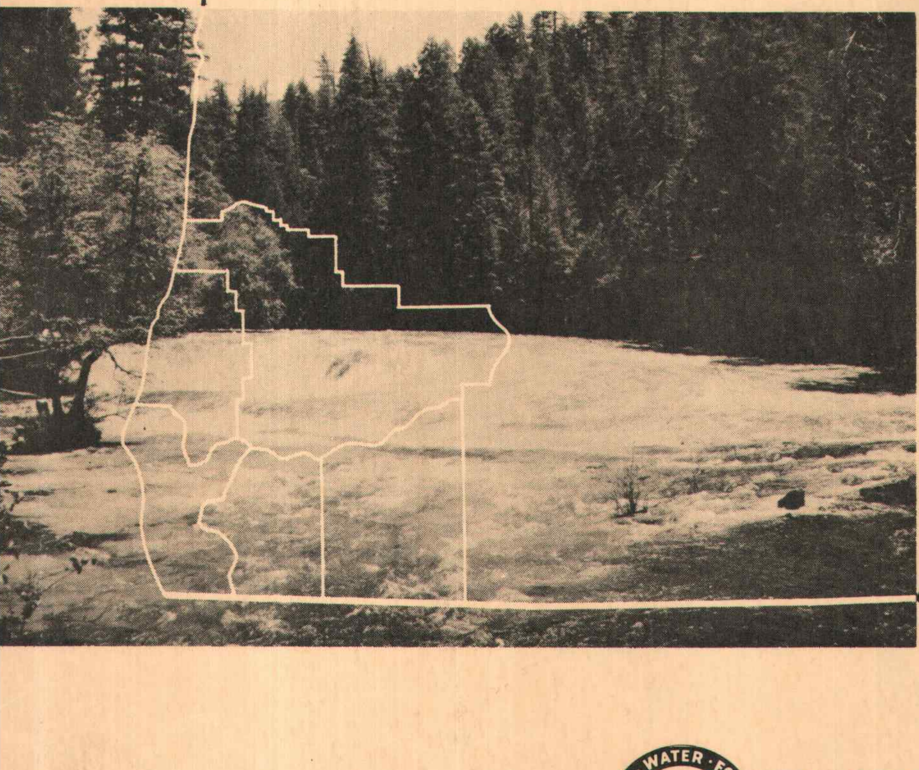
FOREST and FOREST-LAND PROBLEMS of Southwestern Oregon

by G. L. HAYES



PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
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This paper was prepared as a guide in formulating and implementing the Pacific Northwest Forest and Range Experiment Station's research program in southwestern Oregon. At the time the paper was written, the author was in charge of the Experiment Station's Siskiyou-Cascade Research Center at Roseburg, Oreg. At present he is Chief, Division of Forest Management Research, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

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R. W. Cowlin, Director   Portland, Oregon

FOREST SERVICE   U.S. DEPARTMENT OF AGRICULTURE

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INTRODUCTION

Rapidly expanding timber harvesting has given rise to an increased need for organized research to solve forest-land problems in southwestern Oregon. The following analysis was prepared to assist in choosing problems for first attention.

Southwestern Oregon comprises a province exceeding 8 million acres of land in 5 counties--Coos, Curry, Douglas, Josephine, and Jackson--of which 89 percent is forested. Population was nearly 232,000 in 1955. Economically remote from primary transportation systems, large-scale timber harvesting did not start in the interior until World War II. The province contains about 10 percent of the nation's softwood sawtimber.

The economy of the area depends first on timber; second on agriculture, mainly livestock and poultry; and third on outdoor recreation. All three are strongly dependent upon the forests, which produce not only timber products but water for expanding irrigation agriculture and the primary recreational attraction, sports fisheries.

Probably nowhere in the Pacific Northwest are the problems of forest, land, and watershed management so intricate and varied as in southwestern Oregon. Here is a forest transition area of great ecological complexity. Douglas-fir forests, typical of the Cascade and Coast Ranges to the north, meet and intermingle with pine types of the California Sierra Nevada; Sitka spruce-hemlock mixtures of the northern coast yield to Port-Orford-cedar and then to redwood; and ponderosa pine, typical of the eastern slopes of the Cascades, crosses to the western side. The major transition in forest types from north to south is undoubtedly due to climatic changes from the cool, humid environment of Douglas-fir to the warmer and drier environment of the pines.

Geology and accompanying soils are also complex. West of the Cascades proper, Eocene sedimentary formations of the Coast Range meet and overlap in an irregular pattern with the metamorphosed Jurassic and Cretaceous bedrocks and complex, metamorphosed sedimentary formations of the Siskiyou-Klamath Mountains.

Within the Cascade Range, young volcanic rocks exuded in the Pliocene epoch and possibly the Pleistocene epoch cap the Eocene and Miocene flows of the older Cascades. The soils of southwestern Oregon differ considerably in productivity, erodibility, and water-regulation functions. Many thousands of acres underlain by serpentine and peridotite are too infertile to support commercial forest, but at the other extreme are sites where several important tree species attain maximum development. Soils on the older Cascade flows seem reasonably resistant to erosion, whereas those on quartz diorite wash away like sugar, and certain clays when saturated become subject to flow.

Three separate mountain ranges transect the province and strongly influence climate. Precipitation in excess of 100 inches annually and summer fog typify some areas on the west slope of the Coast Range, but as little as 16 inches of precipitation annually and clear, hot summers are found in parts of the Rogue River Valley.

Superimposed upon all this is a complex fire history that has had a marked influence on distribution, stocking, and composition of existing timber stands and brushfields.

Maximum observed flows on the headwaters of the North Umpqua and Rogue Rivers are only 5 or 6 times greater than the minimum, whereas for many streams originating in the lower Cascades and Coast Range the maximums exceed the minimums by 1,500 times and more. For example, the South Umpqua River, which has a mean annual flow of 2,675 cubic feet per second near Brockway, has dropped to less than 40 c.f.s. in summer and would be pumped dry if all irrigation rights were exercised simultaneously. High water temperatures accompanying the low stage of the Rogue River in late summer threaten the survival of one of the most valuable sports fisheries in the nation. Yet water from the Rogue is irrigating less than half the irrigable land in its basin.

Woodland grazing and attempts to convert forest to pasture raise important questions in land use.

Forest and wild-land research was virtually nonexistent in southwestern Oregon before the establishment of the Siskiyou-Cascade Research Center by the Pacific Northwest Forest and Range Experiment Station in 1948. There is, however, considerable information on the management of Douglas-fir to the north, ponderosa pine to the east and south, and sugar pine to the south. This information can be drawn upon and tested for application to local forest types. For the unique and valuable Port-Orford-cedar and Shasta red fir—mountain hemlock types, however, no background information is available.

Timber harvesting, which has been in progress for about a hundred years, is only now penetrating deeply into major watersheds. There is still time to influence harvesting practices on critical upper watersheds if facts can be obtained on which to base an integrated management plan that will permit harvest and regeneration of forests without damaging important soil and water resources.

PHYSICAL SETTING

Topography

The entire length of the Pacific Coast is dominated by the Pacific Mountain System, which includes the coast ranges, Cascade Range, Sierra Nevada, and an intervening belt of valleys, all lying in a north-south direction. In southwestern Oregon and northern California, the Klamath and Siskiyou Mountains, lying east and west, interrupt the Coast Range and connect it with the Cascades. The entire province lies in this belt of interruption so aptly described by Diller and Kay: (2).[1/]

> Between the head of the Willamette Valley and the north end of the Great Valley of California . . . there is a tract of generally mountainous country with transverse drainage, where for 200 miles the threefold longitudinal division of the Pacific system into two ranges and an intervening valley is less evident than elsewhere. The Umpqua Valley, Rogue River Valley and Shasta Valley, lying between the Cascade Range on the east and the Klamath Mountains toward the coast, are not continuous. Nevertheless, they represent the Pacific Valley belt interrupted by transverse ridges, spurs from the Klamath Mountains to the Cascade Range.

1/ Underscored numbers in parentheses refer to Literature Cited.

The Coast Range, averaging 2,000 to 3,000 feet in elevation along the crest, has a choppy, steep topography. The Klamath Mountains are the remnants of an old plateau, deeply incised, steep in the canyons but flatter toward the summits. They average 4,000 to 6,000 feet on the west and 6,000 to 7,000 feet on the east. The Cascades rise in a generally long slope on the west side to an average crest height of 5,000 to 6,000 feet, with volcanic peaks approaching 10,000 feet in the province. The lower slopes are made up of steep ridges and intervening waterways which flatten markedly toward the summit.

Geology

The general geologic pattern in southwestern Oregon has been described. In the absence of detailed soil classification, knowledge of these formations provides the best key now available for delineating different soils.

The exposed rocks of the Klamath Mountains, the oldest feature of the southwestern Oregon landscape, cover roughly half of the province (fig. 1). They are generally harder and more complicated in structure than those of the overlapping parts of the Coast and Cascade Ranges. The Klamath Mountain formations, mapped together in figure 1, include a very wide variety of rock types which date from the Jurassic and Cretaceous periods. Roughly, the southeastern third of the Klamath Mountains is characterized by old, metamorphosed sedimentary and volcanic rocks of great complexity. The central half, oriented northeast and southwest, is dominated by the Jurassic Galice and Dothan sedimentary formations, which are greatly cut up by (1) igneous intrusions, ranging from ultrabasic peridotite to greenstone and basalts, and (2) acidic materials, including dacite porphyry and quartz diorite. The Cretaceous Myrtle formation comprises most of the northwestern extension of the older rocks between the lower Rogue and Coquille Rivers, and forms a narrow band between the Eocene and Jurassic rocks for much of the distance from Roseburg to the junction of the Illinois and Rogue Rivers.

The area north of the Klamath Mountains and part of the area to the east were beneath the seas during the Eocene epoch. Sediments from the Klamath uplift were laid down in these shallow seas to form sandstones and shales that were later uplifted to make the Coast Range. The early Cascade Range mountains were formed by

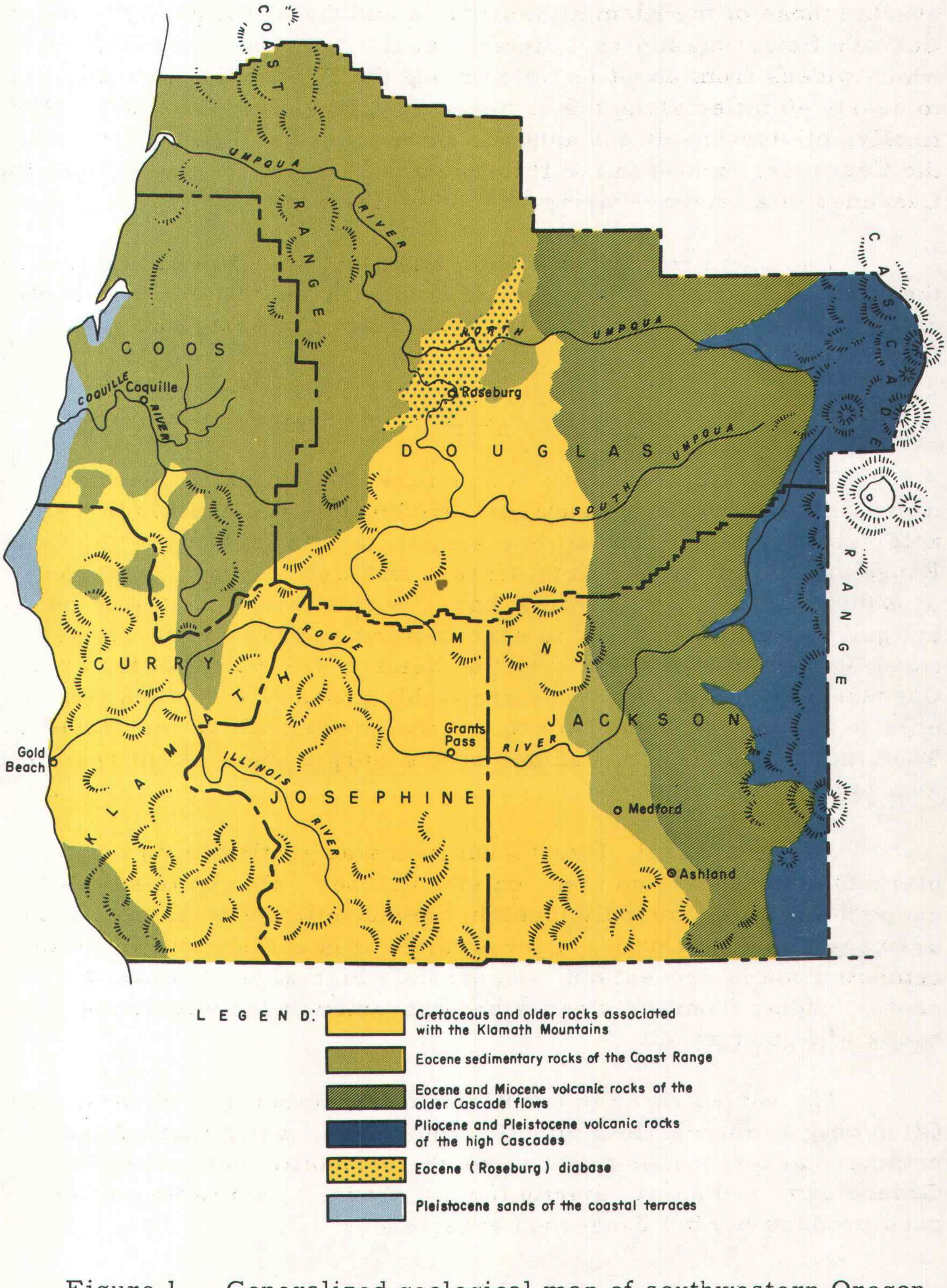

Figure 1.--Generalized geological map of southwestern Oregon.

volcanic flows in the late Eocene and Miocene epochs, and these rocks overlap those of the Klamath Mountains and Coast Range. The older Cascade flows, mainly rhyolite and basalt, are now exposed in a band which widens from about 12 miles along the Oregon-California border to nearly 40 miles along the northern boundary of the province. And finally, olivine-basalt and andesite flows from the high volcanoes of the Cascades, exuded in the Pliocene and Pleistocene epochs, cap the Cascades in a band averaging 15 to 20 miles wide.

Two other rock types of limited extent are shown in figure 1; the intruded Eocene diabase around Roseburg and the poorly consolidated Pleistocene sands along the coast from Coos Bay to Port Orford.

Soils

The varied rock types in southwestern Oregon produce soils which differ in forest productivity, erodibility, and hydrologic characteristics. Soils on the Eocene sedimentary formations of the Coast Range are typically of medium texture and high productivity. They probably have a high infiltration capacity and resist sheet erosion, but gully readily if exposed to concentrated surface runoff. Heavy textured soils with a dense clay "B" horizon are typical of the early Cascade volcanic flows. They are highly productive and are considered to be more resistant to erosion than other soils of the province. ✓ The black adobe clay formed on the Roseburg diabase is not regarded as a forest soil.

Along the coast, Pleistocene sands on gentle slopes are markedly different from those on steep slopes. On gentle slopes, a cemented pan is commonly found in the subsoil, but on steeper slopes, drainage is good. Quality of forest sites is generally low where the cemented pan is present but is apparently high where the pan is absent. Judging from the steep-sided character of the waterways, these sands will gully readily.

The varied rocks of the Klamath Mountains form diverse soils. Often only a thin mantle of mostly iron oxides, which will not support commercial forests, is found above the peridotite and serpentine. Granodiorite and quartz diorite form a coarse, permeable soil of good productivity but dangerous erosiveness.

Extensive pumice deposits of the high Cascades are in some places nearly sterile and in others of very high productivity. They are ideal for stream regulation, being so porous that all the water is absorbed and much of it released slowly into streams. They erode rapidly, however, if subjected to concentrated flows, which may accumulate on improperly engineered roads. Most soils of the high and younger parts of the Cascades contain considerable pumice. They seem moderately productive and probably have good infiltration capacity. Little is known of their erodibility. Insufficient study has been devoted to other formations to permit any generalizations concerning soils derived from them.

Early completion of a forest soil survey in southwestern Oregon would provide a badly needed tool for improved land management.

Climate

The province has a moderate, semihumid climate modified by local topography. Summers are dry and winters are wet. On the west side of the Coast Range and Klamath Mountains, the climate is marine: precipitation is heavy, humidities generally high, summer fog frequent, and temperatures moderate. Interior valleys are drier and have more widely fluctuating temperatures. The Cascades tend even more toward a continental climate, receiving increasing precipitation as elevation increases but subject to low relative humidities.

Distribution of precipitation probably results from two factors: reduction from north to south in number of storms that cross the province, and influence of varied topography. The latter is the more important. Going from west to east, precipitation averages about 70 inches along the coast, increases to probably 100 inches or more along the crest of the Coast Range, then declines to about 30 inches in the Umpqua Valley and to less than 20 inches in the Rogue River basin (fig. 2). As the Cascades are ascended, precipitation increases again to maximums of 40 to 60 inches.

The moderate temperatures along the coast vary but little with season--from an average of about 45° F. in January to 60° F. in July (fig. 2). For the interior valleys, winter temperatures are 5 to 8 degrees cooler and summer temperatures 6 to 12 degrees warmer; January means range from 37° to 40° F. and July means

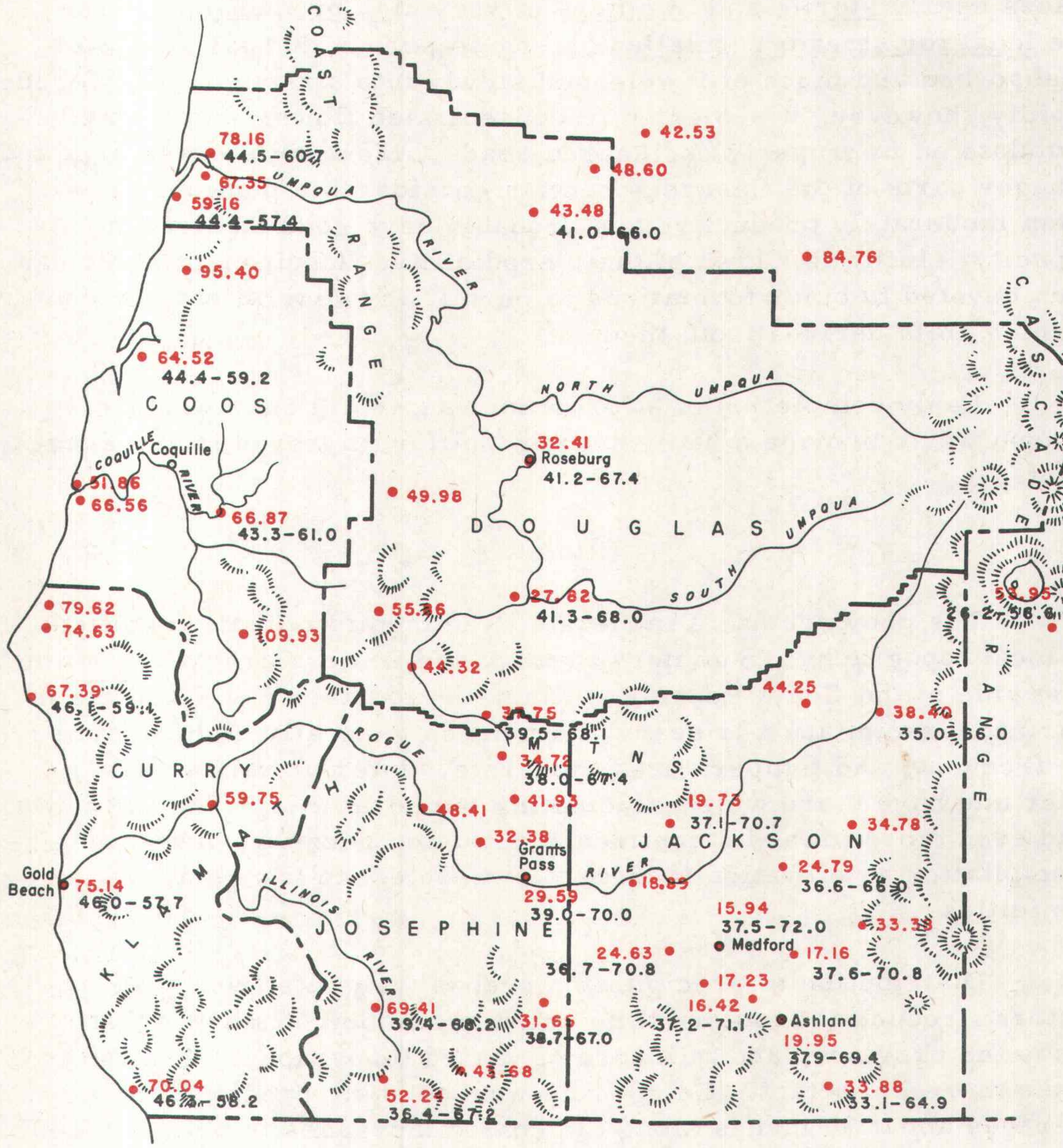

Figure 2. --Climatic data for southwestern Oregon. Red figures represent mean annual precipitation; black figures, the mean January and July temperatures.

from 66° to 72° F. At increasing elevations in the Cascades, both winter and summer temperatures decline: January and July average only 26.0° and 56.6° respectively at Crater Lake National Park headquarters, 6,475 feet above sea level.

H. B. Shepard (9) divided the Pacific Coast States into seven zones of "forest fire climate" based on: (1) precipitation, (2) mean drought period, (3) maximum drought period, (4) average low relative humidity, and (5) number of days in which relative humidity went below 35 percent for the period April through October. Zone 1 represents the least fire danger, zone 7 the greatest. Six of Shepard's zones are found in the province (fig. 3). Since drought and atmospheric humidity are strongly reflected in these fire climate zones, they are indicative not only of forest fire danger but also the relative transpiration draft and general effectiveness of precipitation for forest growth. The influence of humid air and summer fog along the coast and that of dry air in the arid country east of the Cascade Range is strikingly evident.

RESOURCES

Land

Of 8,145,000 acres of land in the province, about 7,234,000 acres or 89 percent are forested (table 1). A total of 1,515,935 acres were in farms in 1954, of which 299,942 acres were cropland and 1,076,912 acres were pastured (table 2). Irrigation of cropland and improved pastures is increasing rapidly, but is not yet approaching the potential. Less than half of the irrigable land along the Rogue River in Jackson and Josephine Counties was irrigated in 1958 (8), and less than 14,000 acres were irrigated in Douglas County in 1955 out of a potential of nearly 120,000 acres (10).

Due to rough topography, four-fifths or more of the province will continue to be best adapted to tree growing, less than one-tenth to crops, and the remainder to pasture.

Timber

Of the 7,234,000 forested acres in the province, 6,581,000 or 91 percent are considered commercial forest land (table 1). Over half the commercial forest land is federally owned or managed. Seventy-three percent of the commercial forest land is still in

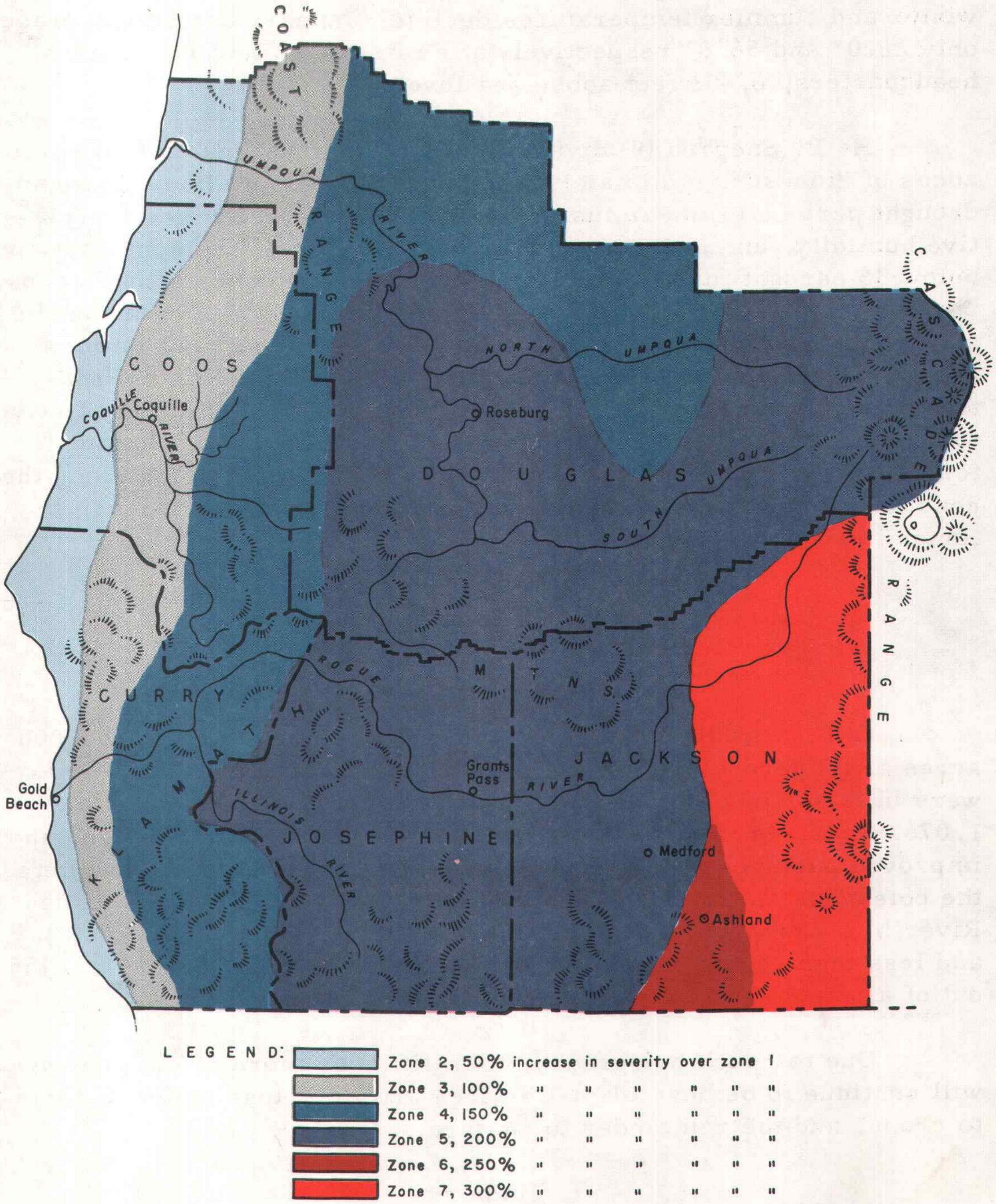

Figure 3.--Forest fire climatic zones of southwestern Oregon (9--Zone 1, the standard, is not represented in SW. Oregon).

Table 1.--Area of all land and forest land, by major class; and area of commercial forest land, by ownership: southwestern Oregon, 1948 (3)

Class of land or ownership	Area	
	Thousand acres	Percent
All land:		
Forest	7,234	89
Nonforest	911	11
Total	1/ 8,145	100
Forest land:		
Commercial	6,581	91
Reserved commercial	221	3
Noncommercial	364	5
Reserved noncommercial	68	1
Total	7,234	100
Commercial forest land:		
Privately owned	2,717	41
Federally owned or managed	3,529	54
Other public	335	5
Total	6,581	100

1/ The U.S. Census of Agriculture reports total land area as approximately 8,151,680 acres. The disparity is due to different standards of classification and methods of compilation.

Table 2.--Area of all land and selected farm-land classes in southwestern Oregon counties, 1954[1/]

Item	County					Total
	Coos	Curry	Douglas	Jackson	Josephine	
	Acres					
Land area	1,031,040	1,038,080	3,239,680	1,802,880	1,040,000	8,151,680
Land in farms	271,784	120,392	553,903	472,739	97,117	1,515,935
Cropland	53,481	24,175	101,423	89,084	31,779	299,942
All land pastured	173,937	94,370	423,585	344,309	40,711	1,076,912
Woodland	140,560	50,278	265,365	201,232	53,549	710,984
Woodland pastured	78,853	31,732	200,779	158,416	21,361	491,141

1/ From 1954 U.S. Census of Agriculture (vol. 1, part 32).

sawtimber, 11 percent in poletimber, 7 percent supports only seedlings and saplings, and 9 percent is nonstocked (table 3). Of the 4,835,000 acres classified as sawtimber, 81 percent is in the Douglas-fir type, 12 percent in pine types, and 7 percent other types. The total sawtimber volume of 153 billion board feet is 72 percent Douglas-fir, 8 percent pine, 18 percent other conifers, and 2 percent hardwoods (table 4).

Forest Types

The province is a forest transition zone in which Douglas-fir is the most abundant species. The transition from north to south is evident in several ways: (1) an increasing frequency of ponderosa pine, sugar pine, and incense-cedar in the interior; (2) a general decline in site quality for Douglas-fir; (3) a generally better growth rate and timber quality for the pines; (4) appearance of Port-Orford-cedar, then redwood, in mixtures along the coast; and (5) appearance of many species not found further north, such as Jeffrey pine, knobcone pine, tanoak, California-laurel, California black oak and canyon live oak. The transition is most rapid from the North Umpqua River to the Rogue River.

Table 3.--Area of commercial forest land, by stand-size class; and area of sawtimber stands, by forest type: southwestern Oregon, 1948 (3)

Stand-size class or forest type	Area	
	Thousand acres	Percent
Commercial forest land:		
Sawtimber	4,835	73
Poletimber	713	11
Seedlings and saplings	456	7
Nonstocked	577	9
Total	6,581	100
Sawtimber stands:		
Old growth	3,084	64
Large young growth	931	19
Small young growth	820	17
Total	4,835	100
Sawtimber stands:		
Douglas-fir	3,892	81
Pine	596	12
Other	347	7
Total	4,835	100

Table 4.--Volume of live sawtimber on commercial forest land, by species group and ownership, southwestern Oregon, 1948 (3)

(Scribner rule)

Species group or ownership	Volume	
	Billion board feet	Percent
Species group:		
Douglas-fir	110	72
Pines	13	8
Other conifers	27	18
Hardwoods	3	2
Total	153	100
Douglas-fir:		
11.0-20.9"	12	11
21.0-30.9"	23	21
31.0-40.9"	24	22
41.0" and larger	51	46
Total	110	100
Ownership:		
Private	58	38
National forest	49	32
Revested grant lands	34	22
Other public lands	12	8
Total	153	100

Northern and western parts of the province are considered Douglas-fir forests from the standpoint of abundance, growth rate, and apparent economic desirability. But farther south and inland, where other species become prominent and frequently exceed Douglas-fir in growth and quality, there is valid doubt whether Douglas-fir should be encouraged to remain predominant. This area has been termed the "mixed-conifer zone." An attempt has been made (fig. 4) to delimit the zone[2] in which Douglas-fir is likely to remain the most desirable species. Also included in figure 4 are the distinctive, high-elevation true fir—mountain hemlock type, the lodgepole pine type, the coastal Sitka spruce—western hemlock type, and the subzone where Douglas-fir is the predominant species but where Port-Orford-cedar is also commercially important.

The Douglas-fir zone thus delineated occupies 33.5 percent of the province, nearly half of which is within the commercial area for Port-Orford-cedar. Douglas-fir should remain the primary species to manage in the Douglas-fir zone and part of the mixed-conifer zone, but Port-Orford-cedar should also be considered in the subzone where it is abundant.

Port-Orford-cedar has been greatly sought ever since logging commenced along the southwest Oregon coast. For many years it was the only species cut in quantity. Today its future is clouded. The supply is limited and its special markets have been to a great extent invaded by substitutes. A lethal root rot, caused by the fungus Phytophthora lateralis, now present in Port-Orford-cedar's natural range, can potentially eliminate the species if the environment is hospitable and feasible control measures are not developed. If time and research show that cedar is to remain in the stands, special efforts should be made to favor it. Port-Orford-cedar is a wood of outstanding properties and should remain a valuable component of our rich timber resource.

The mixed-conifer zone, which contains many combinations and degrees of mixture of Douglas-fir, ponderosa pine, sugar pine, white fir, incense-cedar, and others, occupies 44 percent of the

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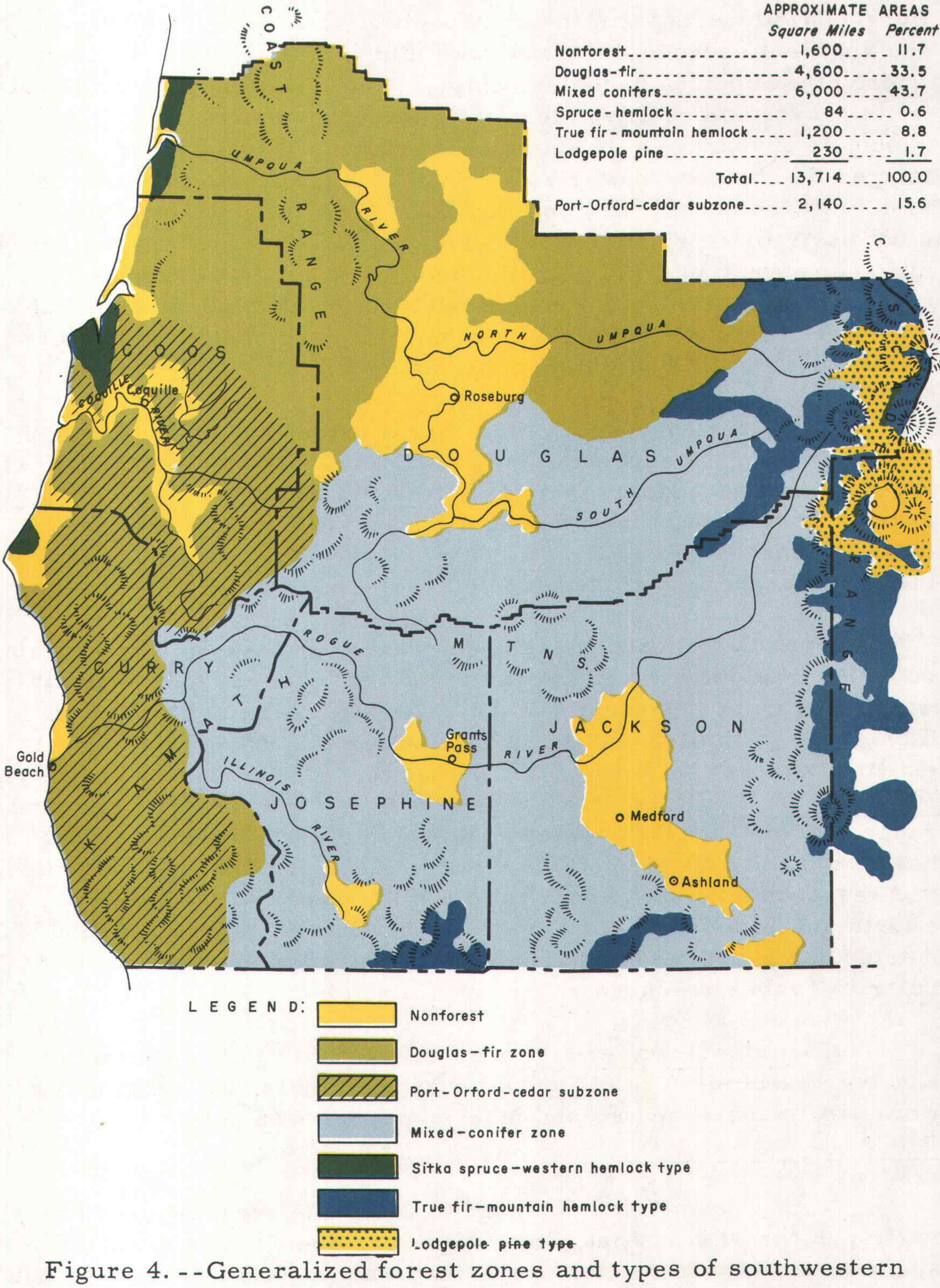
[2] The term "zone" is used to designate areas occupied by a variety of forest types but within which one species, or group of species, appears to be most important from the standpoint of forest management.



APPROXIMATE AREAS

	Square Miles	*Percent*
Nonforest	1,600	11.7
Douglas-fir	4,600	33.5
Mixed conifers	6,000	43.7
Spruce-hemlock	84	0.6
True fir-mountain hemlock	1,200	8.8
Lodgepole pine	230	1.7
Total	13,714	100.0
Port-Orford-cedar subzone	2,140	15.6

Figure 4. --Generalized forest zones and types of southwestern Oregon.

province. It may equal the Douglas-fir zone in commercial importance and has many more management problems. Although the mixed conifers generally occupy drier sites than the other types, their potential productivity under management may be far greater than is indicated by present stands.

A major part of the mixed-conifer zone is classified as Douglas-fir type, but present stands are far from uniform in composition. Sugar pine, ponderosa pine, and incense-cedar are commonly present. Both sugar and ponderosa pines predominate in some places and form extensive types. Western white pine is an important constituent on limited areas, and a white fir—Douglas-fir mixture is common in the Cascade Range east of Ashland.

The true fir—mountain hemlock type occupies 1,200 square miles of the higher Cascades. Shasta red fir dominates from Crater Lake southward, and either Shasta red fir or noble fir dominates to the north. The boundary or zone of mixing between the two has not yet been satisfactorily identified. They probably hybridize. Their woods are superior to those of other true firs, stands are dense, and yields are high. Both are highly valued for Christmas trees. Within its altitudinal range the true fir—mountain hemlock type is considered worthy of intensive management. The type is also important for water production. Lying at high elevations where deep snow accumulates in winter, it is a primary source of water for summer streamflow. Watershed needs should be a major consideration in its management.

The Sitka spruce—western hemlock and lodgepole pine types are too limited in southwestern Oregon to be important. Lodgepole pine occupies about 2 percent of the province near the sources of the North Umpqua and Rogue Rivers. It occupies poor soils and is of little commercial value. The Sitka spruce—western hemlock type along the coast occupies less than 1 percent of the province.

Interspersed with the conifers, especially in Curry County, are 3 billion board feet of hardwoods--2 percent of the total sawtimber volume. Hardwood types (not shown in fig. 4) occupy about 2 percent of the land area.

Following is a list[3/] of tree species and subspecies native to southwestern Oregon, showing both scientific and common names.

Commercially Important Softwoods

Abies concolor	(white fir)
Abies grandis	(grand fir)
Abies magnifica var. shastensis	(Shasta red fir)
Chamaecyparis lawsoniana	(Port-Orford-cedar)
Libocedrus decurrens	(incense-cedar)
Pinus lambertiana	(sugar pine)
Pinus monticola	(western white pine)
Pinus ponderosa	(ponderosa pine)
Pseudotsuga menziesii	(Douglas-fir)
Thuja plicata	(western redcedar)
Tsuga heterophylla	(western hemlock)
Tsuga mertensiana	(mountain hemlock)

Commercially Unimportant Softwoods[1/]

Abies amabilis	(Pacific silver fir)
Abies lasiocarpa	(subalpine fir)
Abies magnifica	(California red fir)
Abies procera	(noble fir)
Chamaecyparis nootkatensis	(Alaska-cedar)
Cupressus bakeri	(Modoc cypress)
Cupressus macnabiana[2/]	(MacNab cypress)
Juniperus occidentalis	(western juniper)
Picea breweriana	(Brewer spruce)
Picea engelmannii	(Engelmann spruce)
Picea sitchensis	(Sitka spruce)

1/ Unimportant either because of small quantity or because little used.

2/ Presence not confirmed.

3/ Names are in accordance with: Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr. Handb. 41, 472 pp. 1953.

Pinus albicaulis	(whitebark pine)
Pinus attenuata	(knobcone pine)
Pinus balfouriana[2/]	(foxtail pine)
Pinus contorta	(lodgepole pine)
Pinus jeffreyi	(Jeffrey pine)
Sequoia sempervirens	(redwood)
Taxus brevifolia	(Pacific yew)

Hardwoods

Acer circinatum	(vine maple)
Acer macrophyllum	(bigleaf maple)
Alnus rhombifolia	(white alder)
Alnus rubra	(red alder)
Arbutus menziesii	(Pacific madrone)
Castanopsis chrysophylla	(golden chinkapin)
Cornus nuttallii	(Pacific dogwood)
Crataegus douglasii	(black hawthorn)
Fraxinus latifolia	(Oregon ash)
Lithocarpus densiflorus	(tanoak)
Prunus emarginata	(bitter cherry)
Prunus virginiana	(common chokecherry)
Populus tremuloides	(quaking aspen)
Populus trichocarpa	(black cottonwood)
Quercus chrysolepis	(canyon live oak)
Quercus garryana	(Oregon white oak)
Quercus kelloggii	(California black oak)
Quercus X moreha	(oracle oak)
Rhamnus purshiana	(cascara buckthorn)
Umbellularia californica	(California-laurel)

[2/] Presence not confirmed.

Brushfields

In some places brush apparently excludes forest reproduction and in others causes long delays in restocking. It may take 30 to 50 years for seedlings to get above the brush cover. And wherever present, brush undoubtedly slows tree growth.

Any lands not fully covered with trees are typically brush covered. No record is available of the extent of brush-covered lands, but it can be estimated. The Forest Survey reports 315,000 acres of nonstocked burns and old cutovers (table 5), all of which are probably densely covered with brush. Of 1,169,000 acres of pole-timber and seedling and sapling stands, almost three-fourths (865,000 acres) is less than 70 percent stocked. There is no record of the acreage of saw-log-size timber not fully stocked, but it probably exceeds that of smaller trees. Brush therefore is a problem on more than 2 million acres.

Brushfields are of many types, differing in ecological requirements, degree of competition they afford to forest regeneration and growth, and degree to which they may protect and build the soil and aid its watershed functions. The more common brush and weed species and subspecies in southwestern Oregon, listed by scientific name, are as follows:[4]

Acer circinatum	(vine maple)
Acer glabrum	(Rocky Mountain maple)
Acer macrophyllum	(bigleaf maple)
Alnus rhombifolia	(white alder)
Alnus rubra	(red alder)
Amelanchier alnifolia	(Saskatoon serviceberry)
Amelanchier florida	(Pacific serviceberry)
Arbutus menziesii	(Pacific madrone)
Arctostaphylos canescens	(hoary manzanita)
Arctostaphylos columbiana	(hairy manzanita)
Arctostaphylos hispidula	(Howell manzanita)
Arctostaphylos nevadensis	(pinemat manzanita)
Arctostaphylos patula	(greenleaf manzanita)
Carex spp.	(sedges)
Castanopsis chrysophylla	(golden chinkapin)
Castanopsis chrysophylla var. minor	(golden evergreenchinkapin)
Ceanothus cordulatus	(mountain whitethorn ceanothus)
Ceanothus cuneatus	(buckbrush ceanothus)
Ceanothus integerrimus	(deerbrush ceanothus)

4/ Names of trees are in accordance with: Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr. Handb. 41, 472 pp. 1953.

Names of shrubs and weeds follow: Kelsey, Harlan P., and Dayton, William A. Standardized plant names. Ed. 2, 675 pp. Harrisburg, Pa. 1942.

Ceanothus prostratus	(squawcarpet ceanothus)
Ceanothus sanguineus	(redstem ceanothus)
Ceanothus thyrsiflorus	(blueblossom ceanothus)
Ceanothus velutinus	(snowbrush ceanothus)
Ceanothus velutinus var. laevigatus	(varnishleaf ceanothus)
Cornus nuttallii	(Pacific dogwood)
Corylus cornuta var. californica	(California hazel)
Cytisus scoparius	(Scotch broom)
Fraxinus latifolia	(Oregon ash)
Garrya flavescens var. buxifolia	(boxleaf silktassel)
Garrya fremonti	(Fremont silktassel)
Gaultheria shallon	(salal)
Holodiscus discolor	(creambush rockspirea)
Lithocarpus densiflorus	(tanoak)
Lithocarpus densiflorus var. montanus	(scrub tanoak)
Mahonia aquifolium	(Oregongrape)
Mahonia nervosa	(Cascades mahonia)
Myrica californica	(Pacific bayberry)
Osmaronia cerasiformis	(osoberry)
Pachistima myrsinites	(myrtle pachistima)
Polystichum munitum	(western swordfern)
Prunus emarginata	(bitter cherry)
Pteridium aquilinium var. pubescens	(western bracken)
Quercus chrysolepis	(canyon live oak)
Quercus garryana	(Oregon white oak)
Quercus kelloggii	(California black oak)
Quercus sadleriana	(Sadler oak)
Quercus vaccinifolia	(huckleberry oak)
Quercus X moreha	(oracle oak)
Rhamnus purshiana	(cascara buckthorn)
Rhododendron macrophyllum	(Pacific rhododendron)
Rhododendron occidentale	(western azalea)
Ribes bracteosum	(stink currant)
Ribes lobbi	(Lobbs gooseberry)
Ribes roezli var. cruentum	(blood Sierra gooseberry)
Ribes sanguineum	(winter currant)

Ribes viscosissimum	(sticky currant)
Rubus laciniatus	(cutleaf blackberry)
Rubus leucodermis	(whitebark raspberry)
Rubus parviflorus	(western thimbleberry)
Rubus spectabilis	(salmonberry)
Rubus procerus	(Himalaya blackberry)
Rubus ursinus var. vitifolius	(grapeleaf California dewberry)[1]
Salix spp.	(willows)
Sambucus callicarpa	(Pacific red elder)
Sambucus glauca	(blueberry elder)
Toxicodendron diversilobum	(Pacific poison-oak)
Ulex europaeus	(common gorse)
Umbellularia californica	(California-laurel)
Vaccinium ovatum	(box blueberry)[2]
Vaccinium parvifolium	(red whortleberry)[3]
Whipplea modesta	(modest whipplea)
Xerophyllum tenax	(common beargrass)

1/ Known locally as trailing blackberry.

2/ Known locally as evergreen huckleberry.

3/ Known locally as red huckleberry.

Water

The province feeds two large rivers, the Umpqua and Rogue--which cut through the coastal mountains from the Cascades to the coast--and many smaller streams draining the west side of the coastal mountains. Annual water yield from the Umpqua drainage above Elkton is 26.64 inches from its 3,680 square-mile watershed. The Rogue may yield a similar amount. Greatest water yields are obtained from the high-elevation pumice areas around the sources of the North Umpqua and Rogue Rivers (30 to 50 inches annually) and from streams on the west slope of the coastal mountains (61.62 inches from the South Fork of the Coquille River at Powers). Lower elevation interior streams produce much less flow. Cow Creek above Azalea, for example, yields only 17.48 inches annually (10).[5]

5/ Runoff values in this paragraph are 10-year averages, 1941-50.

Table 5.--Area of nonstocked burns and old cutovers and understocked stands of poletimber and seedlings and saplings, southwestern Orĕgon, 1948 (3)

Condition	Area
	Thousand acres
Nonstocked land:	
Burns	269
Old cutovers[1/]	46
Total	315
Understocked poletimber and seedling and sapling stands:	
10 to 40 percent stocked	222
40 to 70 percent stocked	643
Total	865
Total	1,180

[1/] Clear cut before 1940.

Water Flow

Due to the wide variation in flow of most streams, only a small part of the total is usable--the amount of water used cannot exceed the minimum flow unless it is stored. The Umpqua has a mean annual flow of 7,425 cubic feet per second at Elkton, but has sunk to 640 c.f.s.; the Rogue averages 3,505 c.f.s. at Grants Pass, but has dropped to 637 c.f.s. (11). The South Umpqua averages 2,858 c.f.s. at Brockway, but has fallen to 36 c.f.s.; and the South Fork of the Coquille averages 768 c.f.s. at Powers, but has dribbled down to 12 c.f.s. (table 6).

Table 6.--Variations in flow of selected southwestern Oregon streams, records through 1956[1]

Stream and station	Discharge: Mean annual	Discharge: Maximum	Discharge: Minimum	Ratio, minimum to maximum	Runoff	Length of Record
	----- Cubic feet per second		------		Inches	Years
1. North Umpqua R., below Lake Cr.	394	1,190	206	1:6	30.56	25
2. North Umpqua R., above Clearwater R.	842	3,680	395	1:9	44.30	6
3. Clearwater R., above Trap Cr.	163	598	91	1:7	53.19	27
4. Clearwater R., at mouth	356	1,380	192	1:7	64.43	7
5. Rogue R., above Bybee Cr.	498	4,430	180	1:25	43.61	22
6. Rogue R., above Prospect	788	16,600	200	1:83	32.22	34
7. North Umpqua R., at Winchester	3,512	100,000	566	1:176	2/ 35.47	12
8. Rogue R., at Raygold	2,887	110,000	616	1:179	19.40	51
9. S. Fork Rogue R., above Imnaha Cr.	127	2,170	27	1:80	33.15	18
10. Imnaha Cr., near Prospect	43	500	11	1:45	22.35	18
11. Middle Fork Rogue R., near Prospect	184	3,120	72	1:43	43.82	30
12. Red Blanket Cr., near Prospect	113	1,840	34	1:54	38.35	31
13. Big Butte Cr., near McLeod	341	8,950	54	1:166	18.59	11
14. Althouse Cr., near Holland	69	2,160	3	1:720	39.13	6
15. Sucker Cr., near Holland	209	7,150	19	1:376	37.33	15
16. Applegate R., near Copper	445	20,300	3/ 20	1:321	27.46	17
17. South Umpqua R., at Tiller	1,055	37,400	20	1:1,870	31.90	17
18. South Umpqua R., near Brockway	2,858	102,000	4/ 36	1:2,833	23.23	22
19. Cow Cr., near Azalea	107	5,920	4/ 4	1:1,480	18.62	26
20. S. Fork Coquille R., at Powers	768	30,500	12	1:2,542	61.69	37

1/ Data are from U.S. Geological Survey Water-Supply Paper 1448 (11), except for stations 1, 2, 4, 5, 9, 10, 11, and 14, which are from earlier U.S. Geological Survey water-supply papers.

2/ Measured above Rock Creek, 5 years only.

3/ Diversions of 43.3 c.f.s. above the station should be added to the observed flow of 20 c.f.s.

4/ Small diversions above the station.

The North Umpqua and Rogue Rivers are moderately well regulated by the uniform flow from the deep pumice areas around their headwaters. The North Umpqua down to the mouth of the Clearwater River, the Clearwater, and the Rogue River to the mouth of Bybee Creek vary little from summer to winter. About 90 to 95 percent of the flow of the entire North Umpqua during the driest part of summer originates on the 30 percent of the headwaters area covered by pumice.

Other streams originating in the high Cascades; such as the Middle and South Forks of the Rogue, Imnaha Creek, Red Blanket Creek, and Big Butte Creek; are also reasonably well regulated. Streams originating in the Siskiyou Mountains along the California border--such as Althouse Creek, Sucker Creek, and the Applegate River--are much more poorly regulated, and those originating on the lower Cascades--like the South Umpqua River, Cow Creek, and the South Fork of the Coquille, fluctuate even more widely.

Water Use

Water is used primarily for irrigation and domestic purposes in southwestern Oregon. In 1949, when 49,346 acres in Jackson County and 19,718 acres in Josephine County were irrigated by waters from the Rogue, it was estimated that 40,300 irrigated acres should have additional water and 73,340 additional acres could be irrigated if water were available. In 1954, acreage irrigated in Jackson and Josephine Counties had increased to 53,674 acres and 20,820 acres, respectively. Under present diversions, waters of the lower Rogue become so warm in summer that fish die and the future of one of the most valuable fresh-water fisheries in the nation is threatened.

Irrigation is also increasing in other counties. If all water rights on the South Umpqua River, for example, were exercised simultaneously, it would be pumped dry in late summer.

Shortages of water are becoming acute. The city of Medford used 2,250 million gallons of water in 1951, with a peak daily use--under severe restrictions--of 14 million gallons. Ashland used about a third as much as Medford.

Sedimentation

Additional summer water can be made available in large quantity only by storage, and storage capacity on several streams might rapidly be lost by sedimentation. The winter average sediment load for eight southwestern Oregon streams was found to be 651 parts per million in 1951 and 1952 (table 7). This average is deceptively high due to one stream (South Fork of the Coquille R.). Based on the other seven streams, the average was 224 p.p.m. In contrast, the Wilson River in northwestern Oregon carried a load of only 72 p.p.m. and six streams in western Washington averaged 47 p.p.m.

Forage

The Forest Survey found 115,000 acres of oak-madrone woodland, much of which is used for grazing, and 46,000 acres of subalpine forest, much of which makes excellent summer grazing. Some stockmen have sown grass seed on cutover lands to increase available pasture, and some local groups advocate grass sowing on all cutover public lands.

Problems in land use have arisen where woodland grazing infringes on the coniferous forests of the interior and from attempts to convert excellent forest lands to pasture, especially in Coos County.

Scenic Resources and Wildlife

Recreation is exceeded in importance in the economy of southwestern Oregon only by timber and agriculture. Recreational use centers around the scenic resources and fish and game.

Scenic resources include such attractions as Crater Lake National Park; Oregon Caves National Monument; the Oregon Coast; the high Cascades; and mountain forests, lakes, and streams. Tourist use is very heavy in the upper Rogue and North Umpqua River areas. In 1958, the Rogue River National Forest reported 194,200 recreational visits, the Umpqua National Forest 116,500 visits, and the Siskiyou National Forest 39,500 visits. Winter sports use is still relatively small but is developing in several places.

Table 7.--Suspended sediment loads in selected streams in southwestern and northwestern Oregon and in Washington (1)

Area and stream	Sediment load: Maximum	Sediment load: Minimum	Sediment load: Average[1/]
	----- Parts per million -------		
Southwestern Oregon:			
Illinois R. (Kirby)	204	(2/)	67
S. Fork Coquille R. (Powers)	38,200	¼	4,061 (267)
Ashland Cr. (Ashland)	2,410	2	401 (97)
South Umpqua R. (Tiller)	853	¼	94 (49)
South Umpqua R. (Brockway)	6,850	(2/)	552 (102)
Calapooya Cr. (Nonpariel)	2,930	½	252 (61)
North Umpqua R. (Glide)	2,100	3	220 (94)
Elk Cr. (Tiller)	450	(2/)	106
Little R. (Glide)	777	2	104 (56)
Average	--	--	651
Northwestern Oregon:			
Wilson R. (USGS)	295	9	84
Wilson R. (Lees Bridge)	229	4	59
Average	--	--	72
Washington:			
Chehalis R.	164	3	50
Skookumchuck R. (Bucoda)	98	2	41
Cowlitz R.	112	27	62
E. Fork Lewis R. (Tenino)	88	1	37
S. Fork Newaukum R. (Forest)	195	13	60
S. Fork Newaukum R. (Alpha)	71	(2/)	33
N. Fork Newaukum R. (Water Intake)	65	(2/)	30
N. Fork Newaukum R. (Forest)	304	½	65
Average	--	--	47

1/ Averages were based on approximately 15 samples per station. Averages in parentheses were obtained by omitting maximum sediment loads.

2/ Trace.

Fishing, centered around the thousands of miles of trout, salmon, and steelhead streams originating in the forested mountains, is one of the leading recreational uses. The Umpqua National Forest alone was visited by 69,600 anglers in 1958. Sport fish harvest for the province was estimated at more than 1,100,000 pounds in 1956.

The Umpqua River and Winchester Bay at its mouth, the Rogue River, and the Coos River and Bay are the principal areas for salmon and steelhead fishing. In 1955 Winchester Bay ranked second, Rogue River third, and Coos River and Bay fourth in number of salmon and steelhead caught by sports fishermen in Oregon. In the same year, 38 percent of salmon and steelhead combined and 53 percent of salmon alone caught in Oregon by sports fishermen were landed in southwestern Oregon (6).

The estimated total population of anadromous salmonoids in the Umpqua basin in 1955 was as follows: (5).

Spring chinook	9,500	to	10,000
Fall chinook	4,500	to	6,000
Silver salmon	54,000	to	90,000
Summer steelhead	3,430		
Winter steelhead	35,000	to	40,000
Cutthroat trout	20,000	to	32,000

The estimated probable capacity of Umpqua basin for the several anadromous salmonoids is as follows: (5).

Spring chinook	20,000	to	25,000
Fall chinook	30,000	to	40,000
Silver salmon	300,000	to	350,000
Summer steelhead	10,000	to	12,500
Winter steelhead	100,000	to	150,000
Cutthroat trout	200,000	to	250,000

Fishing for trout--chiefly rainbow--also attracts a large number of fishermen to the streams and lakes of southwestern Oregon. There were approximately 10,000 fishermen at Diamond Lake opening day of 1957. In 1955 (when Diamond Lake was closed) the Oregon State Game Commission estimated that 20,000 to 25,000 man-days were spent in trout fishing on streams in the Umpqua River basin.

Big game--principally black-tailed deer and, to a much lesser degree, Roosevelt elk--are the most important wildlife for the hunters. The reported legal kill was 11,606 deer and 1,082 elk in 1957 (7). Big game on the national forests are estimated to total about 23,900 deer, 390 elk, and 2,350 black bear. Since the national forests include only about a third of the forest lands, total numbers of big game in the province could be roughly estimated at three times the figures for the national forests. However, big-game population estimates in this area are highly speculative because of dense cover and the nonmigratory nature of most of the herds.

Before intensive fire protection was started in southwestern Oregon, intentional and accidental burns created ideal deer habitat. Hunting in this period has been reported as very good. With the advent of intensive fire protection, the old burns have grown to dense stands of high brush or young timber. Because of poor visibility and hindrance to travel, hunting became much more difficult. In recent years extensive clear cutting has added large acreages of ideal deer habitat. Hunting is easy on these clear-cut areas for a number of years after logging. Also, logging roads provide good access. Because a large acreage of new clearcuts will be added each year, good habitat and hunting areas will continue to be available as the older clearcuts grow up to young timber. Although many people believe the deer population is increasing or will increase because of the clearcuts, there is no conclusive evidence that the number of deer are increasing.

SOCIAL AND ECONOMIC DEVELOPMENT

Furs and minerals attracted the first white men to southwestern Oregon; but with permanent settlement about a century ago, agriculture pre-empted first place as a means of livelihood, a position it continued to hold until the expansion of timber harvesting during World War II. Timber has since been the most important resource in the economy and should retain that position indefinitely.

Population

As agriculture developed, population grew steadily. By 1930, southwestern Oregon had 98,011 people; in 1940 there were 115,009, a growth of 17 percent; and in 1950 the total reached 187,914, an increase of 63 percent from the 1940 figure (table 8). The increase in the 1940-50 period was due mainly to the expansion of the timber

Table 8.--Population of southwestern Oregon; 1930, 1940, 1950, and 1958[1/]

County	Census year				Growth		
	1930	1940	1950	1958	1930-40	1940-50	1950-55
	Number				Percent		
Coos	28,373	32,466	42,265	56,330	14	30	26
Curry	3,257	4,301	6,048	12,690	32	41	77
Douglas	21,965	25,728	54,549	62,880	17	112	31
Jackson	32,918	36,213	58,510	68,660	10	62	12
Josephine	11,498	16,301	26,542	29,070	42	63	13
Total	98,011	115,009	187,914	229,630	17	63	23

1/ From U.S. Census of Population through 1950; from (4) for 1958.

industry. The population of Douglas County during this time jumped 112 percent.

Population should increase rapidly for many years. The medium of three projections by the U. S. Census Bureau estimates that Oregon will have 1,918,000 people by 1960 and 2,417,000 by 1975. The Columbia Basin Inter-Agency Committee's medium estimate for 1975 of 2,591,000 seems more in keeping with recent birth and in-migration rates. Between 1910 and 1940, southwestern Oregon averaged 10 percent of the State's population, in 1950 it had 12 percent. The province will probably maintain or even increase the higher percentage, since its resources are less fully developed than those of the State as a whole. A population of 310,000 by 1975 seems likely.

Forest Industries

Exploitation of the province's timber started early in the more accessible stands. In fact, logging has been continuous in the vicinity of Coos Bay, where water transportation is available, since the 1850's. Pine was cut heavily at the lower elevations in the Rogue

River valley by 1900, but the vast mountain stands of the interior and Curry County were economically inaccessible until the 1940's (table 9). In the period 1925-29, cutting was concentrated in Coos County, near tidewater in Douglas County, and in the pine stands of Jackson County, with 64 percent of the total cut coming from Coos County. After the interior stands became marketable in the early 1940's, the cutting rate increased rapidly in Douglas, Jackson, and Josephine Counties, but it was 1950 before Curry County really opened up. In the period 1955-57, Douglas County contributed 48 percent of the total cut and Coos County 17 percent.

Table 9.--Mean annual log production in southwestern Oregon counties, by 5-year periods, 1925-54, and for 1955-57[1/]

(Scribner rule)

Period[2/]	County					Total
	Coos	Curry	Douglas	Jackson	Josephine	
	M board feet					
1925-29	312,662	4,436	89,454	72,160	9,850	488,562
1930-34	153,375	2,993	49,089	41,927	12,694	260,078
1935-39	327,251	40,224	142,497	91,192	25,513	626,677
1940-43	458,536	54,992	379,354	265,609	79,671	1,238,162
1945-49	448,129	61,120	852,456	397,761	187,361	1,946,827
1950-54	655,600	372,479	1,438,650	548,509	283,715	3,298,953
1955-57	594,604	391,738	1,687,222	567,611	252,990	3,494,165

1/ 1925-48 from (3); 1949-57 from unpublished data in Pacific Northwest Forest and Range Experiment Station files.

2/ 1944 data not available.

Since more than half the commercial forest is in public ownership and managed for sustained yield, a continuous and reasonably high-level flow of products seems assured. Present cutting rates probably cannot be long maintained, however, due to overcutting on some private lands.

Thus far, the timber industry has been concerned mainly with primary manufacture--the production of lumber, veneer, plywood, poles, and shingles. At present there is a small pulp mill and a fiberboard plant at Coos Bay, a particle board plant at Dillard, and a fiberboard plant at Grants Pass. If the industry is to maintain its present importance in the economy, a gradual change toward more complete utilization and secondary manufacturing will be needed. Table 10 shows that there is an abundant source of material for pulp, fiberboard, and chip-board. Secondary manufacture might include products such as moldings, doors, softwood furniture, boxes, crates, and laminated structural members.

Table 10.--Estimated annual usable wood residue developed in Douglas County

Source	Logs used	Residue
	M board feet	M cubic feet
Log production	1,620,000	53,460
Lumber production	1,000,000	55,000
Plywood production	173,000	14,360

Agriculture

Agriculture should remain a primary activity and lend stability to the economy. As previously pointed out, a total of 1,515,935 acres, or 19 percent of the land area, is in farms (1954). Of this amount, 299,942 acres are cropland. Lands under irrigation increased from 72,021 acres in 1940 to 93,294 acres in 1954 (table 11).

Livestock provide more than half of the income from farm holdings, crops provide approximately a third, and forest products about an eighth (table 12). Dairying, beef cattle, sheep, and poultry lead in the interior counties; dairy herds and sheep are prominent in the coastal counties.

Little is known of the extent of the forage resource, but the sale of livestock and livestock products accounts for more than half

Table 11.--Land irrigated on southwestern Oregon farms; 1944, 1949, and 1954[1/]

Year	County					Total
	Coos	Curry	Douglas	Jackson	Josephine	
	Acres					
1944	644	3	1,735	48,590	21,049	72,021
1949	4,382	923	3,798	49,346	19,718	78,167
1954	6,301	1,701	10,798	53,674	20,820	93,294

1/ From U.S. Census of Agriculture, 1950 and 1954 (vol. 1, part 32).

Table 12.--Value of southwestern Oregon farm products sold, 1949 and 1954[1/]

Products	Value			
	1949		1954	
	Dollars	Percent	Dollars	Percent
Crops	9,657,702	36.0	8,236,701	30.4
Livestock and livestock products	15,812,885	58.9	15,482,736	57.1
Forest products	1,368,074	5.1	3,378,563	12.5
All farm products	26,838,661	100.0	27,098,000	100.0

1/ From 1954 U.S. Census of Agriculture (vol. 1, part 32).

of farm income in the province. Over 1 million acres of land on farms is pastured (table 13). The Rogue River National Forest reported that 371,430 acres were grazed in 1952 to provide 12,946 cow-months and 7,111 sheep-months of use. Grazing use is small on the Umpqua and Siskiyou National Forests. Farmers reported 324,912 animals on farms and ranges in 1954 (table 14).

Table 13.--Pastured land on farms in southwestern Oregon counties; 1944, 1949, and 1954[1]

County	1944	1949	1954
	Acres		
Coos	188,458	173,397	173,937
Curry	85,667	83,112	94,370
Douglas	526,293	421,714	423,585
Jackson	242,789	246,296	344,309
Josephine	67,184	36,885	40,711
Total	1,110,391	961,404	1,076,912

1/ From U.S. Census of Agriculture, 1950 and 1954 (vol. 1, part 32).

Table 14.--Livestock on farms and ranges in southwestern Oregon counties, 1954[1]

County	Horses and mules	Cattle	Sheep	Goats	Hogs	Total
	Number					
Coos	641	31,720	17,953	1,485	574	52,373
Curry	320	7,977	26,672	1,665	621	37,255
Douglas	1,512	24,457	103,308	8,166	3,488	140,931
Jackson	1,756	51,321	11,618	1,086	3,912	69,693
Josephine	521	18,048	2,473	1,256	2,362	24,660
Total	4,750	133,523	162,024	13,658	10,957	324,912

1/ From 1954 U.S. Census of Agriculture (vol. 1, part 32).

Recreation

Recreation, centered around scenic attractions and fish and game, is the third most important source of income in southwestern Oregon. Furthermore, recreation is the least developed of major resources. No overall measure of the economic value of the recreation resource is available, but the value of the fish and game resource for southwestern Oregon in 1956 has been estimated by the Roseburg office of the Oregon State Game Commission as follows:

Fish:	
Dollar redistribution by anglers (table 15)	$8,435,000
Value of fish caught (table 15)	802,375
Total "income"	9,237,375
Game:	
Dollar redistribution by hunters--46,613 hunters at $79.49 per hunter (National Wildlife Economic Survey)	3,705,267
Harvested meat value (table 16)	1,002,940
Total "income"	4,708,207
Capital Values:	
Income from fish, capitalized at 4%	230,934,375
Income from game, capitalized at 4%	117,705,184
Total	348,639,559

Other Industries

Sand and gravel, limestone, nickel, mercury, chromium, and gold are the important minerals in southwestern Oregon. In 1954 the M. A. Hanna Co. began operating nickel deposits near Riddle under contract with the Defense Minerals Procurement Agency, which advanced $24,800,000. All but $2,400,000 of this was to be spent on a smelter. The Hanna Nickel Smelting Co. contracted to produce between 95 and 125 million pounds of nickel for the government.

Table 15.--Southwestern Oregon sports fishery values, 1956[1/]

Area	Anglers dollar redistribution		Fish harvested			
	Anglers	Value	Salmon	Steelhead	Trout	Value[2/]
	Number	Dollars	Pounds	Pounds	Pounds	Dollars
Rogue River	230,000	[3/] 3,450,000	291,930	32,278	26,500	244,379
Umpqua River	140,000	[3/] 2,100,000	56,100	34,310	15,000	73,734
Coastal	125,000	[3/] 1,875,000	80,100	75,000	25,000	124,468
Coos Bay and Winchester Bay	50,500	[4/] 1,010,000	529,109	0	0	359,794
Total		8,435,000	957,239	141,588	66,500	802,375

[1/] Compiled by Roseburg office, Oregon State Game Commission, February 1958.

[2/] $0.68 per pound for salmon, $0.60 per pound for steelhead, and $1.00 per pound for trout.

[3/] $15 per angler.

[4/] $20 per angler.

Table 16.--Southwestern Oregon sports game values, 1956[1/]

Game bird or animal	Total birds or animals	Value per bird or animal	Total value
	Number	Dollars	Dollars
Elk	552	150.00	82,800
Deer	8,293	50.00	414,650
Geese	43,605	5.00	218,025
Ducks	100,144	2.50	250,360
Pheasants	7,842	2.50	19,605
Quail	3,500	1.00	3,500
Grouse	3,500	2.50	8,750
Doves	2,000	1.00	2,000
Pigeons	2,500	1.00	2,500
Squirrels	750	1.00	750
Total	--	--	1,002,940

[1/] Compiled by Roseburg office, Oregon State Game Commission, February 1958.

Commercial fishing is important along the coast, and probably contributes between 1 and 2 percent of the net income of the province.

Transportation

Poor transportation facilities and remote markets have delayed the development of the forest resources in most of the province. One branch of the Southern Pacific Co. railroad traverses the interior from north to south and another extends from Eugene to Coos Bay. Two major north-south highways cross the province: U.S. 101 along the coast, and U.S. 99 through the interior. These are connected by east-west highways from Winston to Coquille and from Drain to Reedsport. Other east-west highways from Eugene to Florence and from Grants Pass to Crescent City, Calif., although outside the province, are important in the movement of forest products. Two highways cross the Cascades, one from Ashland to Klamath Falls and another by way of the upper Rogue River. Salt-water transportation is available at Coos Bay, Reedsport, and Bandon.

Water Power

The province is well supplied with potential water power and development is keeping pace with needs. The California-Oregon Power Co., which serves most of the province, had plant capacities totalling 232,773 kw. by the end of 1957. Mountain States Power Co. (now part of Pacific Power and Light Co.) has a steam plant at Coos Bay with a capacity of 15,000 kw., and the city of Ashland has a hydro plant of 300 kw. capacity. The Bureau of Reclamation has under construction on Emigrant Creek, and scheduled for completion in 1959, a plant which will add 16,000 kw. Pacific Power and Light Co. has a Federal Power Commission preliminary permit for construction of a plant on the Coquille River to develop 67,500 kw.[6/] Other hydroelectric projects are under consideration. Federal power from the Bonneville system is available to southwestern Oregon.

Employment

Manufacturing of wood products accounted for 31.5 percent, and agriculture 11.8 percent, of employment in the province in 1950 (table 17).

6/ From unpublished data supplied by the Bonneville Power Administration, Portland, Oreg., and The California Power and Light Co., Medford, Oreg.

Table 17.--Employment in southwestern Oregon counties, by selected industrial groups, 1950[1]

Industrial group	County					Total
	Coos	Curry	Douglas	Jackson	Josephine	
	Number					
Employed labor force	16,661	2,563	19,838	20,145	9,381	68,588
Agriculture	1,219	595	1,802	2,707	1,641	7,964
Forestry & fisheries	277	103	75	92	59	606
Manufacturing	6,852	738	8,941	4,679	2,623	23,833
Furniture; lumber and wood products	6,170	643	8,383	3,757	2,381	21,334
Trucking, warehousing	124	13	159	251	87	634
	Percent[2]					
Agriculture	7.3	23.2	9.1	13.4	17.5	11.6
Forestry & fisheries	1.7	4.0	.4	.5	.6	.9
Manufacturing	41.1	28.8	45.1	23.2	28.0	34.7
Furniture; lumber and wood products	37.0	25.1	42.3	18.6	25.4	31.1
Trucking, warehousing	.7	.5	.8	1.2	.9	.9

1/ From 1950 U.S. Census of Population (vol. 2, part 37).

2/ Number of employees as percentage of employed labor force.

PROBLEMS OF FOREST MANAGEMENT

The major forest problems in southwestern Oregon fall into two categories: (1) those which are provincewide in scope, and (2) those which relate only to certain forest types, or ecological situations within forest types. The two groups of problems will be discussed separately.

Provincewide Problems

Ecological Relationships

A knowledge of environment and environmental requirements of species is fundamental to the management of any forest. It is especially important in southwestern Oregon, where forests of many tree species are superimposed upon a complex environment and extensive brushfields occupy many forest and nonforest sites.

The broad ecological requirements of some species, such as Douglas-fir and ponderosa pine, are fairly well known for many areas in the Pacific Northwest. It is not known, however, whether local strains and ecotypes have similar requirements. Even less is known about species other than Douglas-fir and ponderosa pine.

Few ecological studies have been made in the province. Obvious changes in the environment may be responsible for some changes of forest types, but there are no apparent reasons for others, such as in the northern limits of redwood and Port-Orford-cedar. Causes of variations in composition of stands in the mixed-conifer zone are obscure. The most abundant species may not be the best in all environments. The problem of management, therefore, is to learn which species to favor for all environments.

Little is known of the environmental requirements of brush species and what their presence means. Fire is considered to have been a primary factor in the formation and maintenance of brushfields. Some brush-covered sites may be suitable for forests, others not. In any brushfield reclamation program the best forest sites should be reclaimed first.

Preservation of Soil and Water Values

Although apparently rich in water, southwestern Oregon is having water troubles. Acute summer shortages are now experienced locally and more widespread shortages can be anticipated as population expands. Winter floods are increasing in frequency, and silt loads are becoming intolerable. Much of the increasing turbidity is caused by logging and associated road construction, which are rapidly pushing toward the remotest headwaters. It is interesting to note that the public policy of the State of Oregon, as expressed in its code of laws, is:

> to preserve the natural purity of the water of all rivers, streams, lakes, and watersheds, and the coastal areas of the State in the interest of the public welfare, for the protection and conservation of the public health, and recreational enjoyment of the people, and for the protection and conservation of fish, aquatic life, and migratory birds, and to foster and encourage the cooperation of the people, of industries, of incorporated cities, and of towns and counties, in preventing and controlling the pollution of said waters.[7]

Watershed damage now prevalent in southwestern Oregon clearly does not meet this goal.

Guides are needed for cutting, logging, and road-building practices on different kinds of soils. These guides should permit harvesting of timber with minimum damage to soils and water regulation and minimum erosion and sedimentation.

Cutting Practices

Clear cutting in staggered settings is widely practiced in the Douglas-fir type whereas partial cutting is the most common in ponderosa pine. Both methods have been practiced in the southwestern Oregon transition forests. Different cutting practices may be required for best management in the mixed-conifer zone because of (1) intricate mixtures of age classes and species; (2) low merchantable volumes in many places, often with good advanced reproduction underneath; and (3) old growth of mediocre quality. A major goal on the South Umpqua Experimental Forest will be to experiment with different methods of cutting and find ways of classifying and identifying stands in which specific cutting methods are most advantageous for growth, regulation of cut, and subsequent reproduction of desired species.

Clear cutting in staggered settings, now practiced in the true fir—mountain hemlock type seems rational, but it needs to be further tested. Only a beginning has been made toward prescribing cutting methods to encourage Port-Orford-cedar.

7/ Art. 3, Sec. 116-1118, Oregon Laws pertaining to Public Health. Oregon State Board of Health, 1947.

Natural Regeneration

Perhaps no other phase of forest management is as important as prompt regeneration of cutover lands. Port-Orford-cedar is reproducing well following a variety of cutting methods. Shasta red fir appears to reproduce well on small clearcuts, and Douglas-fir is reproducing well on clearcuts west of the Coast Range. But no species seems to be reproducing satisfactorily on clearcuts in the interior Douglas-fir zone and in the mixed-conifer zone. Sites are severe and there is a definite brush threat in many places. If reproduction is not prompt, brush may occupy the ground.

Natural regeneration surveys are needed to identify problem areas and the conditions which cause them. Also needed are studies of fundamental factors responsible for successes and failures. From these, leads should be developed that will help specify more appropriate cutting methods. We should learn to recognize brush threat areas and how long we can afford to wait to get natural reproduction.

Artificial Regeneration

Uncertainty of natural reproduction, brush threat, and opportunity to control composition of reproduction has led to widespread planting of clear-cut public lands. Further artificial regeneration will be needed if the 577, 000 acres of nonstocked commercial forest land in the province are to be brought back into production.

Although extensively practiced, planting has not achieved uniformly satisfactory results. Ponderosa pine and Port-Orford-cedar have generally survived satisfactorily; Douglas-fir often has not. Sugar pine planting is only in its infancy but looks promising.

Planting, however, is expensive. Direct seeding promises to be more economical of both labor and money. Sugar pine and ponderosa pine have been successfully seedspotted on the clay-loam soils of the South Umpqua River basin, and ponderosa pine has been successfully seedspotted on pumice in the Diamond Lake area. Douglas-fir has not been tested sufficiently.

The potential economies of seeding have not been fully developed and much additional work is needed to attain the goal of artificially reproducing all species by consistently successful and inexpensive methods.

Brushfield Reclamation

The extensive brushfields pose special problems since the land is producing no economic returns. Some soils are known to have deteriorated under the brush cover and their watershed functions are undoubtedly impaired. It is possible that reclamation of brushfields may have more important and far-reaching effects through watershed benefits than the added forest products which may be produced.

We need to learn which brush-covered lands are capable of growing commercial forests and how to prepare them for reforestation, and how to release reproduction that is being suppressed by brush. Fire and chemical, mechanical, and biological methods of control may all prove useful. More information is needed on the ecology of the brush species to assure success.

Cultural Measures

Cultural measures increase in importance as the forests are converted from old growth to young growth and forestry becomes increasingly intensive.

Commercial thinning will be needed to avoid loss of normal mortality, to maintain the resistance of stands against insects and diseases, and to put growth on selected stems. Pruning is necessary if clear wood is to be grown in a reasonable rotation. Pruning may also help protect sugar pine from blister rust. Cultural measures, such as weeding, may control composition in the mixed types and Port-Orford-cedar zone.

Cultural measures have received little research attention in southwestern Oregon.

Protection

The forest fire problem in the province is acute since the climate is hotter and drier for longer periods of time than elsewhere west of the Cascades. Poorer-than-average utilization of the felled trees leaves abundant slash.

Fire has not only been an important factor in the understocked condition of extensive areas but a primary cause of formation and persistence of brushfields. It undoubtedly has contributed to the abundance of heart and root rots.

Sixty-nine percent of the area in Oregon and Washington affected by the epidemic outbreak of the Douglas-fir beetle in 1951-52 was in the province. A survey made about 1946 of a 200,000-acre tract of Douglas-fir in Coos County showed 18 percent of the timber had been recently killed, most of it by the Douglas-fir beetle. The mountain pine beetle and western pine beetle are continuously active in sugar pine and ponderosa pine. An outbreak of western pine beetle in the Rogue River valley was especially severe about 1920. The fir engraver (Scolytus ventralis) recently killed large quantities of white and grand fir. Cone-and-seed-destroying insects are very active in all species of trees. In most years of light and moderate cone crops, so many seeds are destroyed that cones are not worth gathering.

Decay of wood has been the most serious of tree diseases in southwestern Oregon. On two large, intensively surveyed tracts in the South Umpqua area, 25 percent of all Douglas-fir stems were complete culls and 32 percent were partly cull. Such high rates of defect are common. Old-growth incense-cedar is of little value because of pecky rot. A white-pocket rot causes considerable loss of valuable Port-Orford-cedar.

Windthrow is a major cause of losses of Douglas-fir. Although commonly heavier on the west side of the Coast Range, blowdown on the Umpqua National Forest in December 1951 alone was estimated to exceed the allowable annual cut on the forest.

Slash Abatement

The slash problem is more troublesome in southwestern Oregon than elsewhere west of the Cascade Range. Fire danger is greater, providing more reason for burning slash; but environments are hotter, a justification for leaving slash to protect the soil and shade new seedlings.

Utilization

Timber harvesting is still in the pioneering stage with its attendant waste. Defect is higher than average in Douglas-fir. Many species of widely differing wood quality are being cut and few mills are equipped to make the best use of more than one or two. Equipment and methods for handling large and small timber efficiently are not interchangeable. Moreover, the transportation system is inadequate. There is no material market for hardwoods, and plants for chemical utilization of small and "waste" products are virtually lacking. As a result of all these factors, utilization is relatively poor.

Improved utilization consequently is needed to reduce waste, stretch the supply of old-growth timber, increase allowable cuts, diminish slash volumes, and permit more complete and cheaper planting of cutover land.

Regulation of the Cut

A more reliable basis for regulation of the cut should permit a larger flow of products from the public lands. Lack of information needed for predicting future yields accurately is keeping the annual cut on public lands on the conservative side. In some places timber inventories are based on the Forest Survey, which is not sufficiently intensive to be a good basis for management plans. Growth and yield cannot be accurately estimated for mixed stands, nor for several species and types. We do not know what losses to expect from fire, insects, diseases, and wind; how much future mortality may be circumvented or salvaged; nor how much additional wood will be made available by increased utilization.

Recreational Relationships

Southwestern Oregon is plagued with many of the common problems found in most forest-land recreation areas. Some of the more acute ones are lack of adequate facilities, poorly distributed use of the resources, and human relations. However, in this analysis we are primarily concerned with the land-management aspects of recreation and interrelations with other uses.

The problems of land management in relation to fish life are in reasonably clear focus. Land management affects fish life primarily through its influence on streamflow fluctuation, the amount of silt and debris in the streams, and stream shade needed to maintain suitable water temperatures. Consequently, watershed management research aimed at reducing streamflow fluctuations and the amount of silt and debris in streams will also benefit fish life.

In most other aspects, knowledge of the interrelation between recreation and land management is inadequate for even defining critical problems. For example, it would seem that the rapidly increasing area of clearcuts would have marked effects on deer and elk populations. There is no distinct evidence to indicate whether or not populations are increasing in and around clearcuts. Signs of overgrazing have been observed but it may be rare or widespread. Browsing of conifer reproduction by deer or elk is quite severe in some places, but it is difficult to even speculate how widespread this problem may become. More precise knowledge is needed to define critical questions on even this one facet of the whole field.

Before recreational research needs can be realistically delineated, a comprehensive survey is needed to determine (1) the kinds, amounts, and location of scenic attractions, wildlife, etc.; (2) probable future demands on recreational resources and if their conditions are changing for better or worse; and (3) the interrelations or conflicts of recreational use with other uses.

Problems of Certain Forest Types

Species to Favor in the Mixed-Conifer Zone

The species found in the mixed stands differ in productivity and value. Clear cutting followed by seeding or planting provides an opportunity to control composition of the next stand. Each of the major species may prove best for specific environments, but the best species silviculturally may not be the best species for optimum economic return. Objectives need to be developed from both standpoints and the silvical dangers involved in attempting to attain economic values should be ascertained in order that they may be circumvented. Pure stands, for example, should yield maximum economic returns on many environments but they are subject to many ills. Consequently, careful study will be required to learn to what degree mixtures can be altered without encountering ecological difficulties.

The practical need is a means of recognizing the species or mixture best adapted to each environment. It has been observed that sugar pine commonly outgrows all other species on sites with an index of 142 or less and also has the greatest economic value. Blister rust control, however, may make it costly to grow. Ponderosa pine makes equal height growth on many environments but fails to grow as fast in diameter. Douglas-fir keeps up in height on some environments but fails on others, and in the mixed-conifer zone has not been observed to produce as much volume or quality as the pines. Western white pine is being planted on appropriate sites. Even incense-cedar promises to make excellent growth and is increasing in value. Where should the various species be favored?

Soil-Building and Watershed Values of Species

Watershed values are gaining in importance so rapidly that comparative watershed and soil-building values of the different species must be considered in forest management.

Much of the mixed-conifer zone is underlain by soils which have a pronounced "B" horizon of dense clay. Large areas of the Siskiyou uplands have apparently suffered sheet erosion and soil degradation from repeated burning. Streams fed by these soils are poorly regulated, indicating low percolation or water storage capacity, or both.

The tree species of the mixed-conifer types vary in rooting habits and depth of rooting, in volume of litter produced, and possibly in chemical composition of litter. They may also vary in water consumption. All these things can influence their suitability for soil protection, soil improvement, and watershed cover.

Sugar Pine Management

Because of its superior growth and quality on many environments, sugar pine deserves special study. On the South Umpqua Experimental Forest, for example, volumes of individual sugar pines are two to four times those of associated Douglas-firs. In an 80-year-old mixed stand in the Rogue River valley, 34 percent of the sugar pines were found to be dominants; whereas only 9, 11, and 1 percent, respectively, of the ponderosa pines, Douglas-firs, and incense-cedars were dominants. Such differences are common over a wide but unknown part of the mixed-conifer zone.

Sugar pine is also outstanding in quality and freedom from defect (table 18). Altogether, it is more valuable than any associate.

White pine blister rust, which entered the province about 1929 and is now found wherever there are 5-needled pines, must be controlled in order to grow sugar pine. Where relatively few *Ribes* bushes are found, it may prove more profitable to grow sugar pine

Table 18.--Comparison of defect in sugar pine and Douglas-fir in the South Umpqua River basin[1]

Proportion of sound wood in tree (percent)	D.b.h. class (inches) and species							
	4 to 12		12 to 24		24 to 50		50 plus	
	DF	SP	DF	SP	DF	SP	DF	SP
	Percent[2]							
75-100	97	100	87	97	43	87	5	68
35-74	0	0	3	1.5	32	10	52	28
0-34	3	0	10	1.5	25	3	43	4

[1] Hammond, Herbert L., Jr. Report on the work of the South Umpqua combined disease survey and timber cruising party. 1942. (Unpublished report. Copy on file, Siskiyou-Cascade Research Center, Roseburg, Oreg.)

[2] Of total number of trees in species and d.b.h. class.

than other species. The South Umpqua drainage offers special promise because blister rust control costs are low, growth and quality of sugar pine are outstanding, and Douglas-fir is mediocre.

The first requirement is to learn in which environments sugar pine will pay the greatest returns on an investment in blister rust control. Then all aspects of its management must be studied.

Growth and Yield

Standard yield tables for Douglas-fir and ponderosa pine can be applied to unmanaged stands in southwestern Oregon. Means are required, however, for predicting growth and yield for Port-Orford-cedar, sugar pine, Shasta red fir, and stands of mixed species and mixed ages.

Port-Orford-Cedar Management

Port-Orford-cedar--a wood with many desirable qualities but of limited supply--is now of minor economic importance. In the past, Port-Orford-cedar was one of the most valuable timber trees in southwestern Oregon. Special characteristics of the wood uniquely fitted it for several special uses--battery separators in particular. Other materials have replaced Port-Orford-cedar to a large extent for all of these special uses except for arrows. Even arrows are now extensively made of Fiberglas.

Port-Orford-cedar is now just another minor species of somewhat lesser importance than incense-cedar or western redcedar in southwestern Oregon. Of the minor species--which make up only 9 percent of the total sawtimber volume in southwestern Oregon--western hemlock, incense-cedar, and western redcedar each have appreciably more volume than does Port-Orford-cedar.

In light of the present economic status of Port-Orford-cedar, research on its management has, and in the foreseeable future will continue to have, a low priority.

ESTABLISHING PRIORITIES ON PROBLEMS

The group of problems associated with forest-land use in southwestern Oregon has been narrowed down to those having the highest priority based on (1) consideration of forest or cover types of maximum value, (2) the kinds of stands most urgently in need of work, and (3) specific problems that should receive primary attention.

The following general guides have been used in determining the priority of problems which should be investigated:

1. Are they provincewide in scope?

2. Are they associated with keeping forest land in full production, assuming that lands from which timber is now being harvested should not be permitted to become unproductive?

3. Are they associated with minimizing damage to soil and water from land-management practices?

4. Do they promise to yield the greatest results with the limited funds and personnel available?

5. Do they involve cooperation with other agencies?

6. How much is known about them?

7. Can a balance be maintained between long- and short-term studies?

8. Is similar work being done elsewhere?

9. Are special opportunities present to facilitate research on a particular problem?

The timber industries now provide, and promise to continue providing, major support for the economy of southwestern Oregon. Forest exploitation is progressing rapidly, and regeneration is uncertain. There is a distinct brush threat on many lands. Soil and water values are high and damageable. Timber-harvesting activities at best are detrimental in some instances to soil and water. Everything possible should be done to minimize such damage, especially during the exploitation period, when the major roads are being built and heavy equipment used to move the large old-growth timber.

Although forest economic problems are important, they are not as directly concerned as forest management problems in keeping the land and watersheds undamaged and fully productive. Utilization is below average, and the timber industries are preponderantly concerned with primary manufacture, so there is an excellent opportunity for products research. However, there are well-equipped and ably staffed forest products laboratories at Corvallis, Oreg., (State) and Madison, Wis. (Federal), and the function of a local research organization should be to recognize products problems and refer them to the appropriate agency.

The livestock industry is important to the local economy but is mostly concentrated on the farms and ranches below the commercial forest zone. An exception is the Rogue River National Forest, on which there is a substantial amount of forest grazing. Livestock and forest management come into sharp conflict in Coos County, but the problem relates to the economics of land use: Can and should some of the high-site forest land in the Coquille and Coos River areas be converted to grazing use?

Within the framework of the nine general guides listed above, the fields requiring study are arranged in the following order of priority: forest management (including protection), forest influences and watershed management, forest economics, forest products, and range management.

On the basis of their commercial importance and extent, status of exploitation, importance as watersheds, and because of the dearth of information needed for management, forest types are assigned the following priorities: first, mixed-conifer; second, true fir—mountain hemlock; third, Douglas-fir.

Problems of old-growth stands should take priority over those of young growth, since the area and utilization of young growth are limited.

On the basis of the foregoing considerations, the six problems listed in table 19 are considered to be most urgently in need of solution in the designated types. The order of listing is approximate, but all must be regarded as having high priority.

It will be noted that the Douglas-fir type has not been given top priority in many cases because it has long been studied elsewhere. However, Douglas-fir is the major constituent of the mixed-conifer types and the species will receive commensurate consideration in many studies in the mixed types.

Table 19.--Priority of major forest types for important forest problems in southwestern Oregon

Problem	Forest type		
	Mixed-conifer	True fir--mountain hemlock	Douglas-fir
1. Methods of cutting and regeneration. Devise measures to assure that cutover lands will restock promptly to maintain a maximum and constant flow of products under sustained yield.	1	2	--
2. Preservation of soil and water values. Develop methods of logging and road construction and special measures needed to assure minimum damage to the high soil and watershed values. Make a forest soil survey to provide a basic tool for land management.	(1/)	(1/)	(1/)
3. Brushfield reclamation. Develop methods for economically converting suitable brush-covered lands to productive forests and for improving their productivity and hydrologic functions.	1	3	2
4. Forest protection. Ascertain and investigate damage caused by insects, diseases, fire, and other destructive agencies. Report to and cooperate with research and action groups concerned, and investigate as required to minimize timber losses and degrading due to forest enemies.	1	3	2

See footnote at end of table.

Table 19.--Priority of major forest types for important forest problems in southwestern Oregon--Continued

Problem	Forest type: Mixed-conifer	Forest type: True fir-mountain hemlock	Forest type: Douglas-fir
5. Species to favor in management. Conduct studies in fundamental ecology, growth and yield, and economics; and recommend studies of products, as needed, to provide land-managing agencies with sound guides for the most appropriate species to favor in specific environments.	1	2	--
6. Growth and yield studies. Develop a sound basis for regulation of the cut, guides for intermediate cuttings, forecasts of future supplies of specific products and grades, and guides for selection of appropriate species or mixtures to favor.	1	2	--

1/ Equally high priority for all major types.

LITERATURE CITED

(1) Barton, Manes
1951. A progress report on suspended sediment sampling in several western Oregon and western Washington streams. U.S. Forest Serv. Pac. NW. Forest and Range Expt. Sta. Res. Note 75, 19 pp., illus. (Processed.)

(2) Diller, J. S., and Kay, G. F.
1924. Geologic atlas of the United States: Riddle Folio, Oregon. U.S. Geol. Survey Riddle Folio 218, 12 pp., illus.

(3) Moravets, F. L.
1951. Forest statistics for southwest Oregon unit. U.S. Forest Serv. Pac. NW. Forest and Range Expt. Sta. Forest Survey Rpt. 104, 36 pp., illus. (Processed.)

(4) Oregon Secretary of State
1958. Oregon blue book 1959-1960. 448 pp., illus.

(5) Oregon State Game Commission
1956. Statement presented at State water resources board hearing, Roseburg, October 15 and 16, 1956. 21 pp. (Processed.)

(6) Oregon State Game Commission, Fishery Division
1957. 1956 annual report. 283 pp., illus. (Processed.)

(7) Oregon State Game Commission, Game Division
(n.d.) 1958 annual report. 183 pp., illus. (Processed.)

(8) Oregon State Water Resources Board
1959. Rogue River basin summary. 19 pp., illus. (Processed.)

(9) Shepard, H. B.
1937. Forest fire insurance in the Pacific Coast States. U.S. Dept. Agr. Tech. Bul. 551, 168 pp., illus.

(10) U.S. Bureau of Reclamation
1956. Umpqua River basin Oregon, special report. (n.p.n.), illus. (Processed.)

(11) U.S. Geological Survey
1959. Surface water supply of the United States 1956. Part 14. Pacific slope basins in Oregon and lower Columbia River basin. Water-Supply Paper 1448, 305 pp., illus.