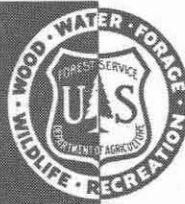


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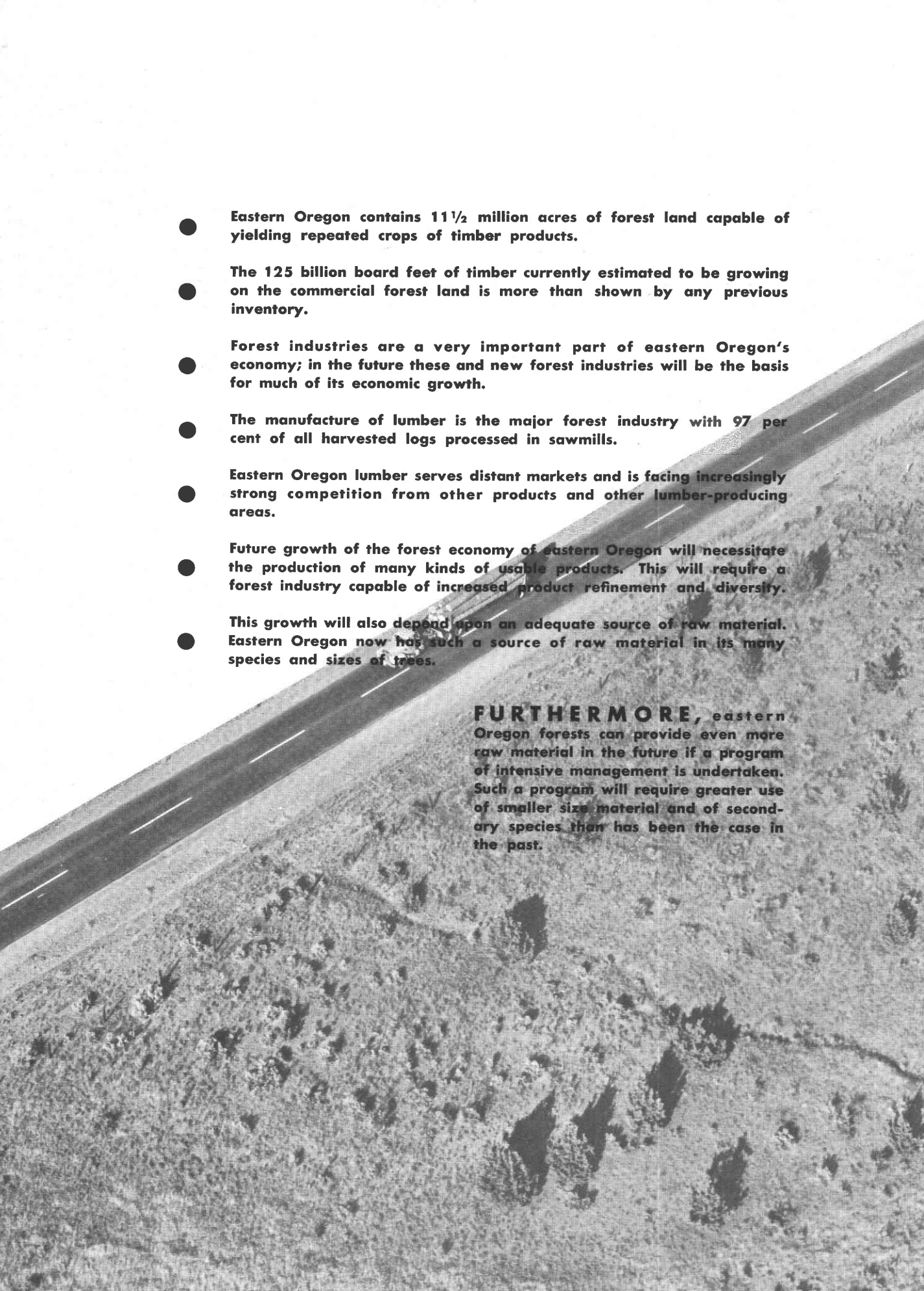
• • • *toward complete use of
Eastern Oregon's forest resources*

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



U. S. FOREST SERVICE
RESOURCE BULLETIN PNW-3

MAY 1963

- 
- Eastern Oregon contains 11½ million acres of forest land capable of yielding repeated crops of timber products.
 - The 125 billion board feet of timber currently estimated to be growing on the commercial forest land is more than shown by any previous inventory.
 - Forest industries are a very important part of eastern Oregon's economy; in the future these and new forest industries will be the basis for much of its economic growth.
 - The manufacture of lumber is the major forest industry with 97 per cent of all harvested logs processed in sawmills.
 - Eastern Oregon lumber serves distant markets and is facing increasingly strong competition from other products and other lumber-producing areas.
 - Future growth of the forest economy of eastern Oregon will necessitate the production of many kinds of usable products. This will require a forest industry capable of increased product refinement and diversity.
 - This growth will also depend upon an adequate source of raw material. Eastern Oregon now has such a source of raw material in its many species and sizes of trees.

FURTHERMORE, eastern Oregon forests can provide even more raw material in the future if a program of intensive management is undertaken. Such a program will require greater use of smaller size material and of secondary species than has been the case in the past.

... Toward complete use of
Eastern Oregon's forest resources

by DONALD R. GEDNEY

PACIFIC NORTHWEST FOREST
& RANGE EXPERIMENT STATION

PHILIP A. BRIEGLEB, Director
Portland, Oregon

**U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE**

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PREFACE

Forestry shares with agriculture a dominant role in the economy of eastern Oregon. Eastern Oregon should look to both these resources for future growth and development. This report intends to take just such a look at one of these — the forest resource.

In 1942 the Pacific Northwest Forest and Range Experiment Station published "Forest Resources of the Ponderosa Pine Region"¹ in recognition of the need for a comprehensive report to assist in understanding the problems and opportunities of eastern Oregon. Now, 21 years later, this new report of the forests and forest industries of eastern Oregon will again review the past and explore the opportunities for the future.

During the decade of the 1950's, a re-inventory of the forests of eastern Oregon was completed. This includes all the area east of the crest of the Cascades. The new estimate of the timber resources of the area adjusted to January 1, 1963, plus several supplementary studies of the forest industries, provides the foundation for this report. These new resource data in themselves are a valuable contribution to our forestry knowledge of eastern Oregon and are included in the appendix.

The new inventory has given a new perspective and offers encouragement for a bright future. The standing-timber volume now present in eastern Oregon is estimated

to be 125 billion board feet;² this compares to an original estimate made in 1936 of 96 billion board feet. The difference between the inventory estimates is a result of the better and more complete new inventory. The increase might be considered just a "paper" increase because certain trees were counted in this inventory that were not considered as merchantable in the previous inventory; and, in many instances, more usable volume was credited to each tree. However, it also comes in the face of cutting which has generally exceeded timber growth over the same period of years.

This more accurate appraisal of the volume in all species that make up the forests provides eastern Oregon with the knowledge that a greater timber bank account is available as a basis for development. The importance of the increased volume is illustrated by the fact that the new inventories and the new growth information available from these inventories have already permitted an increase of about 50 percent in the allowable cut on National Forests in eastern Oregon.

This report, however, is based on something more than the new information mentioned above. It is based also on the premise that the future growth and development of eastern Oregon will depend to a very great extent upon the full utilization of the forest resource obtained through product diversification and refinement by the forest industry.

¹ Forest Resources of the Ponderosa Pine Region, Forest Service, U. S. Dept. Agr. Misc. Pub. 490, 99 pp., illus. 1942.

² International 1/4-inch rule. All timber-volume estimates in this report are expressed in this rule. Equivalent Scribner volumes can be approximated by dividing the International 1/4-inch volume by 1.091.

Experience in other areas shows that steady growth of a strong forest economy is directly associated with the development of a diversified industry. A single-product economy is limited in its ability to use the entire forest resource and is generally more subject to the whims of the market. Diversification provides the means of using all the potential harvest from the forest and of serving the needs of people on a much broader market.

The ultimate level this development can reach will be largely governed by the ability of the forests of eastern Oregon to produce timber products. In order to realize a high-

level sustained output, an active management program geared toward this objective will be necessary. A program of intensive forest management will result in a greatly increased output of forest products, providing a firm basis for the economic growth of eastern Oregon.

This report is not an operating plan. Economic justification is not made for all the public and private investments required. Its purpose is to point up the opportunity for greater yields and the probable direction of effort as the forest lands of eastern Oregon are given more intensive management.

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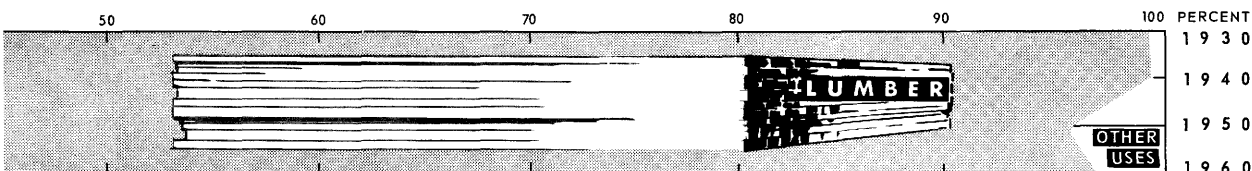
FORESTS and the Economy of Eastern Oregon

Eastern Oregon's economy is definitely timber oriented. Few other segments of its economy have contributed as much to its development or promise more for future growth. The greatest opportunity for expansion through use of its forest resources lies in the direction of greater product diversification and product refinement.

Eastern Oregon's timber economy has developed around the manufacture of a single product — lumber. This is not a desirable situation because it puts the economy at the mercy of a single market. Little leeway exists for weathering depressed periods by taking advantage of any increase in demand for other products made

of wood. Furthermore, if the utilization of the trees is limited to lumber, it is impossible to realize the full potential of the forest.

Softwood sawtimber supplies are increasing in areas nearer to the Nation's principal lumber market. These pose a substantial threat to the demand for eastern Oregon's lumber. Something other than lumber must be marketed if eastern Oregon's forest economy is going to expand. The development of a diversified forest industry capable of making fuller use of the potential of the forest resource can lead the way to such expansion.



THE EASTERN OREGON ECONOMY

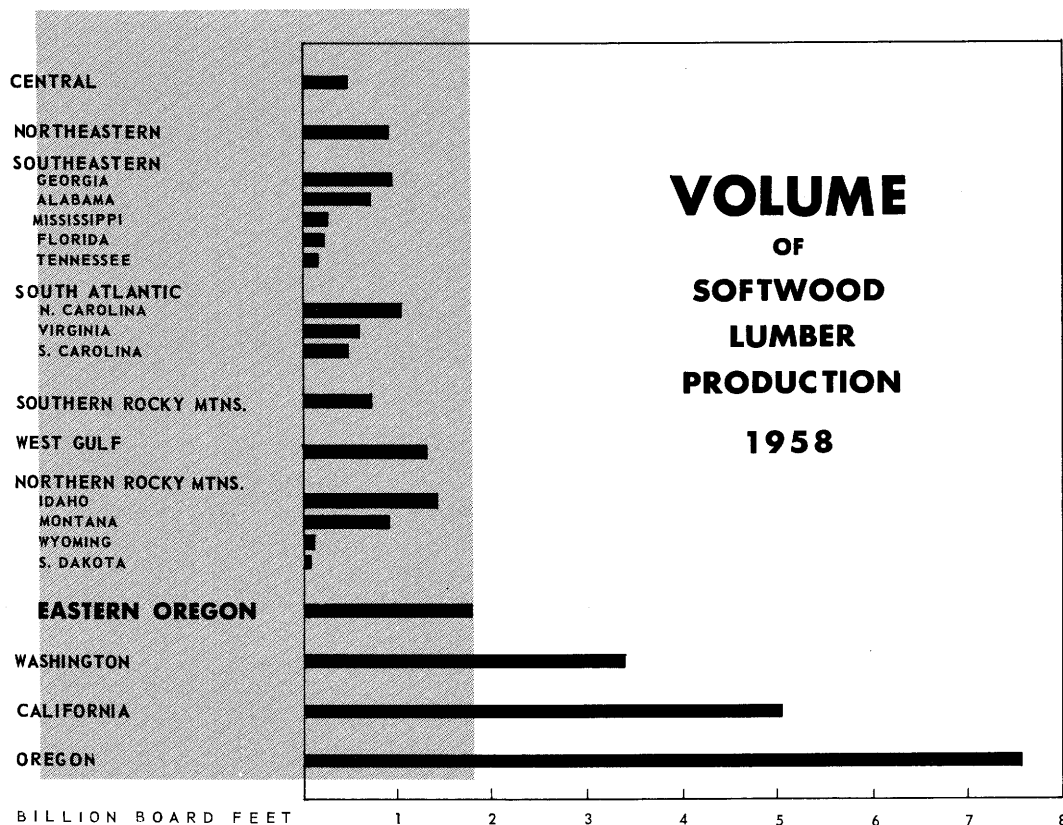
The forest resources of eastern Oregon are not only important locally but also nationally. Eastern Oregon contains 2.4 percent of all the Nation's commercial forest land; it has 4.7 percent of all softwood sawtimber volume; it currently produces 6.0 percent of the country's softwood lumber. This portion of Oregon has more softwood volume than 46 of the other 49 States in the country. The area has a potential of even greater contributions to the Nation's timber wealth than are currently evident (table 1). While

this report is concerned with growth and development in the forest industries, let us first examine what can be expected of other parts of the present eastern Oregon economy.

Table 1. — The forest resources of eastern Oregon

Ownership class	Area of commercial forest land	Volume of live sawtimber ¹
	Acres	Board feet
National Forest	7,459,800	93,663,000,000
Other public	654,400	7,472,000,000
Forest industry	1,476,600	13,860,000,000
Farmer and miscellaneous private	1,940,600	10,477,000,000
Total	11,531,400	125,472,000,000

¹ International 1/4-inch rule.



AGRICULTURAL EMPLOYMENT STIMULATED BY PRODUCT REFINEMENT. — A wide variety of agricultural crops is produced in eastern Oregon. These include beef cattle, sheep, sugar beets, alfalfa, fruit, melons, wheat, potatoes, and peas. Some of the major products currently undergo very little local processing. Cattle are largely shipped from eastern Oregon to packing houses or feeder lots for fattening; wheat goes from eastern Oregon to be converted to flour or reshipped to supply increasing world markets. But in recent years there has been an increasing emphasis on processing agricultural crops locally. Now a number of crops is made ready for table use — the pea crop is canned or frozen, potatoes are processed into various shapes and forms, and sugar is manufactured from sugar beets.

The agricultural labor force exclusive of the food processing plants amounted to

22,451 people in 1950 but decreased to 16,136 in 1960. About 2,000 more were employed in the food processing industries.

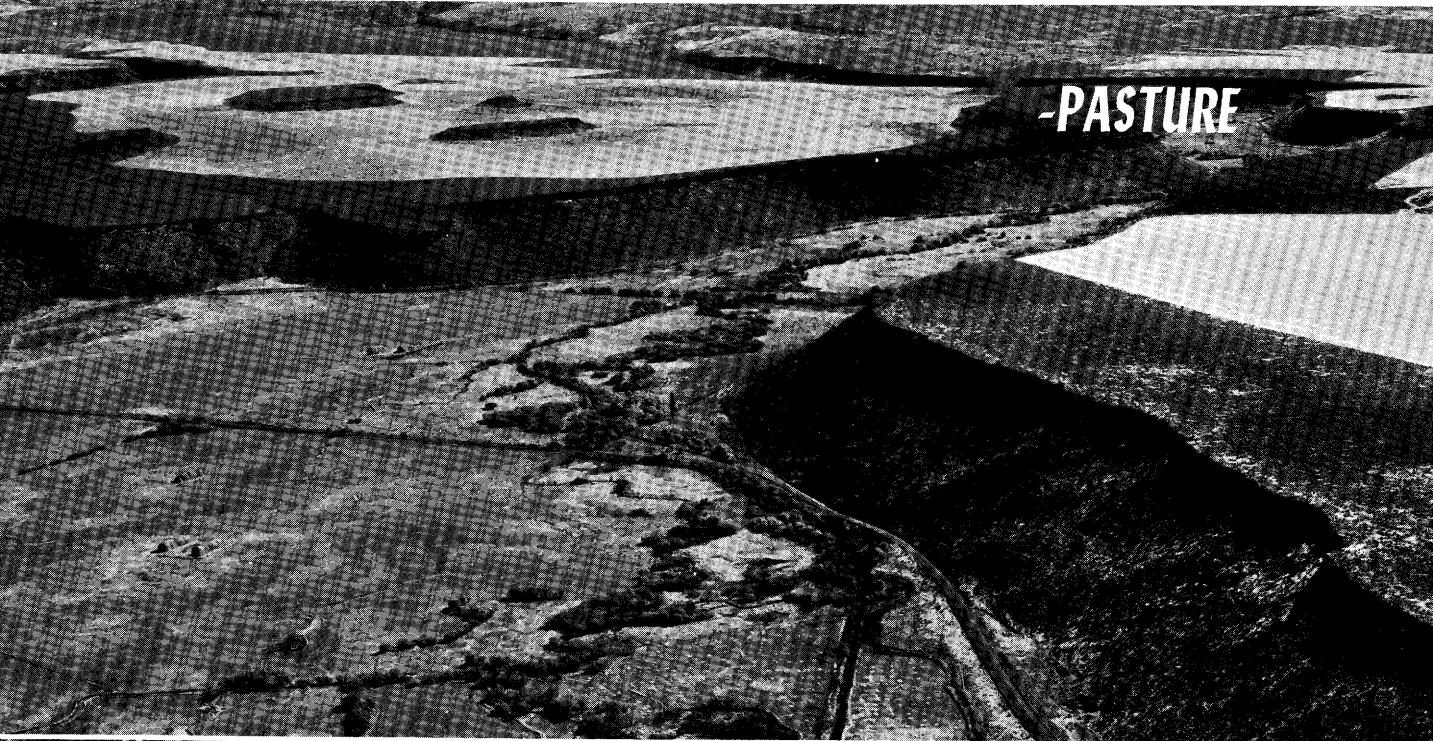
Agriculture is an important part of the overall eastern Oregon economy.¹ Growth of this important segment of the economy may occur in several ways. Some expansion of the agricultural resource base may occur by adding to the total agricultural cropland supply through irrigation or increasing the productivity of land already in agricultural use. Furthermore, food processing industries may expand in eastern Oregon as the American housewife depends more upon processed or partially prepared foods.

¹ Freeman, Otis W., and Martin, Howard H. *The Pacific Northwest*. Ed. 2, 540 pp., illus. New York: John Wiley & Sons, Inc. 1954.

Oregon Conservation Needs Committee. *Oregon soil and water conservation needs inventory*. 80 pp., illus. 1962.



27 million acres of
RANGE



-PASTURE



CROPLAND

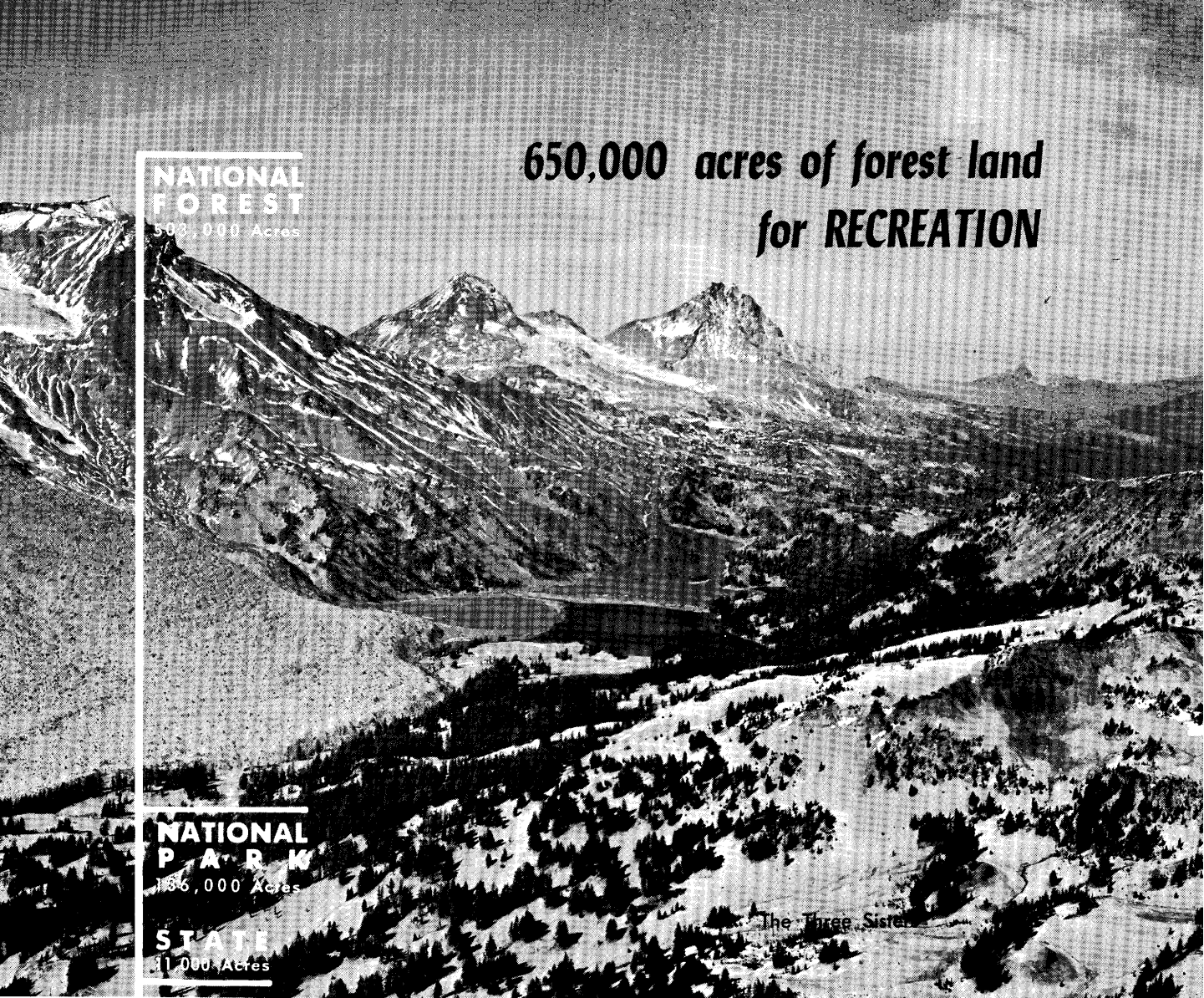
An aerial black and white photograph showing a large reservoir (Ochoa Reservoir) in a mountainous area. A winding road or path runs along the left side of the reservoir. The surrounding landscape is rugged with hills and valleys. The sky is filled with clouds.

Increasing Agricultural Resources

by irrigation

Ochoa Reservoir

by control of sagebrush



650,000 acres of forest land for RECREATION

**NATIONAL
FOREST**
503,000 Acres

**NATIONAL
PARK**
136,000 Acres

STATE
11,000 Acres

The Three Sisters

60-73

INCREASING USE WILL BE MADE OF RECREATIONAL ASSETS. — Outdoor recreation of all types has a tremendous potential in eastern Oregon — a potential that even now is beginning to be realized. Its benefits to the economy are being increasingly recognized as significant to the present and future regional development.

As one evidence of recreation's value, 650,000 acres of forest land have been set aside by public agencies for recreational use. This includes 503,000 acres on National Forests, 136,000 acres in Crater Lake National Park, and 11,000 acres in State

or municipal parks.

Besides these areas, nearly all the remainder of eastern Oregon's wildlands are open to recreational use by campers, hunters, and fishermen in addition to serving other uses such as watershed, timber production, and grazing.

Obviously, what is said about growth of the forest economy in eastern Oregon is quite important to recreation. In the future both public and private forest owners will consider carefully the probable effects upon recreation of any plans for use of the timber resource.



WATER



WILDLIFE



RECREATION

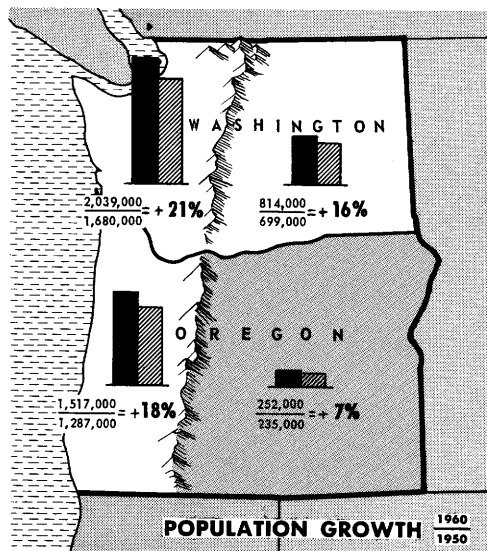


RANGE



LUMBER

Sisters



GROWTH DEPENDS ON INDUSTRIAL EXPANSION. — If economic growth in eastern Oregon follows the pattern set by the rest of the Nation, it will come largely from industrial expansion. This has been the experience throughout the Nation and is the reason for the current emphasis on industrial development by so many communities. Generally, industrial growth depends on either concentrations of natural resources for raw material or of people for labor. Here in the West, industrial growth in the last decade has been substantial with most of it being linked directly to rapidly growing centers of

population. However, there may be little opportunity for eastern Oregon to share in this type of industrial development.

Between 1950 and 1960 the Nation's population increased by 18 percent. Western Oregon and eastern and western Washington contributed much to this growth, increasing in population between 16 and 21 percent. But eastern Oregon increased only 7 percent. This slow rate of growth was even slower than any of the other 9 Western States which had increases ranging from 13 percent to almost 80 percent. Even with a more favorable rate of population growth, the total number of people living in eastern Oregon will not soon become very large. Each of the cities of Dayton, Ohio, Portland, Oreg., and Long Beach, Calif., has more people than eastern Oregon with 252,000 residents. Despite future low or high rates of population growth, the population of eastern Oregon is not likely to support or attract new types of industries dependent upon local markets or upon local supplies of labor.

Eastern Oregon, like many other Western States, has lots of elbow room. The vast empty spaces, exemplified by the photo below, may be put to use by industries that look for isolation as a desirable feature of plant location. Another example of this is the Boardman Bombing Range currently being developed for space-age research.



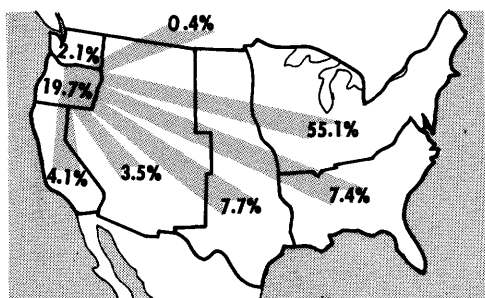
Large areas of arid land

LUMBER IN THE ECONOMY

Forest industries provide two out of every three jobs in manufacturing industries² in eastern Oregon. These forest industries include logging, lumber, plywood, and fiberboard as well as remanufacturing. In 1961, of the 15,900 persons working in all types of manufacturing plants, 10,800 were directly employed by forest industries.

EASTERN OREGON FACES STIFF COMPETITION FOR LUMBER MARKETS. — Eastern United States softwood timber was greatly depleted during the early settlement of our Nation. These forests are gradually being restored through planting and improved forest practices. According to the report "Timber Resources for America's Future" (pages 56-57), "The most significant of all growth-cut relationships is that growth of eastern softwood sawtimber exceeded cut in 1952 by 20 percent The southern yellow pines, which, of course, dominate the eastern picture, show growth to be 22 percent in excess of cut of sawtimber".³ The impact of these increasing volumes of softwood timber may be expected to affect western lumber producing areas primarily because the

LUMBER PRODUCED IN EASTERN OREGON GOES COUNTRYWIDE



² The Technical Committee on Industrial Classification. Standard industrial classification manual. Exec. Office of Pres. U. S. Bur. Budget Office Statis. Standards, 433 pp. 1957.

³ U. S. Forest Service. Timber Resources for America's Future. U. S. Dept. Agr. Forest Resource Rpt. 14, 713 pp., illus. 1958.

eastern markets now served by the West will be more easily served by eastern softwood producers.

No one area can be assured of continuing markets because of past historical experience. This can be illustrated by comparing the Rocky Mountain area with eastern Oregon. In the Rocky Mountain area lumber production has been increasing at a rate more rapid than in eastern Oregon. Between 1947 and 1960 lumber production in the Rocky Mountain area increased 71 percent while at the same time production in eastern Oregon increased only 18 percent.⁴

	Thousands of board feet		Increase (Percent)
	1947	1960	
Rocky Mountain area	2,117,910	3,626,175	71
Eastern Oregon	1,400,787	1,650,380	18

The increased volume of lumber being produced in the Rocky Mountain area has apparently had serious effects in eastern Oregon. Located nearer to eastern, southern, and Great Plains markets, it has been successful in capturing markets formerly held by eastern Oregon. This is shown by the relative shifts in the lumber markets of eastern Oregon and the Rocky Mountain area over the 11 years between 1947 and 1958.

Between 1947 and 1958, eastern Oregon increased its ratio of shipments to the South four times; but at the same time, the Rocky Mountain region increased its ratio 27 times.⁵ Eastern Oregon shipped a smaller proportion to the North in 1958 compared to 1947, and the Rocky Mountain region increased its proportion to the North by 50 percent. The Rocky Mountain region is a growing factor in supplying the Nation's softwood lumber needs.

⁴ Western Pine Association. Production by states and species 1949 to 1960. Cir. 483, 4 pp. 1961.

Many of the other lumber production statistics used in the tables and figures in this report are based on data compiled by the Western Pine Association. We here express our gratitude to the Association for their assistance.

⁵ From Western Pine Association data on shipments by States.

In addition to the competition facing eastern Oregon from within the Nation, an increasing amount of lumber is coming into this country from Canada. This imported lumber is replacing Western States lumber in the important Atlantic coast markets. In 1951, of all waterborne shipments of lumber from the west coast (British Columbia, Washington, Oregon, and California) to the Atlantic coast, 93 percent came from the three Western States. But by 1961 this proportion had dropped to 43 percent. Or in other words, British Columbia has been increasing its share of the Atlantic coast markets from less than a tenth in 1951 to more than half in 1961. During the same period, production of lumber from mills in interior British Columbia almost doubled, with a substantial part of this increase moving by rail into the Central United States area.

EASTERN OREGON FALLING BEHIND IN LUMBER MARKET. — Most forecasts of lumber's future indicate that demand will increase. But the immediate question facing eastern Oregon is whether it will share in this increased demand for softwood lumber or be replaced by other areas. This depends on many factors — including the future level of forest management, population shifts, total demand, costs, prices, and transportation problems.

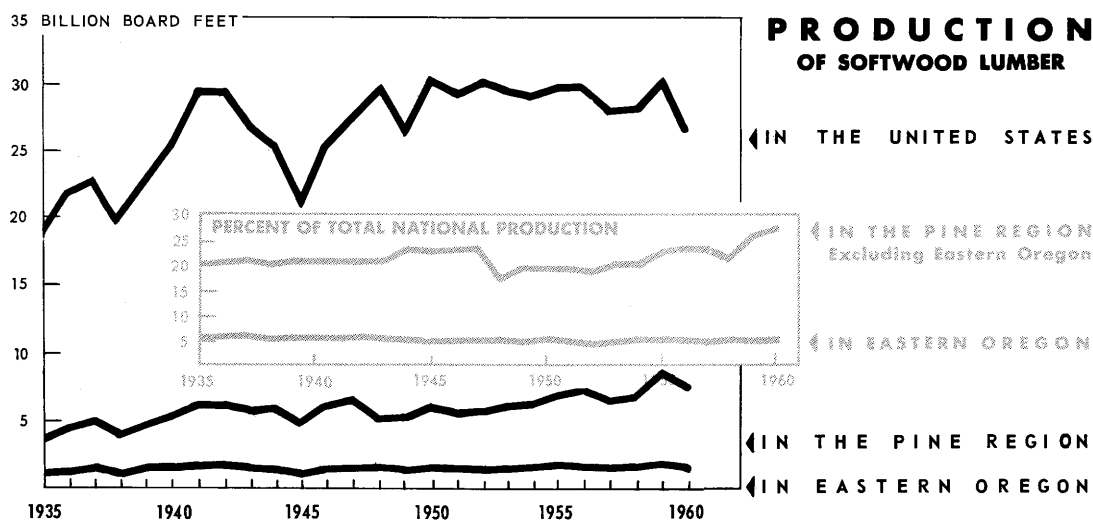
Some important relationships which provide clues can be determined by examining the past and present patterns of production in Oregon in relation to other areas.

The chart shows softwood lumber consumption in the United States since 1935 and softwood lumber production in the western pine region⁶ (except for eastern Oregon), and in eastern Oregon.

The total United States consumption of softwood lumber since 1935, although subject to fluctuations, showed a gradual increase to 1950. Then production leveled off and remained generally stable. In both eastern Oregon and the remainder of the western pine region, production increased in recent years. However, the gain has been more consistent and at a greater rate in the western pine region exclusive of eastern Oregon than in eastern Oregon.

The production from eastern Oregon and the rest of the western pine region is also shown as a percentage of total United States lumber production. These trends indicate that eastern Oregon has not kept its place in the Nation's softwood lumber market. Production in eastern Oregon amounted to

⁶ This is an area defined by the Western Pine Association and includes Arizona, California (except for the 11 coastal redwood counties), Nevada, Colorado, Idaho, Montana, New Mexico, eastern Oregon, South Dakota, Utah, eastern Washington, and Wyoming.



6.5 percent of United States softwood lumber production in 1939. This was the peak year. Since 1939, the percentage has been less with the general shape of the curve downward. But at the same time, the rest of the western pine region has been showing an almost constant increase.

Apparently there is an increasing demand for western pine region lumber. While the rest of the pine region is making the most of this opportunity, eastern Oregon is barely holding its own. This may be due to many reasons — but for our purposes, the single fact that eastern Oregon has not been able to capture its share of the expanding market is important.

One might wonder whether eastern Oregon is making use of all the softwood species that other parts of the pine region use. From 1947 to 1960 the cut from species other than ponderosa pine shifted from 15 percent of the total eastern Oregon output to 37 percent, a change of 22 percent. During this same period, the proportion of other species in the output of the rest of the pine region went from 37 percent to 61 percent. This was a change of 24 percent. Apparently both eastern Oregon and the rest of the pine region are increasing their use of other species at about the same rate.

Table 2. — Relative change in species used for lumber between 1947 and 1960 (in percent)

Species	Eastern Oregon			The rest of the western pine region		
	1947	1960	Difference	1947	1960	Difference
Ponderosa, sugar, and white pine	85	63	-22	63	39	-24
Douglas-fir and larch	11	25	+14	21	32	+11
True firs	4	11	+7	10	18	+8
Other species	--	1	+1	6	11	+5

GROWTH THROUGH DIVERSIFICATION AND PRODUCT REFINEMENT

In the previous section we have questioned whether increased lumber production could

be counted on for economic growth. It appears that if past trends continue, growth through increased lumber production in eastern Oregon is by no means certain.

If the forest economy in eastern Oregon is to grow, it will have to be based on the potential of the region for producing many kinds of usable wood. The forest industry has grown around a single product — lumber. Although substantial benefits have been realized, serious handicaps have arisen.

The demand for lumber, particularly boards, has been the controlling factor in the economic health of the area. Periods of prosperity and depression depend upon whether lumber does or doesn't sell. Further discouragement comes from a sharply dropping nationwide per capita consumption of lumber even though total production is steady or increasing. Substitutes of other construction materials and the use of wood in forms other than lumber have cut sharply into the domain once ruled by lumber, particularly boards.

With all of the forest industry "eggs in one basket," eastern Oregon can expect continued economic hills and hollows, depending on the demand for lumber. Much greater wood product diversification would lead to less severe fluctuations in the overall economy and the means to move ahead to higher levels.

Products other than lumber provide the opportunity for using wood not now used by the lumber industry. As long as trees are round and lumber is rectangular, unused residue results. As long as lumber is best produced from larger trees, the total harvest is limited. The many millions of trees available for cutting, but too small for saw logs, are yet an untapped potential of wood fiber.

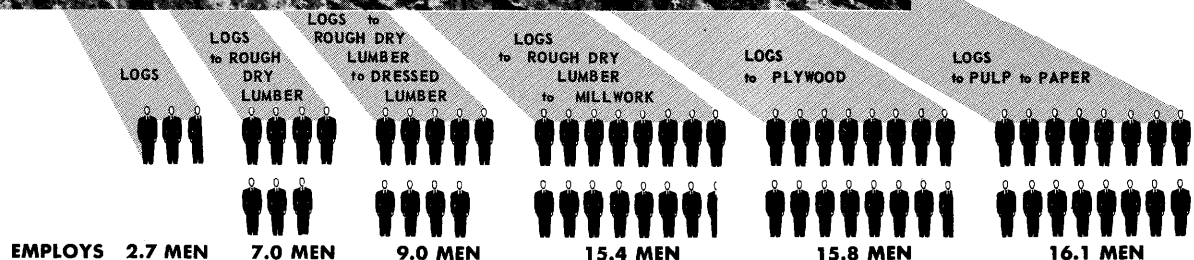
Achieving diversification is not simple. To many it means breaking with tradition and venturing capital into new lines of endeavor. This requires solving not only the technical aspects of product development but also problems of marketing new products and of financing new investments.



CONVERSION

IN ONE YEAR OF ONE MILLION
BOARD FEET OF STANDING TIMBER

TO



GAINS IN EMPLOYMENT ARE POSSIBLE FROM DIVERSIFICATION. — Only limited benefits result from limited use of logs; obviously if logs are shipped outside a region, the local economy benefits little. But if the logs were sawn into rough lumber, the rough lumber dried and planed, and the lumber made into fabricated products, then local and regional employment and income would be increased. In addition, diversification which would allow the use of the peeler grade logs for plywood veneer, then plywood, and residue material for pulp, then paper, would further strengthen the forest economy.

The benefits of product refinement can be measured by gains in employment. When logs are the only product, a million board feet of timber provides employment for about three men for 1 year. But if logs are converted to rough-dry lumber and this to millwork, 15 men could secure employment for 1 year from the same volume of timber. Similarly, the production of dressed lumber, plywood, or paper produces employment in

varying amounts but always greater than a forest economy that produces only logs or rough-dry lumber as end products.

EASTERN OREGON EMPLOYMENT IN FOREST INDUSTRIES CAN BE INCREASED. — In eastern Oregon the lack of diversification of forest industries is indicated by the fact that 90 percent of all forest industry workers is engaged in either logging or sawmilling. This results in employment for only eight or nine men per year for every million board feet of timber harvested.

Western Washington has one of the most industrially advanced forest economies in the West with a complex of differing industries including pulp and paper, veneer and plywood, and fiberboard, as well as lumber. The extent of this development is illustrated by the fact that only 35 percent of all forest industry workers is employed in logging or sawmilling. This plus many other ways to utilize the forest resource results in employment for 20 men for every million board feet of log harvest.

Western Oregon is becoming increasingly diversified. Here, 60 percent of forest industry workers is employed in logging and sawmilling, and 10 men secure employment for every million board feet of timber cut.

Eastern Washington, with a wider industrial base than eastern Oregon, boasts two pulpmills and has only 70 percent of forest industry workers employed in logging or sawmilling. There 11 to 12 men are employed for every million board feet of timber harvested.

While these figures are subject to some error because of the movement of logs and pulp chips between areas and different degrees of mechanization, the general conclusions are valid. The wider the industrial base, with more plants utilizing different forms of wood, the greater is the economic activity and stability stemming from the use of a given volume of wood.

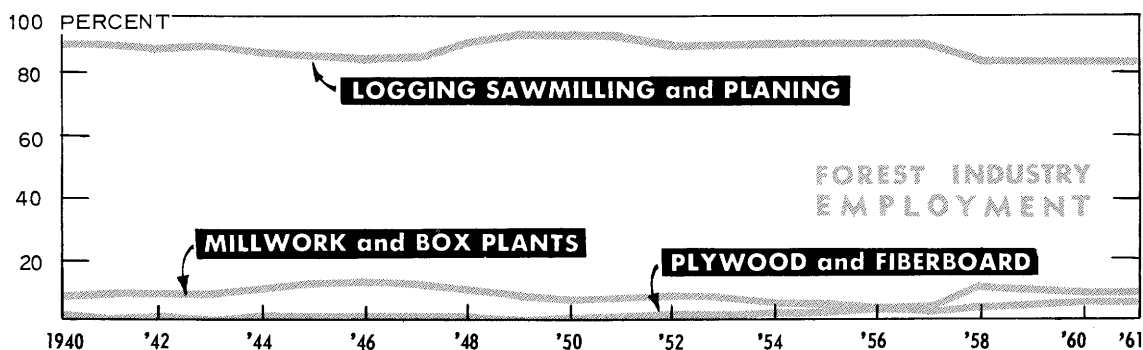
If eastern Oregon could secure greater diversification and more product refinement in forest industries, at least to the same extent as eastern Washington, jobs in forest industries could be increased by 30 percent, resulting in employment of 14,000 instead of the current 10,800. These jobs in turn

Logging, sawmilling, planing, millwork, and the container box industry as a group have never provided less than 90 percent of total forest industry employment.

In 1950, less than 1 percent of all forest industry workers was employed in other than the logging-sawmill group. Since then a small but encouraging start has been made in broadening the industrial base through the development of plywood and fiberboard plants. In 1959, employment in these plants reached almost 7 percent of the total forest industry employment.

There are a number of other forest industries that have developed around the production of minor products. These include fence posts and poles for power and telephone lines. Some juniper is manufactured into novelty items. Although these may be of importance to a community, they are not of sufficient magnitude to be considered as a significant part of a regional forest industry base.

THE FUTURE LOOKS ENCOURAGING. — Demand for lumber, plywood, fiberboard, pulp and paper, and other forest products is expected to increase as a result of the continuing increase in the Nation's popu-



would increase allied and supporting industries and benefit the entire economy.

PROGRESS TOWARD DIVERSIFICATION OF FOREST INDUSTRIES HAS BEEN SLOW. — Eastern Oregon has been slow to diversify and to increase product refinement. Non-lumber forest industries use only 3 percent of the log harvest and account for less than 7 percent of forest industry employment.

lation and productivity. Per capita demand for all of these products except lumber is expected to increase.

The success of eastern Oregon in capturing part of the expected increase in demand depends upon the ability of the region to grow economically competitive timber and upon a diverse forest industry that will meet the need.



Madras



Tygh Valley



Warm Springs

60-90



Klamath Falls

ACHIEVING GROWTH of Forest Industries in Eastern Oregon

The factors that influence development may be placed in several complex groups. First are geographical features; these include the present distribution of the industrial components, location of current markets for timber products, and characteristics and problems of transportation. The second group encompasses characteristics of the timber and includes ownership of the resource, the increasing importance of species other than ponderosa pine, and the quality of the remaining ponderosa pine. The next group has to do with the lumber industry. This industry will be an important factor in the development of new forest industries and has within it a substantial potential for growth. The last group of factors is that of raw material supply including mill and logging residue and mortality salvage. These are supplementary sources of raw material. The harvest of live sound trees will be discussed in the final section of this report.

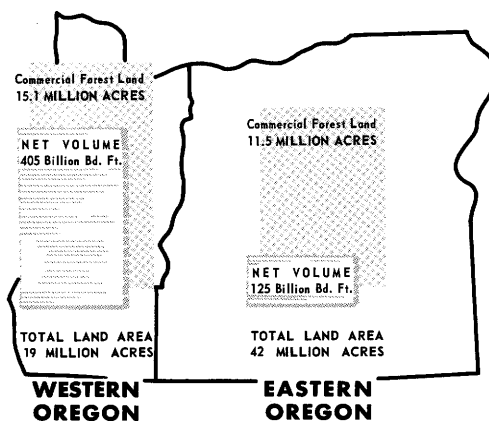
A PROBLEM OF GEOGRAPHY

To realize full value from each log, from each species, and from the residue material from the various manufacturing processes, a diversified industry must have sufficient raw material in adequate concentrations for economical use.

Modern transportation methods have done much to make the world seem smaller. High-powered trucks, high-speed highways, and access roads have brought the more distant timber supplies closer. Intervening mountain ranges are no longer insurmountable barriers to movement of logs or products. Despite all the advantages of increased mobility, distance still remains a deterrent to fuller utilization. Long hauls, whether from the woods

to the mills, between mills, or to the ultimate consumer, create problems and impede development.

Eastern Oregon includes all the land area of the State east of the crest of the Cascades. This is a large area, about equal in size to the entire State of Washington. Within these 42 million acres are 11.5 million acres of commercial forest containing 125 billion board feet of timber. The widespread character of this resource can be appreciated by contrasting it to the more concentrated forest resources of western Oregon. Western Oregon has slightly less than half as much total land area as eastern Oregon, a fourth more commercial timber area, and three times the timber volume.



The relatively low volumes per acre characteristic of much of eastern Oregon's forests have been an important factor in the development of a widely scattered industry. In eastern Oregon, 43 communities have only

1 or 2 mills, while only 6 have 3 or more sawmills:

33 communities	—	1 mill
10 "	—	2 mills
6 "	—	3 or more mills

Sixty-two percent of the lumber is produced in the 43 towns having only 1 or 2 mills; 38 percent in 6 towns having 3 or more mills:

Towns with 1 mill	—	37 percent of lumber production
Towns with 2 mills	—	25 percent of lumber production
Towns with 3 mills	—	12 percent of lumber production
Towns with 5 mills	—	26 percent of lumber production

These towns are distributed widely, spread between Enterprise in Wallowa County, which borders Idaho, and Klamath Falls in Klamath County, which borders California.

This wide scattering of production facilities acts as a barrier to realizing the fullest value from the occasional special kind of

log. Some grades of logs and some species could be used for veneer rather than lumber and some species for pulp. The assembly of enough of a special kind of logs at one place would be costly.

The lack of concentration of sawmills also makes it difficult and costly to assemble an adequate supply of chips for a fiber industry at one location.

SAWMILLS ARE DISTANT FROM TIMBERED AREAS. — Another aspect of this same problem is that mills are relatively far from sources of timber. Most eastern Oregon communities have developed in response to agricultural needs and are therefore in agricultural areas. Location of sawmills in timbered areas is generally impractical; instead they locate in established communities having a labor force, better climatic conditions, and transportation facilities. These conditions generally exist only at some distance from the forests. Thus forest industries, grain elevators, and stockyards are common characteristics of many eastern Oregon towns.



Madras

The Long Haul



In 1958, the small stationary mills sawing up to 39,000 board feet per day had an average maximum log haul of 29 miles; for mills sawing from 40,000 to 79,000 board feet per day this distance was 49 miles, while for mills larger than these the distance increased to 60 miles. As the more accessible timber resources are cut, these current maximums will probably become more nearly average haul distances.

Length of haul has a direct effect on the cost of logs to the mill. With hauling costs of about 19 cents per thousand board feet per mile, the average maximum haul of 29 miles for the small mills adds almost \$6 per thousand board feet to the cost of logs. For the larger mills, transportation costs for hauls of 49 to 60 miles are \$9 to \$11 per thousand board feet.

As hauling distances become greater and transportation costs go up, it becomes more important to achieve fuller use of the increasingly higher cost wood that is brought to the mill. Additional product refinement and more profitable use of mill residues can offset these higher costs.

PRODUCTS MUST MOVE LONG DISTANCES TO MARKETS. — Nationwide markets are reached from inland eastern Oregon mainly by rail. Use of trucks is limited to that volume used locally or sold in nearby States. Some mills truck their rough lumber to larger mills where it is remanufactured and re-shipped by rail. Only 7 percent of total production is shipped by truck while 93 percent moves via rail transportation. Almost all of the larger mills have rail facilities, but a substantial number of the smaller mills are also on rail lines.

Current rail rates to the East for western timber products are not proportional to distance; this favors eastern Oregon over other areas nearer important eastern markets. The favorable rate structure has developed over a long period and appears to be reasonably permanent. In a statement by the Great Northern Railway, the favorable structure is explained as follows:

The eastbound transcontinental rate structure on lumber which has been depressed to move the forest products of the Pacific Northwest is vital to the producers and shippers and to the railroads alike. If the lumber rate structure from the Pacific Northwest was not so depressed, the forest products industry in the Pacific Northwest, which is the keystone of the whole economy would be seriously damaged. This rate adjustment was not created by the Mountain-Pacific railroads but is the natural and compelled results of more than sixty years of experience in testing and evaluating the requirements of the economy of the situation.

Costs of shipping forest products from eastern Oregon to Chicago were the same as those from western Montana to Chicago until 1960.

A recent study⁷ of freight rates showed the following:

"The actual lumber haul distance from the Pacific Coast States to the Northeast was 18 percent longer . . . than from Montana and Idaho, but the rail freight cost per 100 pounds was identical.

The actual Pacific Coast haul to the Central States was 35 percent longer, but the shipping cost was only 9 percent higher than from Montana and Idaho.

The actual Pacific Coast haul to the Plains States was 36 percent longer, but the shipping cost was only 7 percent higher than from Montana and Idaho."

⁷ Hutchison, S. Blair. Production-distribution trends and freight rates as they affect Mountain States lumber producers. U. S. Forest Serv. Intermountain Forest & Range Expt. Sta. Res. Paper 59, 13 pp., illus. 1959.

In 1960 a slight adjustment was made in these rail rates to Chicago, and shipments from eastern Oregon were charged 3 cents more per 100 pounds than those shipments originating in western Montana. However, the amount of the increase was only minor in proportion to the distance between the two areas. Average rates per hundredweight to Chicago were:

From:	1930	1940	1950	1960
Eastern Oregon	\$0.685	\$0.720	\$1.08	\$1.37
Western Montana	.685	.720	1.08	1.34

A recent stimulus to the establishment of diversified wood industries in eastern Oregon has been the extension of the favorable rates for certain lumber products to include a major portion of all products. These include plywood, poles, insulating board, and hardboard.

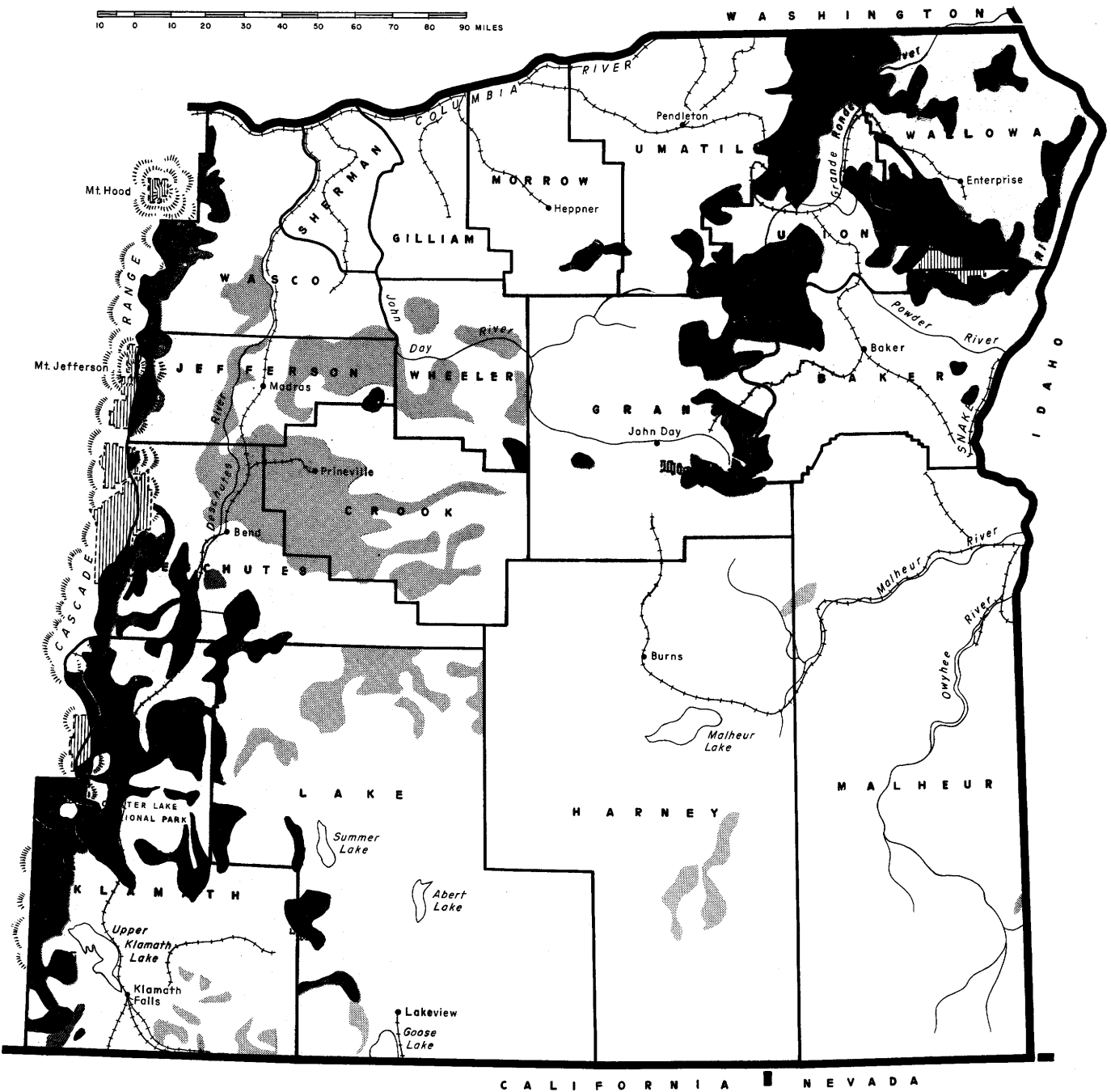
LUMBER INDUSTRY IS BASIC TO DIVERSIFICATION

Undoubtedly the lumber industry will continue to be an important part of the wood products industry in eastern Oregon, and any growth through diversification will be closely allied to it. For instance, the ability of sawmills to furnish residue suitable for use by the pulp and composition board industries will be important to the development of the latter. Similarly, close working relations will have to be developed with sawmills to allow for diversion of peeler quality logs to the veneer and plywood industry.

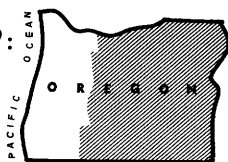
Growth possibilities exist within the lumber industry itself in addition to its central role in providing residue and log concentrations for other industries. The very magnitude of the lumber industry in eastern Oregon assures that any improvement would contribute substantial benefits to the total economy. Most of the possibilities lie in the direction of increased product refinement.

Major Forest Cover Types in Eastern Oregon

10 0 10 20 30 40 50 60 70 80 90 MILES



INDEX MAP:



LEGEND:

	Douglas-fir		Western larch
	Ponderosa pine		Fir, Spruce
	Lodgepole pine		Juniper
	Unproductive forest land		Reserved from timber cutting

FOREST SURVEY, PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION -- 1963

Generally, the larger the mill the more processing is done to the product before shipment. Large mills, sawing 120,000 board feet or more per 8-hour shift, dry and surface 96 percent of their lumber; and for every million board feet of lumber produced, 6.6 men secure employment. Mills sawing between 80,000 and 119,000 board feet dry and surface 86 percent of their output, and 5.2 men are employed for every million board feet of lumber produced. The mills sawing 40,000 to 79,000 board feet and 1,000 to 39,000 board feet dry and surface 69 percent and 17 percent of their output, respectively. Employment opportunities reflect these different levels of manufacturing, with 4.6 and 3.2 men per million board feet, respectively, employed by the two size classes of mills.

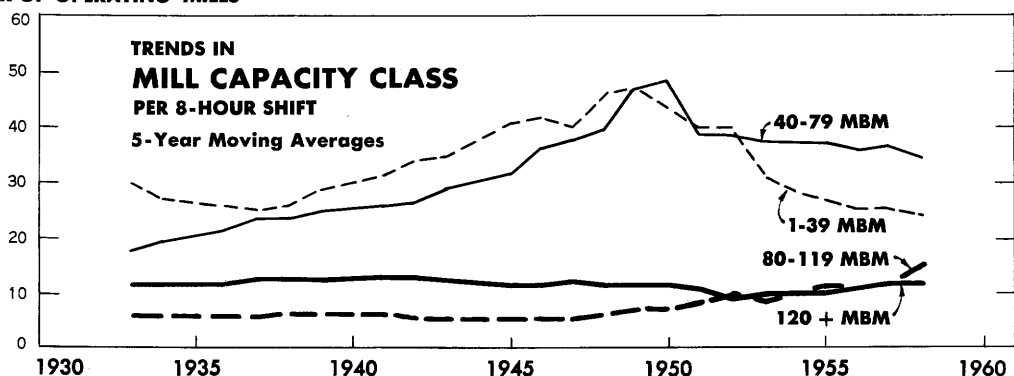
Not all of the differences in employment are due solely to the drying and surfacing of lumber. Edge and end gluing, finger jointing, and the manufacture of a number of small items also add employment. There is also some additional employment created when the rough-green output of other mills is purchased and remanufactured into molding and other products by the larger mills. But the fact that the bigger mills employ twice as many men per thousand board feet of lumber produced indicates the potential gain through more product refinement.

As growth of the forest economy will undoubtedly depend on the lumber industry, it is important to know how stable it is. The

smallest size class of mill, sawing up to 39,000 board feet per 8-hour shift, has the least stable ownership, shows greater fluctuations in number of mills over time, and produces a relatively small proportion of the total lumber production. Shortly after the start of the Great Depression, the number of small mills decreased from around 42 to a low of about 12 mills. In the post-World War II boom, the number of small mills reached a peak of almost 70. Following this boom period, the number decreased to about 30. Only 21 percent of the mills in 1958 had been in the same ownership for 10 years or more; the rest less than 10 years — usually less than 5 years. Mills in the 0- to 39,000-board-foot class accounted for only 5 percent of the total 1958 lumber production.

The mills sawing from 40,000 to 79,000 board feet have been gradually increasing since 1930 when there were only 10 or 11 mills of this size. Now the number has stabilized at almost 40. In 1958, 35 percent of this size of mill had been in the same ownership for more than 10 years, 65 percent less than 10 years. This size class of mill produced 39 percent of the total 1958 lumber production. This was the largest production among mills of any size class. Mills of this size class are sawing slightly more than their installed capacity would indicate. They have an installed capacity amounting to about 36 percent of all sawmills; but in terms of lumber production, they are producing 39 percent.

NUMBER OF OPERATING MILLS



The number of mills in the size class from 80,000 to 119,000 board feet per 8-hour shift has varied, and now it appears to be increasing. These mills produced a volume of lumber second only to the 40,000- to 79,000-board-foot size class of mill. In 1958, they produced 29 percent of the total lumber production with 22 percent of the total installed capacity. These mills — with more than half of them in the same ownership for more than 10 years — have a greater history of stability of ownership than smaller mills.

The mills sawing 120,000 board feet or more per 8-hour shift appear to be fairly well stabilized. More than half of the mills have been in the same ownership for more than 10 years. These mills have about 36 percent of the total installed capacity of all mills but in 1958 produced only 24 percent of the lumber.

Apparently both stability in numbers of mills and continuity of ownership come with increasing mill size. Of increasing consequence are the mills within the 40,000- to 79,000-board-foot daily capacity mill size. The concentration of lumber production in these mills makes them important in considering future developments. Although some increase may take place in numbers of larger mills, the difficulty in developing assured raw material supplies appears likely to limit this.

THE RAW MATERIAL SUPPLY

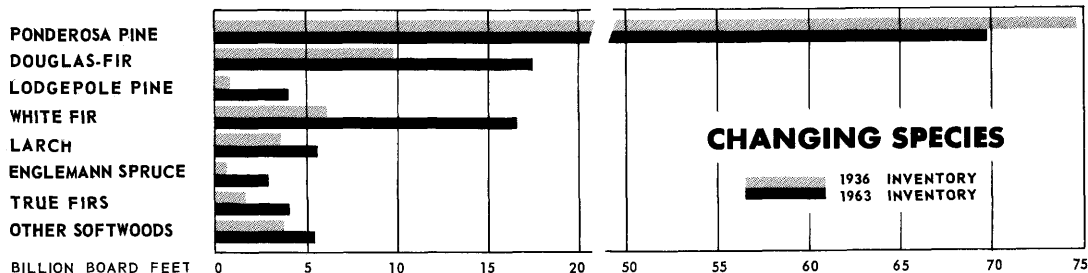
IMPORTANCE OF SPECIES OTHER THAN PONDEROSA PINE IS INCREASING. — The increase in available volume indicated by the recent reinventory of eastern Oregon is of

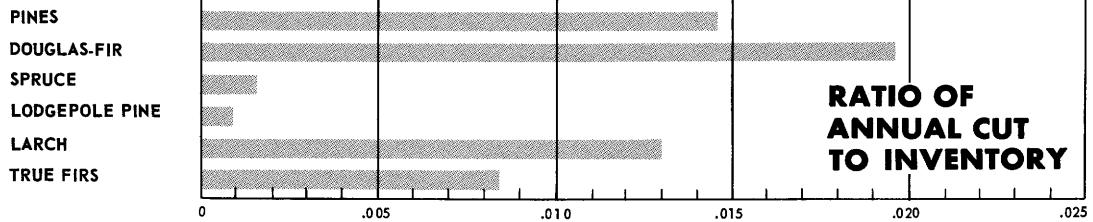
great significance to its economy. One result has been an increase in allowable cuts on National Forest lands.

If full use is to be made of this new inventory of 125 billion board feet, we must recognize that an increasing amount of this volume is in species other than ponderosa pine. In 1936, the inventory showed that 75 percent of the available volume was ponderosa pine. In the new inventory, ponderosa pine is only slightly more than half of the volume. The available volume of lodgepole pine is now estimated to be 3 percent of the total inventory instead of the 1 percent estimated in 1930. Similarly, the proportion of the volume in Douglas-fir, true firs, and Engelmann spruce is twice that estimated earlier.

The lumber industry is to a considerable extent meeting the challenge of the changing species composition (table 2, page 10). In 13 years the ponderosa pine portion of the cut has decreased from 85 percent in 1947 to 63 percent in 1960. The use of true firs for lumber has increased from 4 percent in 1947 to 11 percent. The use of larch and Douglas-fir has increased from 11 to 25 percent.

The species distribution shown by the new inventory presents real problems. Changes in the use of species must be achieved if managed forests are to be attained. Disproportionate use of a species may lead to its early depletion. On the other hand, little use of a species prevents the replacement of older, slower growing trees with younger, more rapidly growing trees. At the present time in eastern Oregon, the ratio of the cut of some species to their inventory volume



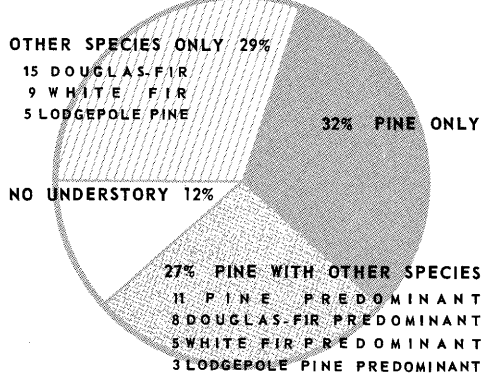


is 20 times as great as the ratio for other species. Even though inherent differences in growth rates require differing cutting rates for various species under management, the use of each species should be more in proportion to its inventory volume than now is the case.

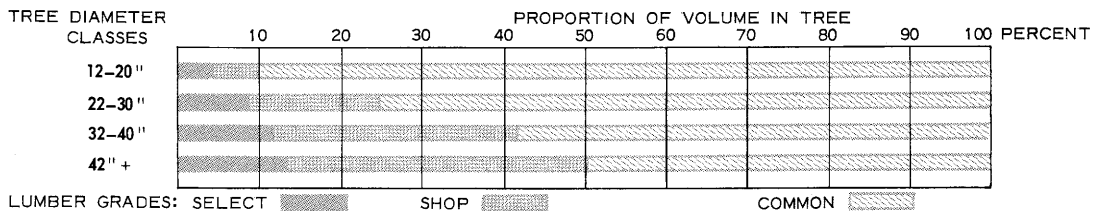
CONTROL MEASURES ARE NECESSARY TO KEEP PONDEROSA PINE IN THE FOREST. — The distribution of species now found in eastern Oregon will change unless definite measures are taken. If present trends continue, the proportion of ponderosa pine will be less in the future than at present. This could have an adverse effect on the forest economy.

The maintenance of ponderosa pine in the forest depends upon the replacing of cut or dead pine trees with young pine trees. But in 29 percent of all the pine sawtimber types, there is no understory of pine, only other species — Douglas-fir, white fir, and lodgepole pine. In another 27 percent of the pine sawtimber stands, the understory is a mixture of young ponderosa pine and other species. On more than half of this area, species other than pine predominate. Unless something happens to change this relationship, or unless more intensive forest management is undertaken, about 40 percent of the pine sawtimber type is likely to shift to some other type.

UNDERSTORY STOCKING



PONDEROSA PINE QUALITY IS HIGH. — Eastern Oregon has an advantage over most other pine producing areas in its ability to produce high-quality pine lumber. This is due primarily to the large diameter of trees in eastern Oregon. Generally, the larger the tree the greater proportion of its volume is clear wood. Pine trees over 40 inches d.b.h. in eastern Oregon have about half their volume in wood capable of sawing out select or shop grades of lumber. In contrast, trees 12 to 20 inches d.b.h. have only 10 percent of their volume in this higher grade material.

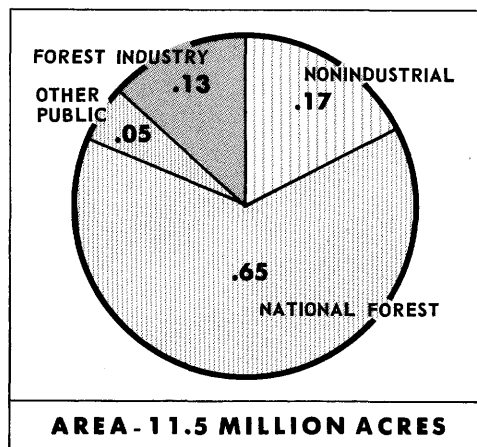


The East, with its smaller trees, is not competitive in producing high-quality lumber. Eastern Oregon leads most of the ponderosa pine area in its potential for producing high-quality lumber. In the Rocky Mountain region the volume in pine trees over 31 inches d.b.h. amounts to 24 percent of the total volume; this compares to 43 percent in eastern Oregon. Only California with 63 percent in trees over 31 inches d.b.h. has a more favorable quality potential (table 3).

Table 3 — The distribution of the sawtimber volume of ponderosa pine trees on commercial forest land by diameter classes (in percent)

Diameter class (Inches)	Eastern Oregon	California	Rocky Mountain
11.0-20.9	16	11	34
21.0-30.9	41	26	42
31.0 and larger	43	63	24
Total	100	100	100

In eastern Oregon the present total stand of ponderosa pine trees contains almost 6 billion board feet in selects and 13 billion board feet of shop-grade lumber. The remaining 50 billion board feet is in common grades of lumber. Much of the quality material comes from old-growth trees; in the more distant future, when old-growth trees are gone, much smaller trees will be harvested. Under these conditions the quality advantage of eastern Oregon will be lessened.

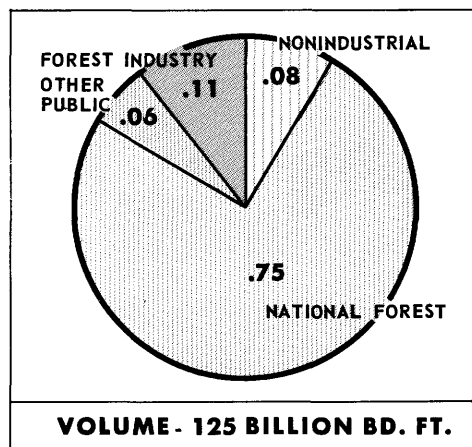


MOST OF THE TIMBER IS SOLD ON THE OPEN MARKET. — The availability of timber supply is largely governed by timber ownership. Both public and nonindustrially owned timber can be bought by those able to out-bid competition. In contrast to these two broad ownership groups is industrially owned forest land on which the timber is usually held for conversion by the specific industry owner.

The timber resource of eastern Oregon in public ownership contains almost 81 percent of the total available volume. There is an additional 8 percent in nonindustrial ownership. The total of these two ownerships amounts to 112 billion board feet or 89 percent of the total available timber. Only 11 percent of the timber volume is in industrial ownership.

Practically all mills in eastern Oregon are dependent upon purchase of timber for their operation. Mills sawing over 40,000 board feet per shift (representing about 95 percent of all lumber produced) obtain about half their timber supply from public lands. The smallest mills obtain most of their timber from the nonindustrial ownership.

According to the current pattern of bidding for National Forest timber, competition is not great. Sales records of timber sold during most of 1960 show that about 55 percent of all the timber sold had only one bidder. The remaining 45 percent of the volume



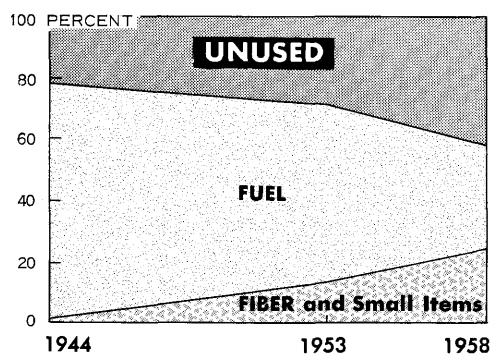
sold had two, three, and four bidders with most of these sales having three bidders. The successful bids on all National Forest sales averaged 5 percent more than the appraised price.

UNUSED MILL RESIDUES ARE ABUNDANT BUT SCATTERED. — The wood available as sawmill residue is a most logical first place to seek additional volume of wood for industrial growth. It is the most immediate, relatively abundant, and least costly of the potential sources of increased supply.

Only half of the volume of a log is sawn into lumber. The other half is residue from the squaring of round logs to rectangular lumber.

In 1958, 1.1 million tons of residue exclusive of bark were developed from the 1.6 billion board feet of lumber sawn by stationary mills. Of this residue, 534,000 tons were classed as coarse. In addition, there were 430,000 tons of sawdust and 177,000 tons of shavings.

Coarse residue, because of its suitability for making chips for pulp and composition board, is the most important segment of residue for industrial expansion. Fine residue, consisting of sawdust and shavings, currently is used for fuel, bedding for livestock, or as agricultural mulch.



More coarse residue is unused now than at any previous time because its use for fuel has decreased rapidly. In 1944, 77 percent of the coarse residue was used for fuel and the remaining volume remained unused. In

1958, the proportion used for fuel dropped to 34 percent while new uses accounted for 24 percent, of which 20 percent is manufactured into pulp, mainly in Washington and Idaho, and 4 percent is used for miscellaneous items including small wooden parts and boxes. The remaining available 42 percent, or 225,000 tons, is almost twice the 123,000 tons that were available in 1944.

The assurance of an adequate supply of pulp chips rather than roundwood is a major requirement for pulp plant development. Many new pulpmills use chips exclusively as a supply of raw material. The volume of coarse residue potentially available for chipping for pulp in eastern Oregon is considered to include that not used for fuel and that sold as chips for pulping elsewhere. Presumably, a new local pulpmill would find that pulp chips now being sold elsewhere would be available locally because of decreased hauling distances. Pooling the 225,000 tons not used for fuel and the 105,000 tons sold makes a total of 330,000 tons potentially available for pulping annually. If all of this residue were available, it could support a pulp industry having a daily pulp capacity of 400 tons.

Current utilization practices require that pulp chips be bark free. Mills have two choices in order to produce this bark-free wood; logs may be barked prior to sawing so that all residue is free of bark, or clean residue wood may be picked out of the conveyor belt. Picking wood is expensive, inefficient, and generally not a satisfactory method for recovering the considerable portion of the log not converted to lumber. But barkers which provide for the most efficient recovery of residue volume are few in eastern Oregon.

Mill size class (board feet):	Mills having barkers and chippers (Percent)	Total unused residue (Thousand tons)
120,000+	50	6.5
80,000 to 119,000	31	84.2
40,000 to 79,000	8	114.7
0 to 39,000	0	19.8

225 Thousand tons Lost Annually



Lakeview

The largest volume of unutilized coarse residue is produced by the mills in the 40,000- to 79,000-board-foot size class. The 115,000 tons from this group of mills are about half of the total volume of unused coarse residue. Barking facilities are needed at these mills to provide for efficient utilization of this residue. But at the present time only 1 out of 12 mills of this class has barkers. Mills in the 80,000- to 119,000-board-foot size class with 84,000 tons of unused coarse residue produce 37 percent of all the unused residue. Only one out of three mills in this class has barkers.

Obviously this unused residue must be debarked before it can be used by pulp plants. If pulpmills develop locally, some sawmills will be able to install barkers. There may be a possibility of a common barker for groups of mills; other mills may have to wait the development of lower cost barking equipment.

LOGGING RESIDUES SHOW LITTLE PROMISE DUE TO LOW QUALITY AND SMALL VOLUME. — In 1961 about 16 million board feet of logging residue was left on the ground following removal of the harvest of 1.5 billion board feet of timber. Much of this material was unmerchantable by present day standards. Of the volume of logs left as residue, 54 percent was in logs containing less than 30 board feet; 40 percent was in logs less than 10 feet in length. Other undesirable characteristics included excessive knots, splits, shake, and rot.

Per-acre volumes of residue material are low after the light harvest cutting that is common to eastern Oregon. This, along with the inherent poor quality of residue material, leaves little prospect in the foreseeable

future for salvage of an appreciable amount of this material. Under greatly improved market conditions, some of the sound material may be recovered during regular logging operations.

MORTALITY CAN BE AN IMPORTANT SOURCE OF WOOD. — Growth of a more diversified forest industry will result in a greater overall consumption of raw material. In part, this increase will come about through more use of residue material. But most likely it will also require an increased log harvest.

The most immediate opportunity for increasing the total volume of logs available for use is by salvage of mortality trees. The current rate of mortality is 1260 million board feet per year. Salvage of these dead trees could be used to maintain or even increase the total harvest of timber without any additional drain on the live timber inventory.

The annual loss of volume in mortality amounted to 87 percent of the live timber volume harvested in 1962. Current harvest of mortality is limited. In 1961, only 21 million board feet of dead trees were harvested. Over 60 times that much is potentially available each year. If only the annual volume of mortality that occurred in concentrations of at least 500 board feet per acre could have been salvaged, it would have increased the 1961 cut by 360 million board feet. Whether this degree of concentration is economically salvable depends upon local factors such as roads, logging costs, and markets. Mortality is concentrated in the more desirable species with 80 percent of the mortality volume in ponderosa pine, Douglas-fir, and larch.

ROADS

ROADS ARE NEEDED. — Vital to all aspects of the management and utilization of the resource is an adequate transportation system. The feasibility of salvaging mortality trees is dependent upon an adequate road coverage to provide ready access to trees having salvageable mortality.

The application of other management measures such as thinning, intermediate cutting, prelogging, and all the other measures necessary to realize the productivity of the forest for growing wood depends upon accessibility.

The key to accessibility is a complete road system. An example of the need for roads can be seen in the National Forest situation. On National Forests an area of almost 2 1/2 million acres of commercial forest land is not adequately roaded for logging or management. This means that 36 percent of the commercial forest land on National Forests is not available for intensive management or utilization. An estimated 10,900 miles of main haul and spur roads are needed before this area can be made accessible. The miles of road needed for each of the National Forests in eastern Oregon and the area of commercial forest land which would be opened up if these roads were developed are as follows:

	Needed road development (Miles)	Currently inaccessible commercial forest land (Acres)
NATIONAL FOREST:		
DESCHUTES	300	79,000
FRAMONT	1,600	377,000
MALHEUR	800	81,000
OCHOCO	800	370,000
WALLOWA-WHITMAN	1,500	911,000
UMATILLA	2,000	514,000
ROGUE RIVER (Klamath County)	400	75,000
Total	10,900	2,407,000



WATER is available

Columbia River.

WATER IS AVAILABLE. — Availability of industrial water is a major limiting factor to pulp plant establishment. Despite the general arid appearance of eastern Oregon, there is water available for industrial use. Comprehensive data for all streams are not yet available, but investigation of the Deschutes and Grande Ronde River basins by the State of Oregon Water Resource Board⁸ indicates areas where streamflow of unallocated water is adequate to support a pulp plant or other water-demanding industrial development. Both the Snake and Columbia Rivers have sufficient flow to support new industrial development. Obviously, specific plant location including problems of waste disposal will require detailed study, but water is not an exclusively limiting factor in eastern Oregon.

SUSTAINED TIMBER HARVEST IS KEY TO INDUSTRIAL GROWTH. — A number of the

factors influencing the industrial development of eastern Oregon has been discussed. Some of these were the spatial pattern of the area both in terms of the resource and the industry, transportation problems, the character of the lumber industry, species distribution, and ownership of the forest resource. In addition, the more critical subject of the potential raw material supply from logging and milling residue and from mortality was discussed. All these must be considered in arriving at a comprehensive view of opportunities in eastern Oregon. But these items do not complete the evaluation. The major controlling item necessary for all development is the ability of the forest resource to produce a continuing harvest of timber for use by present and future industries. Although other conditions must be considered, industrial development will most readily occur when the supply of raw material is both adequate for the present and reasonably assured for the future. Now let us examine the forest and question its ability to produce useful raw materials now and in the future.

⁸ Data obtained from the Oregon State Water Resource Board on the Deschutes River basin are shown in table 44 in the appendix. The water situation in the Grande Ronde basin is detailed in a recent Board publication "Grande Ronde River Basin," 208 pp., Salem, 1960.



The Three Sisters

60-64



Forest Service Nursery



Wol. Rock



Kinzua

Balancing TODAY'S needs with TOMORROW'S

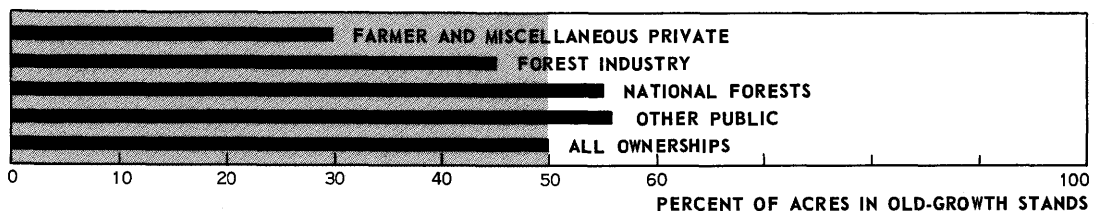
During the transition from the unregulated forest, the management of forest for sustained timber production would have two primary purposes: to supply current needs for wood products and to convert the unregulated forest into a regulated producer of the kind of wood needed in the future. Too much emphasis on current needs might delay or make impossible the achieving of a regulated forest. On the contrary, too much emphasis on achieving a regulated forest could seriously disrupt the flow of timber into the current economy. The most desirable management is that which aims at a reasonable balance between the two purposes: today's needs for wood products and tomorrow's needs for a regulated forest from which wood products will flow continuously in the future.

In this section of the report we will first suggest a model of what the regulated forest condition might reasonably be like and compare it with the existing forest conditions. Then we will estimate what a continuation of current and prospective cutting practices might produce in the way of current and short-run future needs and whether such cutting would result in a regulated forest some time in the future. Finally, we will estimate what levels of cutting and what other practices will be needed to smoothly and reasonably attain a regulated forest condition in the future.

THE FOREST MODEL -- A BASIS FOR EVALUATING THE FOREST CONDITION

Eastern Oregon is now in the process of conversion from an old-growth virgin forest to a young-growth forest. The cutting that has been occurring in eastern Oregon for the past 100 years has removed some of the old growth and converted part of the forest to stands of young trees. About half of the commercial forest area at present is classed as either young-growth sawtimber, poletimber, or seedling and sapling stands. The other half is in old-growth sawtimber stands — the virgin forest. The problem ahead is to change the forest from a mixture of young and old into a forest of young rapidly growing trees adequately utilizing the site and providing a continuous flow of desired products.

For the purpose of comparison in this report, the model for the future regulated forest is based on three assumptions. These set goals for the size of tree to be grown and harvested; they prescribe the diameter distribution believed necessary to produce a continuing flow of timber; and they set a level of growing stock to be maintained. These specifications have been made as practical and realistic as possible. They may not



be the most desirable conditions which could be specified, but they are suitable for the evaluation of past accomplishments and future possibilities for eastern Oregon forests in this report. These specifications in detail are:

1. The development of an integrated forest economy will continue to require an output of saw logs. For all types, except lodgepole pine, crop trees should average 26 inches d.b.h.; for lodgepole pine, 16 inches d.b.h. The actual harvest would include many trees smaller and larger than average.
2. The level of growing stock which should be maintained is estimated to be 95 square feet of basal area per acre.

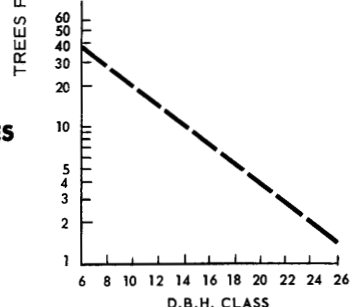
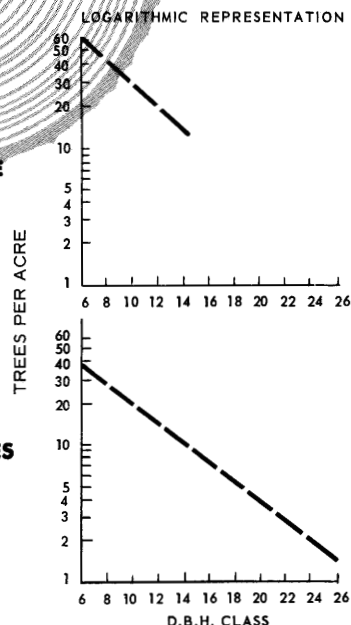
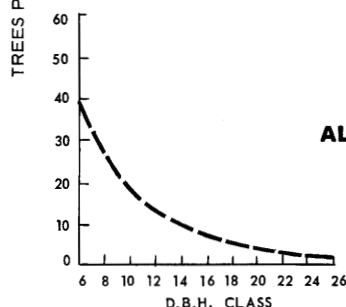
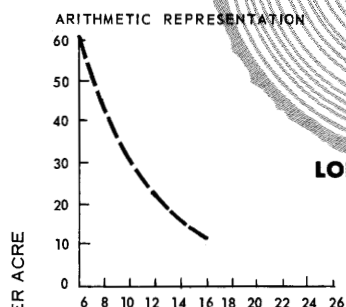
3. The arrangement of trees, i.e., the stand structure, based on this level of growing stock, must be capable of yielding a continuous flow of mature trees. This distribution in numbers of trees per acre by diameter class is shown below.⁹

The graphs used throughout this section of the report are representations of the actual and desired number of trees by size. In these graphs solid (—) lines will be used to show the present forest structure; dashed (---) lines, the forest after 30 years; and a heavy dashed (— — —) line, the forest model.

⁹ Technical details are given in the appendix, pages 53, 54.

STAND STRUCTURE OF FOREST MODEL

	6	8	10	12	14	16	18	20	22	24	26	INCHES D.B.H.
LODGEPOLE PINE												Total
TREES/ACRE	61.4	43.8	31.3	22.4	16.0	11.4						186.3
ALL OTHER TYPES												
TREES/ACRE	38.8	27.7	19.8	14.1	10.1	7.2	5.2	3.7	2.6	1.9	1.3	132.4



THE FUTURE WITH CURRENT CUTTING CONTINUED

If current cutting rates and practices continue, what will future forest conditions be? Will there be a decrease in the potential of the forest? Will they lead to a desired forest structure? Will the impact be the same for all ownerships and for all forest types?

In order to allow enough time for the effect brought about through the continuation of current rates, we will compare the present stand structure with those expected 30 years from now. These comparisons are made for four type groups and two major ownership classes. The types are ponderosa pine (ponderosa, white, and sugar), lodgepole pine, Douglas-fir and larch, and all other types. The ownership groups are public and private.

The stand structure for each type is based on its principal species. Thus lodgepole pine is used to describe the stand structure of the lodgepole pine type and Douglas-fir and larch trees are used to describe the structure of the combined Douglas-fir and larch types. For the ponderosa pine type the stand structure is described by the ponderosa, sugar, and

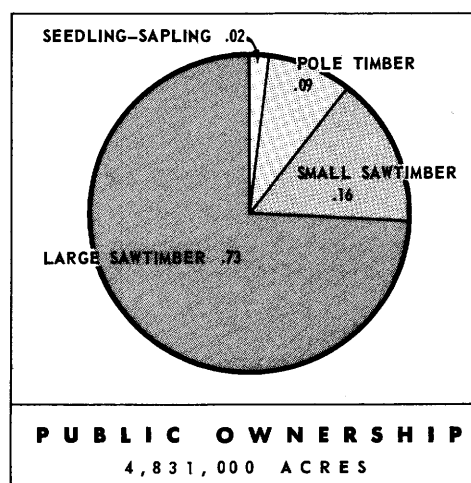
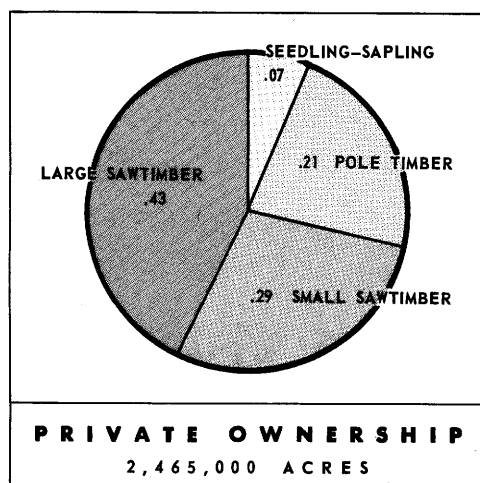
white pine trees. All of the remaining species are grouped to describe the stand structure of the remaining types and are classed "other."

This use of a single species or group of species to describe the stand structure of a type is not wholly accurate. Within each type other species may also occur. However, this simplification was accepted because by far the greater proportion of trees within a designated type are those indicated by the type name.

The stand structure after 30 years of cutting was determined by projecting the present stand structure to the year 1993. This was done by adding to the present diameters the appropriate increment for growth and subtracting the number of trees removed due to cutting and mortality. The rates of growth, mortality, and cutting were established from present conditions and were not changed in the projection.

IN THE PONDEROSA PINE TYPE, TREND TOWARD DESIRED CONDITIONS IS SLOW. — The ponderosa pine type is of greater significance to eastern Oregon than any other forest type. It covers 63 percent, or 7.3 million acres, of the total commercial forest land area. It is the principal type on both

THE PONDEROSA PINE TYPE



public and private ownerships, since it covers 60 percent of the area of commercial forest land in public holdings and 72 percent of the private ownership.

Between 1950 and 1961, the 30 percent of commercial forest land in private ownership produced about 48 percent of the total log production. At the same time, the 70 percent of the commercial forest land which is publicly owned was producing an average of 52 percent of the total log production. Most of this cutting, on both public and private lands, was in the ponderosa pine type.

These different rates of cutting have produced forests with considerably different characteristics. The proportion of large ponderosa pine sawtimber on private land is much less than on public lands. Pole-timber and seedling and sapling stands occur on about 1 out of every 4 acres in private commercial forest land compared to 1 out of every 9 acres on public lands.

Another more revealing way of looking at the effects of past cutting rates on today's forests is by examining the present stand

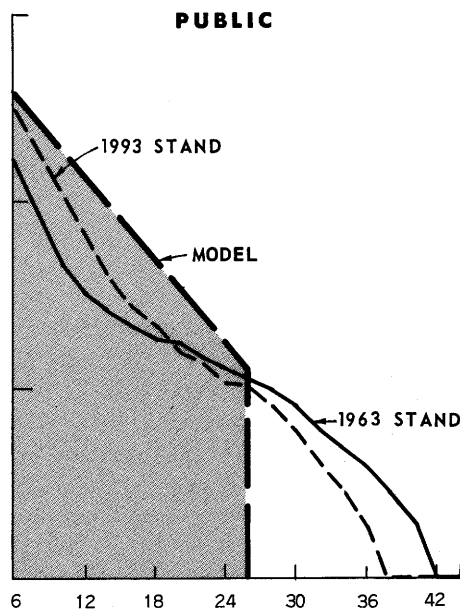
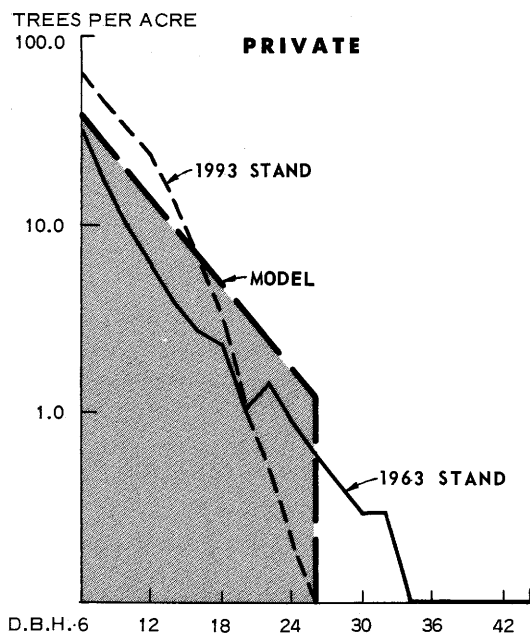
structure of the ponderosa pine type in each ownership group. A comparison of this with the stand structure of the forest model allows evaluating the effects of past practices.

Past cutting on both private and public land has resulted in a forest that differs considerably from our model. There are too few poletimber trees (6 to 10 inches d.b.h.) and sawtimber trees (12 to 26 inches d.b.h.). However, public ownership has a large number of sawtimber trees over 26 inches, almost 10 percent, and private lands have 1 percent. A comparison of forest ownerships with the model reveals the following:

Present diameter class (Inches)	Private (Number of trees per acre)	Public (Number of trees per acre)	Forest model
6-10	61	31	86
12-26	20	16	46
Over 26	1	5	--
Total	82	52	132

If the current rate of cutting on private ponderosa pine land was to continue, by

STAND STRUCTURE - THE PONDEROSA PINE TYPE AVERAGE ACRE



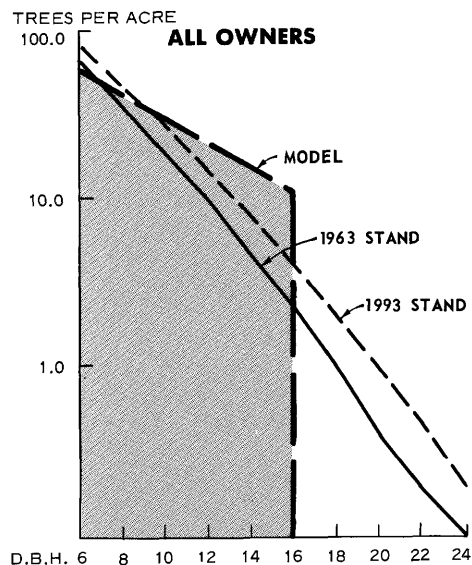
1993 the number of ponderosa pine sawtimber trees 16 to 26 inches d.b.h. would be reduced to half the required 22 trees per acre of the model. By the same future date, the number of poletimber and small sawtimber size trees would be in excess of the forest model.

On public lands the effects of another 30 years of the current type of cutting are more difficult to evaluate. Continued cutting will reduce the number of trees over 26 inches d.b.h., and at the same time the number of smaller sizes will gradually increase. Both of these trends are in the right direction. However, achieving a regulated forest condition will take a long time. At the end of 30 years, a gap will still exist between the number of small trees proposed by the model and those actually on the ground, and there will still be trees larger than desired.

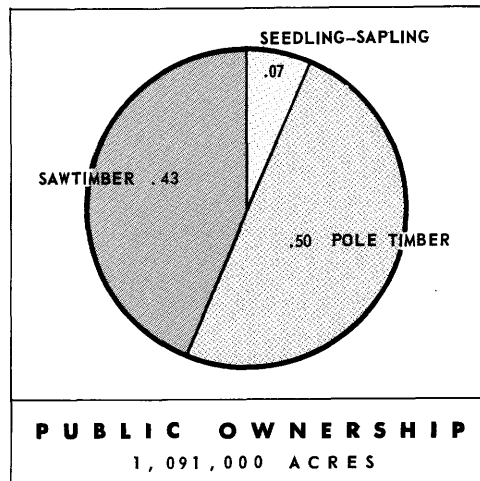
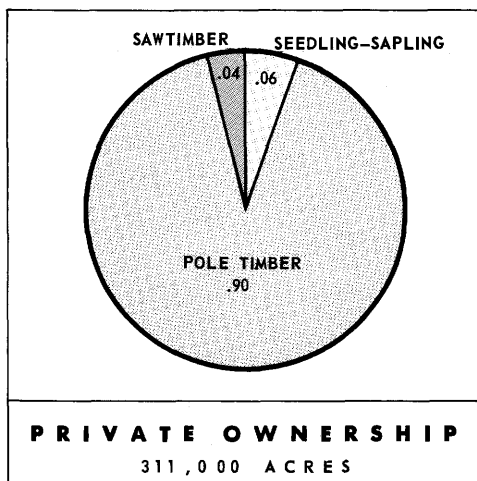
LACK OF MARKETS FOR LODGEPOLE PINE RESTRICTS MANAGEMENT. — There is considerably more lodgepole pine available than is currently used. In 1961 less than 1 percent of the total log production was lodgepole pine. This very low level of production came from 9 percent of the total commercial forest area in private ownership (311,000 acres) and 13 percent of the public holdings (1,091,000 acres).

This production is far short of the lodgepole pine type's potential for producing annual crops. The sustained yield capacity in private ownership is estimated to be 15 times greater than the present rate of cutting, and in public ownership it is estimated at 50 times greater. Our inability to find enough additional uses for lodgepole pine results in a considerable loss now and in the future.

STAND STRUCTURE LODGEPOLE PINE TYPE AVERAGE ACRE



THE LODGEPOLE PINE TYPE



The available information on lodgepole pine is inadequate to develop stand tables for each ownership group. Because of this, the data for all owners are shown here in terms of numbers of trees per acre by size:

Present diameter class (Inches)	All owners (Number of trees per acre)	Forest model (Number of trees per acre)
6-10	124	136
12-16	18	50
Over 16	2	--
Total	144	186

A comparison of the present stand with the desired stand indicates fewer trees than in the model in all except the 6-inch diameter class. There is also a surplus of trees larger than the maximum diameter used in the model. The light rate of cutting over the 30-year period is insufficient to control the stand and the general result is an increase in numbers of trees of all diameters.

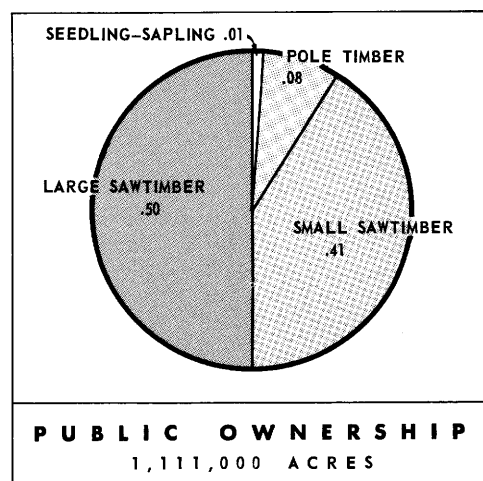
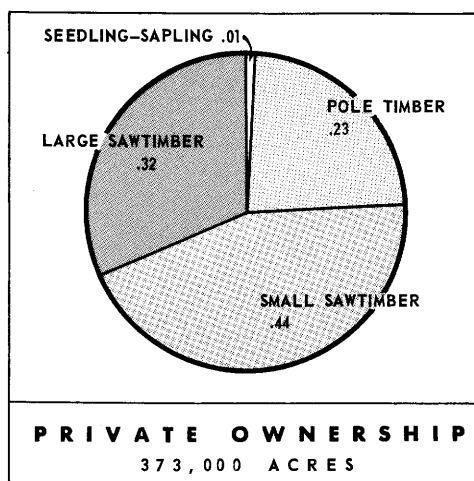
CURRENT CUTTING IN THE DOUGLAS-FIR AND LARCH TYPES LEAVES UNBALANCED GROWING STOCKS. — The forests in Douglas-fir and larch types are an important part of both the private and public ownership of commercial forest land. They cover 11 percent of the commercial forest land in private ownership and 14 percent in public ownership.

Considerable differences exist between stand conditions on private lands and those on public lands in these types. Three-quarters of the area in private ownership is classed as sawtimber compared to the nine-tenths in public ownership. These differences are also revealed in a comparison of the distribution of trees per acre:

Present diameter class (Inches)	Private (Number of trees per acre)	Public (Number of trees per acre)	Forest model (Number of trees per acre)
6-10	196	82	86
12-26	50	42	46
Over 26	1	5	--
Total	247	129	132

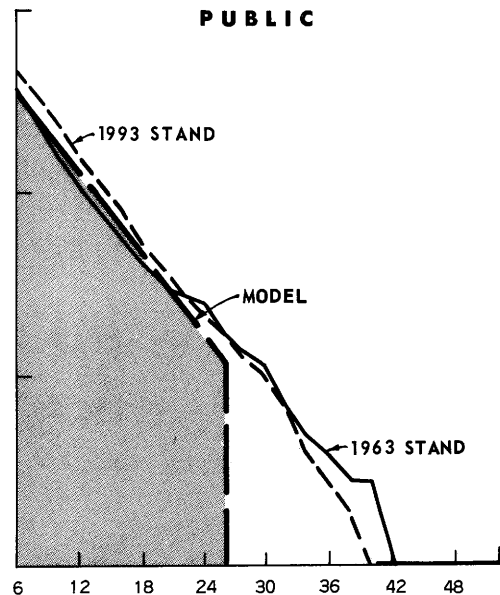
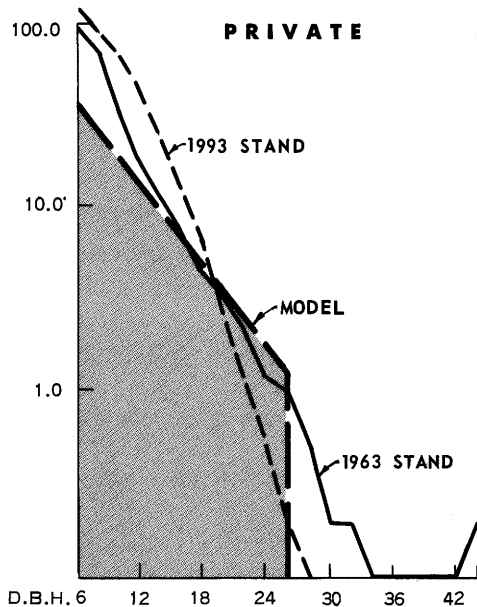
Continuance of the present rate of cutting on private holdings for the next 30 years will reduce the number of sawtimber trees over 20 inches d.b.h. to an undesirable volume and at the same time, the small sawtimber and poletimber trees will increase over the already present excess. Currently on public lands the number of trees 26 inches d.b.h. and under approximates that of the forest model. However, there is a considerable excess of sawtimber over 26 inches. After 30 years of cutting on public lands, the number of trees over 26 inches will be reduced slightly and the number of all others will increase.

THE DOUGLAS-FIR AND LARCH TYPES



STAND STRUCTURE - DOUGLAS FIR AND LARCH TYPES

AVERAGE ACRE



THE "OTHER" TYPES ARE MOSTLY AT HIGH ELEVATIONS. — The combined area of the "other" types amounts to almost 10 percent of the total commercial forest land area. Most of these types occur at the higher elevations of the commercial forest land zone. Because more public ownership of forest land occurs at these elevations, the "other" types represent a correspondingly greater proportion of public than private lands, 13 percent and 5 percent, respectively. White fir and hardwoods are exceptions and occur generally at lower elevations. White fir makes up 78 percent of the "other" types in private ownership; in public ownership it is only 48 percent. Hardwood type makes up 7 percent of the "other" types in private ownership but less than 1 percent of the public ownership. The proportion of the higher elevation types such as the true fir-mountain hemlock, spruce, and true fir types in public ownership is almost four times that in private ownership.

There are only small differences in the

distribution of area by stand size class between ownerships. In public ownership 93 percent of the area is in sawtimber size classes, whereas on private ownership it is 89 percent. The two owner classes also have a generally similar stand structure, marked by an excess number of trees at all diameter levels in comparison with the forest model:

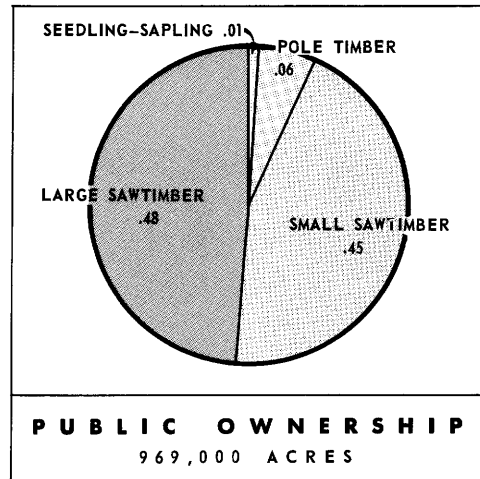
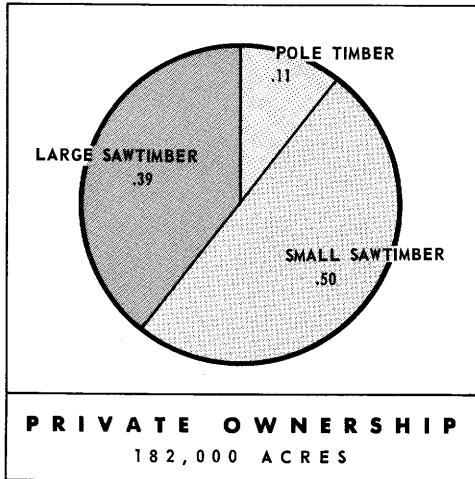
Present diameter class (Inches)	Private (Number of trees per acre)	Public (Number of trees per acre)	Forest model
6-10	237	144	86
12-26	64	66	46
Over 26	5	5	--
Total	306	215	132

A continuation of current cutting rates and practices on private land will lead to a substantial reduction of sawtimber trees over 26 inches d.b.h. in 30 years. However, if there continues to be little or no cutting in poletimber or smaller size sawtimber trees, the present excess of trees in these sizes will become even greater.

On public lands the current light cutting of species common to these "other" types, if continued, is not sufficient to achieve the desired stand structure and the present excess of trees will persist. The lack of roads

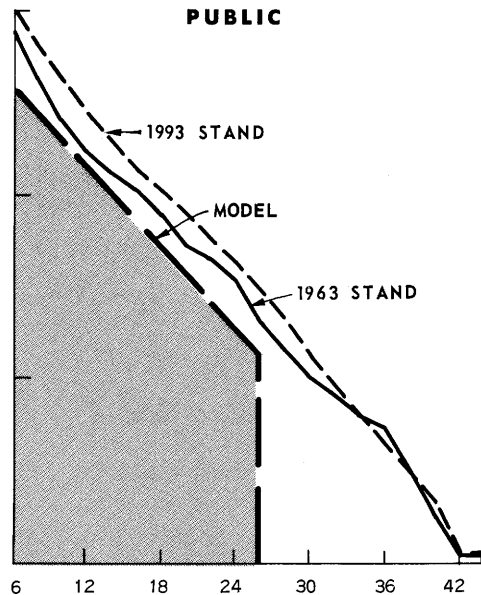
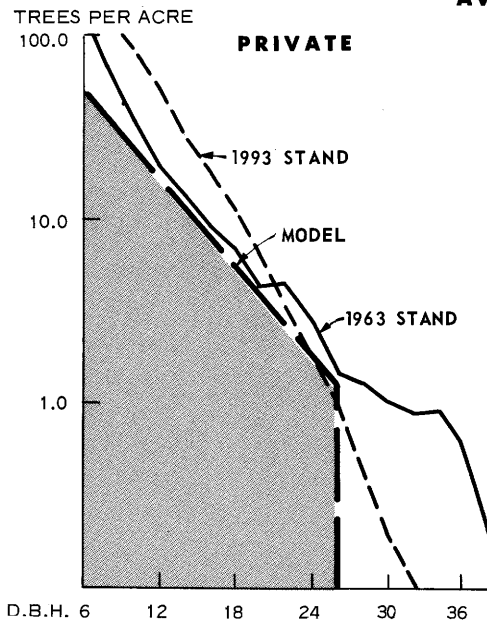
into much of the higher elevation country is a handicap to the use of these species. Road construction and an active effort to promote use of these species are needed to facilitate the management of these stands.

THE "OTHER" TYPES



STAND STRUCTURE - THE "OTHER" TYPES

AVERAGE ACRE



CONTINUATION OF PRESENT CUTTING SCHEDULE IN ALL TYPES IS NOT ENOUGH TO ACHIEVE DESIRED CONDITIONS. — The consequences of a continuation of current cutting practices on the stand structure of the forest have been discussed. Some of the results are expected to be undesirable. Principal among these is that continuation of present cutting practices fails to lead toward development of a desirable stand structure. In general, poletimber trees in all ownerships are expected to form a disproportionately large part of the stand. In some types on private lands, the heavier rate of sawtimber cutting will reduce the number of sawtimber trees to less than desirable. On public lands, the slow rate of cutting in some forest types, due to the absence of markets for the material which should be removed, is expected to result in an undesirable stand structure.

WORKING TOWARD THE FOREST MODEL

What can reasonably be done to achieve the desired stand structure and also provide the forest industry with sufficient raw material? In this section, an estimate is made of the annual harvest possible during a reasonably realistic conversion of the currently unregulated forest stands to a regulated condition. An estimate is also made of the sustained yield possible after the forests are fully regulated.¹⁰ In determining these yields, some assumptions were made concerning the forest owners' objectives and the changing availability of commercial forest land. These are discussed under the next two headings.

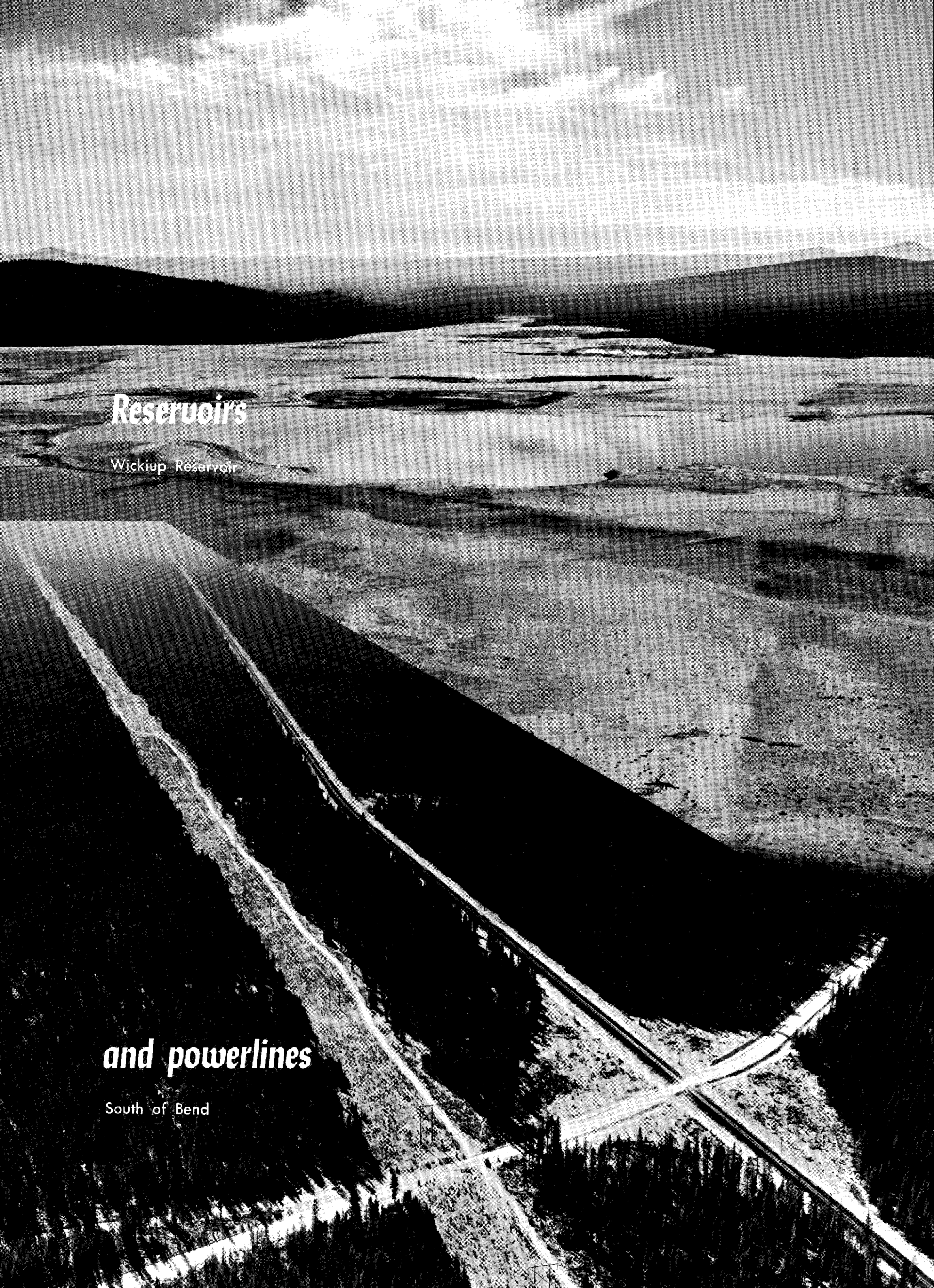
OWNERS' OBJECTIVES VARY. — Each owner, whether an individual, corporation, or a public agency, has specific objectives. Each is limited by factors such as the amount of capital he is willing or able to invest in

future yields. Some owners may have certain product objectives tailored to dependent industries. Specific owners may want to grow pulp-size material, others saw-log-size material. Some owners may have a different concept of the regulated forest than the one used here. For small owners with a limited acreage, periodic rather than annual crops of trees may be a more logical goal. For public owners a policy of even flow of high-quality timber products may have a large influence on the type of forest management. But despite the manifold opportunities for variations, the level and type of management selected here as a standard does serve in making useful estimates (1) of the interim cuts possible while converting the forests of eastern Oregon to a regulated condition and (2) of the sustained output possible once the desired stand structure has been attained.

OTHER USES OF FOREST LAND MUST BE CONSIDERED. — As the Nation feels the full impact of the expanding and increasingly affluent population, competition for the use of land will continue to increase. In the past, the principal competitor for commercial forest land has been agriculture. But from now on other nontimber uses will have an even greater influence on the acreage available for timber production.

The loss of commercial forest land to other uses has been a matter of serious concern in many areas of the West. But in eastern Oregon serious losses are not anticipated. From 1945 to 1953, extension of powerlines took an estimated 2,500 acres of commercial forest land, the building of reservoirs reduced the commercial forest land area by another 10,000 acres, and road development accounted for 2,500 acres. Continuation of this rate of loss would reduce the commercial forest land area by 19,000 acres every 10 years. However, it is unlikely that this rate will be maintained as reservoir sites become more limited, the net of transmission lines becomes more nearly developed, and road development becomes adequate to meet

¹⁰ The technical details of the projection method are given in the appendix, pages 53, 54.

An aerial, black and white photograph showing a vast, flat landscape. In the foreground, a large, dark, rectangular reservoir is visible, with a road or path running alongside it. Beyond the reservoir, the terrain is flat and open, with some small, dark patches that could be trees or shrubs. In the distance, a range of low mountains or hills is visible under a cloudy sky. The overall scene is desolate and expansive.

Reservoirs

Wickiup Reservoir

and powerlines

South of Bend



Recreation

Bachelor Butte,
Deschutes N. F.

needs. In this study, future loss of commercial forest land to these three uses was considered negligible.

Just as eastern Oregon's timber products serve the entire Nation, the beauty and uniqueness of its forest land offers recreation opportunities to the entire country. Under multiple-use management, almost all of the National Forest area is available for recreation. A total of 503,000 acres of primitive, wild, wilderness, or natural areas have been set aside on the National Forests by the Secretary of Agriculture for recreation or scientific study. In eastern Oregon these include the Eagle Cap Wilderness Area, Strawberry Mountain Wild Area, Mount Jefferson Primitive Area, Mount Washington

Wild Area, Three Sisters Wilderness Area, and several natural areas.

Studies of land-use management are being made on the Anthony Lakes, Snake River, and Sky Lakes areas to determine final classification. The decision as to their use rests on a number of factors. These include their value for recreation and timber and the needs of the Nation and local economy for these uses, as well as other multiple-use factors. In recent years decisions have been made both ways. For example, the former Mount Washington Limited Area has been declared a wild area, while the former Waldo Lake and Diamond Lake Limited Areas will have road development and multiple-use management with emphasis on recreation.

In addition to these special areas on the National Forests, there are 136,000 acres of forest land in Crater Lake National Park, 10,220 in State ownership, and 1,010 in municipal holdings devoted primarily to recreation.

Under multiple-use management, not all of the land classed as commercial forest will be used to its full capabilities for the production of timber. On the National Forests this is true of areas having a high recreation value; these areas are classed as Landscape Management Areas. They include "... areas which now receive heavy public use or which will be heavily used in the future. ... The Landscape Management Area varies in size, depending on such factors as topography, timber type, and quality of the recreational attraction — for example, a narrow strip just wide enough to provide a natural beauty along small streams. On the other hand, a primary foreground area may extend for a considerable distance back from a heavy public use area, with various graduations in modification of resource uses."¹¹ On these areas timber management practices normally applied to commercial forest land are modified to the extent necessary to provide for continuing scenic enjoyment. This consists chiefly of lengthening the rotation, employing very light cuts, and giving special attention to logging methods so as to maintain an attractive forest.

CONVERTING A PUBLIC FOREST TO A FULLY REGULATED CONDITION

Under current rates of growth and mortality, it is estimated that 145 years will be necessary to convert the public forest to the model. During this time, the annual cut is estimated at 1.5 billion board feet. This volume of cut is 77 percent more than the average annual volume that was harvested

on public lands during the 5 years from 1957 to 1961 and is 40 percent more than the total 1962 public allowable cut. However, only 75 percent of this 1.5 billion cut is directly comparable to the sizes and species included in the present allowable cut calculations of the public agencies; and this 75 percent is essentially equal to the total 1962 public allowable cut in eastern Oregon. In the year 2108, when a fully regulated condition similar to our forest model is expected to be achieved, the sustained yield could be 1.8 billion board feet a year. This volume assumes all mortality will be harvested.

To increase to these levels, the material harvested will have to be considerably different than at present. It will be necessary to harvest more of the currently less desirable species and trees of smaller diameter. The current harvest by species, the cut recommended during the conversion period, and the cut estimated from the fully regulated forest may be compared in table 4.

Table 4. — The estimated average annual sawtimber harvest on public lands by type at present, during the first 70 years of conversion and when fully regulated

Type	At present		During conversion period		Fully regulated	
	Million bd. ft.	Per-cent	Million bd. ft.	Per-cent	Million bd. ft.	Per-cent
Ponderosa pine	573	64	742	47	1,052	59
Douglas-fir, larch	223	25	328	21	248	14
Lodgepole pine	3	—	109	7	158	9
Other	99	11	407	25	321	18
Total	898	100	1,586	100	1,779	100

Although the total volume of all species cut during conversion can be greater, the greatest increase is possible in the currently little-used lodgepole pine and in the true firs, spruce, mountain hemlock, cedar, and associated species comprising the "other" types. The cut of lodgepole pine can be increased 36 times and that of "other" species 4 times.

The fully regulated forest can yield more lodgepole pine and ponderosa pine than at present or during the conversion period.

¹¹ U. S. Forest Service. Basic objectives and policy to guide multiple use management, Region 6. 33 pp., illus. 1962.

The sustained-yield cut of Douglas-fir and larch would be somewhat less than the present or the conversion cut. The sustained-yield cut of species in the "other" types can be more than the present cut but less than the conversion-period cut. Of greater interest is the proportion of the cut estimated to come from each type group. Notably, Douglas-fir and larch drop from 25 percent now to 14 percent under full regulation, and lodgepole pine increases from less than 1 percent to 9 percent of the total cut under full regulation.

The distribution of the harvest by diameter classes must also be materially different from that at present if the possible gains in harvest volume are to be realized (table 5).

Table 5 — A comparison of the diameter distribution of the present cut of sawtimber to the average estimated during the conversion of each type on public lands (in percent¹)

Type	Diameter class (in inches)			
	12-18	20-28	30-38	40+
Ponderosa pine:				
Present cut	1	16	45	38
Conversion cut	21	49	22	8
Douglas-fir, larch:				
Present cut	7	34	30	29
Conversion cut	16	51	23	10
Lodgepole pine:				
Present cut	84	16	--	--
Conversion cut	88	12	--	--
Other species:				
Present cut	7	50	39	4
Conversion cut	18	51	24	7

¹ Percentages are of total cut in each species.

At the present time, most of the timber cut is from trees 30 inches d.b.h. and larger. During the conversion period, it is estimated that most of the cut should come from smaller trees. For ponderosa pine the present 83 percent of the cut coming from trees over 30 inches d.b.h. would be reduced to 30 percent. The cut of trees less than 30 inches d.b.h. would be increased from 17 percent to 70 percent. Similarly, the cut of Douglas-fir and larch trees over 30 inches d.b.h. would decrease from 59 to 33 percent, and

for the "other" species from 43 to 31 percent. Only in lodgepole pine, where most of the trees are of small size, would the future diameter distribution of the cut be similar to that at present. When sustained yield is reached, the average size of the crop trees, with the exception of lodgepole pine, would be 26 inches d.b.h. For lodgepole pine the average size would be 16 inches d.b.h.

In addition to the board-foot volumes harvestable from sawtimber trees, an estimated 35 million cubic feet in trees 6 to 10 inches d.b.h. would be available annually during conversion. These estimated volumes of species are:

	Million cubic feet
Ponderosa pine	18
Douglas-fir, larch	5
Lodgepole pine	7
Other	5

This projection of public forests to a regulated condition presents a promising picture of the future. But to achieve these results, action must be taken. Much greater emphasis must be placed on the harvest of species not now being fully used, i.e., lodgepole pine and the species in the "other" types. Unless ways are found to utilize these species, the estimated cuts cannot be achieved. Furthermore, for each species group the potential can only be achieved if more use is made of the smaller sizes of material. At the present time only 30 percent of total annual harvest is in materials from 12 to 28 inches. This has to be increased to more than 70 percent during the conversion period if the potential harvest from the public ownerships is to be attained.

CONVERTING PRIVATE FORESTS TO A FULLY REGULATED CONDITION

The past heavy cutting on private lands in eastern Oregon has resulted in conditions differing from our fully regulated model.

The current annual cutting rate must be reduced, and the nature of the cut changed.

The average annual cut on private forest land between 1957 and 1961 was 718 million board feet. During the entire conversion period of 145 years, the cut would average 853 million board feet a year. However, for the first 30 years of the period, the cut should be lowered to an average of 597 million board feet a year.

When a fully regulated forest is achieved, the annual sustained-yield cut is estimated to be 1,064 million board feet from both live and dead trees.

The cut now, that during the first 30 years of the conversion period, and from the fully regulated forest is shown in table 6. During conversion, the volume of cut for ponderosa pine is estimated at 70 percent of the current cut; Douglas-fir and larch 63 percent. The cut of species in "other" types could increase 12 million and the cut of lodgepole pine could increase 15 million.

Table 6. — The estimated average annual sawtimber harvest on private lands by type at present, during first 30 years of conversion, and when fully regulated

Type	At present		During conversion		Fully regulated	
	Million bd. ft.	Percent	Million bd. ft.	Percent	Million bd. ft.	Percent
Ponderosa pine	479	62	337	56	785	74
Douglas-fir, larch	169	22	107	18	116	11
Lodgepole pine	3	--	18	3	45	4
Other	123	16	135	23	118	11
Total	774	100	597	100	1064	100

When the fully regulated forest is achieved, the cut of ponderosa pine can be 64 percent more than at present and the cut of lodgepole pine can increase from 3 to 45 million board feet. The estimated cut of Douglas-fir, larch, and "other" species will be less than at present.

Besides the reduction of total cut during the first part of the conversion period, it is estimated that an increasing proportion must

come from smaller diameter trees. In the following tabulation the proportion of the present cut by diameter classes is compared to the average proportion estimated during conversion:

D.b.h. (inches):	Present cut	Conversion cut
	(Percent)	(Percent)
12-18	3	25
20-28	25	52
30-38	41	20
40 and larger	31	3
Total	100	100

At the present time, almost three-quarters of the total volume of the cut on private land comes from trees 30 inches d.b.h. and larger; during conversion, this will drop to about 24 percent.

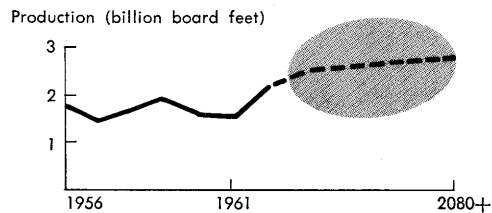
Besides the harvest of sawtimber-size trees, an additional 32 million cubic feet from trees 6 to 10 inches d.b.h. would be available annually during conversion. The estimated volumes by species are:

	Million cubic feet
Ponderosa pine	8
Douglas-fir, larch	13
Lodgepole pine	3
Other	8

ADEQUATE RAW MATERIAL AVAILABLE FOR A DIVERSIFIED INDUSTRY. — The sustained annual cut estimated for all owner-ships in eastern Oregon can be greater than the annual harvest has ever been. The estimated decrease in the private cut during the conversion period is exceeded by the increase possible from public timber.

Although the average annual cut obtainable from all lands during the entire span of the conversion period is estimated at 2,380 million board feet, the cut might reach as low as 2,175 million board feet during the early part of the conversion. Even at this low point, the annual harvest would equal the highest cut yet attained. The estimated sustainable cut of 2,840 million board feet to be reached at about the year 2108 would be about 70 percent more than the present

cut. The following graph presents actual production from 1956 to 1961 and an estimate of production during the conversion of the forests of eastern Oregon to a fully regulated condition:



A program of more intensive management plus changes in the nature of the harvest is required to achieve the high estimated sustained yield. This report assumes that the trends already underway toward intensive management can and will be accelerated.

Certain important aspects can be mentioned. Any program of sustained-yield forest production needs effective regeneration of desirable species, and this one is no exception. Economical thinning procedures must be developed soon and placed into wide use. Additional investments must be made for roads in advance of regeneration cut to facilitate thinning and timely harvest, including prompt mortality salvage.

The character of harvested trees has been described for the present cut, for the esti-

mated conversion cut, and for the projected sustained-yield cut. During the conversion, a greater proportion of the total cut must come from species other than ponderosa pine, and more of the smaller trees must be used than are being used now. These changes in the cut can be made smoothly throughout the transition period but must be started promptly if regulated conditions are to be attained in the future.

Furthermore, there must be recognition that the production potential estimated for private lands can be achieved only if the present cut from these lands is reduced in order to allow buildup of size class and growing stock.

As was pointed out at the beginning of this chapter, the increases in management intensity required to reach the desired forest conditions must concurrently provide the forest industry with its raw material. The estimated cut during the conversion and after sustained regulated yield is reached will provide lots of the same kind of wood that is now required by industry. However, it can and will also provide material not now being used. The full realization of the productive capacity of eastern Oregon's timber resources not only permits but requires that the industry become diversified in the material it uses and the products it manufactures.

Davis Lake
Deschutes N. F.

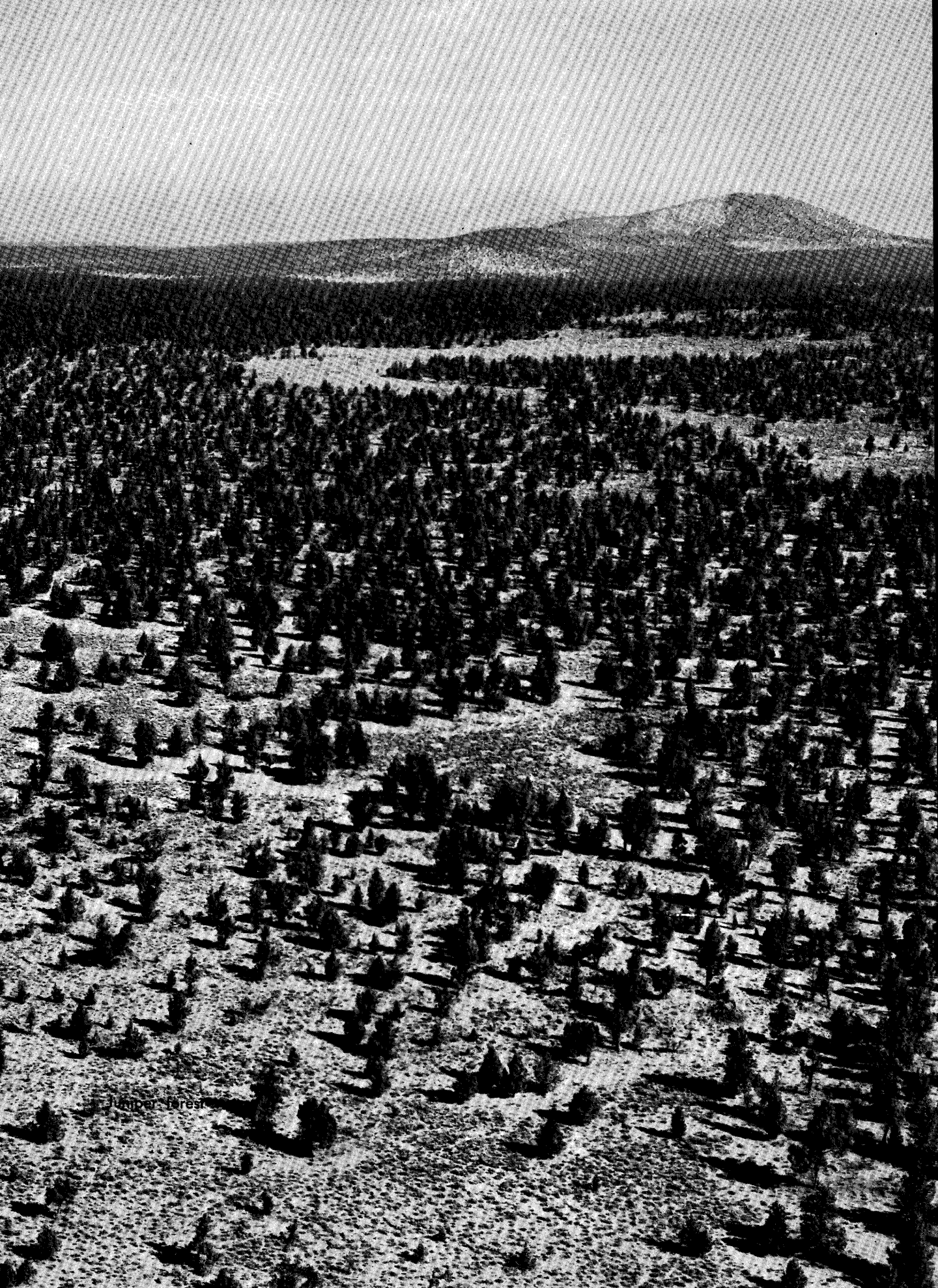




Century Drive
near Bend



Lava Burn,
Deschutes Nat.



Juniper forest

APPENDIX

TECHNICAL ASPECTS OF THE STAND PROJECTION METHOD

In order to meet the objective of this report, a projection system had to be used that would provide estimates of timber yields in sufficient detail so that future harvests could be defined by size and species. The generally accepted procedure for determining level of cut is by formula methods which are useful mainly in developing total volumes. Consequently, another technique had to be used. Since a primary consideration in the choice of method was separation of the cut into size of tree and species, a stand projection method seemed most suitable.

Basic to our needs in the stand projection method was the development of a stand representative of a regulated forest. This regulated forest, or model, provides a basis against which present conditions can be compared and toward which future management can be directed. Conditions needed to define the forest model are stand structure, level of growing stock, and average diameter of crop tree.

In developing the desired stand structure of the forest model, we noted that research by others has shown that the distribution of trees by diameter classes could be expressed in terms of the average of the ratios obtained by dividing the number of trees in each 2-inch diameter class by the number in the next larger class.

This constant ratio to express a stand structure has been the object of considerable research. The concept is one developed in the latter part of the 19th century by a French forester named DeLiocourt. Additional work has been done on it by both European and American foresters. Most notable among the American foresters has been

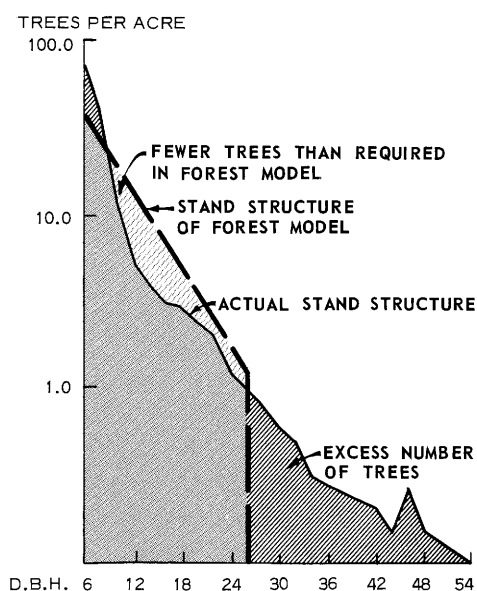
H. Arthur Meyer, who referred to this method in "Methods of Forest Growth Determination" (Pennsylvania Agricultural Experiment Station Bulletin 435, December 1942) and "The Structure and Growth of Virgin Beech-Birch-Maple-Hemlock Forests in Northern Pennsylvania" (Journal of Agricultural Research, volume 67, number 12, December 15, 1943).

The desired structure of trees in the forest model used here was based on the current Forest Survey standards in eastern Oregon. Using these, we found the recommended structure produced an average overall ratio of 1.4. That is, on the average each 2-inch diameter class should have 1.4 times more trees than the next larger diameter class.

Next, it was necessary to define the level of growing stock and average size of crop tree. Here choices were made that appeared reasonable in the light of the available information. These, as previously described in the text, are a growing-stock level of 95 square feet of basal area in trees in the 6- to 26-inch diameter classes for all species, except for lodgepole pine where the upper limit was 16 inches d.b.h.

Estimates of annual cut were made for the period required to convert the forest to a managed condition and for the sustained yield obtainable thereafter. The volume of cut during the conversion period comes from those trees that, at any time during the conversion period, will exceed the stand structure defined by the forest model. These, as shown below, occur as excessive numbers of trees within the established diameter range of the forest model or as trees larger than the diameter of the crop tree. The length of the conversion period is established by the time it takes for the trees to close the gaps between the existing stand and the forest model. In those instances where the present stand had a greater number of trees than

HYPOTHETICAL STAND STRUCTURE



desired in the forest model, a reasonable conversion harvest period was chosen in which the excess numbers of trees could be reduced to those of the model. The annual sustained-yield cut is the gross forest growth of the forest model. This was developed, using growth rates of the present forest under the assumption that all mortality would be salvaged and included in the annual cut.

SURVEY PROCEDURES AND ACCURACY OF DATA

The forest acreage and timber volume statistics in this report are based on the most recently published Forest Survey statistics adjusted to January 1, 1963. The updating procedure took into account area and volume changes occurring since the latest available field inventory.

The dates the counties were last inventoried by Forest Survey range from 1946 to

1958. Specific dates and the methods of inventory used are as follows:

County	Date of inventory	Type map with random sample plots	Systematic field plot sample
Baker	1956	x	--
Crook	1952	x	--
Deschutes	1953	x	--
Gilliam	1954	x	--
Grant	1958	x	x
Harney	1953	x	--
Jefferson	1953	x	--
Klamath	1946	¹ x	--
Lake	1947	x	--
Malheur	1956	x	--
Morrow	1954	x	--
Umatilla	1957-58	x	x
Union	1957-58	x	x
Wallowa	1957	x	x
Wasco	1954	x	--
Wheeler	1953	x	--

¹ Volume estimates obtained through a compilation of cruise data.

In Klamath and Lake Counties, new inventories have been made on the major portion of the public lands within these counties. All of the National Forests were inventoried during the period 1950-59. The volume and area statistics for that part of the Winema National Forest, formerly part of the Klamath Indian Reservation, were based on a 1956 inventory. These data were used in place of or to update the older Forest Survey inventories. These inventories were made to an accuracy comparable to Forest Survey standards.

No new inventory data were available for either private or the public ownerships other than those mentioned in the above paragraph. These were adjusted by determining the percentage change that had occurred in the same ownerships in the more recently inventoried counties in eastern Oregon and applying these changes to the same ownerships in Klamath and Lake Counties.

The statistics were adjusted to January 1, 1963, by modifying the area and volume statistics to account for major changes in ownership. The volume data were adjusted by the addition of gross growth and of depletion due to cutting and mortality.

All of eastern Oregon was reinventoried by the type map method except for Grant,

Wallowa, Union, and Umatilla Counties where the type map method was used for lands outside the National Forests and a systematic grid of field plots was used for the National Forests. All land area was classified and mapped on aerial photos, except for a part of Klamath County where photos were not available and type mapping was done directly through ground reconnaissance. Where aerial photos were used, a type map was prepared by mapping on aerial photos in the field and then transferring the delineations on the photos to a base map. The area of each map class was determined from the type map. As the type map included all the area, the area estimates had no sampling error.

In the systematic field plot sample method, a grid of ground plots was established and each was classified according to land and forest classes. The total area was proportioned into land and forest classes according to the ratio developed from the number of field plots in each class to the total number of plots. The area statistics determined in this method are subject to sampling error.

In the type map method of inventory, volume estimates were obtained through a sampling procedure in which stands were measured on sample plots located at random within given forest types. In the systematic sample, the volume estimates from the field plots were expanded to the total acreage to provide total volume estimates.

The methods of calculation of the basic data, including updating of older inventory data, precluded use of all 14 forested counties in eastern Oregon for development of sampling errors.

Thus the standard error estimates for area and volume were based on the 12 counties reinventoried by Forest Survey since 1952.

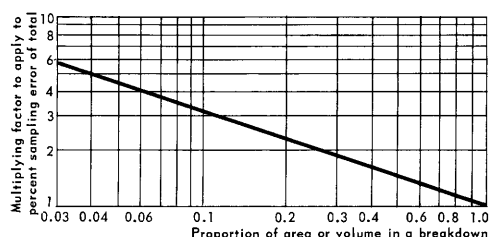
Growth estimates were based on radial growth measurements from field data taken in the 12 most recently inventoried counties. These were applied to the appropriate stand tables to develop estimates of gross growth by ownership group. Mortality ratios were obtained from these 12 counties by relating

plot mortality by ownership group to inventory volume. Mortality was subtracted from gross growth to obtain estimates of net growth. This method precluded a direct calculation of error; instead, the estimate of error was based on plot growth and mortality in six sample counties.

The standard error of timber cut was developed from a 1958 study of logging utilization in eastern Oregon.

	Estimate	Standard error	
		Units	Percent
Commercial forest land	11,531 Acres	± 21 Acres	± 0.2
Noncommercial forest land	3,349 Acres	± 1 Acres	± 0
Growing stock	25,603 MM cu. ft.	± 410 MM cu. ft.	± 1.6
Sawtimber	112,107 MM bd. ft.	± 2,354 MM bd. ft.	± 2.1
Growth	314 MM cu. ft.	± 56 MM cu. ft.	± 17.7
Timber cut	253 MM cu. ft.	± 3 MM cu. ft.	± 1.2

As the estimates of total area, volume, or cut are subdivided, the sampling errors will become larger. Thus the statistics on area by stand-size class, or by forest type, or of volume by species are less accurate than the estimates of the totals. An approximation of the sampling precisions of any specific item can be obtained from the following chart.



For example, assume that the sampling error reported for a total is ± 5 percent, and an estimate of the sampling error for an item which is only 0.25 of this total is desired. Reading from the chart, the multiplying factor for a proportion of 0.25 is 2. The estimated sampling error for the item is then 2 times ± 5 percent, the sampling error of the total, or ± 10 percent.

The information on forest industries was obtained from a 100-percent field canvass of all primary forest industries in eastern Oregon. The statistics obtained from this survey describe the industry in the year 1958.

DEFINITION OF TERMS

LAND AREA

TOTAL LAND AREA. — The area of dry land and land temporarily or partially covered by water. Includes streams less than one-eighth of a statute mile in width, and lakes, reservoirs, and ponds less than 40 acres in area.

FOREST LAND AREA. — Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use.

NONFOREST LAND AREA. — Land that does not qualify as forest land.

COMMERCIAL FOREST LAND AREA. — Forest land which is producing or capable of producing crops of industrial wood and not withdrawn from timber utilization.

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

OWNERSHIP

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

OTHER FEDERAL LANDS. — Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies.

STATE, COUNTY, AND MUNICIPAL LANDS — Lands owned by States, counties, and local public agencies, or lands leased by these governmental units for more than 50 years.

FOREST INDUSTRY LANDS. — Lands owned by companies or individuals operating wood-using plants.

FARMER-OWNED LANDS. — Lands owned by operators of farms.

MISCELLANEOUS PRIVATE LANDS. — Privately owned lands other than forest industry or farmer-owned lands.

STAND-SIZE CLASSES

SAWTIMBER STAND. — Stand at least 10 percent stocked with growing-stock trees, with sawtimber trees making up a plurality of this stocking, and having a minimum per-acre net volume of 1,500 board feet (International 1/4-inch rule).

LARGE SAWTIMBER STAND. — Stand in which the majority of the volume is in trees 21.0 inches d.b.h. and larger.

SMALL SAWTIMBER STAND. — Stand in which the majority of the volume is in trees 11.0 to 20.9 inches d.b.h.

POLETIMBER STAND. — Stand failing to meet sawtimber specifications but at least 10 percent stocked with growing-stock trees, and with poletimber trees making up a plurality of this stocking.

SAPLING AND SEEDLING STAND. — Stand failing to meet poletimber specifications but at least 10 percent stocked with growing-stock trees and with saplings and/or seedlings making up a plurality of this stocking.

NONSTOCKED AREAS. — Commercial forest land less than 10 percent stocked with growing-stock trees.

TREE CLASSES

SAWTIMBER TREES. — Trees of commercial species 11.0 inches d.b.h. and larger which contain at least one 16-foot conifer saw log or one 8-foot hardwood saw log to a variable top diameter never less than 8.0 inches inside bark. Also, 25 percent or more of the

gross board-foot volume must be free from rot or defect.

SAW-LOG PORTION. — That part of the bole of sawtimber trees between the stump and the merchantable top, that is, the point on the bole above which any specified grade of saw log cannot be obtained.

UPPER-STEM PORTION. — That part of the bole of sawtimber trees above the merchantable top to a minimum top diameter of 4.0 inches outside bark, or to the point where the central stem breaks into limbs.

POLETIMBER TREES. — Trees of commercial species 5.0 to 10.9 inches d.b.h.

SAPLING AND SEEDLING TREES. — Live trees of commercial species less than 5.0 inches d.b.h. and of good form and vigor.

GROWING-STOCK TREES. — Growing-stock trees include sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except cull trees.

CULL TREES. — Live trees of sawtimber or poletimber size that are unmerchantable for saw logs, now or prospectively, because of defect, rot, or species.

SOUND CULL TREES. — Live trees 5.0 inches and larger in diameter at breast height that do not contain a saw log now or prospectively, primarily because of roughness and poor form or species (that is, noncommercial species).

ROTTEN CULL TREES. — Live trees 5.0 inches and larger in diameter at breast height that do not contain a saw log now or prospectively, primarily because of rot.

MORTALITY TREE. — Tree which has died from natural causes and which was not a cull tree at the time of death.

SALVABLE DEAD TREES. — Standing or down dead trees of commercial species with at least 25 percent of their volume in board feet International 1/4-inch rule, free from defect or rot.

VOLUME

VOLUME OF GROWING STOCK. — Volume of sound wood in the bole of sawtimber and poletimber trees from stump to a minimum 4.0-inch top outside bark or to the point where the central stem breaks into limbs.

VOLUME OF SAWTIMBER. — Net volume of the saw-log portion of live sawtimber trees, in board feet International 1/4-inch rule.

VOLUME OF SALVABLE DEAD SAWTIMBER-SIZE TREES. — Net volume of salvable dead sawtimber-size trees, standing or down, in board feet International 1/4-inch rule.

NET ANNUAL GROWTH OF GROWING STOCK. — The annual change in volume of sound wood in live sawtimber and poletimber trees during a specified period resulting from natural causes.

ANNUAL MORTALITY OF GROWING STOCK. — The volume of sound wood in live sawtimber and poletimber trees dying annually from natural causes during a specified period.

ANNUAL MORTALITY OF SAWTIMBER. — The net board-foot volume of sawtimber trees dying annually from natural causes during a specified period.

OUTPUT OF TIMBER PRODUCTS. — The volume of timber products, including both roundwood products and byproducts of wood manufacturing plants.

ANNUAL TIMBER CUT. — The volume of sound wood in live sawtimber and poletimber trees cut for forest products during a specified period, including both roundwood products and logging residues.

ANNUAL TIMBER CUT FROM SAWTIMBER. — The net board-foot volume of live sawtimber trees cut for forest products during a specified period, including both roundwood products and logging residues.

VOLUME OF PLANT RESIDUES. — Plant residues include wood materials from primary manufacturing plants that are not utilized for some product.

MISCELLANEOUS

SITE CLASSES. — Site classes represent a classification of forest land in terms of inherent capacity to grow crops of industrial woods.

FOREST TYPES. — A classification of forest land based upon the predominant species in the present tree cover.

STOCKING. — Stocking is the extent to which growing space is effectively utilized by all trees of commercial species. "Degree of stocking" is synonymous with "percent of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Stocking may be measured in terms of number of trees, volume, basal area, cover canopy, or other criterion or combination of criteria.

WELL-STOCKED STANDS. — Stands that are 70 percent or more stocked with growing-stock trees.

MEDIUM-STOCKED STANDS. — Stands that are 40 to 70 percent stocked with growing-stock trees.

POORLY STOCKED STANDS. — Stands that are 10 to 40 percent stocked with growing-stock trees.

NONSTOCKED AREAS. — Forest land less than 10 percent stocked with growing-stock trees.

TREE SPECIES

Tree species found in eastern Oregon include:

SOFTWOODS:

Alaska-cedar (*Chamaecyparis nootkatensis*)

Douglas-fir (*Pseudotsuga menziesii*)

Engelmann spruce (*Picea engelmannii*)

Grand fir (*Abies grandis*)

Incense-cedar (*Libocedrus decurrens*)

Lodgepole pine (*Pinus contorta*)

Mountain hemlock (*Tsuga mertensiana*)

Noble fir (*Abies procera*)

Pacific silver fir (*Abies amabilis*)

Ponderosa pine (*Pinus ponderosa*)

Subalpine fir (*Abies lasiocarpa*)

Sugar pine (*Pinus lambertiana*)

Western hemlock (*Tsuga heterophylla*)

Western juniper (*Juniperus occidentalis*)

Western larch (*Larix occidentalis*)

Western redcedar (*Thuja plicata*)

Western white pine (*Pinus monticola*)

White fir (*Abies concolor*)

Whitebark pine (*Pinus albicanlis*)

HARDWOODS:

Bigleaf maple (*Acer macrophyllum*)

Black cottonwood (*Populus trichocarpa*)

Northwestern paper birch (*Betula papyrifera* var. *subcordata*)

Oregon white oak (*Quercus garryana*)

Quaking aspen (*Populus tremuloides*)

Red alder (*Alnus rubra*)

STATISTICS

Table 7. — Area by land classes in eastern Oregon, January 1, 1963
(In acres)

Land class	Area
Commercial forest	11,531,400
Unproductive forest	2,929,500
Productive-reserved forest	419,700
Total forest	14,880,600
Nonforest	27,543,800
All land	42,424,400

Table 8. — Area (in acres) of commercial forest land by ownership classes in eastern Oregon, January 1, 1963

Ownership class	Area
National Forest	7,459,800
Other Federal:	
Bureau of Land Management	250,400
Indian	345,500
Miscellaneous Federal	3,100
Total other Federal	599,000
State	38,300
County and municipal	17,100
Forest industry:	
Pulp and paper	2
Lumber	1,476,600
Total forest industry	1,476,600
Farmer-owned	1,652,100
Miscellaneous private	288,500
All ownerships	11,531,400

¹ Includes both operable and inoperable forest land.

² As there is only one company classed as a pulp and paper industry owning forest land in eastern Oregon, its commercial forest land area is included in the lumber industry statistics to avoid disclosure.

Table 10. — Area (in acres) of commercial forest land by stand volume classes for sawtimber and other stand-size classes in eastern Oregon, January 1, 1963

Stand volumes per acre ¹	Area by stand-size classes		
	All stands	Sawtimber stands	Other stands
Less than 1,500 board feet	2,608,500	--	2,608,500
1,500 to 5,000 board feet	2,592,200	2,592,200	--
More than 5,000 board feet	6,330,700	6,330,700	--
All classes	11,531,400	8,922,900	2,608,500

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

Table 9. — Area of commercial forest land by stand-size and ownership classes in eastern Oregon, January 1, 1963
(In acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:					
Old-growth ¹	5,782,600	4,169,400	360,400	660,700	592,100
Young-growth ²	3,140,300	2,008,600	145,400	314,700	671,600
Total	8,922,900	6,178,000	505,800	975,400	1,263,700
Poletimber stands	2,044,500	1,032,400	110,600	366,800	534,700
Sapling and seedling stands	365,400	155,100	20,500	88,400	101,400
Nonstocked areas	198,600	94,300	17,500	46,000	40,800
All classes	11,531,400	7,459,800	654,400	1,476,600	1,940,600

¹ Includes stands having a predominance of volume in trees 21.0 inches d.b.h. and larger.

² Includes stands having a predominance of volume in trees 11.0 to 20.9 inches d.b.h.

86 Table 11. — Land area (in acres) by cover type, ownership class, and land-use class in eastern Oregon, January 1, 1963

Cover type or land use	Total unreserved and reserved	Unreserved					Reserved								
		Total	Private	State	County	Municipal	Federal			Total	State	Municipal	Federal		
							Indian	Bureau of Land Mgt.	Bureau of Reclamation				National Forest	National Park	National Forest
PRODUCTIVE FOREST LAND															
Total		Commercial					Noncommercial (productive-reserved)								
Ponderosa pine, large sawtimber	4,572,600	4,531,000	1,052,100	7,100	2,600	300	195,600	94,000	1,000	3,178,300	41,600	3,300	300	8,800	29,200
Ponderosa pine, small sawtimber	1,494,400	1,494,900	719,400	14,900	2,400	100	31,200	28,600	--	698,300	2,500	500	100	300	1,600
Ponderosa pine, poletimber	969,700	969,400	517,500	5,100	3,100	400	20,100	30,400	--	392,800	300	100	--	--	200
Ponderosa pine, sapling and seedling	248,700	248,500	165,100	2,000	1,800	300	1,600	10,300	--	67,400	200	100	--	100	--
Lodgepole pine, large sawtimber	1,700	1,100	12,600	100	200	--	3,800	8,800	300	1,100	600	--	--	4,800	600
Lodgepole pine, small sawtimber	494,400	481,800	279,300	2,600	1,400	--	5,000	28,700	1,700	501,400	76,500	200	--	44,000	7,800
Lodgepole pine, poletimber	896,600	820,100	279,300	2,600	1,400	--	5,000	28,700	1,700	501,400	76,500	200	--	44,000	32,300
Lodgepole pine, sapling and seedling	103,800	98,900	18,900	300	100	--	500	2,500	100	76,500	4,900	--	--	3,000	1,900
Douglas-fir, large sawtimber	557,900	543,300	113,300	300	300	200	26,500	10,400	--	392,300	14,600	300	100	100	14,100
Douglas-fir, small sawtimber	422,800	408,200	129,900	800	100	1,000	22,500	7,900	--	246,000	14,600	500	100	100	14,100
Douglas-fir, poletimber	139,600	135,100	65,100	700	200	300	1,700	2,900	--	64,200	4,500	100	--	--	4,400
Douglas-fir, sapling and seedling	9,600	9,500	3,200	--	--	--	100	100	--	6,100	100	100	--	--	--
Western larch, large sawtimber	138,000	136,100	7,600	--	100	--	300	100	--	128,000	1,900	--	--	--	1,900
Western larch, small sawtimber	224,900	213,900	32,900	300	200	--	1,100	1,400	--	178,000	11,000	--	--	--	11,000
Western larch, poletimber	38,300	35,600	18,900	--	100	--	100	500	--	16,000	2,700	--	100	--	2,600
Western larch, sapling and seedling	2,800	2,600	2,000	--	--	--	--	100	--	500	200	--	--	--	200
White fir, large sawtimber	348,600	336,500	50,900	1,800	100	--	200	3,400	--	280,100	12,100	--	400	2,400	9,300
White fir, small sawtimber	243,800	239,400	77,000	400	600	--	1,600	600	--	159,200	4,400	300	--	400	4,100
White fir, poletimber	35,700	34,900	13,800	100	300	--	--	100	--	20,600	800	100	--	300	400
White fir, sapling and seedling	1,700	1,700	300	--	--	--	--	--	--	1,400	--	--	--	--	--
Western white pine, large sawtimber	31,600	29,600	100	--	--	--	--	--	--	29,500	2,000	--	--	--	2,000
Western white pine, small sawtimber	11,000	10,800	1,300	--	--	--	--	--	--	9,500	200	--	--	--	200
Western white pine, poletimber	2,700	2,700	--	--	--	--	--	--	--	2,700	--	--	--	--	--
True fir--mountain hemlock, large sawtimber	245,500	135,700	17,100	400	--	--	2,200	6,200	--	109,800	109,800	--	--	44,700	65,100
True fir--mountain hemlock, small sawtimber	269,200	193,300	2,100	100	--	--	6,700	--	--	184,400	75,900	--	--	--	75,900
True fir--mountain hemlock, poletimber	42,300	30,000	2,600	--	--	--	2,200	900	--	24,300	12,300	--	--	1,100	11,200
True fir--mountain hemlock, sapling and seedling	2,400	2,000	100	--	--	--	400	--	--	1,500	400	--	--	--	400
Engelmann spruce, large sawtimber	30,900	28,600	700	--	--	--	--	--	--	27,900	2,300	--	--	--	2,300
Engelmann spruce, small sawtimber	77,400	71,200	3,500	--	--	--	--	--	--	67,700	6,200	--	--	--	6,200
Engelmann spruce, poletimber	3,500	3,500	100	--	--	--	--	--	--	3,400	--	--	--	--	--
Engelmann spruce, sapling and seedling	100	100	100	--	--	--	--	--	--	--	--	--	--	--	--
Cedar, large sawtimber	1,500	1,500	--	--	--	--	--	--	--	1,500	--	--	--	--	--
Cedar, small sawtimber	600	600	--	--	--	--	--	--	--	600	--	--	--	--	--

Table 11. (Continued) — Land area (in acres) by cover type, ownership class, and land-use class in eastern Oregon, January 1, 1963

Cover type or land use	Unreserved						Reserved									
	Total unreserved and reserved					Federal										
		Total	Private	State	County	Municipal	Indian	Bureau of Land Mgt.	Bureau of Rec- lamation	National Forest	Total	State	Municipal	National Park	Federal	
PRODUCTIVE FOREST LAND																
	Total	Commercial										Noncommercial (productive-reserved)				
Sugar pine, large sawtimber	9,800	9,300	9,300	--	--	--	--	--	--	--	--	--	500	--	--	500
Western hemlock, large sawtimber	12,200	11,600	--	--	--	--	--	--	--	--	--	--	600	--	--	600
Western hemlock, small sawtimber	3,200	3,200	--	--	--	--	--	--	--	--	--	--	3,200	--	--	--
Western hemlock, poletimber	300	300	--	--	--	--	--	--	--	--	--	--	300	--	--	--
Western hemlock, sapling and seedling	100	100	--	--	--	--	--	--	--	--	--	--	100	--	--	--
True firs, large sawtimber	16,600	16,600	400	--	--	--	7,200	--	--	--	--	--	9,000	--	--	--
True firs, small sawtimber	13,400	13,400	100	--	--	--	8,400	--	--	--	--	--	4,900	--	--	--
True firs, poletimber	6,400	6,400	--	--	--	--	1,500	--	--	--	--	--	4,900	--	--	--
True firs, sapling and seedling	1,900	1,900	--	--	--	--	300	--	--	--	--	--	1,600	--	--	--
Hardwoods, large sawtimber	1,800	1,700	1,300	--	--	--	100	--	--	--	--	--	300	100	--	--
Hardwoods, small sawtimber	9,600	9,600	7,500	--	--	--	100	1,200	--	--	--	--	800	100	--	--
Hardwoods, poletimber	6,600	6,500	4,200	--	--	--	200	300	--	--	--	--	1,800	--	--	100
Hardwoods, sapling and seedling	100	100	100	--	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked area	201,800	198,600	86,800	1,300	800	--	3,200	12,200	--	--	--	--	94,300	3,200	--	2,300
Total	11,951,100	11,531,400	3,417,200	38,300	14,400	2,700	345,500	250,400	3,100	7,459,800	419,700	5,700	1,000	110,500	302,500	
NONCOMMERCIAL UNPRODUCTIVE FOREST LAND																
Subalpine	229,800	77,800	3,300	--	--	--	5,000	500	--	69,000	152,000	--	--	24,500	127,500	
Noncommercial, rocky	252,500	178,200	28,000	1,200	100	--	3,100	31,100	--	114,700	74,300	300	--	1,200	72,800	
Oak-madrone	46,400	46,400	38,200	100	900	--	2,800	1,900	--	2,500	--	--	--	--	--	
Juniper	2,400,800	2,396,600	1,186,200	36,800	24,600	--	81,100	898,000	4,600	165,300	4,200	4,200	--	--	--	
Total	1 2,929,500	2,699,000	1,255,700	38,000	24,800	900	92,000	931,500	4,600	351,500	230,500	4,500	--	25,700	200,300	
NONFOREST LAND																
Vegetative land (cultivated, grass, or brush)																
Nonvegetative land (barrens and cities)																
Total	127,543,800															
ALL LAND																
Forest land:																
Commercial	11,531,400	11,531,400	3,417,200	38,300	14,400	2,700	345,500	250,400	3,100	7,459,800	--	--	--	--	--	
Noncommercial (productive-reserved and unproductive)	3,349,200	2,699,000	1,255,700	38,000	24,800	900	92,000	931,500	4,600	351,500	650,200	10,200	1,000	136,200	502,800	
Total forest land	14,880,600	14,230,400	4,672,900	76,300	39,200	3,600	437,500	1,181,900	7,700	7,811,300	650,200	10,200	1,000	136,200	502,800	
Nonforest land	1 27,543,800															
Total all land	42,424,400															

1 Unclassified as to ownership.

Table 12. — Area (in acres) of commercial forest land by stocking classes of growing-stock trees and by stand-size classes in eastern Oregon, January 1, 1963

Stocking class	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
70 percent or more	6,142,600	5,110,400	895,400	136,800	--
40 to 70 percent	4,144,200	3,327,400	713,600	103,200	--
10 to 40 percent	1,046,000	485,100	435,500	125,400	--
Less than 10 percent	198,600	--	--	--	198,600
All classes	11,531,400	8,922,900	2,044,500	365,400	198,600

Table 13. — Area (in acres) of commercial forest land, by site and ownership classes in eastern Oregon, January 1, 1963

Site class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
120 cubic feet or more	176,200	59,700	24,200	35,400	56,900
85 to 120 cubic feet	1,069,500	552,000	54,300	169,800	293,400
50 to 85 cubic feet	7,388,400	4,804,100	413,600	993,800	1,176,900
Less than 50 cubic feet	2,897,300	2,044,000	162,300	277,600	413,400
All classes	11,531,400	7,459,800	654,400	1,476,600	1,940,600

Table 14. — Area (in acres) of commercial forest land by stocking classes of growing-stock trees and by ownership classes in eastern Oregon, January 1, 1963

Stocking class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
70 percent or more	6,142,600	4,312,200	361,700	554,800	913,900
40 to 70 percent	4,144,200	2,532,800	183,800	647,700	779,900
10 to 40 percent	1,046,000	520,500	91,400	228,100	206,000
Less than 10 percent	198,600	94,300	17,500	46,000	40,800
All classes	11,531,400	7,459,800	654,400	1,476,600	1,940,600

Table 15. — Area of commercial forest land by forest types and ownership classes in eastern Oregon, January 1, 1963
(In acres)

Type	All ownerships	Public ownerships	Private ownerships
Douglas-fir	1,096,100	784,600	311,500
Western hemlock	15,200	15,200	--
Ponderosa pine	7,245,900	4,791,800	2,454,100
Western white pine	52,400	41,700	10,700
Lodgepole pine	1,401,900	1,091,100	310,800
Western larch	388,200	326,800	61,400
Fir—spruce	1,115,200	946,400	168,800
Hardwoods	17,900	4,800	13,100
Nonstocked	198,600	111,800	86,800
All types	11,531,400	8,114,200	3,417,200

Table 16. — Area of noncommercial forest land by forest types in eastern Oregon, January 1, 1963
(In acres)

Type	All areas	Productive-reserved areas	Unproductive areas
Douglas-fir	33,800	33,800	--
Western hemlock	600	600	--
Ponderosa pine	44,600	44,600	--
Western white pine	2,700	2,700	--
Lodgepole pine	94,600	94,600	--
Western larch	15,800	15,800	--
Fir—spruce	224,200	224,200	--
Hardwoods	200	200	--
Nonstocked	3,200	3,200	--
Pinyon—juniper	2,400,800	--	2,400,800
Other	528,700	--	528,700
All types	3,349,200	419,700	2,929,500

Table 17. — Number (in thousands of trees) of growing-stock trees on commercial forest land by diameter classes and by softwoods and hardwoods in eastern Oregon, January 1, 1963

D.b.h. class (inches)	All species	Softwoods	Hardwoods
5.0- 6.9	431,867	429,880	1,987
7.0- 8.9	247,989	247,394	595
9.0-10.9	141,160	140,850	310
11.0-12.9	87,003	86,794	209
13.0-14.9	60,298	60,268	30
15.0-16.9	43,467	43,454	13
17.0-18.9	31,785	31,779	6
19.0-28.9	83,594	83,552	42
29.0-38.9	21,805	21,803	2
39.0 and larger	3,694	3,691	3
All classes	1,152,662	1,149,465	3,197

Table 18. — Number (in thousands of trees) of cull and salvable dead trees on commercial forest land by diameter groups and by softwoods and hardwoods in eastern Oregon, January 1, 1963

D.b.h. class (inches)	Cull trees	Salvable dead trees ¹
Softwoods:		
5.0- 6.9	10,306	--
7.0- 8.9	5,378	--
9.0-10.9	4,290	--
11.0-18.9	5,216	2,078
19.0 and larger	4,095	2,347
Total	29,285	4,425
Hardwoods:		
5.0- 6.9	420	--
7.0- 8.9	174	--
9.0-10.9	18	--
11.0-18.9	36	--
19.0 and larger	9	--
Total	657	--
All species	29,942	4,425

¹ Dead trees less than 11.0 inches d.b.h. are not included in the count of salvable dead trees.

Table 19. — Volume (in million cubic feet) of timber on commercial forest land by class of timber and by softwoods and hardwoods in eastern Oregon, January 1, 1963

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	19,603	19,594	9
Upper-stem portion	1,476	1,475	1
Total	21,079	21,069	10
Poletimber trees	4,522	4,499	23
All growing-stock trees	25,601	25,568	33
Sound cull trees:			
Sawtimber-size trees	66	55	11
Poletimber-size trees	8	7	1
Total	74	62	12
Rotten cull trees:			
Sawtimber-size trees	84	84	--
Poletimber-size trees	3	3	--
Total	87	87	--
Salvable dead trees:			
Sawtimber-size trees	278	278	--
Total, all timber	26,042	25,995	45

Table 20. — Volume of growing stock and sawtimber on commercial forest land by ownership classes and by softwoods and hardwoods in eastern Oregon, January 1, 1963

Ownership class	All species	Softwoods	Hardwoods
GROWING STOCK (Million cubic feet)			
Growing stock:			
National Forest	18,474	18,467	7
Other public	1,476	1,474	2
Forest industry	2,898	2,898	--
Farmer and misc. private	2,753	2,729	24
All ownerships	25,601	25,568	33
SAWTIMBER (Million board feet) ¹			
Sawtimber (International 1/4-inch rule):			
National Forest	93,663	93,645	18
Other public	7,472	7,457	15
Forest industry	13,860	13,860	--
Farmer and misc. private	10,477	10,415	62
All ownerships	125,472	125,377	95

¹ International 1/4-inch rule.

Table 21. — Volume of growing stock and sawtimber on commercial forest land by stand-size classes and by softwoods and hardwoods in eastern Oregon, January 1, 1963

Stand-size class	All species	Softwoods	Hardwoods
GROWING STOCK (Million board feet)			
Growing stock:			
Sawtimber stands	23,837	23,806	31
Poletimber stands	1,741	1,739	2
Sapling and seedling stands	15	15	--
Nonstocked areas	8	8	--
Total	25,601	25,568	33
SAWTIMBER (Million board feet) ¹			
Sawtimber (International 1/4-inch rule):			
Sawtimber stands	122,427	122,335	92
Poletimber stands	2,970	2,967	3
Sapling and seedling stands	50	50	--
Nonstocked areas	25	25	--
Total	125,472	125,377	95

¹ International 1/4-inch rule.

Table 22. — Volume (in millions of cubic feet) of growing stock on commercial forest land by species and diameter classes in eastern Oregon, January 1, 1963

Species	Diameter class (inches at breast height)										
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-28.9	29.0-38.9	39.0 and larger
Softwoods:											
Ponderosa pine	11,653	261	343	413	442	539	615	711	4,331	3,092	906
Douglas-fir	3,821	166	275	276	285	266	269	238	1,149	560	337
Western white pine	142	2	4	6	10	15	20	12	52	13	8
Lodgepole pine	2,000	336	468	411	308	211	132	67	66	14	33
Sugar pine	143	--	--	--	24	7	7	9	49	--	--
White fir	4,092	221	308	317	309	336	333	290	1,242	590	146
Western larch	1,146	70	92	107	90	98	100	96	357	104	32
Western redcedar	8	2	1	1	--	--	--	--	4	--	--
Western hemlock	94	1	1	3	5	10	11	12	41	8	2
Engelmann spruce	639	71	50	57	57	62	61	58	175	37	11
True firs	1,069	29	33	39	68	100	99	123	397	177	4
Other softwoods	761	36	46	53	58	56	55	44	247	128	38
Total	25,568	1,195	1,621	1,683	1,656	1,700	1,702	1,660	8,110	4,724	1,517
Hardwoods:											
Quaking aspen	5	3	1	1	--	--	--	--	--	--	--
Black cottonwood	20	9	1	1	4	--	--	--	4	--	1
Red alder	2	2	--	--	--	--	--	--	--	--	--
Oregon white oak	1	1	--	--	--	--	--	--	--	--	--
Other hardwoods	5	2	1	1	1	--	--	--	--	--	--
Total	33	17	3	3	5	--	--	--	4	--	1
All species	25,601	1,212	1,624	1,686	1,661	1,700	1,702	1,660	8,114	4,724	1,518

Table 23. — Volume (in millions of board feet) of sawtimber on commercial forest land by species and diameter classes in eastern Oregon, January 1, 1963 (International 1/4-inch rule)

Species	Diameter class (inches at breast height)							
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-28.9	29.0-38.9	39.0 and larger
Softwoods:								
Ponderosa pine	69,509	2,197	2,709	3,290	4,066	28,149	22,275	6,823
Douglas-fir	17,049	949	1,107	1,257	1,203	6,574	3,592	2,367
Western white pine	824	48	70	116	79	350	96	65
Lodgepole pine	4,023	1,398	1,095	738	389	399	4	--
Sugar pine	567	5	2	5	8	123	67	357
White fir	16,618	1,125	1,474	1,656	1,493	6,871	3,230	769
Western larch	5,789	372	479	557	588	2,602	893	298
Western redcedar	24	--	--	--	--	24	--	--
Western hemlock	330	11	20	34	47	174	32	12
Engelmann spruce	2,942	258	317	375	372	1,265	279	76
True firs	4,058	306	388	370	298	1,635	788	273
Other softwoods	3,644	66	195	188	420	1,518	1,203	54
Total	125,377	6,735	7,856	8,586	8,963	49,684	32,459	11,094
Hardwoods:								
Quaking aspen	4	4	--	--	--	--	--	--
Black cottonwood	84	18	3	1	--	51	--	11
Other hardwoods	7	2	--	2	--	--	2	1
Total	95	24	3	3	--	51	2	12
All species	125,472	6,759	7,859	8,589	8,963	49,735	32,461	11,106

Table 24. — Volume (in millions of board feet) of sawtimber on commercial forest land by species and quality classes in eastern Oregon, January 1, 1963 (International 1/4-inch rule)¹

Species	Quality classes						
	All classes	1	2	3	4	5	6
Softwoods:							
Ponderosa pine	69,509	2,829	2,736	8,432	2,961	48,633	3,918
Douglas-fir	17,049	154	955	9,155	6,785	--	--
True firs	20,676	--	352	12,199	8,125	--	--
Western larch	5,789	440	1,066	2,639	1,644	--	--
Total	113,023	3,423	5,109	32,425	19,515	48,633	3,918
Hardwoods							
	--	--	--	--	--	--	--
All species	113,023	3,423	5,109	32,425	19,515	48,633	3,918

¹ Currently only log grades are available for the species shown. For ponderosa pine the log grades used are national forest, Region 6 log grades for ponderosa pine and June 1958 Log Grades for Associated Species for other species shown.

Table 25. — Volume (in millions of board feet) of salvable dead sawtimber-size trees on commercial forest land by softwoods and hardwoods in eastern Oregon, January 1, 1963 (International 1/4-inch rule)

Species group	Volume
Softwoods	1,551
Hardwoods	--
All species	1,551

Table 26. — Net annual growth and annual cut (in millions of cubic feet) of growing stock on commercial forest land by species in eastern Oregon, 1962¹

Species	Net annual growth	Annual timber cut
Softwoods:		
Douglas-fir	46	56
Ponderosa pine	93	169
Western white pine	2	1
Western hemlock	1	--
Engelmann spruce	9	1
True firs	72	29
Other softwoods	55	13
Total	278	269
Hardwoods	1	--
All species	279	269

¹ Trend level estimates.

Table 27. — Net annual growth and annual cut (in millions of cubic feet) of growing stock on commercial forest land by ownership classes and by softwoods and hardwoods in eastern Oregon, 1962¹

Species groups	All owner-ships	National Forest	Other public	Forest industry	Farmer and misc. private
Net annual growth:					
Softwoods	278	149	7	53	69
Hardwoods	1	--	--	--	1
All species	279	149	7	53	70
Annual timber cut:					
Softwoods	269	156	14	68	31
Hardwoods	--	--	--	--	--
All species	269	156	14	68	31

¹ Trend level estimates.

Table 28. — Net annual growth and cut (in millions of board feet) of sawtimber on commercial forest land by species in eastern Oregon, 1962 (International 1/4-inch rule)¹

Species	Sawtimber	
	Net annual growth	Annual timber cut
Softwoods:		
Douglas-fir	150	334
Ponderosa pine	363	1,018
Western white pine	4	4
Western hemlock	4	--
Engelmann spruce	34	5
True firs	239	174
Other softwoods	159	80
Total	953	1,615
Hardwoods	2	--
All species	955	1,615

¹ Trend level estimates.

Table 29. — Net annual growth and cut (in millions of board feet) of sawtimber on commercial forest land by ownership classes and by softwoods and hardwoods in eastern Oregon, 1962 (International 1/4-inch rule)¹

Species groups	All owner-ships	National Forest	Other public	Forest industry	Farmer and misc. private
Net annual growth:					
Softwoods	953	455	22	219	257
Hardwoods	2	--	--	--	2
All species	955	455	22	219	259
Annual timber cut:					
Softwoods	1,615	938	81	408	188
Hardwoods	--	--	--	--	--
All species	1,615	938	81	408	188

¹ Trend level estimates.

Table 30. — Annual mortality of growing stock and sawtimber on commercial forest land by species in eastern Oregon, 1962¹

Species	Growing stock	Sawtimber ²
	Million cu. ft.	Million bd. ft.
Softwoods:		
Douglas-fir	60	323
Ponderosa pine	108	595
Western white pine	2	6
Western hemlock	1	3
Engelmann spruce	2	5
True firs	29	124
Other softwoods	59	203
Total	261	1,259
Hardwoods	--	1
All species	261	1,260

¹ Trend level estimates.

² International 1/4-inch rule.

Table 31. — Annual mortality of growing stock and sawtimber on commercial forest land by ownership classes and by softwoods and hardwoods in eastern Oregon, 1962¹

Ownership	Growing stock			Sawtimber ²		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
National Forest lands	195	195	--	965	965	--
Other public lands	18	18	--	90	90	--
Forest industry lands	24	24	--	110	110	--
Farmer & miscellaneous private lands	24	24	--	95	94	1
All ownerships	261	261	--	1,260	1,259	1

¹ Trend level estimates.

² International 1/4-inch rule.

Table 32. — Annual mortality of growing stock and sawtimber on commercial forest land by causes, and by softwoods and hardwoods in eastern Oregon, 1962¹

Cause of death	Growing stock			Sawtimber ²		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Fire	5	5	--	23	23	--
Insects	126	126	--	610	610	--
Disease	23	23	--	111	111	--
Other	72	72	--	346	346	--
Unknown	35	35	--	170	169	1
All causes	261	261	--	1,260	1,259	1

¹ Trend level estimates.

² International 1/4-inch rule.

Table 33. — Total output of timber products by products, by type of material used, and by softwoods and hardwoods in eastern Oregon, 1958

Product and species group	Total output in standard units		Output from roundwood		Output from plant byproducts (standard units)
	Unit	Number	Standard units	M cubic feet	
Saw logs:					
Softwoods	M bd. ft. ¹	1,617,568	1,617,568	272,384	40
Hardwoods	M bd. ft. ¹	--	--	--	--
Total	M bd. ft. ¹	1,617,568	1,617,568	272,384	40
Veneer logs and bolts:					
Softwoods	M bd. ft. ¹	36,760	36,760	6,093	--
Hardwoods	M bd. ft. ¹	--	--	--	--
Total	M bd. ft. ¹	36,760	36,760	6,093	--
Pulpwood:					
Softwoods	Std. cords ²	105,725	3,724	309	102,001
Hardwoods	Std. cords ²	--	--	--	--
Total	Std. cords ²	105,725	3,724	309	102,001
Poles:					
Softwoods	M pieces	9	9	189	--
Hardwoods	M pieces	--	--	--	--
Total	M pieces	9	9	189	--
Posts (round and split):					
Softwoods	M pieces	2,000	2,000	1,701	--
Hardwoods	M pieces	--	--	--	--
Total	M pieces	2,000	2,000	1,701	--
Fuelwood:					
Softwoods	Std. cords	546,280	19,795	1,643	526,485
Hardwoods	Std. cords	--	--	--	--
Total	Std. cords	546,280	19,795	1,643	526,485

¹ International 1/4-inch rule.

² Rough-wood basis (for example, chips converted to equivalent standard cords).

Table 34. — Total output (in thousands of cubic feet) of roundwood products by source, and by softwoods and hardwoods in eastern Oregon, 1958

Source	All species	Soft-woods	Hard-woods
Growing-stock trees: ¹			
Sawtimber trees	274,025	274,025	--
Poletimber trees	1,020	1,020	--
Total	275,045	275,045	--
Cull trees ¹	821	821	--
Salvable dead trees ¹	3,931	3,931	--
Other sources ²	2,522	2,522	--
All sources	282,319	282,319	--

¹ On commercial forest land.

² Includes noncommercial forest land, nonforest land such as fence rows, trees less than 5.0 inches in diameter, and treetops and limbs.

Table 35. — Annual timber cut from growing stock (in thousands of cubic feet) on commercial forest lands by products and logging residues, and by softwoods and hardwoods in eastern Oregon, 1958

Products and residues	All species	Soft-woods	Hard-woods
Roundwood products:			
Saw logs	268,120	268,120	--
Veneer logs and bolts	6,093	6,093	--
Pulpwood	309	309	--
Poles	189	189	--
Posts	170	170	--
Fuelwood	164	164	--
All products	275,045	275,045	--
Logging residues	15,953	15,953	--
Timber cut	290,998	290,998	--

Table 36. — Annual timber cut from live sawtimber (in thousands of board feet, International 1/4-inch rule) on commercial forest lands by products and logging residues, and by softwoods and hardwoods in eastern Oregon, 1958

Products and residues	All species	Soft-woods	Hard-woods
Roundwood products:			
Saw logs	1,601,556	1,601,556	--
Veneer logs and bolts	36,396	36,396	--
Pulpwood	162	162	--
Fuelwood	98	98	--
All products	1,638,212	1,638,212	--
Logging residues	17,226	17,226	--
Timber cut	1,655,438	1,655,438	--

Table 37. — Volume of plant residues (in thousands of cubic feet) by industrial source and type of residue, and by softwoods and hardwoods in eastern Oregon, 1958

Industrial source	Species and character of residues ¹								
	All species			Softwoods			Hardwoods		
	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine
Lumber industry	32,903	16,160	16,743	32,903	16,160	16,743	--	--	--
Veneer and plywood industry	813	813	--	813	813	--	--	--	--
All industries	33,716	16,973	16,743	33,716	16,973	16,743	--	--	--

¹ Coarse — unused material suitable for chipping, such as slabs, edgings, and veneer cores; fine — unused material not suitable for chipping, such as sawdust and shavings.

Table 38. — Timber growth projections in eastern Oregon, 1963-91¹

Timber and period	Assumed cut			Projected growth		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Growing stock:						
1963	268	268	--	268	268	--
1971	270	269	1	320	319	1
1981	286	285	1	369	368	1
1991	303	302	1	412	411	1
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Sawtimber (International 1/4-inch rule):						
1963	1,615	1,615	--	955	953	2
1971	1,767	1,765	2	1,174	1,172	2
1981	1,816	1,814	2	1,463	1,461	2
1991	1,866	1,864	2	1,755	1,753	2

¹ Based on assumptions that the allowable cut on public lands will be harvested, that the cut on private lands will gradually be increased, and that forestry progress will continue at the rate indicated by recent trends.

Table 39. — Production and disposition (in thousands of tons, dry weight) of sawmill residue by capacity class of mill in eastern Oregon, 1958

Residue and disposition	Eight-hour-capacity class			
	120+ M b.m.	80-119 M b.m.	40-79 M b.m.	0-39 M b.m.
Coarse residue:				
Pulp	62	20	23	--
Small items	20	--	3	--
Fuel	68	43	69	--
Unused	6	84	115	20
Total	156	147	210	20
Fine residue:				
Fuel	109	53	102	--
Unused	15	67	67	17
Total	124	120	169	17
Shavings:				
Agricultural and misc. uses	13	--	--	1
Fuel	31	49	47	--
Unused	6	10	14	5
Total	50	59	61	6
Bark	125	131	179	19

Table 40. — Production (in millions of board feet, International 1/4-inch rule) of logs in eastern Oregon, 1952-62¹

Year	Logs produced	Year	Logs produced
1925	1,045	1944	²
1926	1,059	1945	1,168
1927	826	1946	1,369
1928	986	1947	1,382
1929	1,162	1948	1,300
1930	947	1949	1,006
1931	738	1950	1,184
1932	429	1951	1,409
1933	690	1952	1,241
1934	673	1953	1,356
1935	1,108	1954	1,552
1936	1,324	1955	1,644
1937	1,448	1956	1,771
1938	1,121	1957	1,490
1939	1,610	1958	1,635
1940	1,614	1959	1,878
1941	1,745	1960	1,589
1942	1,848	1961	1,521
1943	1,627	1962	1,602

¹ Source: Timber Harvest by Ownership in State of Oregon, prepared by Division of Forest Economics Research, Pacific Northwest Forest & Range Experiment Station, Forest Service, U. S. Department of Agriculture, Portland, Oregon.

² Not available.

Table 41. — Source of logs (in millions of board feet, International 1/4-inch rule) consumed by forest industries in eastern Oregon, 1958

Industry	Eastern Oregon	Western Oregon	California	Washington	Idaho	Total
Stationary sawmills:						
120+ M b.m.	439	10	6	--	--	455
80-119 M b.m.	470	1	10	17	2	500
40-79 M b.m.	638	--	39	1	--	678
0-39 M b.m.	66	1	--	1	--	68
Total	1,613	12	55	19	2	1,701
Portable sawmills	11	--	--	--	--	11
Veneer, fiberboard and misc. plants	39	5	2	--	--	46
All industries	1,663	17	57	19	2	1,758

Table 42. — Ownership (in millions of board feet, International 1/4-inch rule) of logs from eastern Oregon consumed by its forest industries, 1958

Industry	Private			Public	Total
	In- dustry	Other	Total		
Stationary sawmills:					
120+ M b.m.	190	7	197	242	439
80-119 M b.m.	112	132	244	226	470
40-79 M b.m.	150	138	288	350	638
0-39 M b.m.	1	51	52	14	66
Total	453	328	781	832	1,613
Portable sawmills	3	6	9	2	11
Veneer, fiberboard and misc. plants	--	--	--	39	39
All industries	456	334	790	873	1,663

Table 43. — Number of sawmills by capacity class of mill, and production by degree of manufacture in eastern Oregon, 1958¹

Eight-hour capacity class	Sawmills	Volume ² of lumber by degree of manufacture				
		Rough green	Surface green	Rough dry	Surface dry	Total
	Number	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Stationary mills:						
120+ M b.m.	6	14	1	5	451	471
80-119 M b.m.	17	32	34	6	446	518
40-79 M b.m.	38	77	44	85	467	673
0-39 M b.m.	17	19	32	--	15	66
Total	78	142	111	96	1,379	1,728
Portable mills	11	11	--	--	--	11
All mills	89	153	111	96	1,379	1,739

¹ Includes 103 MM b.m. of purchased lumber receiving additional manufacturing.

² Lumber tally.

Table 44. — Availability of industrial water of 20-30 cfs (cubic feet per second) in the Deschutes River Basin

Years	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean monthly	Notes
Deschutes River at Benham Falls (1906-14, 24-58)														
1918-58	1,260	1,050	1,060	1,050	1,110	1,170	1,350	1,630	1,710	1,790	1,710	1,510	1,370	1
Deschutes River below Bend (1915-58)														
1918-58	412	790	913	938	964	982	595	322	283	170	185	266	566	2
Deschutes River at Cline Falls (1910-13, 28-46)														
1918-58	412	823	971	1,015	1,043	1,046	649	353	309	173	183	266	601	2
Deschutes River near Culver (1952-58)														
1918-58	844	1,300	1,540	1,500	1,520	1,500	1,110	844	835	636	600	687	1,080	3
Deschutes River near Madras (1924-58)														
1918-58	3,820	4,320	4,640	4,860	5,210	5,510	5,630	4,570	4,200	3,770	3,610	3,680	4,480	3, 4
Deschutes River at Moody, near Biggs (1897-99, 1906-58)														
1918-58	4,360	4,940	5,890	6,330	6,940	6,980	7,360	6,290	5,360	4,410	4,150	4,170	5,590	3, 4
Crooked River above Hoffman Dam (1909-14, 41-58)														
1918-58	25	57	140	173	409	740	1,200	422	106	23	8	11	274	5
Crooked River near Culver (1918-58)														
1918-58	1,270	1,310	1,400	1,460	1,740	2,090	2,570	1,730	1,360	1,230	1,220	1,250	1,550	6
Lake Creek near Sisters (1911-58)														
1918-58	32	40	57	62	59	53	63	82	69	39	32	30	51	7
Metolius River near Grandview (1912-14, 22-58)														
1922-58	1,330	1,380	1,450	1,480	1,500	1,490	1,530	1,610	1,620	1,500	1,400	1,350	1,470	8
Shitike Creek at Warm Springs (1911-17, 23-58)														
1918-58	69	99	125	123	146	130	139	167	156	101	58	55	113	9
Warm Springs River near Warm Springs (1911-19)														
1918-58	283	323	528	551	691	631	686	738	487	280	236	222	461	9
White River below Tygh Valley (1918-58)														
1918-58	157	277	502	566	616	565	752	828	497	208	138	130	435	10

Notes

Flows are average monthly discharges in cfs and are shown only for streams where gaging records exist and where 20 to 30 cfs of water for industrial use is available. Figures in parentheses indicate years of actual gaging records, figures in first column indicate years for which monthly average discharges were computed. This includes correlated values in several instances.

¹ The Deschutes River and its tributaries above Bend are fully appropriated for irrigation.

² All new water rights are subject to maintaining a minimum conservation flow of 50 cfs to 17 cfs consumptive water rights and a power right for 90 cfs of the Cline Falls power plant downstream. Monthly flows have been lower than 50 cfs several times in past years.

³ Flows below river mile 120.0 withdrawn from industrial use by Oregon State Water Resources Board.

⁴ Monthly flow pattern different since 1958 due to regulation by Pelton Dam.

⁵ Industrial water available from unassigned space of Prineville Reservoir, average annual unassigned yield = 46,200 acre-feet. Monthly flow pattern will change after completion of Prineville Dam.

⁶ Availability of industrial water dependent mainly on power rights of 1,275 cfs of Cove power plant. Flows below river mile 6.5 withdrawn from industrial use by Oregon State Water Resources Board. About 1,000 cfs of flows shown originate from springs below river mile 18.

⁷ Availability of industrial water subject to 8 cfs consumptive and 6 cfs nonconsumptive water rights. Monthly flows have been below 20 cfs several times in past years.

⁸ Flows below river mile 13.0 withdrawn from industrial use by Oregon State Water Resources Board. Sufficient industrial water available on main stem.

⁹ Present water use in Warm Springs Indian Reservation not investigated.

¹⁰ Availability of industrial water subject to 232 cfs consumptive water rights in the whole watershed and to a power right for 250 cfs of the Tygh Valley power plant.

Source: This table was furnished by the Oregon State Water Resource Board, Salem, Oreg., for use in this report.



