USDA United States Department of Agriculture

Forest Service

Rocky Mountain Research Station

December 2003

Forest Resources of the Kaibab National Forest

Tracey S. Frescino

About the author

Tracey S. Frescino is a Forester with the Interior West Forest Inventory and Analysis Program, Rocky Mountain Research Station in Ogden, Utah.

Contents

Page

Description of the Forest 1
Total forest land: highlights of our inventory 2
Nonreserved timberland: highlights of our inventory 9
The inventory methods 11
Documentation 13
For further information 13

Rocky Mountain Research Station
324 25th Street
Ogden, UT 84401

Forest Resources of the Kaibab National Forest

Tracey S. Frescino

The Interior West Forest Inventory, and Analysis (IWFIA) Program of the USDA Forest Service, Rocky Mountain Research Station, as part of its national Forest Inventory and Analysis (FIA) duties, conducted forest resource inventories of the Southwestern Region (Region 3) National Forests. This report presents highlights of the Kaibab National Forest 1995 inventory including population estimates and summaries of commonly requested variables. Any trends or disturbances (such as, fire) that have occurred after 1995 will be discussed in future reports of the Kaibab National Forest.

The information presented in this report is based solely on the IWFIA inventory sample (USDA 1995). The data could be summarized in other ways for different purposes (see "For further information" on the inside back cover for the national FIA database and related contacts). Supplementary documentation and inventory terminology can be found in USDA (2002a), O'Brien (2002), or on the World Wide Web at http://www.fs.fed.us/rm/ogden. Changes in terminology or procedures may limit comparisons with previous estimates and summaries for this area. Additional data collected on the Kaibab National Forest, used separately or in combination with IWFIA data, may produce varying results.

Description of the Forest

The Kaibab National Forest administers 1,558,290 acres (USDA 1996) of which 85 percent is classified as forest land and 15 percent nonforest or water. This report describes the characteristics of the forest land sampled on the Kaibab National Forest. Forest land is land that is at least 10 percent stocked (or formerly stocked) with live tally tree species and is greater than 1 acre in size and 120 feet wide. Based on the tree species present, forest land can be further subdivided into two land categories: timberland and woodland (fig. 1). Timberland is forest land with mostly timber species traditionally used in the forest products industry, such as ponderosa pine and Douglas-fir. Woodland is forest land with mostly woodland species that often have a multistem growth form and are not typically used for industrial wood products, such as pinyon pine, juniper, and some oaks. On the Kaibab, 40 percent of the total forest land is timberland while 60 percent is woodland.

Three percent of the total forest land area administered by the Kaibab National Forest is reserved land. Reserved land is land that has been withdrawn from management for production of wood products, such as wilderness areas. The first section of this report presents summaries of timber and woodland species for all forest land, including reserved designations. The subsequent section addresses nonreserved lands only and includes estimates for timber species sampled on the Kaibab.

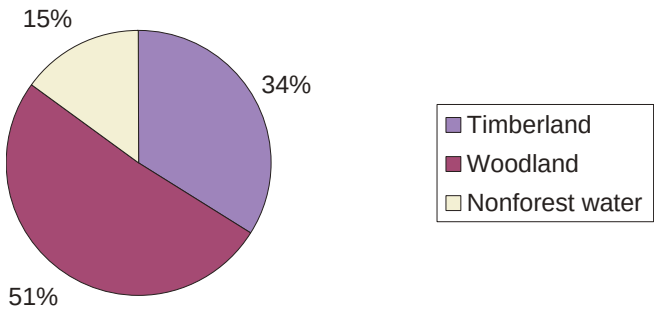

Figure 1—Percent of total area by land category, Kaibab National Forest.

Total forest land: highlights of our inventory

Forest type—Forest resources are often described using a forest type classification. Forest type refers to the predominant tree species in a stand, based on plurality of tree stocking. Stocking is an expression of the extent to which growing space is effectively utilized by live trees.

Figure 2 presents the distribution of forest land area on the Kaibab National Forest by forest type. The pinyon-juniper woodland forest type is the most common forest type, comprising over 50 percent of the total forest land area. Ponderosa pine follows in abundance making up 34 percent of the total forest land area. Other common forest types include juniper and deciduous woodland oak making up a total of 10 percent of Kaibab's forested lands. The remaining 5 percent of forest land includes Engelmann spruce, white fir, aspen, and miscellaneous western hardwood, with a trace of Douglas-fir (fig. 2). For the Kaibab, the miscellaneous western hardwood forest type refers to one sample location having New Mexico locust as the predominant tree species.

A field plot may sample more than one condition (stand). A forest condition is generally defined as an area of relatively homogeneous vegetative cover that meets the criteria for forest land. Forest type is one of several attributes that define and separate conditions identified on the plot. Table 1 presents the number of conditions and the condition proportions sampled on the Kaibab National Forest by forest type and land category for 210 plots that contained at least one forest condition.

Number of live trees—Forest land can also be examined by looking at the composition of tree species. Figure 3 shows total number of live trees for all sampled tree species on the Kaibab for three diameter classes. Sixty-one percent of all live trees on the Kaibab National Forest are from 1.0 to 4.9 inches diameter, 28 percent are from 5 to 10.9 inches diameter, and 11 percent are 11 inches diameter and greater. Over eighty percent of New Mexico locust, gambel oak, and aspen are in the 1 to 4.9-inch class. Twoneedle pinyon and gambel oak combined comprise over 50 percent of the total number of live trees estimated on the Kaibab, with 66 percent of these trees less than 5 inches diameter. Ponderosa pine makes up 14 percent of the total number of live trees; Utah juniper, 10 percent; aspen, 8 percent; oneseed juniper, 4 percent; New Mexico locust and white fir, 3 percent each; and Engelmann spruce, alligator juniper, and Douglas-fir, 2 percent each. Rocky Mountain juniper and Arizona white oak/gray oak combined contribute less than 1 percent and are presented together as other woodland species while subalpine fir and southwestern white pine combined contribute less than 1 percent and are presented together as other timber species. Species that are scarce may not be encountered with the extensive sampling strategy used for this inventory.

Number and weight of dead trees—Standing and down dead trees are important components of forest ecosystems. They provide habitat for many species of wildlife,

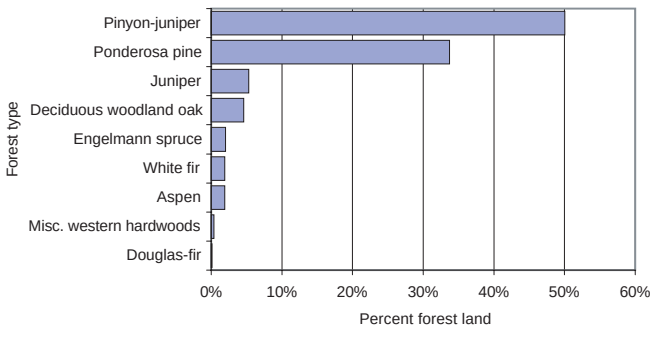

Figure 2—Percent of total forest land area by forest type, Kaibab National Forest.

Table 1—Number of conditions and condition proportions on forest land by forest type and land category, Kaibab National Forest, 1995.

Forest type	Number of conditions[a]	Condition proportions[b]
Timberland		
Ponderosa pine	81	72.7
Engelmann spruce	5	4.2
White fir	5	4.1
Aspen	5	4.0
Douglas-fir	1	0.3
Total Timberland	**97**	**85.3**
Woodland		
Pinyon-juniper	110	100.3
Juniper woodland	14	11.4
Deciduous woodland oak	11	10.3
Misc. western hardwoods	1	0.8
Total Woodland	**136**	**122 .8**
Grand Total	**233**	**208.1**

[a]Number of conditions by forest type that were sampled. The sum of these numbers is often greater than the total number of plots because a plot may sample more than one forest condition.

[b]Sum of the condition proportions of plots by forest type that were sampled. The sum of these numbers is often less than the total number of plots because of nonforest condition proportions (from plots containing both forest and nonforest conditions) that are not included here.

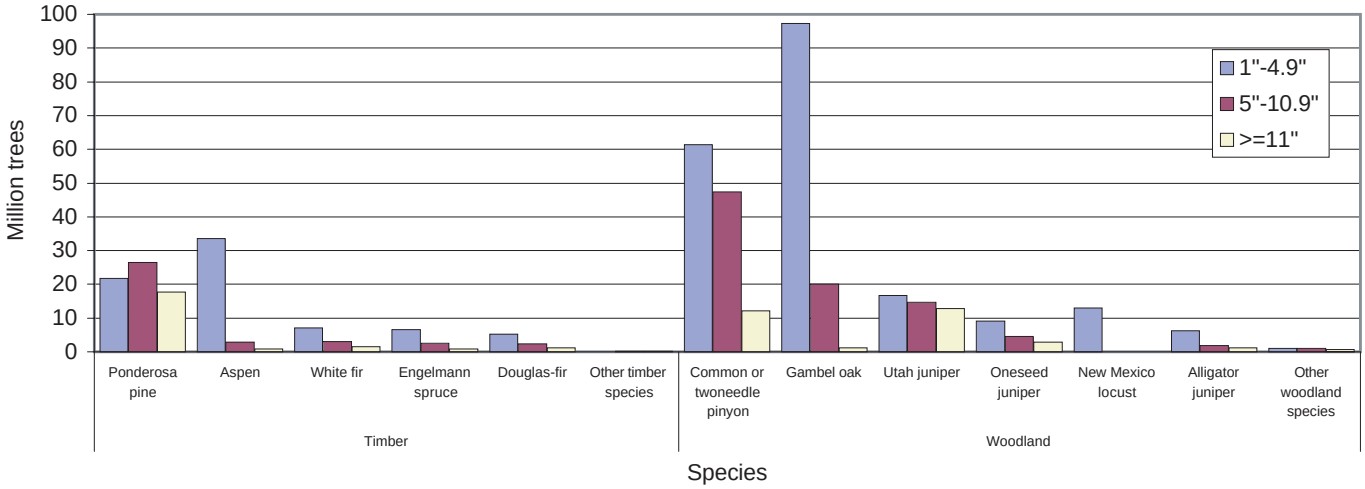

Figure 3—Number of live trees 1 inch diameter and greater on forest land by species and diameter class, Kaibab National Forest.

function as nutrient sinks, and protect the soil from erosion. There are over 51 million standing dead trees (snags) 1 inch diameter and greater on Kaibab forest land with approximately 39 snags per acre. Different size snags provide habitat components for many wildlife species. Figure 4 shows the number of snags by forest type for three diameter classes. Seventy-three percent of the total number of snags are between 1 and 4.9 inches diameter, with more than half of these within the ponderosa pine forest type. Considering snags 11 inches diameter or larger, there are an estimated 3.8 million on Kaibab forest land with an average of 2.9 per acre. The most abundant species of snags with diameter greater than or equal to 11 inches are Utah juniper and twoneedle pinyon. No snags were sampled in the Douglas-fir, juniper, or miscellaneous western hardwood forest types.

The amount of down dead material can contribute significantly to forest fuel loads. There are more than 1.4 million tons of down dead trees on Kaibab National Forest forest land, averaging to just over 1 ton per acre of forest land. This estimate includes the merchantable bole and bark of trees 5 inches diameter and greater. More than half of this estimate is from ponderosa pine and twoneedle pinyon species.

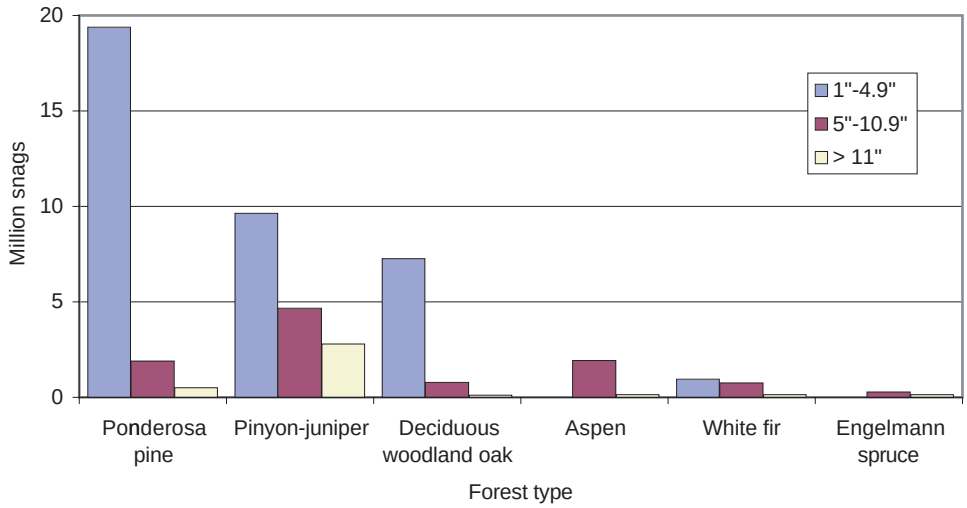

Figure 4—Number of standing dead trees 1 inch diameter and greater on forest land by forest type and diameter-size class, Kaibab National Forest.

Tree and stand size—The size distribution of trees is an indicator of structural diversity. Figure 5 displays the number of live trees by 2-inch diameter class on the Kaibab National Forest, combining trees from all stands. Forty-five percent of the total live trees are between 1 and 2.9 inches diameter.

Stand-size class is a categorization of forest land based on the predominant diameter-size of live trees that contribute to the stocking of a stand. Stocking values for each stand are generally summed by the following diameter classes. The large diameter class includes softwoods 9 inches diameter and greater, and hardwoods 11 inches diameter and greater; the medium diameter class includes softwoods 5 to 8.9 inches diameter, and hardwoods 5 to 10.9 inches diameter; and the saplings/seedlings class includes all trees under 5 inches diameter. Then each stand (condition) is assigned a class according to stocking predominance. In terms of stocking, fewer large-diameter trees compared to small-diameter trees are required to fully utilize a site; therefore, large diameter trees have a greater impact on determining stand-size class. Figure 6 displays forest land area on the Kaibab by stand-size class. About 83 percent of the stands have a plurality of stocking from large trees and about 3 percent are nonstocked, such as stands that have been recently harvested or burned.

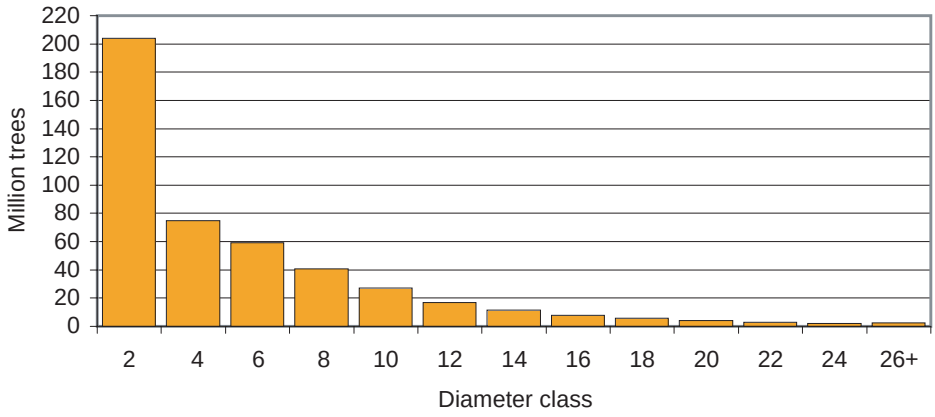

Figure 5—Number of live trees on forest land by 2-inch diameter class, Kaibab National Forest.

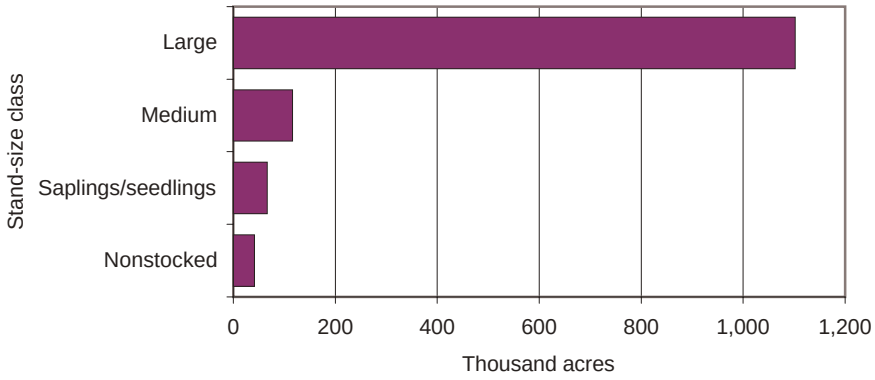

Figure 6—Forest land area by stand-size class, Kaibab National Forest. Large trees include softwoods 9 inches and greater and hardwoods 11 inches and greater; medium trees include softwoods 5 to 8.9" and hardwoods 5 to 10.9"; saplings/seedlings include trees less than 5".

Wood volume, biomass, and basal area of live trees—In general, estimates of volume, basal area, and biomass describe the amount of wood fiber in the forest. Each estimate summarizes different portions of a tree and can therefore be used for various forest resource applications. For example, volume relates closely to wood as a product, basal area to forest or tree size and density, and biomass to forest or tree productivity. Table 2 shows a breakdown by species of net volume, biomass, and basal area for live trees 5 inches diameter and larger on the Kaibab National Forest. Here, volume represents the amount of wood fiber in the merchantable bole of a tree, while biomass represents the amount of wood fiber in terms of oven-dry weight including the bole, bark, and branches of the tree. Basal area estimates include the cross-sectional area of a tree stem/bole at the point where diameter is measured. Ponderosa pine makes up over 46 percent of the volume, over 53 percent of the biomass and 32 percent of the basal area while twoneedle pinyon and Utah juniper combined represent 32 percent of the volume, 23 percent of the biomass, and over 46 percent of the basal area.

Figure 7 shows the distribution of net volume of wood by 2-inch diameter class for Kaibab forest land. While the

Table 2—Net volume, biomass, and basal area on forest land by species, Kaibab National Forest, 1995.

Species	Volume (Million cubic ft.)	Biomass (million tons)	Basal area (million square feet)
Ponderosa pine	803.8	15.8	37.7
Twoneedle pinyon	337.9	4.1	29.2
Utah juniper	217.5	2.7	25.7
Gambel oak	70.9	2.1	6.5
White fir	58.7	1.1	3.2
Douglas-fir	56.9	1.1	2.7
Engelmann spruce	47.9	0.7	2.0
Oneseed juniper	42.1	0.5	6.1
Aspen	37.1	0.7	1.8
Alligator juniper	31.7	0.4	2.9
Rocky Mountain juniper	13.2	0.2	1.1
Subalpine fir	1.4	†	‡
Southwestern white pine	1.2	†	‡
Arizona white oak/gray oak	0.3	†	‡
New Mexico locust	0.0	†	‡
Total (all tree species)**	**1,720.5**	**29.4**	**119.3**

† Less than 100,000 tons
‡ Less than 100,000 square feet
** Numbers do not add to total due to rounding

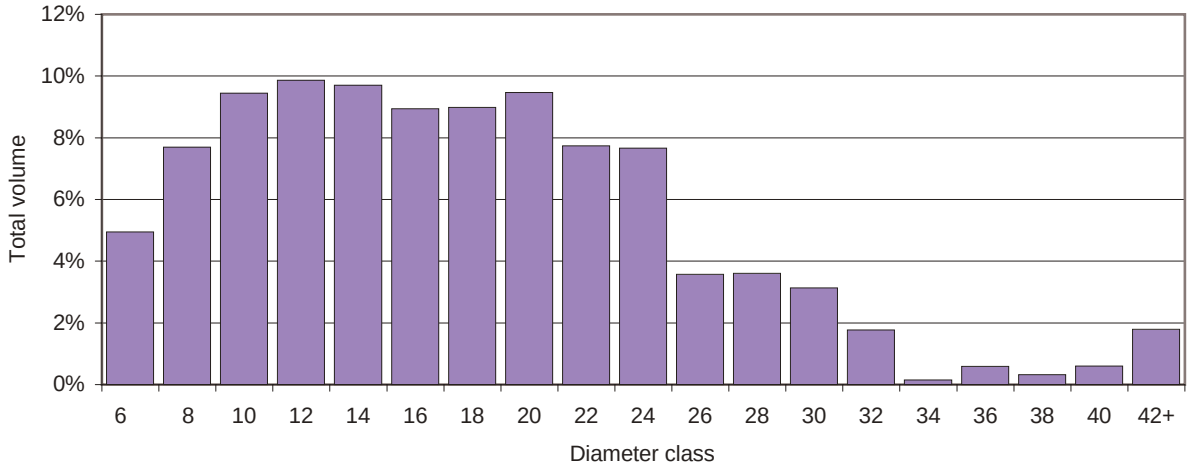

Figure 7—Percent of total net cubic-foot volume of live trees by 2-inch diameter class, Kaibab National Forest.

number of trees declines with larger diameter classes (see fig. 5), the volume increases significantly from diameter class 6 to 10 and stabilizes between diameter classes 10 and 24.

To get an idea of the relative amount of wood fiber supported by different forest types, estimates can be computed per acre of forest land. Table 3 displays per-acre estimates of net volume, basal area, and biomass for live trees 5 inches diameter and greater by forest type on the Kaibab National Forest. These numbers include the many different species that can occur together within each forest type. The highest volume per acre on the Kaibab is in the white fir forest type, followed closely by Engelmann spruce and ponderosa pine forest types. The highest basal area per acre is in the white fir forest type, followed by the deciduous woodland oak forest type. The high basal area per acre in the deciduous oak forest type is influenced by contributions from ponderosa pine species. Biomass estimates are also greatest for white fir, followed by ponderosa pine and Engelmann spruce forest types. Per-acre estimates of Douglas-fir and misc. western hardwoods forest types may not be representative due to small sample sizes (Table 1).

Stand density index—Many factors influence the rate at which trees grow and thrive, or die. As tree size and density increase, competition for available resources increases. Stand density index (SDI), as developed by Reineke (1933) is a relative measure quantifying the relationship between trees per acre, stand basal area, average stand diameter, and stocking of a forested stand. The concept was developed for even-aged stands, but can also be applied to uneven-aged stands (Long and Daniel 1990; see next paragraph for an explanation of even-aged and uneven-aged stands). SDI is usually presented as a percentage of the maximum SDI for each forest type (USDA 1991). SDI was computed for each location using those maximums, and the results were grouped into six classes (fig. 8). A site is considered to be fully occupied at 35 percent of SDI maximum, which marks the onset of competition-related stresses and slowed growth rates (USDA 1991). Based on FIA sample data, 50 percent of all forest stands in the Kaibab National Forest are considered to be fully occupied.

Southwest stand structure—Stands may be categorized on the basis of tree size, often in terms of their predominant diameter or height class. This works well for stands where just one or two size classes dominate. Such stands

Table 3—Net volume, biomass, and basal area per acre on forest land by forest type, Kaibab National Forest, 1995.

Forest type	Volume (cubic feet per acre)	Biomass (tons per acre)	Basal area (square feet per acre)
White fir	2,717.2	49.4	127.5
Engelmann spruce	2,006.7	35.0	97.1
Ponderosa pine	1,914.0	37.0	93.6
Deciduous woodland oak	1,336.7	34.5	105.6
Aspen	1,028.9	19.4	50.6
Douglas-fir	906.0	17.5	60.5
Pinyon-juniper	902.8	11.5	89.5
Juniper	474.8	6.1	61.8
Misc. western hardwoods	104.4	3.1	11.1
Total (all types)	**1,297.5**	**22.2**	**90.0**

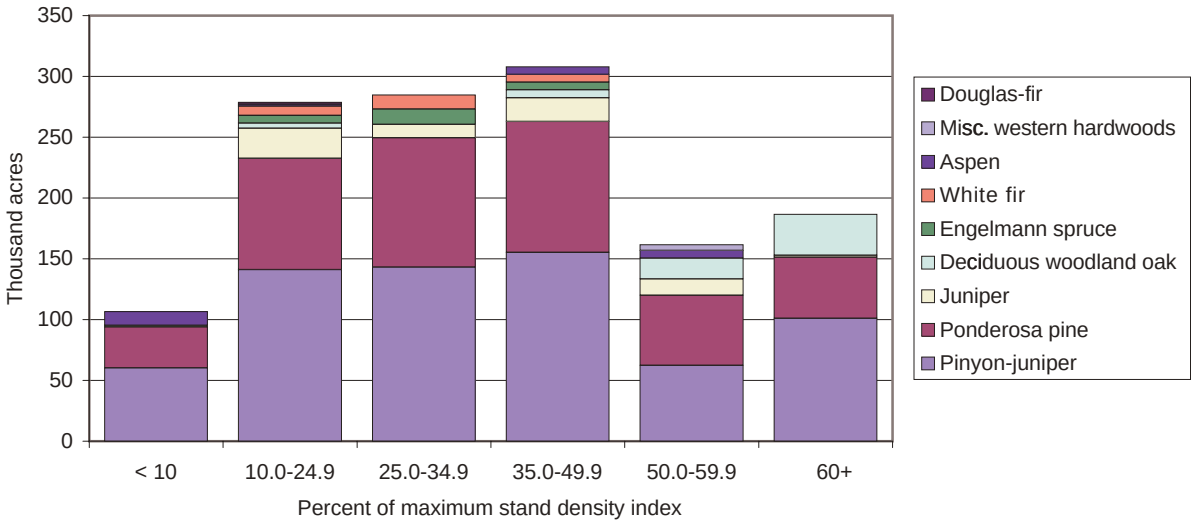

Figure 8—Area of forest land by forest type and percent stand density index, Kaibab National Forest.

are called single-storied, or even-aged, because they have a structure characterized by a single canopy layer or two closely related layers. Stands having a structure composed of three or more size classes are called multistoried or uneven-aged stands. Both types of structure are important in forest diversity. Differences between single-storied stands provide structural diversity across a landscape. Differences between many layers within a multi-storied stand provide vertical diversity.

Figure 9 shows area of forest land by stand structure class and diameter class for three timber softwood forest type groups including pine, mixed conifer, and "other" timber softwood types. On the Kaibab National Forest, the pine category is made up of ponderosa pine, the mixed conifer category includes Douglas-fir and white fir, and the "other" category contains Engelmann spruce. The values shown are based on analysis of SDI and tree diameter classes, a method developed by the Southwest Region (USDA 2002b). In general, the Kaibab is well represented by both single-storied and multistoried stands, but the distribution within single-storied stands occurs mainly in the 5-11.9 inch diameter class.

Growth and mortality—Forest vigor can be analyzed by measures of net annual growth and mortality. Net annual growth is the difference between gross annual growth and losses due to mortality. Gross annual growth is the average

Figure 9—Area of forest land by stand structure class, diameter class, and timber softwood forest type groups, Kaibab National Forest.

annual increase in the volume of live trees while mortality is the net volume of trees that have died over a 1-year time period based on a 5-year average. Gross annual growth of all live trees 5 inches diameter and greater on all forest land on the Kaibab is estimated to be 26 million cubic feet. Subtracting mortality from gross annual growth results in an estimated net annual growth of 20 million cubic feet.

Mortality calculations estimate approximately 6 million cubic feet of wood 5 inches diameter and greater died on the Kaibab from the past year. White fir makes up most of the total mortality volume at over 26 percent with aspen following at 22 percent. Ponderosa pine makes up 17 percent; Engelmann spruce, 13 percent; Douglas-fir, 11 percent; twoneedle pinyon, 5 percent; and subalpine fir, 4 percent. Utah juniper and Gambel oak combined make up the remaining 1 percent of the mortality volume on the Kaibab. About 75 percent of the mortality was caused by disease, 10 percent by fire, 8 percent by weather, and 5 percent by insects. Forty-eight percent of the mortality occurred in just two species: white fir and aspen.

Figure 10 compares gross annual growth to mortality for eight species that included mortality trees. The largest mortality to growth ratio occurs in aspen. White fir, Engelmann spruce and Douglas-fir follow with mortality, each over 50 percent of gross annual growth.

Understory vegetation—Understory vegetation provides forage and cover for wildlife, contributes to forest fuel load, and can be an indication of the successional stage of the forest community. On each plot field crews visually estimated crown canopy coverage for four plant groups—tree seedlings/saplings, shrubs, forbs, and graminoids (see USDA 1995 for details). Figure 11 shows the average percent cover of plant groups on forest land by forest type.

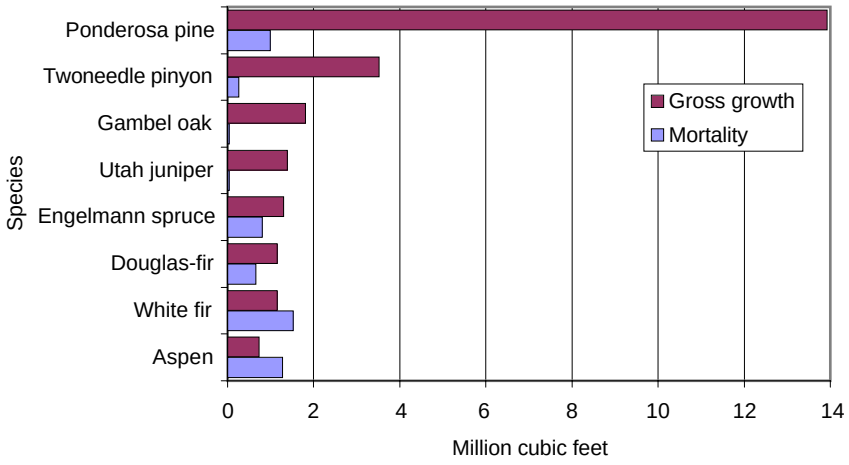

Figure 10—Gross annual growth of live trees 5 inches diameter and greater compared to mortality on all forest land, Kaibab National Forest.

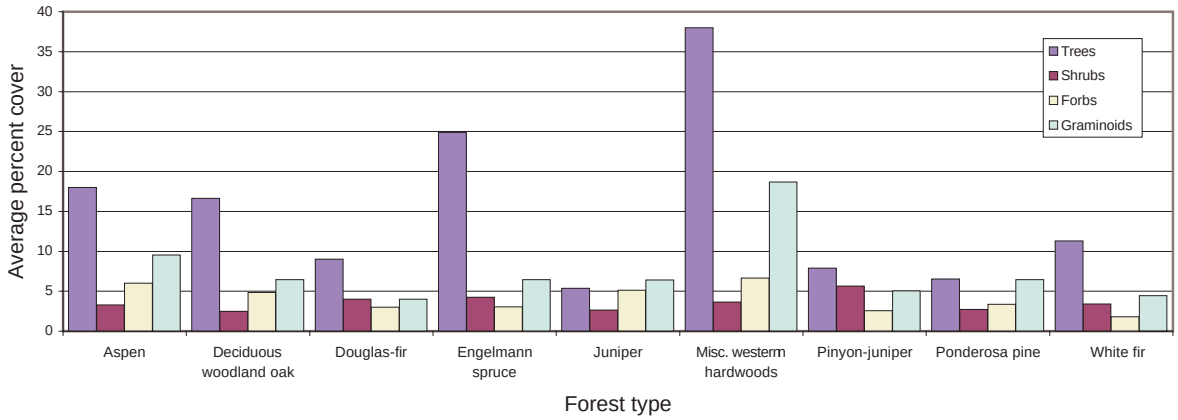

Figure 11—Average percent cover of trees (seedlings/saplings), shrubs, forbs, and graminoids on forest land by forest type, Kaibab National Forest.

Nonreserved timberland: highlights of our inventory

Tree and stand size—Almost 40 percent of forest land on the Kaibab National Forest is nonreserved timberland. The area of nonreserved timberland by stand-size class is presented in figure 12. Similar to all forest land on the Kaibab (see fig. 6), most of the nonreserved timberland area has the plurality of stocking from large trees.

Figure 13 shows the number of growing-stock trees by 2-inch diameter class on nonreserved timberland on the Kaibab. Growing-stock trees are live timber species meeting specific standards of quality and vigor. Twelve percent of the growing-stock trees on nonreserved timberland are greater than 12.9 inches diameter.

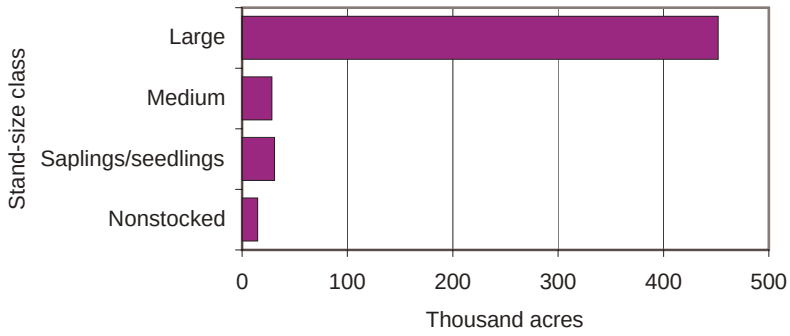

Figure 12—Area of nonreserved timberland by stand-size class, Kaibab National Forest.

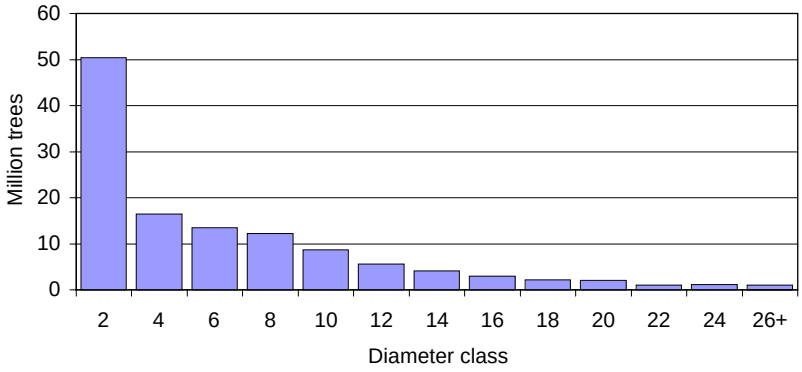

Figure 13—Number of growing-stock trees on nonreserved timberland by 2-inch diameter class, Kaibab National Forest.

Wood volume, biomass, and basal area of growing-stock trees—Table 4 displays a breakdown of net cubic-foot volume, tons of wood biomass, and square foot basal area for growing-stock trees 5 inches diameter and greater by species on nonreserved timberland for the Kaibab National Forest. The total net cubic-foot volume of growing stock on nonreserved timberland is about 948 million, with 80 percent of this volume from ponderosa pine species. The total wood biomass is estimated at over 18 million tons with ponderosa pine greater that 81 percent of this estimate. Total basal area for growing-stock trees on nonreserved timberland is estimated at almost 44 million square feet, with ponderosa pine making up 79 percent of this total.

The total net sawtimber volume on nonreserved timberland is over 4.2 billion board feet (Scribner rule). Sawtimber includes all growing-stock trees 9 inches and greater for softwoods, and 11 inches diameter and greater for hardwoods. Ponderosa pine accounts for the majority (84 percent) of this volume.

Growth and mortality—Gross annual growth of growing-stock trees on nonreserved timberland on the Kaibab National Forest is estimated to be 17.2 million cubic feet, while mortality is estimated to be 5.4 million cubic feet. This calculates to a net annual growth of 11.8 million cubic feet. All of the mortality volume was attributed to six species, with white fir and aspen combined making up more than 52 percent of this volume. Gross annual growth is compared to mortality for these six species in figure 14. Mortality for nonreserved timberland on the Kaibab is about 31 percent of gross annual growth, with the largest mortality-to-growth ratio occurring in aspen, followed by white fir. These results are similar to those shown in figure

Table 4—Net volume, biomass, and basal area of growing-stock trees 5 inches diameter and greater by species on nonreserved timberland, Kaibab National Forest, 1995.

Species	Volume (million cubic feet)	Biomass (million tons)	Basal area (million square feet)
Ponderosa pine	753.2	14.8	34.5
White fir	57.7	1.1	3.1
Douglas-fir	50.8	1.0	2.4
Engelmann spruce	47.9	0.7	2.0
Aspen	35.7	0.7	1.7
Subalpine fir	1.4	*	*
Southwestern white pine	1.2	*	*
Total	**947.9**	**18.2**	**43.9**

* Less than 100,000

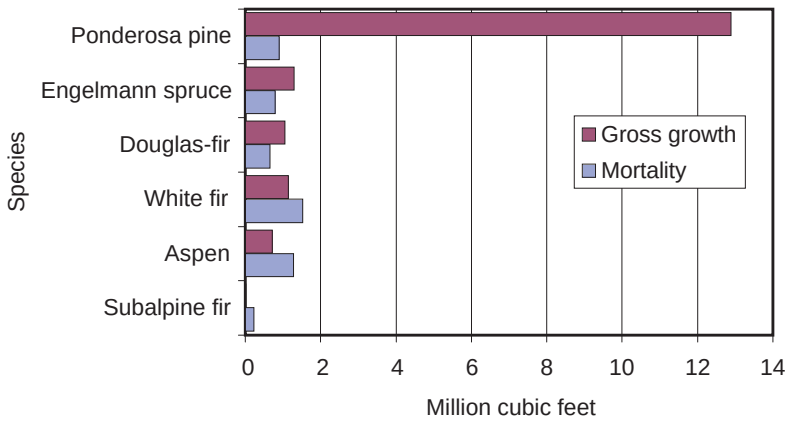

Figure 14—Gross annual growth of growing-stock trees 5 inches diameter and greater compared to mortality on nonreserved timberland, Kaibab National Forest.

10 for all live trees 5 inches diameter and greater on all forest land.

The inventory methods

About the two-phase sample design—FIA 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 (for further information about the national FIA program, refer to the World Wide Web at http://www.fia.fs.fed.us). IWFIA uses a two-phase sampling procedure for all inventories. Phase one of the inventory is based on a grid of sample points systematically located every 1,000 meters (approximately one sample point per 247 acres) across all lands in the State. Phase one points are assigned ownership and vegetative cover attributes using maps and remotely sensed imagery. Field crews conduct phase two of the inventory on a subsample of the phase one points that occur on forest land. The sampling intensity is one field plot every 5,000 meters (approximately one field plot per 6,178 acres), or about every 3 miles. Phase two plots are stratified based on phase one ownership and vegetation information, and weights are assigned to each stratum based on the proportion of phase one points in that stratum.

Phase two plots were sampled using the mapped-plot design. There were 247 field plots on the Kaibab National Forest, of which three were determined to be inaccessible. A total of 195 plots sampled only forest conditions, 15 sampled both forest and nonforest conditions, and 34 sampled only nonforest conditions. A total of 233 forest conditions (stands) were sampled on 210 plots that contain 208.04 forest and 1.96 nonforest condition proportions.

About the mapped-plot design—The mapped-plot design was adopted by Forest Inventory and Analysis nationwide in 1995. The predetermined subplot layout uses boundary delineation, when necessary, to classify differing conditions. Most plots sample a single forest condition, therefore delineating conditions is often not required.

Conditions were separated or mapped on differences in any of five attributes: forest/nonforest, forest type, stand-size class, stand origin, and stand density. The condition proportion is the fraction of plot area sampled on each condition. The sum of all condition proportions for a plot equals 1.00. Therefore, the number and relative size of plot conditions determines the weighted area (condition proportion multiplied by expansion factor) used for sample expansion.

Standard errors—The two-phase sampling scheme 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. Percent standard errors for estimates of area, net volume, net annual growth, and annual mortality are presented in table 5. Standard errors for other estimates are available upon request (see "For further information" section on the inside back cover).

Table 5—Percent standard errors for area estimate on total forest land, and percent standard errors for estimates of net volume, net annual growth, and annual mortality for all live trees on total forest land, and growing-stock trees on nonreserved timberland (5 inches diameter and greater), Kaibab National Forest.

Land class	Attribute	Estimate	Percent standard error
Total forest land (acres)	Area	1,326,020	±2.2
Total forest land (all trees cubic feet)	Volume	1,720,476,197	±5.2
	Growth	19,833,730	±9.8
	Mortality	5,827,954	±22.9
Nonreserved timberland (acres)	Area	525,949	±7.3
Nonreserved timberland (growing-stock trees cubic feet)	Volume	947,869,877	±9.4
	Growth	11,796,572	±16.6
	Mortality	5,377,583	±24.7

Documentation

Long, James N.; Daniel, Theodore W. 1990. Assessment of growing-stock in uneven-aged stands. Western Journal of Applied Forestry 5(3):93-96.

O'Brien, Renee A. 2002. Arizona's Forest Resources, 1999. Resour. Bull. RMRS-RB-2. Ogden, UT: U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 116 p.

Reineke, L.H. 1933. Perfecting a stand density index for even-aged forests. J. Agric. Res. 46:627-638.

U.S. Department of Agriculture, Forest Service. 1991. RMSTAND User's Guide, Chapter 60, p. 106. Unpublished user's guide on file at: U.S. Department of Agriculture, Forest Service, Southwestern Region, Albuquerque, NM.

U.S. Department of Agriculture, Forest Service. 1995. Arizona/New Mexico Region 3 forest survey field procedures, 1995. Ogden, UT: USDA Forest Service, Intermountain Research Station.

U.S. Department of Agriculture, Forest Service. 1996. Land Areas of the National Forest System. FS-383. As of September 1996.

U.S. Department of Agriculture, Forest Service. 2002a. Periodic mapped-plot design inventory terminology (Draft). [Online]. Available: http://www.fs.fed.us/rm/ogden/state_reports/arizona/az_nfs.html (also available on file at: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, UT).

U.S. Department of Agriculture, Forest Service. 2002b. Region-3 Guide For Custom IW-FIA Table Set, 2002. Unpublished report on file at: U.S. Department of Agriculture, Forest Service, Southwestern Region, Albuquerque, NM.

For further information

Interior West Forest Inventory and Analysis Program
Rocky Mountain Research Station
c/o Program Manager
507 25th Street
Ogden, UT 84401
Phone: 801-625-5388
FAX: 801-625-5723
World Wide Web: http://www.fs.fed.us/rm/ogden

Kaibab National Forest
c/o Forest Supervisor
800 South 6th Street
Williams, AZ 86046-2899
Phone: 928-635-8200
FAX: 928-635-8208

Selected data for this Forest are part of a national database that houses information for much of the forest land in the United States. This database can be accessed on the Internet at the following web site:

http://ncrs2.fs.fed.us/4801/fiadb/index.htm

Federal Recycling Program Printed on Recycled Paper

The Rocky Mountain Research Station develops scientific information and technology to improve management, protection, and use of the forests and rangelands. Research is designed to meet the needs of National Forest managers, Federal and State agencies, public and private organizations, academic institutions, industry, and individuals.

Studies accelerate solutions to problems involving ecosystems, range, forests, water, recreation, fire, resource inventory, land reclamation, community sustainability, forest engineering technology, multiple use economics, wildlife and fish habitat, and forest insects and diseases. Studies are conducted cooperatively, and applications may be found worldwide.