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May 1983



Utah's Forest Resources, 1978

Dwane D. Van Hooser
Alan W. Green

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THE AUTHORS

DWANE D. VAN HOOSER is project leader of the Forest Survey Research Work Unit at Intermountain Station. He holds a B.S. degree in forestry and an M.S. in forestry and business management from Southern Illinois University, Carbondale. He began his Forest Service career in 1964 with the Southern Forest Experiment Station, New Orleans. Before coming to Ogden, he held a staff position at the Forest Service national headquarters in Washington, D.C.

ALAN W. GREEN is principal resources analyst in the Forest Survey Research Work Unit at Intermountain Station. His career has included research in silviculture and regeneration, economics of timber production, and foreign forestry resources. In addition to a degree in economics, he holds both B.S. and M.S. degrees in forestry from Purdue University.

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RESEARCH SUMMARY

This resource bulletin presents the principal findings of the second forest survey of Utah's forest resources. Fieldwork began during the summer of 1975 and was completed in the fall of 1978. The Intermountain Forest and Range Experiment Station's Forest Survey Research Work Unit sampled the lands other than the National Forests. Data for National Forest System lands were provided by the Intermountain Region. Forest Survey then combined these data into a State-wide compilation for use in this report.

Originally, Forest Survey was authorized by the McSweeney-McNary Act of 1928. The current authorization is through the Renewable Resources Research Act of 1978. The primary objective of Forest Survey, which is a continuing nationwide undertaking conducted by the USDA Forest Service, is to provide an assessment of the renewable resource situation on the Nation's forests and rangelands. Fundamental to the accomplishment of this objective are the State-by-State resource inventories, which are conducted periodically.

The resource inventories for the Rocky Mountain States of Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming, and South Dakota west of the 103d, meridian, and Oklahoma and Texas west of the 100th meridian, are conducted by the Intermountain Forest and Range Experiment Station, headquartered in Ogden, Utah. These inventories provide information on the extent and condition of State and privately owned forest lands, volume of timber, rates of timber growth, mortality, and removals. These data, when combined with similar information on federal lands, provide a basis for the formulation of forest policies and programs and for the orderly development and use of the resources.

Highlights of the report are as follows:

- Utah holds 16,066,600 acres of forest land, including pinyon-juniper, which is the most extensive forest type.
- About 3,151,300 acres are classified as commercial timberland.
- More than 83 percent of the forest land is administered by public agencies, most of it federal.
- Nearly 70 percent of the commercial timberland is sawtimber stands.
- The spruce-fir and aspen types occupy the most acres of commercial timberland.
- Utah's commercial timberlands contain about 4.4 billion cubic feet of wood, including 15.7 billion board feet¹ of sawtimber.
- Net annual growth averaged only about 21 cubic feet per acre in 1977, less than half the land potential.
- Mortality was about 35 percent of total gross growth, largely from insects, disease, and fire.
- Timber removals amounted to a little more than 13 million cubic feet, or 79 million board feet.
- For most species growth exceeded removals.
- Nontimber uses of Utah's forests are substantial and of high value: they produce 8 million acre-feet of water during a normal year; provided 660,000 Animal Unit Months of grazing in 1978; and provided for over 14 million days of recreation just on the National Forests alone.
- The Wasatch National Forest is the most heavily used National Forest in the Nation for recreation.
- Utah has an enormous mineral estate. The value of mineral production in 1976 was estimated at nearly \$966.5 million, primarily from petroleum, copper, coal, and gold.

¹All estimates of board foot volume in this bulletin are in the International 1/4-inch rule.

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Utah's Forest Resources, 1978

Dwane D. Van Hooser
Alan W. Green

THE FOREST

Utah's scenic forests are part of a complex of surface and subsurface resources.

The 16 million acres of forests in Utah are as varied as they are scenic. Also varied are the uses to which the forested acres are put. They not only provide raw material for the region's forest industries, but also they provide valuable soil-holding properties for the State's watersheds, forage and cover for the State's abundant wildlife and domestic livestock, and recreation for millions of visitors annually. Utah's forests also overlay much of the State's valuable mineral deposits as well as extensive oil and gas reserves, coal, tar sands, and oil shale that may play a significant role in determining the Nation's future energy policies.

Over 30 percent of the State is forested.

More than 30 percent of the State's total land area is occupied by woody vegetation. The composition of the cover is determined by many factors such as elevation, aspect (direction the slope faces, i.e., north, south, east, or west), soils, climate, and past fire history. Much of the forest land occurs in a zone about 60 miles wide along a line roughly paralleling Interstate 15. Additional acreage is found in and around the Manti-LaSal National Forest in southeastern Utah, the Uinta Mountains in northeastern Utah, and a small amount in the Raft River Mountains in the northwestern corner of the State (fig. 1).

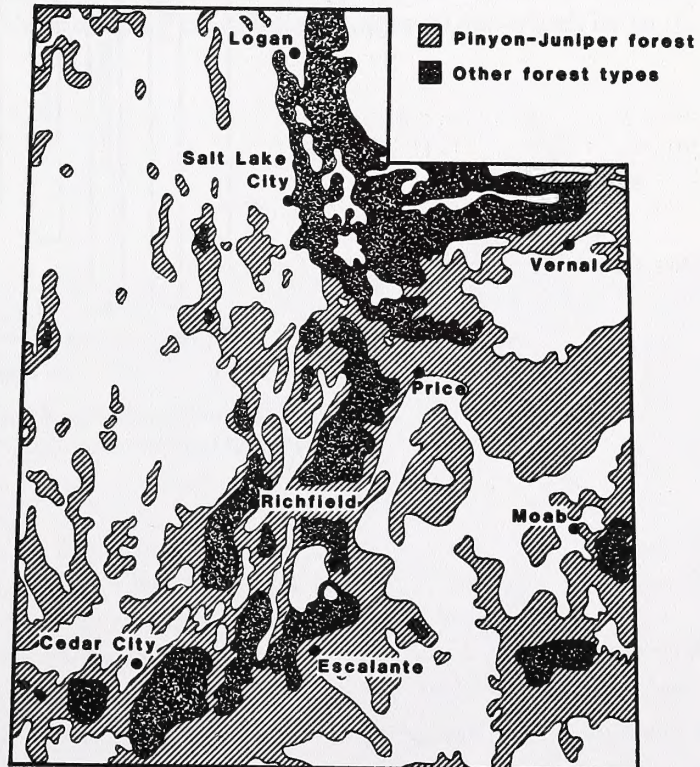


Figure 1.—Distribution of forest land, Utah, 1978.

Elevational Range

Elevation and soil moisture are major influences on where tree species grow.

The occurrence of a predominant tree species is highly correlated with elevation (fig. 2). At the lowest elevation, about 5,000 feet, the vegetation is composed primarily of desert shrub. As altitude increases, the species mix changes to that of pinyon pine (*Pinus edulis* Engelm.) and juniper (*Juniperus osteosperma* [Torr.] Little). Beyond the P-J zone, the next species likely to be encountered is ponderosa pine (*Pinus ponderosa* Laws.) and mountain brush, then Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) mixed with lodgepole pine (*Pinus contorta* Dougl.) and white fir (*Abies concolor* [Gord. and Glend.] Lindl.). Engelmann spruce (*Picea engelmannii* Parry) and subalpine fir (*Abies lasiocarpa* [Hook.] Nutt.) are next on the elevation progression scale. Finally at 10,000 to 11,000 feet, in northern or southern Utah, limber pine (*Pinus flexilis* James) and mountain mahogany (*Cercocarpus* spp.) become the dominant species.

The elevation zones vary considerably. For example, one of the largest limber pines in Utah is found near Bear Lake summit at about 8,500 feet. The species/elevation relationships, however, will generally hold true.

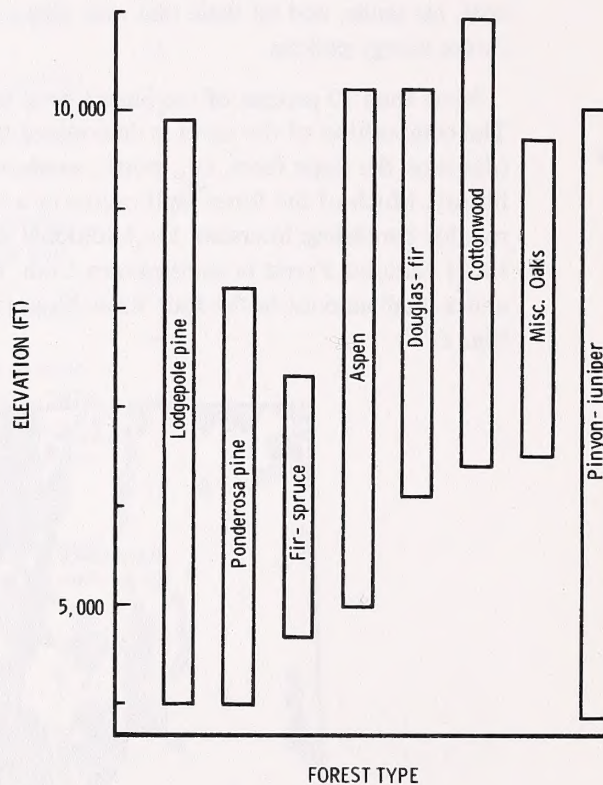


Figure 2.— Occurrence of forest land by forest type and elevation, Utah, 1978.

Forest Land Classes

Forest land classes identify forest productivity and availability of wood for industrial use.

For purposes of inventory, forest land traditionally has been classified by its inherent ability to produce industrial wood products. Those acres that are capable of producing at least 20 cubic feet of industrial wood per acre per year at culmination of average annual increment are classified as productive forest land. Lands that do not meet this minimum productivity standard are placed in the "other" forest land category.

Productive forest land that is publicly owned is further subdivided: areas being considered for inclusion in the wilderness system are classified as productive **deferred**; land that meets or exceeds the minimum productivity standard but already has been **withdrawn** from timber production through statute, ordinance, or administrative order, is classified as productive **reserved** forest land.

Forest land that meets the minimum productivity standard but is not reserved or deferred is classified as commercial timberland. On these acres detailed measurements of the timber resource are taken and are reported here. Only minimal information such as forest type and ownership is presented for productive reserved, productive deferred, and other forest land.

Productive forest land.—Those lands classed as productive forest land account for slightly more than one-fifth of the total forest acres in Utah, and all but 282,000 acres are considered commercial timberland (table 1).

Table 1.—Area of forest land by type of land, Utah, 1978

Type of forest land	Thousand acres
Productive:	
Commercial timberland	3,151.3
Deferred	157.3
Reserved	124.3
Total	<u>3,432.9</u>
Other forest land:	
Reserved	428.7
Nonreserved	12,205.0
Total	<u>12,633.7</u>
Total forest land	<u>16,066.6</u>

About one-fifth of Utah's forests are productive... and nearly all of it is available for timber harvesting.

Although some of the commercial timberlands occur at lower elevation, most are found between 6,500 and 11,000 feet.

Other forest land.—Nearly 13 million acres or 79 percent of the 16.1 million acres of forest land in Utah is classified as other than commercial timberland. By far the largest

There is more pinyon-juniper than any other type...

over 9 million acres...



and about 90 percent is on public lands.

component of "other" forest land is the area occupied by pinyon-juniper (fig. 3). This forest type covers more than 9 million acres and accounts for more than 70 percent of the other forest land in Utah. Almost 90 percent of these acres is in public ownership.

Another 12 percent of other forest land consists of mountain brush and other hardwood types. Ownership of these acres is about equally divided between the public and private sectors.

The remaining 17 percent of the other forest acres are in the aspen, fir-spruce, lodgepole pine, Douglas-fir, and miscellaneous types. The majority of these lands are administered by public agencies.

But these lands have high value for nontimber uses.

But while these lands are not considered to be capable of producing economic timber crops, they are of considerable importance for grazing and cover by both wildlife and domestic livestock. These lands are also becoming a significant source of fuelwood supporting both commercial and permit use operations. Moreover, pinyon and juniper has long been a common source for firewood, Christmas trees, and fenceposts. All of these demands are very likely to increase in the future.

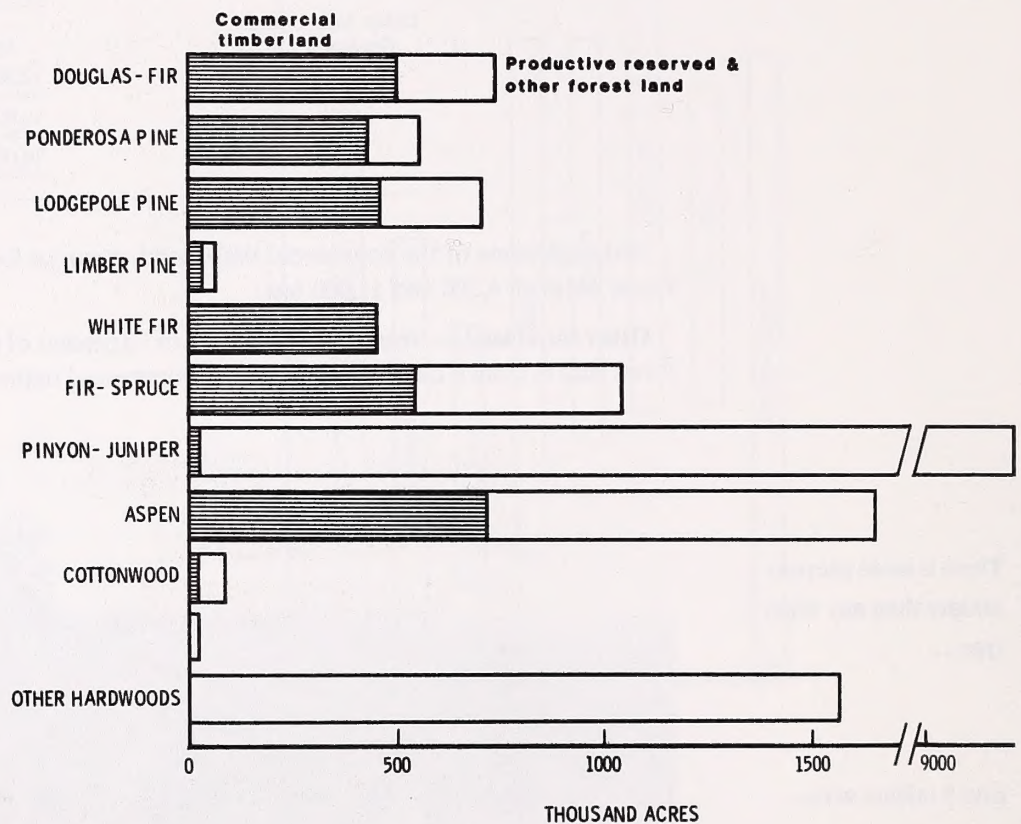


Figure 3.—Area of forest land by forest type and land type, Utah, 1978.

Major Forest Types on Commercial Timberland

Fir-spruce.—One of the most abundant types in the State is fir-spruce, occupying 837,000 acres (fig. 4 and appendix table 8). Stands within the type in which Engelmann spruce dominates amount to 549,000 acres. Subalpine fir is the principal species on 288,000 acres. These stands are usually found above 6,000 feet elevation, with the heaviest concentration between 9,000 and 11,000 feet. Species commonly associated with this type are Douglas-fir, white fir, and lodgepole pine.

Fir-spruce is the most abundant commercial forest type...

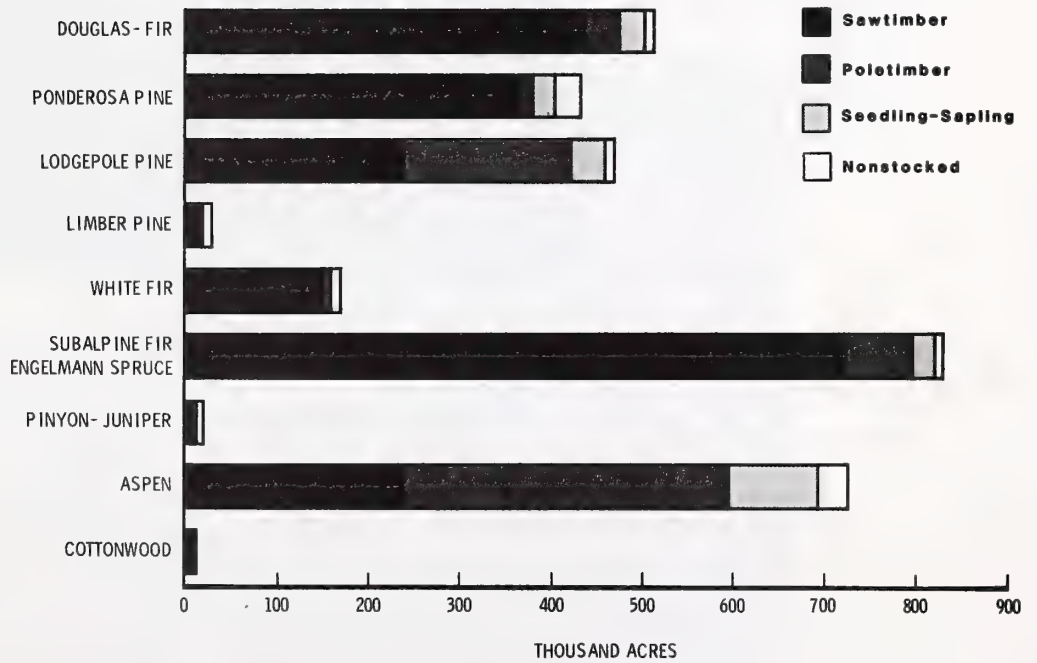


Figure 4.—Area of commercial timberland by forest type and stand-size, Utah, 1978.

and most of it is sawtimber
and...

is on the better sites.

There are one-half million
acres of the Douglas-fir
type...

most of it sawtimber.

About 87 percent of this type are sawtimber-size stands. This apparent lopsided distribution of area by stand-size may be cause for concern if forest industry's dependence on Engelmann spruce continues.

This type occupies the most productive sites in the State, some areas having a growth potential of up to 164 cubic feet per acre per year. But, 776,000 acres of this type have a production capability less than 85 cubic feet per acre per year.

Douglas-fir.—The Douglas-fir type covers slightly more than 500,000 acres and accounts for about 16 percent of commercial timberland in Utah. Like the fir-spruce type, Douglas-fir is fairly well distributed throughout the forest regions of the State. This type has a tendency to grow in an elevational zone that is just above the upper level of the oak brush zone and just below the zone dominated by fir-spruce. Although some stands do occur as low as 5,000 feet and as high as 10,000 feet, most of the Douglas-fir type is found at elevations between about 6,800 and 9,200 feet.



As with most of the other softwood types in Utah, the Douglas-fir type is dominated by sawtimber-size trees. Nearly 85 percent or 427,000 acres of this type are classed as sawtimber stands, with more than two-thirds of these being more than 100 years old.

Potential productivity of the Douglas-fir type could be classed as moderate to low for commercial timberland. More than three-fourths of the area in this type could produce up to 49 cubic feet per acre per year under the best of natural conditions. Another one-fifth would, under similar circumstances, produce between 50 and 85 cubic feet.

Ponderosa and lodgepole pine.—The ponderosa pine and lodgepole pine forest types together account for almost 890,000 acres or 28 percent of the timberlands in Utah. Generally speaking, where lodgepole occurs, ponderosa does not. Practically all of the lodgepole growing in Utah is concentrated in the Uinta Mountains in the northeastern portion of the State, and most of it (about 92 percent) is found on National Forest land.

Ponderosa and lodgepole pine make up over 25 percent of the forest...



with most of the lodgepole in the Uinta Mountains and ponderosa in the south.

Similarly, three-quarters of the area in the ponderosa pine type is in the Dixie and Manti-LaSal National Forests in the southern portion of the State. Although some of the ponderosa pine forest type occurs in northern Utah, these acres account for less than 10 percent of the total occurring in the type.

The ponderosa pine type is also dominated by sawtimber size stands, with some 360,000 acres in this classification. Only half of the area in the lodgepole pine type, on the other hand, is classified as sawtimber size, with poletimber size stands making up 40 percent. Lodgepole pine stands are frequently overcrowded, with thousands of stems per acre. In such stands trees seldom, if ever, reach sawtimber size.



The lodgepole pine are frequently overcrowded and the trees smaller.

In terms of potential productivity, both the ponderosa pine and lodgepole pine types would be classified as low. Virtually all the area in these types has a productivity potential of less than 50 cubic feet per acre per year. Both, however, provide a significant amount of the annual timber harvest taken from Utah's forests.

White fir.—The remaining major forest type, white fir, covers 151,000 acres in Utah. This forest type is usually found below 8,000 feet and is mainly concentrated in a narrow band running south through the central portion of the State.

White fir also is largely in sawtimber stands on moderate to low sites.

The white fir type also has a high percentage (nearly 92 percent) in sawtimber-size stands. And like the Douglas-fir type, the productive potential for white fir type could be classed as moderate to low. About one-third of the acres in this type has the natural potential to produce, on the average, more than 50 cubic feet per acre per year. The remaining two-thirds can produce something less than 50 cubic feet per acre per year.

The coniferous forest types, when combined, account for more than three-quarters of the commercial timberland in Utah.

The remaining 23 percent of the commercial acreage is occupied by hardwoods, with aspen being the only species of any significance.

Aspen is second only to fir-spruce in abundance on commercial timberland.

Aspen.—The aspen forest type covers 717,000 acres of Utah's commercial timberland. Stands of "quakie" are found throughout the timber zones in the State, beginning around 6,000 feet and continuing to 10,000 feet and higher.

Although aspen is considered to have useful industrial properties such as straight grain, uniform texture, and workability, the acreage occupied by this type also has considerable value for uses other than production of timber products. The areas supporting stands of aspen are literally invaluable to the State's watersheds. Aspen also provides an important source of browse and cover for big game and other wildlife. And, finally, no discussion of this forest type is complete without mentioning its esthetic value. The golden hue that aspen's autumn foliage imparts to the mountains of Utah is unsurpassed in scenic beauty. This display of autumn grandeur is internationally famous and draws thousands of visitors to Utah annually.

Aspen's wood value is equaled by its value to wildlife,...



watershed protection, and Utah scenery.

About one-half of this type is classed as poletimber stands, while the other forest types in Utah have well over half of their area in sawtimber-size stands. This is partly due to the definition of poletimber and sawtimber as related to various species. Hardwood poletimber trees, including aspen, are those between 5 and 10.9 inches d.b.h. Softwood poletimber trees, on the other hand, range from 5 to only 8.9 inches d.b.h. This results in a difference in classification of area by stand-size class, with hardwoods having a smaller relative percentage of area in sawtimber stands.

On harsh sites aspen stands frequently do not reach sawtimber size.

Another contributing factor is that on more harsh sites aspen tends to stagnate and may well succumb to pathogens and snow damage before attaining the 11-inch d.b.h. sawtimber threshold. In terms of productivity, the aspen type is about average for the State. Slightly more than three-fourths of the area in this type has the potential to produce between 20 and 49 cubic feet per acre per year. The remaining one-fifth generally has a productive potential of between 50 and 84 cubic feet per acre per year. And in a few areas, stands have the inherent ability to produce wood at the rate of 85 to 119 cubic feet per acre per year.

Owners

About 83 percent of Utah's forest land is administered by public agencies... with Federal agencies responsible for most of it.

A considerable amount of Utah's land is administered by federal agencies (fig. 5). In all, federal agencies, including the USDA Forest Service, USDI Bureau of Land Management, Department of Defense, and others, administer more than 76 percent of the forests. State and local governments administer about 7 percent of the total forest land base. Land management policies on these publicly administered acres are legislatively mandated and politically controlled. In most cases, management objectives are multiple-use oriented and designed to provide maximum benefit to all users.

The remaining 2.7 million acres are privately owned.

Farmers, ranchers, and other private owners, which comprise a diverse group that includes housewives, doctors, lawyers, and numerous other occupations, control some 2.7 million acres (17 percent) of Utah's forest land. Many of these ownerships are small, some under 10 acres, and may not be necessarily managed for maximum wood production. While size, objectives, and proximity to potential industrial users may constrain managing some of these areas as timber units, all of these acres are currently producing wood. Past experience suggests that nearly all of these acres will eventually be used either for industrial products or firewood.

OWNERSHIP

Legend

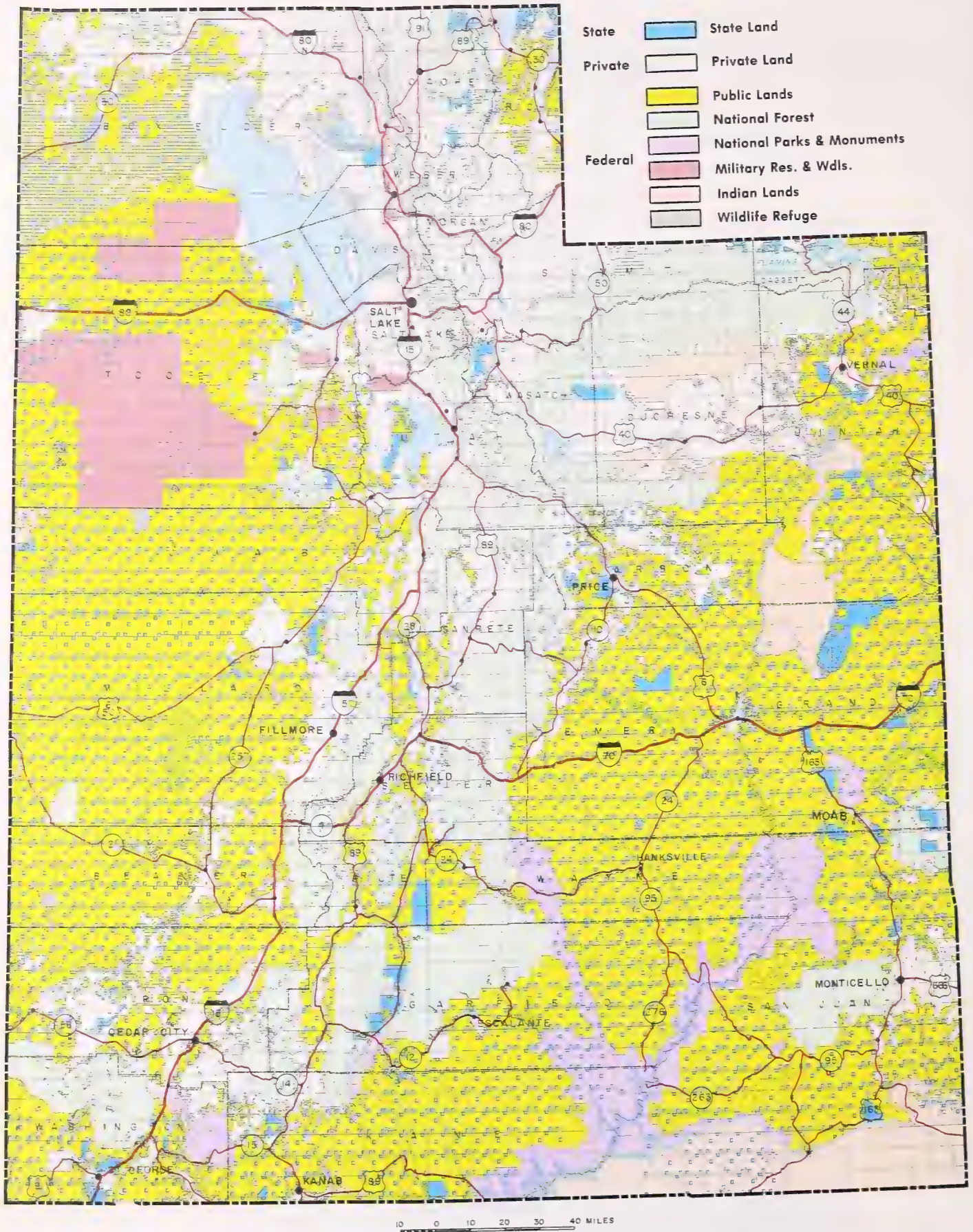


Figure 5.—Ownership of Utah's forest lands (source: Bureau of Land Management).

Nearly three-fourths of the commercial timberland is on National Forests...

As with other forest land, most of the commercial timberland is administered by public agencies. Nearly three-quarters of these acres are in the National Forest System. Other public agencies manage an additional 12 percent. Farmers, ranchers, and other private individuals or corporations own the remaining 16 percent (fig. 6).

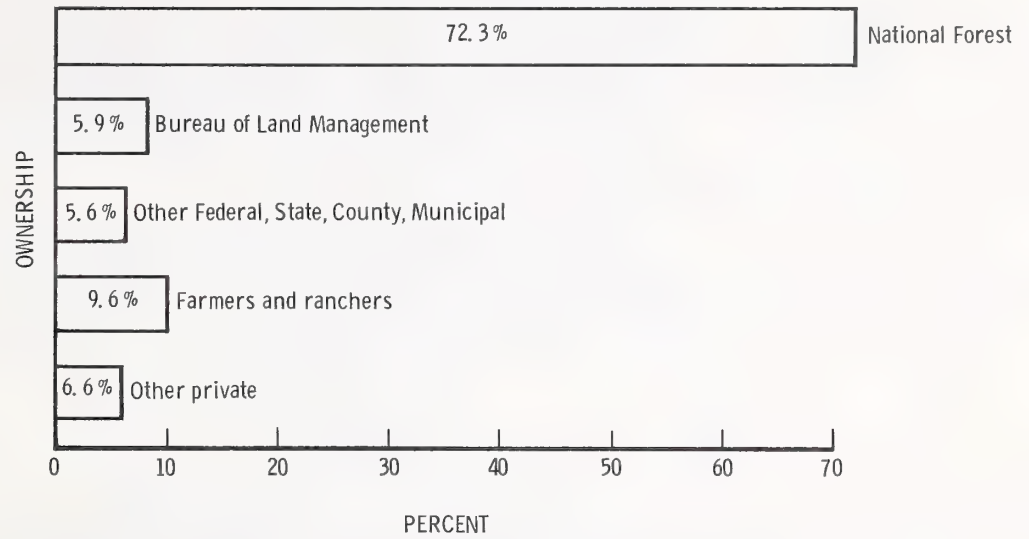


Figure 6.— Distribution of commercial timberland by ownership, Utah, 1978.

Eight National Forests are partially or wholly within the State of Utah (fig. 7) and are found largely down through the center of the State and in the Uinta Mountains. Six of them account for nearly all the 2.3 million acres of the commercial timberland administered by the National Forest System. These lands, which were removed from the public domain at the turn of the century, are by law managed for multiple use. They are especially important as watersheds and for recreation. In fact, the Wasatch National Forest ranks among the highest for recreational use of any National Forest in the United States.

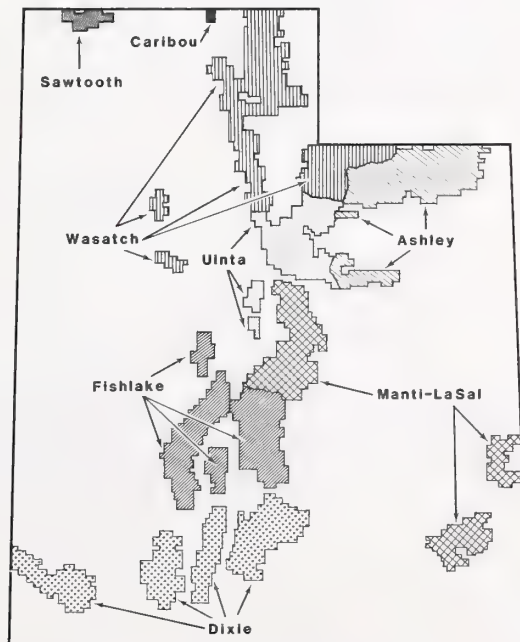


Figure 7.— National Forests located wholly or partly in Utah.

The other public ownership, which is principally Bureau of Land Management and State controlled, is concentrated in the west-central and southeastern portions of the State. The BLM holdings are important for grazing as well as timber production and account for some 186 thousand acres.

State-owned land is scattered...

but most of State-owned commercial timberland is in southern Utah...

and private land is largely in the north.

The State lands originally included Sections 2, 16, 32, and 36 in every township and were to be used in support of the schools, resulting in scattered and fragmented ownerships. Some consolidation did occur, however, as a result of replacement of lands that had already been disposed of by the United States. Nearly 40 percent of the 115,000 acres of commercial timberland owned by the State is found in the southeastern portion of Utah.

Almost 40 percent of the 512,000 acres of commercial timberland in private ownership is found in the northeastern portion of the State (fig. 8). Another one-fourth is located along the Bear River and Wasatch Front. More than 100,000 acres of this ownership is in the southeastern counties of Carbon, Emery, Grand, and San Juan.

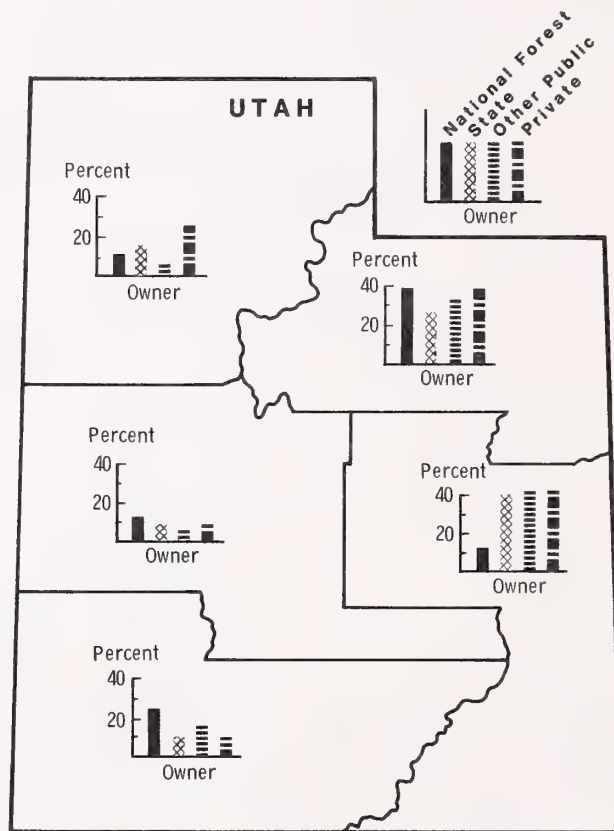


Figure 8.— Distribution of commercial timberland within ownership by survey unit, Utah, 1978. (Since National Forests do not conform to survey unit boundaries, the acreage is included in the survey unit that contains the majority of each individual forest.)

THE TIMBER RESOURCE

Stand-Size Classes

About 70 percent of the commercial timberland is in sawtimber stands, a third of which are old growth,...

Sawtimber stands (see appendix A for definition) predominate in Utah's forests. Nearly 70 percent of the commercial timberland is classified as sawtimber stands (table 2 and fig. 4). And, as would be expected, the distribution of this stand-size throughout the State is essentially the same as the distribution of commercial timberland: 30 percent of the commercial timberland and 30 percent of the sawtimber-size stands occur in south-eastern Utah. Moreover, the distribution of these stands in State and private ownership indicates that fully one-third are more than 100 years old.

Table 2.—Area of commercial timberland by stand-size, Utah, 1978

Stand-size class	Thousand acres
Sawtimber	2,174.7
Poletimber	674.1
Seedling and sapling	225.4
Nonstocked	77.1
Total	3,151.3

20 percent is in poletimber...

Poletimber-size stands make up slightly more than one-fifth of the State's commercial timberland. On the surface, this would seem to augur well for future timber supplies. But the majority of these stands do not lend themselves to sustained timber production. For example, many of the 184,000 acres of poletimber lodgepole are so overstocked that trees will never reach sawtimber size.

and 2 percent has almost no trees.

Of the remaining 9 percent of commercial timberland, 7 percent is in seedling and sapling stands and 2 percent is insufficiently stocked to allow classification by predominant tree size.

How Much Wood?

The commercial timberland has 4.7 billion cubic feet of wood... including 15.7 billion board feet of sawtimber.

Altogether Utah's 3.2 million acres of commercial timberland supports 4.7 billion cubic feet of timber of which 4.4 billion is classified as growing stock. This includes some 15.7 billion board feet that is classified as sawtimber. In addition, there are some 400 million cubic feet in trees that are salvable dead or of such poor quality that they cannot meet the minimum requirement for growing stock. This component of the stand accounts for about 10 percent of total cubic foot volume.

About 80 percent of the volume is on public lands... 75 percent is on National Forests.

More than four-fifths of Utah's growing stock and sawtimber volumes is on land administered by public agencies (fig. 9). The National Forest System contains the largest proportion—nearly 75 percent of both growing stock and sawtimber.

Eighty to ninety percent of the volume is in softwood species...

More than two-thirds of the timber volume in Utah's forests is in trees classed as sawtimber (fig. 10). Poletimber-size trees account for 29 percent of the total volume.

Softwood species dominate Utah's forests. As a group they account for more than 80 percent of the State's growing stock volume (fig. 10), and nine-tenths of the sawtimber inventory. Hardwoods, with aspen being the only species of significance, comprise less than one-fifth of the cubic volume.

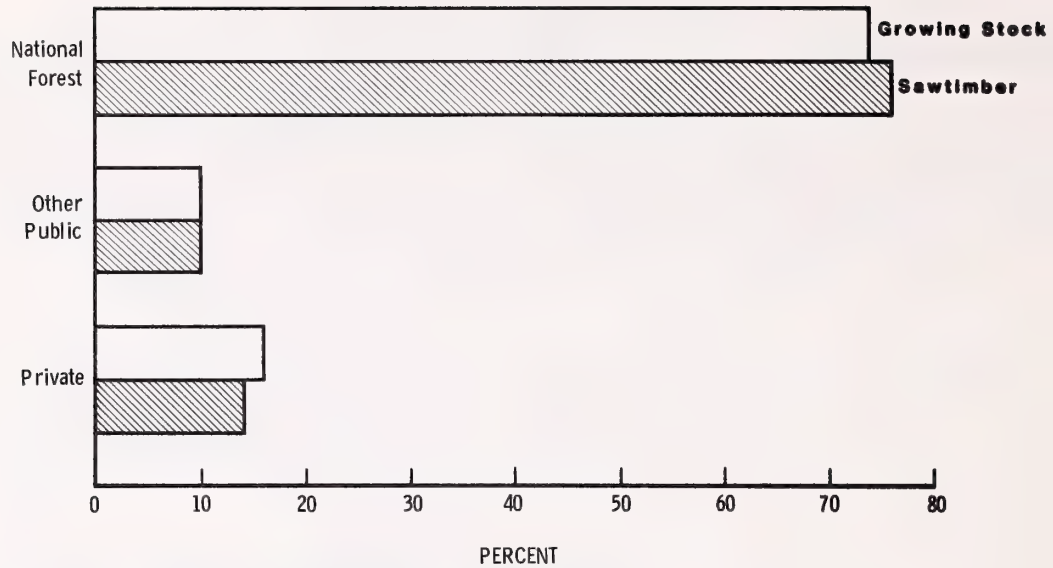


Figure 9.—Distribution of growing stock and sawtimber volume on commercial timberland by ownership, Utah, 1978.

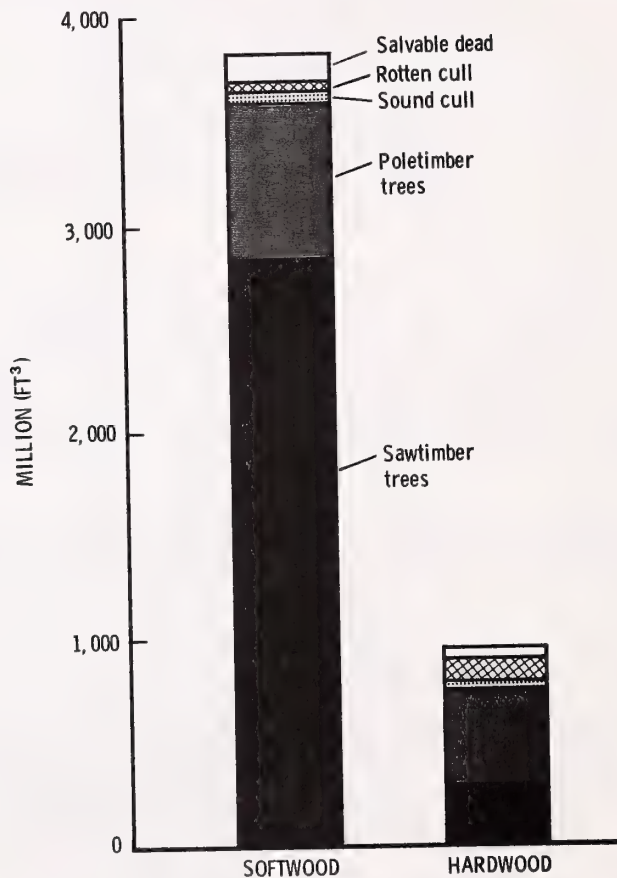


Figure 10.—Net volume of timber on commercial timberland by class of timber, and softwoods and hardwoods, Utah, 1978.

Engelmann spruce, lodgepole pine, subalpine fir, and Douglas-fir have the most volume... but volume by tree size varies.

If individual species are considered, the predominant conifer is Engelmann spruce (fig. 11), accounting for 21 percent of the growing stock volume and 26 percent of the sawtimber volume in Utah. Not far behind is lodgepole pine, with about a fifth of the growing stock inventory, followed by subalpine fir and Douglas-fir. However, variations in tree size distribution among the other species tend to scramble the ranking of sawtimber volume (appendix tables 15 and 16) tabulated below:

Species	Growing Stock Volume	Sawtimber Volume
Englemann spruce	1	1
Lodgepole pine	2	3
Subalpine fir	3	4
Douglas-fir	4	2
Ponderosa pine	5	5
White fir	6	6

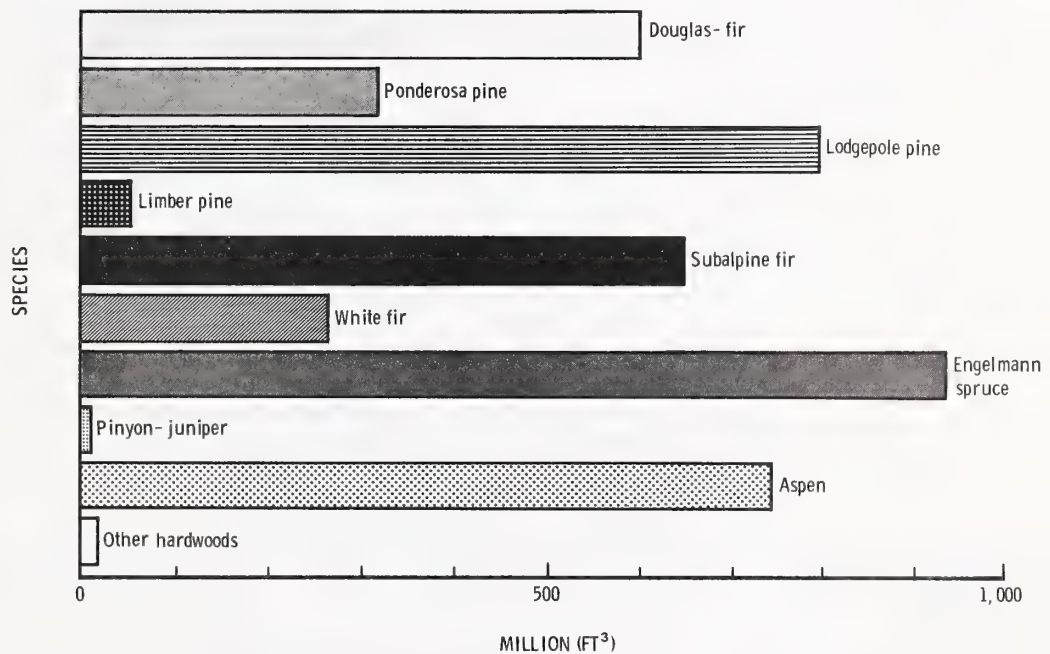


Figure 11.—Growing-stock volume on commercial timberland by species, Utah, 1978.

About 87 percent of lodgepole pine volume is in trees less than 17 inches d.b.h... but 77 percent of the ponderosa pine volume is in trees 17 inches d.b.h. and larger.

Sawtimber volume of both Douglas-fir and Engelmann spruce is consistently distributed over all diameter classes (fig. 12 and appendix table 16). But the volume of lodgepole pine and subalpine fir begins to decline quite rapidly at the 18- to 20-inch d.b.h. class. In fact some 87 percent of the lodgepole pine sawtimber volume is in trees less than 17 inches d.b.h. (appendix table 16). In contrast, although the total volume is not as great as lodgepole pine, about 77 percent of the ponderosa pine sawtimber volume is in trees 17 inches d.b.h. and larger.

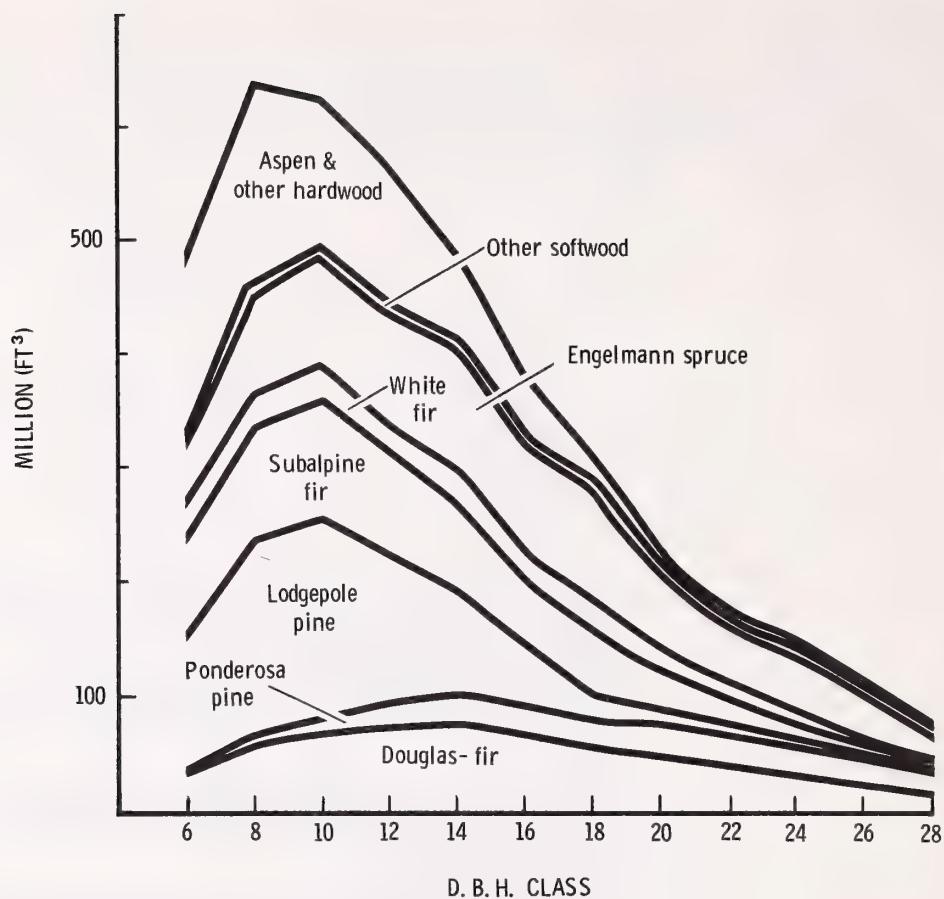


Figure 12.—Growing-stock volume on commercial timberland by species and diameter class, Utah, 1978.

Components of Change

Removals, growth, and mortality combined to increase the stock inventory of wood volume.

The current condition of Utah's forests is determined by the dynamics within the forest over time. The major components of change—growth, removals, and mortality—are displayed in table 3 for 1977.

Table 3.—Summary of components of change, Utah, 1977

Component	Growing stock			Sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	----- Thousand cubic feet -----			----- Thousand board feet -----		
Gross growth	100,710	77,545	23,165	411,028	348,333	62,695
Mortality	35,396	26,090	9,306	123,710	103,010	20,700
Net growth	65,314	51,455	13,859	287,318	245,323	41,995
Timber removals	13,057	12,401	656	79,212	77,092	2,120
Net change	+ 52,257	+ 39,054	+ 13,203	+ 208,106	+ 168,231	+ 39,875
Net change as percent of inventory	+ 1.2	+ 1.1	+ 1.8	+ 1.3	+ 1.2	+ 2.9

In 1977, growth was about 101 million cubic feet; sawtimber 411 million board feet... but trees having 35.4 million cubic feet and 124 million board feet died... leaving a net increase of 65 million cubic feet and 287 million board feet of sawtimber.

Net annual growth per acre was only about 21 cubic feet, less than half the potential.

Growth.—In 1977, the growing stock inventory in Utah increased by 52 million cubic feet, with softwoods accounting for about 75 percent of the increment. The State's sawtimber inventory increased by 208 million board feet. The largest component of change is growth and, for meaningful discussion of stand dynamics, must be discussed as gross growth and net growth. In 1977, gross growth of growing stock was nearly 101 million cubic feet. To determine net growth annual mortality must be subtracted. Thus, in 1977 Utah's forests achieved an average annual net growth of 65 million cubic feet, slightly less than two thirds the total increment.

A comparison of net annual growth with potential growth indicates the extent to which the sites are being utilized (fig. 13). Based on the inventory data, Utah's timberlands are capable of producing on the average 43 cubic feet per acre per year. In 1977, actual net annual growth amounted to only 21 cubic feet per acre, less than one-half the potential attainable. This apparent deficit can be partially explained by stocking levels, stand structure, and stand size.

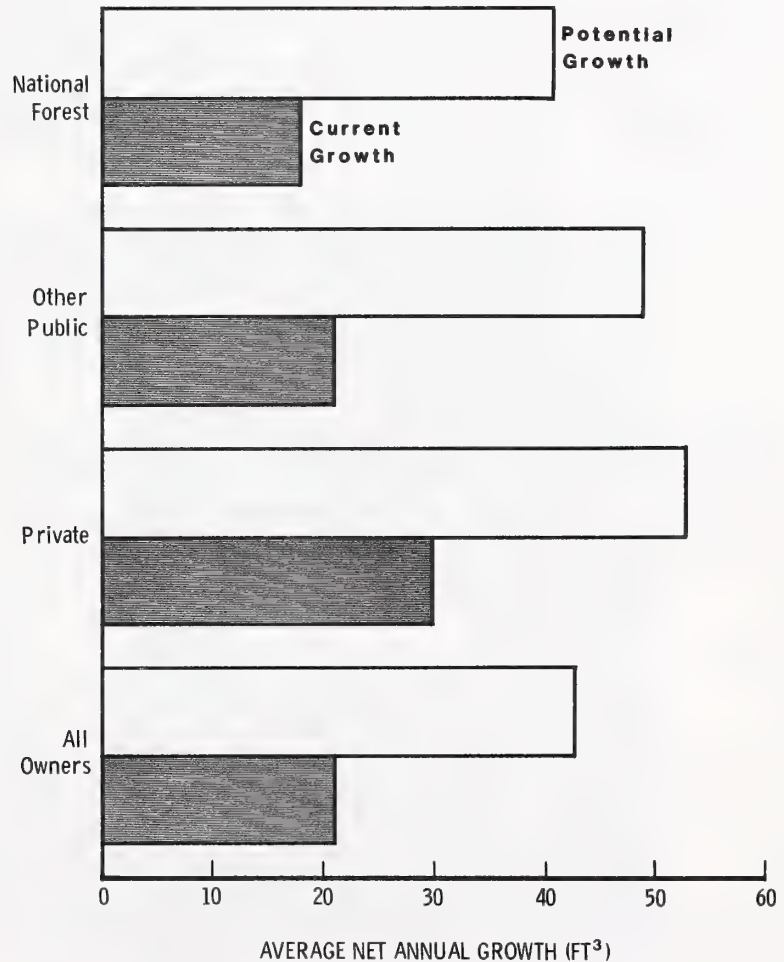


Figure 13.—Current vs. potential growth of growing stock on commercial timberland by ownership, Utah, 1977.

Stocking indicates the extent to which trees utilize the growth potential of a site, and is determined by comparing the stand density—in terms of numbers of trees or basal area—with a specified standard. Full or 100 percent stocking is achieved when there is no increase in growth with an increase in stocking.

Stand stocking and the nature of the trees making up the stand indicates the condition of the forest (table 4). (See definitions of area condition classes.)

Although the data in table 4 cover only “other public” and “private” owner groups, commercial timberland on National Forests is probably similar. Therefore the percentages of area by condition class calculated from table 4 would be essentially the same for all lands.

Old-growth stands occupy 20 percent of commercial timberland.

Old-growth stands (Area Condition Classes 80 and 90) make up nearly 20 percent of the commercial timberland, and well over half is Douglas-fir. Douglas-fir and ponderosa pine together make up nearly 65 percent of the high-risk old-growth stands.

About 75 percent of commercial timberland is understocked with desirable trees.

Excluding old-growth stands, about 75 percent of the commercial timberland is occupied by stands less than fully stocked with desirable trees, including nonstocked areas with virtually no trees. Over half of the nonstocked area is in the ponderosa pine and Douglas-fir types. In many stands, growing space is preempted by rough and rotten trees and brush, which preclude future improvement in stocking.

Large areas of understocked stands, some stagnated stands, some slow-growing old stands, and nonstocked lands are factors in the low growth.

Stand structure or the diameter distribution of stems in the stand in terms of basal area by tree diameter class can also affect net annual growth. Stands in which a large portion of the stand basal area is in trees less than sawlog size often have slow growth because of the overcrowding of small trees. A good example is lodgepole pine stands with several thousand trees per acre.

Slightly more than 300,000 acres are either nonstocked or in seedling or sapling stands. Another 674,000 acres are classed as poletimber. Sawtimber stands occupy 2.2 million acres, and a third of these are classed as old growth. Thus nearly 33 percent of the State's forests are either stocked with small trees or stocked with overmature trees, neither of which contribute much in the way of net annual growth.

Table 4.—Area of commercial timberland by forest type and area condition class; other public, and private owners, Utah, 1978

Forest type	Area condition class									Nonstocked	All classes
	10	20	30	40	50	60	70	80	90		
	-----Acres-----										
Douglas-fir	-	1,404	10,173	12,223	18,232	46,295	50,387	30,478	54,309	5,312	228,813
Ponderosa pine	-	-	-	4,056	-	15,153	34,202	3,777	32,533	13,009	102,730
Lodgepole pine	-	7,633	-	-	10,296	10,163	5,071	-	-	2,562	35,725
Limber pine	-	-	-	-	-	-	-	-	2,365	7,249	9,614
Fir-spruce	2,779	6,005	17,265	15,179	26,378	49,539	12,119	16,116	21,495	-	166,875
White fir	-	-	3,159	-	9,130	9,303	3,064	-	6,608	-	31,264
Pinyon-juniper ¹	-	-	-	-	-	2,454	1,403	7,184	3,770	2,365	17,176
Aspen	2,588	12,602	16,772	47,087	69,498	82,769	33,469	-	5,708	1,172	271,665
Cottonwood	-	-	-	-	140	2,483	5,363	-	2,482	-	10,468
All types	5,367	27,644	47,369	78,545	133,674	218,159	145,078	57,555	129,270	31,669	874,330

¹Pinyon-juniper usually occurs on unproductive forest lands; when mixed with other species on productive sites it is reported in commercial timberland statistics.

Insects, disease, fire, and weather were the primary known causes of death in 1977.

Mortality.—Estimates of net annual growth and the resultant estimates of standing inventory are affected by volume lost to insects, disease, fire, and other destructive agents.

In 1977, more than 35 million cubic feet of growing stock was lost to destructive agents of one sort or another. Mortality of sawtimber amounted to nearly 124 million board feet (table 5).

Table 5.—Annual mortality of growing stock and sawtimber on commercial timberland by cause of death, Utah, 1977

Cause of death	Growing stock	Sawtimber
	<i>Thousand cubic feet</i>	<i>Thousand board feet</i>
Insects	5,477	22,898
Disease	4,679	17,257
Fire	4,939	19,021
Animal	908	858
Weather	4,383	17,986
Suppression	667	805
Logging	133	707
Unknown	14,210	44,178
Total	35,396	123,710

Insects were the most damaging agent, accounting for some 5.5 million cubic feet. Another 4.9 million cubic feet was contained in trees killed by fire, and trees containing 4.7 million cubic feet succumbed to disease. In many cases, however, the actual cause of death could not be determined because several damaging agents usually work in concert or succession to kill the trees. Some 14.2 million cubic feet died of unknown causes.

Insects got 5.5 million cubic feet, 4.9 million cubic feet went up in smoke,...

and 4.7 million cubic feet died of disease.



Salvaging and utilizing dead trees is usually not economically feasible. Generally, volume is low and salvable only in conjunction with a normal harvest.

Lodgepole pine stands frequently offer the best chance for large salvage operations.

Lodgepole pine salvage operations, however, are economically feasible. There are high concentrations of dead but useable standing trees and good markets for small-diameter stems for house logs, posts, corral poles, and so forth. In addition dead lodgepole trees may stand for several years, reducing breakage and making the trees more useful.

The impact of destructive agents is not limited to just the loss of growing stock described above. These agents kill trees under 5 inches in diameter, destroy seed crops and seedlings, inhibit height and diameter growth, reduce the quality and utility of volume, and even change the stand composition from preferred to less desirable species.

Damage by destructive agents is more than just killing trees.

Much of the damage done by insects and diseases either extends the time required to grow trees to a merchantable size or reduces the utility and quality of the wood produced. Insects, such as shoot and tip moths, and diseases, such as dwarf mistletoe, stunt young trees and slow the growth rate. Defoliating insects reduce growth and also kill trees.

Trees can be stunted, growth reduced, or deformed, lowering quality of products.

Means for reducing and controlling the losses to destructive agents include cultural practices such as thinning and the planting of resistant species. Chemicals to control insects and disease have also been widely used, but in recent years, have become both expensive and subject to environmental constraints.

Removals amounted to 13 million cubic feet in 1977, mostly softwoods including 80 million board feet of sawtimber.

Removals.—The final component of change, removals, can be of the following kinds: (1) roundwood harvests for products such as sawlogs, pulpwood, and poles; (2) logging residues; and (3) pre-commercial thinning and other cultural operations, housing developments, and withdrawal of commercial timberland for parks, wilderness areas, and other nontimber uses.

In 1977, removals from Utah's growing stock inventory amounted to 13 million cubic feet and included nearly 80 million board feet of sawtimber (appendix tables 24 and 25). Removals were mainly softwoods, mostly taken from National Forests.



For every cubic foot removed, 5 cubic feet were grown.

Sixty percent of the removals were lodgepole pine and Engelmann spruce.

Eleven million cubic feet, 70 million board feet of sawtimber were cut from roundwood.

At the present time, removals in Utah are equivalent to less than 1 percent of the growing stock and sawtimber inventories. Moreover, in 1977 Utah's forest increased 5 cubic feet for every cubic foot removed. Similar but smaller gains were found in the sawtimber inventory.

Nearly 95 percent of total removals was made up of four species. Lodgepole pine and Engelmann spruce each accounted for some 30 percent. Ponderosa pine added another 22 percent and Douglas-fir accounted for slightly more than 10 percent of all material removed.

Timber harvested for roundwood products was by far the largest of the removals from the growing stock inventory. In 1977, such removals amounted to more than 11 million cubic feet and included nearly 70 million board feet of sawtimber. Practically all of this material was softwood.

Additional material was harvested from the nongrowing stock portion of the inventory. Slightly more than one-half million cubic feet of material came from rough and rotten trees, dead trees and other nongrowing stock sources.

Sawlogs were the number one product (85 percent of total).



In recent years mine timber production has increased, lumber production has decreased.

Sawlogs were the most important single product harvested from Utah's forests in 1977. Total output accounted for nearly 85 percent of the timber products. In 1977 the output of lumber was about 63 million board feet. But in recent years lumber production has declined and substantial amounts of sawlogs are being converted to dimension mine blocks.

The remaining timber products harvest was mostly for miscellaneous industrial products such as poles, posts, mine timbers, and commercial fuelwood. An additional one-half million cubic feet of aspen was harvested for conversion to excelsior.

In 1977 over 1 million cubic feet of wood were left in the woods after logging.



In 1977 more than 1 million cubic feet of growing stock was left in the woods after logging operations. These logging residues amounted to 9 percent of total removals and consisted of those sections of growing stock trees between a 1-foot stump and a 4-inch top (diameter outside bark) that did not find their way to the mill.

The final category of removals is that material taken out of the standing inventory but not converted to any industrial product. This category was not especially significant in Utah in 1977, accounting for less than 3 percent of the volume removed.

Without exception, removals did not exceed an amount equal to 1 percent of the inventory of any species. In addition, removals were exceeded by net annual growth for each species—usually by a substantial margin (fig. 14). An exception is ponderosa pine where removals were 65 percent of net annual growth.

Removals from growing stock and sawtimber in Utah have far less impact on the standing inventory than the amount of material lost annually to insects, disease, fire, and other destructive agents. Volume lost to mortality, in 1977 at least, was nearly three times that removed during timber harvesting operations. The forest in which less than 1 percent of the standing inventory is harvested annually may be contributing to the excess in mortality. If the growing stock inventory continues to increase it will most certainly produce stands that are overcrowded, stagnated, and highly susceptible to serious insect or disease outbreak.

The relatively low level of harvest from Utah's forest in 1977 could be attributed to such factors as inaccessibility, generally low volumes per acre, long haul distances, and low market demand for some of the species. Increasing accessibility and developing markets for small-size material and species with low product value could improve the utilization. As energy requirements and construction costs mount, shoring for increased subsurface mining operations, fuelwood needs, and composite or particle board manufacture could increase the demand for timber products from Utah's forests.

In the meantime, having to forego the management opportunities afforded by a viable timber harvesting program will most likely result in a continuation of current conditions within Utah's forests, which in turn will contribute to less than optimal growth rates and high mortality levels.

The bottom line...

removals were less than 1 percent of the existing volume for any species...

net annual growth was far greater than removals...

the volume lost to mortality was nearly three times that cut in 1977.

Increased demands for energy-related wood products could increase removals from Utah's forests.

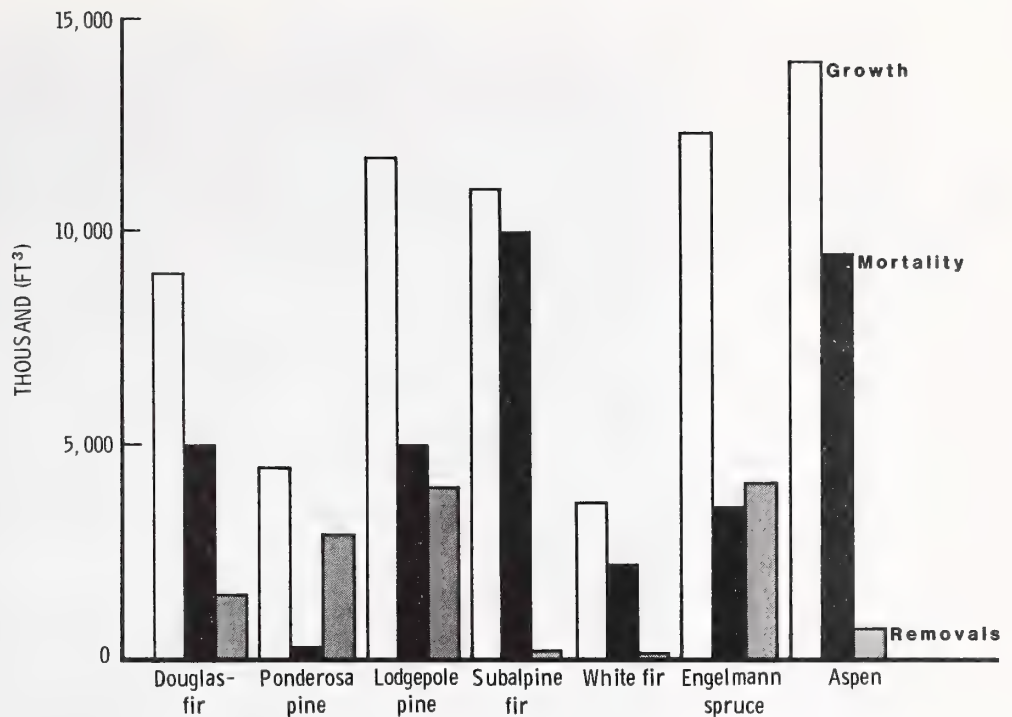


Figure 14.—Net annual growth, mortality, and removals from growing stock on commercial timberland by species, Utah, 1977.

FOREST USES

Utah's forests have high value for nontimber uses.

Utah's forested land provides many values not only to Utah but also the rest of the Nation. Water is fast becoming one of the most valuable, if not the most valuable, output. Much of the forest land provides forage and browse for livestock and big game animals, and almost every acre provides habitat for other species of wildlife. The trees provide a source of timber for commercial use and fuelwood. In addition, most forest land offers some form of outdoor recreation. Moreover, recent developments in energy exploration and development will certainly impact much of the State's forest land.

Water, grazing, recreation, wildlife, and minerals are important to the Nation as well as the State.

Since the mid-1800's when the settlement of Utah really got under way, the water, forage, and timber have been the foundation of economic development of the State. Forest recreation came later. Today even the desert areas are providing recreational opportunities. Minerals underlying much of forest and nonforest land have only recently been tapped. The true value of the mineral resources to the State and the Nation is not really known. But the oil, oil shale, tar sands, and coal deposits are extensive enough to have attracted national attention and significant investment.

Opportunities for more intensive use of forest land are limited in many areas.

In many areas use has reached the limit the land can support. Some areas have been abused and overused. Restoring such lands or preventing further deterioration requires curtailment of some uses.

Water

The water running off Utah's forest (and other lands within the same general elevational range) is a vital source of supply for Utah as well as other western States. It is the principal source of water for irrigation, domestic, and industrial use. Utah-produced water is also essential to Nevada, Arizona, southern California, and Mexico.

The forests and intermingled open lands of the mountains and foothills comprise about half the State's land area, but furnish almost 80 percent of the water runoff. Non-forested lands above and below the forests provide the remaining runoff.

Utah's forests are prime source of water for the Southwest.



The 8 million acre-feet of water generated in Utah is part of 23 million acre-feet of flowing water in or through the State.

Over half the water ends up in the Great Basin area...

and most of the rest goes into the Colorado River at some point before it gets to the Baja.

Utah's average annual precipitation is 13 inches per year. But precipitation varies from 3 inches in the desert to as much as 60 inches in the high mountains. The vast forest watersheds accumulate large amounts of precipitation in the form of snow. The spring runoff feeds the streams and the water storage systems. Although some 23 million acre-feet of water goes into streams flowing in or through Utah, only 8 million acre-feet are derived from Utah watersheds during a year of average precipitation.

The 8 million acre-feet of runoff flows into two major drainage areas. About 56 percent goes into the Great Basin area consisting of the Bear River, Weber River, Jordan River, Sevier River, Beaver River, Provo River, and Great Salt Lake Desert hydrologic areas. About 43 percent goes into the upper and lower Colorado River hydrologic areas (fig. 15). A small amount, about 1 percent of the runoff, from the Raft River Mountains in northwest Utah flows into the Columbia River Basin thru Idaho.

Runoff originating on the forest zones is distributed in about the same proportion as the entire State runoff. The 8 million acre-feet of runoff amounts to about 1.9 inches for the entire State. But there are some large differences in water yield from nonforest and forest areas and from different types of forests during a year of average precipitation:

	Runoff <i>Inches</i>
Nonforest	0.8
Pinyon-juniper	1.0
Other forest	<u>7.8</u>
All lands	1.9



Figure 15.—Major river basins and hydrologic areas of Utah.

The increasing demand for water is expected to continue...

by the year 2000, water use is projected to be some 6.4 million acre-feet in Utah, with nearly half going for irrigation and livestock.

Grazing

The livestock industry heavily contributed to Utah's growth in the 1800's...

Water produced in the forest and high elevation rangelands is of vital importance. The ground water and runoff are the total water supplies for use in homes, industry, agriculture, for recreation, fisheries, and wildlife. Economic development and expansion will bring increased demand for quality water. By the year 2000, water use is expected to increase from 5.7 million acre-feet to nearly 6.4 million acre-feet, with nearly half of it (47.9 percent) to be consumed by irrigation and livestock.²

The importance of water to the State underscores the necessity for watershed protection and resource management that enhance production of high quality water. Research to date indicates that water yields from mountain snowpack and the timing of runoff can indeed be influenced by manipulation of the vegetation. But more research is needed on the effects of water management activities on other forest values.

The forest ranges of Utah have been heavily grazed since the mid 1800's. Before that the forest land supported large populations of deer, elk, antelope, and buffalo. But by 1880 at least 136,000 head of cattle and an estimated 600,000 sheep grazed Utah's ranges, frequently in conflict. By 1900 the numbers were at 344,000 cattle and nearly 4 million sheep.

²Utah Department of Natural Resources. State of Utah water—1980. Salt Lake City, UT: Utah Department of Natural Resources, Division of Water Resources; 1981. 47 p.

but frequently produced disastrous consequences.

In those early years of development, grazing was largely uncontrolled. Overgrazing in the proximity of water or the moving of large herds of sheep between watering places was the rule. By the turn of the century vast areas of forested and other rangeland were badly depleted of forage. With the soil cover gone, the land was unprotected from the frequent high-intensity summer storms and spring and fall showers. The erosion came in many forms and degrees. The most spectacular were the disastrous mud and rock floods pounding down into towns and settlements along the Wasatch Front (particularly in Davis County) and from the Wasatch Plateau into the towns of Ephraim and Manti.

The depleted ranges, the realization of the need for grazing controls, and economic difficulties in the sheep industry all contributed to the decline in grazing on the forest range. From a peak of over 1 million sheep grazing on National Forests in 1913, the numbers fell to 407,000 in 1962. Cattle numbers peaked during World War I at 179,000, but by 1962 only 102,000 were grazing Utah's National Forests.

During Fiscal Year 1978, on the National Forests where much of the forest range is located, 93,083 cattle, 18,074 horses and burros and 254,568 sheep grazed a total of 660,000 animal unit months (AUM's). Cattle accounted for about 60 percent of the AUM's. These are considerably less than even the Statewide populations of 1880.

Livestock grazing is considerably less now than in early Utah.



In 1978, 366,000 animals grazed about 660,000 AUM's, with cattle accounting for 68 percent.

Utah's grazing lands have always been an important resource as they comprise about 92 percent of the State's land. The proper use and development of these lands is critical as a source of water, wildlife habitat, livestock forage, scenery, open space, and many forms of recreation. The conservation, improvement, and maintenance of the State's rangelands for present and future use is important to virtually all segments of the population. It is important to the tourist seeking scenery or open space, the recreationist seeking an enjoyable outdoor experience, the urban resident demanding a high-quality water

supply, the person interested in a healthy wildlife population, and the rural family and community that depend on livestock grazing for their livelihood and economic stability. Under proper management these multiple uses and values are compatible.

The management of forest range is complicated by the necessity of having to consider watershed, wildlife, and recreation values as well as grazing levels when developing management plans.

Competition between big game and livestock has decreased over the last several decades. Although the mountain forest range has ample forage, the lower foothills, which are less productive and more limited in area, are critical winter range for deer and are heavily grazed by domestic livestock during the spring and fall.

But the management of the range has improved considerably over the years. Closer control over numbers of animals, construction of check dams and reservoirs, and conversion of pinyon-juniper and sagebrush to more desirable species of forage and browse have increased the amount and quality of the range. Even watershed rehabilitation measures such as furrowing, trenching, and terracing followed by seeding have improved Utah's livestock and big game range.

Utah's forested mountains are some of the most heavily used recreational lands in the West. In 1977 only the National Forests in Colorado and Arizona had more recreational visitor days of use.

Good range management for livestock and big game goes hand-in-hand with watershed production.

Recreation and Wildlife

Utah's mountain forests are highly prized for recreation.



Campers, hikers, skiers, and hunters from the State, the Nation, and around the world come here to enjoy the many activities available in the vast and varied landscape of the State.

In 1980 the National Forests alone provided over 14 million visitor days...

and the Wasatch was the most heavily used National Forest in the Nation.

A commonly used measure of recreation use is the visitor-day. The National Forest System visitor-day is an aggregate of 12 person hours, which may entail one person for 12 hours, 12 persons for 1 hour, or any combination of individual or group use, either continuous or intermittent. In 1977 the estimated recreational use of Utah's National Forests was 11.3 million visitor-days. In fiscal year 1980 the numbers rose to over 14 million, accounting for about 15 percent of the recreation use on National Forests nationwide. The Wasatch National Forest, with 6.74 million visitor-days, was the most heavily used National Forest in the Nation:

National Forest	Thousands of visitor-days	National rank in use
Wasatch	6,740.8	1
Uinta	2,338.8	34
Ashley	1,579.4	56
Fishlake	1,318.9	61
Dixie	1,232.3	67
Manti-LaSal	982.5	83
Total	14,192.7	--

In 1977 camping and picnicking accounted for 36 percent of the total recreation:

Activity	Thousands of visitor-days
Camping and picnicking	4,070.6
Recreation travel (mechanized)	2,440.8
Fishing	1,240.5
Hunting	689.2
Hiking and mountain climbing	455.3
Winter sports	385.4
Water	294.8
Horseback riding	226.6
Other	1,538.6
Total	11,341.8

Camping, picnicking, and fishing are the favorite activities.

Many recreation sites outside the National Forests are also heavily used. Private enterprises inside and outside the National Forests provide facilities for skiing, boating, float trips, and other activities. The Utah State Park and Recreation Commission, the National Park Service, and other public agencies all provide outdoor recreation opportunities. In 1977, for example, recreation on BLM land in Utah was reported at 1.3 million visitor-days, excluding sightseeing.

The increase in recreational activities in Utah since World War II is due to improved transportation and a more mobile society. The State has made a concerted effort to attract visitors from around the world.

The Lake Powell and Flaming Gorge recreation areas are relatively recent additions to Utah's recreation scene and attract thousands of people annually. Utah's snow provides some of the best skiing anywhere in the world. And big game hunting is not only a local activity, it attracts thousands from out of State, particularly California, as does the fishing.



Wildlife resources help generate much of the recreational use of Utah's forests. Big game animals, always the most spectacular to see in the wild, are abundant and are heavily hunted by several hundred thousand people annually, many from out of State.

Utah's wildlife contributes heavily to Utah's attraction for recreationists...



Although game populations fluctuate yearly for various reasons, the basic herds apparently are reasonably stable or are increasing. The 1982 estimates of populations of some selected big game species in Utah are:

	Species	Number
particularly big game animals,...	Bison	150
	Antelope	2,500
	Bighorn sheep	250
	Mule deer	600,000
	Elk	20,000
	Moose	<u>1,000</u>
	Total	623,900

During 1981 well over 200,000 big game permits were sold and hunters harvested some 90,809 deer, 3,456 elk, and 96 moose.

waterfowl, and other migratory birds.

In addition to big game and nongame animals, Utah has a large population of waterfowl and other birds. Also Utah is part of a major flyway for migratory birds of all kinds. The large variety of bird species afford many hours of recreation, both to hunters and sightseers.

The midsummer resident population of waterfowl is about 11,000. Hunters harvested some 367,265 ducks and more than 25,000 geese (mostly Canadian) in 1980. In addition, an estimated 847,730 upland game birds and animals were taken by 100,165 hunters.³

Recreation and tourism in Utah is a major component of the economy and will remain so. The opportunities for recreation on the forests and other lands in Utah will be major factors in any land use plan.

Minerals

Utah's mineral estate is vast...

Beneath the forest and rangelands of Utah lies an increasingly valuable mineral estate. In 1975, the value of mineral production in Utah was estimated at \$966.5 million, with primary minerals being petroleum, copper, coal, and gold.

especially in the Overthrust Belt area.

Some of the richest deposits of critical energy and mineral resources in the Nation lie in the Overthrust Belt (fig. 16) that runs from Mexico into Canada. The oil, oil shale, tar sands, coal, molybdenum, phosphate rock, and a host of others are being considered for development. But, the forests and rangelands overlaying these deposits have their own mix of high and sometimes conflicting values. In Utah the Overthrust Belt spans the State roughly west of the Green and Colorado Rivers, and east of the Wasatch Front and I-15 (fig. 16). It underlays approximately a third of the land area.

Mineral extraction can disturb the earth's surface to varying degrees...

Some metals and minerals are most efficiently extracted by surface mining with substantial disturbance to surface resources. But any mining, whether from the surface or underground, can cause surface disturbance, i.e. from waste dumps, land subsidence, transportation, and power access corridors.

Oil exploration, drilling, and production can be done in many areas with minimal sustained impact on surface resources.

³Unpublished data, Utah Division of Wildlife Resources.



Figure 16.—Overthrust Belt spanning central Utah.

but proper planning can protect the land resource.



Management of forest and rangeland is being planned in concert with mineral development so all resources can be utilized without permanent damage to the land base.

APPENDIX A: TERMINOLOGY

Acceptable trees—Growing-stock trees meeting specified standards of size and quality, but not qualifying as desirable trees.

Area condition class—See stocking.

Bureau of Land Management land—Federal lands administered by the Bureau of Land Management, U.S. Department of the Interior.

Commercial forest land—See commercial timberland.

Commercial species—Tree species suitable for industrial wood products.

Commercial timberland—Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as commercial timberland have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands. Currently, inaccessible and inoperable areas are included.)

Cord—A pile of stacked wood containing 128 cubic feet within its outside surfaces. The standard dimensions are 4 by 4 by 8 feet.

Cropland—Land under cultivation within the past 24 months, including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, and land in soil improving crops, but excluding land cultivated in developing improved pasture.

Cull trees—Live trees of sawtimber and poletimber size that are unmerchantable for saw logs now or prospectively because of roughness, rot, or species (also see rotten trees and rough trees).

Deferred forest land—National Forest lands that meet productivity standards for commercial forest, but are under study for possible inclusion in the wilderness system.

Desirable Trees—Growing-stock trees (1) having no serious defect in quality to limit present or prospective use for timber products; (2) of relatively high vigor; and (3) containing no pathogens that may result in death or serious deterioration before rotation age.

Diameter classes—A classification of trees based on diameter outside bark measured at breast height (4½ feet above the ground). D.b.h. is the common abbreviation for “diameter at breast height.” When using 2-inch diameter classes, the 6-inch class, for example, includes trees 5.0 through 6.9 inches d.b.h., inclusive.

Ecosystem—A complete, interacting system of organisms considered together with their environment; e.g., a marsh, a watershed, a lake, etc.

Establishment—An economic unit, generally at a single physical location where business is conducted or where services or industrial operations are performed.

Farmer and other private—All private ownerships except industry.

Farmer-owned lands—Lands owned by a person who operates a farm, either doing the work himself or directly supervising the work.

Forest industry lands—Lands owned by companies or individuals operating wood-processing plants.

Forest land—Land at least 10 percent stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. (Also see Commercial timberland, Productive-reserved forest land, and Other forest land.) Forest land includes transition zones, such as areas between heavily forested and nonforested lands that are at least 10 percent stocked with forest trees, and forest areas adjacent to urban and built-up lands. Also included are pinyon-juniper and chaparral areas in the West, and afforested areas. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet in width.

Forest site productivity class—A classification of forest land in terms of potential cubic-foot volume growth per acre at culmination of mean annual increment in fully stocked natural stands.

Forest types—A classification of forest land based upon the tree species presently forming a plurality of stocking. For pole timber-size trees and larger, stocking is determined from basal area occurrence; for trees less than 5.0 inches d.b.h., from number of trees.

Major western forest type groups:

Douglas-fir—Forests in which Douglas-fir comprises a plurality of the stocking. (Common associates include western hemlock, western redcedar, the true firs, redwood, ponderosa pine, and larch.)

Ponderosa pine—Forests in which ponderosa pine comprises a plurality of the stocking. (Common associates include Jeffrey pine, sugar pine, limber pine, Arizona pine, Apache pine, Chihuahua pine, Douglas-fir, incense cedar, and white fir.)

Limber pine—Forests in which limber pine comprises a plurality of the stocking. (Common associates include lodgepole pine, aspen, Engelmann spruce, and subalpine fir.)

Lodgepole pine—Forests in which lodgepole pine comprises a plurality of the stocking. (Common associates are alpine fir, western white pine, Engelmann spruce, aspen, and larch.)

Fir-spruce—Forests in which true firs (*Abies* spp.), Engelmann spruce, or Colorado blue spruce, singly or combination, comprises a plurality of the stocking. (Common associates are mountain hemlock and lodgepole pine.)

White fir—Forests in which white fir comprises a plurality of the stocking. (Common associate is Douglas-fir).

Aspen—Forests in which aspen comprises a plurality of the stocking.

Cottonwood—Forest in which cottonwood comprises a plurality of the stocking. (Common associates are willow and red alder).

Hardwoods—Forests in which red alder or other western hardwoods, singly or in combination, comprises a plurality of the stocking.

- Pinyon-juniper—Forests in which pinyon pine or juniper (or both) comprises a plurality of the stocking.
- Growing-stock trees—Live sawtimber trees, poletimber trees, saplings, and seedlings meeting specified standards of quality or vigor; excludes cull trees.
- Growing-stock volume—Net volume in cubic feet of live sawtimber and poletimber trees, from stump to a minimum 4-inch top (of central stem) outside bark or to the point where the central stem breaks into limbs.
- Growth—See definition for “Net annual growth.”
- Hardwoods—Dicotyledonous trees, usually broad-leaved and deciduous.
- Indian lands—Tribal lands held in fee by the Federal Government but administered for Indian tribal groups and Indian trust allotments.
- Industrial wood—All commercial roundwood products except fuelwood.
- Land area—Census definition: The area of dry land and land temporarily or partially covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds less than 40 acres of area. Forest Survey definition: Same as above except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is 1 acre.
- Logging residues—The unused portions of poletimber and sawtimber trees cut or killed by logging.
- Mortality—The volume of sound wood in live trees that have died from natural causes during a specified period.
- National Forest System land—Federal lands designated by Executive Order or statute as National Forests or purchase units, and other lands under the administration of the Forest Service including experimental areas and Bankhead-Jones Title III lands.
- Net annual growth—The net increase in the volume of trees during a specified year. Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus the net volume of trees reaching the minimum size class during the year, minus the volume of trees that died during the year, and minus the net volume of trees that became rough or rotten trees during the year.
- Net volume in board feet—The gross board-foot volume of trees less deductions for rot or other defect affecting use for lumber.
- Net volume in cubic feet—Gross volume in cubic feet less deductions for rot, roughness, and poor form. Volume is computed for the central stem from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.
- Nonforest land—Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline

- clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as nonforest land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.)
- Nonstocked areas**—Commercial timberland less than 10 percent stocked with growing-stock trees.
- Other Federal land**—Federal land other than lands administered by the Forest Service or the Bureau of Land Management.
- Other forest land**—Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions because of adverse site conditions such as sterile soils, dry climate, poor drainage, high elevation, steepness, or rockiness.
- Other land**—All land area other than forest and range lands.
- Other private land**—Privately owned land other than forest industry or farmer-owned.
- Other public land**—Publicly owned land other than National Forest System land.
- Other removals**—The net volume of growing-stock trees removed from the inventory by cultural operations such as timber-stand improvement, by land clearing, and by changes in land use, such as a shift to wilderness.
- Other species**—Tree species of typical small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.
- Ownership**—The property owned by one owner, including all parcels of land in the United States.
- Pasture**—Land which is currently improved for grazing by cultivation, seeding, or irrigation.
- Plant byproducts**—Wood material from primary manufacturing plants (such as slabs, edgings, trimmings, miscuts, sawdust shavings, veneer cores and clippings, and pulp screenings) that are used for some products.
- Poletimber stands**—Stands at least 10 percent stocked with growing-stock trees, of which half or more of the stocking is sawtimber and/or poletimber trees with poletimber stocking exceeding that of sawtimber. (See definition for Stocking.)
- Poletimber trees**—Live trees of commercial species at least 5.0 inches in diameter at breast height but smaller than sawtimber size, and of good form and vigor.
- Potential growth**—The average net annual growth per acre attainable in fully stocked natural stands at culmination of mean annual growth of dominant or codominant trees.
- Primary manufacturing plants**—Plants using roundwood products such as saw logs, pulpwood bolts, veneer logs, etc.
- Productive-reserved forest land**—Productive public forest land withdrawn from timber utilization through statute or administrative regulations.
- Productivity class**—A classification of forest land in terms of potential growth in cubic feet of fully stocked natural stands.

Rangeland—Land on which the potential natural vegetation is predominantly grasses, grass-like plants, forbs, or shrubs, including land revegetated naturally or artificially that is managed like native vegetation. Rangeland includes natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows that are less than 10 percent stocked with forest trees of any size.

Removals—The net volume of growing-stock or sawtimber trees removed from the inventory by harvesting; cultural operations, such as timber stand improvement; land clearings; or changes in land use.

Residues:

Coarse residues—Plant residues suitable for chipping, such as slabs, edgings, and ends.

Fine residues—Plant residues not suitable for chipping, such as sawdust, shavings, and veneer clippings.

Logging residues—The unused portions of sawtimber and poletimber trees cut or killed by logging.

Plant residues—Wood materials from primary manufacturing plants that are not used for any product.

Urban residues—Wood materials from urban areas, such as newspapers, lumber and plywood from building demolition, and used packaging and shipping wood materials.

Rotten trees—Live trees of commercial species that do not contain a saw log, now or prospectively, primarily because of rot (e.g., when rot accounts for more than 50 percent of the total cull volume).

Rough trees—(a) Live trees of commercial species that do not contain a saw log, now or prospectively, primarily because of roughness, poor form, splits, and cracks, and with less than one-third of the gross tree volume in sound material; and (b) all live trees of noncommercial species.

Roundwood equivalent—The volume of logs or other round products required to produce the lumber, plywood, woodpulp, paper, or other similar products.

Roundwood logs—Logs, bolts, or other round sections cut from trees.

Salvable dead trees—Standing or down dead trees that are considered currently or potentially merchantable by regional standards.

Saplings—Live trees of commercial species 1.0 inch to 5.0 inches in diameter at breast height and of good form and vigor.

Sapling and seedling stands—Stands at least 10 percent occupied with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

Saw log—A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter inside bark for softwoods of 6 inches (8 inches for hardwoods) or other combinations of size and defect specified by regional standards.

Saw log portion—That part of the bole of sawtimber trees between the stump and the saw log top.

- Saw log top**—The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw log top is 7.0 inches d.o.b. for softwoods, and 9.0 inches d.o.b. for hardwoods.
- Sawtimber stands**—Stands at least 10 percent occupied with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.
- Sawtimber trees**—Live trees of commercial species containing at least one 12-foot saw log or two noncontiguous 8-foot logs, and meeting regional specifications for freedom from defect. Softwood trees must be at least 9 inches in diameter and hardwood trees 11 inches in diameter at breast height.
- Sawtimber volume**—Net volume of the saw log portion of live sawtimber trees in board feet.
- Seedlings**—Established live trees of commercial species less than 1.0 inch in diameter at breast height and of good form and vigor.
- Softwoods**—Monocotyledonous trees, usually evergreen, having needle or scalelike leaves.
- Special interest areas**—Areas described in the Environmental Policy Act of 1970 which include (1) cultural areas—historic or prehistoric sites and places of obvious future historical value—and (2) natural areas—outstanding examples of the Nation’s geological and ecological features.
- Standard error**—An expression of the degree of confidence that can be placed on an estimated total or average obtained by statistical sampling methods. Sampling errors do not include technique errors that could occur in photo classification of areas, measurement of volume, or compilation of data.
- Stand improvement**—Measures such as thinning, pruning, release cutting, girdling, weeding, or poisoning of unwanted trees aimed at improving growing conditions for the remaining trees.
- Stand-size classes**—A classification of forest land based on the predominant size of timber present. See Poletimber stands, Sapling seedling stands, and Sawtimber stands.
- State, county, and municipal lands**—Lands owned by States, counties, and local public agencies, or lands leased by these governmental units for more than 50 years.
- Stocking**—Stocking is an expression of the extent to which growing space is effectively utilized by present or potential growing stock trees of commercial species. “Percent of stocking” is synonymous with “percentage of growing space occupied” and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.
- Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range, which represents full-site occupancy. This is called 100-percent stocking. The upper limit of full stocking

has been set at 132 percent. Sites with less than 100-percent stocking represent less than full-site occupancy. Overstocking is characterized by sites with 133 percent or more stocking.

“Stocking percentages” express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land, and are summarized into the following area condition classes:

Class 10—Areas fully stocked (100 to 132 percent) with desirable trees and not overstocked (133 percent or more).

Class 20—Areas fully stocked with desirable trees, but overstocked with all live trees.

Class 30—Areas medium to fully stocked (60 to 99 percent) with desirable trees and with less than 30 percent of the area controlled by other trees or inhibiting vegetation, or surface conditions that will prevent occupancy by desirable trees.

Class 40—Areas medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees, or conditions that ordinarily prevent occupancy by desirable trees.

Class 50—Areas poorly stocked (16.7 to 59 percent) with desirable trees, but fully stocked with growing-stock trees.

Class 60—Areas poorly stocked with desirable trees, but with medium to full stocking of growing-stock trees.

Class 70—Areas nonstocked (less than 16.7 percent) or poorly stocked with desirable trees, and poorly stocked with growing-stock trees.

Class 80—Low-risk old-growth stands.

Class 90—High-risk old-growth stands.

Nonstocked—Areas less than 16.7 percent stocked with growing-stock trees.

Upper-stem portion—That part of the main stem or fork of sawtimber trees above the saw log top to a minimum top diameter of 4 inches outside bark or to the point where the main stem or fork breaks into limbs.

Urban and other areas—Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; school yards; cemeteries; roads; railroads; airports; beaches; powerlines and other rights-of-way; or other nonforest land not included in any other specified land use class.

Water—Census definition: Streams sloughs, estuaries, and canals more than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds more than 40 acres in area.

Forest Survey definition: Same as above except minimum width of streams, etc. is 120 feet, and minimum size of lakes, etc. is 1 acre.

Wilderness—An area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value (from Wilderness Act 1964).

APPENDIX B: INVENTORY TECHNIQUES

The inventory was designed to provide reliable statistics primarily at the State and working circle levels. Procedures were as follows:

1. Initial area estimates were based on the classification of 668,057 sample points systematically placed on the latest aerial photographs available. The sample points were summarized and grouped into strata for subsequent field sampling. The photopoints, adjusted to meet known land areas, were used to compute area expansion factors for the field stratum means.

2. Land classification and estimates of timber characteristics and volume were based on observations and measurements recorded at 719 ground sample locations. Sample trees were selected using a 10-point cluster, which includes fixed plots (1/300-acre) for trees less than 5 inches d.b.h. and variable plots (40-BAF) for trees 5 inches d.b.h. or larger.

3. For most species, volume and defect were computed using equations developed for the Ashley National Forest. For other species, Kemp's equations were used.

4. All photo and field data were sent to Ogden, Utah, for editing and were punched onto cards and stored for machine computing, sorting, and tabulation. Final estimates were based on statistical summaries of the data.

APPENDIX C: RELIABILITY OF THE DATA

Individual cells within tables should be used with caution. Some are based on very small sample sizes, and so result in high sampling errors. The standard error percentages shown in tables 6 and 7 were calculated at the 67 percent confidence level.

Table 6.--Area of forest land (excluding National Forests) with percent standard error, Utah, 1978

Item	Softwoods		Hardwoods		All types	
	Acres	Percent	Acres	Percent	Acres	Percent
Commercial timberland	592,197	±4.9	282,133	±8.4	874,330	±3.7
Productive reserved ¹	28,241		4,011		32,252	
Other forest land:						
Unproductive reserved ¹	371,495		34,698		406,193	
Unproductive nonreserved	8,133,599	±0.7	1,543,295	±3.7	9,676,894	±0.4

¹Reserved land areas are estimated from aerial photos without field verification; therefore, standard errors are not calculated.

Table 7.--Net volume, net annual growth, and annual mortality of growing stock and sawtimber on commercial timberland (excluding National Forests) with percent standard error, Utah

Item	Softwoods		Hardwoods		All species	
	Volume	Percent	Volume	Percent	Volume	Percent
Net volume, 1978:						
Growing stock (M cubic feet)	801,290	±5.7	310,195	±8.7	1,111,485	±4.8
Sawtimber (M board feet ¹)	3,138,966	±6.1	568,689	±14.2	3,707,655	±5.7
Net annual growth, 1977:						
Growing stock (cubic feet)	13,728,031	±11.6	9,461,733	±10.7	23,189,764	±8.2
Sawtimber (board feet ¹)	68,115,628	±10.6	31,273,739	±22.2	99,389,367	±9.8
Annual mortality, 1977:						
Growing stock (cubic feet)	5,679,847	±21.2	2,090,010	±23.7	7,769,857	±17.0
Sawtimber (board feet ¹)	19,599,960	±21.0	2,723,219	±46.8	22,323,179	±19.4

¹International 1/4-inch rule.

APPENDIX D: FOREST SURVEY TABLES 8-31

Table 8.--Total land and water area by ownership class, Utah, 1978

Land class	Thousand acres
Commercial timberland	3,151.3
Commercial deferred	157.3
Noncommercial forest land:	
Other forest nonreserved	12,205.0
Productive reserved	124.3
Other forest reserved	428.7
Total forest land	16,066.6
Nonforest land	36,460.1
Total land area¹	52,526.7

¹Source: Bureau of the Census, land and water area of the United States, 1980.

Table 9.--Area of commercial timberland by ownership class, Utah, 1978

Ownership class	Thousand acres
National Forest	2,277.0
Bureau of Land Management	186.0
Indian	50.7
Miscellaneous Federal	6.3
State	114.8
County and municipal	3.7
Forest industry	.0
Farmer	303.9
Other private	208.9
All ownerships	3,151.3

Table 10.--Area of commercial timberland by forest type, stand-size class, and site class, Utah, 1978

Forest type and stand-size class	Site class				Total acres	
	165+	120-164	85-119	50-84		20-49
----- Thousand acres -----						
Douglas-fir:						
Sawtimber	--	(¹)	6.1	101.4	319.1	426.6
Poletimber	--	--	--	1.2	38.2	39.4
Sapling and seedling	--	--	--	4.4	24.6	29.0
Nonstocked	--	--	2.7	2.6	1.8	7.1
Total	--	(¹)	8.8	109.6	383.7	502.1
Ponderosa pine:						
Sawtimber	--	--	--	14.8	348.4	363.2
Poletimber	--	--	--	--	13.6	13.6
Sapling and seedling	--	--	--	--	26.1	26.1
Nonstocked	--	--	--	7.2	16.7	23.9
Total	--	--	--	22.0	404.8	426.8
Lodgepole pine:						
Sawtimber	--	--	--	8.0	228.9	236.9
Poletimber	--	--	--	1.8	182.3	184.1
Sapling and seedling	--	--	--	--	35.9	35.9
Nonstocked	--	--	--	--	3.5	3.5
Total	--	--	--	9.8	450.6	460.4
Limber pine:						
Sawtimber	--	--	--	(¹)	21.0	21.0
Poletimber	--	--	--	--	.7	.7
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	7.2	7.2
Total	--	--	--	(¹)	28.9	28.9
White fir:						
Sawtimber	--	--	5.2	33.7	100.1	139.0
Poletimber	--	--	--	--	7.2	7.2
Sapling and seedling	--	--	--	1.9	3.3	5.2
Nonstocked	--	--	--	--	--	--
Total	--	--	5.2	35.6	110.6	151.4
Fir-spruce:						
Sawtimber	--	2.5	55.7	289.9	379.0	727.1
Poletimber	--	--	2.8	18.7	55.0	76.5
Sapling and seedling	--	--	--	10.3	20.2	30.5
Nonstocked	--	--	--	--	3.0	3.0
Total	--	2.5	58.5	318.9	457.2	837.1
Pinyon-juniper:						
Sawtimber	--	--	--	--	14.8	14.8
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	2.3	2.3
Total	--	--	--	--	17.1	17.1
Aspen:						
Sawtimber	--	--	7.0	71.8	156.8	235.6
Poletimber	--	--	8.2	63.7	280.7	352.6
Sapling and seedling	--	--	--	18.0	80.7	98.7
Nonstocked	--	--	--	2.3	27.8	30.1
Total	--	--	15.2	155.8	546.0	717.0
Cottonwood:						
Sawtimber	--	--	--	--	10.5	10.5
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	10.5	10.5
All forest types:						
Sawtimber	--	2.5	74.0	519.6	1,578.6	2,174.7
Poletimber	--	--	11.0	85.4	577.7	674.1
Sapling and seedling	--	--	--	34.6	190.8	225.4
Nonstocked	--	--	2.7	12.1	62.3	77.1
Total	--	2.5	87.7	651.7	2,409.4	3,151.3

¹Less than 0.05 thousand acres.

Table 11.--Area of commercial timberland in National Forest ownership by forest type, stand-size class, and site class, Utah, 1978

Forest type and stand-size class	Site class					Total acres
	165+	120-164	85-119	50-84	20-49	
----- Thousand acres -----						
Douglas-fir:						
Sawtimber	--	(¹)	0.9	48.4	189.4	238.7
Poletimber	--	--	--	1.2	27.9	29.1
Sapling and seedling	--	--	--	(¹)	3.7	3.7
Nonstocked	--	--	--	--	1.8	1.8
Total	--	(¹)	.9	49.6	222.8	273.3
Ponderosa pine:						
Sawtimber	--	--	--	2.5	273.4	275.9
Poletimber	--	--	--	--	13.6	13.6
Sapling and seedling	--	--	--	--	23.7	23.7
Nonstocked	--	--	--	--	10.9	10.9
Total	--	--	--	2.5	321.6	324.1
Lodgepole pine:						
Sawtimber	--	--	--	8.0	208.5	216.5
Poletimber	--	--	--	1.8	172.1	173.9
Sapling and seedling	--	--	--	--	33.4	33.4
Nonstocked	--	--	--	--	.9	.9
Total	--	--	--	9.8	414.9	424.7
Limber pine:						
Sawtimber	--	--	--	(¹)	18.6	18.6
Poletimber	--	--	--	--	.7	.7
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	(¹)	19.3	19.3
White fir:						
Sawtimber	--	--	--	18.1	91.5	109.6
Poletimber	--	--	--	--	7.2	7.2
Sapling and seedling	--	--	--	--	3.3	3.3
Nonstocked	--	--	--	--	--	--
Total	--	--	--	18.1	102.0	120.1
Fir-spruce:						
Sawtimber	--	--	23.5	215.2	346.9	585.6
Poletimber	--	--	--	8.3	50.9	59.2
Sapling and seedling	--	--	--	3.4	19.0	22.4
Nonstocked	--	--	--	--	3.0	3.0
Total	--	--	23.5	226.9	419.8	670.2
Pinyon-juniper:						
Sawtimber	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	--	--
Aspen:						
Sawtimber	--	--	--	16.9	135.3	152.2
Poletimber	--	--	--	16.1	201.9	218.0
Sapling and seedling	--	--	--	--	46.2	46.2
Nonstocked	--	--	--	2.3	26.6	28.9
Total	--	--	--	35.3	410.0	445.3
Cottonwood:						
Sawtimber	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	--	--
All forest types:						
Sawtimber	--	(¹)	24.4	309.1	1,263.6	1,597.1
Poletimber	--	--	--	27.4	474.3	501.7
Sapling and seedling	--	--	--	3.4	129.3	132.7
Nonstocked	--	--	--	2.3	43.2	45.5
Total	--	(¹)	24.4	342.2	1,910.4	2,277.0

¹Less than 0.05 thousand acres.

Table 12.--Area of commercial timberland in other public ownership by forest type, stand-size class, and site class, Utah, 1978

Forest type and stand-size class	Site class					Total acres
	165+	120-164	85-119	50-84	20-49	
----- Thousand acres -----						
Douglas-fir:						
Sawtimber	--	--	1.1	21.8	74.5	97.4
Poletimber	--	--	--	--	3.9	3.9
Sapling and seedling	--	--	--	2.6	11.4	14.0
Nonstocked	--	--	.5	.5	--	1.0
Total	--	--	1.6	24.9	89.8	116.3
Ponderosa pine:						
Sawtimber	--	--	--	8.3	53.6	61.9
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	1.4	1.4
Nonstocked	--	--	--	5.9	2.3	8.2
Total	--	--	--	14.2	57.3	71.5
Lodgepole pine:						
Sawtimber	--	--	--	--	6.7	6.7
Poletimber	--	--	--	--	2.1	2.1
Sapling and seedling	--	--	--	--	.5	.5
Nonstocked	--	--	--	--	1.7	1.7
Total	--	--	--	--	11.0	11.0
Limber pine:						
Sawtimber	--	--	--	--	1.4	1.4
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	6.0	6.0
Total	--	--	--	--	7.4	7.4
White fir:						
Sawtimber	--	--	.9	5.1	1.3	7.3
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	.5	--	.5
Nonstocked	--	--	--	--	--	--
Total	--	--	.9	5.6	1.3	7.8
Fir-spruce:						
Sawtimber	--	.4	13.6	23.5	8.9	46.4
Poletimber	--	--	1.9	4.4	1.4	7.7
Sapling and seedling	--	--	--	2.2	.7	2.9
Nonstocked	--	--	--	--	--	--
Total	--	.4	15.5	30.1	11.0	57.0
Pinyon-juniper:						
Sawtimber	--	--	--	--	9.5	9.5
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	1.3	1.3
Total	--	--	--	--	10.8	10.8
Aspen:						
Sawtimber	--	--	2.1	23.9	6.2	32.2
Poletimber	--	--	2.3	11.0	17.8	31.1
Sapling and seedling	--	--	--	4.2	10.0	14.2
Nonstocked	--	--	--	--	.5	.5
Total	--	--	4.4	39.1	34.5	78.0
Cottonwood:						
Sawtimber	--	--	--	--	1.7	1.7
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	1.7	1.7
All forest types:						
Sawtimber	--	.4	17.7	82.6	163.8	264.5
Poletimber	--	--	4.2	15.4	25.2	44.8
Sapling and seedling	--	--	--	9.5	24.0	33.5
Nonstocked	--	--	.5	6.4	11.8	18.7
Total	--	.4	22.4	113.9	224.8	361.5

Table 13.--Area of commercial timberland in farm and other private ownership by forest type, stand-size class, and site class, Utah, 1978

Forest type and stand-size class	Site class					Total acres
	165+	120-164	85-119	50-84	20-49	
----- Thousand acres -----						
Douglas-fir:						
Sawtimber	--	--	4.1	31.2	55.2	90.5
Poletimber	--	--	--	--	6.4	6.4
Sapling and seedling	--	--	--	1.8	9.5	11.3
Nonstocked	--	--	2.2	2.1	--	4.3
Total	--	--	6.3	35.1	71.1	112.5
Ponderosa pine:						
Sawtimber	--	--	--	4.0	21.4	25.4
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	1.0	1.0
Nonstocked	--	--	--	1.3	3.5	4.8
Total	--	--	--	5.3	25.9	31.2
Lodgepole pine:						
Sawtimber	--	--	--	--	13.7	13.7
Poletimber	--	--	--	--	8.1	8.1
Sapling and seedling	--	--	--	--	2.0	2.0
Nonstocked	--	--	--	--	.9	.9
Total	--	--	--	--	24.7	24.7
Limber pine:						
Sawtimber	--	--	--	--	1.0	1.0
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	1.2	1.2
Total	--	--	--	--	2.2	2.2
White fir:						
Sawtimber	--	--	4.3	10.5	7.3	22.1
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	1.4	--	1.4
Nonstocked	--	--	--	--	--	--
Total	--	--	4.3	11.9	7.3	23.5
Fir-spruce:						
Sawtimber	--	2.1	18.6	51.2	23.2	95.1
Poletimber	--	--	.9	6.0	2.7	9.6
Sapling and seedling	--	--	--	4.7	.5	5.2
Nonstocked	--	--	--	--	--	--
Total	--	2.1	19.5	61.9	26.4	109.9
Pinyon-juniper:						
Sawtimber	--	--	--	--	5.3	5.3
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	1.0	1.0
Total	--	--	--	--	6.3	6.3
Aspen:						
Sawtimber	--	--	4.9	31.0	15.3	51.2
Poletimber	--	--	5.9	36.6	61.0	103.5
Sapling and seedling	--	--	--	13.8	24.5	38.3
Nonstocked	--	--	--	--	.7	.7
Total	--	--	10.8	81.4	101.5	193.7
Cottonwood:						
Sawtimber	--	--	--	--	8.8	8.8
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	8.8	8.8
All forest types:						
Sawtimber	--	2.1	31.9	127.9	151.2	313.1
Poletimber	--	--	6.8	42.6	78.2	127.6
Sapling and seedling	--	--	--	21.7	37.5	59.2
Nonstocked	--	--	2.2	3.4	7.3	12.9
Total	--	2.1	40.9	195.6	274.2	512.8

Table 14.--Area of commercial timberland by stand-size class and ownership class, Utah, 1978

Stand-size class	National Forest	Other public	Farmer and other private	All ownerships
- - - - - <i>Thousand acres</i> - - - - -				
Sawtimber stands	1,597.1	264.5	313.1	2,174.7
Poletimber stands	501.7	44.8	127.6	674.1
Sapling and seedling stands	132.7	33.5	59.2	225.4
Nonstocked areas	45.5	18.7	12.9	77.1
Total	2,277.0	361.5	512.8	3,151.3

Table 15.--Area of productive deferred, productive reserved, and other timberland by land class, ownership class, and forest type, Utah, 1978

Land class	Forest type										All types	
	Douglas-fir	Ponderosa pine	Lodgepole pine	Limber pine	Fir-spruce	Pinyon-juniper	Other softwoods	Aspen	Cottonwood	Other hardwoods		
----- Thousand acres -----												
Productive deferred:												
National Forest	20.2	15.4	41.9	0.1	63.7	--	--	16.0	--	--	--	157.3
Total	20.2	15.4	41.9	.1	63.7	--	--	16.0	--	--	--	157.3
Productive reserved area:												
National Forest	10.6	--	33.4	--	40.5	--	--	7.5	--	--	--	92.0
Other public	7.3	14.9	--	.1	4.8	--	--	3.9	--	--	--	31.0
Farmer and other private	.2	1.0	--	--	(¹)	--	--	.1	--	--	--	1.3
Total	18.1	15.9	33.4	.1	45.3	--	--	11.5	--	--	--	124.3
Other forest land area:												
Unproductive reserved:												
National Forest	2.8	--	8.3	--	9.1	--	--	2.3	--	(¹)	--	22.5
Other public	3.2	1.8	11.0	1.4	(¹)	352.3	(¹)	1.2	1.5	29.6	--	402.0
Farmer and other private	--	.1	--	--	--	1.7	--	(¹)	--	2.4	--	4.2
Total	6.0	1.9	19.3	1.4	9.1	354.0	(¹)	3.5	1.5	32.0	--	428.7
Unproductive nonreserved:												
National Forest	167.0	78.9	145.5	4.5	381.5	790.3	--	531.0	--	429.4	--	2,528.1
Other public	17.6	11.7	.6	11.3	6.8	7,001.6	1.0	79.1	15.4	331.8	--	7,476.9
Farmer and other private	11.0	5.3	2.0	6.8	3.4	1,054.1	.4	289.9	52.1	775.0	--	2,200.0
Total	195.6	95.9	148.1	22.6	391.7	8,846.0	1.4	900.0	67.5	1,536.2	--	12,205.0
Total other forest land:												
National Forest	169.8	78.9	153.8	4.5	390.6	790.3	--	533.3	--	429.4	--	2,550.6
Other public	20.8	13.5	11.6	12.7	6.8	7,353.9	1.0	80.3	16.9	361.4	--	7,878.9
Farmer and other private	11.0	5.4	2.0	6.8	3.4	1,055.8	.4	289.9	52.1	777.4	--	2,204.2
Total	201.6	97.8	167.4	24.0	400.8	9,200.0	1.4	903.5	69.0	1,568.2	--	12,633.7
Total all areas:												
National Forest	200.6	94.3	229.1	4.6	494.8	790.3	--	556.8	--	429.4	--	2,799.9
Other public	28.1	28.4	11.6	12.8	11.6	7,353.9	1.0	84.2	16.9	361.4	--	7,909.9
Farmer and other private	11.2	6.4	2.0	6.8	3.4	1,055.8	.4	290.0	52.1	777.4	--	2,205.5
Total	239.9	129.1	242.7	24.2	509.8	9,200.0	1.4	931.0	69.0	1,568.2	--	12,915.3

¹Less than 0.05 thousand acres.

Table 16.--Number of growing-stock trees on commercial timberland by species and diameter class, Utah, 1978

Species	Diameter class (inches at breast height)																All classes
	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+		
----- Thousand trees -----																	
Douglas-fir	28,336	18,370	17,684	13,872	8,021	5,571	3,869	2,140	1,415	895	574	368	196	112	251	101,674	
Ponderosa pine	14,642	11,155	4,778	3,856	2,464	1,781	1,509	1,119	750	667	494	381	267	182	392	44,437	
Lodgepole pine	61,200	64,905	44,050	27,564	15,630	7,510	3,724	1,427	657	255	94	44	12	7	4	227,083	
Limber pine	1,935	1,409	908	623	580	484	260	153	192	85	25	56	20	13	11	6,754	
Subalpine fir ¹	93,961	60,243	35,148	17,932	11,009	5,941	3,346	1,970	1,196	571	358	190	106	52	28	232,051	
White fir	19,802	13,760	13,974	6,077	3,913	2,079	1,637	1,079	806	412	251	176	68	54	86	64,174	
Engelmann spruce	34,097	22,058	21,446	14,945	9,852	6,299	4,600	2,719	2,005	1,186	752	563	382	214	290	121,408	
Pinyon/juniper	1,221	1,385	1,072	355	396	215	95	188	61	18	18	16	2	13	21	5,153	
Other softwoods	206	--	--	--	--	--	--	--	--	--	--	--	--	--	--	206	
Total softwoods	255,400	193,285	139,060	85,224	51,865	29,880	19,040	10,702	7,209	4,132	2,566	1,794	1,053	647	1,083	802,940	
Aspen	97,416	95,831	76,792	34,660	14,621	8,208	3,546	1,500	588	129	76	42	12	3	--	333,424	
Cottonwood	176	323	63	57	111	139	98	64	52	26	30	3	6	9	6	1,163	
Other hardwoods	--	--	138	30	--	--	--	--	--	--	--	--	--	--	--	168	
Total hardwoods	97,592	96,154	76,993	34,747	14,732	8,347	3,644	1,564	640	155	106	45	18	12	6	334,755	
All species	352,992	289,439	216,053	119,971	66,597	38,227	22,684	12,266	7,849	4,287	2,672	1,839	1,071	659	1,089	1,137,695	

¹Includes corkbark fir.

Table 17.--Net volume of growing stock on commercial timberland by species and diameter class, Utah, 1978

Species	Diameter class (inches at breast height)																All classes
	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+				
----- Million cubic feet -----																	
Douglas-fir	29.6	57.4	64.9	71.9	73.8	63.0	52.4	45.4	37.8	29.3	19.0	10.6	44.4	599.5			
Ponderosa pine	2.7	9.7	16.8	20.3	25.6	28.0	26.6	29.9	27.5	26.9	23.4	18.7	61.0	317.1			
Lodgepole pine	118.6	170.0	172.8	130.7	92.9	49.9	30.7	14.9	6.9	3.7	1.3	.8	.7	793.9			
Limber pine	3.9	5.2	5.8	6.7	5.1	3.9	6.5	3.3	1.3	4.0	1.6	1.5	1.2	49.8			
Subalpine fir	88.9	99.7	104.2	89.3	72.9	60.6	47.5	29.7	22.7	13.9	8.6	5.0	3.2	646.2			
White fir	28.8	31.1	31.6	26.0	30.4	26.0	26.7	17.2	12.2	11.0	5.0	4.4	9.5	259.9			
Engelmann spruce	52.7	86.7	96.2	97.9	110.2	92.5	94.5	70.9	55.6	51.7	43.6	27.9	52.0	932.4			
Pinyon/juniper	.5	.7	1.2	.9	.7	1.0	2.4	1.0	.5	.3	.1	.3	.7	10.3			
Total softwoods	325.7	460.5	493.5	443.7	411.6	324.9	287.3	212.3	164.5	140.8	102.6	69.0	172.7	3,609.1			
Aspen	155.3	179.4	133.8	119.8	72.5	43.0	22.8	6.1	4.7	3.2	1.1	.5	--	742.2			
Cottonwood	.1	.4	.8	1.8	1.9	1.7	1.5	1.0	1.3	.2	.3	.4	.5	11.9			
Other hardwoods	.1	.1	--	--	--	--	--	--	--	--	--	--	--	.2			
Total hardwoods	155.5	179.9	134.6	121.6	74.4	44.7	24.3	7.1	6.0	3.4	1.4	.9	.5	754.3			
All species	481.2	640.4	628.1	565.3	486.0	369.6	311.6	219.4	170.5	144.2	104.0	69.9	173.2	4,363.4			

Table 18.--Net volume of sawtimber on commercial timberland by species and diameter class, Utah, 1978

Species	Diameter class (inches at breast height)										All classes	
	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9		29.0+
----- Million board feet, International 1/4-inch rule -----												
Douglas-fir	257.1	347.8	384.3	337.3	304.9	255.8	221.4	180.4	118.1	71.9	315.5	2,794.5
Ponderosa pine	40.5	80.1	124.4	148.2	150.6	175.6	165.4	166.0	144.0	117.1	390.8	1,702.7
Lodgepole pine	689.2	656.1	471.1	253.5	155.5	75.5	35.4	18.8	7.0	3.9	4.0	2,370.0
Limber pine	25.6	31.9	26.1	20.9	35.1	18.5	6.9	22.2	8.8	7.6	6.7	210.3
Subalpine fir	445.7	412.1	351.3	293.9	232.8	149.2	116.1	72.3	44.6	25.8	16.9	2,160.7
White fir	112.8	112.3	145.8	132.0	137.9	89.3	64.6	59.6	27.6	22.6	52.1	956.6
Engelmann spruce	451.9	505.0	574.1	485.6	498.5	374.4	306.9	287.4	240.2	154.3	295.5	4,173.8
Pinyon/juniper	3.7	2.7	2.8	2.9	7.2	2.6	2.1	.8	.2	.9	2.0	27.9
Total softwoods	2,026.5	2,148.0	2,079.9	1,674.3	1,522.5	1,140.9	918.8	807.5	590.5	404.1	1,083.5	14,396.5
Aspen	XXXXX	555.4	342.5	211.2	112.4	29.9	24.1	16.7	6.0	3.1	--	1,501.3
Cottonwood	XXXXX	9.4	9.4	8.5	7.3	4.7	6.1	.9	1.4	2.0	2.2	51.9
Other hardwoods	XXXXX	--	--	--	--	--	--	--	--	--	--	--
Total hardwoods	XXXXX	564.8	351.9	219.7	119.7	34.6	30.2	17.6	7.4	5.1	2.2	1,553.2
All species	2,026.5	2,712.8	2,431.8	1,894.0	1,642.2	1,175.5	949.0	825.1	597.9	409.2	1,085.7	15,749.7

Table 19.--Net volume of growing stock and sawtimber on commercial timberland by ownership class and species, Utah, 1978

Ownership class	Species										All species		
	Douglas-fir	Ponderosa pine	Lodgepole pine	Limber pine	Subalpine fir	White fir	Engelmann spruce	Pinyon/juniper	Total softwoods	Aspen		Cottonwood	Other hardwoods
----- Million cubic feet -----													
National Forest	341.3	238.7	755.2	36.5	426.3	178.8	831.0	--	2,807.8	443.9	0.2	444.1	3,251.9
Other public Farmer and other private	116.2	52.4	11.8	5.5	80.5	21.5	41.4	7.3	336.6	85.5	2.2	87.7	424.3
Total	142.0	26.0	26.9	7.8	139.4	59.6	60.0	3.0	464.7	212.8	9.5	222.5	687.2
----- Million cubic feet -----													
GROWING STOCK													
Total	599.5	317.1	793.9	49.8	646.2	259.9	932.4	10.3	3,609.1	742.2	11.9	754.3	4,363.4
----- Million board feet, International 1/4-inch rule -----													
SAWTIMBER													
National Forest	1,734.8	1,286.5	2,248.8	150.3	1,395.6	712.3	3,729.2	--	11,257.5	784.2	0.3	784.5	12,042.0
Other public Farmer and other private	480.8	279.3	37.8	24.2	289.9	66.5	183.1	20.1	1,381.7	166.7	9.8	176.5	1,558.2
Total	578.9	136.9	83.4	35.8	475.2	177.8	261.5	7.8	1,757.3	350.4	41.8	392.2	2,149.5
Total	2,794.5	1,702.7	2,370.0	210.3	2,160.7	956.6	4,173.8	27.9	14,396.5	1,301.3	51.9	1,353.2	15,749.7

¹Less than 0.05 million cubic feet.

Table 20.--Net volume of timber on commercial timberland by class of timber and softwoods and hardwoods, Utah, 1978

Class of timber	Softwoods		Hardwoods		All classes	
	----- Million cubic feet -----					
Sawtimber trees:						
Saw log portion	2,550.1	238.2			2,788.3	
Upper-stem portion	272.8	46.1			318.9	
Total	2,822.9	284.3			3,107.2	
Poletimber trees	786.2	470.0			1,256.2	
All growing stock trees	3,609.1	754.3			4,363.4	
Sound cull trees	49.7	12.6			62.3	
Rotten cull trees	35.3	135.0			170.3	
Salvable dead trees	132.6	35.6			168.2	
Total, all timber	3,826.7	937.5			4,764.2	

Table 21.--Net annual growth of growing stock and sawtimber on commercial timberland by ownership class and species, Utah, 1977

Ownership class	Species										Total hardwoods	Total softwoods	All species
	Douglas-fir	Ponderosa pine	Lodgepole pine	Subalpine fir	White fir	Engelmann spruce	Total softwoods	Aspen	Cottonwood	Other hardwoods			
GROWING STOCK													
----- Thousand cubic feet -----													
National Forest	3,749	2,917	11,762	325	6,387	2,006	10,581	37,727	4,397	(¹)	--	4,397	42,124
Other public	1,851	1,028	-422	79	1,703	407	751	5,397	2,298	60	2	2,360	7,757
Farmer and other private	2,396	439	307	117	2,823	1,225	1,024	8,331	6,822	273	7	7,102	15,433
Total	7,996	4,384	11,647	521	10,913	3,638	12,356	51,455	13,517	333	9	13,859	65,314
SAWTIMBER													
----- Thousand board feet, International 1/4-inch rule -----													
National Forest	19,540	15,357	55,215	1,126	27,429	7,901	50,640	177,208	10,719	2	--	10,721	187,929
Other public	9,083	6,065	-250	594	8,541	2,463	3,304	29,800	7,328	467	--	7,795	37,595
Farmer and other private	11,945	2,428	2,194	712	10,030	6,060	4,946	38,315	21,493	1,986	--	23,479	61,794
Total	40,568	23,850	57,159	2,432	46,000	16,424	58,890	245,323	39,540	2,455	--	41,995	287,318

¹Less than 0.5 thousand cubic feet.

Table 22.--Net annual growth of growing stock on commercial timberland by species and diameter class, Utah, 1977

Species	Diameter class (inches at breast height)														All classes
	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+		
	----- Thousand cubic feet -----														
Douglas-fir	1,768	1,433	1,300	1,331	1,024	604	405	137	241	155	-86	-503	187	7,996	
Ponderosa pine	198	464	618	528	591	475	327	347	109	231	144	95	257	4,384	
Lodgepole pine	7,160	2,424	1,379	838	267	-120	-8	-168	-52	-27	-49	2	1	11,647	
Limber pine	234	55	79	62	52	21	52	15	5	-66	4	4	4	521	
Subalpine fir	4,607	1,684	1,241	1,246	889	536	387	27	17	122	86	45	26	10,913	
White fir	1,674	337	436	151	383	186	227	73	6	64	23	31	47	3,638	
Engelmann spruce	2,134	1,602	1,553	1,474	1,387	977	961	679	374	350	381	168	316	12,356	
Total softwoods	17,775	7,999	6,606	5,630	4,593	2,679	2,351	1,110	700	829	503	-158	838	51,455	
Aspen	5,695	3,215	2,067	1,541	451	375	192	4	-35	-2	9	5	--	13,517	
Cottonwood	11	28	33	63	65	52	24	12	28	1	7	5	4	333	
Other hardwoods	7	2	--	--	--	--	--	--	--	--	--	--	--	9	
Total hardwoods	5,713	3,245	2,100	1,604	516	427	216	16	-7	-1	16	10	4	13,859	
All species	23,488	11,244	8,706	7,234	5,109	3,106	2,567	1,126	693	828	519	-148	842	65,314	

Table 23.--Net annual growth of sawtimber on commercial timberland by species and diameter class, Utah, 1977

Species	Diameter class (inches at breast height)													All classes
	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+			
	----- Thousand board feet, International 1/4-inch -----													
Douglas-fir	20,451	7,611	6,059	3,460	2,579	1,014	1,271	825	-594	-3,191	1,083		40,568	
Ponderosa pine	3,733	3,344	3,801	2,936	2,151	2,246	766	1,533	940	635	1,765		23,850	
Lodgepole pine	52,677	4,727	1,657	-425	-40	-817	-250	-141	-246	12	5		57,159	
Limber pine	1,564	364	293	119	304	81	29	-399	27	26	24		2,432	
Subalpine fir	27,667	6,801	4,674	2,984	1,963	305	125	658	453	230	140		46,000	
White fir	9,096	1,135	2,343	1,180	1,230	409	108	364	130	163	266		16,424	
Engelmann spruce	19,520	8,190	7,626	5,400	5,291	3,706	2,149	2,049	2,167	974	1,818		58,890	
Total softwoods	134,708	32,172	26,453	15,654	13,478	6,944	4,198	4,889	2,877	-1,151	5,101		245,323	
Aspen	XXXXX	34,496	2,480	1,880	904	-34	-235	-22	46	25	--		39,540	
Cottonwood	XXXXX	1,546	319	234	107	50	117	5	33	23	21		2,455	
Other hardwoods	XXXXX	--	--	--	--	--	--	--	--	--	--		--	
Total hardwoods	XXXXX	36,042	2,799	2,114	1,011	16	-118	-17	79	48	21		41,995	
All species	134,708	68,214	29,252	17,768	14,489	6,960	4,080	4,872	2,956	-1,103	5,122		287,318	

Table 24.--Annual mortality of growing stock and sawtimber on commercial timberland by ownership class and softwoods and hardwoods, Utah, 1977

Species group and ownership class	Growing stock		Sawtimber
	- Thousand cubic feet -	- Thousand board feet - International 1/4-inch rule	
Softwoods:			
National Forest	20,410	83,410	
Other public Farmer and other private	2,221	7,458	
	3,459	12,142	
Total	26,090	103,010	
Hardwoods:			
National Forest	7,216	17,977	
Other public Farmer and other private	828	1,563	
	1,262	1,160	
Total	9,306	20,700	

Table 25.--Annual mortality of growing stock on commercial timberland by species and diameter class, Utah, 1977

Species	Diameter class (inches at breast height)													All classes
	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+	
Douglas-fir	111	305	495	328	485	520	416	538	289	220	330	621	276	4,934
Ponderosa pine	2	6	4	4	6	6	24	6	188	26	54	4	26	356
Lodgepole pine	550	765	1,129	759	534	514	218	262	87	46	55	--	--	4,919
Limber pine	6	8	30	40	31	25	29	12	18	111	19	9	15	353
Subalpine fir	1,009	1,555	2,065	1,343	1,021	1,015	671	602	435	134	89	10	22	9,971
White fir	111	334	273	317	206	234	162	178	142	55	40	34	57	2,143
Engelmann spruce	262	258	262	296	318	418	350	331	269	202	157	110	181	3,414
Total softwoods	2,051	3,231	4,258	3,087	2,601	2,752	1,870	1,929	1,428	794	744	788	577	26,090
Aspen	1,505	1,254	1,803	1,653	1,512	780	409	153	150	73	13	--	--	9,305
Cottonwood	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Total hardwoods	1,505	1,254	1,803	1,653	1,512	780	409	154	150	73	13	--	--	9,306
All species	3,556	4,485	6,061	4,740	4,113	3,512	2,279	2,083	1,578	867	757	788	577	35,396

Table 26.--Annual mortality of sawtimber on commercial timberland by species and diameter class, Utah, 1977

Species	Diameter class (inches at breast height)										All classes	
	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9		29.0+
----- Thousand board feet, International 1/4-inch rule -----												
Douglas-fir	1,967	1,576	2,352	2,734	2,096	2,782	1,710	1,287	1,963	3,866	1,462	23,795
Ponderosa pine	17	23	29	33	121	29	1,154	154	324	20	157	2,061
Lodgepole pine	4,133	3,493	2,547	2,506	1,080	1,327	440	239	278	--	--	16,043
Limber pine	150	221	168	138	159	65	98	653	105	52	86	1,895
Subalpine fir	9,268	6,542	5,250	5,002	3,433	3,001	2,296	732	486	55	121	36,186
White fir	1,055	1,532	1,038	1,158	840	899	686	304	221	185	312	8,230
Engelmann spruce	1,132	1,507	1,616	2,148	1,791	1,702	1,399	1,081	847	588	989	14,800
Total softwoods	17,722	14,894	13,000	13,719	9,520	9,805	7,783	4,450	4,224	4,766	3,127	103,010
Aspen	XXXXX	6,639	6,811	3,484	1,807	735	789	367	65	--	--	20,697
Cottonwood	XXXXX	--	--	--	--	3	--	--	--	--	--	3
Total hardwoods	XXXXX	6,639	6,811	3,484	1,807	738	789	367	65	--	--	20,700
All species	17,722	21,533	19,811	17,203	11,527	10,543	8,572	4,817	4,289	4,766	3,127	123,710

Table 27.--Annual mortality of growing stock and sawtimber on commercial timberland by cause of death and species, Utah, 1977

Ownership class	Species										Total hardwoods	
	Douglas-fir	Ponderosa pine	Lodgepole pine	Limber pine	Subalpine fir	White fir	Engelmann spruce	Total softwoods	Aspen	Cottonwood		
----- Growing Stock -----												
----- Thousand cubic feet -----												
Insects	1,340	96	377	56	2,690	759	--	5,318	159	--	159	5,477
Disease	675	--	--	--	597	--	299	1,571	3,108	--	3,108	4,679
Fire	875	179	3,605	280	--	--	--	4,939	--	--	--	4,939
Animal	--	--	136	--	147	--	--	283	625	--	--	908
Weather	169	--	282	--	1,863	260	1,227	3,801	582	--	--	4,383
Suppression	--	--	112	--	112	514	--	626	41	--	41	667
Unknown	1,742	81	519	17	4,562	610	1,888	9,419	4,790	1	4,791	14,210
Logging	133	--	--	--	--	--	--	133	--	--	--	133
Total	4,934	356	4,919	353	9,971	2,143	3,414	26,090	9,305	1	9,306	35,396
----- Sawtimber -----												
----- Thousand board feet, International 1/4-inch rule -----												
Insects	5,560	548	1,840	225	10,522	3,893	--	22,588	310	--	310	22,898
Disease	3,589	--	--	--	2,182	--	--	5,771	11,486	--	11,486	17,257
Fire	5,023	1,028	11,349	1,621	--	--	--	19,021	--	--	--	19,021
Animal	--	--	549	--	--	--	--	549	309	--	309	858
Weather	362	--	1,478	--	6,154	837	3,658	12,489	5,497	--	5,497	17,986
Suppression	--	--	--	--	--	805	--	805	--	--	--	805
Unknown	8,554	485	827	49	17,328	2,695	11,142	41,080	3,095	3	3,098	44,178
Logging	707	--	--	--	--	--	--	707	--	--	--	707
Total	23,795	2,061	16,043	1,895	36,186	8,230	14,800	103,010	20,697	3	20,700	123,710

Table 28.--Annual timber removals from growing stock on commercial timberland by item and softwoods and hardwoods, Utah, 1977

Item	All species	Softwoods	Hardwoods
<i>----- Thousand cubic feet -----</i>			
Roundwood products:			
Sawlogs	9,762	9,729	33
Veneer logs and bolts	--	--	--
Pulpwood	554	--	554
Other industrial	906	897	9
Fuelwood	343	331	12
All products	<u>11,565</u>	<u>10,957</u>	<u>608</u>
Logging residues	<u>1,188</u>	<u>1,159</u>	<u>29</u>
Other removals	<u>304</u>	<u>285</u>	<u>19</u>
Total removals	<u>13,057</u>	<u>12,401</u>	<u>656</u>

Table 29.--Annual timber removals from sawtimber on commercial timberland by item and softwoods and hardwoods, Utah, 1977

Item	All species	Softwoods	Hardwoods
<i>----- Thousand board feet, International 1/4-inch rule -----</i>			
Roundwood products:			
Sawlogs	62,572	62,360	212
Veneer logs and bolts	--	--	--
Pulpwood	1,514	--	1,514
Other industrial	3,877	3,832	45
Fuelwood	1,992	1,922	70
All products	<u>69,955</u>	<u>68,114</u>	<u>1,841</u>
Logging residues	<u>7,374</u>	<u>7,207</u>	<u>167</u>
Other removals	<u>1,883</u>	<u>1,771</u>	<u>112</u>
Total removals	<u>79,212</u>	<u>77,092</u>	<u>2,120</u>

Table 30.--Output of roundwood products by source, product, and softwoods and hardwoods, Utah, 1977

Products and additional removals	Species group	Standard units	Output of roundwood products					Output from sawtimber	
			All sources roundwood products		Growing stock trees	Rough and rotten trees	Salvable dead trees		Other sources
			Number of units	Thousand cubic feet	Thousand cubic feet	Thousand cubic feet	Thousand cubic feet		Thousand cubic feet
Saw logs	Softwoods	Thousand board feet	63,962	9,978	9,729	--	200	49	62,360
	Hardwoods		244	38	33	--	4	1	212
	Total		64,206	10,016	9,762	--	204	50	62,572
Veneer logs and bolts	Softwoods		--	--	--	--	--	--	--
	Hardwoods		--	--	--	--	--	--	--
	Total		--	--	--	--	--	--	--
Pulpwood	Softwoods	Standard cords	--	--	--	--	--	--	--
	Hardwoods		6,442	554	554	--	--	--	1,514
	Total		6,442	554	554	--	--	--	1,514
Miscellaneous industrial: Cooperage	Softwoods	Thousand board feet	--	--	--	--	--	--	--
	Hardwoods		--	--	--	--	--	--	--
	Total		--	--	--	--	--	--	--
Piling	Softwoods	Thousand linear feet	--	--	--	--	--	--	--
	Hardwoods		--	--	--	--	--	--	--
	Total		--	--	--	--	--	--	--
Poles	Softwoods	Thousand pieces	36	583	583	--	--	--	2,759
	Hardwoods		1	9	9	--	--	--	45
	Total		37	592	592	--	--	--	2,804
Mine timbers (round)	Softwoods	Thousand cubic feet	245	245	245	--	--	--	677
	Hardwoods		--	--	--	--	--	--	--
	Total		245	245	245	--	--	--	677
Posts (round and split)	Softwoods	Thousand pieces	93	91	12	79	--	--	67
	Hardwoods		--	--	--	--	--	--	--
	Total		93	91	12	79	--	--	67
Other	Softwoods	Thousand cubic feet	76	76	57	4	15	--	329
	Hardwoods		2	2	--	1	--	1	--
	Total		78	78	57	5	15	1	329
Summary, all miscellaneous	Softwoods		n.a.	995	897	83	15	--	3,832
	Hardwoods		n.a.	11	9	1	--	1	45
	Total		n.a.	1,006	906	84	15	1	3,877
Fuelwood	Softwoods	Standard cords	6,256	538	331	207	--	--	1,922
	Hardwoods		140	12	12	--	--	--	70
	Total		6,396	550	343	207	--	--	1,992
Total, all products	Softwoods		n.a.	11,511	10,957	290	215	49	68,114
	Hardwoods		n.a.	615	608	1	4	2	1,841
	Total		n.a.	12,126	11,565	291	219	51	69,955
Additional removals: Logging residues	Softwoods		n.a.	n.a.	1,159	n.a.	n.a.	n.a.	7,207
	Hardwoods		n.a.	n.a.	29	n.a.	n.a.	n.a.	167
	Total		n.a.	n.a.	1,188	n.a.	n.a.	n.a.	7,374
Other removals	Softwoods		n.a.	n.a.	285	n.a.	n.a.	n.a.	1,771
	Hardwoods		n.a.	n.a.	19	n.a.	n.a.	n.a.	112
	Total		n.a.	n.a.	304	n.a.	n.a.	n.a.	1,883
Total removals	Softwoods		n.a.	n.a.	12,401	n.a.	n.a.	n.a.	77,092
	Hardwoods		n.a.	n.a.	656	n.a.	n.a.	n.a.	2,120
	Total		n.a.	n.a.	13,057	n.a.	n.a.	n.a.	79,212

¹International 1/4-inch rule.

Table 31.--Annual removals of growing stock and sawtimber on commercial timberland by species, Utah, 1977

Species	Growing stock	Sawtimber
	<i>- Thousand cubic feet -</i>	<i>- Thousand board feet, - International 1/4-inch rule</i>
Douglas-fir	1,479	9,195
Ponderosa pine	2,897	18,012
Engelmann spruce	3,913	24,330
White fir	12	76
Subalpine fir	121	749
Lodgepole pine	3,978	24,727
Other softwoods	1	3
Total softwoods	12,401	77,092
Aspen	573	1,853
Other hardwoods	83	267
Total hardwoods	656	2,120
All species	13,057	79,212

Van Hooser, Dwane D.; Green, Alan W. Utah's forest resources, 1978. Resour Bull. INT-30. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1983. 58 p.

Reports findings of the comprehensive inventory of Utah's 16 million acres of forest land, which include 3.2 million acres of commercial timberland. Presents area, volume, growth, mortality, and timber use; also describes timber types, volumes per acre, stocking, ownership, and major nontimber uses of the forest land.

KEYWORDS: commercial timberland, forest inventory, timber volume, timber growth, timber mortality, timber removals

The Intermountain Station, headquartered in Ogden, Utah, is one of eight regional experiment stations charged with providing scientific knowledge to help resource managers meet human needs and protect forest and range ecosystems.

The Intermountain Station includes the States of Montana, Idaho, Utah, Nevada, and western Wyoming. About 231 million acres, or 85 percent, of the land area in the Station territory are classified as forest and rangeland. These lands include grasslands, deserts, shrublands, alpine areas, and well-stocked forests. They supply fiber for forest industries; minerals for energy and industrial development; and water for domestic and industrial consumption. They also provide recreation opportunities for millions of visitors each year.

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