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Forest Resources of the Uinta National Forest

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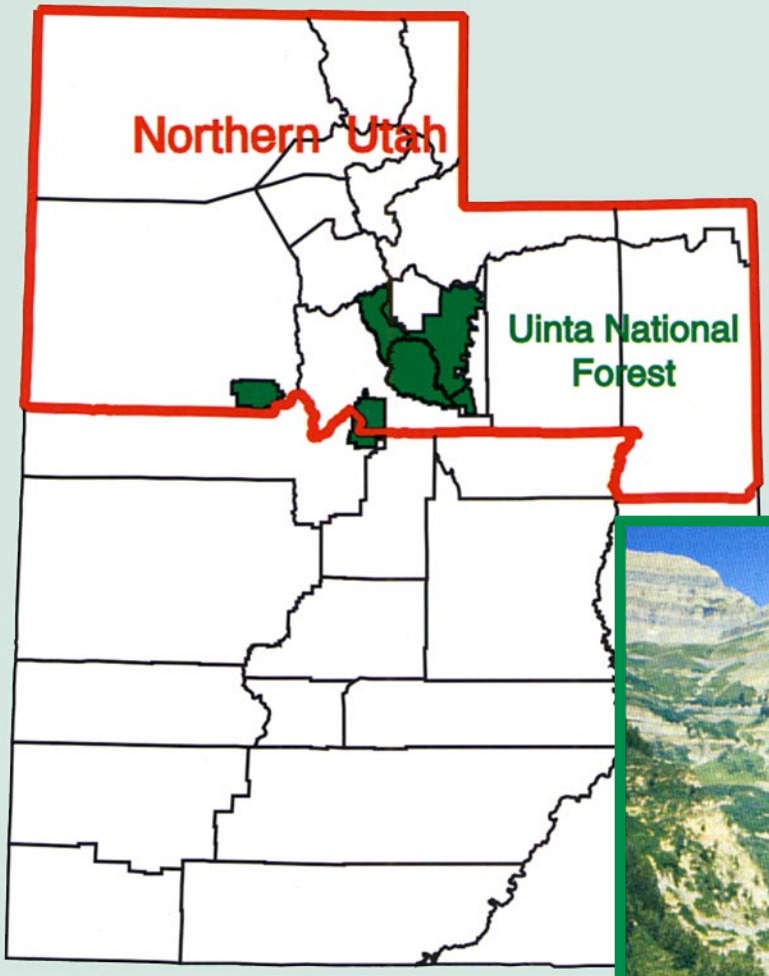

This summary of the forest resources of the Uinta National Forest is based on a comprehensive inventory of all forested lands in Utah. The inventory was conducted in 1995 by the Interior West Resource Inventory, Monitoring, and Evaluation (IWRIME) Program of the U.S. Forest Service, Intermountain Research Station, as part of its National Forest Inventory and Analysis (FIA) duties.

About the authors

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What forest resources are found on the Uinta National Forest?

The 883,225 acres in the Uinta National Forest encompass 552,021 acres of forest land, made up of 68 percent (377,651 acres) "timberland" and 32 percent (174,370 acres) "woodland." The other 331,204 acres of the Uinta are nonforest (fig. 1). This report discusses forest land only. In the Uinta, 7 percent of the total area and 4 percent of the forest land is in reserved status such as Wilderness or Research Natural Areas. Unless otherwise stated, lands of both reserved and nonreserved status are included in the following statistics. Field crews sampled 258 field plots on the Uinta.

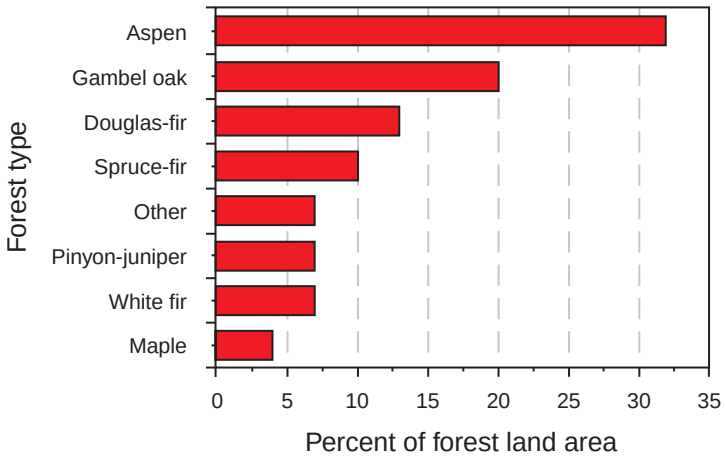


Figure 2—Percent of forest area by forest type, Uinta National Forest.

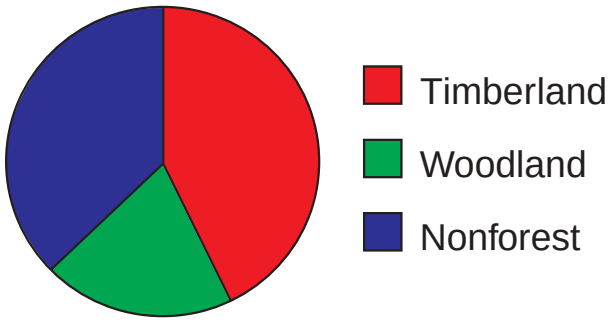


Figure 1—Area by land class, Uinta National Forest (see page 8 for definitions of timberland and woodland).

Forest diversity

Forest type—one indicator of forest diversity—refers to the predominant tree species in a stand, based on tree stocking. On the Uinta, the most common forest type in percentage of area is aspen with 32 percent, followed by Gambel oak 20 percent, Douglas-fir 13 percent, spruce-fir 10 percent, and white fir and pinyon-juniper 7 percent each (fig. 2). Other forest types that make up the remaining 11 percent are maple, limber pine, Engelmann spruce, cottonwood, and lodgepole pine.

The composition of the forest by individual tree species is another measure of forest diversity. Gambel oak makes up 42 percent of the total number of trees; aspen 27 percent, bigtooth maple 13 percent, subalpine fir 8 percent, and white fir and Douglar-fir, each 3 percent (fig. 3). Utah juniper, Rocky Mountain maple, Engelmann spruce, curlleaf mountain mahogany, blue spruce, Rocky Mountain juniper, lodgepole pine, cottonwood, common pinyon, and limber pine contribute a total of about 4 percent. Species that are scarce may not be encountered with the sampling intensity used for this inventory.

Size distribution of individual trees indicates structural diversity. Figure 4 displays the tree size distribution on the Uinta. Another stand structure variable, stand-size class, is based on the size of trees contributing to the majority of

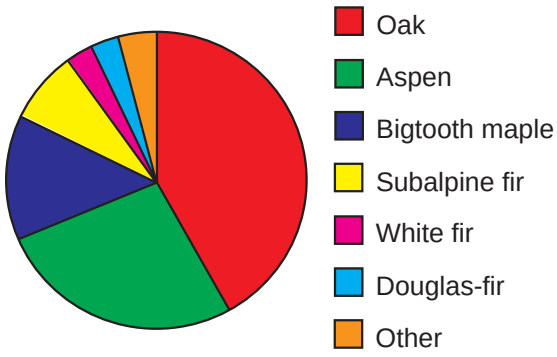


Figure 3—Percent of total number of trees by species, Uinta National Forest.

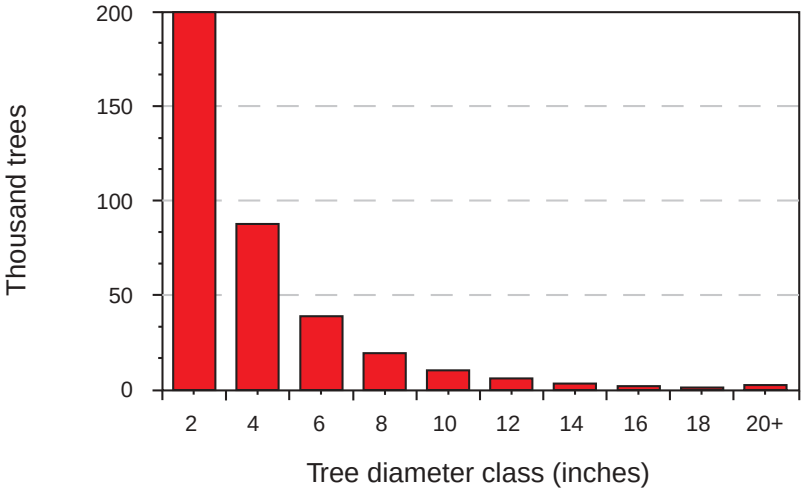


Figure 4—Number of live trees on forest land by diameter class, Uinta National Forest.

the stocking. Figure 5 gives a breakdown of forest land by stand-size classes. This figure shows that relatively few stands are composed mostly of small trees, such as stands that have been clear cut or burned.

Dead trees—an important component of forest ecosystems—contribute to diversity and serve a variety of functions including wildlife habitat and nutrient sinks. There are roughly 16.4 million standing dead trees (snags) on the Uinta National Forest. This number includes both hard and soft snags of all species and diameters. Many wildlife species are dependent upon these standing dead trees. The species, size, and density of snags required vary according to the species of wildlife. Large diameter snags are generally somewhat scarce, making them more valuable than smaller snags. Considering snags 11 inches in diameter or larger, an estimated 3.9 per acre occur on Uinta forest land. Of the large snags (19 inches in diameter or larger) only an average of one per every 2.6 acres occur on the Uinta. The most abundant species of snags in the 19 inch and larger category is subalpine fir, followed by limber pine.

Forest successional stage

Habitat types describe lands potentially capable of producing similar plant communities at successional climax. The climax plant community, which is the theoretical end result of plant succession, reflects the integration of environmental factors that affect vegetation such as soils, climate, and landform. Habitat type classifications are named for the predominant overstory and understory plant species at the time of successional climax. In Utah, habitat type classifications have been defined for most forest types traditionally considered to be "timberland" (Mauk and Henderson 1984). However, because well-defined successional states are not known for aspen, classification schemes for aspen are called community types instead of habitat types (Mueggler 1988). Most "woodland" types also remain unclassified in Utah.

The use of potential vegetation to classify forests does not imply an abundance of climax vegetation in the current Utah landscape. In fact, most forest landscapes reflect some form of disturbance and various stages of succession. Fire is a natural disturbance that affects the successional stage of forests. Forest management activities do so as well. For the Uinta National Forest, figure 6 compares existing forest types with habitat type series and gives a general indication of

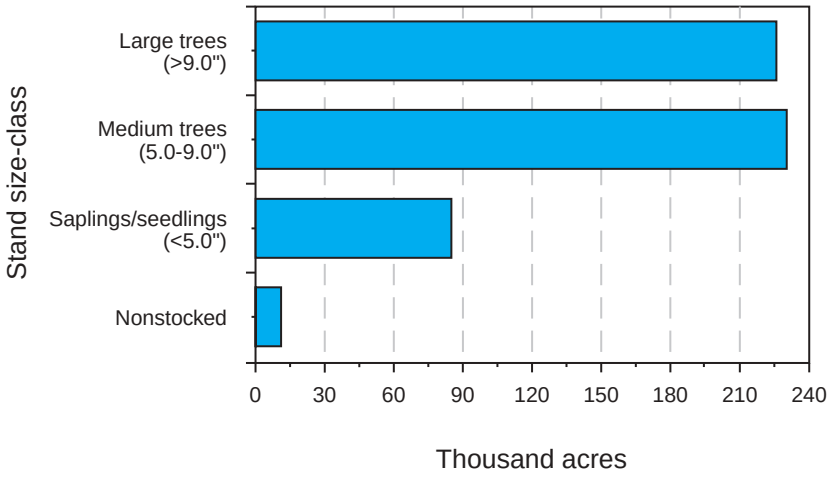
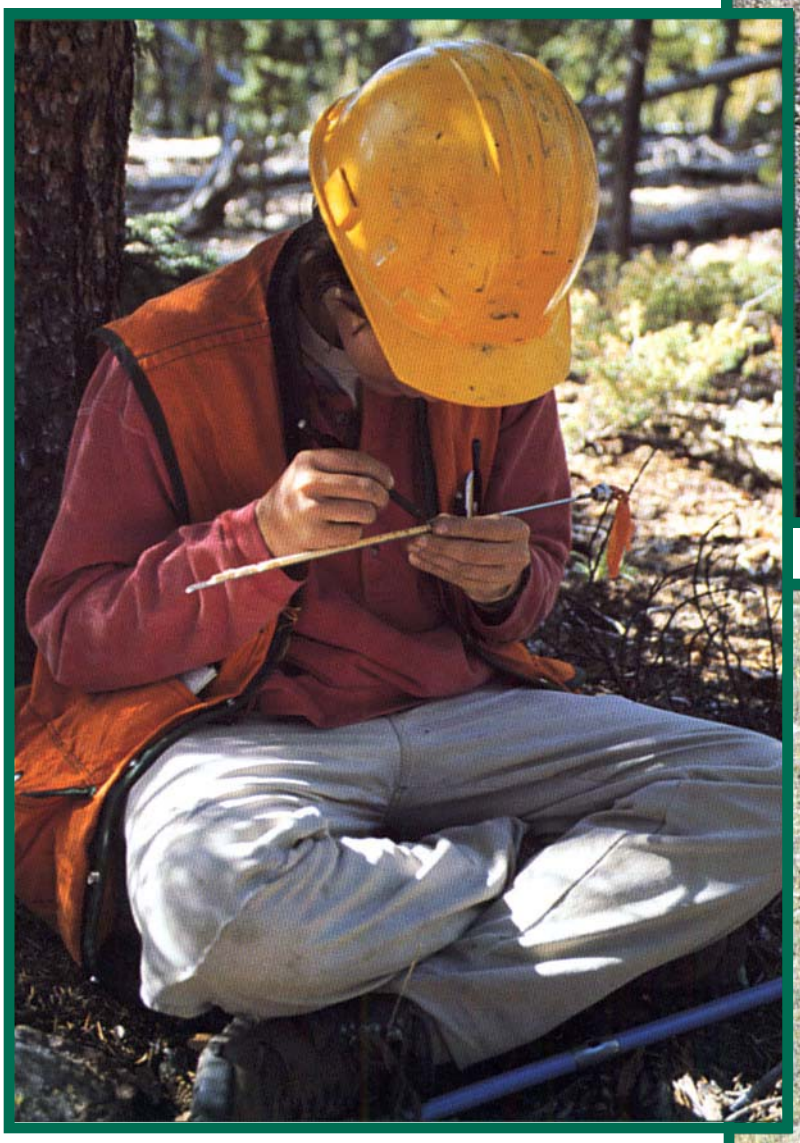


Figure 5—Forest land area by stand-size class, Uinta National Forest.



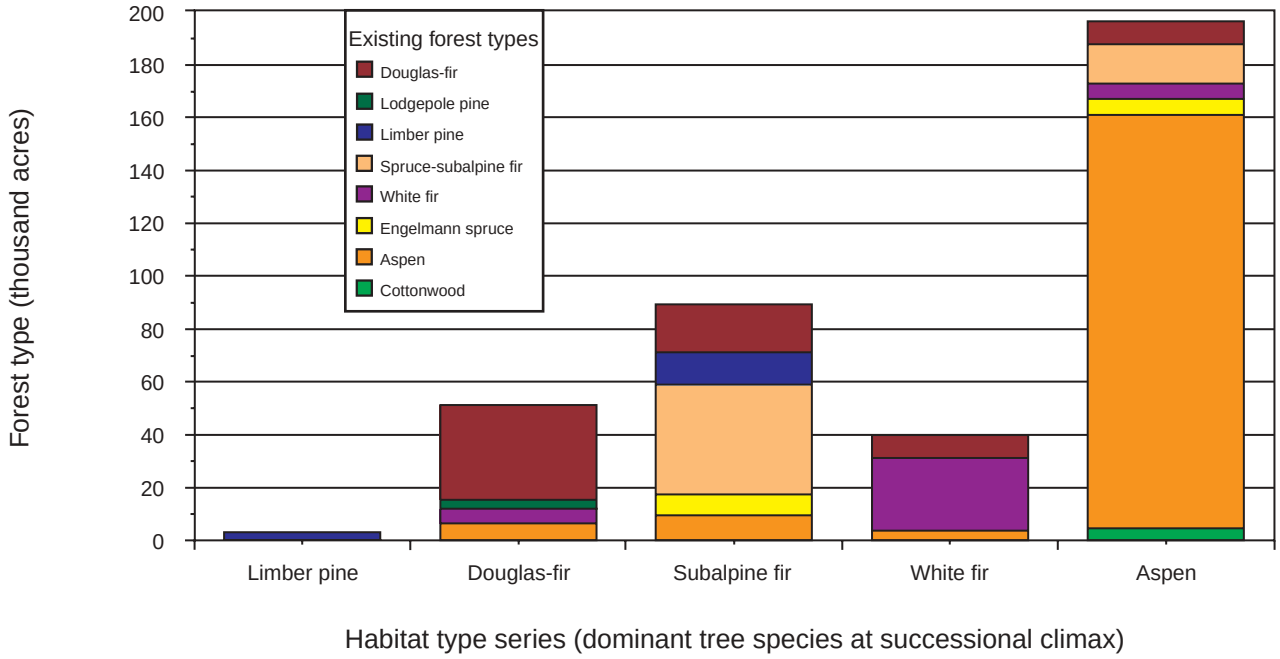


Figure 6—Area of forest type by habitat type series, Uinta National Forest.

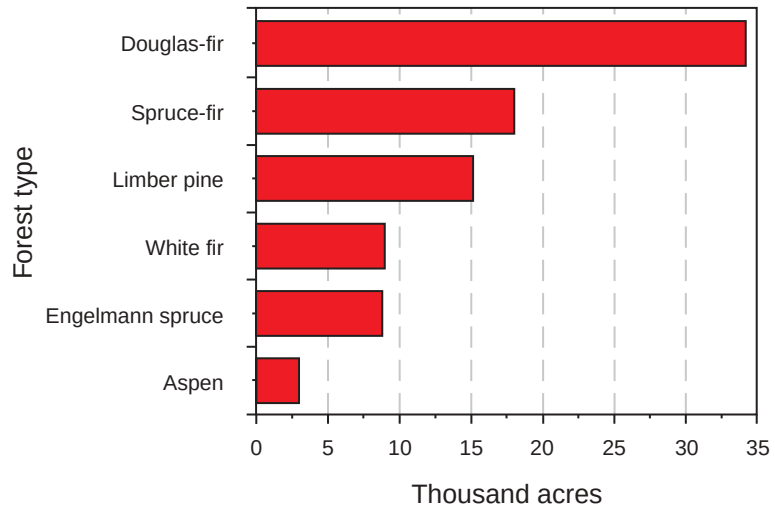


Figure 7—Area of mature stocking condition by forest type, Uinta National Forest.

forest successional status. The use of classifications based on climax vegetation does not suggest that climax conditions should be a management goal. By summarizing inventory data by habitat type, a picture can be drawn of Uinta forests that theoretically will not change with disturbance or advancing succession.

How we define and assess "old growth" forest is important for many reasons. To improve communication about old growth, the Forest Service produced a report on the characteristics of old growth forests in the Intermountain Region (USDA Forest Service 1993). The physical characteristics of old growth are fairly easy to quantify, inventory, and map, but determining functionality with any acceptable agreement or consistency is difficult. Consequently, we prefer to present inventory data using the term "mature" forest, defined as sites with stand age in excess of 100 years. For the Uinta, figure 7 shows an estimate of the area of mature forest by forest type, components of which may be candidates for the designation of old growth.

Tree biomass

Total biomass of wood in live trees on the Uinta National Forest is estimated at almost 17 million tons. Biomass estimates include boles (trunk and stem), bark, branches, and foliage of all live trees including saplings and seedlings. Here is a breakdown of tree biomass by species:

Species	Thousand tons
Aspen	4,057
Gambel oak	3,009
Douglas-fir	2,700
Subalpine fir	2,213
White fir	1,604
Engelmann spruce	1,043
Utah juniper	760
Bigtooth maple	676
Limber pine	249
Rocky Mountain maple	203
Blue spruce	92
Rocky Mountain juniper	88
Curlleaf mountain mahogany	59
Common Pinyon	31
Lodgepole pine	24
Other poplar	16
Total	16,824

Wood volume

Wood produced on the Uinta National Forest is valuable. The total volume of wood in live trees is estimated to be in excess of 736 million cubic feet. This includes trees 3.0 inches in diameter and larger for woodland species and 5.0 inches and larger for timber species. Here is a breakdown of cubic-foot volume by species:

Species	Thousand cubic feet
Aspen	207,989
Douglas-fir	132,719
Subalpine fir	125,603
White fir	79,167
Engelmann spruce	65,038
Utah juniper	38,960
Gambel oak	34,474
Bigtooth maple	16,109
Limber pine	13,286
Rocky Mountain maple	8,438
Blue Spruce	5,567
Rocky Mountain juniper	3,688
Common pinyon	1,857
Lodgepole pine	1,375
Curlleaf mountain mahogany	1,255
Other poplar	579
Total	736,104

Over 62 percent of this cubic foot volume is in trees 11 inches in diameter or greater. Approximately 88 percent of Douglas-fir, 83 percent of white fir, and 76 percent of subalpine fir volume are in trees larger than 11 inches in diameter. About 29 percent of aspen volume is in trees less than 11 inches in diameter.

The volume of sawtimber trees on timberland not reserved from timber harvest is estimated to be 1.7 billion board feet (Scribner rule). Douglas-fir and subalpine fir account for 51 percent of the total sawtimber volume. Figure 8 shows percent distribution of sawtimber on nonreserved timberland by species.

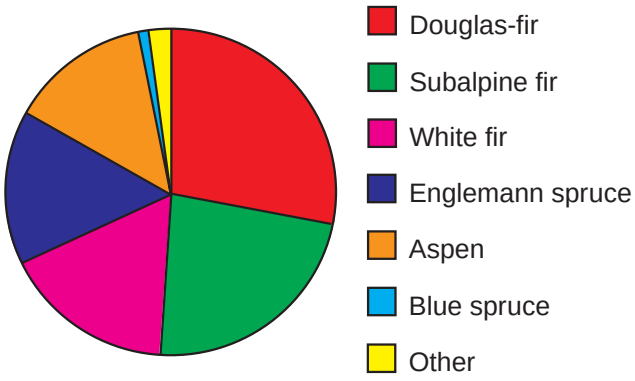


Figure 8—Percent of sawtimber volume on nonreserved timberland by species, Uinta National Forest.

How does the forest change?

Many factors influence the rate at which trees grow and thrive, or die. One of those factors is the stocking (relative density) of trees. Overstocking causes tree growth to slow, which makes trees more susceptible to insect attack. About 33,365 acres or 9 percent of all timberland on the Uinta is overstocked (fig. 9). This includes 18,548 acres of aspen forest type, which is about 11 percent of the aspen on the Forest. Fully stocked stands may also be susceptible to insects and disease because of decreasing tree vigor. Approximately 71,212 acres, or 19 percent of the timberland, is estimated to be fully stocked.

Another measure of forest vigor is net growth. Net growth is the difference between gross growth and losses due to mortality (fig. 10). Net annual growth on all forest land of the Uinta is estimated to be 4.8 million cubic feet. Figure 10 shows that the ratio of mortality to gross growth is greater in some species than others. For example, subalpine fir has a negative net growth. More than twice as much volume was lost to mortality as was gained from tree growth.

In 1992, trees containing an estimated 12.9 million cubic feet of wood died in this forest. Almost half of the mortality was estimated to be caused by disease. Weather was estimated to be the cause of another 21 percent, and insects 19 percent. About 62 percent of the mortality occurred in just one species, subalpine fir.

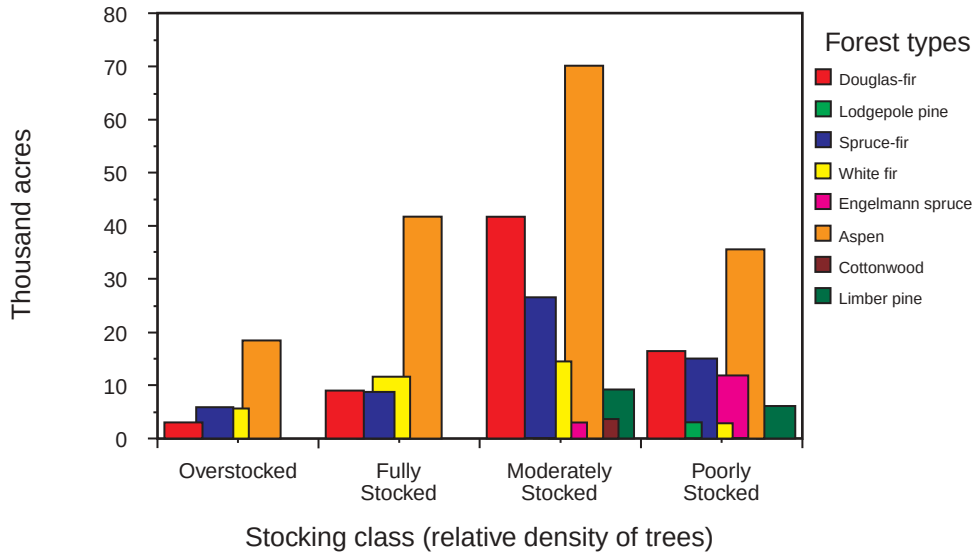


FIgure 9—Area of stocking class by predominant forest type, Uinta National Forest.

What about damage from insects?

Hazard ratings for risk of attack by four bark beetle species—Douglas-fir beetle, mountain pine beetle, western pine beetle, and spruce beetle—were adapted for use in Utah forests from Steele and others (1996) and applied to the inventory data. Plots in spruce, spruce-fir, lodgepole pine, Douglas-fir, and ponderosa pine forest types were assigned classes of hazard ratings, and estimates of the area at high, moderate, or low risk of attack by bark beetles were calculated for Utah forests. The area of each forest type in each insect attack risk category on the Uinta is presented in table 1. Stands in the spruce and spruce-fir forest types were evaluated for hazard of attack on spruce by bark beetle if there was at least one spruce tree 10 inches in diameter or larger present. Stands in the lodgepole type were evaluated if at least one lodgepole pine tree 5 inches in diameter or larger was present. Stands in the Douglas-fir type needed at least one Douglas-fir tree 9 inches diameter or larger. No ponderosa pine stands were sampled on the Uinta. The table also includes the acreage of each forest type where 80 percent of the trees are already dead (and consequently now at low risk of attack) and the area of each type that was not evaluated because the trees in the stands did not meet the minimum size criterion.

Of the spruce/spruce-fir complex, 38 percent is at moderate to high risk of attack by bark beetles. Also, 100 percent of the lodgepole and 87 percent of the Douglas-fir type are at moderate to high risk. Moderate to high risk conditions indicate the possibility of bark beetle population increases, which can in turn cause significant tree mortality and changes in stand structure over a short time. For forest managers, these changes could greatly affect objectives related to fire, recreation, wildlife habitat, threatened and endangered species, and water quality and quantity.

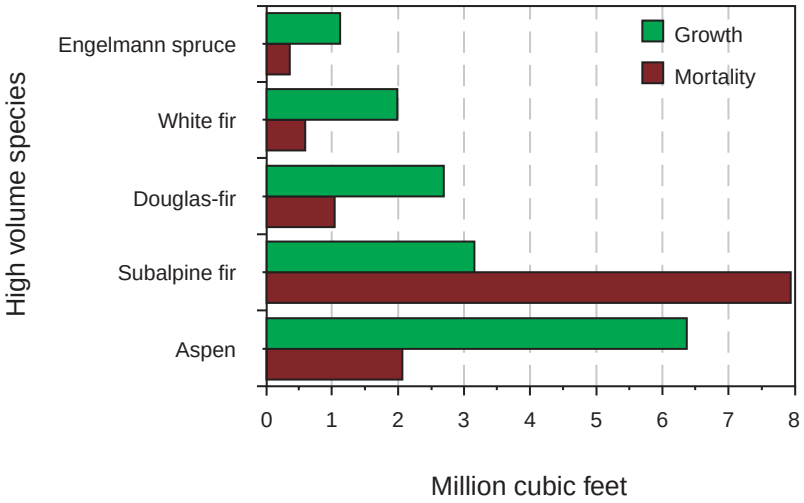


Figure 10—Gross annual growth compared to mortality, Uinta National Forest.

Table 1—Area at risk of attack by bark beetles by forest type and risk category, Uinta National Forest.

Forest type	Risk rating category					
	Low	Moderate	High	80 percent dead	Not evaluated	Total
	Acres					
Spruce and spruce-fir	14,827	23,790	3,006	3,006	26,511	71,140
Lodgepole	—	2,997	—	—	—	2,997
Douglas-fir	8,503	18,142	43,415	—	—	70,060

Are aspen forests declining?

Stands of aspen—an important forest type throughout much of the Western United States—provide critical habitat for many wildlife species, forage for livestock and wildlife, and protection and increased streamflow in critical watersheds. Aspen stands have great aesthetic value and enhance the diversity of the conifer-dominated forests of Utah. Information from various sources indicates that aspen is declining in much of its range (Bartos 1995; USDA Forest Service 1996).

Aspen forests are unique because they reproduce primarily by suckering from the parent root system. Often a disturbance or dieback is necessary to stimulate regeneration of the stands. Because these self-regenerating stands have existed for thousands of years, even minor amounts of aspen in stands probably indicate that a site was previously dominated by aspen. Based on this assumption, an estimated 285,351 acres on the Uinta National Forest were formerly aspen forest type. By comparison, only about 174,492 acres (61 percent) currently have the required aspen stocking to be considered aspen forest type. These acreage comparisons support the hypothesis that aspen dominance in Utah forests is decreasing.

How does the Uinta compare with the rest of Utah's forests?

Reports summarizing the inventory data for northern Utah have been prepared by O'Brien (1996) and Brown (in press). A Utah State report is also currently being prepared (O'Brien, in preparation). These researchers found that an estimated 29 percent of all Utah, and 25 percent of northern Utah, is forest land. The most common forest type in northern Utah (fig. 11) and the entire state (fig. 12) is pinyon-juniper, followed by aspen.

Comparing figures 11 and 12 to figure 2, the reader will see how the overall breakdown of the Uinta in terms of forest type differs from northern Utah and the rest of the State. For example, aspen is the most common forest type on the Uinta, and the Gambel oak forest type is second.

Another report on the condition of Utah forests is being prepared by the Intermountain Station's Interior West Resource Inventory, Monitoring, and Evaluation Program, in conjunction with the Intermountain Region's Forest Health Protection staff (LaMadeleine and O'Brien, in preparation). That report for the entire State will include estimates of area and volume that are impacted by mistletoe and root disease, and the number of acres at risk of attack by bark beetles.

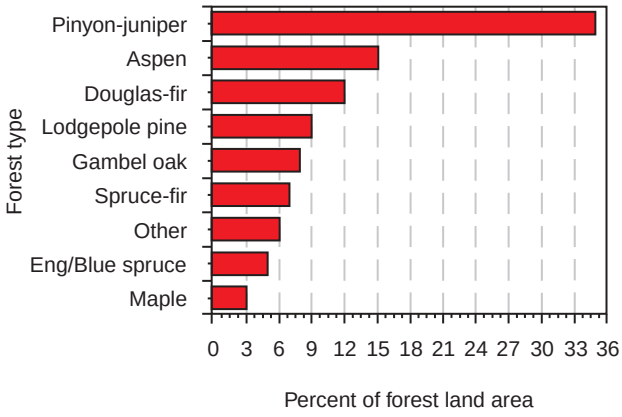


Figure 11—Percent of forest land area by forest type, northern Utah.

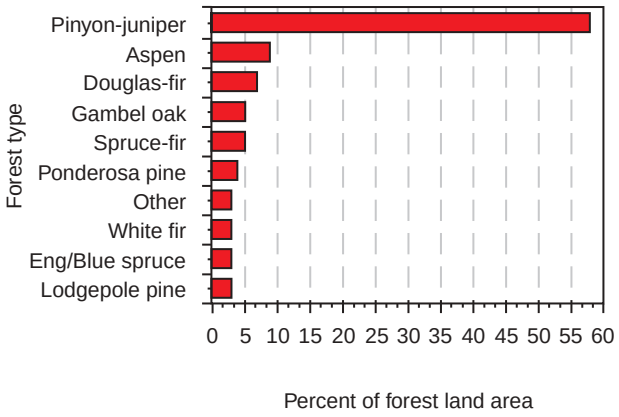
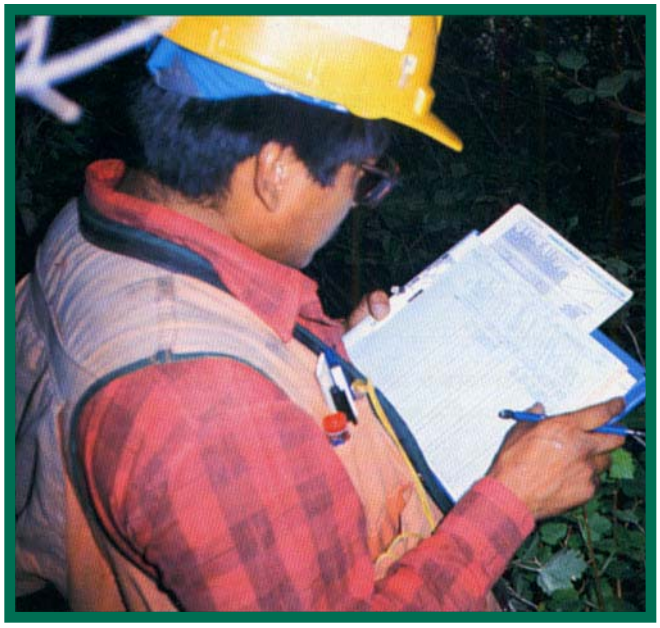


Figure 12—Percent of forest land by forest type, entire Utah State total.



How was the inventory conducted?

In 1995, the Interior West Resource Inventory, Monitoring, and Evaluation Program of the U.S. Forest Service, Intermountain Research Station, as part of its national Forest Inventory and Analysis duties, completed a comprehensive forest resource inventory of all forested lands in Utah. Our inventories provide a statistical-based sample of forest resources across all ownerships that can be used for planning and analyses at local, State, regional, and national levels. We have not traditionally conducted inventories on National Forest lands in the West, but in Utah, a cooperative agreement and funding from the Forest Service Intermountain Region made possible an expanded inventory that included National Forest System lands.

In the past, we collected inventory data only for tree species normally favored for commercial timber harvest—"timber species" such as ponderosa pine, lodgepole pine, and Douglas-fir. Since the early 1980's, we have expanded our inventory to include other tree species such as pinyon, juniper, and oak, collectively known as "woodland species." In Utah, a location was classified as timberland if there existed a minimum of 5 percent crown cover of timber species. For current and future reporting, the more ecological and all-encompassing term "forest land" is preferred instead of timberland and woodland. However, some mensuration and silvicultural definitions and techniques that were developed for timberland species are not yet available for woodland species. Therefore, the separate terms are used occasionally in this report.

We use a two-phase sampling procedure for State inventories. The first, or photo interpretive, phase is based on a grid of sample points systematically located every 1,000 meters across all lands in the State. Forestry technicians used maps and aerial photos to obtain ownership and stratification for field sampling. Field crews, made up of forestry technicians, biologists, botanists, and some college students, conducted the second, or field, phase of the inventory on a subsample of the phase one points that occurred on forest land. For this inventory, we defined forest land as land with at least 10 percent stocking (or 5 percent cover) of trees; or lands currently nonstocked but formerly having such stocking, where human activity does not preclude natural succession to forest. All conifers of any size except pinyon, juniper, and yew automatically qualify as trees, as do aspen, cottonwood, and paper birch. Other species such as pinyon, juniper, maple, mountain mahogany, and oak were classified as either trees or shrubs, depending on whether they have the capacity to produce at least one stem 3 inches or larger in diameter at root collar, and 8 feet or more in length to a minimum branch diameter of 1.5 inches. The sampling intensity on lands outside the National Forest was one field plot every 5,000 meters, or about every 3 miles. The sampling intensity on National Forest System lands was double that of outside lands.

Our sample was designed to meet national standards for precision in State and regional estimates of forest attributes. Standard errors, which denote the precision of an estimate, are usually higher for smaller subsets of the data, such as National Forest summaries. Standard errors were computed for each National Forest and are available upon request (see the "For further information" section on the following page).

Scientific documentation

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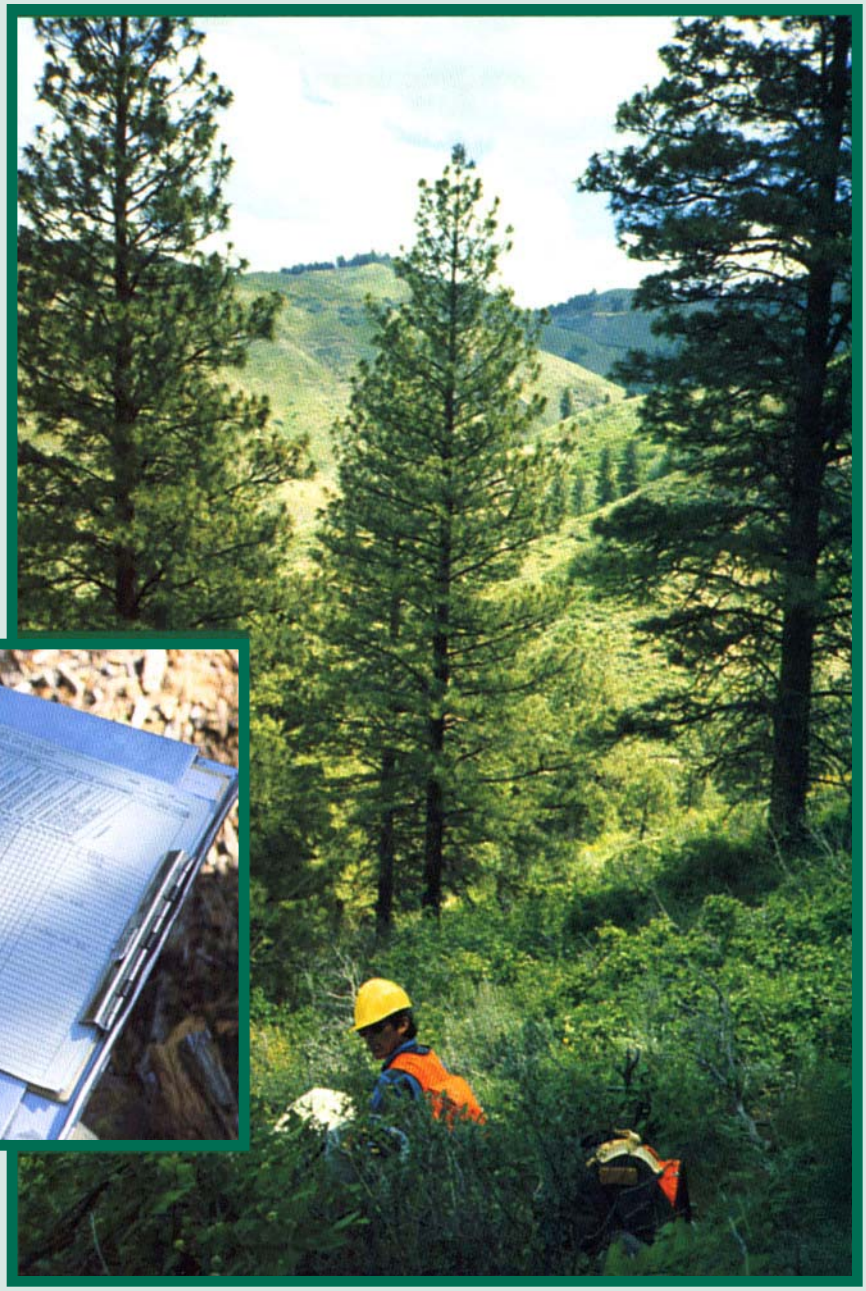
The information presented here is just a small part of a national data base that houses information for much of the forest land in the United States. This data base can be accessed on the Internet at the following web site:

http://www.srsfia.usfs.mmstate.edu/scripts/ew.htm



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