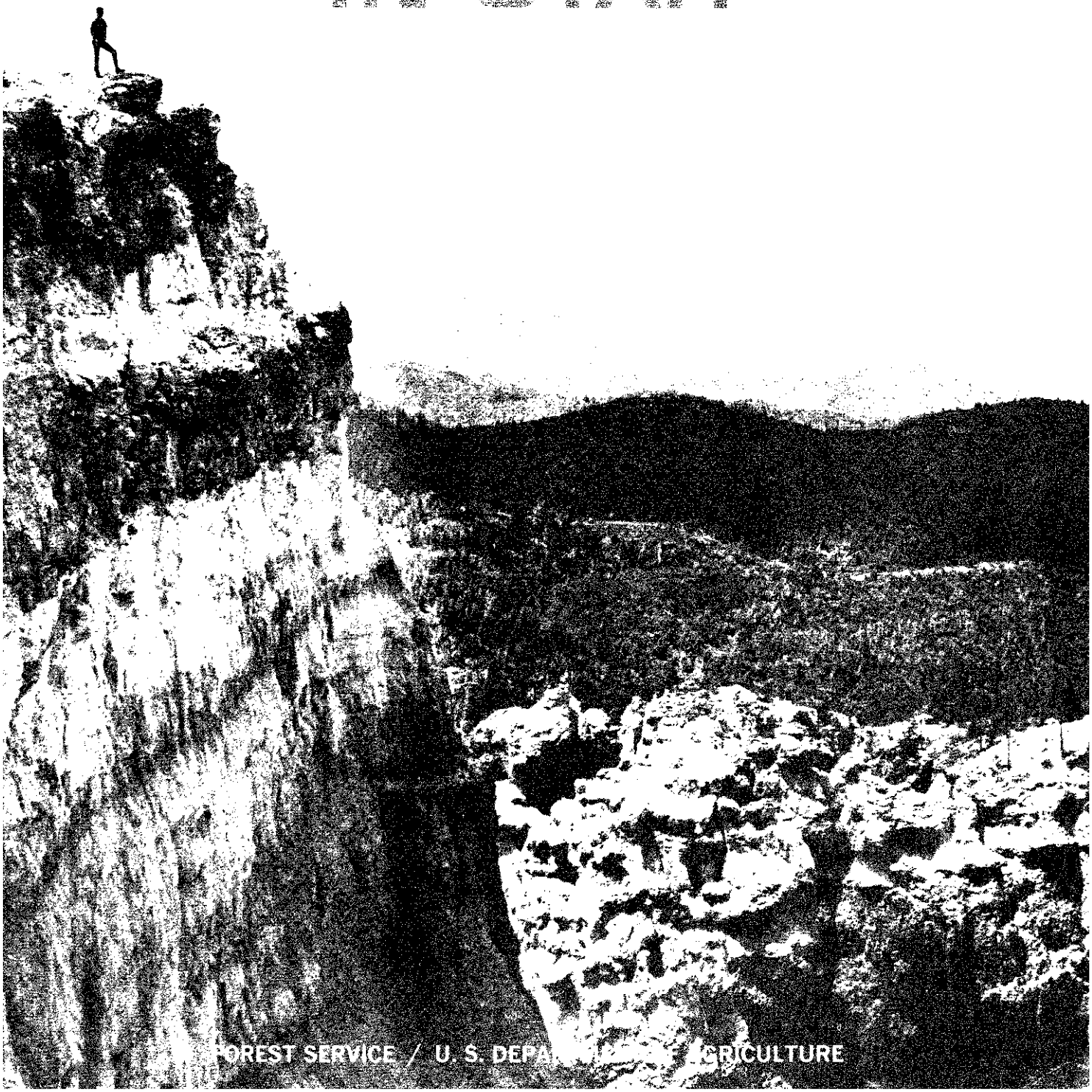
FORESTS IN UTAH



FOREST SERVICE / U. S. DEPA[illegible] OF AGRICULTURE

THE AUTHOR

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COVER PHOTO

View from Strawberry Point, Dixie National Forest. Extensive forests of ponderosa pine, Douglas-fir, aspen, and pinyon-juniper in contrast with colorful and deeply eroded rock formations make this one of the most spectacular landscapes in the United States.

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FORESTS IN UTAH

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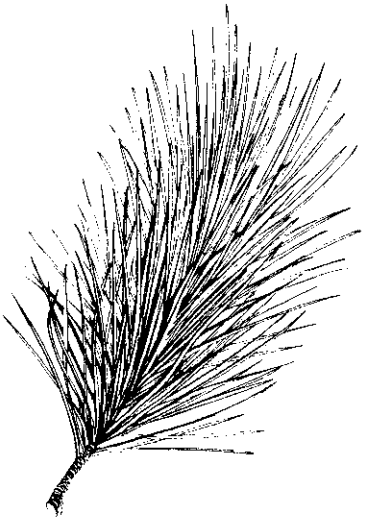


Intermountain Forest and Range Experiment Station
Forest Service
U.S. Department of Agriculture
Ogden, Utah
Joseph F. Pechanec, Director

FOREWORD

Inventory data in this report are the result of the first comprehensive survey of Utah's timber resource. The survey was conducted as part of the continuing nationwide Forest Survey. Fieldwork started in 1956 and was completed in 1961. The Intermountain Region of the U. S. Forest Service inventoried National Forest lands, and the Intermountain Forest and Range Experiment Station inventoried lands outside National Forests. The Intermountain Station combined the two sets of data into the Statewide compilation on which this report is based. Statistics on timber cut and timber products output for 1962 were collected in 1963 by the Intermountain Station.

Although the Survey shows that Utah has 1.3 times the commercial forest area and 2.5 times the volume of live sawtimber that were reported for 1952 in "Timber Resources for America's Future," (U.S. Forest Serv. 1958),[1] actual changes in timber conditions are believed minor. The most recent figures are based on a statistically designed survey, whereas the previous estimates were not. Also, some of the differences in estimates result from changes in commercial forest area and tree measurement standards.

The appendix to this report should be consulted for definitions of terms, description of survey methods, reliability of estimates, detailed timber statistics, and a generalized timber type map.

[1] *Names and dates in parentheses refer to Literature Cited, p. 41.*

CONTENTS

STATISTICAL HIGHLIGHTS

FOREST AREA

- Utah's forested area is 14.9 million acres, or 28 percent of its land area.
- The commercial forest covers 4 million acres, or 27 percent of the forest land.
- 9.3 million acres are classed as pinyon-juniper type. This is 86 percent of the noncommercial forest and 18 percent of the land area of the State.
- 83 percent of the commercial forest is publicly owned. The U.S. Forest Service administers 70 percent of the total commercial forest.
- Two-thirds of the commercial forest is in sawtimber stands, and these stands average 6,904 board feet per acre.[2]
- Aspen and fir-spruce are the largest timber types in the commercial forest. They cover about one-third and one-fourth of the commercial area, respectively.

TIMBER VOLUME

- Commercial forests have 5.8 billion cubic feet in sound, live trees, and 19.5 billion board feet in sawtimber trees.
- About 90 percent of the timber volume is publicly owned.
- Engelmann spruce is the leading species in sawtimber inventory—comprising 5.8 billion board feet or 30 percent of the total in all species.

[2]*International ¼-inch log rule board-foot volumes are used throughout this report unless otherwise stated.*

STAND CONDITIONS

- Most sawtimber stands and at least one-fourth of the poletimber stands are overmature. Seventy percent of the growth on sawtimber trees is offset by trees that die.
- Sawtimber mortality is more than three times the sawtimber cut.
- Insects and disease cause at least one-third of the mortality.

TIMBER USE

- In 1962 Utah's timber cut of 12.6 million cubic feet was one-fifth of 1 percent of its inventory. This is one-third the cutting rate for the Mountain States[3] as a whole.
- 90 percent of the roundwood products in 1962 was saw logs for lumber.
- Between 1960 and 1962 roundwood production decreased 19 percent and lumber production 3 percent.
- Between 1960 and 1962 the number of active sawmills dropped from 99 to 73, but average annual production per mill increased from 700,000 board feet to 918,000.
- Engelmann spruce was the leading lumber species in 1962 and accounted for about one-third of the lumber cut.
- Garfield County was the only county that had a saw log cut of more than 10 million board feet in 1962.

[3]*The following are considered as Mountain States in this report: Montana, Idaho, Nevada, Utah, Wyoming, Colorado, New Mexico, and Arizona.*

THE FORESTS

Utah's forest lands—15 million acres of foothills, high mountains, and plateaus—comprise 28 percent of the land area of the State. These forested highlands, which provide contrast and scenic relief from the arid climate of the level expanses of the Great Basin to the west, and of the canyon country to the south and east, have long been highly important to Utah and the Nation. The water these highlands could furnish for irrigation, and the timber needed for dwellings and many other uses, were important reasons why the Mormon migrants chose Utah as their stopping place in 1847. Subsequently, uses of forest lands have expanded in number and intensity until now some of Utah's forests are as heavily used as any in the country. The variety of uses and the effect one has on another, make it necessary to go beyond a discussion of the timber situation—the principal concern of this report. Water, recreation, and forage uses of forest lands also will be discussed in terms of values, trends, and some of the problems related to multiple use management.

The forests lie mostly between 5,500 and 11,000 feet in elevation

On the average, the forests begin at 5,500 feet in elevation. They extend up to timberline of about 10,000 feet in the northern part of the State and 11,000 feet in th southern. However, local conditions of soil and climate cause substantial variations. For example, near Santa Clara in southwestern Utah, pinyon and juniper trees grow at elevations as low as 3,200 feet.

Within the forested zone, precipitation and other climatic influences greatly affect the distribution of species. The general increase in precipitation from low to high elevations is a principal factor in the zonation of vegetation. Most of the pinyon-juniper lands receive from 10 to 16 inches of water a year. Above the 16-inch precipitation zone the general progression of species is (1) mountain brush[1] and/or ponderosa pine, (2) aspen, Douglas-fir, white fir, lodgepole pine, (3) subalpine fir and Engelmann spruce (fir-spruce type) and, (4) whitebark, limber, and bristlecone pines. This zonation, however, is far from consistent. Wide local variations occur because of site factors (as shown by the photo on the next page), fires, logging, and other land uses.

Fire has greatly affected the distribution and extent of the forest area and of individual species. Many of the biggest fires that influenced or determined present forest patterns occurred before white men settled in Utah. As John Wesley Powell (1879) observed in his Utah explorations between 1868 and 1879, Indians habitually set fires to drive game. His description of the vast acreages burned at that time and earlier is supported by the present area and age of stands of aspen and lodgepole pine. These species, which are noted for ability to regenerate after fire or to invade burned-over lands, now cover 2.0 million acres. Age of the stands indicates a great many started growing before 1850. After the Mormon pioneers settled in Utah the annual burn declined. Intensified detection and suppression efforts in recent decades reduced the forest area burned in Utah from 21,000 acres annually in the period 1943-52 to about 16,000 acres annually in the decade 1953-62. One of the most important results of reduced annual burn has been more favorable conditions for pinyon-juniper.

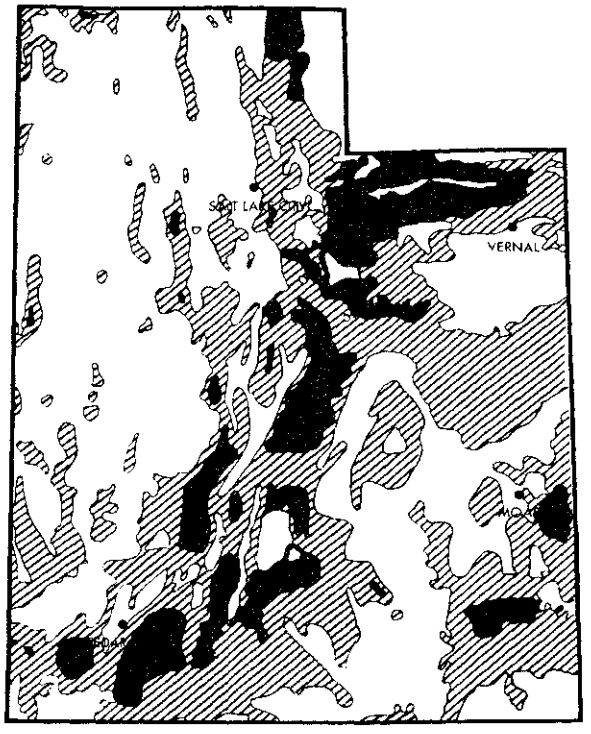
[1] *Mountain brushlands in Utah that are classified as forest consist largely of Gambel oak. However, other deciduous species are present in some areas, as well as broadleaf evergreens such as mountain mahogany. These lands are considered by Forest Survey as chaparral and are so designated in the statistical tables and generalized type map in the appendix to this report.*

About one-fourth of the forest area is commercially valuable for timber production

Four million acres, or 27 percent, of the forest area is classed as commercial.* The other 73 percent of the forest is classed as noncommercial and consists mainly of lands not suitable for commercial timber production. (Photo above and map on next page.) Only 165,000 acres of commercial quality forest in Utah are reserved from timber cutting and are therefore considered noncommercial. These lands lie in parks and wilderness area.

Forest land that is producing or is capable of producing crops of industrial wood and is not withdrawn from timber utilization.

Commercial and noncommercial forest lands on the Manti-LaSal National Forest, east of Fairview. This photo, which was taken facing east, shows commercial forest of Douglas-fir and aspen on the north-facing slopes. Parts of the hotter and drier south-facing slopes have noncommercial forest of mountain brush.



	million acres
commercial	4.0
noncommercial	10.9
total forest	14.9

The noncommercial forest is mainly pinyon-juniper

Utah has a lot of pinyon and juniper. The 9.3 million acres covered with these scrub conifers is almost 18 percent of the area of the State, and about 86 percent of the total noncommercial forest area. One million acres of mountain brush and about 0.6 million acres in aspen, fir-spruce, Douglas-fir, and other types make up the remainder of the noncommercial area.

Most of the noncommercial forest is at low and relatively dry elevations below the commercial forest zone and consists largely of pinyon-juniper and mountain brush. However, adverse climate and soil conditions at the upper forest elevation cause some of the timber to be noncommercial also. At intermediate elevations there are still other patches of noncommercial forest on poorer, shallower soils within the commercial zone.

Ownership of the 10.9 million acres of noncommercial forest is largely (about 80 percent) public. Roughly, 50 percent of the total noncommercial forest is administered by the Bureau of Land Management.

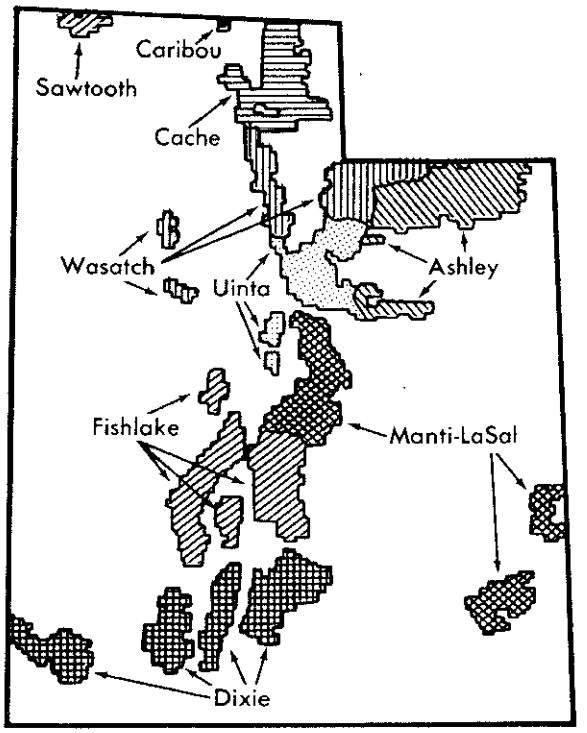
Pinyon-juniper lands are important in a number of ways. These dwarf trees form the predominant vegetative type on a substantial percentage of Utah's rangeland. Many thousands of acres of pinyon-juniper land have had sufficient potential for forage and cropland to justify clearing by public agencies and private owners. Use of the estimated 1,573 million cubic feet of wood in the two species (pinyon 48 percent, juniper 52 percent) has been minor. Fenceposts, fuelwood, charcoal, and Christmas trees are the principal products. The Bureau of Land Management (in cooperation with Utah State Experiment Station, Utah State University) is sponsoring research that may lead to greater use of pinyon-juniper lands.

The commercial forest is largely on public lands

About 83 percent of the commercial forest area and approximately 90 percent of the timber volume are in public ownership—mainly as National Forest. The distribution among ownerships is as follows:

	Thousand acres	*Million cubic feet*	*Million board feet*
National Forest	2,783	4,635	15,951
Bureau of Land Management	155	166	579
Indian	158	165	545
State	240	237	719
Farmer	540	500	1,354
Miscellaneous private	123	122	373
Total	3,999	5,825	19,521

NATIONAL FORESTS



National Forests in Utah form a broken band running down the center of the State (map above). They lie on the Wasatch Mountains at the north end and follow high plateaus — Wasatch, Markagunt, Paunsaugunt, Aquarius, and others—to the south. Other principal areas are the arm to the east along the Uinta Mountains, and isolated patches on the LaSal and Abajo Mountains in the southeast.

The lands that are now in nine National Forests were removed from the public domain between 1897 and 1908 as areas of particular importance for preservation of watershed and timber values. The Uinta was the first National Forest in the State, and one of the first in the United States.

Commercial forest lands administered by the Bureau of Land Management, or in State or private ownership, are generally in small and scattered parcels. Many of these tracts border or lie within the National Forests, although some occur on isolated highlands within the Great Basin or Colorado Plateau.

Holdings are less dispersed in the Indian and National Forest lands. Indian lands are largely within the Uinta-Ouray and Navajo Reservations. (Only 13 percent of all lands within National Forest boundaries is not in National Forest ownership.)

Sawtimber stands predominate in the commercial forest

About 66 percent of the commercial forest area is in sawtimber stands. Only 28 percent is poletimber, 5 percent saplings and seedlings, and 1 percent nonstocked.

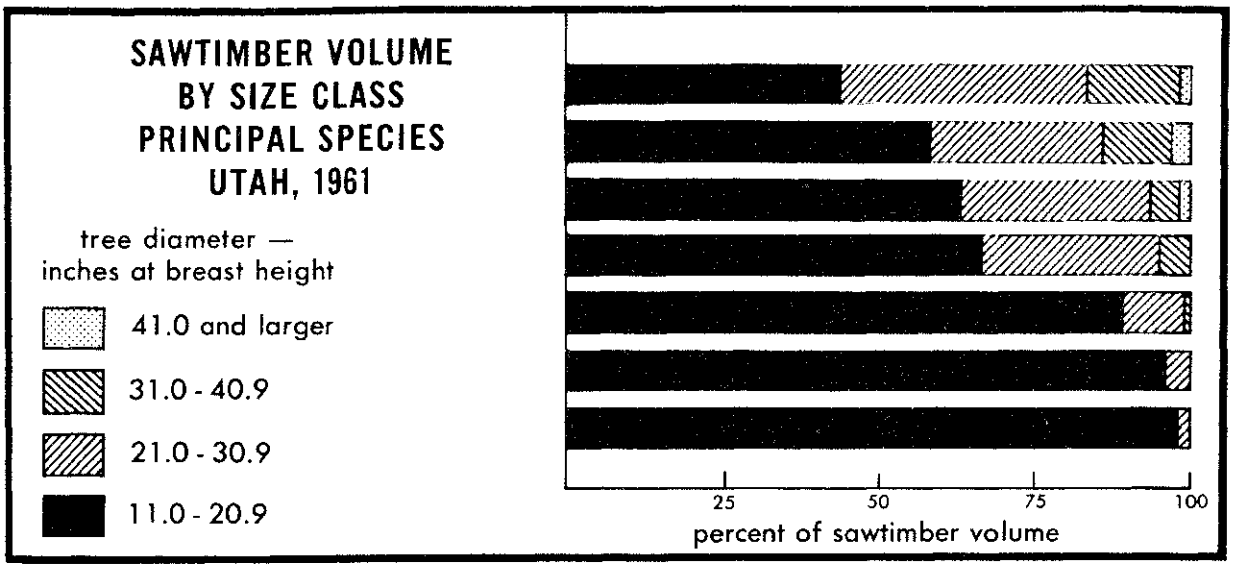
	Thousand acres
Large sawtimber[1]	572
Small sawtimber	2,057
Total sawtimber	2,629
Poletimber	1,125
Sapling and seedling	218
Nonstocked	27
Total all classes	3,999

[1] *Stands in which most of the board-foot volume is in trees 21.0 inches d.b.h. and larger.*

The figures above are for all commercial forest land, but the proportions are about the same for each of the principal classes of owners.

Of the 2.6 million acres of sawtimber stands in the State, only 22 percent is classed as large sawtimber. This compares with about 36 percent for the entire Rocky Mountain area. Twenty-eight percent of Utah's 19.5 million board feet of sawtimber is in large sawtimber trees.

Sawtimber stands in Utah have an average volume of 6,904 board feet per acre. In comparison, the average for Idaho is 12,560, Montana 9,661, and Colorado 7,317.



Average diameter of sawtimber trees varies greatly among species. Ponderosa pine has a greater percentage of sawtimber volume in larger diameter classes than any other species (chart above).

Height must also be considered in comparing tree sizes. Engelmann spruce sawtimber trees have a greater average total height than those of other species — although a height of more than 100 feet is not common for this species. White fir and Douglas-fir have relatively few trees over 90 feet high, while not many ponderosa pine are taller than 80 feet—except on parts of the Dixie National Forest.

Tree height in relation to age is the criterion used as the measure of site quality (site index[6]) in the table on this page. A close and reliable comparison of site quality in Utah with that of other Mountain States will not be possible until more data are available from some of the other States. Perhaps the best indication of productivity is yields of sawtimber stands. According to that criterion Utah is considerably below average. The photo on the following page shows the change in site quality that frequently occurs within a short distance on Utah's steep slopes.

[6]*Site index is the height in feet of average dominant and codominant trees at a specified age (100 years for ponderosa and lodgepole pines, 50 years for other species). For example, "site index 70" for ponderosa pine means the dominant and codominant trees on the area referred to average, have averaged, or will average 70 feet in 100 years.*

PERCENT OF AREA OF PRINCIPAL TIMBER TYPES BY SITE INDEX CLASSES

Type	Site index class										Average site index
	20	30	40	50	60	70	80	90	100	110	
Fir spruce[1]	4	28	33	25	8	2					40
Douglas-fir	3	21	39	24	9	4					43
Ponderosa pine			22	9	43	10	14	2			59
Lodgepole pine			30	41	18	8	2	1			51
Aspen	12	37	33	12	4	2					36

[1]*Based on site index for Engelmann spruce*

This aspen stand (along the edge of the nonforested area) illustrates how site quality for a species can change from good to poor within a very short distance on Utah's steep slopes. Trees at the bottom and top of the slope are the same age. However, those growing under the favorable soil and moisture conditions of the lower slopes are of sawtimber size and nearly 100 feet tall while those on the dry thin soils of the upper slopes are scrubby saplings. This stand covers an elevational range of about 1,000 feet on the west slopes of Monroe Peak, Fishlake National Forest.

Most stands are old; insect and disease losses are high

Although precise figures on age of stands are lacking, rough estimates can be made. About 70 percent of the coniferous sawtimber stands are more than 100 years old. More than 85 percent of the aspen sawtimber stands are more than 80 years old and can therefore be considered overmature. Many lodgepole pine stands of poletimber size are also mature. Trees in these old stands are growing very slowly and many are dying. While sawtimber trees make a total annual growth of about 321 million board feet, trees that die reduce this gain by about 70 percent.

Old stands are especially susceptible to disease and to attack by certain species of insects. The primary effect of most diseases is a reduction in growth rates, rather than a rapid killing of trees. On the other hand, insects—especially bark beetles—frequently kill trees very rapidly in old growth stands. For example, heavy attacks by Engelmann spruce and mountain pine beetles mean that infested trees will die within a year or two.

Among the many insects prevalent in Utah's forests, bark beetles have done the most damage in recent years and have been the most expensive to control. The mountain pine beetle has been particularly troublesome —especially in lodgepole pine stands, and to a lesser extent in ponderosa pine. Control measures have greatly reduced populations within the major epidemic areas on the north slope of the Uinta Mountains (photo on next page).

Many areas have infestations of other bark beetles — Engelmann spruce beetle, Douglas-fir beetle, fir engraver beetle, and Black Hills beetle. Although epidemic populations of these beetles develop periodically, they are not now at high levels. Defoliating insects are also widespread—in epidemic proportions in some areas. They chiefly cause loss of growth rather than death of trees, but several species are known to be tree killers.

Diseases and decay, while usually less dramatic in their effects than insects, nevertheless take as big if not a bigger toll from Utah's forests. Dwarfmistletoe is one of the worst enemies of the forest. This parasite is particularly common on lodgepole pine and Douglas-fir, but also thrives on ponderosa pine, especially in southern Utah. Although there are no data to show the total effect of dwarfmistletoe on timber growth and volume in Utah, some idea may be gained from local studies. About 55 percent of an area of 283,000 acres of lodgepole pine on the north slope of the Uinta Mountains has a significant amount of infection. Surveys in lodgepole pine stands in similar areas in Wyoming and Colorado showed that gross merchantable volumes in virgin stands free of dwarfmistletoe were 1.5 times as large as those in infected stands (Hawksworth 1958). These surveys also showed that dwarfmistletoe is especially prevalent in cutover stands such as those which were partially cut for railroad ties many years ago. Many such areas are included in the 216,000 acres of poorly stocked stands, and 226,000 acres of medium-stocked stands of lodgepole pine in Utah.

Many important diseases attack other species. Cull and growth loss caused by broom rusts are important in the fir-spruce type. Several native rusts of ponderosa and lodgepole pine deform many trees and cause cull, growth reduction, and mortality. In aspen, cankers are a major chronic affliction, and foliage diseases are periodically widespread.

Mountain pine beetle control in lodgepole pine stands on the Wasatch National Forest. This insect has ravaged extensive areas on the north slope of the Uinta Mountains. Here, during the years 1958 to 1963, more than 500,000 infested lodgepole pine trees were treated on an area of roughly 165,000 acres straddling the Utah-Wyoming border. Many of these trees were treated with toxic chemicals, some standing trees were burned (as in the photo above), some trees were felled and burned, and others were logged. Beetle populations in this particular area of infestation have been reduced to a relatively low level.

Five timber types make up almost the entire commercial area

Five timber types — fir-spruce, ponderosa pine, Douglas-fir, lodgepole pine, and aspen — comprise more than 99 percent of the commercial forest area. The distribution of area among these types is shown in the table below. Volumes of the seven principal species that occur in these types are as follows:

	Sound live trees[1]	Sawtimber trees
	Billion cubic feet	*Billion board feet*
Aspen	1.3	2.1
Engelmann spruce	1.2	5.8
Lodgepole pine	1.0	2.5
Douglas-fir	.9	3.9
Subalpine fir	.6	1.7
Ponderosa pine	.4	1.9
White fir	.3	1.3

[1]*Sawtimber and poletimber trees.*

In addition to the five types listed above, which are illustrated and described on pages 10 to 19, there are two minor types—white-bark-limber-bristlecone pine, and cottonwood.

Whitebark, limber, and bristlecone pines are high-elevation species often intermingled with Engelmann spruce, subalpine fir, and Douglas-fir. Because they grow on thin soils and in exposed locations most of the trees of these species are noncommercial. However, the whitebark, limber, and bristlecone pines on 29,000 acres are of sufficiently good quality to be classified as a commercial timber type. Most of the 221 million board feet of sawtimber in these species is limber pine. Very little is being harvested.

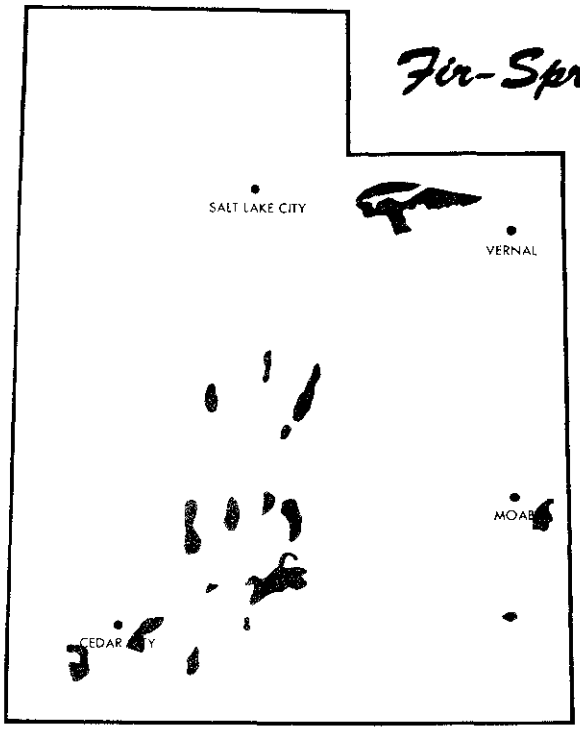
Far more cottonwood grows in Utah than is shown by Forest Survey estimates of 2,000 acres of cottonwood type and 2.3 million cubic feet of wood. Probably several times this amount is in clumps and stringers along streams; such areas are too narrow to qualify as forest by Forest Survey standards, and are classed as nonforest or are included in other forest types. Because cottonwood grows at lower elevations than other species suitable for lumber, it was important as a timber species to the early settlers. Substantial amounts have been cut annually throughout the years and in 1960 and 1962 cottonwood lumber production was 1.3 and 0.6 million board feet, respectively.

COMMERCIAL AREA OF PRINCIPAL TIMBER TYPES BY STAND-SIZE CLASS

	All stands	Sawtimber	Poletimber	Sapling-seedling	Nonstocked stands
			Thousand acres		
Aspen	1,280	386	753	124	17
Fir-spruce[1]	1,047	947	77	22	1
Douglas-fir	646	556	56	33	1
Lodgepole pine	563	311	223	28	1
Ponderosa pine	432	403	14	8	7

[1]*Included in the fir-spruce type is an area of 192,000 acres that is predominantly white fir. White fir is not recognized by Forest Survey as a major independent type.*

Fir-Spruce Forests



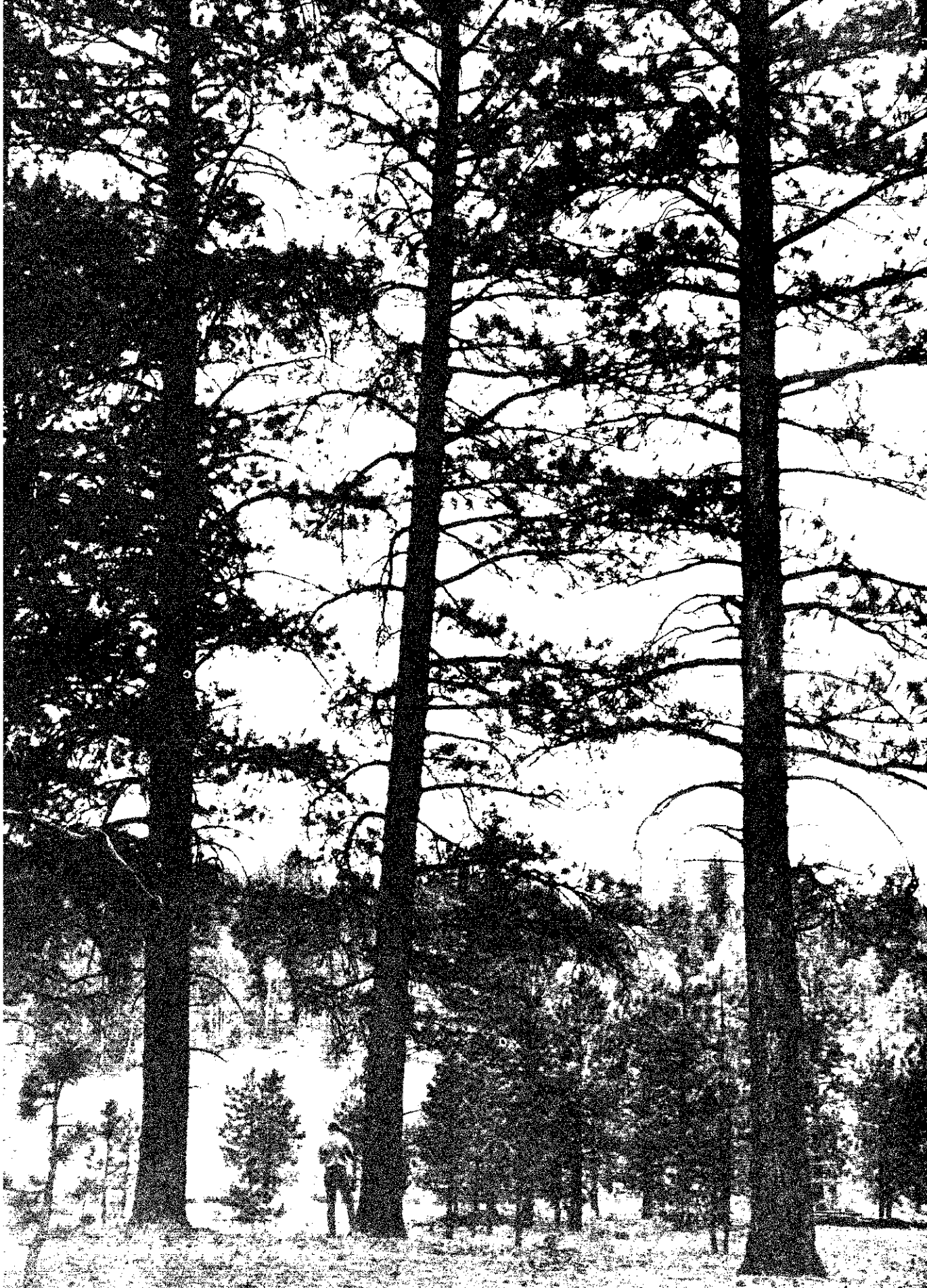
The stand of Engelmann spruce shown on the facing page is growing at an elevation of about 10,000 feet on the Fishlake National Forest. Larger trees are mature, more than 21 inches in diameter, and more than 110 feet in height.

The fir-spruce type occupies about 26 percent of the commercial forest area in Utah; in area covered, it is second only to aspen. The type occurs in many areas in the State, but always at high elevations—usually just below timberline, although it extends to lower elevations in sheltered locations. Engelmann spruce or subalpine fir predominate, either singly or in combination, in areas classified as fir-spruce type; Douglas-fir, white fir, and lodgepole pine are common associates. Ninety percent of the type is in sawtimber stands; about one-half of these stands are overmature. The 5.8 billion board feet of spruce in Utah is 30 percent of the State's sawtimber inventory. Subalpine fir and white fir comprise 9 and 7 percent, respectively, of the sawtimber in Utah.

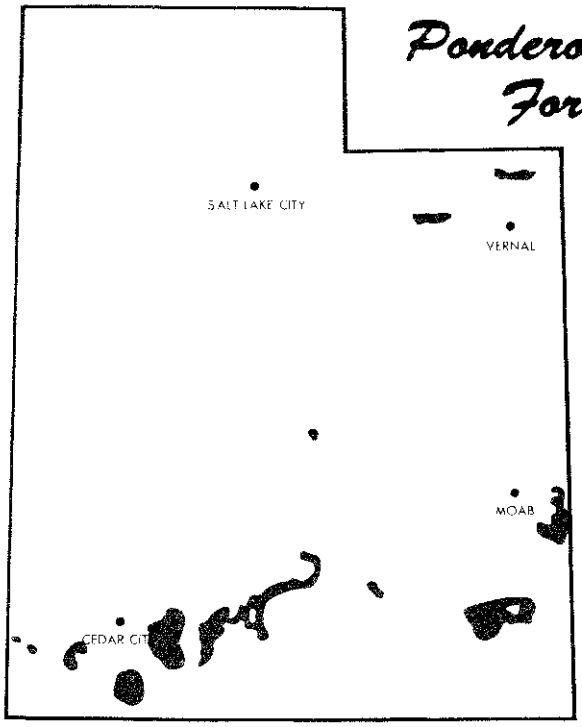
Slightly more than one-fourth of all lumber produced in Utah since 1869 has been Engelmann spruce. Starting in 1959, spruce became the leading species for lumber and in 1962 accounted for about one-third of the State's lumber production.

True firs[1] have generally accounted for only about 6 percent of the State's annual lumber production. However, in 1962 about 15 percent, or almost 10 million board feet, was from true firs; probably much more than 50 percent of this was white fir.

[1]*Subalpine fir and white fir are reported together as* true firs *in estimates of lumber and saw log production.*



Ponderosa Pine Forests

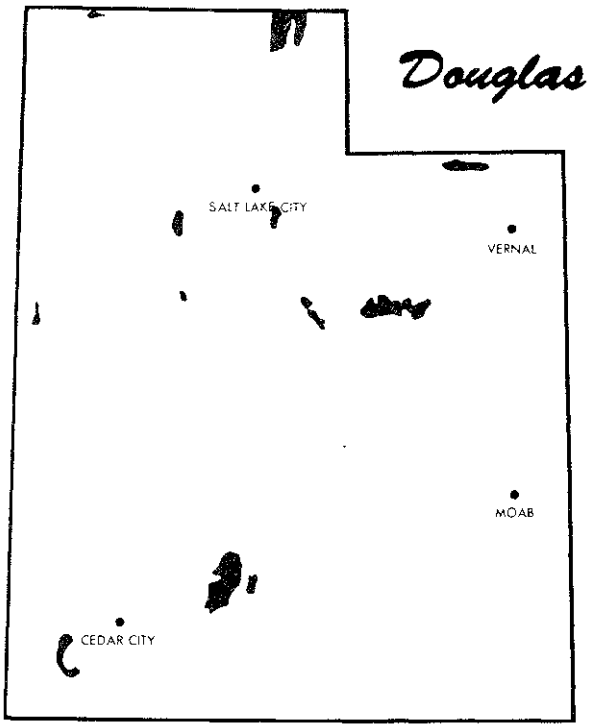


The photo facing this page shows a stand of ponderosa pine of large sawtimber size on the Markagunt Plateau, Dixie National Forest. Trees in the foreground are about 26 inches in diameter, 90 feet high, and 180 years old.

About 432,000 acres, or 11 percent, of the commercial forest in Utah is ponderosa pine. The greatest proportion of the type is in the southern part of the State—53 percent is on the Dixie National Forest, and 14 percent on the Manti-LaSal (principally on the LaSal Division, which lies near the Colorado border). Ponderosa pine generally grows at lower elevations than any other commercial species, and in many areas oak and herbaceous vegetation are abundant in the type. Although 93 percent of the type area is sawtimber, a smaller percentage of the trees are overmature than is the case in other types. This reflects the relatively heavy use of ponderosa pine for many years.

About 41 percent of all lumber sawed in Utah since 1869 has been ponderosa pine, and between 1869 and 1904 this species accounted for about 90 percent of the cut. In 1962, ponderosa pine made up about one-fifth of the sawtimber cut. Ponderosa pine continues to be the leading species harvested annually in terms of the percentage of inventory of individual species (see chart page 32) because it is a large tree, has good wood properties, and is easily accessible for logging.

Douglas Fir Forests

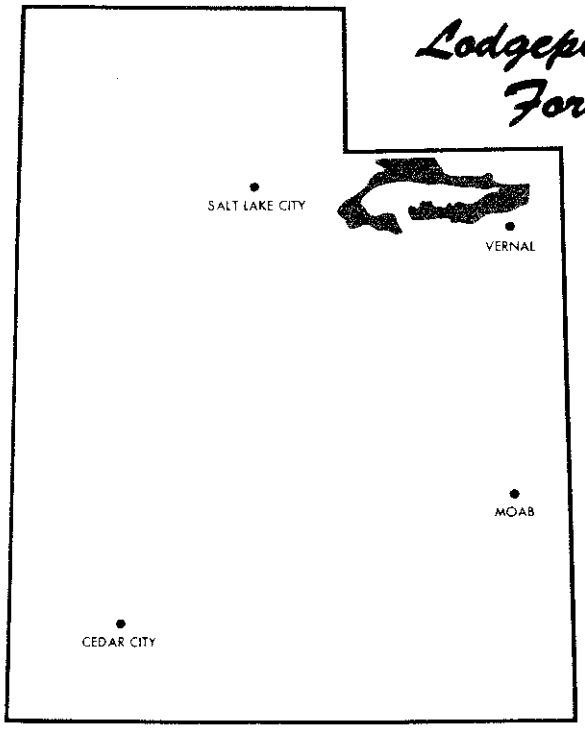


A stand of Douglas-fir poles and small sawtimber (photo on facing page) in Logan Canyon, Cache National Forest. These trees are growing in a draw on a north-facing slope. This is a more favorable site than the steep and exposed slopes with thin soils characteristic of Douglas-fir sites in Utah. Under the latter conditions trees are more widely spaced, shorter, and of poorer form than those seen in this photo. For this reason Douglas-fir timber value is usually low, but watershed protection value is high.

The Douglas-fir type covers 646,000 acres, or 16 percent of the commercial forest. The type is widely distributed geopraphically and grows at intermediate elevations—above ponderosa pine and mountain brush but below the principal areas of fir-spruce. Trees of most of the other commercial species are also often present in the type. Eighty-six percent of the area of Douglas-fir type is in sawtimber stands, and between 40 and 50 percent of these are overmature. Compared to most other types, a relatively high proportion (22 percent) is in private ownership. The 3.9 billion board feet of Douglas-fir sawtimber in Utah comprises 20 percent of the State's sawtimber inventory.

The cut of Douglas-fir has generally been small compared to that of the other principal species in Utah's forests. Since 1869 only 8.5 percent of the lumber sawed in the State has been Douglas-fir. In 1962 it was only about 10 percent.

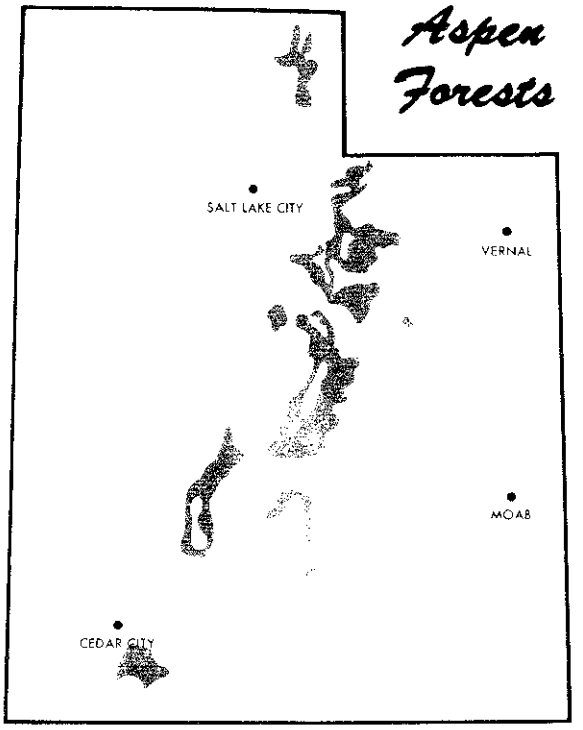
Lodgepole Pine Forests



The photo to the left shows a lodgepole pine stand of small sawtimber trees on the Wasatch National Forest. This stand on the north slope of the Uinta Mountains has features of many of the old stands in this area. It was logged for railroad ties in the 1800's and only trees that would meet specifications for tie timber were cut; trees that were too large or too small were left. Opening the stand favored development of dwarfmistletoe which is now extremely widespread and has a big effect in reducing tree growth. "Brooms," such as appear on many of the trees shown in the photo, are one indication of the presence of dwarfmistletoe. Presence of this parasite is only one of the several problems involved in managing lodgepole pine, discussed later in this report.

The lodgepole pine type grows mainly on the Uinta Mountains in the northeast portion of the State. Of the 563,000 acres of commercial lodgepole area in Utah, 83 percent is in National Forest ownership within the Wasatch and Ashley Forests. Much of the remainder is also within the boundaries of these Forests but is in private and other public ownership. The type covers a considerable range of intermediate elevations—in some places from the upper limit of the pinyon-juniper area up to almost timberline. More than 50 percent of the lodgepole pine area has stands that are beyond rotation age. These old stands are largely of sawtimber size. However, because lodgepole pine tends to grow in stands that are so crowded that growth is badly inhibited (often to the point of stagnation of the stand), many trees reach maturity before graduating from pole-timber size.

Lodgepole pine has averaged only about 15 percent of the annual lumber production in recent years as well as throughout the period since 1869. However, large volumes of nonlumber products have been cut from lodgepole pine stands. Millions of railroad ties were hand hewn from this species during the "tie-hack" era of the late 1800's and early 1900's. Most of these were cut on the north slope of the Uintas and floated down to concentration yards in Wyoming. Round mine timbers, poles, and posts were also cut in great numbers from lodgepole pine for many years. Lumber, including sawed mine timber and ties, has gradually increased as a proportion of the cut, and now roundwood products make up only 5 percent of the output of all lodgepole pine products.



Aspen sawtimber on the Fishlake National Forest (photo on facing page). This mature stand is at an elevation of almost 10,000 feet. The larger trees shown here are about 18 inches in diameter and 80 feet high.

Utah shares with Colorado the distinction of having some of the finest aspen in North America. Within recent years several aspen trees in Utah have been acclaimed the largest (in diameter) in North America. The latest is a tree 42 inches in diameter at the foot of Mt. Nebo (Cottam 1963).

The aspen type covers more acres in Utah than any other commercial type — 1.3 million acres, or 32 percent of the commercial forest. It grows throughout the elevational range of commercial forest and under a wider range of site conditions than any other species. As a result, many acres of unthrifty stands are on poor sites. On the other hand, Utah has extensive areas of thrifty, well-formed aspen trees, especially at mid-elevations in the central part of the State. Many aspen stands have a substantial understory of conifers which will eventually replace the aspen. Extensive areas, however, do not have such an understory and will continue indefinitely as aspen stands by reproducing through sprouts.

About 30 percent of the aspen stands are sawtimber size and 59 percent are poletimber size. The latter comprise two-thirds of the stands of poletimber size in the State. The aspen sawtimber volume of 2.1 billion board feet is about 11 percent of all the sawtimber in the State. Nearly seven-eighths of the sawtimber stands are overmature.

Aspen wood has properties that are desirable for many industrial purposes, but its use has been very minor in Utah. The wood is soft but tough, straight-grained, uniform in texture, tasteless and odorless, easy to work, relatively low in shrinkage, and shock resistant for a light wood. In Utah, aspen has been used principally for lumber, excelsior, houselogs, and core stock. Elsewhere, other important uses for aspen are for pulpwood, dimension stock, containers, and matchsplint veneer. Despite the potentialities for use, only 2.1 million board feet were sawed into lumber and 382,000 cubic feet used for excelsior and farm timbers in 1962. The timber cut for these products was only one-twentieth of 1 percent of the inventory of aspen—by far the lowest percentage of any of the major species.

The aspen forest, however, is very important for uses other than timber. It provides extremely valuable watershed protection. Aspen is an important browse species for big game and livestock, and in many areas the undergrowth in aspen stands provides some of the State's best wild land forage. And scenic value must be mentioned in any discussion of the importance of aspen. The brilliant autumn foliage of aspen stands in the American Fork and other canyons along the heavily populated Wasatch Front and elsewhere probably does as much to bring the forest to the attention of the average citizen as any of its economic values.

THE FOREST IN USE

The nearly 15 million acres of forest land in Utah have many values to the State and the Nation. Practically all these lands are very important for the water they provide the otherwise arid lowlands. A large proportion of these same acres also provides forage for livestock and big game, and nearly every acre provides habitat for other species of wildlife. Trees have been cut and used from many of the 4 million acres of commercial timberland. And practically the entire forest area is available to the public for recreation in some form—hunting, camping, and so forth.

The forests have been important for water, forage, and timber supplies since pioneer days. Substantial recreation use is a later development. Some forest uses have developed to the maximum that the land will support in its present condition. Many areas have been overused, and problems have resulted when attempts were made to restore these lands or least prevent further deterioration. On the other hand, large areas remain untapped for some values.

The next few sections discuss in a general way forest values and trends in their use.

Forests mean water

The water that runs off Utah's forests and other lands within the elevational range of the forests is an important source of supply in the Western States. It is by far the principal water supply for irrigation, domestic, and other uses in Utah's valleys and flatlands. It is also essential to downstream States, particularly Arizona and southern California.

Forests and intermingled open lands within the forested zone of Utah's mountains and foothills comprise about 49 percent of the land area of the State, but they furnish 78 percent of the State's water runoff.[5] The remaining 22 percent comes from the nonforest lands below or above the forest.

About 8.6 million acre-feet of water runs off all lands in the State each year. It flows in three drainages—Great Basin (56 percent), Colorado River (43 percent), and Columbia River (1 percent). The 78 percent of the State's total runoff that is contributed by lands in the forest zone is distributed among drainages in about the same proportion as the runoff from all lands in the State.

The total annual runoff of 8.6 million acre-feet represents an average of 1.9 inches over the entire State. However, as shown in the the following tabulation, there are substantial differences in the yield of water from nonforest and forest areas, and from different types of forest areas.

	Runoff Inches
Nonforest	0.8
Pinyon-juniper	1.0
Other forest	7.8
All lands	1.9

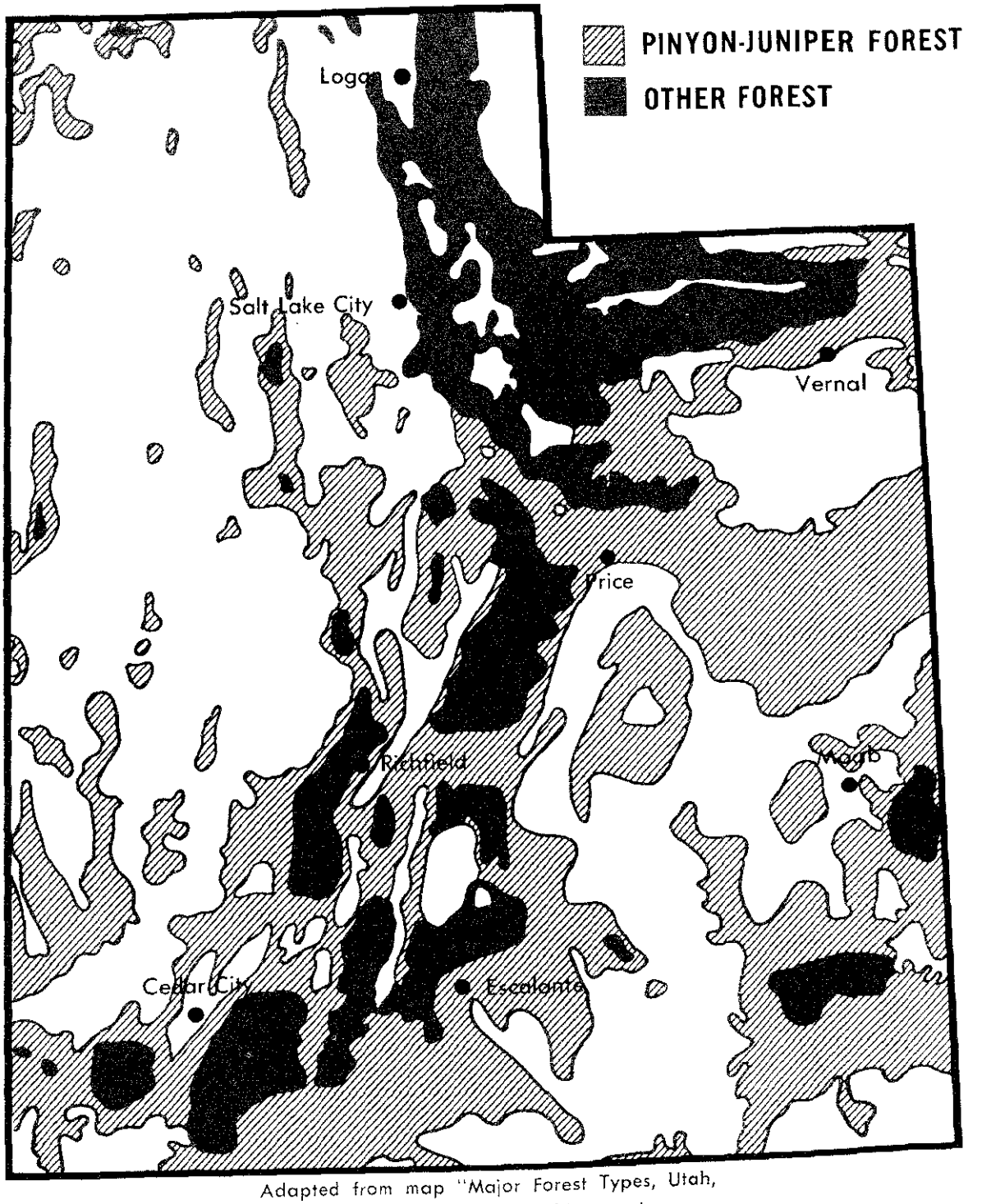
The generalized maps on pages 22 and 23 indicate the distribution of the classes listed above, principal water-yielding areas in terms of inches of runoff, and the major drainages.

[5] *Estimates of water yield from forest lands (and other lands within the elevational range of the forests) are based on two sources of information: (1) the map* Major Timber Types *in the appendix of this report, and (2) the map* Mean Annual Runoff *in the report* Developing a State Water Plan, *Utah State University and Utah Water and Power Board, 1963. The maps were brought to a common scale and one superimposed on the other to determine relationships.*

This photo shows a panorama of multiple use opportunities at the south end of the Wasatch Plateau. This area, between 9,000 and 10,000 feet in elevation on the Manti-LaSal National Forest, is representative of many areas in Utah. These forests are of primary importance for protecting soil and other watershed values. This predominantly forested area, with its meadows, lakes, and streams, provides fir and spruce timber, forage for wildlife and livestock, water for many uses, and recreational values such as hunting, fishing, and scenery. Much of the forest and interspersed nonforest land in southern Utah presents outstanding opportunities for full and immediate multiple use management.

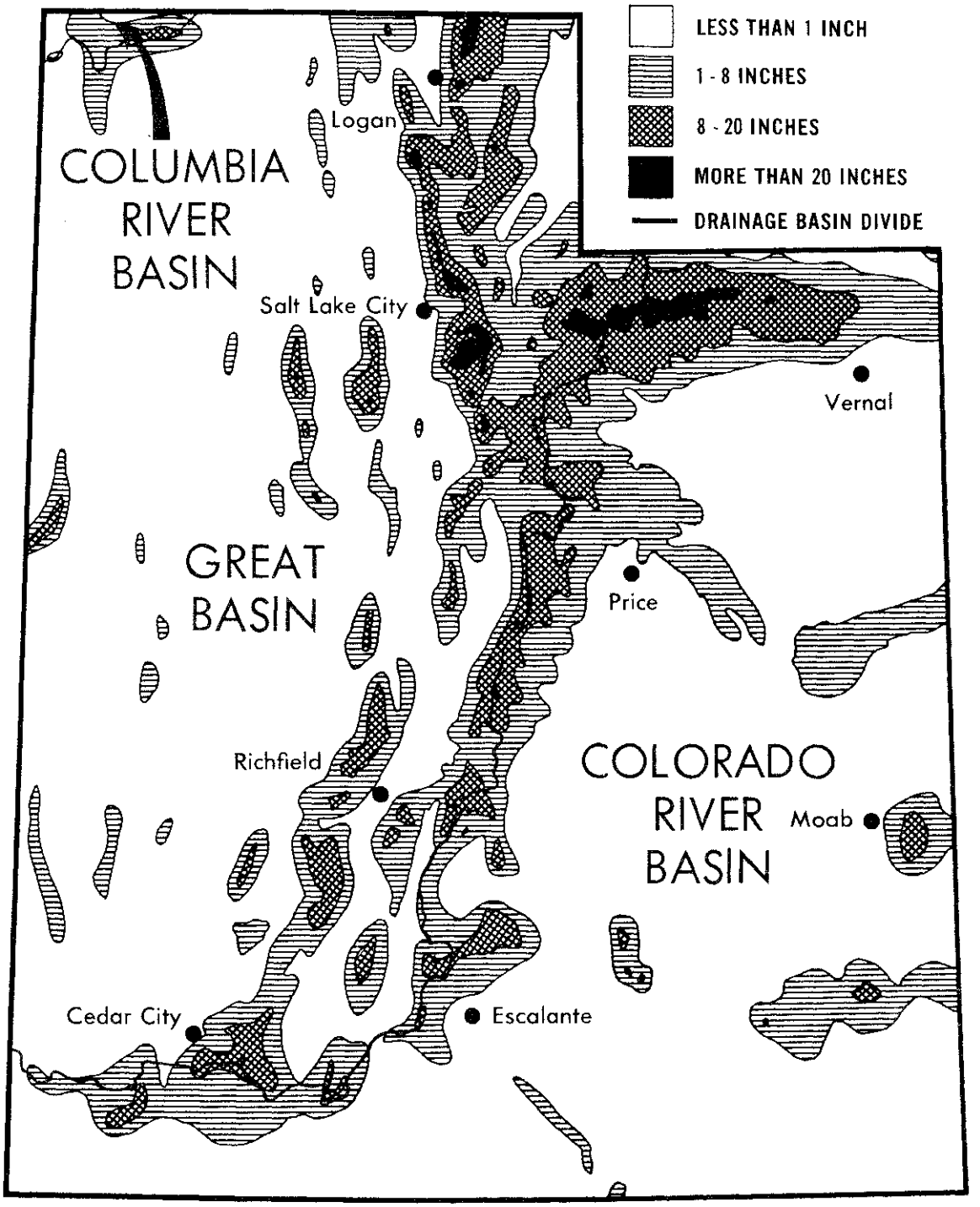
Water originating from the remains of the snowpack on the headwaters of Ephraim Creek at an elevation of about 9,500 feet. These waters will eventually be used in the Great Basin for irrigation, domestic needs, and other purposes. Almost four-fifths of the Great Basin's water runoff originates from mountain lands within the forested zones.

FOREST LANDS



Adapted from map "Major Forest Types, Utah, 1964" in appendix of this report.

MEAN ANNUAL RUNOFF AND PRINCIPAL DRAINAGE BASINS



Adapted from map "Mean Annual Run-off" shown in the report "Developing a State Water Plan," Utah State University and Utah Water and Power Board, 1963.

The value of forest and high elevation rangelands for water production is underscored by the importance of the water itself. Runoff, together with ground water supplies, represents the total available water for irrigation, municipalities, industries, livestock, recreation, fisheries, waterfowl, and other wildlife. The State's water requirements are expected to increase about 21 percent by 1980 (Utah State University and Utah Water and Power Board 1963).

The importance of Utah's mountains for water clearly indicates the vital need for watershed protection and other management. To date, projects on public lands have attempted mainly to restore impaired watersheds and to maintain soil stability on watersheds which are still in good condition. However, the expected increase in demands for water point to the need for increasing the quantity and quality of yields by forest management measures.

For many years the U.S. Forest Service has conducted research in Colorado and Utah into techniques for improving and increasing water supplies from forest lands in the Rocky Mountains. Studies in Colorado indicate that yields of water from the mountain snowpack and timing of the runoff vary significantly with the kind of forest (hardwood or softwood), size of trees, stocking of stands, degrees of thinning, harvesting patterns, and other factors. Evidence strongly indicates that yields of usable water can be increased by manipulating tree cover. However, much more research is needed before conversion from one type of tree cover to another can be considered economically practical. As part of this research the effects of such conversion on other forest values must be studied.

The forest range has a history of heavy and sustained use

Utah's forest ranges have been grazed for a long time. Pinyon-juniper, aspen, ponderosa pine, and other forested lands provided forage for deer, elk, antelope, and buffalo long before 1847 when Mormon pioneers drove in their herds of gaunt cattle. Livestock numbers were not long in building up. By 1880 at least 136,000 head of cattle and almost 600,000 head of sheep grazed on Utah ranges. Still greater increases in the boom period following 1880 resulted in statewide populations of 344,000 cattle and 3,818,000 sheep by 1900.

National Forest figures showing animals under permit provide a basis for indicating trends in use of the forest range since 1900. These data indicate the number of sheep on National Forests dropped from a peak of 1,001,000 in 1913 to 407,000 in 1962—a decrease of 59 percent. Cattle numbers were at their peak during World War I because of pressures for meat production. From a peak of 179,000 head of cattle on the National Forests in 1918, there was a drop of more than 40 percent to a level of 102,000 in 1962.

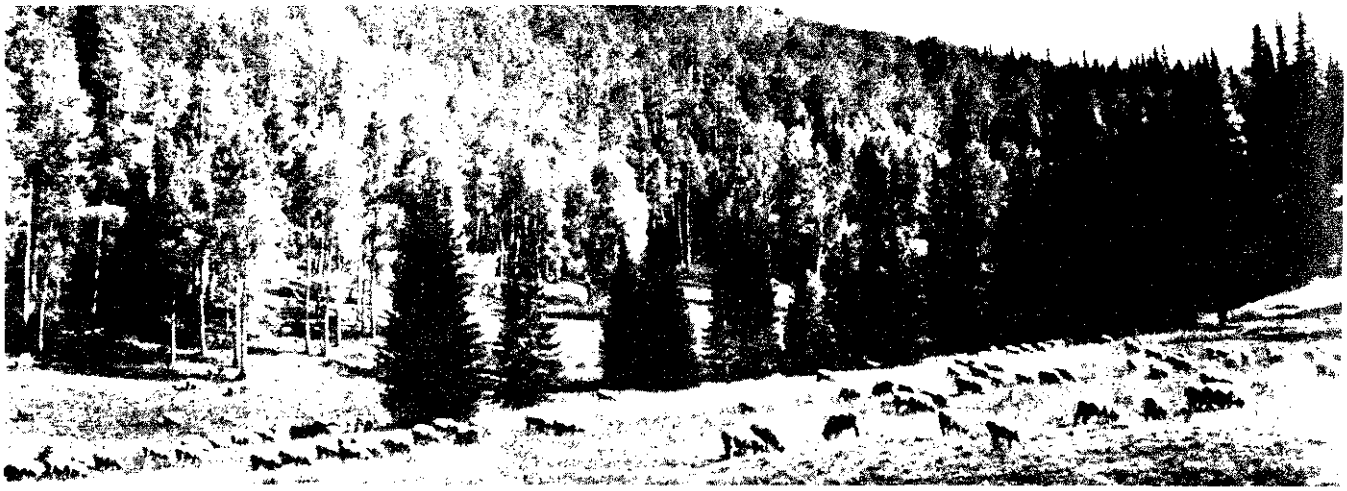
The largely uncontrolled grazing in early days left its mark on the range. As early as 1900 large areas of pinyon-juniper, aspen, ponderosa pine, and other forest rangelands were badly depleted of forage; even worse, soil cover was destroyed and the lands laid open for erosion. Depleted ranges, realization of the need for grazing controls, and economic difficulties in the sheep industry all contributed to the decline in number of livestock on the forest range.

Management of the range is complicated by the need for considering water, recreation, and wildlife values on practically the entire forest range. Competition for forage by deer and livestock has been a problem for many years, especially with the buildup of the deer population since 1930. However, competition is less acute in the mountain forest range than in the foothills because the amount of forage on the former is usually more plentiful. The foothill range, which generally is less productive and more limited in area than the summer range, is used more heavily—by deer in the winter and by livestock in the spring and fall seasons.

Many improvements are being made in management of the forest range. Programs of the Bureau of Land Management and the U.S. Forest Service (the two principal public

administrators of the forest range) include: closer control of number of livestock, construction of check dams and reservoirs, contour trenching, more use of rotation and deferred grazing practices, and control of juniper and sagebrush followed by reseeding of thousands of acres to desirable species of grass and browse. Cooperative programs of public agencies and livestock operators have also been carried out successfully in several parts of the State.

Many of the methods for improving winter ranges for big game were developed cooperatively by the Utah State Department of Fish and Game and the Intermountain Forest and Range Experiment Station.



The photo above shows sheep on meadow and forest range at about 9,000 feet on the Manti-LaSal National Forest. Many thousands of acres of aspen lands—similar to those on the slope in the background—provide excellent forage of forbs, shrubs, and grasses for Utah livestock and game. In some places, such as large areas on the Dixie National Forest, very heavy browsing by big game and domestic livestock has eliminated most of the aspen reproduction. This has accelerated the takeover by coniferous trees and the consequent deterioration of forage values. This situation typifies the complex problems in multiple use management in Utah.

The photo on the right shows range revegetated for livestock and deer. These cattle are grazing on an area where scattered pinyon-juniper and ponderosa pine grow at an elevation of 8,000 feet on the Paunsaugunt Plateau, Dixie National Forest. This is part of about 25,000 acres revegetated by drill seeding between 1948 and 1950.

Recreational use of forests is especially intense in Utah

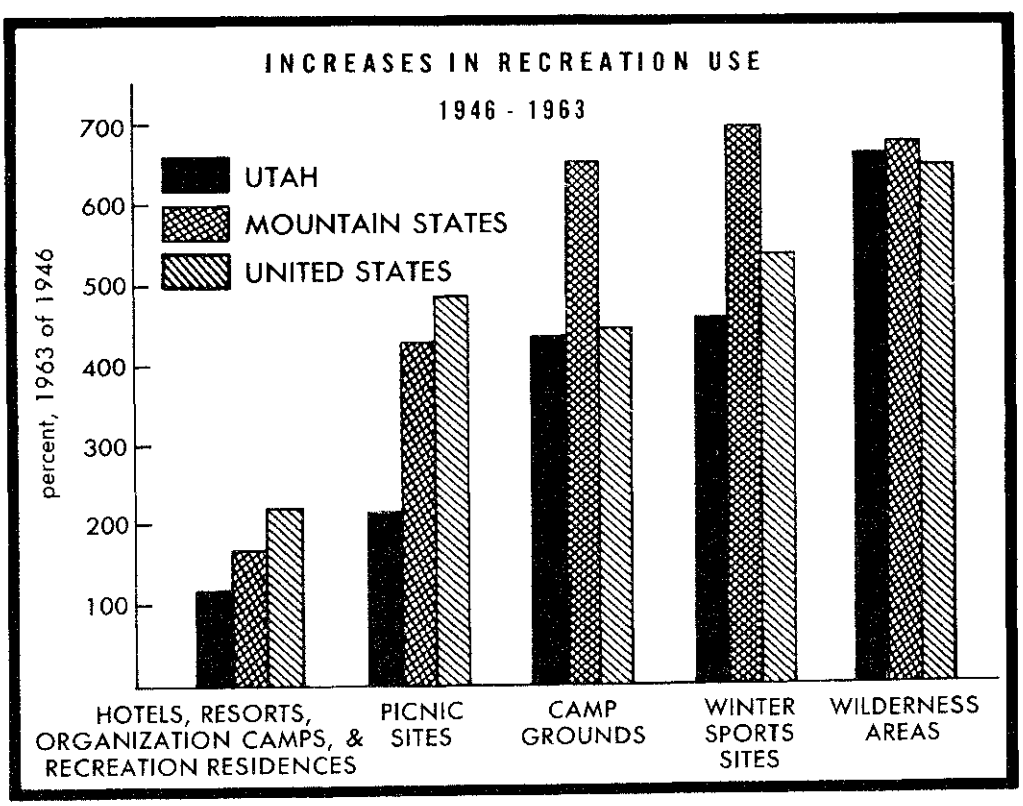
Utah's forested mountains, which attract campers, picnickers, hunters, skiers, and many others, are some of the most heavily used recreational lands in the West. Use is especially heavy on the forest area along the heavily populated Wasatch Front.[1] For example, in 1963 the Wasatch National Forest ranked third in recreational traffic among the 154 National Forests in the United States. The official tally showed 3.2 million man-days of recreation use.

There are also indications that Utah ranks first among the Mountain and Pacific Coast States in recreation visits per acre of forest land. Although figures are not available on the recreation use of all forest lands by States, National Forest estimates of number

[1] *In 1960, 82 percent of Utah's 891,000 people lived in the six Wasatch Front counties — Cache, Box Elder, Weber, Davis, Salt Lake, and Utah.*

Photos on the facing page show some of the opportunities for year-round forest recreation in Utah. A chair lift on sparsely timbered upper slopes at Alta Ski Area, Wasatch National Forest, is illustrated in the upper photo. Skiing conditions in many of Utah's forest areas, particularly on the Wasatch Mountains, are unexcelled in the United States. The long ski season, with fluffy, dry, powder snow, results in heavy local and out-of-state use of ski facilities and expenditures of several million dollars a year by skiers. Facilities at major ski areas such as Alta, Brighton, and Park City are constructed and operated by private enterprise on both public and private lands. These ski areas and others are important in the year-round use of Utah's forest lands for recreation.

Lower right photo shows a campground in Sheep Creek Canyon, Ashley National Forest. This is one of about 215 campgrounds on State and Federal lands in Utah. Brilliant autumn foliage of aspen in contrast with dark evergreens, against a background of massive upthrust and eroded rock formations, creates major scenic attractions in many areas of the State.



of visits by recreationists do permit certain comparisons.[10] On this basis, the following tabulation shows Utah's preeminent position in 1963 in relation to other leading States, and in comparison with averages for western regions and the country as a whole.

	Number of visits per 1,000 acres of National Forest Land
Utah	1,127
Colorado	909
California	886
Mountain States	539
Pacific Coast States	665
United States	673

The number of visits to Utah's National Forests by class of use in 1963 were as follows:

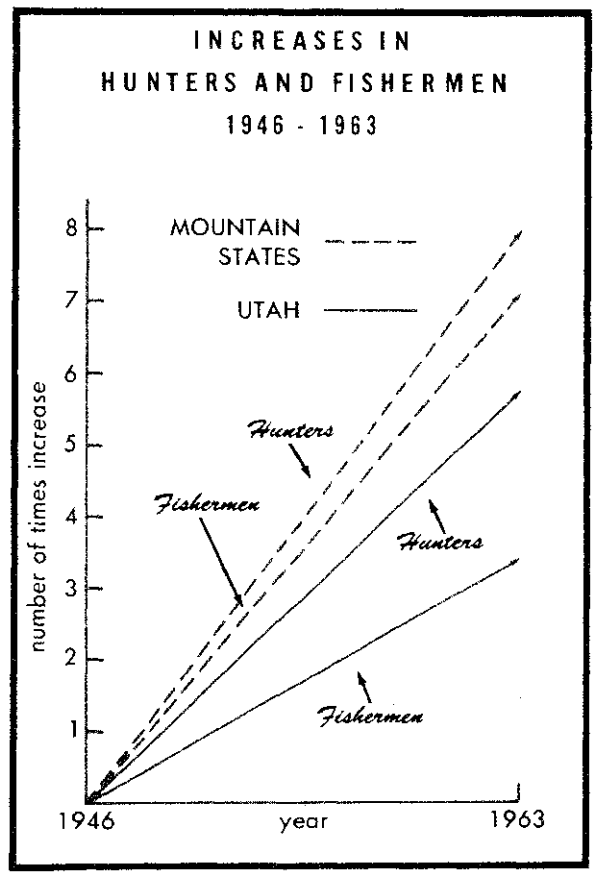
Picnic sites	2,617,900
Campgrounds	1,499,200
Winter sports sites	662,000
Hotels or resorts	75,600
Organization camps	68,700
Recreation residences	64,800
Wilderness areas	45,400
Other forest areas	3,847,900
Total	8,881,500

Many forest recreation areas outside the National Forests are probably just as heavily used. Private enterprises, both inside and outside National Forests, provide facilities for skiing, boating, pack-tripping, and other activities. The Utah State Park and Recreation Commission, National Park Service, and Bureau of Land Management all have active programs to foster outdoor recreational use of the forests.

Although Utah is the leading western State in intensity of recreation use of the forests (as indicated by National Forest data), the State has been falling behind in the *rate* of increase in recreation traffic since World War II (chart page 26). This situation is also illustrated by estimates of Utah's share of the recreation visits to National Forests of the Mountain States. In 1946, 36 percent of the visits were in Utah, but by 1963 the percentage dropped to 18. In other words, while Utah had a head start, other States have been catching up.

As in every other State, hunting and fishing have become increasingly popular since World War II. Between 1946 and 1963 there was almost a sixfold increase in the number of visits to National Forests for hunting deer, elk, moose, bear, and upland game birds. During the same period the number of visits by fishermen increased about 3.4 times. As shown by the chart on this page, both of these increases are less than Mountain States averages.

The estimated legal take of 96,000 head of big game on the National Forests in 1963 represents a substantial increase over the 35,000 in 1946.



[10] *National Forest statistics on number of recreation visits are used here and elsewhere in this report for two reasons: (1) they are practically the only data available for forest land as distinguished from all lands that are used for outdoor recreation, and (2) they permit ready comparisons among States.*

Timber cut and economic returns are low in relation to inventory

Utah's forests have never been heavily exploited for timber. In contrast to the very high value of forest lands for water, capacity use of the forest range, and the bustling demands of recreation, timber use has been moderate. Millions of trees have grown to sawtimber size and died without the touch of an ax or a saw.

Many factors discourage timber operations in Utah. Size of trees, grades of logs, and volumes per acre are generally less favorable for logging in Utah than in most areas of the Mountain States. Steep slopes, delicate soils, and the isolated location of much of the best timber result in high costs for constructing roads that will not cause erosion. As a result of these various considerations, a great many stands (although classed as commercial forest) are not profitable logging chances. This is particularly the case when the timber operator is required to bear all, or even a major portion of road construction costs. In other stands classed as commercial, existing or planned use of the forest for recreation or other purposes limits timber-harvesting opportunities. These limiting factors, as well as other considerations that enter into long-term timber management planning in Utah, are discussed later in this report.

In 1962, Utah's cut of 12.6 million cubic feet was only one-fifth of 1 percent of its inventory of 5.8 billion cubic feet of sound live trees. The following tabulation shows how low this cut is in comparison with other Mountain States and the United States.

	Percent of inventory cut, 1962, all species
Utah	0.22
Colorado	.22
Wyoming	.29
Nevada	.36
New Mexico	.60
Montana	.83
Idaho	1.02
Arizona	1.08
Mountain States	0.69
United States	1.62

Relationships among Mountain States are almost the same when sawtimber cut is considered in relation to sawtimber inventory.

Utah's low cutting rate is the principal factor in a low rate of economic returns from the timber resource. Data for 1958[11] (U.S. Forest Service 1963) can be used to compare Utah with the Mountain States average by certain economic measures. For 1958 the stumpage value of $47.62 per thousand cubic feet of timber cut in Utah was practically as high as the $48.84 average for the Mountain States. However, as shown in the following tabulation, Utah is far below the Mountain States average when value of products shipped from primary manufacturing plants[12] is related to the inventory of wood in the forest.

	Value of shipments	Value of shipments per billion cubic feet of inventory
	Thousand dollars	
Utah	6,000	1,030
Mountain States	319,300	3,300

The primary reason for the low value shown above for Utah (actually the lowest of all Mountain States) is the small amount of wood processed in comparison with inventory volume. A related reason is that Utah does not have industries that convert wood to relatively high-value products such as plywood and pulp and paper. Utah is at a disadvantage in comparison with the West Coast in producing for national markets. The extensive areas of big timber on the coast favor establishment of large integrated mills with lower production costs.

A number of roadblocks standing in the way of a rapid increase in timber cut are discussed later in this report. To the extent that these problems can be reduced, the people of Utah will realize greater returns in wages, profits, and taxes from more timber harvesting and bigger wood conversion industries.

[11] *1958 is the latest year for which there is Census of Manufactures data of the type used for this analysis.*

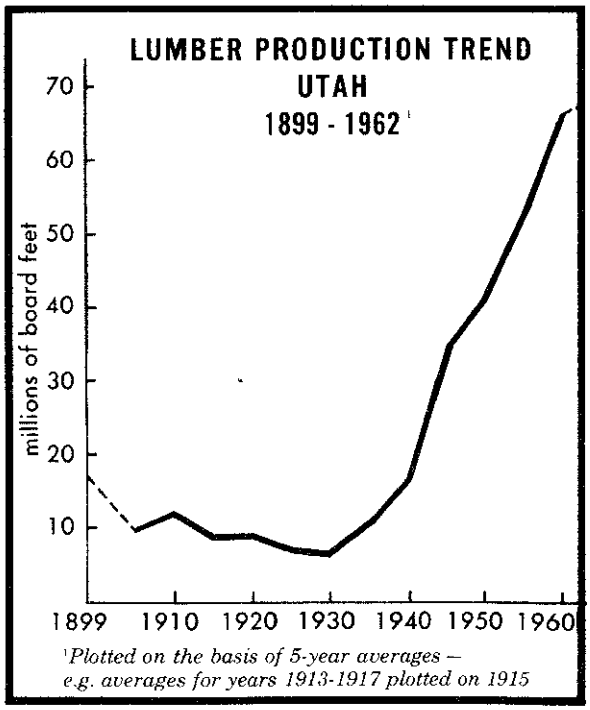
[12] *Includes sawmills and planing mills, veneer and plywood plants, paper and paperboard mills, and miscellaneous products plants.*

Lumber is the principal timber product

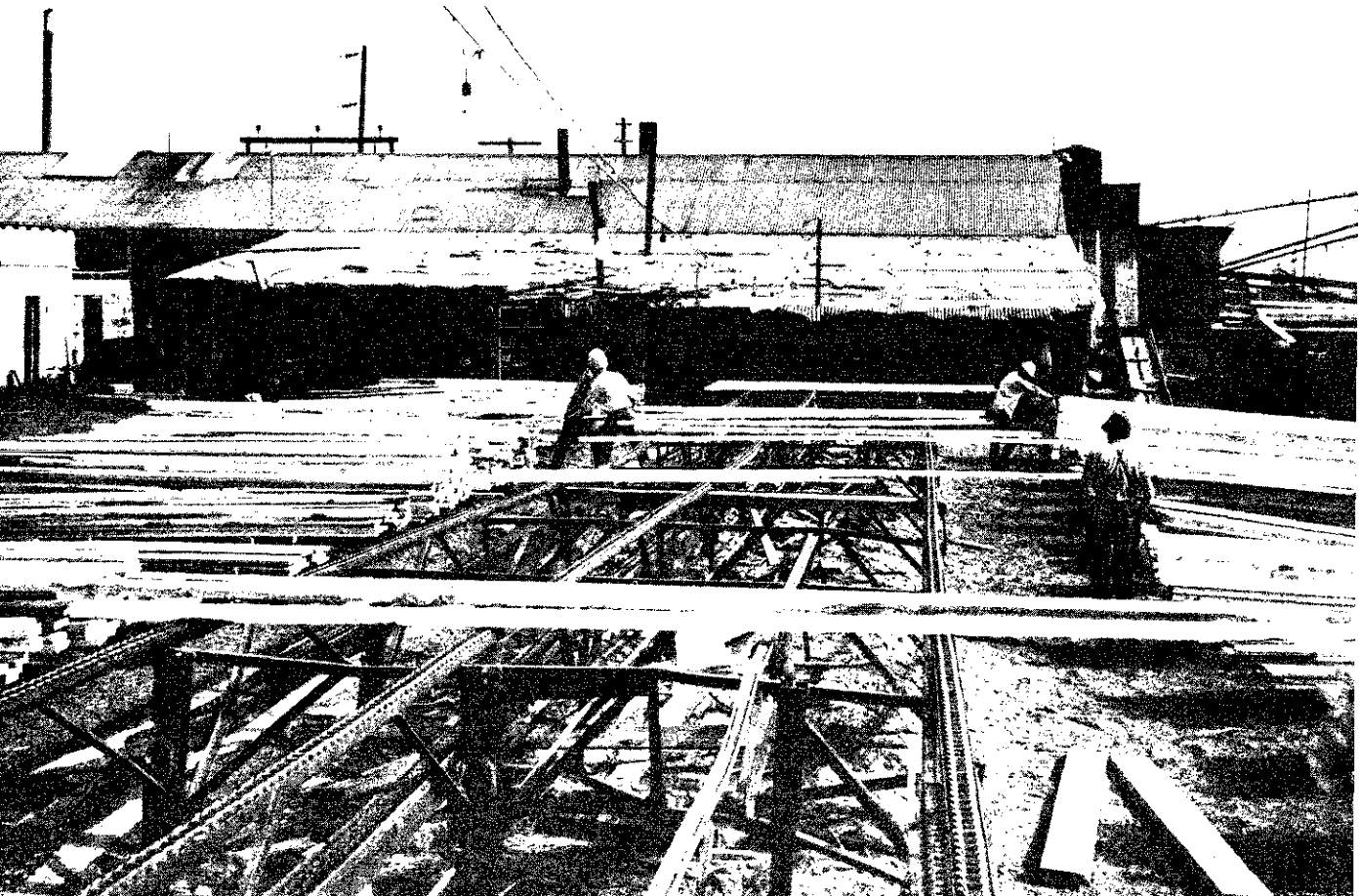
Although demands for Utah timber have not been widespread and though the harvest and economic returns have always been well below the potential, local timber has played a very important role in the development of this State, as well as adjoining areas. The first sawmill was established in 1847, shortly after the arrival of the Mormon vanguard. As settlements spread from the Salt Lake City area, more mills were established to provide lumber for local development. In 1889 Utah had 30 sawmills. Undoubtedly, during these early years much less timber was used for lumber than for fuel and roundwood products such as houselogs, poles, posts, railroad ties, and mine timbers. In 1867-69 tracks of the transcontinental railroad were laid on countless ties that had been hewn by hand from lodgepole pine on the north slope of the Uinta Mountains and floated down such streams as the Blacks Fork and Smiths Fork. Other areas were also selectively cut for tie timber as railroads were built throughout the State. Local forests also have been the source of round mine props for underground coal mines and metal mines.

In recent years roundwood products have gradually been replaced by sawed material. In 1962, 90 percent of all roundwood products was in saw logs for lumber.

	Thousand cubic feet
Saw logs (for lumber)	10,845
Converter poles, excelsior bolts, charcoal wood, and commercial poles	703
Round mine timbers	245
Posts, fuelwood, miscellaneous farm timbers	212
Total	12,005



Harvesting and milling saw logs in southern Utah (photos on facing page). The Crofts-Pearson Industries truck shown in the upper photo is hauling ponderosa pine logs from a Dixie National Forest timber sale on the Paunsaugunt Plateau, to the company's mill at Panguitch. The lower photo shows lumber being sorted and piled from the green chain after logs have been cut by gangsaws. Subsequent operations will include kiln drying and planing. This sawmill, with an output of about 120,000 board feet a day, is by far the largest in Utah.



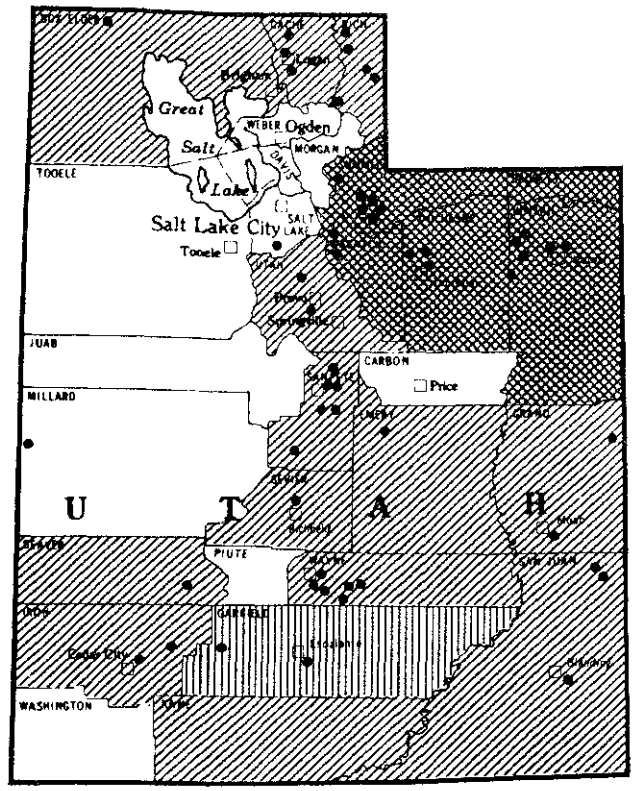
UTAH SAWMILLS AND SAWLOG PRODUCTION 1962

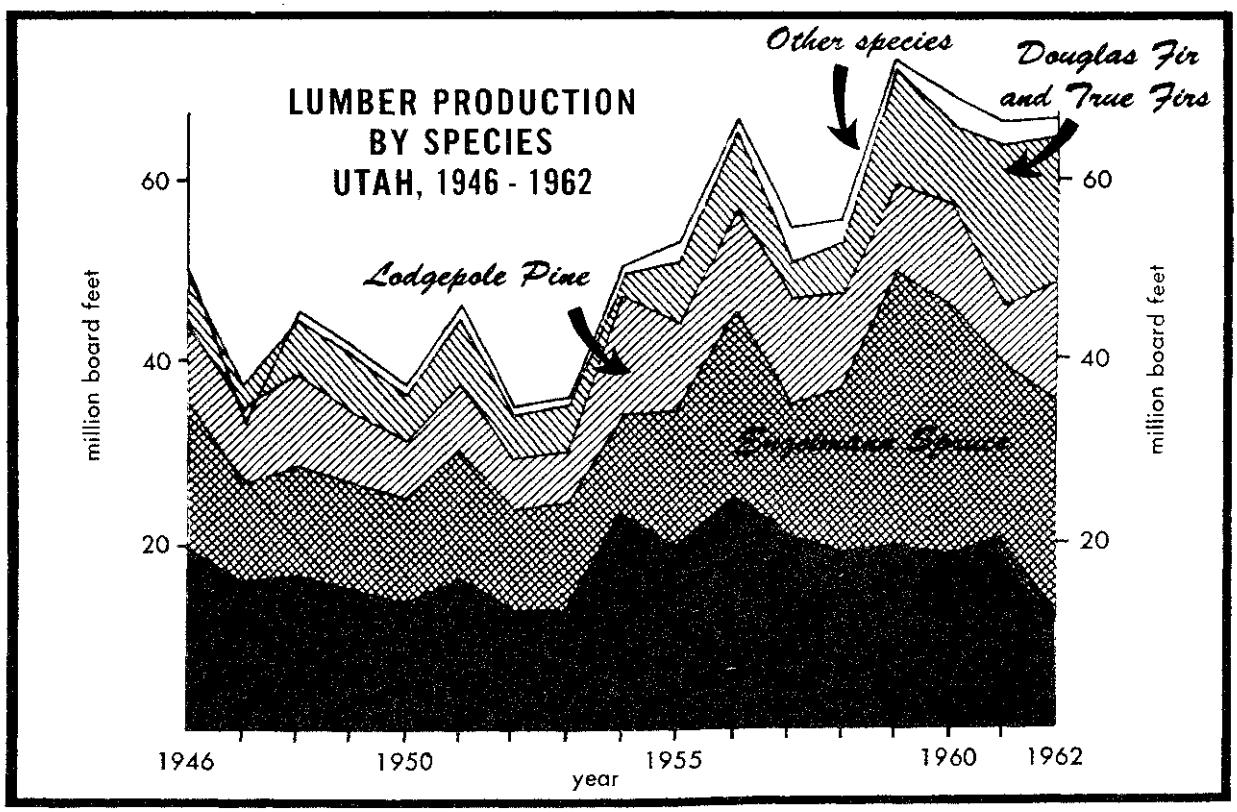
● Sawmill reported as operating in 1962

Sawlog output by county in million board feet

- No reported production
- Less than 5
- 5 to 10
- More than 10

In addition to the mills plotted on the map, there were an estimated 19 active mills, all small, for which no sawlog reports were received in the 1962 products survey. These mills received about 5.1 percent of the State's sawlog output in 1962.





There was a fairly steady upward trend in annual lumber production from the early 1930's until 1960; since then production has leveled off (chart on this page). Figures for lumber and total of all products cut in recent years are as follows:

	Lumber	All products
	Million board feet[1]	*Million cubic feet*
1952	35	8.8
1960	69	14.8
1962	67	12.0

[1]*Lumber tally as estimated for Utah by the U.S. Bureau of the Census.*

Utah's lumber industry has not been stable. Between 1889 and 1940, the number of mills fluctuated between 30 and 95. From 1941 to 1948 more than 100 mills were in operation, with a peak of 170 in 1948. By 1962, however, only 73 plants were operating. The number of mills by size classes were as follows:

Sawmill size class (Thousand board feet per year)	*Number of mills*[1]
Less than 50	19
50 to 499	33
500 to 999	4
1,000 and over	17
Total	73

[1]*The classification of individual mills was estimated from saw log receipts rather than from lumber production.*

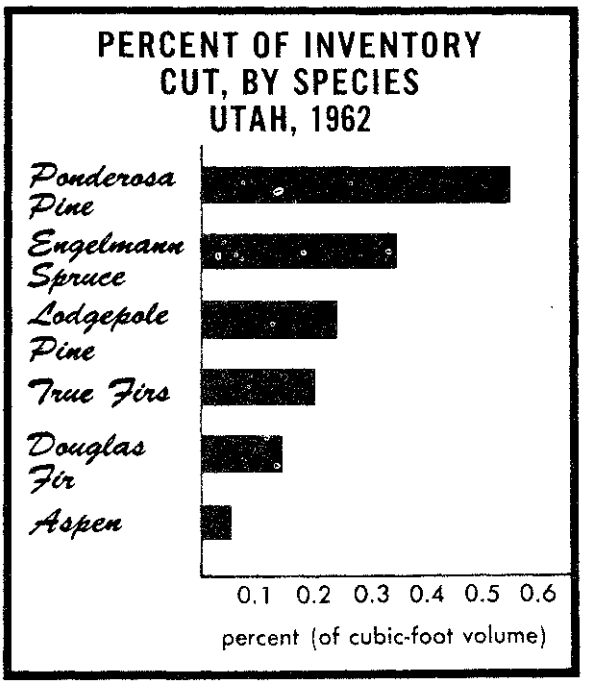
In Utah, as in the other Mountain States, the recent trend is toward fewer, but larger and more efficient, mills. The number of active mills in Utah dropped from 99 in 1960 to 73 in 1962; the concurrent increase in the State's lumber production resulted in greater average annual production per mill. This increase was from 700,000 to 918,000 board feet.[13]

[13]*Lumber tally.*

The map on the facing page shows the geographic distribution of active sawmills and indicates the principal counties that produce saw logs. Garfield County was the only county that produced more than 10 million board feet of saw logs in 1962.

Since the early days of lumbering in Utah, there have been important shifts in the relative importance of species. In Utah, more ponderosa pine has been cut into lumber than any other species. The excellent lumber properties of ponderosa pine, as well as relative accessibility of the timber, have resulted in heavy use of this species ever since lumbering began. Despite year-to-year fluctuations in the volume of ponderosa pine cut since World War II, the overall trend has been fairly level—with an average of 18 million board feet a year. During this period the output of other species has increased, as shown by the chart on the facing page.

Engelmann spruce replaced ponderosa pine as the leading species in 1959, and in 1962 accounted for slightly more than one-third of the total lumber output. The chart on this page compares species in terms of cut in relation to inventory in 1962.



THE FUTURE

Demands on the forest will increase

To the extent that past trends are indicative of the future, it is very evident that Utah's forests will receive much greater use in the coming years. This is portended not only by trends within the State (as discussed earlier in this report) but also by national and regional forecasts.

Projections of demands for water, recreation, timber, and other resources indicate big increases by 2000. However, the projected rate of increase differs substantially among resources. And projections for an individual use can vary greatly depending on assumptions relative to technological changes, use of competing resources, disposable income, amount of leisure time, etc. A basic assumption, of course, is the extent of increase in the country's population. The latest median projection by Bureau of the Census indicates that the present population of 193 million people will increase to about 325 million by 2000.

Demands on forest lands for water will be much greater than they are now. A projection for the West[1] by Resources for the Future, Inc. (Landsberg et al. 1963) indicates that use of water for irrigation, municipal, and other consumption will increase more than 1.5 times between 1960 and 2000. Projected demands for hydroelectric and recreation uses are also much greater than at present.

Recreation demands will probably develop extremely rapidly. According to the report of the Outdoor Recreation Resources Review Commission, outdoor recreation in general will probably increase threefold in the United States by 2000 (Outdoor Recreation Resources Review Commission 1962). Much larger increases for forest recreation than this are suggested by other national projections for use of certain types of public recreation areas (Landsberg et al. 1963).

	1960	2000
	Million visits	
National Parks, Monuments, and Recreation Areas	41	390
National Forests	93	2,010
State Parks	259	2,770

National demands for timber are also projected to increase sharply by 2000. Recent estimates (U.S. Forest Service 1965) indicate an increase of 81 percent in the total volume of roundwood products. Pulpwood demand is expected to increase more rapidly than this—about 2.7 times.

Utah's forests probably will be in an increasingly favorable location with respect to markets for wood products. The especially rapid growth in population of the West since World War II has meant bigger markets for lumber from the Mountain States. An increasing amount of lumber from these States is going to California. That this trend will continue is suggested by population projections which indicate that by 2000 the population of the Pacific Coast States will be about 2.2 times the number in 1960. The estimated increase for the country as a whole is 1.8 times. This changing distribution of population should favor an improving market for Utah timber.

The extent to which demands can be met in the future undoubtedly depends on greatly intensified multiple use management. There is likely to be some reduction in Utah's forest area in coming years to meet needs for rights-of-way, for highways and utility lines, reservoirs, urban expansion, and farmlands. Management that is coordinated with respect to water, timber, recreation, and forage values is already the objective on practically all public lands. Intensified management will be necessary in the years ahead.

[1] *Roughly, the area west of 95° longitude, exclusive of the Pacific Northwest.*

More information about forest lands is a basic requirement for future management. Much more and better inventory data are needed to evaluate present forest conditions and management needs, and to estimate the potential of forest lands for various uses. However, efficient data collection and its application in on-the-ground management will not be possible without much more research in all fields of management in Utah. Studies in water, range, wildlife habitat, timber management, forest protection, and timber utilization have been underway for many years. Relatively new fields of study in Utah include recreation, timber marketing, and multiple use management.

The concluding sections of this report are concerned primarily with timber management needs and industrial opportunities for timber development.

A steadily increasing supply of timber depends on farsighted management

Capability of the land to produce timber is not one of the reasons that Utah cut only 67.3 million board feet of sawtimber in 1962. This volume is about equal to the annual yield potential, without management, of the ponderosa pine lands alone (432,000 acres or 10.8 percent of the commercial forest area). Data are not available for making direct estimates of the capability of lands occupied by other timber types. If their timber-growing capability is the same as for ponderosa pine, the entire 4 million acres of commercial forest has an annual potential of roughly 616 million board feet. This is undoubtedly a conservative estimate because the potential for ponderosa pine lands is generally considered as substantially lower than the average for the commercial forest. Regardless of its magnitude, the timber potential can never be realized, because of overriding considerations of other uses on much of the area.

Many things must be considered in pushing the timber cut to higher and higher sustainable levels. Some of the factors, especially present forest conditions, have already been described in this report. These and other general considerations can be summarized as shown below.

PRINCIPAL TIMBER MANAGEMENT CONSIDERATIONS

FOREST LANDS ARE EASILY DAMAGED AND DIFFICULT TO REPAIR.

Very careful management is necessary to maintain enough vegetative cover to prevent erosion on lands where rainfall is low and erratic, slopes are steep, and soils thin and unstable.

A BIGGER PROPORTION OF THE AREA NEEDS TO BE IN VIGOROUS YOUNG STANDS.

To attain the distribution of age classes desirable for sustained yield management, there should be a reduction in the area of old growth that is risky to hold and costly to protect from insects and diseases.

MANY MORE ROADS MUST BE BUILT BEFORE THE TIMBER MANAGEMENT EFFORT CAN BE SUBSTANTIALLY INCREASED.

Lands that are presently accessible have been cut over. Roads are needed for stand protection and improvement, and for timber harvesting.

A GREAT MANY MATURE STANDS WOULD BE UNPROFITABLE LOGGING CHANCES IF OPERATORS WERE REQUIRED TO BEAR ACCESS ROAD COSTS.

Small size of trees, low volumes per acre, low-grade logs, and patchy distribution of stands are factors that make many stands marginal at best.

STAND IMPROVEMENT WORK OF ONE KIND OR ANOTHER IS ESSENTIAL.

Thinning, planting and other types of work are a necessary part of a full management program.

TIMBER MANAGEMENT MUST BE GEARED TO MULTIPLE USE MANAGEMENT.

Practically no public lands will be managed for timber products alone.

TIMBER YIELDS MUST BE SUSTAINED.

Industries based on the timber resource must be assured of a steady, and desirably an increasing, supply of timber from year to year.

None of the considerations listed on the previous page can be neglected in a program directed toward full and sustained use of Utah's forests. The most basic consideration is the extremely fragile nature of the country. Unless road construction, logging, and management practices in general are designed very carefully, consequences can be serious. Once removed, many kinds of vegetation take a long time to come back. And on the tilted terrain typical of much of Utah's forest area, destruction of protective vegetation or plant cover usually promotes erosion—erosion of soils and erosion of sustained yield values. Both types of erosion are evident on the numerous lands in the State that have been overused and misused in the past.

Incipient erosion following logging on the hillside above Tropic Reservoir, Dixie National Forest. Prevention of erosion and maintenance of watershed values are primary considerations in planning and conducting logging operations on the fragile lands characteristic of most of Utah's forest area. Effective erosion control in skid trails such as this would require ditching with bulldozer or slash scattering and seeding, or possibly both.

More cutting and reforestation are requirements for improved timber management

Judicious timber cutting, in one form or another, should be a principal method of increasing productivity of Utah's commercial timberlands. As pointed out earlier there is far too much old growth, in relation to area in young stands, for long-term sustained yield management. Accelerated harvest cutting is necessary to attain a distribution of age classes that eventually will result in about the same volume of timber reaching maturity each year.

In addition to timber harvesting, cutting must also be done to thin, release, and weed many immature stands. These measures are necessary to increase yields of desirable species, sizes, and qualities. Many areas will remain relatively unproductive for the next 100 years or more unless they receive cultural treatment very quickly. These include young overstocked stands and old stands of cull trees, badly infected with mistletoe, that were left from early logging. Many of the young stands will respond to thinning. The old stands present a more serious problem; on many of them, trees should be felled and burned and new trees started. Of course, lands of better site quality provide best opportunities for improving yields by cultural work.

Until more surveys are conducted it is impossible to estimate reliably the backlog of cultural needs.[1] There is little doubt, however, that a much greater stand improvement effort will be needed in the future. Accomplishments on National Forests for 1964 only, and the total for all years to date are as follows:

	1964	To date
	- - - - - *Acres* - - - - -	
Release and weeding	875	18,204
Precommercial thinning	3,309	5,707
Pruning	126	52,940

[1] *Surveys currently underway will provide data on the amount, kind, and priority of cultural work needed on National Forests.*

Precommercial thinning in ponderosa pine on the Dixie National Forest, 1964. This stand is about 50 years old — almost the maximum age at which most ponderosa pine stands in Utah will adequately respond to thinning.

Regeneration, as well as timber cutting, is an integral step in farsighted management. Cutting without regenerating cutover areas is a backward step. The problem of regenerating Engelmann spruce is probably the most difficult, particularly at the high elevations at which this species grows in southern Utah. Especially careful logging techniques must be used here to assure that spruce that is cut will be replaced by spruce seedlings.

Although data are not yet available indicating the area in need of reforestation—for timber growing, erosion control, and other purposes—it is almost certain that the present program of seeding and planting should be stepped up. Areas that have been seeded and planted on National Forests are as follows:

	1964	To date
	Acres	
Seeding	542	556
Planting	1,126	4,908
Total	1,668	5,464

Some planting has also been done on private, state, and federal lands not in National Forest ownership. About 1,100 acres were planted by the end of 1963. Of these, 65 acres were planted in 1963.

Machine planting of ponderosa pine on Dixie National Forest, 1964. The National Forest planting program calls for about 50 percent of the planting to ponderosa pine and 50 percent to other species. About 30 percent of future planting will be by machine.

Cutting, reforestation, and other timber management treatments affect one or more of the other forest uses on practically every acre of the State's commercial forest. Obviously, therefore, timber management decisions should be made within the framework of a coordinated program that defines priorities among uses and management objectives of each use.

Programs for multiple use management have not been developed to the point where they adequately guide timber management in many areas of the State. This is particularly true where there is conflict because of overlapping jurisdictions. For example, while the Board of Big Game Control is responsible for controlling levels of deer population, most of the forest land on which deer feed is in Federal ownership. In many areas there is a lack of agreement among agencies and individuals about desirable deer and livestock population levels in relation to hunter and rancher demand, other forest uses, and supplies of forage and browse. Aspen is a principal browse species but is giving way to conifers over substantial areas. Objectives for timber production and animal grazing must be reconciled before managers can decide how much land should go to conifers desirable for timber and how much should be retained in aspen for forage. This is but one example of present difficulties in defining management objectives on many individual acres of public land.

A multiple-purpose road system is a basic need

For many reasons, more roads are needed for adequate timber use and management. In the first place, more roads would permit better distribution of the timber cut. Continued cutting in already accessible areas could lead to excessive reduction in inventories on these lands, while at the same time large numbers of trees are dying and rotting in remote stands. If these remote stands were accessible, they could be logged on the basis of priority of risk and other considerations for the commercial forest *as a whole*. Furthermore, the same latitude would be permitted in selecting areas in need of thinning, release, and planting.

More roads are needed for forest protection. Better access is especially important to areas of old growth that may be subject to heavy loss from insect epidemics. For example, extensive blowdowns of Engelmann spruce would undoubtedly be followed by bark beetle epidemics. Unless major areas of this species were accessible by road, control measures would be severely handicapped and big areas could be devastated very rapidly.

Timber values alone will not justify construction of a transportation network adequate for multiple use management of public forests in Utah. As pointed out earlier in this report, tree size, tree quality, and timber volumes per acre are generally less in Utah than in the principal timber producing areas of the Mountain States. Also, there are many small patches of mature timber in Utah that have insufficient volume to warrant cost of road construction in addition to other logging expenses. Such stands are especially common in northern areas of the Wasatch Mountains. Timber on steep slopes is another problem. In many places cost would prohibit construction of logging roads that would not result in excessive erosion and impairment of watershed values.

Timber, however, is only one factor in considering better access to Utah's forests. More roads must be built to meet expanding recreation use and for more intensive management of water, wildlife, and livestock resources. Therefore, planning and financing should be directed toward a multiple-purpose road system. This implies that on public lands a much greater proportion of road financing must be by direct appropriation with proportionately less dependence on timber sale money. Although the proportion of road construction financed under sale contracts has been decreasing on National Forests, it still amounted to about one-third during the period 1960-64.

National Forest managers are currently replanning their transportation system to meet objectives of the Multiple Use and Sustained Yield Act of 1960. Planning to date, though incomplete, does provide a basis for some observations. One is that fewer miles of permanent roads will be needed than envisioned in past plans. But future roads must be much better roads, and will be more costly to construct. They must be located to meet multiple use needs and built to standards required for the greater traffic expected in managing all resources—rather than primarily timber. Also, greater consideration must be given to harmonizing roads with the environment to maintain soil stability and scenic values.

The rate of road construction must be sharply increased if anticipated transportation needs are to be met. On Utah's National Forests in 1964, only 51 miles of new roads were constructed and 112 miles reconstructed. This rate of construction probably will provide less than 60 percent of the transportation network needed for timber management and use by 2000.

Bigger markets will encourage better management

In addition to more roads and greater management effort, markets are the third key to more rapid development of Utah's timber resource. Markets for lumber and pulpwood appear to offer the best opportunities. All the State's commercial species are suitable for one or the other or both of these products.

Lumber will probably continue as the principal wood product. As discussed earlier, production has been increasing at a fairly steady rate since the early 1930's; markets should continue to improve with the country's westward shift of population.

The sawmill industry would stand to gain if a market develops for pulpwood. Utah's sawmills have not had the opportunity that mills in some other Mountain States have to sell their slabs, edgings, and trim residues in the form of chips suitable for pulping. This material, which is presently waste and usually is disposed of at some expense, represents roughly one-fifth the volume of saw logs. A market for pulp chips could encourage establishment of larger sawmills—mills of sufficient capacity to warrant the substantial expense of installing debarkers and chippers.

A market for round pulpwood would provide an opportunity to use large volumes of trees that are too small or are otherwise submarginal for lumber. Many stands consist entirely of such trees. In other stands they are mixed with sawtimber trees, but cannot be used in saw log operations. For example, of the 688 million cubic feet of lodgepole pine in sawtimber stands, almost two-fifths is in poletimber trees. A market for this material not only would make more sawtimber stands economically operable, but would favor clearcutting—the usual objective of even-age management.

Although the feasibility of establishing a pulpmill in Utah appears unlikely for some time, there is a possibility of marketing pulpwood from the Uinta Mountains. A recent U.S. Forest Service study (U.S. Forest Service 1964) shows there is enough timber within a 200-mile radius of Green River, Wyoming, to support at least a 200-ton-per-day sulphate pulp and paper mill at that location. Preliminary estimates indicate an annual volume of about 82,000 cords of lodgepole pine, Engelmann spruce, and other species could be supplied from sound, live timber on the Ashley and Wasatch National Forests in Utah. Roughly 5 percent of this would be in the form of chips from sawmills. These National Forest lands can supply another 4,700 cords a year from cull and dead (but usable) trees. Still additional volumes are available on public lands other than National Forest, and on private holdings.

An opportunity to market big volumes of pulpwood from the Uinta Mountains is highly desirable. Aside from the substantial economic returns, such a market would be of enormous benefit to long-term timber management in this area.

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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; (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 foreseeable 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 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	Fir-spruce
Ponderosa pine	Aspen
Lodgepole pine	Cottonwood
Whitebark, limber, and bristlecone pines	

Additional forest types which occur only on noncommercial forest land are:

Pinyon-juniper

Chaparral

Other (unclassified)

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 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. National Forest lands.—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.

b. All other lands.—At least one-fourth of the dominant trees are sawtimber trees.

Large sawtimber

a. National Forest lands.—A stand in which the majority of the net board-foot volume is in sawtimber trees 21.0 inches d.b.h. and larger.

b. All other lands.—At least one-half the dominant sawtimber trees are at least 21.0 inches d.b.h.

Small sawtimber

a. National Forest lands.—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.

b. All other lands.—At least one-half the dominant sawtimber trees are less than 21.0 inches d.b.h.

Poletimber stand

Stand failing to meet the sawtimber stand specifications, but at least 10 percent stocked with poletimber and larger trees (5.0 inches d.b.h. and larger) and with at least half the 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, pole-

timber, 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 utilized by trees. In this report it is expressed as the percentage of the available space that is occupied by live trees.

Well-stocked stand

A stand that is 70 percent or more occupied.

Medium-stocked stand

A stand that is 40 to 70 percent occupied.

Poorly stocked stand

A stand that is 10 to 40 percent occupied.

Nonstocked area

An area that is less than 10 percent occupied.

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.

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 United States 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 lands

Lands owned by the State.

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, white	*A. concolor*
Juniper	*Juniperus*
Pine, limber	*Pinus flexilis*
Pine, lodgepole	*P. contorta*
Pine, ponderosa	*P. ponderosa*
Pine, whitebark	*P. albicaulis*
Pine, bristlecone	*P. aristata*
Pinyon	*P.*
Spruce, Engelmann	*Picea engelmannii*
Spruce, blue	*P. pungens*

Hardwoods

Aspen, quaking	*Populus tremuloides*
Cottonwood, black	*P. trichocarpa*

SURVEY METHODS[16]

Area statistics were determined by two methods: (1) Mapping on aerial photographs was done on about 3.0 million acres of forest. Primary delineations of forest areas were into commercial and noncommercial classes. Commercial forest areas were further subdivided into types, stand-size classes, and stocking classes. Photo delineations were then transferred to base maps. Dot counts were made on maps to obtain estimates of area of commercial and noncommercial forest, and subdivisions of commercial forest. (2) Sampling was done on a forest area of 11.8 million acres (1.5 million acres of National Forest and 10.3 million acres in other ownerships). Points were classified on aerial photos to determine the proportion of area by forest and nonforest and by class of forest. Ownership of lands other than National Forest was also determined by sampling. A percentage of photo points was checked on the ground for correctness of interpretation of land class. Results of the field check were then used to adjust photo estimates of proportions. Acreages were determined by applying the adjusted proportions to the gross area as determined from maps.

Volume estimates are based on tree measurements taken on 2,184 sample areas located at random on commercial forest lands. Sample locations were pricked on aerial photos then located on the ground and established on a permanent basis to permit remeasurement on future surveys. Two somewhat different sampling procedures were used: (1) On National Forests measurements were taken on circular plots of fixed radius. On some Forests one plot was taken at each sample location, on others two plots were measured. Each plot consisted of four circular and concentric subplots. The area of subplots and kind of trees tallied on them are as follows:

1/500-acre—live seedling-sapling size trees
1/50-acre—live pole-size trees
1/5-acre—live sawtimber-size trees, and all salvable dead trees (poletimber size and sawtimber size)
1/3-acre—mortality trees, pole size and larger

(2) On lands not in National Forest ownership sample locations were 1 acre in size. Each location was subsampled at 10 points. At each point trees were tallied on two plots—one of fixed radius (1/250-acre) and one of variable radius. On the former all trees were measured and live trees were classified as crop trees or excess trees from the standpoint of management treatment. The variable radius plot (trees are sampled in proportion to their basal area) was used for live sawtimber trees and for mortality trees.

Under both of the systems described above the customary measurements and classifications of trees were made for volume and quality, and 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 volumes shown in statistical tables.

Estimates of timber cut are based on periodic surveys of forest industries. The latest surveys are for 1962 and are the basis for data shown in the appendix tables. Utilization trends discussed in the text are based mainly on lumber production data, since complete information on output of all products for years prior to 1960 is not available. Data for estimating the volume of logging residues are obtained by special studies on active woods operations.

[16] *Methods described here are those that were used for inventorying all forest lands except the 280,302 acres of forest within the Navajo and Uinta-Ouray Indian Reservations. Data for these lands were provided by the Indian Service from their management plan inventory.*

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 Utah have been determined by statistical analysis of the data.

Estimates of the acreage of the various classes of forest land were determined by two procedures—mapping (3.0 million acres) and sampling (11.8 million acres). There are no sampling errors for the mapped area. Sampling errors for the sampled portion and for the total estimates of commercial and noncommercial breakdowns are shown in the following tabulation:

	Mapped area		Sampled area			Total forest area		
	Area	*SE*	*Area*	*SE*		*Area*	*SE*	
	M acres		*M acres*	*Acres*	*Percent*	*M acres*	*Acres*	*Percent*
Commercial	**1,733**	**0**	**2,266**	**27,192**	**1.20**	**3,999**	**27,192**	**0.68**
Noncommercial	**1,307**	**0**	**9,559**	**81,252**	**.85**	**10,866**	**81,252**	**.75**
Total	**3,040**		**11,825**			**14,865**		

The sampling error for the estimated 5,825 million cubic feet of growing stock in Utah is ±2.5 percent.

The sampling error for the total timber cut from growing stock (12,558,000 cubic feet) is estimated at ±3.25 percent.

All errors are computed on the basis of odds of two out of three that values which would result from a 100-percent survey would lie within the range indicated by the error.

SPECIAL NOTE — SAWTIMBER CLASSIFICATION

The following statistics for Utah classify all trees 11.0 inches in diameter and larger as sawtimber. The publication, *Timber Trends in the United States*, Forest Resource Report 17, Forest Service, U.S. Department of Agriculture, February 1965, although bearing an earlier printing date, contains a subsequent adjustment of the *softwood* sawtimber category to include trees down to 9.0 inches. Estimates of the board-foot volume, growth, and mortality in 9.0- to 10.9-inch softwood trees are not available for all of the categories in the following tables. However, in those instances where the data are available the board-foot estimates for 9.0- to 10.9-inch trees are shown in a footnote.

TIMBER STATISTICS

Table 1.—**Area by land classes, Utah, 1961**

Land Class	Thousand acres
Commercial forest land	3,999
Unproductive forest land	10,701
Productive-reserved forest land	165
Total forest land	14,865
Nonforest land	37,832
All land	[1]52,697

[1]*From U.S. Bureau of the Census, Land and Water Areas of the United States, 1960.*

Table 2.—**Area of commercial forest land by ownership classes, Utah, 1961**

Ownership class	Thousand acres
National Forest	2,783
Other Federal:	
Bureau of Land Management	155
Indian	158
Miscellaneous Federal	--
Total other Federal	313
State	240
County and municipal	--
Forest industry	--
Farmer-owned	540
Miscellaneous private	123
All ownerships	3,999

Table 3.—**Area of commercial forest land by stand-size and by ownership classes, Utah, 1961**

Stand-size class	All ownerships	National Forest	Other public	Farmer and misc. private
		Thousand acres		
Sawtimber stands:				
Large sawtimber	572	75	233	264
Small sawtimber	2,057	1,782	146	129
Total	2,629	1,857	379	393
Poletimber stands	1,125	840	103	182
Sapling and seedling stands	218	80	61	77
Nonstocked areas	27	6	10	11
All classes	3,999	2,783	553	663

Table 4.—**Area of commercial forest land, by stand-volume classes for sawtimber and other stand-size classes, Utah, 1961**

Stand volumes per acre[1]	Area by stand-size classes		
	All stands	Sawtimber stands	Other stands
		Thousand acres	
Less than 1,500 board feet	1,353	16	1,337
1,500 to 5,000 board feet	1,000	968	32
5,000 to 10,000 board feet	1,315	1,314	1
10,000 to 20,000 board feet	303	303	--
More than 20,000 board feet	28	28	--
All classes	3,999	2,629	1,370

[1]*Net volume, International ¼-inch rule.*

Table 5.—**Area of commercial forest land, by stocking classes of all live trees and by stand-size classes, Utah, 1961**

Stocking class	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
			Thousand acres		
70 percent or more	1,200	657	381	162	--
40 to 70 percent	909	471	411	27	--
10 to 40 percent	1,863	1,501	333	29	--
Less than 10 percent	27	--	--	--	27
All classes	3,999	2,629	1,125	218	27

Table 6.—**Area of commercial forest land, by forest types and by ownership classes, Utah, 1961**

Forest type	All ownerships	Public ownerships	Private ownerships
	Thousand acres		
Douglas-fir	646	507	139
Ponderosa pine	432	400	32
Lodgepole pine	563	531	32
Whitebark, limber, and bristlecone pines	29	18	11
Fir-spruce[1]	1,047	963	84
Aspen	1,280	915	365
Cottonwood	2	2	--
All types	3,999	3,336	663

[1] *Includes 192,000 acres of white fir type.*

Table 7.—**Area of commercial forest land by forest types and by stand-size classes, Utah, 1961**

Forest type	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
			Thousand acres		
Douglas-fir	646	556	56	33	1
Ponderosa pine	432	403	14	8	7
Lodgepole pine	563	311	223	28	1
Whitebark, limber, and bristlecone pines	29	24	2	3	--
Fir-spruce[1]	1,047	947	77	22	1
Aspen	1,280	386	753	124	17
Cottonwood	2	2	--	--	--
All types	3,999	2,629	1,125	218	27

[1] *Includes 192,000 acres of white fir type.*

Table 8.—**Commercial forest area of lands not in National Forest ownership, by county, Utah, 1961**

County	Total commercial forest land	County	Total commercial forest land
	Thousand acres		*Thousand acres*
Box Elder	12	San Juan	28
Cache	47	San Pete	20
Carbon	113	Sevier	28
Daggett	10	Summit	160
Duchesne	88	Tooele	21
Emery	40	Uintah	62
Garfield	39	Utah	35
Grand	129	Wasatch	85
Iron	68	Washington	34
Juab	26	Weber	36
Kane	41	Beaver, Millard,	
Morgan	39	Piute, Wayne	20
Rich	25	Salt Lake, Davis	10
		Total	1,216

Table 9.—**Area of noncommercial forest land, by forest types, Utah, 1961**

Forest type	All areas	Productive-reserved areas	Unproductive areas
		Thousand acres	
Douglas-fir	102	30	72
Ponderosa pine	33	7	26
Lodgepole pine	41	36	5
Whitebark, limber, and bristlecone pines	8	2	6
Fir-spruce[1]	187	90	97
Aspen	145	--	145
Cottonwood	1	--	1
Chaparral	1,005	--	1,005
Pinyon-juniper	9,326	--	9,326
Other (unclassified)	18	--	18
All types	10,866	165	10,701

[1]*Includes 25,000 acres of white fir type.*

Table 10.—**Volume of timber on commercial forest land, by class of timber, and by softwoods and hardwoods, Utah, 1961**

Class of timber	All species	Softwoods	Hardwoods
		Thousand cubic feet	
Sawtimber trees:			
Saw-log portion	3,275,474	2,973,360	302,114
Upper-stem portion	342,709	248,105	94,604
Total	3,618,183	3,221,465	396,718
Poletimber trees[1]	2,207,277	1,268,456	938,821
All growing-stock trees	5,825,460	4,489,921	1,335,539
Sound cull trees:			
Sawtimber-size trees	331,824	317,268	14,556
Poletimber-size trees	263,201	168,211	94,990
Total	595,025	485,479	109,546
Rotten cull trees:			
Sawtimber-size trees	101,530	49,552	51,978
Poletimber-size trees	156,164	9,006	147,158
Total	257,694	58,558	199,136
Salvable dead trees:			
Sawtimber-size trees	485,881	431,774	54,107
Poletimber-size trees	455,951	277,367	178,584
Total	941,832	709,141	232,691
All timber	7,620,011	5,743,099	1,876,912

[1]*Poletimber trees are trees 5.0 inches d.b.h. to 10.9 inches d.b.h.*

Table 11.—**Volume of growing stock and sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Utah, 1961**

Ownership class	All Species	Softwoods	Hardwoods
		GROWING STOCK (*Million cubic feet*)	
National Forest	4,635	3,687	948
Other public	568	438	130
Farmer and misc. private	622	365	257
All ownerships	5,825	4,490	1,335
		SAWTIMBER (*Million board feet*)[1]	
National Forest	15,951	14,243	1,708
Other public	1,843	1,711	132
Farmer and misc. private	1,727	1,439	288
All ownerships	19,521	17,393	2,128

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note, page 47. There is an additional softwood sawtimber volume in 9.0-to 10.9-inch trees.*

National Forest	*2,309 MM board feet*
Other public	*278 MM board feet*
Farmer and misc. private	*233 MM board feet*
All ownerships	*2,820 MM board feet*

Table 12.—**Volume of growing stock and sawtimber on commercial forest land, by stand-size classes and by softwoods and hardwoods, Utah, 1961**

Stand-size class	All species	Softwoods	Hardwoods
		GROWING STOCK (*Million cubic feet*)	
Sawtimber stands	4,664	4,010	654
Poletimber stands	1,134	462	672
Sapling and seedling stands	26	17	9
Nonstocked areas	1	1	--
All classes	5,825	4,490	1,335
		SAWTIMBER (*Million board feet*)[1]	
Sawtimber stands	18,150	16,624	1,526
Poletimber stands	1,346	746	600
Sapling and seedling stands	23	21	2
Nonstocked areas	2	2	--
All classes	19,521	17,393	2,128

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note on page 47.*

Table 13.—**Volume of growing stock and sawtimber on commercial forest land, by stand-size classes and by species, Utah, 1961**

Stand-size class	All species	Douglas-fir	Ponderosa pine	Lodgepole pine	White fir	Alpine fir	Engelmann spruce[1]	Other softwoods[2]	Aspen	Cottonwood
				GROWING STOCK (*Million cubic feet*)						
Sawtimber stands	4,664	838	421	688	306	541	1,164	52	652	2
Poletimber stands	1,134	58	12	273	7	57	50	5	672	--
Sapling and seedling stands	26	3	([3])	10	--	1	3	--	9	--
Nonstocked areas	1	--	1	--	--	--	--	--	--	--
All classes	5,825	899	434	971	313	599	1,217	57	1,333	2
				SAWTIMBER (*Million board feet*)[4]						
Sawtimber stands	18,150	3,733	1,891	2,310	1,322	1,575	5,582	211	1,515	11
Poletimber stands	1,346	116	50	219	16	133	202	10	600	--
Sapling and seedling stands	23	2	([3])	1	--	2	16	--	2	--
Nonstocked areas	2	--	2	--	--	--	--	--	--	--
All classes	19,521	3,851	1,943	2,530	1,338	1,710	5,800	221	2,117	11

[1] *Includes negligible amount of blue spruce.*
[2] *Whitebark, limber, and bristlecone pines.*
[3] *Less than 0.5 million feet.*
[4] *International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger.* *See special note on p. 47.*

Table 14.—**Volume of growing stock on commercial forest land, by species and by diameter groups, Utah, 1961**

Species	*Diameter group (inches at breast height)*					
	All classes	5.0-10.9	11.0-20.9	21.0-30.9	31.0-40.9	41.0 and larger
	Million cubic feet					
Softwoods:						
Douglas-fir	899	182	472	201	31	13
Ponderosa pine	434	35	190	159	46	4
Lodgepole pine	971	511	443	17	--	--
White fir	313	65	150	65	26	7
Subalpine fir	599	267	300	30	2	--
Engelmann spruce[1]	1,217	193	706	272	42	4
Other softwoods[2]	57	15	29	13	([3])	--
Total	4,490	1,268	2,290	757	147	28
Hardwoods:						
Aspen	1,333	939	388	6	--	--
Cottonwood	2	([3])	1	1	--	--
Total	1,335	939	389	7	--	--
All species	5,825	2,207	2,679	764	147	28

[1]*Includes negligible amount of blue spruce.*
[2]*Whitebark, limber, and bristlecone pines.*
[3]*Less than 0.5 million cubic feet.*

Table 15.—**Volume of sawtimber on commercial forest land, by species and by diameter groups, Utah, 1961**

Species	Diameter group (inches at breast height)				
	All classes	11.0-20.9	21.0-30.9	31.0-40.9	41.0 and larger
	Million board feet[1]				
Softwoods:					
Douglas-fir	3,851	2,427	1,151	195	78
Ponderosa pine	1,943	828	780	295	40
Lodgepole pine	2,530	2,438	92	--	--
White fir	1,338	771	374	152	41
Subalpine fir	1,710	1,532	165	13	--
Engelmann spruce[2]	5,800	3,898	1,617	261	24
Other softwoods[3]	221	151	68	2	--
Total	17,393	12,045	4,247	918	183
Hardwoods:					
Aspen	2,117	2,083	34	--	--
Cottonwood	11	3	8	--	--
Total	2,128	2,086	42	--	--
All species	19,521	14,131	4,289	918	183

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note, page 47.*
[2]*Includes negligible amount of blue spruce.*
[3]*Whitebark, limber, and bristlecone pines.*

Table 16.—**Volume of salvable dead sawtimber-size trees on commercial forest land, by softwoods and hardwoods, Utah, 1961**

Species group	Volume
	Thousand board feet[1]
Softwoods	2,360,450
Hardwoods	239,138
All species	2,599,588

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note, page 47. There is an additional salvable dead, softwood sawtimber volume of 616,550,000 board feet in the 9.0- to 10.9-inch trees.*

Table 17.—**Net annual growth and annual cut of growing stock on commercial forest land, by species, Utah, 1962**

Species	Net annual growth	Annual timber cut
	Thousand cubic feet	
Softwoods:		
Douglas-fir	5,776	1,254
Ponderosa pine	6,337	2,390
Lodgepole pine[1]	12,947	2,191
True firs[2]	872	1,794
Engelmann spruce[3]	7,818	4,137
Total	33,650	11,766
Hardwoods	22,446	792
All species	56,096	12,558

[1]*Includes minor volume of whitebark, limber, and bristlecone pines.*
[2]*White and subalpine firs.*
[3]*Includes negligible amount of blue spruce.*

Table 18.—**Net annual growth and annual cut of sawtimber on commercial forest land, by species, Utah, 1962**

Species	Net annual growth	Annual timber cut
	Thousand board feet[1]	
Softwoods:		
Douglas-fir	12,018	6,969
Ponderosa pine	23,394	13,222
Lodgepole pine[2]	13,926	12,139
True firs[3]	−370	9,901
Engelmann spruce[4]	26,542	22,928
Total	75,510	65,159
Hardwoods	19,771	2,092
All species	95,281	67,251

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note, page 47.*
[2]*Includes minor volume of whitebark, limber, and bristlecone pines.*
[3]*White and subalpine firs.*
[4]*Includes negligible amount of blue spruce.*

Table 19.—**Net annual growth and annual cut of growing stock on commercial forest land, by ownership classes, and by softwoods and hardwoods, Utah, 1962**

Species group	All ownerships	National Forest	Other public	Farmer and misc. private
		NET ANNUAL GROWTH (*Thousand cubic feet*)		
Softwoods	33,650	40,031	-3,583	-2,798
Hardwoods	22,446	15,174	2,116	5,156
All species	56,096	55,205	-1,467	2,358
		ANNUAL TIMBER CUT (*Thousand cubic feet*)		
Softwoods	11,766	10,657	235	874
Hardwoods	792	717	16	59
All species	12,558	11,374	251	933

Table 20.—**Net annual growth and annual cut of sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Utah, 1962**

Species group	All ownerships	National Forest	Other public	Farmer and misc. private
		NET ANNUAL GROWTH (*Thousand board feet*)[1]		
Softwoods	75,510	113,803	—21,075	—17,218
Hardwoods	19,771	7,296	3,831	8,644
All species	95,281	121,099	—17,244	—8,574
		ANNUAL TIMBER CUT (*Thousand board feet*)[1]		
Softwoods	65,159	59,020	1,303	4,836
Hardwoods	2,092	1,895	42	155
All species	67,251	60,915	1,345	4,991

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note, page 47.*

Table 21.—**Annual mortality of growing stock and sawtimber on commercial forest land, by species, Utah, 1962**

Species	Growing stock	Sawtimber
	Thousand cubic feet	*Thousand board feet*[1]
Softwoods:		
Douglas-fir	8,272	37,139
Ponderosa pine	920	4,768
Lodgepole pine	7,115	27,942
White fir	1,345	5,275
Subalpine fir	20,095	57,067
Engelmann spruce	12,449	54,909
Other softwoods[2]	665	3,360
Total	50,861	190,460
Hardwoods	15,526	35,539
All species	66,387	225,999

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note, page 47.*
[2]*Whitebark, limber, and bristlecone pines.*

Table 22.—**Annual mortality of growing stock and sawtimber on commercial forest land by ownership classes and by softwoods and hardwoods, Utah, 1962**

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Thousand board feet*[1]		
National Forest lands	38,905	29,577	9,328	134,339	106,909	27,430
Other public lands	14,109	11,661	2,448	48,395	45,775	2,620
Farmer and misc. private lands	13,373	9,623	3,750	43,265	37,776	5,489
All ownerships	66,387	50,861	15,526	225,999	190,460	35,539

[1]*International ¼-inch rule. Volumes are for trees 11.0 inches d.b.h. and larger. See special note, p. 47.*

Table 23.—**Total output of timber products by products, by type of material used, and by softwoods and hardwoods, Utah, 1962**

Product and species group	Total output in standard units		Output from roundwood from growing stock		Output from roundwood from nongrowing stock		Output from plant by-products (standard units)
	Unit	Number	Standard units	M cubic feet	Standard units	M cubic feet	
Saw logs:							
Softwood	M bd. ft.[1]	62,916	60,085	10,034	2,831	473	0
Hardwood	M bd. ft.[1]	2,022	1,931	323	91	15	0
Total	M bd. ft.[1]	64,938	62,016	10,357	2,922	488	0
Mine timbers:							
Softwood	M cu. ft.	245	147	147	98	98	0
Hardwood	M cu. ft.	0	0	0	0	0	0
Total	M cu. ft.	245	147	147	98	98	0
Miscellaneous industrial wood:							
Softwood	M cu. ft.	389	332	332	57	57	0
Hardwood	M cu. ft.	402	384	384	18	18	0
Total	M cu. ft.	791	716	716	75	75	0
Posts:							
Softwood	M pieces	16	0	0	16	16	0
Hardwood	M pieces	0	0	0	0	0	0
Total	M pieces	16	0	0	16	16	0
Fuelwood:							
Softwood	M std. cds.	1	0	13	1	94	0
Hardwood	M std. cds.	0	0	0	0	1	0
Total	M std. cds.	1	0	13	1	95	0
All products:							
Softwood	M cu. ft.	--	--	10,526	--	738	--
Hardwood	M cu. ft.	--	--	707	--	34	--
Total	M cu. ft.	--	--	11,233	--	772	--

[1] *International ¼-inch rule.*

Table 24.—**Total output of roundwood products, by source and by softwoods and hardwoods, Utah, 1962**

Source	All species	Softwoods	Hardwoods
	Thousand cubic feet		
Growing-stock trees:[1]			
Sawtimber trees	9,279	8,695	584
Poletimber trees	1,954	1,831	123
Total	11,233	10,526	707
Cull trees	0	0	0
Salvable dead trees[2]	742	723	19
Other sources	30	15	15
All sources	12,005	11,264	741

[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 25.—**Annual timber cut from growing stock on commercial forest land, by products and logging residues, and by softwoods and hardwoods, Utah, 1962**

Products and residues	All species	Softwoods	Hardwoods
	Thousand cubic feet		
Roundwood products:			
Saw logs	10,357	10,034	323
Pulpwood	0	0	0
Mine timbers	147	147	0
Miscellaneous industrial wood	716	332	384
Posts	0	0	0
Fuelwood	13	13	0
All products	11,233	10,526	707
Logging residues	1,325	1,240	85
Timber cut	12,558	11,766	792

Table 26.—**Annual timber cut from live sawtimber on commercial forest land, by products and logging residues, and by softwoods and hardwoods, Utah, 1962**

Products and residues	All species	Softwoods	Hardwoods
	Thousand board feet[1]		
Roundwood products:			
Saw logs	62,016	60,085	1,931
Pulpwood	0	0	0
Mine timbers	96	96	0
Miscellaneous industrial wood	26	25	1
Posts	0	0	0
Fuelwood	0	0	0
All products	62,138	60,206	1,932
Logging residues	5,113	4,953	160
Timber cut	67,251	65,159	2,092

[1]*International ¼-inch rule.*

Table 27.—**Volume of plant residues by industrial source and type of residue, and by softwoods and hardwoods, Utah, 1962**

Industrial source	Species and character of residues								
	All species			Softwoods			Hardwoods		
	Total	Coarse[1]	Fine[2]	Total	Coarse	Fine	Total	Coarse	Fine
	Thousand cubic feet								
Lumber industry	4,413	2,401	2,012	4,276	2,326	1,950	137	75	62
Veneer and plywood industry	0	0	0	0	0	0	0	0	0
Other primary industries	282	282	0	273	273	0	9	9	0
All industries	4,695	2,683	2,012	4,549	2,599	1,950	146	84	62

[1]*Unused material suitable for chipping such as slabs, edgings, and veneer cores.*
[2]*Unused material not suitable for chipping, such as sawdust and shavings.*

FOREST SERVICE

The Forest Service of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives as directed by Congress--to provide increasingly greater service to a growing Nation.

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