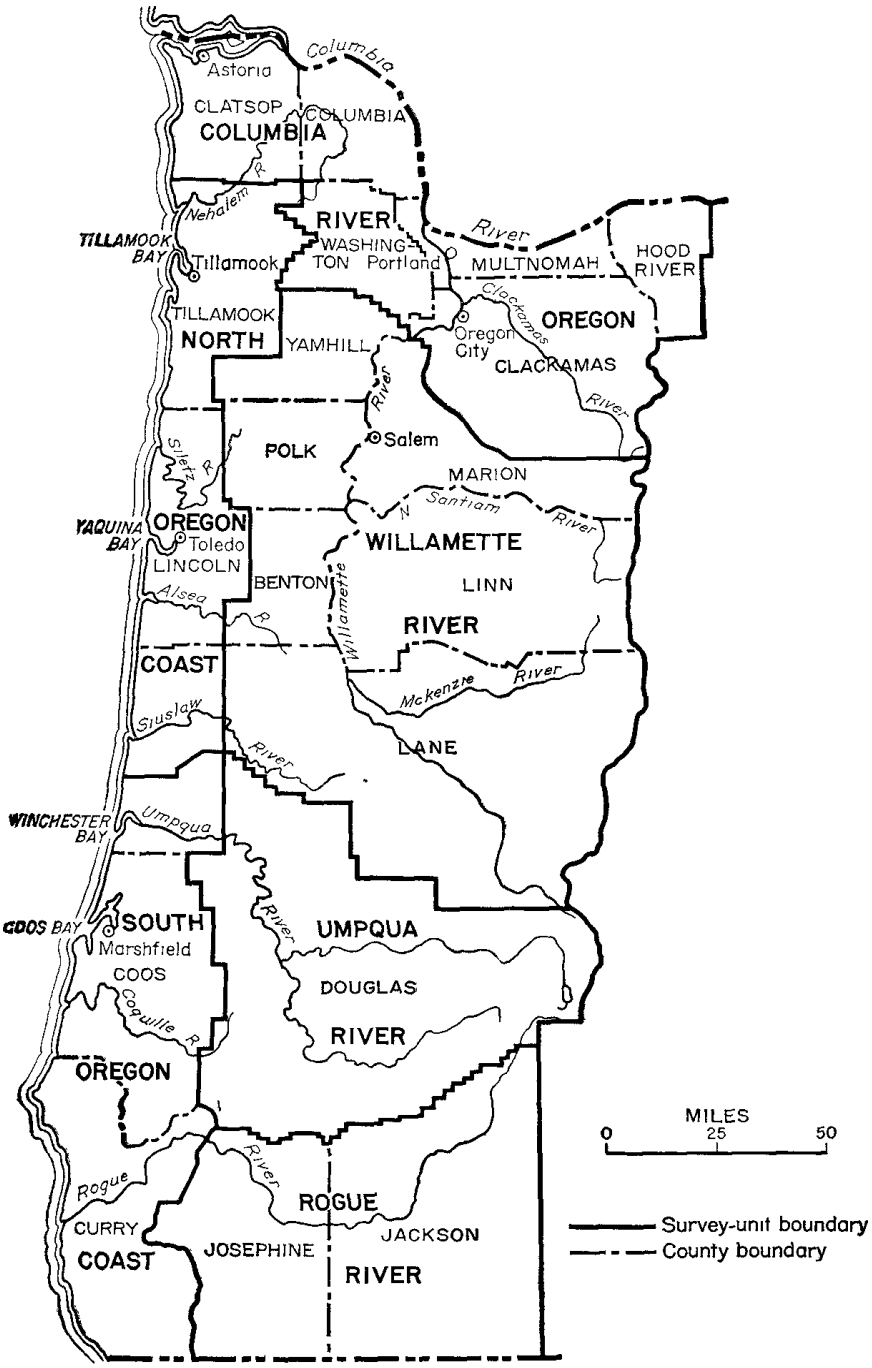

FIGURE 4—*Map of western Oregon showing survey units, counties, and important drainages*

conditions. In most cases unit boundaries were made to coincide with county lines, so that data could be assembled by counties. It was impossible to establish absolutely self-contained units.

Saw timber was ranked in three classes according to economic availability. Class 1 includes timber that according to estimate could profitably be logged under the production and marketing conditions that prevailed during the period 1925-29; class II, timber that under those conditions could be logged at a loss of not more than $5 per 1,000 board feet; and class III, all other timber.

In order to calculate growth and volume of immature conifer stands, most of these stands were classified according to age, in 10-year classes, and according to density, in three degrees of stocking. If an area were 70- to 100-percent covered, according to the stocked-quadrat method of measurement (explained in the appendix), it was classified as well stocked; if 40 to 69 percent, medium stocked; if 10 to 39 percent, poorly stocked; and if less than 10 percent, nonstocked.

The term "site quality" denotes the forest-productive capacity of an area, determined by the composite effect of all climatic and soil conditions. Site-quality classifications based on height of dominant and codominant trees at a given age have been adopted for the Douglas-fir type and the ponderosa pine type.

The classification for Douglas-fir consists of five classes and that for ponderosa pine of six classes; in each case, the highest class is designated I. The Douglas-fir classification was employed for all forest-cover types in the region except ponderosa pine, lodgepole pine, subalpine, oak-madrone, hardwood, and noncommercial rocky. The ponderosa pine classification was used for all ponderosa pine types except woodland. Land occupied by the other types listed was not classified by site quality.

Pages 13-144 not included

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Appendix

Inventory Methods and Sources

Volume Tables

Several existing Douglas-fir volume tables had given satisfactory results for certain localities, but comparison with measurements of felled timber showed that they could not be used regionally. Accordingly, a form-class table was developed and checked against measured volume of 1.6 million board feet of felled and bucked timber in different sections of the region. In nearly every instance this table checked within 0.5 percent of the actual measurements, and in no case did it deviate more than 2.6 percent.

A western hemlock volume table was constructed in the same way, and was proved to be accurate. For western redcedar a volume table made on the Quinault Indian Reservation by Henry B. Steer, then of the United States Indian Service, was used. For Sitka spruce, table 80 of Volume Tables for the Important Timber Trees of the United States: Part I, Western Species (17), was accepted after adjustment to a 12-inch top diameter. Table 79 from the same publication was adopted for silver fir and white fir, after it had been adjusted to a 12-inch top diameter and extended to include trees as large as 70 inches in diameter.

Table 77 in the publication just mentioned, prepared by R. H. Weidman in 1917, was accepted for noble fir. A table made by Henry B. Steer on the Quinault Indian Reservation was used for western white pine. A form-class table was constructed for ponderosa pine. A table for use in estimating red alder was prepared on the basis of an existing table (10) made by Griffin and Wilcox. The second-growth cottonwood table (table 11) in Volume Tables for the Important Timber Trees of the United States: Part III, Eastern Hardwoods, was found to be suitable for other hardwoods.

Organization of Field Work

More than 40 percent of the region's total forest-land area is within the boundaries of national forests. This portion, 84 percent of which is in Federal ownership, includes the most mountainous, rugged, and inaccessible lands of the region. When this work was started, national forests either wholly or chiefly within the Douglas-fir region numbered 12; since then, without any significant change in total area, the number has been reduced by consolidations to 10. These national forests now range in gross area from about 700,000 to 1,850,000 acres each, averaging approximately 1,200,000 acres.

A greater part of the national-forest lands than of the other lands had to be covered by field examination. The procedure followed on them was influenced not only by the ruggedness of the many mountain areas but also by scarcity of roads and shortness of field season. It was decided that the work on national-forest areas that had not been intensively cruised should be an intensive reconnaissance. Men familiar with the national forests of the region were selected from the local forest organizations to do this work.

For lands outside the national forests a permanent organization of 5 type mappers and 3 check cruisers was formed. This was augmented by field assistants during the field season and computers during the winter months. In peak periods as many as 40 or 50 men were employed on the survey of these lands.

Collection of Existing Information

The sources of information already in existence for national-forest areas included intensive timber cruises covering about 15 percent of their total records of an extensive reconnaissance made in 1909-10 and amended in 1922, of examinations of cut-over land, of planting reconnaissance work, of land-exchange examinations, of appraisals, of settlement cases, of trespass cases, and of fire damage; aerial and panoramic photographs; and miscellaneous other records. Of the land outside national forests about 30 percent had been covered by intensive cruises. Collecting information on areas outside national forests involved investigation of the records of all counties and consultations with lumbermen, public officials, foresters and engineers in private employ, and many other persons. The principal sources of information found were private timber cruises in the hands of timber owners or their agents, county cruises made for taxation purposes, and cruises of State-owned lands, Oregon & California Railroad revested grant lands, and Indian reservations. In cases in which county cruises were sufficiently complete and appeared to be reliable enough to use, no attempt was made to collect private cruises.

Private timberland owners contributed materially to the success of this undertaking. With very few exceptions and reservations they tendered the use of their cruise data, which in the aggregate are estimated to have cost them more than a million dollars. Each cooperator was assured that private cruises given would be kept in strict confidence and that cruise data from private sources would be made public only in such combinations as would safeguard their confidential character. It was emphasized also that the type maps would not indicate density of stand for the mature types.

Field Procedure

The intensive reconnaissance method applied on national forests consists in mapping areas that are uniform as to type conditions and estimating the average volume per acre for each of these type areas. Type boundaries were determined by working along trails, roads, and ridges, by using high points

for lookouts, and by running random strips, and were placed directly on base maps. For each saw-timber-type area, estimates of average volume per acre were made ocularly and were checked by use of data taken on a number of well-distributed sample plots. Sample plots were either quarter-acre circles (58.9-feet radius) or 1-acre strips (66 by 660 feet). For all trees of saw-timber size on these plots species, height, and diameter were recorded and volume was computed. For second-growth areas, that is, areas occupied by stands less than about 150 years of age, average age of timber and average stocking were recorded. At frequent Intervals site observations were taken and recorded; the age of the stand was determined with an increment borer, average height of the dominant and codominant trees was determined with an Abney level, and site values were read from a curve of height over age. In determining site only Douglas-fir trees were measured where the Douglas-fir classification was used, and only ponderosa pines were measured where the ponderosa-pine classification was used.

In the Cascade Range, the Siskiyou Mountains, and the Olympic Mountains, because of the distinctness of the topography it was possible to determine type boundaries largely by observation from vantage points. On the Siuslaw National Forest, in the Coast Range, mapping was seriously impeded by numerous small canyons and short ridges with no definite topographical pattern, by luxuriant brush and tree cover, and by poor weather. Here aerial photography was used as an adjunct to ground work. Oblique rather than vertical pictures were taken, because of lower cost and greater ease of orientation.

For areas outside national-forest boundaries the first step in preparing type maps was to record the collected type data on transparent vellum plats fitted over base maps. Each type mapper visited the county seat in search of additional information and familiarized himself with the county in a general way by driving over the roads. Having selected an area on which to begin work, he mapped as much as he could from the roads and trails. Picking points that would give the best view of the country and using as a control the roads, streams, and other features on the base map and the type areas already entered on the vellum from office records, he oriented himself with a compass and mapped all that could be seen. Each type area was viewed from several vantage points to determine its exterior boundaries. In this region of dense cover and irregular, often rugged topography, once under forest cover it is difficult to see out, and great care was necessary to avoid overlooking any small farms, pasture lands, burns, or small second-growth areas. On areas of mixed types it was customary to map the smaller type areas first, thus fixing the boundaries of the larger types.

For areas not covered by existing data, which were principally second-growth areas, land cut over prior to 1920, burns, woodland areas, farm woods, agricultural lands, grassland, brush areas, and barrens, the field examiner located, and sketched on the map, the boundaries of each type. For second-growth areas, he determined also the age class of the timber, its species composition, and the degree of stocking. For areas occupied by merchantable timber he estimated the board-foot content of the stand by species. For all coniferous types except lodgepole pine, noncommercial rocky, and subalpine, he made site determinations at frequent intervals.

Several large agricultural areas contain scattered forests and woods that are too small to be shown on the type map but that in the aggregate constitute a forest resource too large to be ignored. These agricultural areas are fairly well defined; an example is the Willamette Valley of Oregon. To get a statistical expression of the extent and character of their forest stands, they were covered by a linear survey. Type and volume data were taken on transects at intervals of 3 miles or less.

Lands shown by county and private records to have been clear cut since the beginning of 1920 (type 36) were not classified in the field but were examined in the field to verify that they had been clear cut. These areas cannot satisfactorily be classified as to restocking, because of the periodicity of adequate seed crops, the practice of slash burning, high fire hazard, and the nature of logging practice in the region. However, a statistical expression was obtained of the condition of those logged prior to the period of general seed-crop failure that began in 1924. A linear survey was made of the areas logged in 1920–23, transects being spaced 2 miles apart or at the rate of 1 mile of strip for every 1,280 acres. At 1-chain intervals on these transects four 13.2-foot quadrats were examined, and each of these was classified as stocked or nonstocked according to whether it contained one well-established seedling (the stocked-quadrat method).

The site map was made on a skeleton vellum overlay map of the county, scale one-half inch to the mile. All the site determinations made were plotted on the map and by interpolation site-class boundary lines were sketched in. This of course, gave only a generalized picture, but by referring to topographic features and using his knowledge of the country the field examiner was able to make a sufficiently accurate map for an area as large as a county. The site maps were intended to show not the site class of specific small areas but the area of each site class in the county.

The final field job was “adjustment cruising” of contributed cruise data. It was impossible to adjust these data to survey standards without resorting to field work because (1) specifications were often incomplete or lacking and (2) errors made by cruisers might have caused considerable inconsistency in a given cruise. The adjustment cruising consisted in cruising well-distributed sample areas according to the specifications adopted for the forest survey and comparing the results with the original cruise data. The size chosen for the individual sample was 160 acres.

Volume was recorded for quarter-acre circular plots at 2-1/2-chain intervals, or for 16 such plots on each 40-acre tract;

in other words, a 10-percent cruise was made. The circular-plot system was admirably adapted to the purpose, and speeded up the work. Locations of all doubtful line trees were determined with a tape, all trees apparently more than 60 inches d. b. h. were measured for diameter, and a considerable percentage of the smaller trees were measured. Heights were measured with the Abney level and by taping a number of windfalls each day. Deductions for breakage and defect were calculated for each 40-acre tract. These deductions were carefully checked, for each tract cruised, by examining felled and bucked timber on neighboring logging operations and by interviewing superintendents, foremen, check scalers, and managers of logging operations in the vicinity.

Per-acre volume of the hardwood stands, usually not included in commercial cruises in the region, had been determined by the type mappers, but information was lacking as to the volume of the hardwood timber occurring as an understory in mature coniferous forests. As a part of the adjustment-cruising project, therefore, data on this hardwood understory were collected.

Each check cruiser compiled his data currently and made frequent comparisons with the original cruise until he was satisfied that the results were consistent and that reliable adjustment factors could be computed. Usually 3 to 4 percent of the area included in the original cruise was check cruised.

Compilation of Data

In many counties a year or more elapsed between the completion of the original field work and the beginning of compilation. In such cases the status of areas logged and burned in the intervening period had to be investigated. This involved a check of cutting and fire records, and in some cases additional field mapping.

Before type acreages could be computed it was necessary to determine the exact land area of each township, each county, and each national forest. General Land Office plats were used for townships for which they were available.

Areas of unsurveyed townships were determined by planimetering the most accurate maps available.

Information as to ownership was obtained from county records for county-owned and municipal lands, State records for State-owned lands, Department of Interior records for national-park, Indian, and revested grant lands and for unappropriated public domain, and Forest Service records for national forests. All land not shown by public records to be public property was considered private.

Acreage for each of the various types and for divisions of some types by age class and degree of stocking was determined for each section and for each ownership class from the field maps. For each national forest this was done by compartment, block, and working circle and also by county. Acreage was determined by use of the planimeter or by counting squares.

Site-class acreages were compiled for each county and national forest from site maps by planimetering. Percentages of total acreage in each site class represented were determined for each township in the same manner, for use in computing volume of second-growth stands.

Volume data for national forest areas were compiled by applying to type areas the stand-per-acre values determined in the field. Volumes were compiled by compartment and were summarized by block and finally by working circle.

For areas outside national forests, the adjustment factors determined by check cruising were applied to the volume figures taken from existing cruise records and the corrected totals, recorded by section, township, and county. Volumes for areas of merchantable timber, including hardwoods, not covered by previous cruises were compiled by applying to each area the figure for stand per acre shown by the type map. Commercial cruises had omitted a large majority of the second-growth stands in which the average breast-height diameter was below a standard ranging, according to species, from 20 to 24 inches. For uncruised second-growth stands in which the trees averaged 16 inches d. b. h. or more, volumes were obtained from tables adapted from the Douglas-fir yield tables (12). Volume data for second-growth areas were segregated from the others.

Depletion-Study Methods and Sources

Cutting Depletion

The data taken on depletion by cutting covered the material removed not only as sawlogs but also as so-called minor timber products. The records used included only wood material actually taken out of the woods, omitting sound material left by operators on the ground as nonutilizable. This sound unused material entered the study only when future depletion was being estimated. Its quantity had been accurately determined in a previous study (7).

The study of annual log depletion was based on the 9-year period 1925–33 because more and better data were available for this period than for any other. It is true that in this period sawlog production reached a peak that it may never reach again, but the period included some years of extremely low production; all things considered, the data are believed to be representative.

The log-production data used were taken from several sources but principally from the biennial lumber- and log-production censuses of Oregon and Washington for the years 1925, 1927, 1929, 1931, and 1933 taken by the Pacific Northwest Forest and Range Experiment Station in cooperation with the Bureau of the Census. Sawlog production as reported by the independent loggers and logger-manufacturers was used in preference to lumber, lath, shingle, veneer, and pulpwood

production because in this way the material could be traced to its sources and classified by county and unit. Data for 1926, 1928, 1930, and 1932 were obtained partly from records of the Portland, Oreg., regional office of the Forest Service and partly by interviewing officials of timber companies and lumber associations and other individuals having personal knowledge of lumber operations.

A check of the sawlog data was made by comparing the sum of the county totals with a regional total obtained by combining census and other official figures. The differences found were 3.7 percent for western Washington, 2.1 percent for western Oregon, and 1.9 percent for the region as a whole. The errors for survey-unit totals were estimated to be well within ± 5 percent.

The study of depletion for minor forest products had to be based on 1930 production alone, as data for previous or subsequent years were either missing or too incomplete for satisfactory use. The basic data were obtained through field investigations and by means of questionnaires circulated to producers and consumers. Information of satisfactory accuracy was obtained by this method for all items except round and split fence posts. Since posts are produced in small quantities and by many individuals, largely by farmers for their own use, it was impossible to canvass the field thoroughly. A figure was obtained by adding to the output reported by the large-scale commercial operators an estimate of annual farm requirements.

Fire Depletion

The study of depletion of the forest capital by fire was much more complex than the study of depletion by cutting.

The two sources of information available were Forest Service reports covering burned area on the national forests and State foresters' reports covering burned area on all other forest lands. The data were summarized by survey unit, those for national forests being treated separately from those for all other lands.

The basic data used for the analysis of depletion by fire on the national forests were the reports of all class C fires (fires 10 acres or more in area) on the national forests of the region in the 10-year period 1924-33. Site and type before fire were determined by superimposing on the forest-survey site and type maps the outlines of the areas reported to have been covered by the fires. Each fire was classified and the essential data regarding area, location, type, site, and volume were separately recorded. These were compiled by county and summarized by unit. A field check was made of about 25 percent of the total area reported to have been covered by class C fires, and from the data thus obtained correction factors for both area and volume were computed. No blanket deduction was made for salvage. In the few cases in which material was known to have been salvaged this material was deducted from the loss. When the 10-year totals of area burned and timber killed had been adjusted, they were converted to average annual-loss rates.

Reports made to the State foresters on individual fires in the region in the 5-year period 1926-30, which had been analyzed in connection with the forest fire insurance study (20) recently made by the Pacific Northwest Forest and Range Experiment Station, formed the basic data used in computing fire-depletion rates for land other than national forests. Supplementary reports on nearly all the fires covering 50 acres or more were obtained from the fire wardens, and checked in the field, for all counties except San Juan and Island in Washington and Hood River, Jackson, and Josephine in Oregon. The areas covered by the supplementary fire reports were classified as to site and type by reference to the forest-survey site and type maps, and the volume loss estimated. These data were recorded by county and the totals combined by forest-survey unit. The data were then compared with the State foresters' published reports of total area burned in the same period in the same group of counties and were adjusted to them. They were next converted to an annual loss rate. This procedure automatically included Island, San Juan, and Hood River Counties. Jackson and Josephine Counties were covered by a separate analysis of individual fire reports to the State foresters for the period 1926-32. Finally, annual loss rates were calculated for the entire region by survey unit. Salvage rates for lands outside the national forests were computed on the basis of data obtained in the forest fire insurance study, and were applied to volume-loss totals.

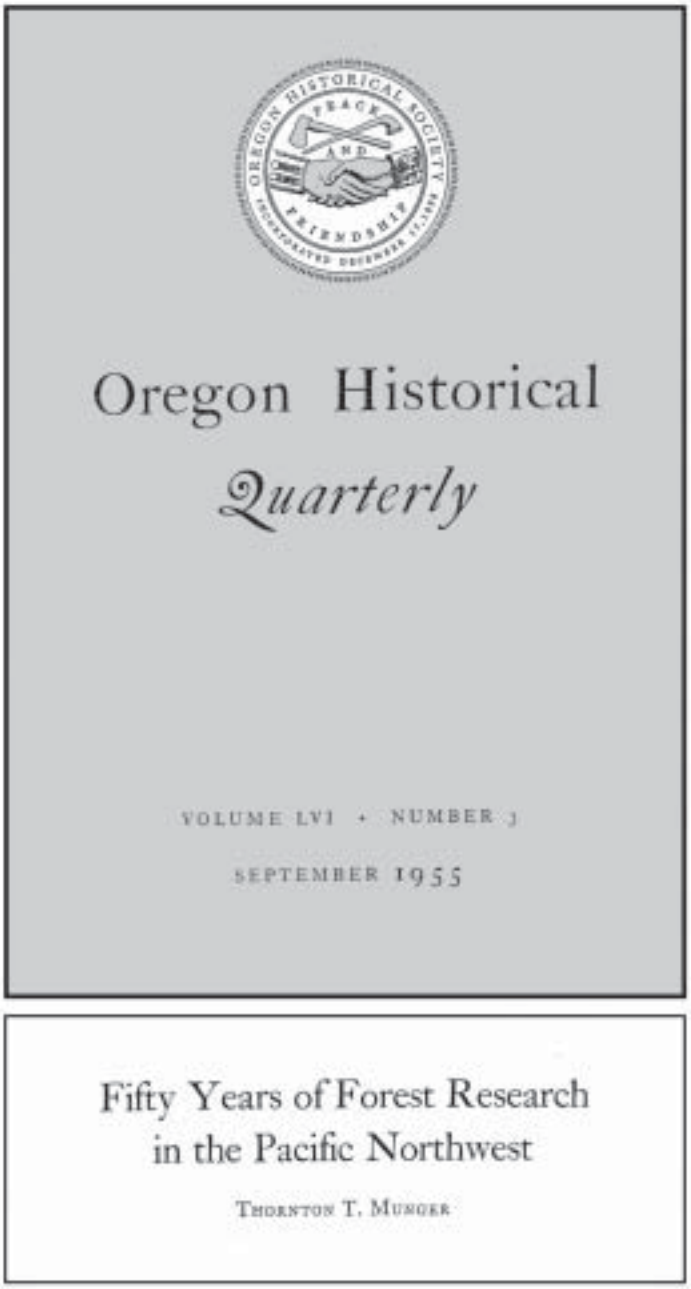
Future Depletion

No specific formula could be evolved for making estimates of future depletion from cutting. The economic forces that could influence the situation are many and complex. The Douglas-fir region is farther removed than any other forest region of the United States from the large markets of the Midwestern and Eastern States. What quantities of lumber will be shipped from it will depend somewhat on the extent to which the other forest regions can fulfill the requirements of the country's heavily populated sections. On the other hand this region is favorably situated in relation to Asia, Africa, and the antipodes, the world's largest undeveloped markets for softwoods. The depletion estimates are pure assumptions, based on careful analysis of cutting records and of current trends in lumbering, not only regional but national, and all other known influences.

Future depletion from fire, while not subject to so many dynamic economic forces as cutting, was equally difficult of prediction.

Pages 150-169 and bound maps not included

Appendix E: Selected pages from Fifty Years of Forest Research in the Pacific Northwest (by T.T. Munger)



The following section is from pages 237-239 in Munger, Thornton T. 1955. Fifty years of forest research in the Pacific Northwest. Oregon Historical Quarterly. LVI(3): 226-247.

One of the major projects of the Forest Experiment Station since 1930 has been a survey of the forest resources of Oregon and Washington.[4] The survey included not only an inventory of forest resources of all ownerships, but an estimate of forest growth, both actual and potential, a survey of depletion from cutting, fire and pests, and of the prospective requirements for wood products. Such an extensive project had never been undertaken before, and the techniques later adopted elsewhere were initiated here.

The Forest Survey was directed from the start by the late Horace J. Andrews, who was succeeded in 1938 by Robert W. Cowlin. Between 1930 and 1936 the Forest Survey completed coverage of all the forested portions of Oregon and Washington—some 33,000,000 acres. It was then probably the largest forest acreage in the world ever to be cruised and type-mapped so intensively. When the project was at its height the annual expenditure was $150,000 to $200,000, including emergency relief funds, and excluding valued help from various segments of the industries, from timberland owners, the states and other cooperators, whose data contributed greatly to the completeness and economy of the project.

No sooner was the last county completed than the need for revision of the inventory of the first counties was necessary, particularly where there had been rapid cutting or holocausts. So it has been a continuing project to keep the forest resource data up to date. Survey results have been circulated through maps, statistics, texts and other methods. They have been the bases for all broad-scale planning for sustained-yield units on and off the national forest. The Survey has given an economic foundation for the planning of public services and of transportation and the development of forest management plans. Merged with the data from other forest regions, the Survey furnishes conclusions which make possible national planning to balance the timber budget of production and consumption.

During the depression of the thirties, when regular appropriations were cut to the bone, the Experiment Station benefited greatly from the Civilian Conservation Corps, the Works Progress Administration, and the Emergency Relief Administration. Some experimental forests had a side camp of twenty-five CCC boys available for station projects. Other persons were employed under various relief programs, both in the field and in the office. New residences and office buildings were built at Wind River, Cascade Head, Pringle Falls, Port Orford Cedar, and Blue Mountain experimental forests, as were roads, trails and bridges. During the early phases of this emergency work, certain technical activities, particularly on the Forest Survey, were greatly accelerated by the personnel supplied from relief rolls. At one time twenty-eight ERA computers, clerks, and map colorists were employed in the Portland office.

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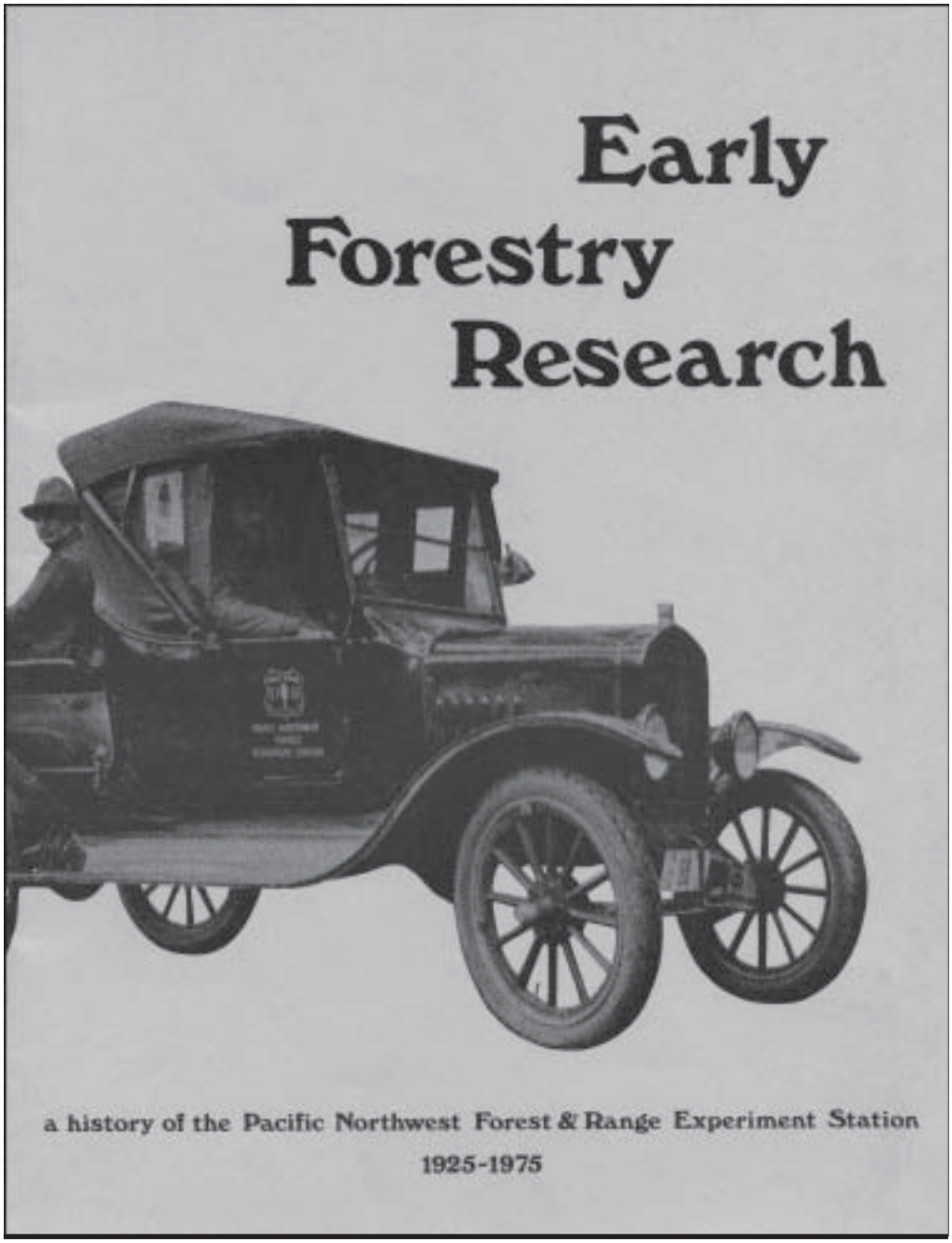
[4]The 1930 Forest Survey was not the first attempt to inventory the woods. Prior to 1905 when the General Land Office of the Department of the Interior still had charge of the “forest reserves” a number of highly competent forest explorers under the Division of Forestry, USDA, made reconnaissances in the vast Oregon and Washington forest reserves that were notable for the scope and keenness of their observation. Soon after the establishment of the district office in 1908, an “extensive reconnaissance” was made of every national forest. The work was done by a local technical assistant cruising and mapping in a year or two, the million or so acres assigned to him. Concurrently, of course, a great deal of “intensive reconnaissance” was done by detailed cruising and mapping methods. This has now been extended to cover most of the commercial timbered areas in the national forests.

Appendix F: Selected pages from *Early Forestry Research*:
a History of the Pacific Northwest Forest & Range Experiment Station, 1925-1975 (by Ivan Doig)



Doig, Ivan. 1977. Counting the trees. In: Early forestry research: a history of the Pacific Northwest Forest & Range Experiment Station, 1925-1975. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station: 10-14.

COUNTING THE TREES

The Arkansas day of 'can see to cain't see' was in effect much of the time.-Thornton T. Munger, June 1931, describing field work during the Lewis County phase of the Forestry Survey

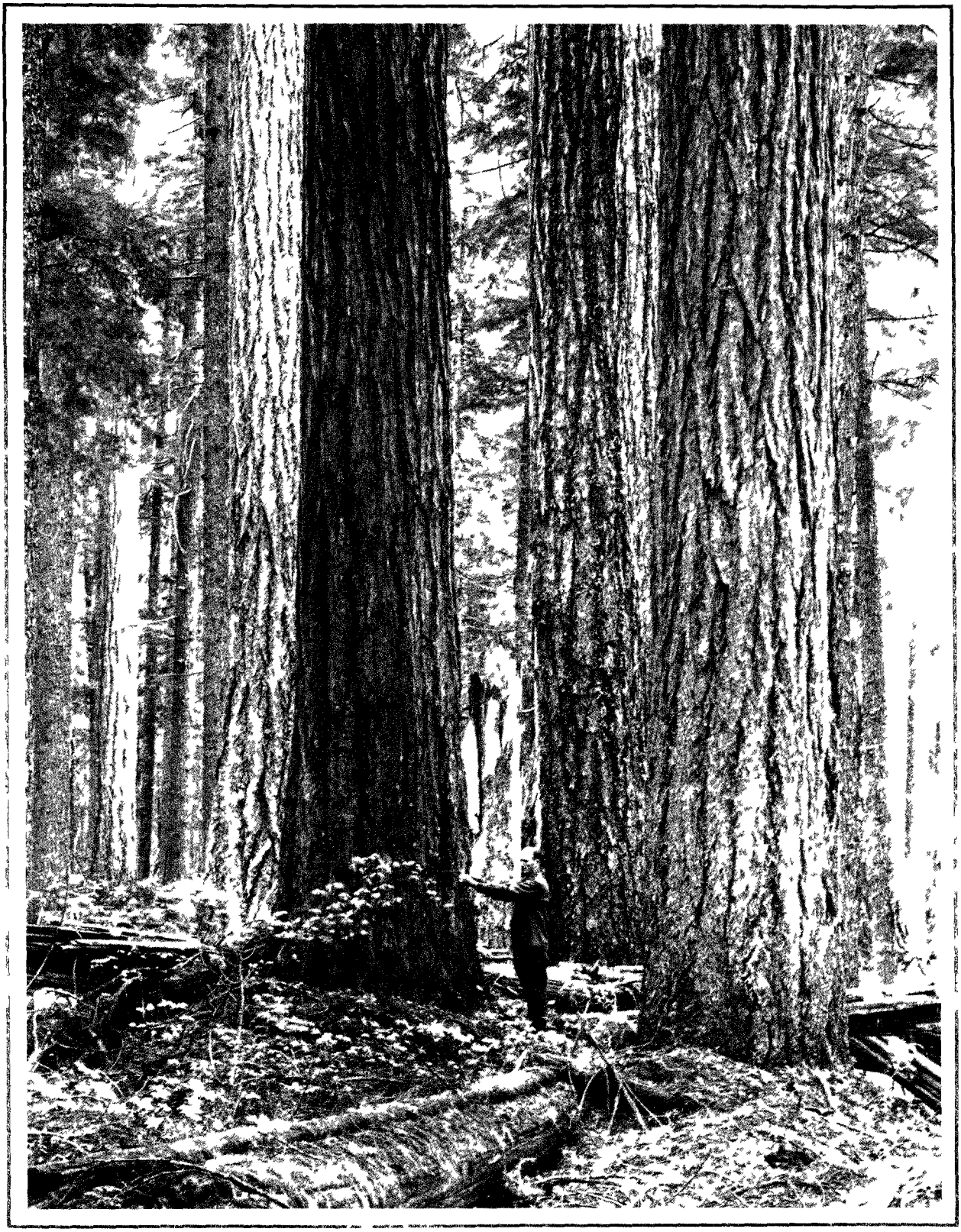
Early in 1929, Munger went to Washington, D.C., to discuss an ambitious new project prescribed in Section 9 of the McSweeney-McNary Act. This was to conduct a long-needed inventory of American timber resources—both private and public—an accounting of the timber stands left after many generations of logging. The nationwide Forest Survey began with the Douglas-fir region west of the Cascade Range in Oregon and Washington.

The Douglas-fir country was no capricious choice. Although totaling only about 30 million acres of forest land, a fraction of the national total, the region was known to have a major share of the nation's remaining volume of sawable timber. Much of it was in old-growth stands, and many of those were within the boundaries of National Forests.

Even as plans for the Forest Survey were being shaped, the Pacific Northwest lumber industry was suffering economic heaves and staggers. The slackening of the postwar boom of the Twenties meant a decline in lumber sales and a sag in lumber prices. Now, with the onset of the Depression, lumber production plummeted. In the Douglas-fir region which was the focus of the Forest Survey, lumber production dropped from about 10 billion board feet in 1929 to 7.5 billion board feet the next year.

Economic woes threatened the cooperation which the Station needed to conduct the Forest Survey. Hard-pressed timberland owners were leery that making public the timber volume data on their holdings would inspire tax officials to boost assessed valuations. Eventually, the Station agreed that all private timber cruise data would be kept confidential and compilations would not be released in any form that would disclose the timber holdings of any single private owner.

Once that rift with the lumbermen had been smoothed over, plans for the Forest Survey forged ahead. Early in January 1930, Horace J. "Hoss" Andrews, a forester who had directed a forest land and economic survey for the state of Michigan, was brought in as senior forest economist and director of the project. The same week, Christopher M. Granger, who had been District Forester, was appointed national director of the Forest Survey and moved his office to the Station. Walter H. Meyer was the Station's resident authority on statistical methods, and he was given responsibility for the methods of predicting forest growth. Donald N. Matthews came from the Umpqua National Forest to head the teams gathering field information on National Forest lands. Robert W. Cowlin, a young forest economist with a background in the California redwood country, was put in charge of assembling data on timberlands outside the National Forests. Foresters were added to take the measurements in the woods. Among them was Jim Girard, a lanky woodsman out of Appalachia, who had the knack of glancing at a stand of trees and estimating its timber volume with uncanny accuracy.



A beautiful stand of Douglas-fir in Skamania County, Washington (1936).

The Forest Survey was well underway in 1930. Munger reported that private timber cruise records "continue to be gathered in at the rate of about one-half million acres a month," while the estimable Girard coached survey teams in his skills of "ocular estimation."

But if the Station's major project was prospering, its personnel were not. The effects of the Depression began to wash over the Station early in 1931. Munger was instructed to hold up the expenditure of a portion of appropriated funds during the next 2 fiscal years. Promotions, hirings, and travel were restricted. Salaries, never very substantial in the Forest Service (junior foresters with college degrees were being hired for about $2000 a year), now stood frozen year after year. Then in July 1932, annual vacations were scrapped and the "Hoover holiday" was instituted—2 days off each month without pay.

For all that, a belt-tightened job was better than no job. Philip A. Briegleb, a researcher who joined the staff just before the rapid slide into the Depression in late 1929, recalled the reassurance of even a diminished paycheck: "In those years, an assignment in the Forest Service was a pretty good looking asset."

While the Depression years meant lean pay, they also proved to be an era of expansion for Federal forestry. Out of the New Deal flowed funds and personnel made available by the new emergency agencies. The CCC (Civilian Conservation Corps) channeled plentiful manpower into the forests. Munger remembered the labors of the CCC youths: "They did a lot of development work, including building residences and office buildings at several places," plus "a substantial amount" of work at the five new Experimental Forests under the Station's administration. ECW (Emergency Civil Works) funds financed the rehiring of temporary workers who had been laid off in the budget crunch and the hiring of field assistants and scientific aides to help with the Forest Survey and other Station projects.

Even before that transfusion, a study of fire loss was carried out by experienced timber cruisers and graduate foresters left short of employment by the Depression. Late in 1933, more funds and people were made available to the Station from the NIRA (National Industrial Recovery Agency) and CWA (Civil Works Administration). By the new year, these accounted for some 50 more people on the Station work force.

In the midst of the hectic year of growth, the Station moved to new quarters in the Federal Courthouse in Portland. It was the Wind River exodus of 1924 writ much larger—workers grappling furniture, scientific equipment, and shelves of books into panel sedans. As promptly as the move was made, the new quarters were outgrown by the influx of staffers. Two large jury rooms of the U.S. Circuit Court of Appeals were borrowed for the overflow—only to be promptly taken back by an irate judge who discovered a fresh cigarette burn on an oak desk.

These CCC boys, with the foreman and cook, spent the summer of 1934 thinning plots at the Pringle Falls Experimental Forest near Bend, Oregon.

While the Station headquarters crammed in its new personnel and projects, the field work on its biggest research program—the Forest Survey of the Douglas-fir region—was nearing completion. The survey had taken an unexpected turn in late 1930, when Forest Service headquarters in Washington, D.C., decided that the estimate-and-compile method being used by the Station crews should be tested against what was called the line-plot method. Lewis County, Washington, one of the larger units of the Douglas-fir region, was chosen as a test area. Across some 1 million acres, linear swaths of timber were singled out at 3-mile intervals. Crews then measured timber volume on quarter-acre plots at regular intervals within the forested strips.

Cowlin, who had charge of the line-plot survey experiment, calculated that 960 man-days were spent in the woods. "The 8-hour day was unheard of," he recalled, "for in some instances it would take several hours or more to reach the line in the morning and a like amount of time or more to reach the camp, night lodging place, or automobile at the end of the day." He remembered rewarding moments out in the big trees. Francis X. Schumacher, a visiting scientist from the Washington, D.C., headquarters, profited nicely from the Survey crew in a weekend poker game at Chehalis. But on Monday, Cowlin and a cohort evened the score with bets on tree diameters before they were measured. "Schu had a tendency to underestimate the large old-growth Douglas-fir," Cowlin reported.

The Lewis County measurements were finished in June 1931, and computations were begun to compare the two methods of survey. They were found to be fairly close in results, with the line-plot method proving a bit more precise in revealing stands of hardwood within the coniferous forests, the compilation method more flexible for use in varied terrains and expanses. The decision was made to continue the compilation method, not only for the Douglas-fir region but also for the ponderosa pine survey to be carried out east of the Cascades.

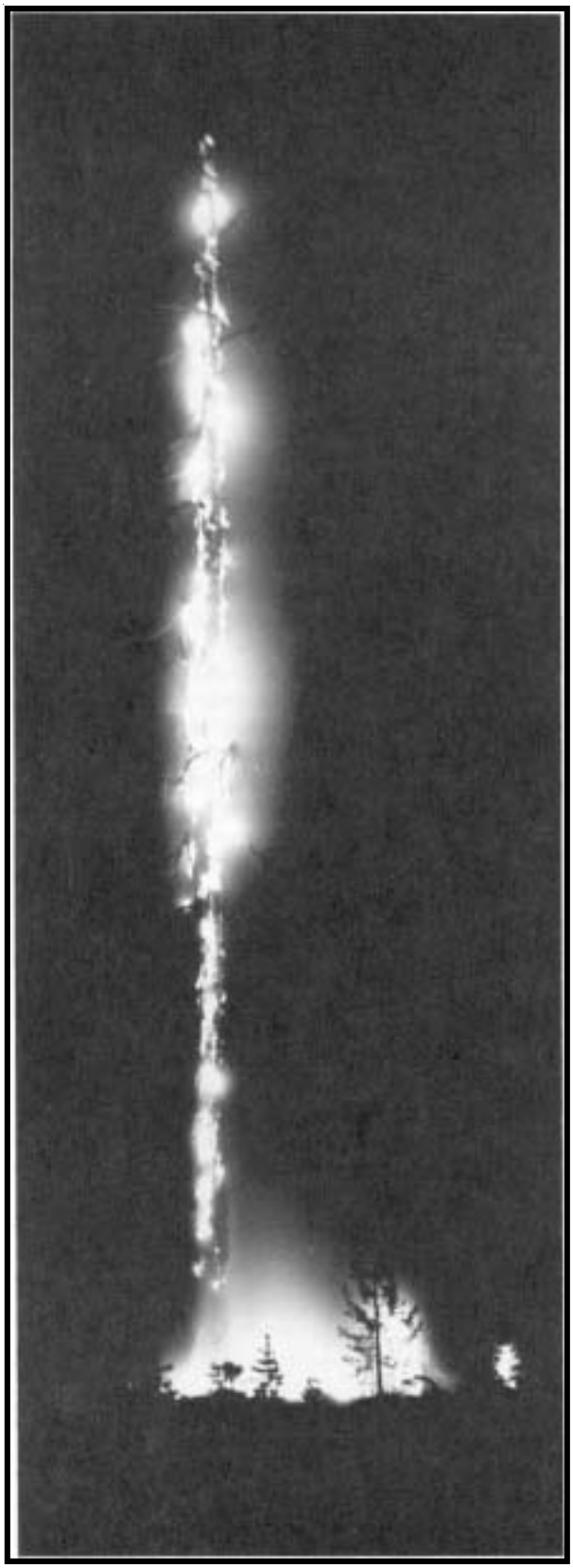
By the end of 1932, the inventory of National Forest lands in the Douglas-fir country was completed. What remained to be done on the privately held timber stands and in compilation and evaluation was hastened by the supervisory abilities of "Hoss" Andrews, something of an artist at evading red tape. In 1934, the compilations and measurement of timber stands were translated into color-coded maps. Late in 1935, fieldwork was completed in the ponderosa pine region. Within about another year, the final Forest Survey report for the Douglas-fir region was completed.

The Forest Survey was the Station's major research achievement in this era, but other milestones can be counted as well:

- This was the period when Experimental Forests were authorized and established, one in the Douglas-fir groves of the Wind River Valley, another in the western yellow pine country near Pringle Falls on the upper Deschutes River. The Experimental Forests made it possible to study various forest types in their natural state and to document their response to resource management practices.
- Aerial photography was contracted for by the Forest Survey staff, chiefly to see whether it could be used on the most inaccessible back country of the Siuslaw National Forest in southwestern Oregon. The results were promising, but the method too costly. The extensive use of aerial photography awaited more sophisticated equipment and film.
- When the Tillamook fire destroyed a vast swath of old-growth timber in northwestern Oregon in August 1933, Leo Isaac and fellow researcher George Meagher followed up with a study of regeneration in burned-over areas. Their findings, which pointed out erosion hazards in the steep Pacific Coast area, made front-page headlines in the Portland newspapers. The Isaac-Meagher report was perhaps the most widely noticed of the many publications which came from the Station in these years.

Points of conflict between researchers also began to show up in the Depression era. In March 1934, researcher Axel J. F. Brandstrom presented findings on a system called economic selective logging. The Brandstrom formula called for cutting the highest value trees and leaving the rest to grow into a future timber crop — a sharp break with the prevalent practice of clearcutting entire areas. Brandstrom's idea set off a dispute within the Station that went to the highest echelons of the Forest Service.

In 1936, Brandstrom and Burt P. Kirkland, a well-known Northwest forester then serving in the Washington, D.C., office of the Forest Service, prepared a report titled "Selective Timber Management in the Douglas Fir Region." Munger and Isaac objected to many points in the manuscript, particularly what they saw as wholesale conversion to partial cutting in the old-growth Douglas-fir forests. This, they argued, would lead to timber stands of uneven age, which would favor shade-tolerant species of less commercial value than Douglas-fir. Kirkland and Brandstrom held the view that selective logging was efficient and economical, particularly with the advent of logging tractors and trucks which they said were more flexible than the old system of railroad spur and cable logging.



This was an early round in the complex battle over clearcutting. Munger was especially perturbed — although he termed it merely "muffled disapproval" — that Regional Forester C. J. Buck was determined to make selective cutting the policy on National Forest timberlands in the Northwest. Over Munger's protests, the disputed report was published with a foreword by Chief Forester Ferdinand A. Silcox which called the Brandstrom-Kirkland proposals "thought provoking, original, and constructive." Selective cutting did become the regional policy for several years, until the pendulum of economics swung in favor of clearcutting once again.

One achievement of these years was long overdue — the Station's first laboratory. A small building was rented in southeast Portland, renovated, and some basic equipment installed. It was at best a modest start: a staff member of the time points out that the miniature laboratory, "if it could be so dignified," was shared with other federal scientists doing research on forest insects.

This era has a selection of endings. One was the waning, by early 1938, of New Deal programs and money which had fueled much of the Station's research. Another was the completion of the Douglas-fir Forest Survey, a landmark effort in evaluating our timber resources. Another occurred on July 1, 1938, when Thornton Munger stepped down as Director and took on the job of heading up forest management research at the Station.

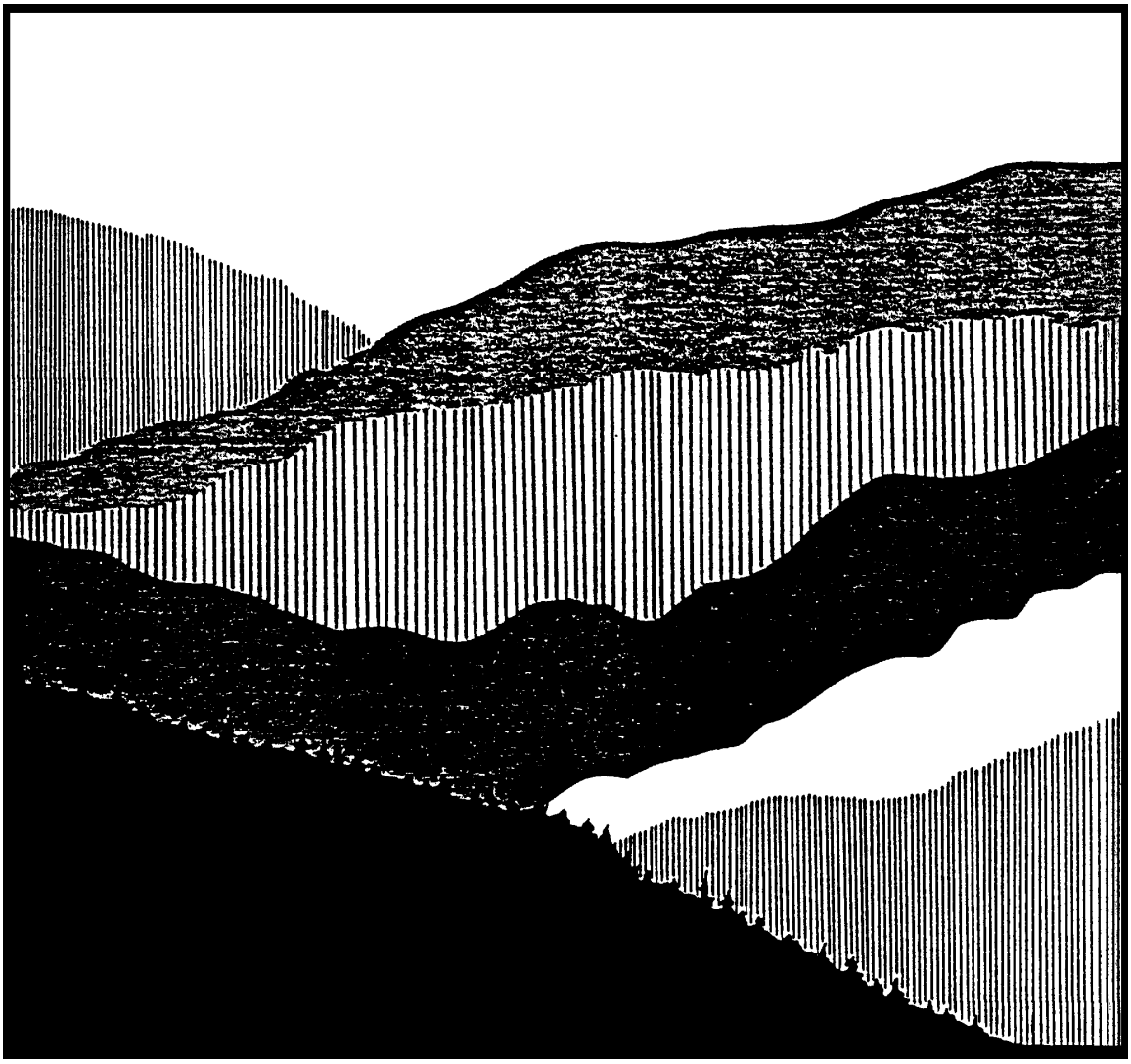
Appendix G: Selected Portions From *Federal Forest Research in the Pacific Northwest: The Pacific Northwest Research Station*.
(by Robert W. Cowlin)

Federal Forest Research in the Pacific Northwest

The Pacific Northwest Research Station

Robert W. Cowlin

October 1988



The following section contains paragraphs relevant to the 1930s forest survey from pages 29 – 100 in Cowlin, Robert W. 1988. Federal forest research in the Pacific Northwest: the Pacific Northwest Research Station. 244 p. Unpublished document distributed by the Pacific Northwest Research Station.Note, footnote numbers correspond with those in the original document.

from page 29-30

Overshadowing all these accomplishments was the enactment by Congress of the McSweeney-McNary Act of May 22, 1928. This was and remains the most important Federal legislation related to forest research. It contains 10 sections which provided the basic framework for the organization of regional Forest Experiment Stations and named and described the following broad fields of study in separate sections: "forest diseases; forest insects; forest animals, birds, and wildlife; forest fire weather; forest range and watershed; forest products; forest survey; and forest reforestation and economic studies." Annual amounts were authorized for each of the eight fields of study and an overall ceiling was placed on the original forest survey. These amounts seemed generous at the time, particularly when compared with the amounts previously appropriated. As time passed, they proved inadequate and the basic act was amended and supplemented a number of times. However, it still stands as an example of prescient and progressive forest legislation.[10] Senator Charles L. McNary of Oregon was behind this legislation in Congress. At the time, he was in his second term and the acknowledged national leader of forest legislation. Other Oregon and Washington senators and congressmen have followed in his footsteps as leaders in forest legislation.

Actual appropriations were not made under the McSweeney-McNary Act until the fiscal year commencing July 1, 1929. In anticipation of funds forthcoming for the forest survey under Section 9 of the Act, Munger went to Washington in January 1929 to review plans for the forest survey with Washington Office research personnel.

Prior to this time, the nature of the proposed forest inventory had been discussed with the Advisory Council and the Investigative Committee. Both of these groups strongly supported Munger's belief that a forest type map was an essential part of such a project. An allotment of $30,000 for the forest survey was made effective July 1, 1929. This doubled the financial funding for the Station. Staffing commenced immediately with the appointment of Philip A. Briegleb from the junior forester rolls on July 1. Briegleb was detailed to Wind River to work on projects there until the forest survey plans could be finalized. On November 5 of that year, Robert W. Cowlin was appointed as an associated forest economist and Floyd L. Moravets was transferred from District 6 as a junior forester to serve on this project, and Edith A. Parmeter was appointed October 14 as junior clerk to complete the staffing for that year. The remainder of the year this group reviewed literature, defined forest types, investigated sources of information, and commenced preparing working plans under the direct supervision of Director Munger. It was planned to divide the forest survey into four phases, which were: the timber inventory, forest growth phase, forest depletion, and the requirements for forest products. This was in accord with the language of Section 9 of the McSweeney-McNary Act. The Douglas-fir region, the area west of the Cascade Range summit in Oregon and Washington, was selected from all other forest regions of the country as the starting point for this important new project. Since this project was to be extended to other forest regions in future years, considerable attention was directed to the plans and procedures developed and executed here. Furthermore, this region, despite the fact that it contained only about 30 million acres of commercial forest land, was known to have a major share of the Nation's remaining sawtimber volume, most of it in old-growth stands. Since the National Forests contained a large part of the forestland acreage and timber volume, there were prospects that the historical trends of forest resource depletion in the Lake States, East, and South might

10 "A National Program of Forest Research," published in 1926 by the American Tree Association for the Society of American Foresters, furnished a "blueprint" for this legislation. It was prepared by Earle H. Clapp as a special report of a special committee on forest research of the Washington Section of the Society of American Foresters. Other members of the committee were R. C. Hall and A. B. Hastings. However, many other foresters, entomologists, plant pathologists, and wood technologists contributed to it. It made an analysis of the forest problems of this country and research needed to solve these problems. It went into great detail of the kinds of research needed, its complexities and interrelationships. The report described existing agencies—private, public, educational, and institutional—and current programs and discussed agency needs and responsibilities. It drew certain conclusions and made suggestions for an organic act for forest research in the U.S. Department of Agriculture.

from page 30 to 31

be averted here. Also, the private lands of this region were generally located in the areas of higher productivity, and there were indications of interest in holding timberlands for continuous timber production by some owners. One of the factors arousing this interest was the passage of "the reforestation land tax bill" by the Oregon Legislature in March 1929.[11] The Fairchild study definitely had some influence in awakening public awareness of the adverse effect of current property tax laws and practices upon private forest-land ownership and management.

The sudden collapse of common stock prices on the New York Stock Exchange signaled the beginning of an economic depression that was to endure nearly a decade and that was to result in numerous radical changes in the Nation's economic and social structures and political institutions. Forest resource management, the forest industries, and forest research programs were influenced in a number of ways by the economic forces at work and by Governmental actions.

For several years before 1929, lumber production nationally had been declining. In the Douglas-fir region, volume of lumber production had remained practically stationary from 1926 to 1929. There were signs that the postwar boom of the twenties had run its course. Lumber prices were weakening under slackening demand. Many timber companies were financially overextended with burdensome debt charges on bonded indebtedness. Installed capacity was greatly in excess of that needed to supply national demand. Lumber production nationally declined from 37 billion board feet in 1929 to 26 billion feet in 1930, and the bottom was not in sight. During the same 1-year period, production in the Douglas-fir region dropped from about 10 billion board feet to 7.5 billion board feet. Since the timber industries were by far the leading manufacturing industry in the Pacific Northwest, the impact on this region's economy was severe.

With this stage setting, a strengthening of the economic aspects of forestry in the Station's research program commenced in 1930. The funds allotted to the forest survey more than doubled and other new projects of an economic nature were planned.

On January 6, 1930, Horace J. Andrews was appointed senior forest economist to provide the leadership of the forest survey project. On the same day, Donald N. Matthews was transferred from the Umpqua National Forest of District 6 to assist on the survey. "Hoss" Andrews was particularly well qualified for this position. A graduate of the School of Forestry, University of Michigan, he was Director of the forest land and economic survey of the Michigan State Conservation Department in 1924 and 1925. Following this period, he was Chief Fire Warden and in charge of the State of Michigan Division of Lands until he left to join the Station.

January 1, 1930, District Forester Christopher M. Granger was appointed as Head Forest Economist to be the national director of the forest survey, and later in the month moved his office from District 6 headquarters to the Lewis Building in the Experiment Station suite. With the principal staffing of the survey group completed, the working plan could be developed and fieldwork commenced. A "Digest of the Tentative Working Plan" was prepared for presentation to the Forest Research Council and mailed to members on February 14, a week before the scheduled annual meeting.

Exploration of existing information that might be used in the survey had disclosed that private and public timber cruises were in existence covering practically all the stands of mature commercial timber on lands other than the National Forests and National Parks. From these records, forest type and tentative timber volume could be determined in the office. Field crews type mapped the remaining area, consisting principally of cutover lands, deforested burns, and second-growth stands, by traversing roads, trails, and logging railroads and occupying vantage points. Occasional patches of remnant old-growth forests not covered by records were assigned sawtimber volumes by ocular estimation by the type mapper. Records of areas cut over by date of logging and area of recent deforested burns were available in a number of sources such as State Foresters' offices, fire protection associations, county assessors, and timber owners.

11 This law provided the landowner with the option of having cutover land suitable for reforestation classified and withdrawn from ordinary operation of property taxation. The classified lands would pay 5 cents per acre annually and a harvest tax when the merchantable crop was cut.

from page 31-32

In contrast, the National Forest timberlands were only partly covered by intensive surveys, and these were commonly made in areas where timber sale programs were active. Accordingly, a somewhat different procedure was employed on the National Forests than was used on private lands, although the basic objectives and forest type and timber volume specifications were identical, assuring that the data would be additive. On all lands, each unit of commercial forest land was classified by forest type, site or productivity class, and ownership class, and was assigned a sawtimber volume value for each species if of merchantable quantity. Second-growth stands were classified by 10-year age class and three degrees of stocking; from these data, board-foot and cubic-foot volume could be determined by applying the appropriate yield table. Deforested burns and non-restocked cutover lands were classified as such with the exception of lands cut over within 10 years of the date of the survey which were designated as "recent cutovers." The reasoning was that since Douglas-fir, the principal species, did not produce adequate seed crops each year, no immediate judgment could be made on re-stocking. At this time, practically all timber harvested was by clearcutting with defective trees[12] left standing which furnished a seed source.

Noncommercial forest lands were classified by ownership class only. Forest lands withdrawn from cutting by statute, such as national parks and primitive areas, were designated as reserved and although timber volume values were assigned to such lands, they were declared unavailable for cutting.

Each National Forest was divided into working circles and compartments. The county was the basic area unit used for lands of other ownership, and forest type and timber volume data were gathered and compiled by township and section. The smallest area unit recognized in classifying by land use, forest type, or ownership was 40 acres. This survey procedure, commonly called the "compilation method," was a contrast to forest survey methods used in European countries such as Sweden and Finland where linear-plot surveys had been made on a national scale. This system consisted of measured plots of a fixed area at certain distances along lines at spaced intervals. Sampling accuracy of the resulting timber volume and forest type or land use area could be determined for large political units such as provinces. On the other hand, the compilation method was not susceptible of accuracy determination and specification by statistical analysis. However, since the region's forest area was to be completely covered by the survey, it was reasoned there would be no sampling error as far as area values were concerned. Obviously, there could be personal errors and bias on the part of field crews, which was also true of surveys by any other method. The fact that forest type maps and localized area and volume data could be obtained by the compilation method outweighed other considerations in the judgment of the Director and survey leaders and this method was adopted. The linear survey system could only yield schematic type maps and generalized area and volume data at the intensity permitted by funds available for the project.

At the annual meeting of the Forest Research Council in February 1930, plans for conducting the forest survey were presented. An entire afternoon was devoted to discussion of the methods to be used, timber volume and area specifications, and how the information was to be released to the public upon completion of the survey. Some members advocated compilation of the data by large watersheds rather than by county. Generally, those advocating this position represented private timberland owners who feared that release of timber volume data by county would prompt taxing officials to increase assessed valuations of private forest land and timber.

During World War I, corporation Federal income tax rates increased tremendously. This required a great expansion of Federal auditing of returns of timber owners, including the valuation they placed upon their timber holdings.[13] The owners were directed to evaluate their timber by quantity, character, and value as of March 1, 1913. Some owners chose to provide the forest survey with this information instead of more recent data. And, too, some private owners, particularly nonoperating owners, had only rough estimates of their timber holdings.

12 These trees were culled owing to a high incidence of decay in the lower trunk as a general rule. Such trees were not genetically inferior to the trees that had been harvested.

13 In 1919, David T. Mason was appointed to organize and head the timber valuation section of the Federal Bureau of Internal Revenue.

from page 32 to 33

The specifications for merchantable timber volume adopted as a regional standard for the survey were generally more rigid than those used in commercial private cruises and in cruises used by the counties for tax assessments. At that time, practically all the county cruises were made by commercial timber cruising firms under contract. Specifications and degrees of statistical reliability of the county cruises varied. Cruises made recently of private timber likewise varied, although generally they were more uniform than the county cruises. However, it was reported that there were substantial differences in timber volume if they were "buying" or "selling" cruises. Practically all the cruises, both county and private, underestimated the volume of the minor species, and in some cases ignored it completely. Timber volume was rarely estimated for the hardwoods, which often occurred as an understory in the conifer old-growth stands or in pure hardwood stands along the river bottoms and other favorable sites.

Obviously, the survey would have to adjust the timber volume data collected from the timber owners and the counties. In nearly all cases, this would mean an increase in total merchantable timber volume for the particular area of forest land covered. Some council member suggested using private cruises only as a sample to adjust county cruises. One member voiced the opinion that release of timber volume estimates by counties might cause county officials to have recruises made. Chairman Chapman suggested that the Station collect the data and decide later how it would be released. Other council members pointed out the advantage of having these data by county in planning forest resource development and management. It was pointed out that other economic data were available by county units. However, the Station agreed that all private timber cruise data used would be kept confidential and that it would not be released in any form that would disclose the timber holdings of a single private owner, and that the unit area of release would be the subject of future discussion and decision. Moreover, the Station agreed to qualify the timber volume data released by explicitly defining the standards used which exceeded current commercial practice and therefore was not necessarily economically available. The question of classifying private forest land and timber by accessibility zones was raised and discussed. The British Columbia Forest Service was also conducting a forest survey of the province at this time. Mr. F. D. Mulholland, who was directing this survey, was present and described their system which classified timber volume on the basis of two classes of economic availability.

Granger, Munger, Andrews, and Cowlin attended a meeting of the Forestry Committee of the West Coast Lumbermen's Association to present the plans for the forest survey and discuss them with committee members. The meeting was called by Colonel Greeley[14] who had resigned as Chief of the Forest Service in 1928[15] to become executive head of the association. The "Colonel," as he was respectfully and affectionately known by foresters and timber men, undoubtedly had considerable influence in the high degree of cooperation which the Station obtained from the timber industry in launching the forest survey. His influence was also a positive factor in support of many other Station programs and in gaining the endorsement of the association for the Station generally.

A detailed work plan and fieldwork instructions for the forest survey were completed during the early part of 1930. The first step was location and investigation of sources of information. Lists of large private timberland owners and approximate acreage owned were compiled from several sources. Sources of base map information were located and collection of maps of each county on a 1-mile-to-the-inch scale commenced for use in field type mapping of lands other than National Forests. The Forest Service District Office of Maps and Surveys had on file maps for each of the National Forests. With financial aid from State forestry departments of Oregon and Washington, work was commenced upon compiling the most recent cartographic data to draft new base maps of the two States on a 1/4-inch-to-the-mile scale.

14 Following World War I, Greeley was commonly referred to by his military title.

15 He was succeeded by Major R. Y. Stuart.

from page 33 and 34

The actual fieldwork of the survey was divided into two sections. Donald N. Matthews was placed in charge of the National Forest section. One or two men from the staff of each National Forest in the Douglas-fir region was assigned to the project. For areas not covered by intensive surveys made for timber sale preparation or land classification and exchange purposes, a field examination was made which consisted of a type map and a timber volume estimate. This was described as an "intensive application of an extensive reconnaissance"[16] (a use of words which might cause a semanticist to wince). About 1920, an extensive reconnaissance of the National Forests in the District had been made and timber volume estimated and compiled. This provided a starting point for the detailed forest survey.

Supervision of the office work and fieldwork on lands other than the National Forests was assigned to Cowlin. Timberland owners were contacted and asked for use of their timberland information. County assessor offices were visited and the job of collecting timber cruise work commenced before mid-1930. Washington County, on the outskirts of Portland, was selected as the first county to be covered, and Briegleb was assigned to it after a brief field training period conducted by Andrews with Cowlin, Matthews, Briegleb, and Moravets to test procedures. Other field tests were made with Munger and Granger as participants to settle final plans for the work. A field school in estimation of defect in Douglas-fir was conducted by Dr. Boyce[17] in early fall for members of the survey staff on the Cascade National Forest near Westfir, Oreg.

With additional funds in sight for fiscal year 1931, three additional men[18] were selected and transferred from other Forest Service Districts shortly before June 30. These men were young professional foresters. Each was assigned a county to work under Cowlin's supervision after a training session. Moravets, who had done a large part of the data collecting process, was also assigned a county.

For convenience in the field and facility in compilation and interpretation of the forest survey inventory, growth, and depletion data, the Douglas-fir region was divided into 11 subregional geographic units. With one exception, each of these units contained two or more counties. Generally, one field man was assigned one of these subregions or units as they were called. As funds permitted, they were provided with field assistants.

It was evident that the problem of adjusting the timber estimates on private lands to a common standard called for special expertise. With this need in mind, James W. Girard[19] was added to the forest survey staff July 1 as a senior logging engineer. Jim Girard had worked for the Forest Service in other Districts as log scaler, timberman, and logging engineer, and had also worked in the timber industry in similar capacities. He was more or less self-educated, but had not only acquired a wealth of practical woods experience, but had also grasped the fundamentals of forestry by observation and association with professionals. He had an unusual faculty for judging timber volumes by ocular estimation and applying this information to large areas by extensive observation. In the years to come, after working in all parts of this country and some foreign countries examining large tracts of timber, he became a legendary figure among timbermen, if anyone merits this description.

16 An extensive reconnaissance had been made of all Pacific Northwest National Forest lands in 1920-23 to provide timber volume data for the Capper Report.

17 Dr. John S. Boyce transferred from the Bureau of Plant Industry March 1, 1928, to become Director of the Northeastern Forest Experiment Station, U.S. Forest Service, Amherst, Mass. One year later, he resigned to become the first Professor of Forest Pathology at the School of Forestry, Yale University. In 1923, "Decay and Other Losses in Western Oregon and Washington," U.S.D.A. Technical Bulletin 280, 60 pp., illus., was published under his authorship.

18 Edward D. Buell, Warren H. Bolles, and Paul D. Kemp.

19 Girard also participated in the Westfir training session with Dr. Boyce.

from pages 34 and 36

Gerard worked out plans for adjusting the timber cruises used by the forest survey and described the qualifications for the personnel to do this work. The Civil Service Commission, upon representation by the Forest Service, agreed to hold a special examination for a position called “timber expert.” It was classified as the equivalent in grade to an associate forester, or P-3 as it was known in the vernacular of the Civil Service.

In the fall of 1930, three timber experts were appointed from the roll established by the examination, which was unassembled. They were Charles W. Kline, William J. Wakeman, and Percy N. Pratt. The first two named were forest school graduates, qualified logging engineers, and with a background of employment in the timber industry. Pratt was a member of a Portland timber cruising firm, Pearson and Grady, and had many years of practical experience.

Work on all parts of the inventory phase of the forest survey could now proceed full steam ahead with the opening of the field season in 1931.

The forest insurance study also got underway in 1930 with the transfer of Harold B. Shepard, senior forest economist from the Washington Office of the Forest Service, on July 1. Work commenced in the Douglas-fir region, and it was planned to extend its application to other forest regions, depending upon the findings of this study, which was the first systematic study of this subject undertaken in this country.

The effects of the Great Depression began to influence Station activities early in 1931. The Station was ordered to withhold expenditure of a portion of appropriated funds during fiscal years 1931 and 1932. In addition, restrictions were placed on promotions, filling of vacancies, and travel. At this time, there was no provision for automatic periodic salary step increases within a Civil Service grade. As a result, salaries of appointed clerical and professional employees were at a stationary or reduced level for a number of years. In July 1932, annual leave was canceled and the “Hoover Holiday,” which consisted of 2 days off each month without pay was instituted. Despite these draconian measures, morale of Station personnel remained high; work output did not suffer as many employees did not exercise their rights to the “day off.” A moderating condition was the cost of living which did not increase and for some items of necessity decreased in cost.

With the funds available, the forest survey was able to step up its activities and recruit half a dozen or more temporary field assistants, either experienced timber cruisers or graduate foresters who could not find other employment. These men were principally used for the job of adjusting private and county timber cruises; some of them served as compassmen for the permanent staff of “timber experts,” and others of greater experience worked in the same capacity as the staff cruisers after a short training period in survey techniques and standards.

Late in 1930, G. H. Lentz of the Southern Forest Experiment Station, which was scheduled to initiate the forest survey in the Southern forest regions, spent some time in Portland reviewing Pacific Northwest methods and problems. He also reviewed with Granger and Girard forest conditions in his area as they related to survey methodology. Lack of existing timber volume information in county (or parish in Louisiana) records and in possession of the many small owners precluded adoption of the compilation method as used in the Pacific Northwest. The more favorable topography and uniformity of stands, absence of areas of high-volume, old-growth forests compared with the Douglas-fir region, and the vast total area of forest land were factors that favored the linear method of survey, and the conclusion was reached to use that method in the South.

This action revived the question of using the linear method in the Douglas-fir region in the minds of Washington Office personnel and Granger. Consequently, it was decided to make a comparative test of the two systems in this region. Lewis County, Washington, one of the larger counties in the region, was selected as the area to be used and work plans were made for the fieldwork. This county extended from the crest of the Cascade Range on the east to the Coast Ranges on the west and included a variety of forest conditions and topography. That portion of the county within the National Forest boundaries was not included since the survey method used for the National Forests was not susceptible to comparison. There was no other choice of method for such forest lands with the funds available because of the rugged nature of the terrain, short field seasons, and relatively poor accessibility.

from pages 36 and 37

The test area consisted of 40 townships, approximately 1 million acres, extending from the National Forests[21] on the east to the county boundary on the west. Linear strips were spaced at 3-mile intervals across the county in an east-west direction. Timber volume was estimated on quarter-acre circular plots at 10-chain (660 feet) intervals. Forest type changes were recorded whenever intersected by the strip; however, no length of strip less than approximately 2 chains was considered. Fieldwork was started in January 1931 with a crew consisting of Briegleb, Pratt, and Fire Warden George Herger who was assigned by State Forester Joy of Washington to help on the project. This crew, working in the more accessible part of the county's mixed farm and forest land, tested the techniques. A final working plan based on this crew's experiences was prepared. Fortunately, the winter, although unusually rainy, was not cold, and there was little snow in the low-lying hills of the Chehalis River valley. Later in the year, other crews were added until practically the entire forest survey crews working on the private lands, and some from the National Forests, were in Lewis County. Some crews were composed of three men, and in the more accessible country two-man crews could be used. All in all, 16 men (not including overhead personnel) were employed on the Lewis County strip survey for 960 man-days in the field, and 900 of these days were spent on the line regardless of weather. Packers, horse and human, were needed in some locations, and line camps could seldom be occupied more than one night. The 8-hour day was unheard of, for in some instances it would take several hours or more to reach the line in the morning and a like amount of time or more to reach the camp, night lodging place, or automobile at the end of the day. In a few cases, crews "bundled" up for the night on the line. Wherever roads permitted, automobiles were used to reach the vicinity of the fieldwork location. Review and transcription of field records was done at night usually, although in a few locations where several crews were quartered in a small-town hotel, it was rumored that penny-ante poker games were an occasional diversion.

Girard spent considerable time in Lewis County after he returned from the South about the first of April. He worked with Kline who was doing the cruising for adjustment of the county and private cruises used in the compilation method. He also spent a few days with some of the crews on the strip survey. Andrews and Girard took over field responsibility for several miles of strip in rough country near the end of the job, spending overnight camping on the line. They claimed a record for ground covered in the allotted time. Director Munger spent a day with one of the strip crews and another day with Girard and Kline on the adjustment cruising.

Buell was responsible for the type mapping portion of the compilation method survey of Lewis County. Working all through the winter on this job, he completed his assignment in April. Cowlin spent considerable time with Buell, and Andrews and Cowlin both worked with the strip crews, visiting each of them together or separately at least once during the course of the work and usually spending 2 days with each crew.

F. X. Schumacher,[22] then on the staff of the Washington Office as a mensurationist, visited the project for several days and was out on the line with Cowlin and the crew headed by Moravets for a strenuous time in rough country. "Schu," as he was known to many, had been successful in a poker game over the weekend at a hotel where a group of the men were staying in Chehalis, the county seat of Lewis County. The next day proved to be "blue" Monday for him as Moravets and Cowlin evened the score by wagering on tree diameters before they were taped. Schu had a tendency to underestimate the large old-growth Douglas-fir.

All of the fieldwork in Lewis County was completed the last half of June. Under Cowlin's supervision, office computations had been organized on a current basis as field records were available. Buell finished computation of the forest type and timber volume data gathered by the compilation method in June for all of Lewis County with a separate summary for the 40-township test area.

21 An isolated block of National Forest land called the Mineral Addition was included in the test area.

22 Francis X. Schumacher was a member of the faculties of the University of California and Duke University teaching forest mensuration. He published many articles on growth and yield of California conifers and sampling methods and a text and reference book with Donald Bruce entitled "Forest Mensuration," McGraw-Hill, New York and London, 1933. 360 pp., illus.

from pages 37 and 38

Upon completion of the strip survey and computation of the data for the test area in July, Meyer analyzed the sampling errors of the various areas by statistical analysis. It soon became apparent that a reasonable sampling error could be obtained for broad groups of data only. Innumerable combinations of forest type area, site class, stand class, timber volume by species and ownership could be made, but a valid comparison of the two methods could only be made for major items for unit areas as small as a million acres.[23] The comparison showed that for areas of major forest types the two methods were reasonably close, particularly in consideration of the unavoidable differences in field definition of types. The strip method picks up small openings of hardwoods, brush, waters, etc., too small in extent to map in place.

Sawtimber volume estimates by the two methods were reasonably close with the exception of hardwoods. This pointed the way for a refinement in the compilation method to allow for hardwood volume occurring as an understory in the conifer types and for small stringers along stream courses.

Forest site data for the area by the two methods were very close.

Growth estimates which had been calculated by Meyer were in a reasonable range for the two methods for both total board-foot and cubic-foot volumes, but varied widely for components of ownership and species.

Clapp and Granger came to Portland to participate in the discussion of this test of methods. The decision was made to continue the compilation method, not only for the Douglas-fir region but also for the ponderosa pine region of the Pacific Northwest. The forest survey of the Northern Rocky Mountain region was scheduled to start soon and the compilation method was adopted for that area.

Considerable detail has been accorded this episode in the nationwide forest survey, since it was a unique project in forest research and was precedent setting in treatment of forest resource data. One distinction that bears emphasis is that the size of the unit area for release of forest resource information was not a controlling factor in the compilation method of making surveys as it was in the linear method.

Future sophistications in statistical analysis, data processing, sampling techniques, and aerial survey techniques altered the situation. However, events of the next two decades proved the usefulness of having localized forest resource data for the Pacific Northwest region, a keystone in studies of the Nation's forest resource situation and development of programs of national and regional scope.

Aerial photography in making forest surveys was still in an experimental stage of development at this time. It had been used to some extent in eastern Canada, and the British Columbia forest survey group was studying its use. The latter organization was using amphibious planes extensively to transport men and supplies to interior inaccessible portions of the province. In 1927, Lage Wernstedt,[24] attached to the Region 6 Division of Maps and Surveys, photographed rugged portions of the Mount Baker National Forest from the air, using oblique shots. The film used at that time produced photos that were fuzzy and did not give clear distinction of the forest cover.

Early in 1931, Andrews, Cowlin, and Briegleb made a field study of the usability of a series of vertical aerial photographs taken by Fairchild Airways transecting a township of mixed forest and farm land in Clackamas County, Oregon. Fairchild Airways was a pioneer in promoting the use of aerial photographs in many forms of land use examination. Andrews, Cowlin, and Matthews also studied the use of aerial obliques taken by Lage Wernstedt of another area. Later in the year, Wernstedt photographed a considerable portion of the Siuslaw

23 A number of counties in the Douglas-fir region were less than a million acres in total land area.

24 Lage Wernstedt, a Swedish born and educated forester, had an absorbing interest in aerial photography. Later in his career, he was on the supervisor's staff of the Mount Baker National Forest as an assistant forester and continued his aerial photography work.

from pages 38, 42 and 43

National Forest in the Coast Ranges of western Oregon. These mountains, although not rising to high altitudes, were greatly dissected by stream courses and ridges. Forest types, although predominately Douglas-fir except near the coast where western hemlock and Sitka spruce dominated, were interspersed with hardwoods, usually red alder (*Alnus rubra*), and open areas of bracken fern and grass. Age classes of the conifers were mixed. Passable roads were infrequent and vantage points where the field crews could overlook large areas were scarce, owing to the topography and density of vegetation. In this situation, the aerial oblique photos served as a feasible and useful adjunct to field type mapping.

Results of the comparison and study of the application of both vertical and oblique photos led to the conclusion by the forest survey staff that although there was a great potential use of forest aerial photography, it could only be used in this survey in a limited manner. With funds available, original vertical photography was prohibitive, and with a few exceptions the less expensive oblique photographs were also too costly. There were few or no aerial photographs taken for other agencies available, as was the case in later years. Sensitive types of film and sophisticated photo interpretation techniques and accessory equipment had not been developed, although it was probable that considerable research in this field was being initiated and conducted by the military agencies even at this early time.

Granger was with the forest survey staff most of July and part of August reviewing the results of the Lewis County comparison of methods, National Forest inventories, and the plans for the growth and depletion phase of the survey. With Andrews, Girard, and Matthews, he spent a week in the field on the Umpqua National Forest. The object of this trip was to devise and test a technique for checking the type maps and timber volume estimates to assure a reasonable degree of accuracy. Later in the year and in 1932, Girard and crews of the Station's timber experts (check cruisers) applied the technique to all the National Forests in the Douglas-fir region. Melvin Bradner of the Northern Rocky Mountain Station came to Portland near the end of July to review all phases of the forest survey with Granger and members of the local forest survey. The forest survey of the Northern Rocky Mountain region was to be initiated soon under Bradner's direction, and the plan was to use essentially the same methods that were being used in the Pacific Northwest. Bradner and Granger also made a field trip to join Kemp who was type mapping Tillamook County, Oreg., and see firsthand the techniques employed.

Early in August, Assistant Chief Clapp came to Portland and participated in the final review of the Lewis County test and decision to continue using the compilation method of forest surveys. Clapp and Granger, with Munger, Andrews, and others of the forest survey staff, tested the "stocked quadrat" method,[29] adopted by the survey, of judging degree of reproduction stocking of cutover lands and deforested burns on a nearby logged-over area.

Fieldwork on the forest survey of the Douglas-fir region neared completion in 1932. The inventory of the National Forest lands was completed during the year and Matthews was transferred to the Station's fire research project. A type map of the Rainier National Park was made by Frank Brockman of the National Park Service, based on fieldwork done the previous year. An estimate of the sawtimber volume of the park was made by Girard during an extensive reconnaissance in the summer of 1931. Although the park and certain other lands, such as the national monuments, were reserved and not subject to commercial cutting, they were included in the forest survey to present complete coverage of the forest resources. Forest resource information on the reserved lands was so designated in forest survey public reports and maps.

29 This method was first developed by I.T. Haig and refined by the forest survey. It was used extensively in this and other western forest regions for forest surveys of all kinds.

from pages 43 and 44

Base maps on a quarter-inch-to-the-mile scale were completed for the western halves of Oregon and Washington. Each individual map covered a quarter of a State in order to keep the map to a convenient size for use on table or wall. The compilation and tracings were done by the Region 6 office of Maps and Surveys[31] with the help of many outside agencies and people, including financial cooperation of the States of Oregon and Washington and Region 6 of the Forest Service. Lewis A. (Tam) McArthur, vice president of the Pacific Power & Light Co., Portland, Oreg., gave generously of his time, and carefully checked for accuracy the cartography of each map before the final tracing. "Tam" McArthur was an authority on Northwest geography and author of "Oregon Geographic Names" and many articles on this subject. His knowledge was encyclopedic.

The completed tracings were sent to Washington, D. C., for lithography in 1932. Although the maps were made primarily as a vehicle for superimposition of forest type delineation by color, they were useful simply as base maps. Nothing of this sort was previously available. Accordingly, an edition of the maps with geographic features in black and blue ink was ordered for public distribution. The half-inch-to-the-mile, hand-colored county maps which the Station was making were in demand. These were made available in blue-line prints to users for duplication and hand-coloring at their own expense. The many requests for these maps confirmed the Station's decision to make type mapping a required part of the forest survey methodology. It also gave the Station a measure of the prospective demand for the final quarter-inch-to-the-mile, colored, lithographed type maps of the two States.

March 10, 1932, the U.S. Senate agreed to Senate Resolution 175, introduced by Senator Royal S. Copeland of New York, which authorized and directed the Secretary of Agriculture to make a comprehensive report on the Nation's forest resources and attendant problems. The Forest Service had been anticipating this action and work had been underway in revising timber volume estimates and other resource data for a year or more. Passage of the resolution quickened this work. In the Pacific Northwest, compilation of the forest survey inventory data had been completed for some areas in the Douglas-fir region which were useful in adjusting previous estimates of timber volume and forest-land areas and condition. Other Station projects contributed valuable data. Munger, Meyer, Wilson, Brandstrom, and Cowlin devoted much time in late summer assembling data for the "Copeland" study. In September 1932, Brandstrom went to Madison, Wis., to collaborate with Kirkland on preparation and report writing on the subject of private forestry for inclusion in the report. Director Munger left October 1 for Washington, D.C., to stay until mid-December on other phases of the Copeland study.

Matthews' first assignment in his new position was the completion of the fire depletion phase of the forest survey of the Douglas-fir region. This work was closely interrelated with the fire damage studies and the forest fire insurance project. The latter study was in a finishing stage and was awaiting availability of the forest survey inventory totals for the preparation of the final report for the Douglas-fir region. At the same time, Shepard was completing plans for extending the insurance study to the pine region of eastern Oregon and Washington. Fieldwork there was commenced in early summer and extended through most of the fall.

Early in 1932, a conference was held in Portland on the "requirements" phase of the forest survey, directed by F. J. Hallauer of the Washington Office who was conducting this work on a national basis. The purpose of the requirements phase was "to determine the present consumption and the probable future trends in requirements for timber and other forest products." A study of such a scope and character did not lend itself to separate regional studies, and the task of the various regional forest survey groups was to determine and provide information on relevant local practices and conditions for integration and analysis at the national level. Attendants at the conference included Melvin Bradner of Northern Rocky Mountain Station and Carey Hill of the California Station in addition to local Forest Survey and Products men. Following the conference, Lodewick spent a good part of the year in analyzing past consumption of lumber for single-family dwellings and garages in the Pacific Northwest. He learned that a revamping of the working plan and field procedures for the sake of simplicity was needed before extending the study to other uses of wood products and commencing similar studies in other parts of the country.

31 Victor H. Flach, in charge of this office, was a major factor in the success of this project.

from pages 47 and 48

The fiscal situation was a "mixed bag" in 1933. Effective April 1, salaries of all regular Federal employees were reduced 15 percent. This salary cut was restored in three equal installments on March 16 and July 1, 1934, and April 1, 1935, and the savings impounded. To make matters worse, allotment of regular appropriated funds was reduced with the net effect that at the end of fiscal year 1934, the Station received about $51,500, or 60 percent less than the previous fiscal year. It was necessary to terminate all temporary employees and practice strict economies in travel, supplies, etc. The fiscal situation changed suddenly with the enactment of legislation providing funds for civil work programs to give jobs to the jobless and to prime the pump for recovery of the private sector of the economy.

President Roosevelt's interest in conservation of the country's natural resources directed a substantial part of these measures to forestry programs on public lands including research. This was also the "year of the alphabet," and appellations attached to the various programs and acts were commonly shortened to key letters.

The ECW[37] legislation and programs were first, and in May 1933 funds were made available indirectly to the Station under this authority. The CCC[38] camps and personnel were a part of this general program. Three men, all experienced foresters,[39] were made ECW foremen and assigned to work under C. W. Kline's supervision to make detailed topographic maps and timber volume estimates of the Wind River and Pringle Falls Experimental Forests. Crews of CCC enrollees[40] from nearby camps were assigned to assist these three men, later increased to six. The Wind River project was practically completed, but the Pringle Falls project languished because the local CCC camp was discontinued. However, basic land survey was completed, facilitating later mapping and timber estimating work.

Later in the year, direct allotment of ECW funds was made to the Station, permitting the reemployment of temporary workers laid off and the employment of additional temporary field assistants and scientific aides who assisted in the large volume of computational work that had accumulated on the forest survey, other forest economic projects, fire and silvicultural projects, and mensuration studies.

In October and November, funds and people were made available to the Station under additional Federal legislation supplementing the ECW Act. These were known as Impnira[41] and CWA[42] funds. This greatly bolstered all research activities of the Station, although it created many additional administrative problems, including budgetary accounting and personnel management. June Wertz and the capable regular clerical force coped with the problem, freeing professional people to carry on research with a minimum of disruption.

The NIRA funds were principally used to finance the forest survey and skilled people could be selected. However, some anomalous and difficult personnel situations developed. For example, six former field assistants were reemployed as NIRA technicians, qualified as junior foresters. Under regulations imposed by the NRA administration, their pay scale was fixed at $2,600 per annum. At the same time, junior foresters under regular appointment, including some with more than 4 years of service, were still being paid $2,000 per annum, the entrance salary less the 15-percent cut. Naturally, there were gripes mixed with bewilderment at the ways of bureaucracy, but the work went on and the quality of research did not suffer.

37 Emergency Civil Works; authorized by the Unemployment Relief Act of March 31, 1933.

38 Civilian Conservation Corps, also authorized by the above Act.

39 W. E. Griffee, C. V. Zaayer, and Lloyd H. De Groote. Later, Griffee and Zaayer joined the staff of the Western Pine Association. Bill Griffee became its secretary-manager in 1959 and remained in that post until the Western Wood Products Association was formed through consolidation with the West Coast Lumbermen's Association.

40 Occasionally, forest school students were located among enrollees. Other enrollees developed an interest in forestry from work in the Corps and later studied forestry at the college level.

41 The National Recovery Act (NRA, the Blue Eagle Act) of June 16, 1933. The administering body was the National Industrial Recovery Agency, NIRA.

42 The Civil Works Administration.

from pages 48 thru 53

Progress on the forest survey speeded up with the additional field and office staff. Fieldwork on the Douglas-fir region inventory was completed. The working plan for the inventory of the ponderosa pine region was revised and tested in the field early in 1933. In this region, the same man was responsible for the work on all lands in a county, regardless of ownership. There were no separate crews for the National Forests. By midsummer, work was well started in central Oregon.

Compilation of the basic inventory data for the Douglas-fir region was completed and preparation of statistical reports commenced. A supply of the 1/4-inch-to-the-mile lithograph base maps was received and distributed to cooperators. The hand-colored generalized 1/2-inch-to-the-mile type maps covering each of the 38 counties in the Douglas-fir region were proving useful to many agencies. Interest in land use planning was developing at State and local government levels. Requests were being received for special compilation of forest resource information in analyzing justification for public works programs such as river and harbor improvements.

Fiscal arrangements continued to be an important factor in conducting an orderly and balanced research program at the Station during 1934. Administration of the emergency funds was becoming more complex with frequent changes in rules and regulations concerning use of the funds and personnel employable under the several programs. June Wertz became very competent in the intricacies of the financial situation and successfully kept the Station financing and budgetary records in order. The CWA program was terminated April 26, 1934; however, April 1 an ECW allotment of funds to the Station permitted transfer of most of the people to ECW financing.

Some research programs were better adapted by nature of the work to use emergency money and people than others, although in the long run, all or nearly all of the Station's active studies received some benefits. The forest survey in particular and the other economic programs to considerable extent profited by the emergency work funds and people. Andrews, an able administrator and an innovative researcher uninhibited by bureaucratic red tape, grasped the opportunity to speed the progress of the survey and enlarge the scope of its coverage in the form of reports, type maps, and special studies. He also gave the Director strong support and assistance in managing the Station's budget problems. Others of the survey regular staff likewise had strong supervisory talents. The new public domain project and related land use planning activities were also able to use CWA crews effectively, gathering tax delinquency data at county seats and transferring the data to county maps. This work was done in cooperation with the Washington State Agricultural Experiment Stations, starting late in 1933 and continuing through the first half of 1934.

Completion of the fieldwork and computation of the forest survey inventory data cleared the decks for publication of results. There was no longer any noticeable objection to release of timber volume data by counties. Attitudes of the timber industry had changed materially, probably partly as a consequence of the existing economic conditions and partly as a realization that such basic forest resource data were needed by private and public agencies alike to plan courses of action to restore the forest-based economy of the Pacific Northwest to a healthy condition.

Acting Assistant Chief Marsh[46] of the Washington Office was in Portland for several weeks and devoted a major part of his time to the forest survey. The scope of the final regional report for the Douglas-fir region was discussed in a conference with Munger, Andrews, and Cowlin. Later, Marsh and Cowlin discussed an outline of the proposed report in detail. The latter completed a draft of the introductory chapter of the report giving scope, methodology, and specifications by the summer's end. In the general conference, it was decided to present complete inventory, growth, and depletion data for each of the 11 units or regions.[47] It was also decided to issue as a Station mimeographed publication, a minireport for each of these units. Near the end of the year, when final growth and depletion data were available, Cowlin completed a draft of the report for the North Puget Sound unit.

46 Earle H. Clapp was made Associate Chief of the Forest Service about this time, leaving the position of Assistant Chief in charge of Research.

47 The matter of nomenclature becomes confusing as the term "region" is popularly used in describing varying areas. That is the reason the forest survey adopted the term "units" to apply to groups of counties in the Douglas-fir region having homogeneity.

from pages 53 through 56

By late summer, Johnson and Lodewick of the Products group completed the cutting depletion estimates and Matthews the fire depletion estimates, and projections of future forest depletion or drain (as some writers call it) were made. This provided the basis for Meyer to complete forest survey growth projections for the Douglas-fir region and the 11 units.

Lodewick continued to gather information for the requirements phase of the survey, expanding the work to rural and industrial usage and needs. Survey of farm needs was done in cooperation with the State colleges of agriculture.

The forest survey program of map production moved into a final stage in 1934. Half-inch-to-the-mile generalized and 1-inch-to-the-mile detailed type maps had been completed for each county in the Douglas-fir region. Arrangements had been made for making these maps available to prospective users in blue-line print form at their own expense by making vandyke negatives and lending them to commercial blueprinting companies. The Station provided a mimeographed forest type legend and instructions for coloring. Many public and private users, including a number of timber companies, took advantage of this service.

The forest survey's 48 detailed types for the Douglas-fir and ponderosa pine regions were consolidated into 25 types for presentation on the quarter-inch-to-the-mile type maps. The four western quarters of the two States included all of the Douglas-fir region and extreme western part of the ponderosa pine region. The crest of the Cascade Range forms the boundary dividing the two forest regions and is also the eastern boundary of all counties in the Douglas-fir region, except Skamania County, Washington, and Hood River and Jackson Counties, Oregon. The first two named border the Columbia River and extend a comparatively short distance east of the Cascades. Jackson County borders California on the south where the Cascade Range crest is indistinct. In this county's extreme eastern part, forest types are dominated by ponderosa pine.

Fieldwork in the portion of the ponderosa pine region appearing on maps of the west half was completed in 1934. In December of that year, George T. Wilkinson of the U.S. Geological Survey, an authority on lithography and engraving, spent 10 days in Portland with the survey staff advising on procedures in preparing maps for color lithography. Color combinations and patterns were selected with his help and a legend was decided upon. Soon after, draftsmen started work preparing the copy which would be furnished the Geological Survey in Washington, D.C., for lithography.

Forest survey fieldwork moved ahead in the ponderosa pine region during the summer and fall. After the crews returned in November, Moravets directed half a dozen NIRA and ECW workers gathering advance data – ownership data, timber cruises, maps, and aerial photos[48] in preparation for completing fieldwork of the inventory phase of the survey during the next field season.

In August of 1934, Miss Jean Kerr, an assistant editor of the Washington Office of the Forest Service, was moved to Portland for an indefinite detail. The Station had several major publications in office report form and others in the offing. Previously, publications for printing by the Government Printing Office and certain other major publications planned for other outlets received final editing in the Washington Office. This procedure was laborious and time consuming, involving considerable exchange of correspondence or an author's trip to Washington, D.C., or occasionally both.

The forest survey completed all fieldwork in the ponderosa pine region late in 1935. In the office, work was progressing on the compilation of inventory, growth, and depletion data gathered in previous years, so that results could be released promptly. Experience in the Douglas-fir region had shown that use of this information was increasing greatly in planning activities, in programs to restore stability in the timber industry, in public works programs, and in the other Station economic studies. There was a lively interest by some midwestern and eastern financial institutions in effecting a merger of companies in the Douglas-fir region to bring financially weak companies under stronger ownership. Responsible leaders in the industry were advocating Federal Government acquisition of large blocks of old-growth Douglas-fir that were not operable under current conditions and which were a heavy burden on the owners.

48 Wernstedt had taken aerial photos of portions of the National Forests recently and some photos were becoming available from other sources. These photos were a valuable adjunct to the field men.

from pages 56, 57, and 64

From the beginning of the forest survey, industry members of the Advisory Council had suggested that the saw-timber inventory be classified or qualified in some way to show that much of it was not operable under current conditions and, in fact, a considerable portion could not be exploited commercially for many years. After the survey had been in progress for several years, the survey staff developed a classification and plan for rating inventory board-foot regional totals by three classes of economic availability. Two ownership classes were recognized. National Forest and "all other" (the great majority, private ownership), and three species groups, Douglas-fir, pulp species, and all other species. Girard assisted by Kline and Wakeman in collaboration with Bruce E. Hoffman[51] of the Regional Office, did the classifying.

In December 1935, the Station published a mimeographed report on the pulpwood situation in the Pacific Northwest, based upon forest survey findings.[54]

Experience on the growth and yield studies, other mensurational and silvicultural studies, the mill-scale studies, and the forest survey disclosed the need for more expertise in modern techniques of statistical analysis and experimental design such as Dr. Meyer possessed. The Washington Office Branch of Research was initiating an in-Service training program at this time to fill this gap which was prevalent at the field stations. Briegleb was selected to attend the forest measurements training session held in Washington in December 1935. This anticipated the resignation of Dr. W. H. Meyer, effective January 1, 1936, to join the faculty of the College of Forestry, University of Washington. This was the beginning of a long and distinguished career by Meyer in forest education at the universities of Washington and Yale.

With fieldwork on all phases of the forest survey completed during 1936, the staff could put in full time on report writing, map preparation, and answering the numerous inquiries for special information regarding the forest-land and timber resources. The success of the county report program for the Douglas-fir region prompted the writing of similar reports for forested counties of the pine region. Staff members in charge of the fieldwork for a county were also assigned the report writing job.

Supplies of the lithographed 1/4-inch-to-the-mile colored type maps were received for three of the quarter-State maps for Washington and two for Oregon. The remaining three quarter-State maps were still in process by the lithographer at year end. These maps were the first of the kind ever done on such a large scale in this country. Copies were distributed free of charge to cooperators, public and quasi-public agencies, and put on sale to others desiring copies. A nominal charge of $1 a copy was made to narrow the demand to legitimate requests. Funds received were returned to the Treasury as miscellaneous receipts.

Findings of the growth phase of the forest survey were analyzed and published June 1, 1936, in mimeographed form as Station Forest Research Notes No. 20. "Forest Growth in the Douglas-fir Region," by W. H. Meyer, P. A. Briegleb, and the forest survey staff. Four kinds of growth calculation were made and presented in estimates of board-foot (Scribner) and cubic-foot volumes. These were (1) current annual growth; (2) realizable mean annual growth, an approximation of the growth that will actually occur in the future under forest practice prevailing in the past;[61] (3) potential annual growth, the average annual growth that could be obtained on the whole of the region's commercial forest land under intensive forest practice; and (4) periodic growth, the estimated growth in a 10-year period.

51 Hoffman, logging engineer, Timber Management, Region 6, was detailed to the Station for several months to work on this project. He had extensive knowledge of conditions on the National Forests and other lands.

54 Pulpwood Resources of Western Oregon and Western Washington. Forest Research Notes No. 17. Mimeo. Dec. 10, 1935. H. J. Andrews, R. W. Cowlin, F. L Moravets, and W. H. Meyer.

61 Realizable growth was a new concept developed by Dr. W. H. Meyer. R. D. Garver, who replaced Granger as national head of the forest survey, and Dan S. A. Dana, on leave from the University of Michigan and currently a consultant to the Washington Office Division of Economics, visited the Station the fall of 1936 to review the forest survey reporting program and other activities. Garver questioned the realizable growth concept. Fortunately, Meyer was present to explain it in detail. Dana, a keen and perceptive scholar, grasped the concept at once and joined the survey staff in convincing Garver that it was a valid and useful growth calculation.

from pages 64, 65, and 67

Throughout 1936, Andrews and Cowlin were giving major attention to writing the final forest survey report for the Douglas-fir region. Since this was the first regional report of its kind to be undertaken by the Forest Service, there were many questions of policy and procedure to be resolved. Earlier report on the extent and condition of the Nation's forest resource by broad forest regions did not have the benefit of comprehensive and authoritative information and the burden it placed upon the analyst. Early in the year, drafts of several of the beginning chapters and a sample of the 11 regional unit reports which had been prepared by various members of the staff were sent to the Washington Office for preliminary review. It was the original intent to issue these unit reports in conjunction with the regional report as a publication of the Government Printing Office. It was decided that for the sake of brevity and speed in publication, the unit reports would be issued as Station mimeographs for local audiences. It was agreed that a greatly condensed statement be included in the final regional report, describing special features and conditions in six major districts of the region formed by combinations of the 11 units. It was also decided that the regional report itself should be made as brief as possible. A large part of Miss Jean Kerr's time was spent in editing forest survey reports. Other Station authors were also in line for her attentions. It was evident that professional editing was a full-time need at the Station, and Miss Kerr's detail to the Station was prolonged.

Several personnel changes of 1936 were noted earlier. In addition, Pratt, the last of three original timber experts to remain on the staff, transferred on July 1 to the Northern Rocky Mountain Station where the forest survey staff was being enlarged. As the nature of the forest survey program was changing with completion of the fieldwork, staff changes were appropriate.

Losses of personnel were sustained, too, during [1937]. Paul D. Kemp, associate forester, was transferred to the forest survey project at the Northern Rocky Mountain Station on March 31. At this time, Region 1 and the Northern Rocky Mountain Forest Experiment Station had responsibility for Stevens, Pend Oreille, and Spokane Counties in extreme northeastern Washington. This condition necessitated close coordination of forest survey specifications and procedures between the two Stations in order to have uniform State statistical totals and type maps. Bradner and DeJarnette of the Northern Rocky Mountain Station had made a number of trips to this region and knew Pacific Northwest Station procedures and personnel well.

During 1937, the final report of the forest survey for the Douglas-fir region was completed and sent to the Regional Office for review before forwarding to Washington for approval and publication. Editing was done in Portland by Jean Kerr.

Work commenced on keeping the survey current during the summer in Clatsop County, Oreg., and Grays Harbor County, Wash. The original survey of these two counties was done in 1931 and 1932. Heavy cutting had taken place in the comparatively short time that had elapsed, significantly altering the forest resource. The McSweeney-McNary Act as amended provided authority and funds for keeping the survey current. In the Pacific Northwest, the interval between periodic surveys could be varied to meet the situation in a particular county, a shorter period in counties where depletion was heavy and a longer period in counties where changes were not as severe. Work in Grays Harbor and Clatsop Counties furnished experience for perfecting survey techniques in both field and office work. Fieldwork in Grays Harbor was completed in December 1937 in spite of a record monthly rainfall of 26 inches.

County reports for each of the forested counties in the ponderosa pine region were completed and released in 1937. These reports gave the basic forest inventory data.

Briegleb was devoting a large part of his time in 1937 to completing the growth phase of the forest survey of the pine region in addition to many other current mensurational studies. Many complex computational problems appeared. Alinement charts for estimating in various pine types were constructed. In the fall, Briegleb spent several days in Missoula with the Northern Rocky Mountain staff discussing correlation of growth techniques between the two regions.

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Andrews spent the month of May in the Washington Office, ostensibly to discuss final review of the forest survey Douglas-fir regional report and other Station matters. There is no doubt his career prospects in Forest Research and elsewhere in the Forest Service was a subject of discussion. Many at the Station and elsewhere in the Pacific Northwest assumed that he would succeed Munger, since he had handled a difficult situation as Acting Director for a year or more very well and had previously demonstrated his capabilities as a forest research administrator and scholar as regional head of the forest survey and participant in related land economic studies and programs. "Hoss" Andrews was direct and candid with his associates in the Forest Service and the forest industries. He believed in getting at the heart of a problem and had no time for technical verbiage. He was not hesitant to state his position with equivocation, and if he disagreed with a Forest Service policy or decision in which he was involved or had knowledge, he would speak out spelling out his reasons. It may be that these characteristics obscured his abilities to analyze a forest problem and to seek all the pertinent facts before reaching a conclusion. There were reports that Andrews was being considered for the position of Associate Regional Forester in an eastern forest region since he had extensive previous experience with the State of Michigan and other Middle Western States.[67]

In many respects, this change of commands marked the passing of an era in the history of Forest Service research in the Pacific Northwest. Prior to 1924, research was organized as a rule on the basis of individual projects conducted by silviculturists or other biologists or by engineers doing forest products work. These men worked with considerable latitude and freedom from close direct supervision and gave almost exclusive attention to work on their projects. When the Experiment Stations were established in the early 1920's, the skeleton of an organized research system was created. The first directors were selected largely on their proven ability as research project scientists, and with small research staffs the administrative burden was comparatively light, leaving time and opportunities for personal research. As funds increased and the scope of the study program widened and personnel increased in number, the situation changed. By the mid-1930's, administrative duties were occupying nearly all of the directors' time. Meetings, conferences, seminars, and a steady stream of professional visitors from abroad and this country seeking information on research methods and findings, usually people of a professional stature that demanded a director's personal attention, preempted a considerable amount of time. The Washington Office of the Forest Service was starting to exercise stricter controls and making field inspections of study program conduct. More of the directors' time had to be given to public relations activities and personal contacts to gain legislative support for the Stations' work. At least, that appeared to be the situation here when Munger, who found this type of responsibility burdensome and in some cases downright unpleasant, decided to return to a position where he could be more intimately connected with the actual research work.

When Andrews left, Robert W. Cowlin was placed in his position as Chief of the Division of Forest Survey. The last of the 1/4-inch quarter-State colored lithographed type maps, that of northeastern Washington, was completed and the supply received for public distribution. This quarter-State had been held up to include type mapping of the three Washington counties that were part of the Northern Rocky Mountain Station territory, and also because of a poor color run on the proof copies. The report writing phase for the pine region was well along. Forest inventory statistical reports were issued for each county. The final comprehensive report for the Douglas-fir region was received for revision after Washington Office review, corrections made, and the manuscript returned for publication by the Government Printing Office. Requests for special compilations and analyses of forest survey data had reached such proportions that one man was occupied nearly full time performing this service. Among the special jobs, there were two in 1938 that were highly important. One was a special compilation of timber inventory, depletion, and growth statistical data for use in the Northern Pacific Railroad Co. controverted lands case. Owing to its Servicewide importance, this work took precedence over all other activities of the survey for 2 months. The other was preparation of forest-land and timber statistics covering the Pacific Northwest for inclusion in a national report to a joint congressional committee created by Senate

67 The writer has good reason to believe Andrews understood he was going to be offered a position in National Forest Administration involving a grade promotion upon his return from Washington. However, no positive offer was made during the summer of 1938.

from pages 76, 81, and 82

Concurrent Resolution, adopted June 13, 1938, to study the forest situation in the United States. Although this study was not of the dimensions of the Copeland Report, it did present authoritative statistics on the forest resource, making use of forest survey data which were now available for the most important timber-producing region in the country.

Completion of the initial forest survey of the Douglas-fir and ponderosa pine regions made available reliable and detailed information on the forest inventory, rate of depletion by cutting and fire, and rate of growth by forest-land ownership class localized for areas as small as a county. Less was known concerning endemic losses of timber volume and growth potential from insects, disease, and windthrow. However, records of losses from epidemics and catastrophes, such as the Olympic blowdown, were reasonably reliable. Need for greater attention to these problems was recognized but would have to wait for increased funds for manpower and physical facilities.

With the forest survey information at hand, problems in forest management and protection, forest products utilization, and forest economics could be put in perspective and quantified. Completion of the forest fire insurance study by Shepard was a one-time thing which could be put on the reference shelf for other people and agencies to use when economic and political conditions were appropriate. The forest taxation studies by Wilson and DeVries, although of longer life and more pertinent than the insurance study, were soon to reach the stage where action agencies and legislatures should take over and free the forest economics research staff to tackle many other pressing problems.

Availability of the wealth of forest survey localized information on the forest resource was timely and indispensable for the various depression-born agencies active in land use planning at the county, State, and regional level. It was also essential to cost-benefit analyses in planning public works such as development of hydroelectric power-generating facilities, river and harbor improvements, flood control measures, and extension of overland and water transportation systems. Timber companies and supporting industries, including banks and investment companies, were other users and beneficiaries of these data in industrial planning.

No new study programs were undertaken during 1939 and no major publications were completed or published. Because of restriction from a tighter fiscal situation and rising costs, it was a time for settling down and getting into gear after the changes in command. With the economic recovery process underway after the 1938 recession,[1] emergency funds were being either phased out or reduced. Allotment of regular funds remained at about the same level as the previous year with two exceptions: funds for the forest survey were reduced about one-third and the money was diverted to other Stations where this work was being initiated or accelerated. This was anticipated as the reinventory work in this region was of lower priority. On the other hand, flood control funds were sharply increased over the amounts received previously. In view of this increase, Raymond H. Chapler was appointed as Senior Forester in Charge of Flood Control Surveys in the middle of the year. Chapler was secretary-manager of the Oregon Forest Fire Association for a number of years prior to joining the Station. However, he had been in National Forest Administration in earlier years. About the same time, Junior Forester Dunford transferred to the Rocky Mountain Forest Experiment Station where he started a career in watershed management research that was to bring him back to this Station years later.

1 Under the aegis of Roosevelt's administration, deficit spending was used to solve the Depression's economic problems. In 1938, Roosevelt balanced the Federal budget and the economy faltered, and the term "recession" was added to the economist's vocabulary. In 1939, financing of recovery jobs was renewed, although the Station's research program was not noticeably benefited.

from pages 86 and 88

The forest survey staff completed a draft of a comprehensive report on the forest resources of the ponderosa pine region of Oregon and Washington in the fall of 1939 for review prior to publication. The corresponding report for the Douglas-fir region was moving slowly through the publication channels. Reinventory of the Douglas-fir region was moving ahead; one of the counties completed was Snohomish County, Wash. Availability of up-to-date information proved useful to the fire control case study of that county. Among a number of special studies completed by the forest survey staff during the year was supplying information to the Washington State Planning Council and the Regional Office for use in studies of a proposal for a Cascade Mountains National Park.[7] This proposal originated with the National Park Service and its more militant supporters. The North Cascades proposal was reported to be a part of a greater plan to establish a series of national parks surrounding each of the snow-capped peaks of the Cascade Range from the Canadian border to the California line; each of these parks was to be connected by a strip of park land along the crest of the Range. Some of the more ambitious of the proposal's advocates suggested it might be extended along the Sierra Nevada in California. The Washington State Planning Council staff considered this proposal and requested the forest resource analysis by the Station. The Council recommended against the park proposal, urging that the land remain in National Forest.[8]

By 1940, serious attention was being given nationwide to taking stock of the strength of our national defense position. In the Pacific Northwest, plans were made to analyze the role of forest and range land resources and plan for their effective use in the defense program.

Nearly every year since the Station was established, visitors from this region, other forest regions in the United States, and from abroad came to Portland to learn of the Station's work in the office and field. The year 1940 had its usual quota or more, including a number of foreign visitors. Ordinarily, this would not appear unusual, but in view of the European political climate, a few drew special attention. Dr. Adelbert Ebner, a German forester, spent some time in the Pacific Northwest, ostensibly representing the German Library of Information[11] in New York City, which was reputed to be a part of the Nazi propaganda organization. He showed an unusual interest in the forest survey type maps of Oregon and Washington and requested copies. Acting upon instructions, the Station told him they would be mailed to him at New York. His request was sent on to the Washington Office for action there. Another cloak and dagger event was the appearance of two Finnish foresters whose names and actions seemed to arouse suspicion that their background was more German than Finnish. They left Portland to travel leisurely down the Oregon coast for California by private auto, reportedly under surveillance of the FBI, who occupied neighboring offices to the Station on the fourth floor of the Federal Courthouse in Portland.

7 In 1937, the Director of the U.S. National Park Service appointed a committee to investigate the park potential of the North Cascades. Frank A. Kittridge, regional director of the Park Service, headquartered in San Francisco, was active in this effort.

8 The Olympic National Park was established by President Roosevelt under the Act of June 29, 1938, containing the lion's share of the Mount Olympus Primitive Area, which had been established on the Olympic National Forest in 1935. The Act of June 29, 1938, also authorized the President to make additions to the park from adjoining National Forest lands. By proclamation, President Roosevelt made additions to the park on January 2, 1940, and May 29, 1943.

11 Recalled from memory of the author and confirmed by P.A. Briegleb.

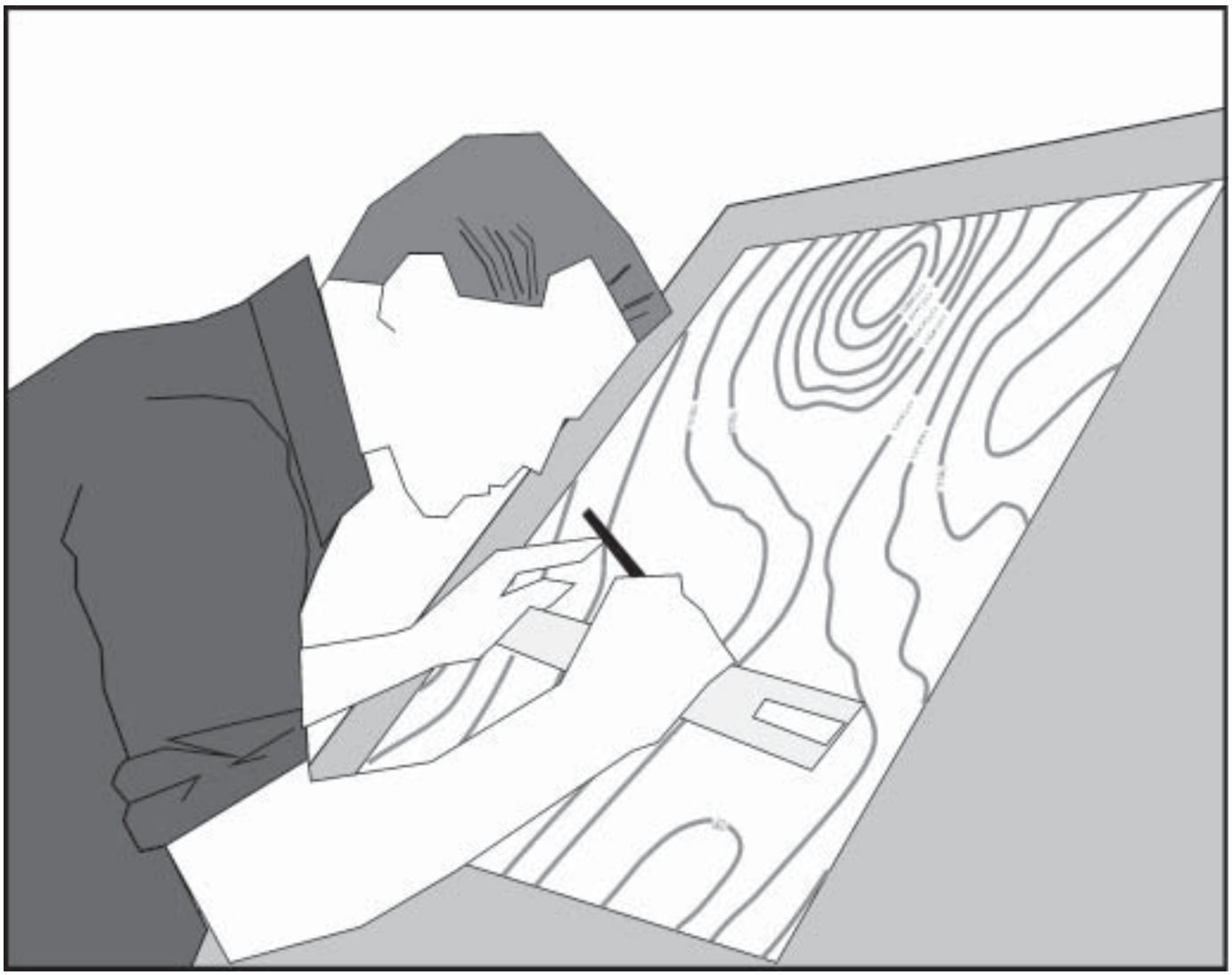
From pages 92 and 100

The forest survey section continued the reinventory program of the Douglas-fir region at the rate of about six counties a year. County statistical reports were being issued and distributed within about 6 months' time after completion of the fieldwork.

The year 1940 was a big one for major forest survey publications. "Forest Resources of the Douglas-Fir Region," U.S.D.A. Misc. Pub. 389, by Andrews and Cowlin, was published in December of that year. This was the first of the comprehensive regional reports issued by the nationwide forest survey. A State report, "Forest Resources of Washington," by Cowlin and Moravets, was printed and distributed by the Division of Forestry, Washington Department of Natural Resources. Briegleb's "Forest Growth in the Ponderosa Pine Region of Oregon and Washington" was issued June 1940 as the Station's Forest Survey Report No. 78. It was issued as a multigraphed paper to expedite dissemination of this information, which was very timely in view of the public concern for the future growth prospects to supply the pine timber industry in this region. This was to be followed by a comprehensive regional report. The manuscript, entitled "The Ponderosa Pine Region of Oregon and Washington," by Cowlin, Briegleb, and Moravets, was in final form and was transmitted late in the year to the Washington Office for review and approval for printing. However, this report was fated to be edited in Washington, and a year or two was required to respond to editorial questions and changes, galley proof and page proof review, and making necessary corrections. From the time since the forest survey was initiated, the Station had followed a policy of using technical journals, trade journals, public addresses, and the press to distribute information on survey methodology, preliminary findings, and selected items of current interest. This policy and internal Forest Service use of forest survey data and conclusions drawn from them gave wide currency to up-to-date information on the forest resources of the Pacific Northwest.

Late in the year [1942], U.S.D.A. Misc. Pub. 490, "Forest Resources of the Ponderosa Pine Region of Washington and Oregon," by Cowlin, Briegleb, and Moravets, was printed by the G.P.O. However, copies for public distribution were not received until early 1943. This completed the set of two comprehensive regional reports giving the results of the initial forest survey of the Pacific Northwest forest resources.

Appendix H: Description of Map Files From 1930s PNW Forest Survey by Rick Jordan[1]



[1] Rick Jordan is a geographic information system analyst, Olympic National Forest, 1835 Black Lake Blvd. SW, Suite A, Olympia, WA 98512.

General Information

The 1930s Forest Survey geographic information system (GIS) data are included in CoverSizeCl.shp, an ArcView shape file. Counties.shp, an ArcView shape file displaying county boundaries for the states of Washington and Oregon, also is included to assist users to more easily identify the location of data of interest. The following provides some information on the use of these data.

GIS Projection Notes

Both Counties.shp and CoverSizeCl.shp have the following properties:

Horizontal coordinate system is UTM; Zone 10 north; NAD 27

ArcExplorer Projects

Two project files are included on the disk to facilitate displaying the data in ArcExplorer:

CoverSize.aep displays forest cover data by tree species and size class.

CoverType.aep displays forest cover data by tree species.

For users who wish to install ArcExplorer to view the forest survey map data, an ArcExplorer distribution file is included on the CD-ROM. To install ArcExplorer, exit other applications, navigate to the ArcExpInstall directory on the CD-ROM and double-click ae2setup.exe. Follow the on-screen directions to install ArcExplorer. You will have to reboot your computer as part of the installation process. For users not familiar with ArcExplorer, a very good users guide is copied to disk as part of the install process. The users guide “Using ArcExplorer” is in the file ArcExplorer.pdf in the ArcExplorer2.0 directory (if you accepted the default options when you installed ArcExplorer, this file will be in C:\Program Files\ESRI\ArcExplorer2.0).

To view the files in ArcExplorer, double click on one of the two project files (files with .aep extension). Loading one of these files can initially take 10 minutes, so be patient. Once the file is loaded, other commands (such as zooming or querying the data) are executed fairly quickly.

ArcView Projects

One ArcView project file is included on the disk to allow ArcView users to view CoverSizeCl.shp and Counties.shp. CoverSize.apr contains two views of the data.

The Cover Type view displays vegetation species information. The Cover Type and Size Class view displays vegetation data by species and size class.

Graphics Display of Forest Survey data

For users who do not wish to use either ArcExplorer or ArcView, two graphics files are included on the CD-ROM.

CoverSize.jpg displays the Cover Type and Size Class view from ArcView as a JPEG image.

CoverType.jpg displays the Cover Type view from ArcView as a JPEG image.

Note: jpeg files lose resolution through repeated compressions, so if you create a new version of the project (zoomed in or resized) be sure to choose a compression option that will retain as much of the original file’s resolution as possible. You should retain a copy of the original file for future use.

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