USDA United States Department of Agriculture

Forest Service

Rocky Mountain Research Station

May 2008

Forest Resources of the Gila National Forest

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About the author

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Contents

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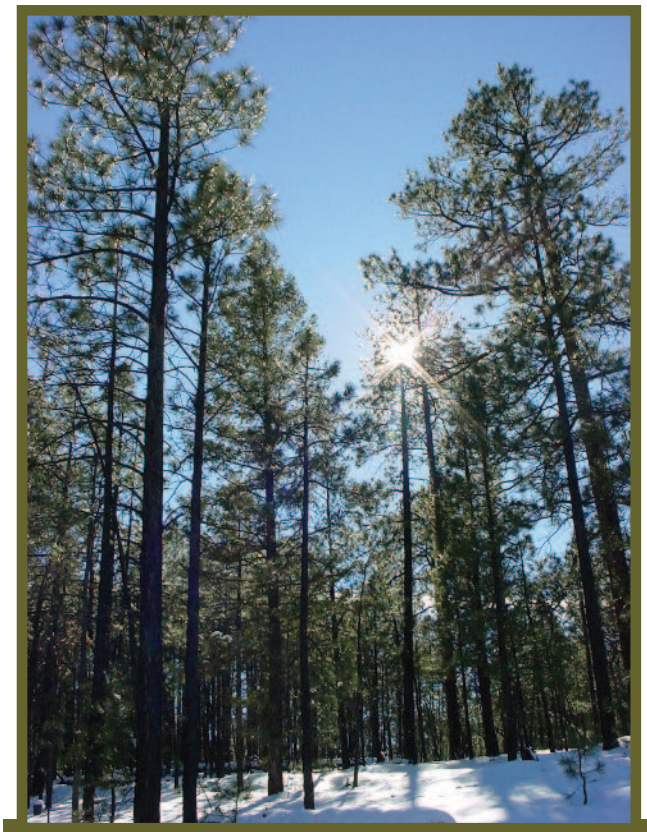
The Interior West Forest Inventory and Analysis (IWFIA) program of the USDA Forest Service, Rocky Mountain Research Station, as part of its national Forest Inventory and Analysis (FIA) duties, conducted forest resource inventories of the Southwestern Region (Region 3) National Forests. This report presents highlights of the Gila National Forest 1994 inventory including population estimates and summaries of commonly requested variables. Any trends or disturbances (such as fire) that have occurred after 1994 will be discussed in future reports of the Gila National Forest.

The information presented in this report is based solely on the IWFIA inventory sample (USDA 1995). The data can 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). Supplemental documentation and inventory terminology can be found in USDA (2002a), O'Brien (2003), 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 for the Gila National Forest, used separately or in combination with IWFIA data, may produce varying results.



Description of the Forest

The Gila National Forest administers 3,324,594 acres (USDA 1996) of which 88 percent is classified as forest land and 12 percent nonforest or water. This report describes the characteristics of the forest land sampled on the Gila. 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 (Figure 1). Timberland is forest land with mostly timber species typically used in the wood 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, junipers, and some oaks. On the Gila, 38 percent of the forest land is timberland and 62 percent is woodland.

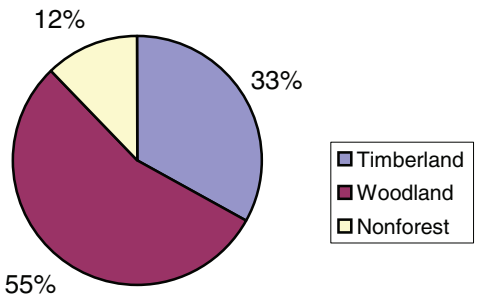


Figure 1—Percent of total area by land category, Gila National Forest.

Twenty-four percent of all land administered by the Gila National Forest is reserved land, such as wilderness areas, meaning that it has been withdrawn from management for production of wood products. 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 Gila.

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 Gila by forest type. Pinyon-juniper is the most common forest type, accounting for 48 percent of forest land, followed by ponderosa pine (32 percent), evergreen oak woodland (7 percent), deciduous woodland oak (5 percent), Douglas-fir (3 percent) and juniper (3 percent). The remaining 2 percent comprises a variety of timber and woodland types including aspen, cottonwood, mesquite, spruce-fir, Engelmann spruce, and white fir.

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 Gila National Forest by forest type for 461 plots that contained at least one forest condition. In the case of the Gila, all plots sampled only one condition (see "Mapped-plot Design").

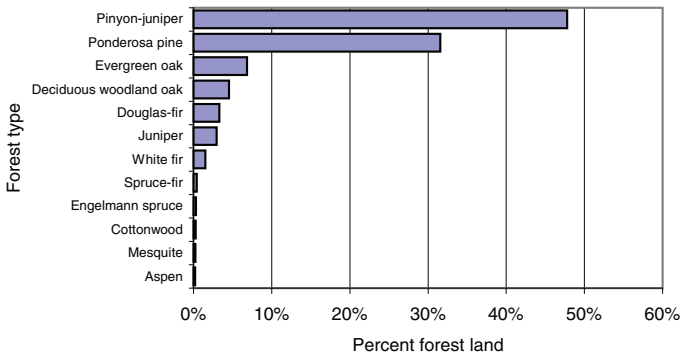


Figure 2—Percent of total forest land area by forest type, Gila National Forest.

Table 1—Number of conditions and condition proportions on forest land by forest type and land category, Gila National Forest, 1994.

Forest type	Number of conditions[a]	Condition proportions[b]
Timberland		
Ponderosa pine	143	143
Douglas-fir	15	15
White fir	7	7
Spruce-fir	2	2
Aspen	1	1
Cottonwood	1	1
Engelmann spruce	1	1
Total Timberland	**170**	**170**
Woodland		
Pinyon-juniper	225	225
Evergreen oak	30	30
Deciduous woodland oak	21	21
Juniper	14	14
Mesquite	1	1
Woodland Total	**291**	**291**
Grand Total	**461**	**461**

[a] Number of conditions by forest type that were sampled. The sum of these numbers is equal to the total number of plots because all plots on the Gila sampled only one forest condition.

[b] Sum of the condition proportions of plots by forest type that were sampled. The sum of these numbers is equal to the total number of plots because nonforest conditions are not included here.

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 Gila for three diameter classes. Gambel oak and common (twoneedle) pinyon are the most common trees, each accounting for approximately 19 percent of live trees. Arizona white oak/gray oak makes up another 16 percent. Ponderosa pine is the most common timber species, with over 12 percent of live trees on the Gila. Other common trees include alligator juniper (8 percent), evergreen oaks (5 percent), silverleaf oaks (5 percent) and Douglas-fir (4 percent). The rest of the live trees make up about 10 percent of the total. Timber species (4 percent) include aspen, Engelmann spruce, narrowleaf cottonwood, Apache pine, Chihuahua pine, southwestern white pine, white fir, and corkbark fir, and woodland species (6 percent) include bigtooth maple, border pinyon, Emory oak, Utah juniper, Rocky Mountain juniper, oneseed juniper, mesquite, and New Mexico locust. Species that are scarce may not be encountered with the sampling strategy used for this inventory.

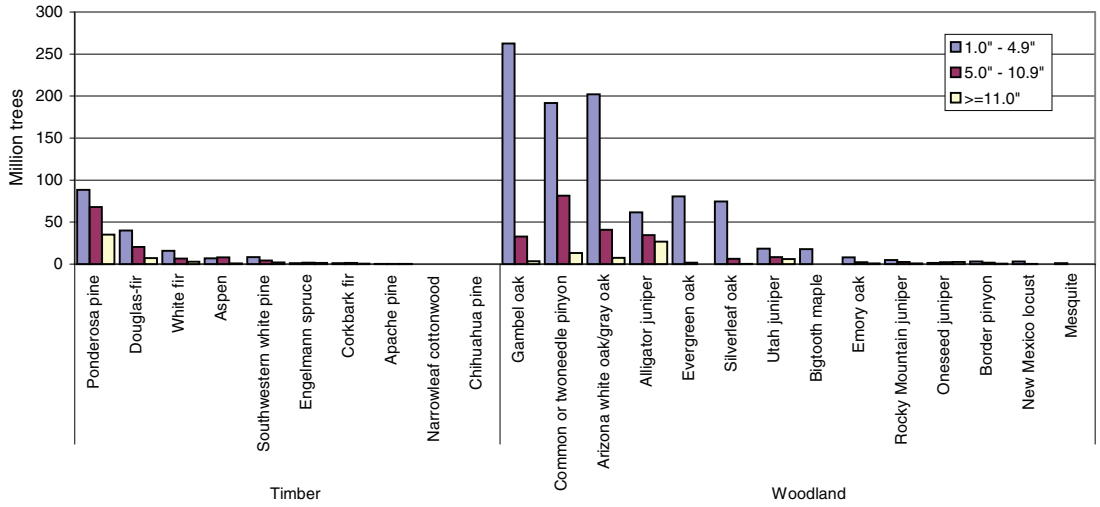


Figure 3—Number of live trees 1.0 inch diameter and greater on forest land by species and diameter-size class, Gila National Forest.

Number and weight of dead trees—Standing and down dead trees are important to forest ecosystems because they provide habitat for many species of wildlife, function as nutrient sinks, and protect the soil from erosion. Approximately 32.3 million standing dead trees (snags) and 12.9 million down dead trees 1 inch diameter and greater are on Gila forest land, an average of 19.6 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. Of the total numbers of snags, 28 percent are between 1 inch and 4.9 inches diameter, with nearly 73 percent of these within the ponderosa pine forest type. Snags 5.0 to 10.9 inches in diameter account for 42 percent of the total, with 28 percent in the ponderosa pine forest type and 27 percent in the pinyon-juniper type. Snags 11 inches diameter or larger make up 30 percent of the total, with 2.9 snags per acre. Most of these large snags are in the pinyon-juniper (45 percent) and ponderosa pine types (37 percent).

Dead and down material contributes to forest fuel loads and fire potential. Approximately 800 thousand tons of down dead trees and 4.6 million tons of standing dead trees are on Gila forest land. Our estimate of down dead trees includes only the merchantable portion of trees 5.0 inches diameter and greater that have recently fallen. On forested land, this works out to an average of approximately 0.25 tons of down dead trees per acre. About 35 percent of the down dead weight in our sample is alligator juniper, 19 percent is common pinyon, and 10 percent is Gambel oak.

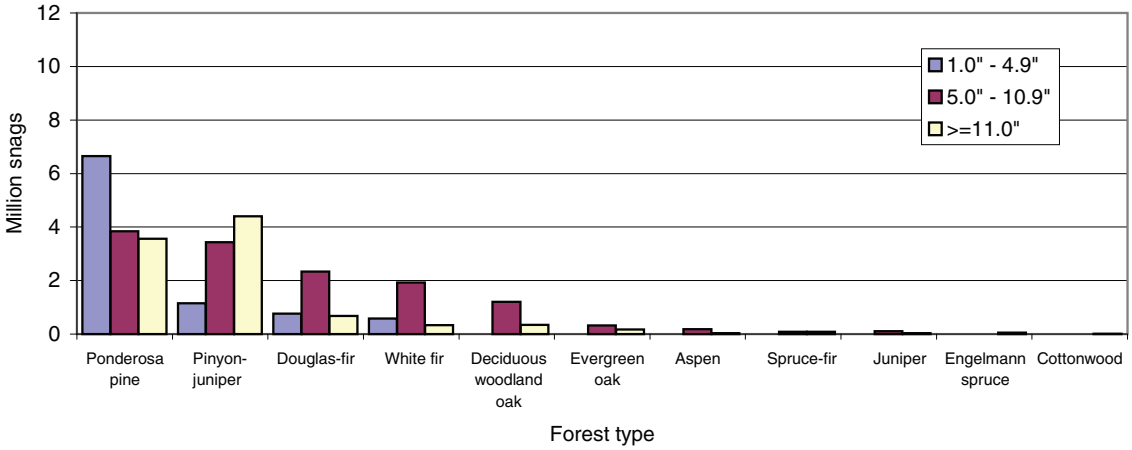


Figure 4—Number of standing dead trees 1.0 inch diameter and greater on forest land by forest type and diameter-size class, Gila National Forest, 2000.

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 Gila, combining trees from all stands. Overall, this shows a typical diameter distribution with a higher number of small trees than large trees.

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 Gila by stand-size class. Approximately 58 percent of the stands have a plurality of stocking from large trees and about 1 percent are nonstocked, such as stands that have been recently harvested or burned.

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 is therefore more appropriate for various forest resource applications. For example, volume relates closely to wood as a product, basal area to forest or tree density, and biomass to forest or tree productivity. In table 2, volume represents the amount of wood fiber in the

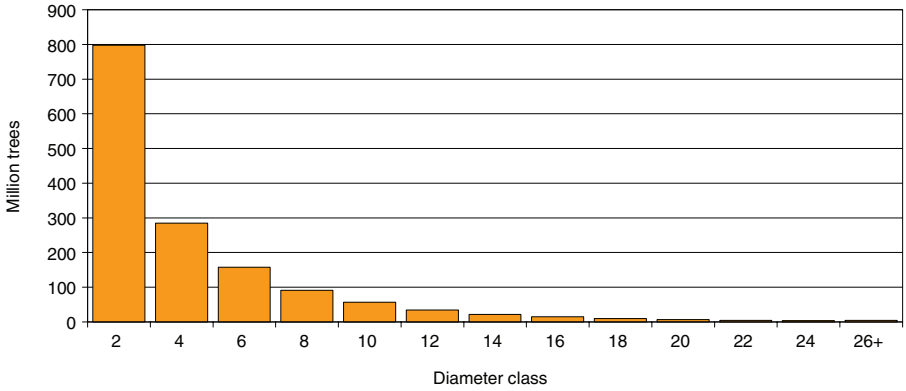


Figure 5—Number of live trees on forest land by 2-inch diameter class, Gila National Forest, 2000.

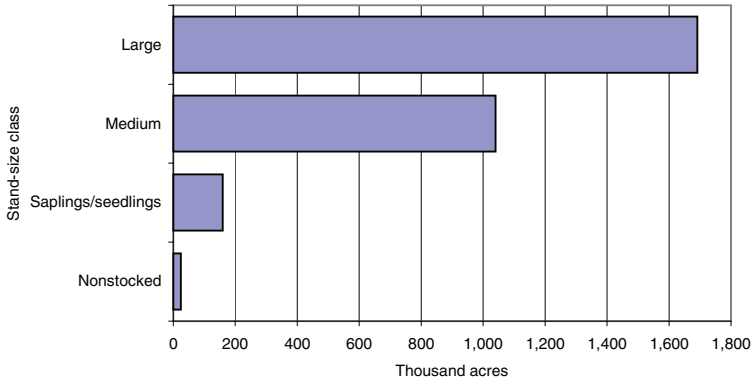


Figure 6—Forest land area by stand-size class, Gila National Forest. Large trees include softwoods 9.0"+ and hardwoods 11.0"+; medium trees include softwoods 5.0" to 8.9" and hardwoods 5.0" to 10.9"; saplings/seedlings include trees, < 5.0".

Table 2—Net volume, biomass, and basal area on forest land by species for trees 5.0 inches diameter and greater, Gila National Forest, 1994.

Species	Volume (million cubic feet)	Biomass (million tons)	Basal Area (million square ft.)
Ponderosa pine	1,278.7	26.6	67.6
Common or twoneedle pinyon	439.4	5.3	35.1
Alligator juniper	389.7	4.9	50.3
Douglas-fir	285.6	6.0	15.8
Gambel oak	125.9	4.0	11.7
White fir	102.2	2.0	5.6
Engelmann spruce	94.8	1.5	2.9
Arizona white oak / gray oak	83.2	3.0	19.6
Utah juniper	79.4	1.0	10.7
Southwestern white pine	54.6	1.0	3.2
Aspen	52.0	1.1	2.9
Oneseed juniper	24.3	0.3	3.9
Corkbark fir	23.8	0.4	1.0
Border pinyon	12.0	0.1	1.0
Rocky mountain juniper	10.3	0.1	1.2
Silverleaf oak	9.1	0.3	1.8
Emory oak	9.1	0.3	1.3
Apache pine	3.7	0.1	0.3
Narrowleaf cottonwood	2.0	†	0.1
Evergreen oak	1.6	0.1	0.5
Chihuahua pine	0.6	†	‡
New Mexico locust	0.4	†	‡
Mesquite	0.2	†	‡
Total (all tree species)	***3,082.6**	***58.2**	***236.5**

† less than 100,000 tons
‡ less than 100,000 square feet
* numbers may not add to total due to rounding

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. Table 2 shows a breakdown by species of net volume, biomass, and basal area for live trees 5 inches diameter and larger on the Gila. Ponderosa pine makes up the plurality of volume (41 percent) and biomass (46 percent), and accounts for 29 percent of basal area. Common pinyon makes up 14 percent of net volume, followed by alligator juniper (12 percent) and Douglas-fir (9 percent).

Figure 7 shows the distribution of net volume of wood in trees by 2-inch diameter class on Gila forest land. While the number of trees declines with larger diameter classes (see fig. 5), the volume increases significantly from diameter class 6 to 10 inches, where net volume peaks. Nearly two thirds of net volume occurs in the 18-inch and smaller size classes.

Another way to look at wood volume is by forest type, for which per acre estimates can be computed along with biomass and basal area (table 3). These numbers include the many different species that can occur together within each forest type. The highest volume per acre on the Gila is in the Engelmann spruce forest type, followed by the aspen, spruce-fir, white fir, and Douglas-fir types. These three timber forest types also contain the highest biomass per acre, because biomass is strongly correlated with volume. Some of the forest types listed in table 3 may not be representative due to small sample sizes (see table 1). Only the pinyon-juniper, ponderosa pine, and evergreen oak forest types have large samples.

Some of the figures listed in table 3 may not be representative of their forest types due to small sample sizes (see table 1). The pinyon-juniper, ponderosa pine, evergreen oak, and deciduous woodland oak forest types have large samples that provide better per-acre estimates.

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.

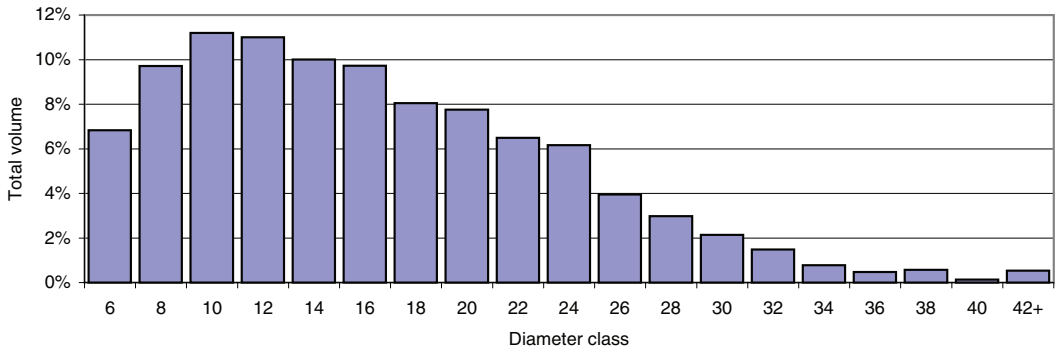


Figure 7—Percent of total net cubic-foot volume of live trees by 2-inch diameter class, Gila National Forest.

The concept was developed for even-aged stands, but can also be applied to uneven-aged stands (Long and Daniel 1990, Shaw 2000; 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, 51 percent of all forest stands in the Gila 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 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 multistoried 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 Gila, the pine category is made up of ponderosa pine, the mixed conifer category includes Douglas-fir and white fir, and the "other" category contains the Engelmann spruce and spruce-fir types. The values shown are based on analysis of SDI and tree diameter classes, a method developed by the Southwest Region (USDA 2002b). Single-storied and 2-storied stands are most common on the Gila but almost 40 percent of stands are multi-storied. Over 87 percent of the single-storied stands occur in the diameter classes smaller than 18.0 inches.

Table 3—Net cubic foot volume per acre, tons of biomass per acre, and basal area per acre by forest type, Gila National Forest, 1994.

Forest type	Volume (cubic ft. per acre)	Biomass (tons per acre)	Basal area (square feet per acre)
Engelmann spruce	8,162	127	233
Aspen	7,244	138	392
Spruce-fir	4,812	86	201
White fir	3,052	67	170
Douglas-fir	2,335	54	154
Ponderosa pine	1,438	32	94
Deciduous woodland oak	829	23	89
Cottonwood	747	18	51
Pinyon-juniper	717	11	91
Juniper	475	8	63
Evergreen oak	341	11	85
Average (all types)	1,060	21	95

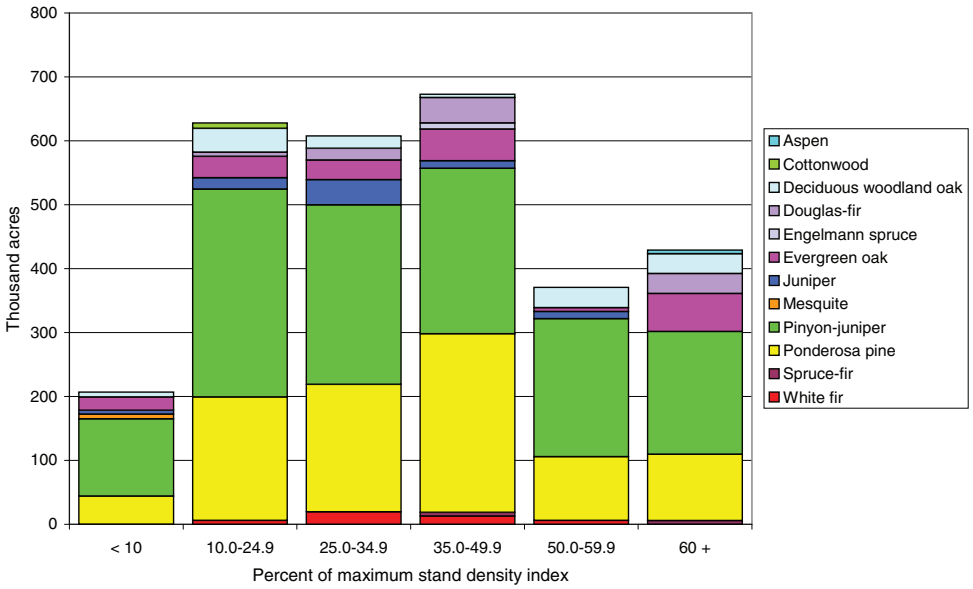


Figure 8—Area of forest land by forest type and percent stand density index, Gila National Forest.

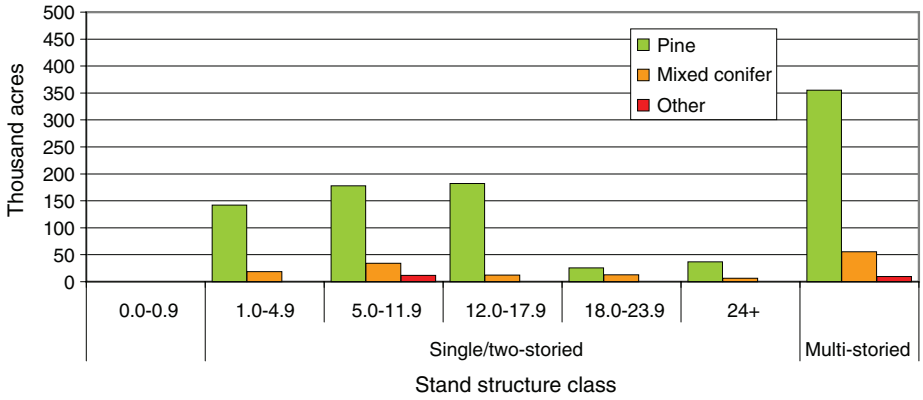


Figure 9—Area of forest land by stand structure class, diameter class, and timber softwood forest type groups, Gila National Forest.

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 annual increase in the volume of live trees while mortality is the net volume of trees that have died over a 1-year 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 Gila is estimated to be 60 million cubic feet. Subtracting mortality results in an estimated net annual growth of 53 million cubic feet.

Mortality calculations estimate approximately 7 million cubic feet of wood 5 inches diameter and greater died on the Gila in 1993. Ponderosa pine makes up the plurality of total mortality volume at over 38 percent, with Douglas-fir at 19 percent, common pinyon 10 percent, and Engelmann spruce at 9 percent. The remaining mortality volume (about 24 percent) was distributed among aspen, Gambel oak, corkbark fir, alligator juniper, Utah juniper, white fir, southwestern white pine, and narrowleaf cottonwood. No mortality trees were recorded for the remainder of species found on the Gila.

Based on field observations, 35 percent of the cubic-foot volume mortality on the Gila was caused by fire, 26 percent by disease, and 22 percent by weather-related stresses. The remaining 1 percent was attributed to insects, suppression by other vegetation, or unknown causes. These figures reflect the fact that our inventory methods record the direct, or proximate, cause of mortality. Commonly, on the Gila and elsewhere, the ultimate cause of mortality is high stand density. Fire is more severe in dense stands because of greater fuel volume and continuity, and insects and diseases take advantage of stress caused by overcrowding. Drought-induced stress and mortality are also exacerbated by overcrowding, because of intense competition for soil moisture.

Figure 10 compares gross annual growth to mortality for all trees. For narrowleaf cottonwood, mortality volume is nearly four times growth, yielding negative net growth. However, the estimate is based on few sample trees and, therefore, may not be representative of the species condition forest-wide. All other species show positive net growth, but for some mortality is a significant fraction of growth: Engelmann spruce, 54 percent; corkbark fir, 44 percent; Utah juniper 26 percent; aspen, 26 percent. Although these estimates are high, these species account for a small fraction of growth and mortality on the Gila as a whole. Ponderosa pine accounted for 48 percent of net growth, with gross growth greater than 10 times mortality. Common pinyon accounted for 16 percent of net growth, with gross growth over 12 times mortality, and Douglas-fir accounted for 11 percent of net growth, with gross growth over 5 times mortality. Overall gross growth on the Gila National Forest was 8.2 times mortality.

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. Aspen, cottonwood, Engelmann spruce, spruce-fir, and mesquite are based on relatively small samples (see table 1).

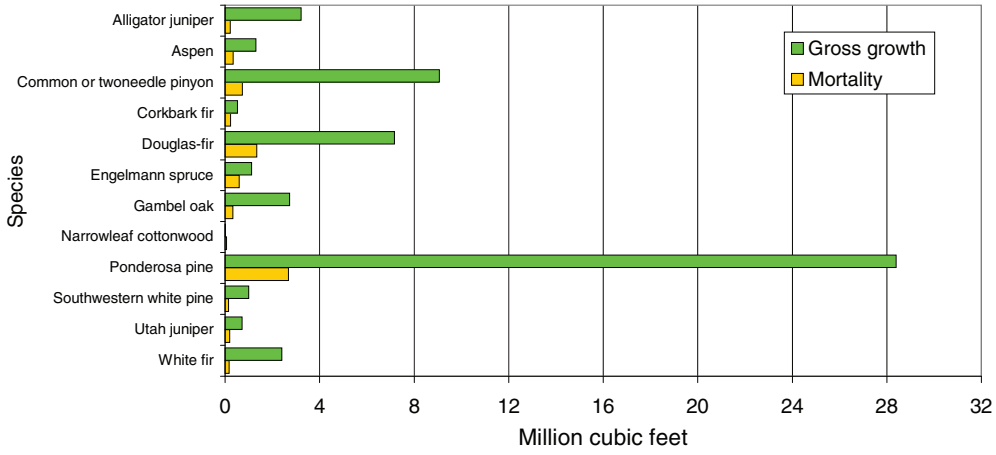


Figure 10—Gross annual growth of live trees 5.0 inches diameter and greater compared to mortality on all forest land, Gila National Forest.

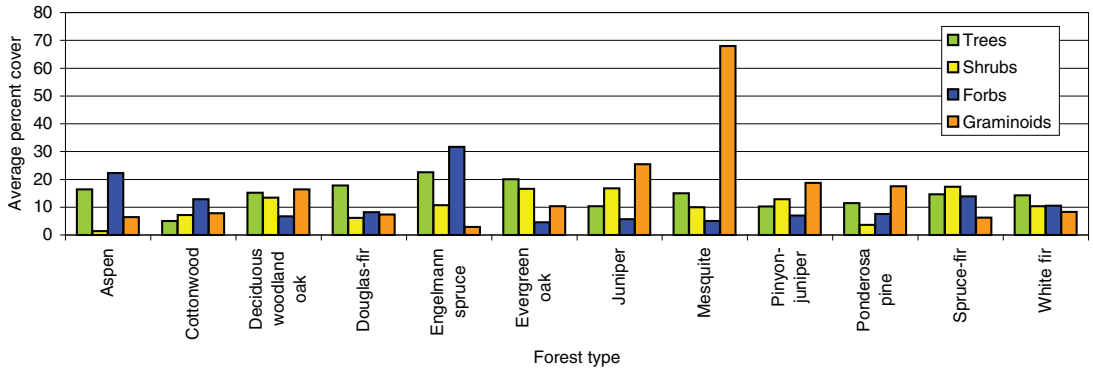


Figure 11—Average percent cover of trees (seedlings/saplings), shrubs, forbs, and graminoids on forest land by forest type, Gila National Forest.

Nonreserved timberland: highlights of our inventory

Tree and stand size—Over 76 percent of forest land in the Gila National Forest is nonreserved timberland. The area of nonreserved timberland by stand-size class is presented in figure 12. Similar to all forest land in the Gila (see fig. 6), most of the nonreserved timberland area has a 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 Gila. Growing-stock trees are live timber species meeting specific standards of quality and vigor. Of all growing-stock trees on nonreserved timberland on the Gila, 25 percent are 9 inches diameter or greater.

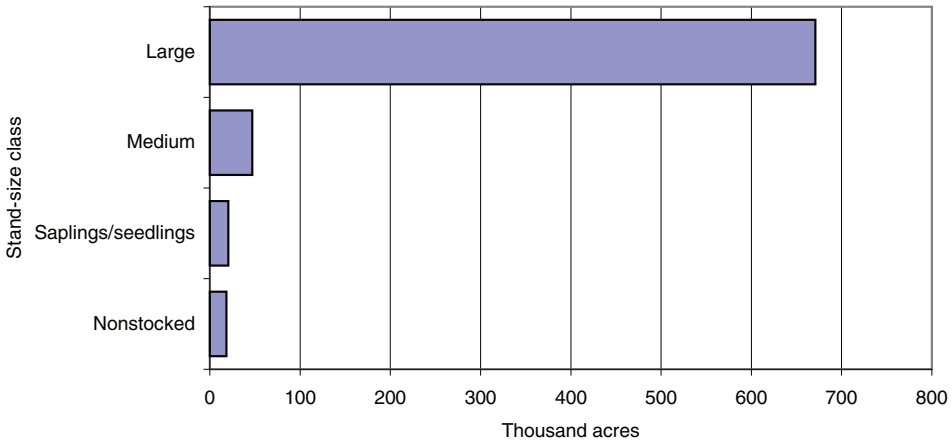


Figure 12—Area of nonreserved timberland by stand-size class, Gila National Forest.

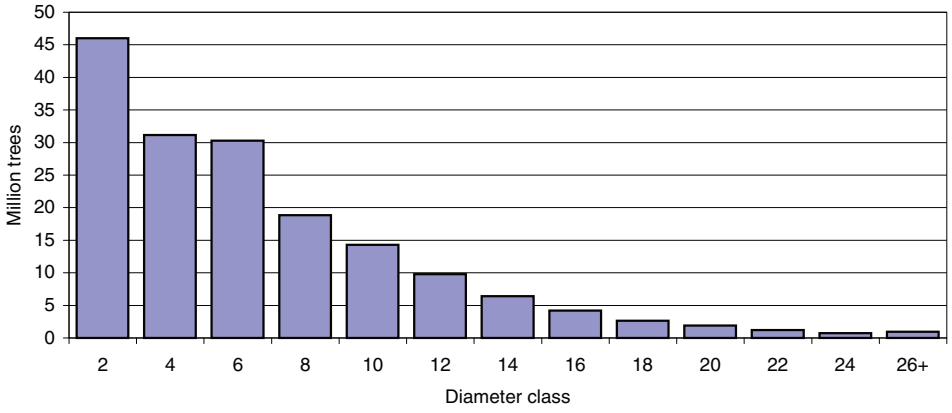


Figure 13—Number of growing-stock trees on nonreserved timberland by 2-inch diameter class, Gila National Forest.

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 Gila. The total net cubic-foot volume of growing stock on nonreserved timberland is about 886 million cubic feet. Ponderosa pine accounts for 83 percent of this volume. Total wood biomass is estimated at 18.3 million tons, with ponderosa pine again making up 83 percent of this amount. Total basal area for growing-stock trees on nonreserved timberland is estimated at nearly 49 million square feet, 82 percent of which is ponderosa pine.

The total net sawtimber volume on nonreserved timberland is estimated at 3.6 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 over 84 percent of this volume and Douglas-fir accounts for nearly 9 percent.

Growth and mortality—Gross annual growth of growing-stock trees on nonreserved timberland on the Gila is estimated to be 21.9 million cubic feet, with mortality estimated at 1.4 million cubic feet. This calculates to a net annual growth of 20.5 million cubic feet. All of the mortality volume was attributed to only four species, with ponderosa pine accounting for two thirds of the total and Douglas-fir accounting for an additional 26 percent. Gross annual growth is compared to mortality for timber species in figure 14. Gross annual growth is 20 times mortality for ponderosa pine and almost 7 times mortality for Douglas-fir. Mortality for nonreserved timberland on the Gila is about 6 percent of gross annual growth, somewhat lower than the 12 percent mortality for all forest land.

Table 4—Net cubic-foot volume, tons of biomass, and square feet of basal area by species on nonreserved timberland, 5.0 inches diameter and greater, Gila National Forest, 1994.

Species	Volume (million cubic feet)	Biomass (million tons)	Basal area (million square feet)
Ponderosa pine	732.5	15.2	40.0
Douglas-fir	93.0	2.0	5.6
White fir	28.6	0.6	1.6
Southwestern white pine	21.9	0.4	1.3
Aspen	7.4	0.1	0.3
Narrowleaf cottonwood	2.0	†	0.1
Corkbark fir	0.7	†	‡
Total*	***886.1**	***18.3**	**49.0**

† less than 100,000 tons
‡ less than 100,000 square feet
* numbers may not add to total due to rounding

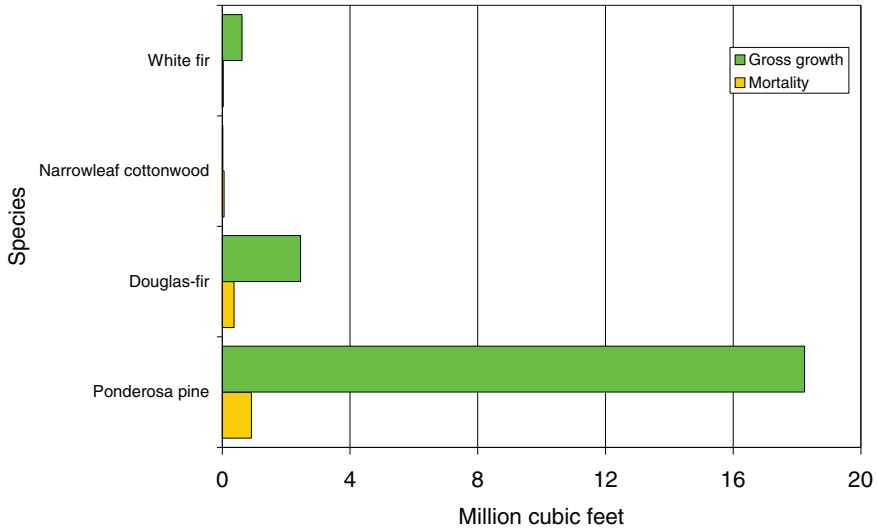


Figure 14—Gross annual growth of growing-stock trees 5.0 inches diameter and greater compared to mortality on nonreserved timberland, Gila National Forest.

The Inventory Methods

About the two-phase sample design-FIA inventories provide a statistically-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://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 526 field plots on the Gila National Forest. All field plots sampled only one forest condition, as the mapped plot design was not implemented at the time the Gila was sampled (see below).

About the mapped-plot design—The mapped-plot design was adopted by Forest Inventory and Analysis nationwide by 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. Since the mapped-plot design was not implemented at the time the Gila was sampled, condition proportions are 1.0 for all plots. Mapped-plot design will be used when the annual inventory system is implemented on the Gila.

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

Land class	Attribute	Estimate	Percent standard error
Total forest land (acres)	Area	2,915,230	1.7
Total forest land (all trees, million cubic feet)	Volume	3,082.55	4.8
	Growth	53.03	6.0
	Mortality	7.03	22.2
Nonreserved timberland (growing-stock trees, million cubic feet)	Volume	886.14	9.3
	Growth	20.49	9.5
	Mortality	1.37	38.1

Documentation

Long, J.N.; Daniel, T.W. 1990. Assessment of growing-stock in uneven-aged stands. West. J. Appl. For. 5(3):93-96.

O'Brien, R.A. 2003. New Mexico's Forest Resources, 2000. Resour. Bull. RMRS-RB-3. 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.

Shaw, J.D. 2000. Application of stand density index to irregularly structured stands. West. J. Appl. For. 15(1):40-42.

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.

U.S. Department of Agriculture, Forest Service. 2002a. Reference documents. [Online]. Available: http://www.fs.fed.us/rm/ogden/publications/new_mexico/nm_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.

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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://www.fia.fs.fed.us/tools-data/default.asp

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