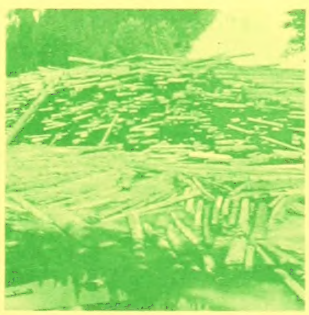
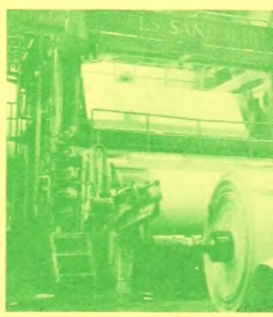
U.S. Forest Service Resource Bulletin INT-1

FOREST RESOURCES OF WESTERN MONTANA





INTERMOUNTAIN FOREST & RANGE
EXPERIMENT STATION
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE
OGDEN, UTAH
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The survey of Western Montana was conducted as part of the continuing nationwide Forest Survey. Work started in 1953 under the Northern Rocky Mountain Forest Experiment Station, Missoula, Montana. Fieldwork was completed in 1958 under the Intermountain Station after consolidation of the two Stations.

The Northern Region of the U.S. Forest Service assisted in fieldwork and compilation.

1963

THE FOREST RESOURCE OF WESTERN MONTANA

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WESTERN MONTANA IS THAT PORTION OF THE STATE DRAINING TO THE PACIFIC OCEAN: THAT IS, THE AREA WEST OF THE CONTINENTAL DIVIDE. IT INCLUDES ALL OR PART OF THE FOLLOWING COUNTIES: DEERLODGE, FLATHEAD, GRANITE, LAKE, LEWIS AND CLARK, LINCOLN, MINERAL, MISSOULA, POWELL, RAVALLI, SANDERS, AND SILVER BOW.

FOREWORD

In 1925 the sawtimber volume in Western Montana was estimated to be about 37.5 billion board feet (*2*).[1] Forest Survey compilations in 1949 (*4*) based on field surveys prior to World War II raised the estimates to 39.7 billion. The most recent estimates, given in this report, show a present sawtimber volume of 73.5 billion board feet.

Startling though this difference is, it will not surprise anyone who has followed the history of timber utilization and inventory practices in this country. Inventories have been geared largely to obtaining estimates of currently merchantable timber, rather than the total stand. Also, timber cruisers through the years have traditionally been cautious souls. They have found it more acceptable practice to underestimate rather than risk an overestimate. These two factors — rapidly changing utilization and conservative estimates — have generally resulted in rapid obsolescence of inventory estimates.

The trend toward more intensive utilization during the period between old and new surveys is exemplified in Western Montana. Since World War II, the stumpage value of all species has risen. As a result, 1.5 million acres are today included as commercial that previously had been classified as noncommercial. This increase has been accompanied by a reduction of 1 million acres in nonstocked and seedling and sapling area and an increase of about 2.6 million acres of sawtimber. A substantial area within the 1910 burn has reached pole size, and about an equal area of the 1942 poletimber has become sawtimber.

Changes in the economic importance of species and closer utilization with respect to tree size have both contributed to higher current estimates. Prior to World War II, timber utilization rested heavily on white pine and ponderosa pine. Other species were far less valuable. As a consequence, even the early estimates of white pine volume were very realistic and those of ponderosa pine were not much in error. In contrast, the inventory of other species was at best very rough. Today there are 61 billion board feet of Douglas-fir, western larch, Engelmann spruce, lodgepole pine, and the minor species. This amounts to more than twice the volume of these species reported earlier.

Improved inventory techniques have been another major development. Estimates from earlier surveys were based largely on the compilation of public and private cruises, which varied greatly in objectives and standards. Although Forest Survey made check cruises to adjust estimates to a common standard, the total result could not be statistically evaluated for reliability. Estimates presented in this report are based on greatly improved sampling procedures that reduce the risk of bias.

Timber inventory procedures are constantly being improved. Although it is now possible with the sampling system used in Western Montana to estimate volumes within prescribed rates of accuracy, the need today is for additional information that describes management needs and opportunities. Currently this Experiment Station is giving much attention to the development of inventory systems that will do this.

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[1] Italicized numbers in parentheses indicate numbered references on page 17. International ¼-inch log rule is used throughout this report unless otherwise stated.

THE FOREST

Western Montana is a green country. Its many mountains are almost completely covered with coniferous timber. In fact, 80 percent of the 16.0 million acres west of the Continental Divide is classified as forest. However, the importance of the trees goes beyond the fact that they are almost everywhere. Along with the forest of northern Idaho this is some of the best timberland in the Rocky Mountains — best from the standpoint of volume yields, timber quality, and operability.

The 10.5 million acres of commercial timberland in Western Montana grow a dozen important species of trees. Here is the largest single block of western larch in the United States (about 51 percent of the national area). Ponderosa pine, inland Douglas-fir, western white pine, and spruce have also been important sources of industrial wood.

Lumbermen moved into this country late in the last century. Sawmills, plywood, pole, paper, and other wood-using industries today provide the principal employment in this part of the State and the principal manufacturing employment for the whole State.

Despite all the timber cutting that has taken place, most of the commercial forest still contains sawtimber stands. Two out of three acres are in the sawtimber category today; that is, they contain more than 1,500 board feet per acre in sawtimber trees.

Ponderosa pine stands attracted eastern lumbermen to Montana in the first place and since then have borne the brunt of the logging. However, three other types today exceed the ponderosa pine type in area: Douglas-fir, lodgepole pine, and larch. There is reason to presume that ponderosa pine may at one time have been the principal type. Much of the logged-over ponderosa pine area is now dominated by other species, mainly Douglas-fir.

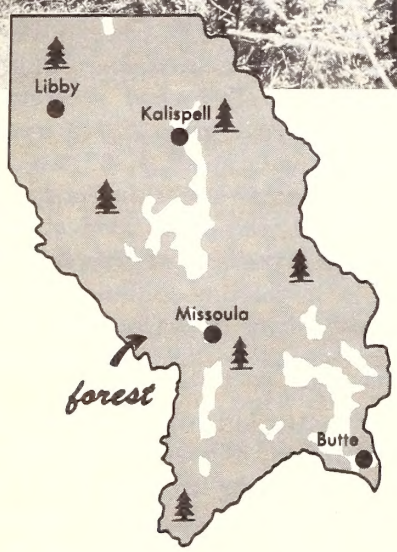
The commercial forest

	Million acres
Douglas-fir	2.8
Lodgepole pine	2.8
Larch	1.9
Ponderosa pine	1.7
Other types	1.3
Total	10.5

Western Montana has had a turbulent fire history. The years 1910, 1919, and 1926 stand out because of the extensive areas burned. Nevertheless, only 2 percent of the commercial forest is nonstocked. Natural restocking on most areas has been rapid. Larch and lodgepole pine have been particularly aggressive in reseeding burned areas.

Actually, the big problem in Western Montana has been too many rather than too few trees in the younger stands. Approximately 52 percent of the seedling-sapling, and pole stands are classed as "well stocked." Much of this area is really overstocked. The problem is most significant in the lodgepole pine, larch, and Douglas-fir types, which have about 95 percent of the well-stocked seedling-sapling, and pole stands in Western Montana. For these types, well-stocked seedling and sapling stands average about 3,700 trees per acre and pole stands about 1,360 trees. For sawtimber production, a stocking of not more than about 1,000 well-distributed stems per acre is desirable in seedling-sapling stands and fewer than 500 in poletimber stands. Thinning is urgently needed in the large area of overstocked stands which will still respond to treatment.

Although restocking of cutover areas has usually been prompt, the species, quality, and vigor of the restocking trees in many areas leave something to be desired. Therefore, better stand regeneration also appears to be a high priority management job in Western Montana. Management problems in this locality have been discussed in several recent reports (*3*, *5*, *7*).

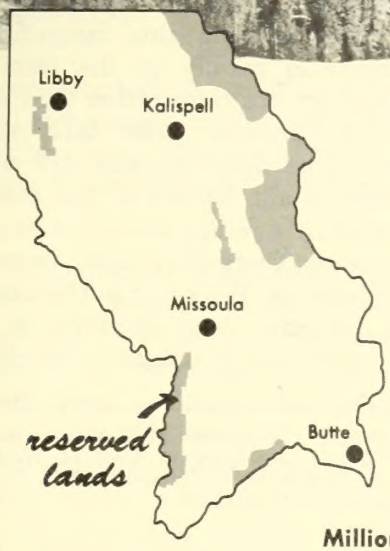


PHOTOS: U.S.F.S.

Commercial forest of ponderosa pine in Kootenai National Forest. Almost two-thirds of Western Montana is covered by commercial forest. Trees are not confined to the higher mountain slopes as they are in eastern Montana and the Rockies to the south but extend down to and sometimes cover the valley floor.

	Million acres
Total land	**16.0**
Total forest	**12.7**
Commercial forest	**10.5**

PHOTOS: U.S.F.S.



	Million acres
Reserved-productive	0.9
Reserved-unproductive	.8
Unreserved-unproductive	.6
Total, noncommercial	2.3

Noncommercial forest such as this area on Kootenai National Forest constitutes about 18 percent of the forest area of Western Montana. This area is so classified because it is either nonproductive forest (mostly at the upper elevations) or is reserved from timber cutting, or both. The important reserved areas in Western Montana are Glacier National Park, Bob Marshall Wilderness, Selway Bitterroot Wilderness, Anaconda Pintlar Wilderness, Cabinet Mountain Wild Area, and Mission Mountain Wild Area. Watershed protection and recreation use rather than timber production are paramount in these areas.

Four and one-quarter million acres of old growth constitute another management problem. This timber, which occupies about 40 percent of the commercial forest area, is largely beyond rotation age — much of it more than 140 years old. Growth rates are low, and in many areas mortality is greater than growth. Some of this old growth is considered "high risk." That is, it is likely to be seriously decimated if not harvested within the next several decades.

These overage stands are very vulnerable to insects and disease. Large-scale insect infestations and disease epidemics can rapidly devastate extensive areas. The death of nearly 1.6 billion board feet[2] of spruce in Western Montana between 1952 and 1957 illustrates this danger. Although roughly half of this volume was salvaged by the end of 1957, this was done only at the expense of efficient sustained-yield management of the entire forest.

Dwarfmistletoe, though less dramatic than the spruce bark beetle, may be even more serious in its long-term impact on productivity. The toll from this insignificant looking parasite is mainly in the form of greatly reduced growth rates rather than outright mortality. Infected trees take much longer to reach merchantable size and some never get there at all. Extent of this growth loss is indicated by a recent survey[3] of mistletoe infection in the Clark Fork River drainage (about two-thirds of Western Montana). Within this drainage, about one-third of the commercial forest area is infected. Incidence

[2]Estimate does not include losses on reserved lands.

[3]Graham, Donald P., Dwarfmistletoe surveys in the Clark Fork Timber Development Unit of Western Montana. U.S. Forest Serv., Intermountain Forest and Range Expt. Sta. In process.

A stand of lodgepole pine severely infested with dwarfmistletoe. Growth has been greatly retarded for many years and trees are finally dying. Photo: R. B. Herrington.

Logging in an area infested by spruce bark beetle on Lolo National Forest. Besides salvaging beetle-killed timber, this operation removed live infested trees as a control measure. Photo: U.S.F.S.

is especially high in the Douglas-fir, lodgepole pine, and western larch types. For the Clark Fork area alone, the annual loss in sawtimber growth is estimated as 70 to 80 million board feet.

Management is severely handicapped by an entirely inadequate road system. Although annual timber production goals are being met, much of the production is coming from the wrong places. Great areas of overmature timber with high mortality rates and consequent economic losses cannot be reached at present, and as a result many stands of lower priority are being logged. Similarly, many younger stands having high priority for cultural work cannot be reached.

Management problems, like those described above, can and will be brought under control. Improvement, however, will not be rapid. Markets must be developed, much more road construction is necessary, more silvicultural research is necessary, logging techniques for use on steep and unstable terrain must be developed, and finally a forward-looking program of thinning, pruning, and stand rehabilitation must be instituted.

Of the many products of Western Montana's forests, water may eventually provide the most far-reaching benefits. The water supply will be particularly significant for hydroelectric and irrigation development of downstream areas outside Western Montana. The Clark Fork and Kootenai river systems are principal headwaters of the Columbia River. The area has many full flowing streams such as the Blackfoot, Clark Fork, Flathead, Kootenai, and Thompson Rivers, that are significant both as a water supply and a recreational resource. Likewise, Flathead Lake and numerous smaller lakes scattered throughout the commercial and noncommercial forest are valuable from both standpoints. Practically all of this water falls on forest land.

Photos: U.S.F.S.

Photos on this page illustrate some of the attributes of Western Montana as an important national playground. Here are broad expanses of public land, beautiful and fishable lakes and streams, outstanding scenery, and fine hunting. Except for seashore, Western Montana offers a full range of outdoor environment from the very wild to the more or less domesticated.

The photo of boating and water skiing on Seeley Lake illustrates the rapidly increasing importance of recreation among the multiple uses of forests and waterways.

The photo on the right shows deer on winter ranges in the Salmon Lake area. Other big game are also important for hunting and as sightseeing attractions. For example, Western Montana provides some of the best elk hunting in the United States — more than 15,000 elk were taken by hunters in 1961. Here, too, is the largest remaining stronghold of the grizzly bear in the continental United States.

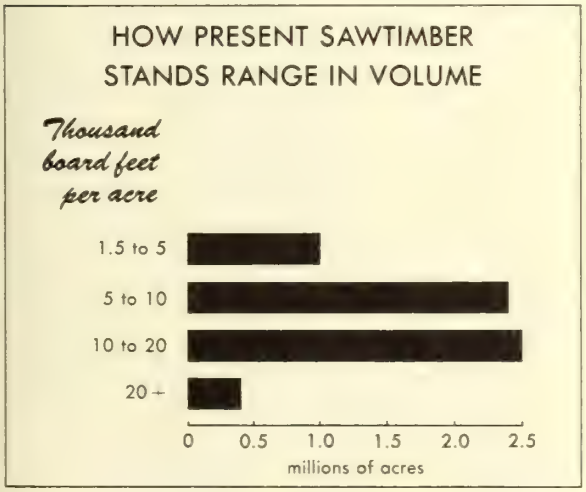
TIMBER VOLUME

Western Montana has a lot of wood, more wood in fact than most states. The recent survey indicates a total merchantable stand of 19.5 billion cubic feet in trees 5 inches and larger. Only five states have more timber than this: Idaho, Washington, Oregon, California, and Alaska.

About two-thirds of the wood is in sawtimber trees that have an aggregate volume of 73.5 billion board feet. This sawtimber, of course, constitutes the main part of the presently utilizable wood supply in Western Montana. However, much of the 7 billion cubic feet of smaller trees is likewise available for harvesting. These harvestable small trees are in sawtimber stands and in pole stands that have virtually ceased to grow and should be cut as soon as possible. In the past, most of the trees cut have been sawtimber. The lack of markets for trees smaller than sawtimber size is one of the big utilization headaches in this region.

Commercial forests of sawtimber size are dominated by four species: Douglas-fir, western larch, Engelmann spruce, and ponderosa pine. One-third of the sawtimber volume is Douglas-fir and the four species combined make up about 80 percent of the total volume.

Western Montana is hardly in the class with the west coast in producing big trees. Nevertheless, this area compares favorably with much of the rest of the United States so far as capacity to grow trees is concerned. Four-tenths of all the board-foot volume of sawtimber is in trees 21 inches and larger. The table below shows how the more important species compare in size:



Average diameter of sawtimber trees

	Inches
Douglas-fir	16.2
Engelmann spruce	18.1
Western larch	18.0
Ponderosa pine	17.8
Lodgepole pine	13.1

Lodgepole pine lags far behind other species in size. Characteristically a small tree, its average diameter is reduced further by the usual overcrowding. Approximately four-fifths of the total cubic volume of lodgepole pine timber is in pole trees. Lodgepole pines 21 inches and larger are rare.

The average volume in sawtimber stands in Western Montana today is only 10,860 board feet per acre. This is because some of these stands have been partially cut. Others have produced less volume than they might have because of overcrowding. Still others are very old and have lost some of their original volume because of insects, disease, and other "eroding" factors.

That the commercial forest is potentially more productive is indicated by the following table based on the application of per-acre yield potentials (75 percent of full yields in yield tables) to the area of various site classes and types.

Harvest yield capabilities of commercial forest

Board feet per acre	Acres
30,000 and more	4,100,000
20,000 to 30,000	3,800,000
10,000 to 20,000	1,000,000
Less than 10,000	1,600,000

Western Montana has the potential for a sustained annual cut of about 2.1 billion board feet — nearly twice the current sawtimber cut. However, it can be realized only under fairly intensive management — much more intensive than is currently practiced.

The photos on this and the opposite page illustrate extremes in the timber situation in Western Montana. The larch and spruce stands are typical of the better sawtimber. They provide an indication of the potentialities of much of the forest in Western Montana.

The other extreme is illustrated by the lodgepole pine stand. Only 12 percent of the 2.7 million acres of lodgepole pine type is sawtimber. However, much of the 1.8 million acres of pole-size lodgepole pine timber is mature. Small by nature, this tree tends to crowd itself into stagnation. In years to come, some of this type should be converted to other species; much of the remainder will require thinning to keep the growth rate up to what it should be. At present the market for this large volume of small trees is extremely limited. Inability to market the lodgepole pine and small trees in other stands has seriously handicapped management efforts.

Sawtimber quality as measured by log grades also varies greatly among species. About 14 percent of all saw logs are grade 1. Species showing the highest percentage of grade 1 logs are western white pine (38 percent), western larch (35 percent), and ponderosa pine (21 percent). In sharp contrast are lodgepole pine, spruce, and Douglas-fir — all with less than 6 percent top-quality logs. Timber culture can considerably improve both timber quality and size.

Spruce sawtimber, Kootenai National Forest. Photo: U.S.F.S.

Larch sawtimber, Flathead National Forest. Photo: U.S.F.S.

Lodgepole pine poles, Flathead National Forest. Photo: U.S.F.S.

OWNERSHIP

Most timberland in Western Montana is in big holdings. Under present circumstances, this is conducive to enlightened management. Eighty-three percent of the commercial forest land is owned or administered by agencies and companies with sufficiently large holdings to make forestry feasible and with the capacity to practice forestry and multiple use management. Seventy-three percent of the commercial forest is in public holdings, principally the National Forests. One million acres, or 10 percent, is in industrial forest ownership. Several of the large private timber owners employ foresters and have an interest in forestry as an enterprise.

Small private owners have 17 percent of the commercial forest land. While these holdings include some of the best forest land, this property is divided among a large number of owners and the individual holding is small. For the most part, these small owners do not know how to manage their timberlands nor do they have the interest. As a consequence they pose one of the more serious forestry problems of the area. This situation is not peculiar to Western Montana: the low productivity of small ownerships is a problem over the whole Nation.

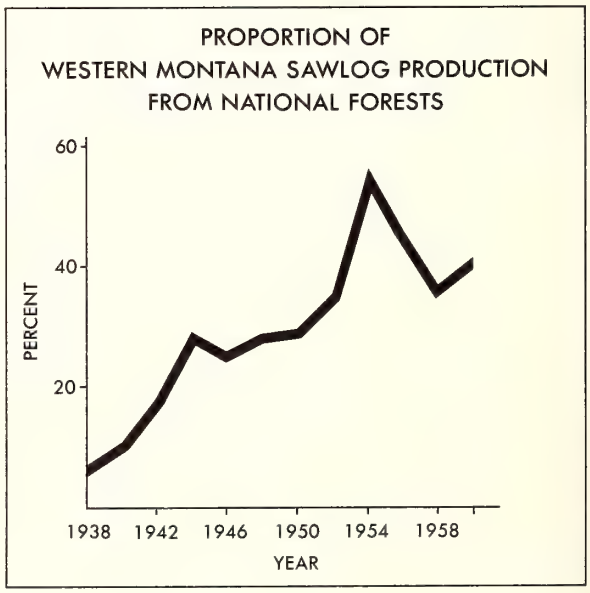
Ownership of commercial forest land

	Million acres
National Forest	6.7
Other Federal	.5
State, county, and municipal	.5
Industry	1.0
Other private	1.8
Total	10.5

Because so much of the forest is in public ownership, the future of the wood industries in Western Montana is tied closely to these lands and their management. However, the 7.7 million acres of publicly owned commercial forest land must be discounted somewhat in relation to private land. For the most part, public holdings are more remote and less productive than the privately owned forest.

Of the commercial forest, the public owns a very high proportion of the lower value, less accessible, and less easily operable area. This is indicated in a general way by the type of commercial forest in public and private ownership. Only half of the ponderosa pine land, which is readily accessible and has a high value, is in public ownership. By contrast, the public owns virtually all of the high-elevation inaccessible spruce and low-value lodgepole pine.

On the positive side, insofar as public lands are concerned, is the fact that higher elevations generally receive more precipitation, thus offsetting somewhat poorer soils and more severe physiographic conditions.



Public ownership of commercial forest land by types

Type	Percent publicly owned
Ponderosa pine	51
Douglas-fir	68
Larch	76
Fir-spruce	93
Lodgepole, whitebark, and limber pine	83

In 1938, about 14 million board feet of sawtimber were logged on the National Forests. This was 7 percent of the total cut in this part of the State. Between 1938 and 1959 the total saw log cut increased about 500 percent, but the cut on National Forest lands increased 3,000 percent. The more rapid increase of cutting on public lands reflects two things:

- The fact that wood industries have expanded beyond the capacity of private lands to produce wood.
- Progress made in opening up these public lands.

Production from the National Forests and other public lands will increase still further as the road system is extended and as the forestry effort is intensified. Between 1951 and 1961 approximately 3,120 miles of road were built on the Western Montana National Forests to make timber accessible. Money available for stand regeneration and cultural work in young stands on National Forests has substantially increased in recent years.

How much wood the public forests of Western Montana will contribute to industry in the future will depend upon how much this land is developed and how intensively it is managed. It will also depend somewhat on the demands made on public forests for other uses. About 71 percent of the timber production potential in Western Montana is on public lands.

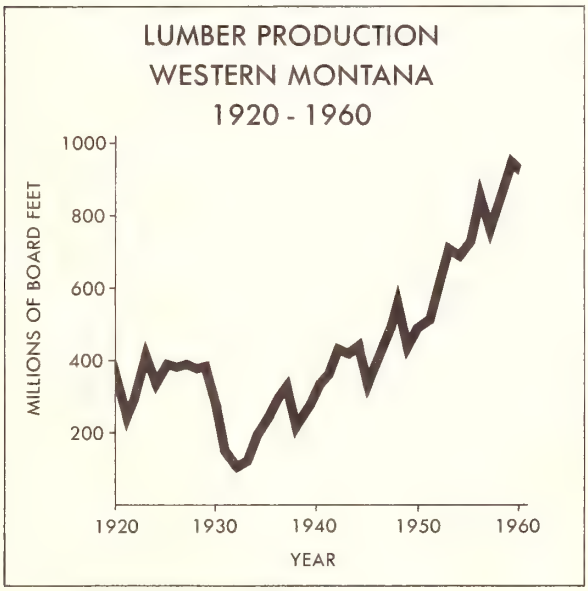
THE PLACE OF PUBLIC FOREST LAND IN WESTERN MONTANA

PUBLIC LANDS INCLUDE

- *77 percent of the total forest*
- *73 percent of the commercial forest*
- *97 percent of the noncommercial forest*
- *74 percent of the sawtimber volume*
- *53 percent of the sawtimber cut*
- *71 percent of the timber growth potential*

THE FOREST INDUSTRIES

In recent years the timber cut in Western Montana has reached an all time high. For example, the total cut in 1956 (the latest year for which complete data are available) was more than twice the cut in 1925 and about one-third greater than in 1948. Because about 93 percent of the timber cut is processed into lumber, data on lumber production generally indicate timber utilization. The upsurge in utilization is reflected by the chart below.



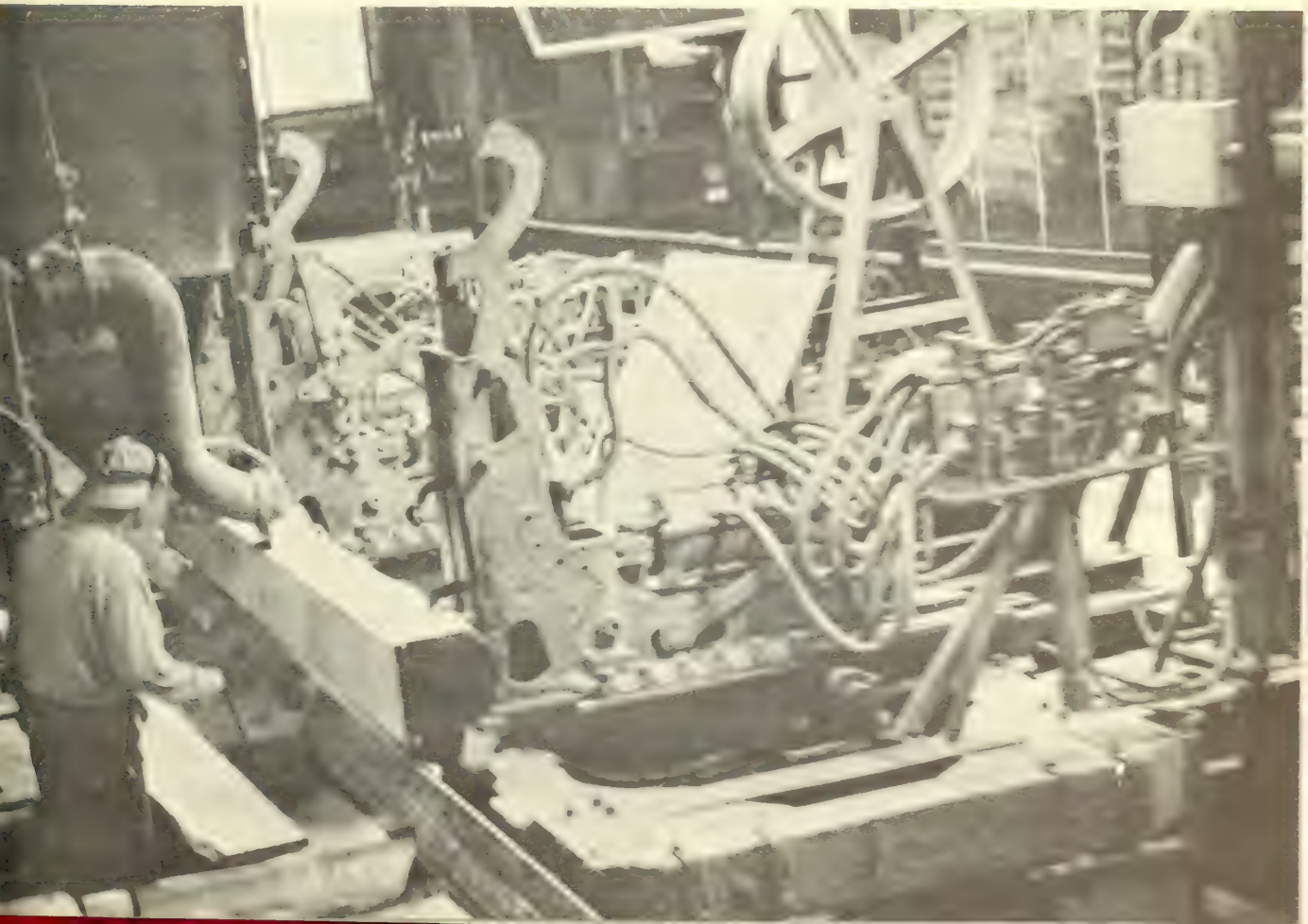
Accompanying the increase in production has been a 35 percent increase in employment between 1950 and 1960 (*1*). This increase in employment in wood industries has helped significantly in compensating for a concurrent statewide reduction of employment in agriculture and mining. It also contrasts sharply with an increase of only 4 percent in other manufacturing industries within the State during the same period.

The rise in lumber production from the depression low of the 1930's of less than 110 million board feet annually to the present level of about 900 million board feet has been paralleled by some striking shifts in the structure of the industry. Even within the last 10 years, there has been substantial change. Perhaps the most important development has been the swing away from the so-called "small" sawmill. Western Montana's early lumbering was by large mills because they alone had the efficiency to offset the high freight costs to the Middle West and East. Following World War II, there was an influx of small mills. In 1948, for example, 43 percent of the lumber was cut by sawmills producing less than 5 million board feet each, while 35 percent was cut by mills producing 10 million board feet or more. In 1956, the percentages had changed to 20 and 68, respectively. As profit margins have narrowed, many small mills have either grown into large mills or dropped out. Small mills, especially the 8-foot stud mills, can play an important role in processing small timber — either second growth, or the characteristically small lodgepole pine. Many of these mills survive mainly because they belong to companies also owning large mills, or are associated with concerns that market the ouput of several small mills. In general, large-scale operation appears to be a prerequisite for continuing competition as markets fluctuate. For example, data collected for the Clark Fork drainage of Western Montana in 1956 showed that sawmills producing 20 million board feet or more in that year all had planers and dry kilns. None of the sawmills producing less than 5 million board feet annually had dry kilns; only 25 percent had planers. Seventy-one percent of the large mill production was finished lumber; only 17 percent of the small mill production was finished lumber. The large mills operated year-round; the small ones less than half the year.

No doubt the increasing dominance of the large sawmills has been the result of their move toward full mechanization. For example, between 1955 and 1960 there is evidence that the cost of producing lumber in larger mills remained fairly constant, although wage rates rose about 16 percent.

Small Sawmill in Granite County. Photo: J. H. Wikstrom.

Headsaw in a large sawmill. Anaconda Forest Products, Inc., Bonner. Photo: Charles R. Lockard.



There has also been a longer time shift in the size and species composition of the lumber produced. For many years production ran heavily to ponderosa pine, which is most commonly sawed into 1-inch boards. In recent years, larch and Douglas-fir, primarily structural species, have made up the bulk of the lumber output.

	Percent of lumber production that was ponderosa pine
1940	46
1950	37
1960	11

Establishment of a pulpmill near Missoula has been a big step forward in wood utilization. Raw material for the present plant is sawmill residue. A substantial further expansion of pulpmill capacity would be possible, using timber not suitable for lumber. Western Montana has at least 75 million cords of such roundwood suitable for pulping. Much of this wood is in mature but pole-size lodgepole pine trees. The rest is in cull and small trees in sawtimber stands. This timber has not been attractive to pulpmills because the cost of utilization is high. The problem has been to reduce these costs. Experiments in field debarking and chipping and pipeline transportation of chips may help open the way to further expansion of the pulp industry.

This part of the State is blessed with an abundance of good quality water as well as a lot of wood. In 1955 the U.S. Public Health Service and the Montana Board of Health (*6*) surveyed Western Montana streams, rating their capacity to handle pulpmill waste or effluent. The survey report recommended six presently unused stretches of river and suggested the kraft mill capacity that each river could tolerate.

	Kraft mill capacity at undeveloped pulpmill sites Tons of pulp per day
Clark Fork River — St. Regis to junction with Flathead River	300
Clark Fork River below Plains, Montana	1,000
Flathead River — South Fork to Flathead Lake	200
Flathead River — Flathead Lake to junction with Clark Fork	400
Kootenai River — above Libby, Montana	300
Kootenai River — below Libby, Montana	400

If per-ton waste is reduced or treated beyond the standards assumed in the millsite survey, additional pulping capacity would be available; that is, larger mills could be established at the sites listed above, and certain additional sites would be suitable. For example, although the plant of the Waldorf-Hoerner Paper Products Company at Missoula considerably exceeds the capacity once recommended at that point, the increased capacity was approved by the State because improved design reduced the per-ton waste load.

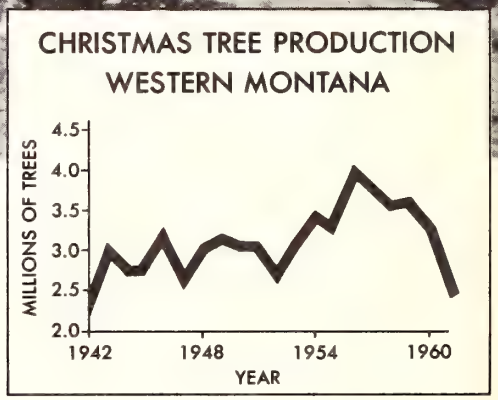
Another bright spot in Western Montana's timber development has been the construction of five plywood plants in the last 10 years. Plywood plants also provide important diversification as they offer a market for top quality logs. Western Montana has 30,869 million board feet in trees 21 inches and larger. Twenty-seven percent is larch, a proven plywood species. Plywood plants provide an opportunity to get high revenue from this timber. Other species also offer plywood opportunities.

Utilization of larch is expected to increase further as a result of a recently developed commercial process for extracting industrial gum (arabinogalactan). The gum, which has demonstrated important advantages over gum arabic for lithography and other purposes, is being produced at a prototype plant operated by the J. Neils Lumber Company Division of St. Regis Paper Company at Libby. Here sawmill and plywood mill residues provide the raw materials for gum extraction. The fact that the chips are still suitable for pulp making after extraction of gum is a notable event in the trend toward more complete use of the tree.

Some of the 175,000 tons of chips in storage at Waldorf-Hoerner Paper Products Company, Missoula. This plant employs about 220 people. It subsists entirely on sawmill residue and provides a market for chips from slabs and edgings of sawmills as far away as 300 miles. Photo: Charles R. Lockard.

Glue spreading, Van-Evan Plywood Company, Missoula. Photo: Charles R. Lockard.

PHOTO: Ben M. Huey



These two photos — a Christmas tree yard at Missoula and the Montana Pole Company yard at Butte — show two other Montana forest products.

Western Montana, one of the main Christmas tree producing areas in the United States, has an estimated potential of 5 million trees a year on a sustained basis.

Wide fluctuations in pole production reflect an erratic market. Between 1950 and 1960 the number of poles produced in Western Montana ranged between 116,000 and 244,000 a year.

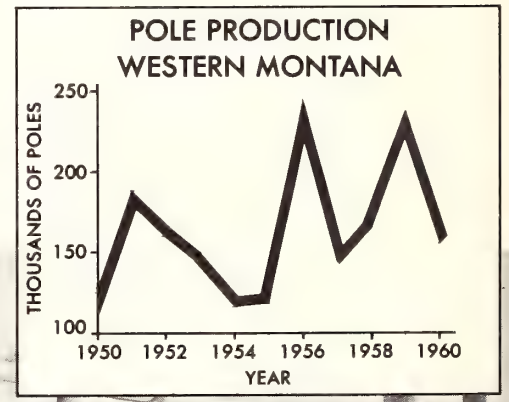


PHOTO: Charles R. Lockard

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APPENDIX

TERMINOLOGY

Forest Land

The term *forest land* includes (a) land which is at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking, and which has not been developed for other use; (c) afforested areas.

At the time the fieldwork for this report was performed, the minimum unit of area for forest land classification was 10 acres with a minimum width of stringer strips of 120 feet.

The principal classes of forest land are:

Commercial forest land. — Forest land which is (a) producing, or is physically capable of producing, usable crops of wood (usually sawtimber), (b) economically available now or prospectively, and (c) not withdrawn from timber utilization.

Noncommercial forest land. — Three classes of noncommercial forest land are recognized: *Productive-reserved*, *Unproductive-nonreserved*, and *Unproductive-reserved.*

Productive-reserved is public forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land.

Unproductive indicates forest land incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or forest land so physically inaccessible as to be unavailable economically in the forseeable future.

Forest Types

Forest land is classified into types on the basis of tree species; the type name is that of the predominant species. The predominant species is the one which has a plurality of (a) gross cubic volume in the case of sawtimber and poletimber stands, or (b) the number of stems in seedling and sapling stands. Both growing stock and cull trees are considered in the classification. Forest types which occur on both commercial and noncommercial forest land are:

Douglas-fir
Ponderosa pine
Western white pine
Lodgepole pine
White bark and limber pine
White fir
Grand fir
Subalpine fir
Engelmann spruce
Mountain hemlock
Western hemlock
Western redcedar
Western larch
Aspen
Cottonwood
Other western hardwoods

Two additional forest types which occur only on noncommercial forest land are:

Pinyon-juniper
Chaparral

Tree-Size Classes

Sawtimber-size tree

A tree 11.0 inches d.b.h. or larger.

Pole-size tree

A tree 5.0 to 10.9 inches d.b.h.

Seedling-sapling trees

Trees at least 1 foot high and less than 5.0 inches d.b.h.

Tree-Merchantability Classes

Sawtimber tree

Live tree of commercial species, 11.0 inches d.b.h. or larger, that contains at least one 10-foot log to a merchantable top diameter and having the likelihood of

eventually containing at least a 16-foot minimum saw log. Also, at least one-third of the board-foot volume must be free from rot or other defect.

Poletimber tree

Live tree of commercial species, 5.0 to 10.9 inches d.b.h., free of rot and having the likelihood of growing into a sawtimber tree.

Sapling and seedling trees

Live trees of commercial species, less than 5.0 inches d.b.h., with form and quality to qualify as potential poletimber trees.

Growing stock trees

Sawtimber trees, poletimber trees, saplings and seedlings; i.e., all live trees except cull trees.

In discussion and tables on volumes, growth, and mortality, the term *growing stock* refers only to sawtimber trees and poletimber trees; i.e., all live trees 5 inches d.b.h. and larger (except cull trees). Saplings and seedlings are not part of growing stock in this usage of the term.

Cull tree

Live tree of sawtimber- or poletimber-size that is unmerchantable for saw logs, now or prospectively, because of rot or other defect, or species.

Sound cull trees include:

a. Sawtimber-size trees that have more than two-thirds of their gross board-foot volume in cull with at least one-half of this cull the result of sweep, crook, or other sound defect. Also included are sound trees which do not contain at least one 10-foot saw log.

b. Poletimber-size trees that are unlikely to grow into sawtimber trees because of serious fire and basal scars, broken tops, severe mistletoe, crooks or girdling by porcupine. No rot may be present.

Rotten cull trees include:

a. Sawtimber-size trees that have more than two-thirds of their gross board-foot volume in cull, with more than half of the cull due to rot.

b. Poletimber-size trees showing any evidence of rot in the main stem.

Mortality tree

A tree 5.0 inches d.b.h. or larger, standing or down, which has died within the past 5 years and was not a cull tree at time of death.

Salvable dead tree

Dead tree 5.0 inches d.b.h. or larger, standing or down (but not lying on the ground) which has 50 percent or more of its cubic-foot volume in sound wood.

Stand-Size Classes

Sawtimber stands

A stand with a minimum net volume per acre of 1,500 board feet (International ¼-inch rule) in sawtimber trees. Two classes of sawtimber stands are recognized:

Large sawtimber. A stand in which the majority of the net board-foot volume is in sawtimber trees 21.0 inches d.b.h. and larger.

Small sawtimber. A stand in which the majority of the net board-foot volume is in sawtimber trees from 11.0 to 20.9 inches d.b.h.

Poletimber stand

Stand failing to meet the sawtimber stand specifications, but at least 10 percent stocked with poletimber and larger

(5.0 inches d.b.h. and larger) trees and with at least half the minimum stocking in poletimber trees.

Seedling and sapling stand

A stand not qualifying as either a sawtimber or poletimber stand, but having at least 10 percent stocking of trees of commercial species and with at least half the stocking in seedling and sapling trees.

Nonstocked area

An area not qualifying as a sawtimber, poletimber, or a seedling-sapling stand; i.e., normally an area less than 10 percent stocked.

Stocking

Stocking is a measure of the degree to which growing space is effectively utilized by trees. In this report it is expressed as the percentage of the available space that is occupied by tree crowns as viewed on aerial photographs.

Well-stocked stand

A stand that is 70 percent or more covered by tree crowns.

Medium-stocked stand

A stand with 40 to 70 percent coverage by tree crowns.

Poorly stocked stand

A stand with 10 to 40 percent coverage by tree crowns.

Nonstocked area

An area with less than 10 percent coverage by tree crowns.

Timber Volume

All-timber volume

Volume in cubic feet of sound wood in the bole of growing stock, cull and salvable dead trees 5.0 inches and larger in diameter at breast height, from stump to a minimum 4.0-inch top inside bark.

Growing stock volume

Net volume in cubic feet of sawtimber trees and poletimber trees from stump to a minimum 4.0-inch top inside bark.

Live sawtimber volume

Net volume in board feet, International ¼-inch rule, of the saw log portion of sawtimber trees.

Saw log portion

That portion of the bole of sawtimber trees between the stump and the merchantable top.

Merchantable top

The point at which the upper limit of saw log merchantability is limited either by limbs or by a minimum diameter. The latter varies with diameter class ranging from 5 inches inside bark for trees 11 inches at breast height to 10 inches for trees 26 inches or larger.

Upper-stem portion

That part of the bole of sawtimber trees above the merchantable top to a minimum top diameter of 4.0 inches inside bark.

Quality class

A classification of sawtimber volume in terms of log grades. Four grades are recognized and distinguished by the occurrence and characteristics of knots. The log grades corresponding to the quality classes are:

Grade 1 (select logs) are essentially smooth and surface clear, except that in logs 16 inches and larger in diameter a few visible knots are permitted, provided there are no more than 1 large

knot, or 2 medium or small knots, or 4 pin knots.

Knot sizes for all grades are:

Pin knots	0.5 inch or less
Small knots	0.5 to 0.75 inch
Medium knots	0.75 to 1.5 inches
Large knots	Larger than 1.5 inches

Occasional logs having a greater number of knots are admitted provided these knots may be boxed in an area not exceeding one-third the area of one face or an equivalent area of two faces.

Grade 2 (shop logs) display relatively few knots of any size, so spaced that at least 50 percent of the surface of the log is in smooth, clear areas, the size of which must be at least one-fourth the girth of the log in width, by 4 feet or more in length.

A log with no more than 12 medium or smaller knots, or more than 8 large ones, may immediately be classed as grade 2. If this number of knots is exceeded, the clear area basis governs.

Grade 3 (common logs) display either (a) pin, small, or medium knots of which 80 percent are either live or will cut out red (intergrown) beneath the slab, or (b) 16 dead knots (an average of 4 per face) averaging medium in size.

Grade 4 (low common logs) display medium, large, and very large live and/or dead knots in excess of the numbers permitted in grades 2 and 3.

Growth

Net annual growth of sawtimber or growing stock

The average annual change, calculated from the total change over a 10-year period, in net board-foot or cubic-foot volume of live sawtimber or growing stock on commercial forest land.

Mortality

Net annual mortality of sawtimber or growing stock

The average annual net board-foot or cubic-foot volume removed from live sawtimber or growing stock through death, calculated from the total net volume removed by such causes over a 10-year period.

Timber Cut

Timber cut from growing stock

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.

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.

Logging residues from growing stock

The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land and not converted to timber products.

Ownership Classes

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 For-

ests, 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 State, counties, and local public agencies, or lands leased by these governmental units more than 50 years ago.

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.

Principal Tree Species

Softwoods

Douglas-fir	*Pseudotsuga menziesii*
Fir, subalpine	*Abies lasiocarpa*
Fir, grand	*A. grandis*
Fir, white	*A. concolor*
Hemlock, mountain	*Tsuga mertensiana*
Hemlock, western	*T. heterophylla*
Juniper	*Juniperus* spp.
Larch, alpine	*Larix lyalli*
Larch, western	*L. occidentalis*
Pine, limber	*Pinus flexilis*
Pine, lodgepole	*P. contorta*
Pine, ponderosa	*P. ponderosa*
Pine, western white	*P. monticola*
Pine, whitebark	*P. albicaulis*
Redcedar, western	*Thuja plicata*
Spruce, Engelmann	*Picea engelmannii*

Hardwoods

Aspen, quaking	*Populus tremuloides*
Cottonwood, black	*P. trichocarpa*
Birch, paper	*Betula papyrifera*

SURVEY METHODS

Area statistics were determined by mapping. About 20 percent of the survey area was completely mapped; for the remainder, mapping was done only on sample sections located at 4-mile intervals in a rectangular grid pattern. In both cases mapping was done on aerial photographs and subsequently field checked. Delineations segregated nonforest from forest land, noncommercial from commercial forest, and classified commercial forest by timber type, stand size, and stand density. Areas were classified to a minimum area of 10 acres. Ownership classes were also outlined. Area of the various cover classes by ownerships was determined by dot counts which were then summarized and, in the case of sample areas, multiplied by appropriate factors to give total area.

Volume statistics were derived from field samples taken at 4-mile intervals on the rectangular grid mentioned above. Plots were taken in the immediate vicinity of the section corners designated by the grid. In the area which had been mapped on a sampling basis plots fell within the mapped sections.

Samples were taken at 1,172 locations in Western Montana. Each sample consisted of two plots, spaced 5 chains apart. If necessary the predetermined compass bearing from the first to the second plot was altered to insure that both plots fell in the same type-size-density stratum. Each plot consisted of four concentric circular subplots. Seedlings and saplings were tallied an 1/500 acre, poles on 1/50 acre, sawtimber on 1/5 acre, and mortality on 1/3 acre.

In addition to making the customary measurements and classifications of trees for volume and quality, increment borings were taken for growth estimates.

Formulas equating field measurements to volume, growth, and mortality were applied as part of the machine data processing to provide average volumes per acre for the various classifications based on type, size, stocking, etc. These averages, applied to area estimates, provided the total volumes used in statistical tables.

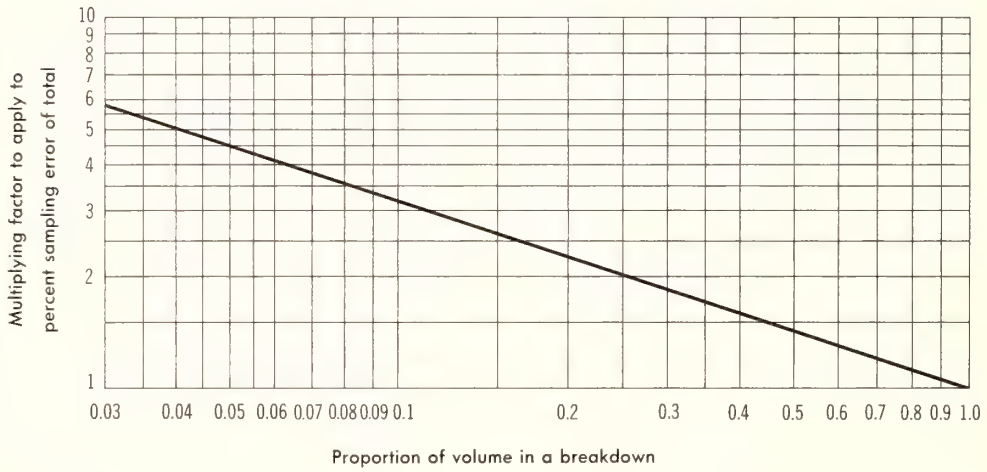
Timber-cut estimates in some cases are based on output data for a single year when that year is considered typical of the period during which the survey was conducted. In other instances primary product output and logging residue figures are averages based on periodic surveys of the forest industries. Lumber industry surveys, conducted in cooperation with the Bureau of the Census, provide lumber production and log receipts data for estimating the predominant part of the cut. Periodic surveys are also conducted to determine the output of pulpwood, commercial poles, fuelwood, mine timbers, posts, and miscellaneous timbers of lesser importance. Data for estimating the volume of logging residues are obtained by special studies on active woods operations.

RELIABILITY OF ESTIMATES

Data collected by sampling are not entirely reliable; i.e., there is a sampling error. Sufficient samples are taken to insure that the error is not above a specified maximum. Magnitude of the errors associated with area and volume estimates for Western Montana have been determined by statistical analysis of the data.

Estimates of acreage of the various land and forest classes were determined by sampling on about 84 percent of Western Montana and compilation from type maps on the remainder. For the sampled portion the sampling error of the estimate of commerical forest area is ±1.83 percent, and of noncommercial forest ±11.48 percent. These errors are on the basis of odds of two out of three that values which would result from a 100-percent cruise would lie within the range indicated by the error. There is no sampling error for the area which was completely mapped.

The sampling error for the estimated 19,541 million cubic feet of growing stock in Western Montana is ±2.42 percent. The sampling error for estimates other than total volume can be roughly approximated by using the following chart:



Ratio of sampling error of a volume breakdown to sampling error of total area or volume.

As an example of the use of the chart, assume that the sampling error reported for a total is ±5 percent. An estimate is desired of the sampling error for an item which is only 0.25 of this total. 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, or ±10 percent.

APPENDIX TABLES

Table 1.—**Area by land classes, Western Montana, 1958**

Land class	Thousand acres
Commercial forest land	10,453
Noncommercial forest land:	
Unproductive-nonreserved	598
Productive-reserved	889
Unproductive-reserved	768
Total forest land	12,708
Nonforest land	[1]3,266
Total, all land	[2]15,974

[1]Includes 95,000 acres of water according to Survey standards of area classification but defined by Bureau of Census as land.

[2]From U. S. Bureau of the Census, Land and Water Areas of the United States, 1950.

Table 2.—**Area of commercial forest land, by ownership classes, Western Montana, 1958**

Ownership class	Thousand acres
National Forest	6,680
Other Federal:	
Bureau of Land Management	156
Indian	373
Miscellaneous Federal	3
Total other Federal	532
State	439
County and municipal	2
Forest industry:	
Pulp and paper	—
Lumber	1,047
Other	—
Total forest industry	1,047
Farmer-owned	471
Miscellaneous private	1,282
All ownerships	10,453

Table 3.—**Area of commercial forest land, by stand-size and ownership classes, Western Montana, 1958**

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
	Thousand acres				
Sawtimber stands:					
Large sawtimber	1,595	998	102	355	140
Small sawtimber	4,730	2,788	553	468	921
Total	6,325	3,786	655	823	1,061
Poletimber stands	2,937	1,973	232	178	554
Sapling and seedling stands	1,018	788	76	35	119
Nonstocked area	173	133	10	11	19
All classes	10,453	6,680	973	1,047	1,753

Table 4.—**Area of commercial forest land, by stocking classes of all live trees and by stand-size classes, Western Montana, 1958**

Stocking class (all trees)	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Non-stocked stands
	Thousand acres				
70 percent or more	5,730	3,674	1,426	630	—
40 to 70 percent	3,366	2,106	1,032	228	—
10 to 40 percent	1,184	545	479	160	—
Less than 10 percent	173	—	—	—	173
All classes	10,453	6,325	2,937	1,018	173

Table 5.—**Area of commercial forest land, by types and ownership classes, Western Montana, 1958**

Type	All ownerships	Public ownerships	Private ownerships
	Thousand acres		
Douglas-fir	2,837	1,926	911
Ponderosa pine	1,668	852	816
White pine[1]	181	160	21
Lodgepole pine[2]	2,850	2,374	476
Fir-spruce	896	831	65
Hemlock[3]	33	29	4
Larch	1,939	1,474	465
Hardwoods	49	7	42
All types	10,453	7,653	2,800

[1]Includes 35,000 acres of western redcedar type.
[2]Includes 104,000 acres of whitebark and limber pine type.
[3]Includes 6,000 acres of mountain hemlock.

Table 6.—**Number of growing-stock trees on commercial forest land, by diameter classes and by softwoods and hardwoods, Western Montana, 1958**

D.B.H. class (inches)	All species	Softwood	Hardwood
	Thousand trees		
1.0 to 2.9	7,285,560	7,238,621	46,939
3.0 to 4.9	2,074,365	2,061,869	12,496
5.0 to 6.9	830,351	826,240	4,111
7.0 to 8.9	430,663	429,086	1,577
9.0 to 10.9	237,892	237,670	222
11.0 to 12.9	119,822	119,446	376
13.0 to 14.9	76,645	76,370	275
15.0 to 16.9	51,409	51,183	226
17.0 to 18.9	34,645	34,507	138
19.0 to 28.9	61,195	61,026	169
29.0 to 38.9	6,640	6,640	—
39.0 and larger	532	532	—
Total	11,209,719	11,143,190	66,529

Table 7.—**Number of cull and salvable dead trees on commercial forest land, by diameter groups and by softwoods and hardwoods, Western Montana, 1958**

D.B.H. class (inches)	Cull trees			Salvable dead trees
	Total	Sound	Rotten	
	Thousand trees			
Softwoods:				
5.0 to 8.9	94,624	49,972	44,652	73,518
9.0 to 18.9	31,036	11,335	19,701	59,568
19.0 and larger	2,680	102	2,578	6,325
Total	128,340	61,409	66,931	139,411
Hardwoods:				
5.0 to 10.9	3,393	1,131	2,262	19
11.0 to 18.9	450	324	126	—
19.0 and larger	415	233	182	—
Total	4,258	1,688	2,570	19
All species	132,598	63,097	69,501	139,430

Table 8.—**Volume of timber on commercial forest land, by class of timber and by softwoods and hardwoods, Western Montana, 1958**

Class of timber	All species	Softwoods	Hardwoods
	Thousand cubic feet		
Sawtimber trees:			
Saw log portion	11,589,751	11,557,217	32,534
Upper-stem portion	925,200	916,055	9,145
Total	12,514,951	12,473,272	41,679
Poletimber trees	7,025,665	6,998,906	26,759
All growing-stock trees	19,540,616	19,472,178	68,438
Sound cull trees:			
Sawtimber-size trees	68,089	55,803	12,286
Poletimber-size trees	200,300	197,551	2,749
Total	268,389	253,354	15,035
Rotten cull trees:			
Sawtimber-size trees	101,687	98,758	2,929
Poletimber-size trees	161,704	159,709	1,995
Total	263,391	258,467	4,924
Salvable dead trees:			
Sawtimber-size trees	1,599,848	1,598,890	958
Poletimber-size trees	673,200	672,976	224
Total	2,273,048	2,271,866	1,182
All timber	22,345,444	22,255,865	89,579

Table 9.—**Volume of growing stock and sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Western Montana, 1958**

Ownership class	All species	Softwoods	Hardwoods
		GROWING STOCK (*Million cubic feet*)	
National Forest	13,056	13,034	22
Other public	1,590	1,584	6
Forest industry	2,155	2,149	6
Farmer and misc. private	2,740	2,706	34
All ownerships	19,541	19,473	68
		SAWTIMBER (*Million board feet*)[1]	
National Forest	48,596	48,542	54
Other public	5,716	5,689	27
Forest industry	9,440	9,419	21
Farmer and misc. private	9,702	9,597	105
All ownerships	73,454	73,247	207

[1]International ¼-inch rule.

Table 10.—**Volume of growing stock and sawtimber on commercial forest land, by stand-size classes and by softwoods and hardwoods, Western Montana, 1958**

Stand-size class	All species	Softwoods	Hardwoods
		GROWING STOCK (*Million cubic feet*)	
Sawtimber stands	15,143	15,095	48
Poletimber stands	3,945	3,927	18
Sapling and seedling stands	418	416	2
Nonstocked areas	35	35	(1)
Total	19,541	19,473	68
		SAWTIMBER (*Million board feet*)[2]	
Sawtimber stands	68,691	68,498	193
Poletimber stands	3,890	3,880	10
Sapling and seedling stands	798	794	4
Nonstocked areas	75	75	(1)
Total	73,454	73,247	207

[1]Less than 0.5 million feet.
[2]International ¼-inch rule.

Table 11.—**Volume of growing stock on commercial forest land, by species and diameter groups, Western Montana, 1958**

Species	Diameter class (inches at breast height)					
	All classes	5.0 to 10.9	11.0 to 20.9	21.0 to 30.9	31.0 to 40.9	41.0 and larger
	Million cubic feet					
Softwoods:						
Douglas-fir	5,429	1,375	2,732	1,135	159	28
Ponderosa pine	1,949	192	800	741	206	10
White pine	320	55	176	74	8	7
Lodgepole pine	4,346	3,515	819	12	—	—
True firs[1]	1,428	815	539	71	3	—
Spruce	2,261	369	993	670	218	11
Western hemlock	165	39	87	25	14	—
Western redcedar	412	96	112	114	51	39
Western larch[2]	2,896	448	1,161	1,024	254	9
Other softwoods	267	95	148	24	—	—
Total	19,473	6,999	7,567	3,890	913	104
Hardwoods:						
Aspen and cottonwood	54	16	27	11	—	—
Other hardwoods	14	11	3	—	—	—
Total	68	27	30	11	—	—
All species	19,541	7,026	7,597	3,901	913	104

[1]White, grand, and subalpine firs.
[2]Includes a negligible amount of alpine larch.

Table 12.—**Volume of sawtimber on commercial forest land, by species and diameter groups, Western Montana, 1958**

Species	Diameter class (inches at breast height)				
	All classes	11.0 to 20.9	21.0 to 30.9	31.0 to 40.9	41.0 and larger
	Million board feet[1]				
Softwoods:					
Douglas-fir	22,970	14,841	6,973	980	176
Ponderosa pine	10,498	4,425	4,598	1,402	73
White pine	1,547	1,019	440	50	38
Lodgepole pine	4,648	4,577	71	—	—
True firs[2]	3,427	2,984	423	20	—
Spruce	11,393	5,717	4,174	1,432	70
Western hemlock	727	489	153	85	—
Western redcedar	1,712	593	649	279	191
Western larch[3]	15,379	6,979	6,716	1,626	58
Other softwoods	946	807	139	—	—
Total	73,247	42,431	24,336	5,874	606
Hardwoods:					
Aspen and cottonwood	188	135	53	—	—
Other hardwoods	19	19	—	—	—
Total	207	154	53	—	—
All species	73,454	42,585	24,389	5,874	606

[1]International ¼-inch rule.
[2]White, grand, and subalpine firs.
[3]Includes a negligible amount of alpine larch.

Table 13.—**Volume of sawtimber on commercial forest land, by species and diameter groups, Western Montana, 1958**

Species	Diameter class (inches at breast height)				
	All classes	11.0 to 20.9	21.0 to 30.9	31.0 to 40.9	41.0 and larger
	Million board feet[1]				
Softwoods:					
Douglas-fir	19,767	12,475	6,224	901	167
Ponderosa pine	9,073	3,647	4,073	1,285	68
White pine	1,355	880	394	46	35
Lodgepole pine	3,850	3,787	63	—	—
True firs[2]	2,923	2,526	379	18	—
Spruce	10,263	5,126	3,774	1,298	65
Western hemlock	633	417	138	78	—
Western redcedar	1,455	481	551	245	178
Western larch[3]	13,309	5,713	6,046	1,495	55
Other softwoods	803	679	124	—	—
Total	63,431	35,731	21,766	5,366	568
Hardwoods:					
Aspen and cottonwood	179	128	51	—	—
Other hardwoods	16	16	—	—	—
Total	195	144	51	—	—
All species	63,626	35,875	21,817	5,366	568

[1]Scribner rule.
[2]White, grand, and subalpine firs.
[3]Includes a negligible amount of alpine larch.

Table 14.—**Volume of sawtimber on commercial forest land, by softwood species and quality classes, Western Montana, 1958**

Species	Quality class (log grade)				
	All classes	1	2	3	4
	Million board feet[1]				
Softwoods:					
Douglas-fir	22,970	1,204	3,766	7,086	10,914
Ponderosa pine	10,498	2,245	1,629	2,146	4,478
White pine	1,547	581	292	411	263
True firs[2]	3,427	41	125	1,327	1,934
Spruce	11,393	414	1,221	4,914	4,844
Western hemlock	727	9	11	210	497
Western larch[3]	15,379	5,346	3,468	3,047	3,518
Other softwoods	7,306	313	1,349	2,395	3,249
Total	73,247	10,153	11,861	21,536	29,697

[1]International ¼-inch rule.
[2]White, grand, and subalpine firs.
[3]Includes a negligible amount of alpine larch.

Table 15.—**Volume of salvable dead sawtimber-size trees on commercial forest land by softwoods and hardwoods, Western Montana, 1958**

Species group	Volume (thousand board feet)	
	International ¼-inch rule	Scribner rule
Softwoods	9,334,989	8,061,849
Hardwoods	4,828	4,148
All species	9,339,817	8,065,997

Table 16.—**Net annual growth and annual cut of growing stock on commercial forest land, by species, Western Montana**

Species	Net annual growth, 1958	Annual timber cut, 1956
	Thousand cubic feet	
Softwoods:		
Douglas-fir	84,330	37,539
Ponderosa pine	27,651	28,395
Western white pine	6,698	3,553
Lodgepole pine	100,562	4,362
True firs[1]	28,193	1,436
Engelmann spruce	2,313	26,540
Western hemlock	4,485	104
Western larch	25,404	27,978
Other softwoods	10,051	366
Total	289,687	130,273
Hardwoods	2,078	397
All species	291,765	130,670

[1]White, grand, and subalpine firs.

Table 17.—**Net annual growth and annual cut of growing stock on commercial forest land, by ownership classes and by softwoods and hardwoods, Western Montana**

Species group	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
	NET ANNUAL GROWTH, 1958 (Thousand cubic feet)				
Softwoods	289,687	182,368	27,425	28,360	51,534
Hardwoods	2,078	668	195	208	1,007
All species	291,765	183,036	27,620	28,568	52,541
	ANNUAL TIMBER CUT, 1956 (Thousand cubic feet)				
Softwoods	130,273	59,068		[1]71,205	
Hardwoods	397	0		[1]397	
All species	130,670	59,068		[1]71,602	

[1]Includes "other public," "forest industry," and "farmer and miscellaneous private."

Table 18.—**Net annual growth and cut of sawtimber on commercial forest land, by species, Western Montana**

Species	Net annual growth, 1958	Annual timber cut, 1956
	Thousand board feet[1]	
Softwoods:		
Douglas-fir	296,982	254,669
Ponderosa pine	142,883	193,467
Western white pine	30,719	24,339
Lodgepole pine	84,768	27,980
True firs[2]	55,292	9,860
Engelmann spruce	–40,843	181,742
Western hemlock	20,159	622
Western larch	84,719	190,890
Other softwoods	40,950	2,398
Total	715,629	885,967
Hardwoods	4,803	2,360
All species	720,432	888,327

[1]International ¼-inch rule.
[2]White, grand, and subalpine firs.

Table 19.—**Net annual growth and cut of sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Western Montana**

Species group	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
	NET ANNUAL GROWTH, 1958 (Thousand board feet)[1]				
Softwoods	715,629	403,757	83,046	85,367	143,459
Hardwoods	4,803	1,849	637	600	1,717
All species	720,432	405,606	83,683	85,967	145,176
	ANNUAL TIMBER CUT, 1956 (Thousand board feet)[1]				
Softwoods	885,967	401,524		[2]484,443	
Hardwoods	2,360	0		[2]2,360	
All species	888,327	401,524		[2]486,803	

[1]International ¼-inch rule.
[2]Includes "other public," "forest industry," and "farmer and miscellaneous private."

Table 20. — **Annual mortality of growing stock and sawtimber on commercial forest land, by species, Western Montana, 1958**

Species	Growing stock	Sawtimber
	Thousand cubic feet	*Thousand board feet*[1]
Softwoods:		
Douglas-fir	20,426	103,915
Ponderosa pine	6,572	39,228
White pine	733	3,164
Lodgepole pine	17,652	42,980
True firs[2]	9,510	36,670
Spruce	36,678	225,384
Western hemlock	290	508
Western larch	11,646	69,510
Other softwoods	855	2,989
Total	104,362	524,348
Hardwoods	46	—
All species	104,408	524,348

[1]International ¼-inch rule.
[2]White, grand, and subalpine firs.

Table 21.—**Annual mortality of growing stock and sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Western Montana, 1958**

Ownership	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Thousand board feet*[1]		
National Forest lands	74,427	74,426	1	373,991	373,991	—
Other public lands	6,745	6,742	3	33,826	33,826	—
Forest industry lands	12,879	12,877	2	67,638	67,638	—
Farmer and misc. private lands	10,357	10,317	40	48,893	48,893	—
Total, all ownerships	104,408	104,362	46	524,348	524,348	—

[1]International ¼-inch rule.

Table 22.—**Annual mortality of growing stock and sawtimber on commercial forest land by causes, and by softwoods and hardwoods, Western Montana, 1958**

Cause of death	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Thousand board feet*[1]		
Fire	1,291	1,291	—	5,610	5,610	—
Insects	57,319	57,319	—	311,865	311,865	—
Disease	5,493	5,451	42	28,983	28,983	—
Other	40,305	40,301	4	177,890	177,890	—
All causes	104,408	104,362	46	524,348	524,348	—

[1]International ¼-inch rule.

Table 23.—**Total ouput of timber products, by products, by type of material used, and by softwoods and hardwoods, Western Montana, 1956**

Product and species group	Total output in standard units		Output from roundwood from growing stock		Output from roundwood from nongrowing stock sources		Output from plant by-products (standard units)
	Unit	Number	Standard units	M cubic feet	Standard units	M cubic feet	
Saw logs:[1]							
Softwood	M bd.-ft.[2]	1,055,783	807,280	115,326	[3]248,503	35,500	0
Hardwood	M bd.-ft[2]	2,147	2,147	307	0	0	0
Total	M bd.-ft.[2]	1,057,930	809,427	115,633	248,503	35,500	0
Pulpwood:							
Softwood	M std. cords[4]	35	1	81	[3]34	2,241	0
Hardwood	M std. cords[4]	([5])	([5])	12	0	0	0
Total	M std. cords[4]	35	1	93	34	2,241	0
Poles:							
Softwood	M pieces	244	244	2,378	0	0	0
Hardwood	M pieces	0	0	0	0	0	0
Total	M pieces	244	244	2,378	0	0	0
Mine timbers (round):							
Softwood	M cu. ft.	4,996	4,746	4,746	250	250	0
Hardwood	M cu. ft.	0	0	0	0	0	0
Total	M cu. ft.	4,996	4,746	4,746	250	250	0
Misc. industrial wood:[6]							
Softwood	M cu. ft.	244	244	244	0	0	0
Hardwood	M cu. ft.	0	0	0	0	0	0
Total	M cu. ft.	244	244	244	0	0	0
Posts (round and split):							
Softwood	M pieces	763	565	452	198	158	0
Hardwood	M pieces	0	0	0	0	0	0
Total	M pieces	763	565	452	198	158	0
Fuelwood:							
Softwood	M std. cords[4]	511	9	704	129	9,967	373
Hardwood	M std. cords[4]	48	1	62	12	881	35
Total	M std. cords[4]	559	10	766	141	10,848	408
Misc. farm timbers:							
Softwood	M cu. ft.	397	327	327	70	70	0
Hardwood	M cu. ft.	0	0	0	0	0	0
Total	M cu. ft.	397	327	327	70	70	0
All products:							
Softwood	M cu. ft.	—	—	124,258	—	48,186	—
Hardwood	M cu. ft.	—	—	381	—	881	—
Total	M cu. ft.	—	—	124,639	—	49,067	—

[1]Includes veneer logs and bolts.

[2]International ¼-inch log rule.

[3]Largely from dead timber salvaged in the spruce salvage project (to salvage beetle-killed spruce) that was started in 1952 and continued for several years.

[4]Rough wood basis.

[5]Less than 0.5 M standard cords.

[6]Includes shingle bolts, house logs, converter poles.

Table 24.—**Total output of roundwood products, by source and by softwoods and hardwoods, Western Montana, 1956**

Source	All species	Softwoods	Hardwoods
	Thousand cubic feet		
Growing-stock trees:[1]			
Sawtimber trees	120,601	120,282	319
Poletimber trees	4,038	3,976	62
Total	124,639	124,258	381
Cull trees[1]	47	47	0
Salvable dead trees[1]	[3]47,380	[3]47,380	0
Other sources[2]	1,640	759	881
All sources	173,706	172,444	1,262

[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.
[3]Largely from dead sawtimber trees salvaged in the spruce salvage project.

Table 25.—**Annual timber cut from growing stock on commercial forest lands, by products and logging residues, and by softwoods and hardwoods, Western Montana, 1956**

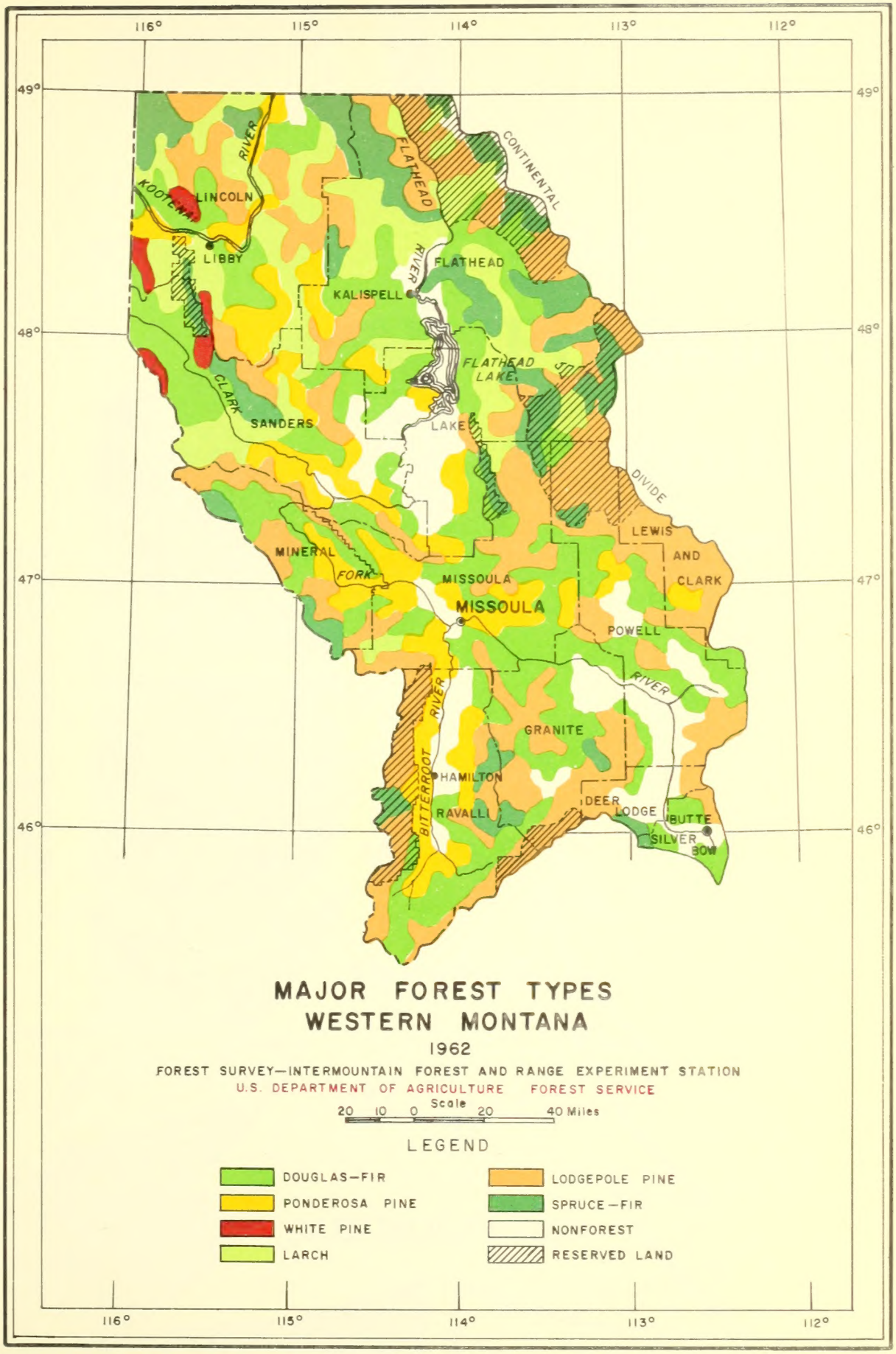
Products and residues	All species	Softwoods	Hardwoods
	Thousand cubic feet		
Roundwood products:			
Saw logs	115,633	115,326	307
Veneer logs and bolts	([1])	([1])	([1])
Cooperage logs and bolts	0	0	0
Pulpwood	93	81	12
Piling	([2])	([2])	([2])
Poles	2,378	2,378	0
Mine timbers	4,746	4,746	0
Misc. industrial wood[3]	571	571	0
Posts	452	452	0
Fuelwood	766	704	62
All products	124,639	124,258	381
Logging residues	6,031	6,015	16
Timber cut	130,670	130,273	397

[1]Included with saw logs to avoid disclosing individual operations.
[2]Included with poles.
[3]Includes 327,000 cubic feet of miscellaneous farm timbers.

Table 26.—**Annual timber cut from live sawtimber on commercial forest lands, by products and logging residues, and by softwoods and hardwoods, Western Montana, 1956**

Products and residues	All species	Softwoods	Hardwoods
	Thousand board feet[1]		
Roundwood products:			
Saw logs	809,427	807,280	2,147
Veneer logs and bolts	([2])	([2])	([2])
Cooperage logs and bolts	0	0	0
Pulpwood	561	486	75
Piling	([3])	([3])	([3])
Poles	14,271	14,271	0
Mine timbers	29,622	29,622	0
Misc. industrial wood[4]	1,437	1,437	0
Posts	126	126	0
Fuelwood	708	654	54
All products	856,152	853,876	2,276
Logging residues	32,175	32,091	84
Timber cut	888,327	885,967	2,360

[1]International ¼-inch rule.
[2]Included in saw logs to avoid disclosing individual operations.
[3]Included with poles.
[4]Includes 126,000 board feet of miscellaneous farm timbers.


116°
115°
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113°
112°
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KOOTENAI RIVER
LINCOLN
LIBBY
FLATHEAD
CONTINENTAL DIVIDE
FLATHEAD RIVER
KALISPELL
FLATHEAD LAKE
CLARK FORK
SANDERS
LAKE
MINERAL
MISSOULA
MISSOULA
LEWIS AND CLARK
POWELL
BLACKFOOT RIVER
GRANITE
BITTERROOT RIVER
HAMILTON
RAVALLI
DEER LODGE
BUTTE
SILVER BOW
MAJOR FOREST TYPES
WESTERN MONTANA
1962
FOREST SURVEY—INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
Scale
20 10 0 20 40 Miles
LEGEND
DOUGLAS-FIR
PONDEROSA PINE
WHITE PINE
LARCH
LODGEPOLE PINE
SPRUCE-FIR
NONFOREST
RESERVED LAND