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Alabama's
Forests, 2010

Andrew J. Hartsell and Jason A. Cooper

Southern Research Station

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All photographs taken by Andrew J. Hartsell unless otherwise noted.

Front cover: top left, fall colors at Cheaha State Park; top right, deer on forest edge; bottom, a hardwood forest in autumn. Back cover: top left, sunrise in north Alabama; top right, fall colors at Cheaha State Park; bottom, a woodland stream in Alabama. (photo by Kelvin J. Daniels of Alabama Forestry Commission).

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Gray squirrels such as this one, are found throughout Alabama.

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A white oak ablaze in autumn.

Blackgum leaves turn bright red in the fall.

Foreword

The Forest Inventory and Analysis (FIA) unit of the U.S. Department of Agriculture Forest Service, Southern Research Station (SRS), conducts continuing inventories of forest resources in 13 Southern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia), as well as Puerto Rico and the U.S. Virgin Islands. It is a collaborative partnership with the Southern Group of State Foresters of these States; the Southern Region National Forest System; and State and private forestry.

This bulletin presents the findings of the ninth survey of Alabama's forest resources. Earlier inventories of Alabama, also known as the yellow-hammer State, have been performed by the Forest Service, Southern Forest Experiment Station. The first of these was performed in 1936 (Duerr 1946). This was followed up by surveys performed in 1953 (Wheeler 1953), 1963 (Sternitzke 1963), 1972 (Murphy 1973), 1982 (Rudis 1984), 1990 (McWilliams 1992), 2000 (Hartsell 2009), and 2005 (Hartsell and Johnson 2009). In 1995, the Southern Forest Experiment Station, headquartered in New Orleans, Louisiana, merged with the Southeastern Forest Experiment Station, headquartered in Asheville, North Carolina, to become the SRS, which is headquartered in Asheville, North Carolina. The Alabama Forestry Commission (AFC) performed the majority of the field work, and SRS personnel provided oversight. SRS is responsible for processing, disseminating, and reporting the data.

Methodology used in collecting and processing inventory data has changed over time. Various sampling schemes have been used over the last 70 years. Strips, fixed plots, and variable-radius plots have been installed across the State at one time or another. Variable-radius plots were utilized from 1972 to 1990, while the last two surveys have used a four-subplot fixed-radius design. Systems for determining forest area have evolved from interpretation of aerial photographs by FIA personnel to automated classification of satellite imagery. These changes help facilitate the collection and processing of data for the purpose of obtaining accurate assessment of the State's forests. However, the changes can confound long-term trend analysis, particularly for the average annual change variables—growth, removals, and mortality. The evolution and alterations of the sample design are detailed in older State publications. Changes that are more recent are described in the methods section in the appendix of this report. When possible, older data were reprocessed to account for some of these changes. This reprocessing failed to capture all changes and is not possible for data collected prior to 1972, as electronic datasets are not available for these surveys. Therefore, some caution is advised when comparing inventory data from different periods. Still, this information represents the best data available for describing the history of Alabama's forests.

The tables and figures throughout this report represent the most current data available at the end of the 2010 data collection period. It is important to note that during this time, Alabama adopted a 7-year cycle for the State inventory. That is, all plots are to be visited over a 7-year span starting in 2006. National FIA policy requires a report on the status and condition of Alabama's forests be produced every 5 years. In order to create a complete dataset, plot and tree information from the 2001–05 survey are incorporated in this analysis. All inventory and field data was compiled and uploaded to FIA database (FIADB) on June 3, 2011. The data used in this report were obtained from FIADB between June 4 and September 22, 2011.

Tabular data included in FIA reports are designed to provide a comprehensive array of forest resource statistics, but additional data can be obtained for those who require information that is more specialized. The forest resource data for Southern States can be accessed directly via the Internet at http://srsfia2.fs.fed.us/.

Additional information about any aspect of this survey may be obtained from:

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Acknowledgments

The Southern Research Station gratefully acknowledges the cooperation and invaluable assistance provided by the AFC in the collection of field data. This bulletin was made possible through the collaboration of the Forest Service FIA personnel (including those in Data Collection, Information Management, Analysis, and Publication Management). We also appreciate the cooperation of other public agencies and private landowners for providing access to measurement plots.

This beautiful lake is found in Cheaha State Park, Alabama.

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Colorful daffodils provide bursts of color.

Area

- The total forest land area for Alabama in 2010 was 22.8 million acres.
- Alabama's forest lands have increased 21 percent since 1936.
- Oak-hickory is the predominate forest type in Alabama, accounting for 32 percent or 7.3 million acres of forests.

Ownership

- Private landowners owned almost 94 percent of all forests statewide.
- Family forests, a subset of private landowners, controlled 14.8 million acres, or 65 percent of the forests.
- Family owners listed the top three reasons for owning forests were to pass on as inheritance, investment, and esthetics/beauty.

Volume

- Alabama's timberlands contain 14.8 billion cubic feet of softwood growing-stock species and 15 billion cubic feet of hardwood growing stock.
- Softwood growing-stock volume on timberland increased 163 percent since 1953, while hardwood volume rose 146 percent.

Species

- Loblolly pine is the predominant softwood species statewide, accounting for nearly 12 billion cubic feet, or 75 percent of Alabama's all-live softwood volume.
- Red oaks, sweetgum, yellow-poplar, white oaks, and hickory species are the most frequently occurring hardwood species.

Groups of trees provide shade in the summer.

Growth and Removals

• Over 1.0 billion cubic feet of softwood growing stock is grown each year on Alabama timberlands, a 15 percent increase over the previous survey period.

• Alabama is growing 1.3 times more softwood growing stock each year than are being removed.

• Alabama is currently growing 74 percent more softwood than it grew between 1953 and 1962.

• Presently, 486 million cubic feet of hardwood growing stock are grown each year, while 319 million is removed.

• As of 2010, the yellow-hammer State grows more than twice the amount of hardwood growing stock than it did in 1963, while hardwood removals have increased by <50 percent over the same time period.

Plantations

• Planted stands occupy 6.9 million acres, or roughly 30 percent, of Alabama's forests.

• Southern pine plantations occupy 26 percent of the State's forest area, yet they contain 44 percent of the State's softwood volume.

• Plantations account for 62 percent of the State's annual softwood growth and 63 percent of the annual removals of softwood species.

National and Regional Importance

• The South contains 204 million acres, or 40 percent, of the Nation's timberlands and 72 percent of all the county's planted stands.

• Over 3 percent of the Nation's timberland area and growing stock volume are found within Alabama.

• Seven percent of the Nation's average annual growth and 9 percent of the removals of softwood species occur within Alabama.

• Alabama accounts for 11 percent of southern timberland area and 10 percent of growing-stock volume.

• As of 2009, the forest sector contributed >88,000 full- and part-time jobs statewide.

• Alabama's forest sector's total production output accounted for >$18.9 billion in 2009.

Forest Health

• During the 2010 survey period, annual mortality of softwood and hardwood trees averages 205.2 and 222.3 million cubic feet, respectively.

• Japanese honeysuckle is the most frequently detected invasive plant species in Alabama.

• Southern pine beetle infestation levels occurred at low levels between 2006 and 2010.

Red-headed woodpeckers prefer older stands of trees.

Forest Area

Trends in Forest Area

The total land area for Alabama in 2010 was 33.5 million acres (table 1). Almost 68 percent, or 22.8 million acres, of this land area was classified forested by Forest Inventory and Analysis (FIA). Forest land was composed of three components, as listed here from largest to smallest in area: timberland (22.7 million acres), reserved (71,000 acres), and unproductive (5,900 acres). Combinations of site characteristics (shallow soils, southern exposures, etc.) were responsible for most of the unproductive forests in the Southwest-South unit (fig. 1). The Southeast survey unit accounted for over one-quarter (27 percent) of the forest land in the State, while the North Central unit was second in total forested area, containing >4.4 million acres (20 percent) of the State's forests. All other survey units each accounted for 9 to 16 percent of Alabama's forested acreage.

The proportion of land area in forests for Alabama's 67 counties ranged from 28 to 91 percent. Twenty-eight counties had >75 percent of their land area in forests

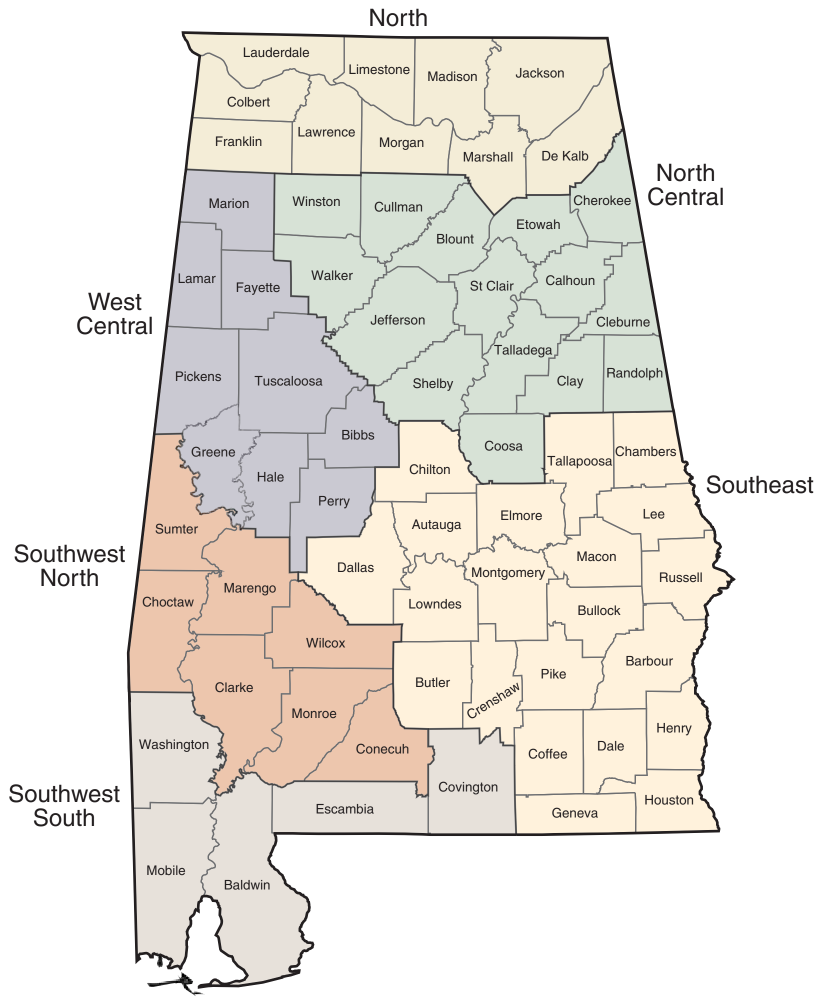


Figure 1—Forest survey regions in Alabama.

Table 1—Area by survey unit and land status, Alabama, 2010

			Unreserved			Reserved				
Unit	Total area	All forest	Total	Timber-land	Un-productive	Total	Productive	Un-productive	Nonforest land	Census water
					thousand acres					
Southwest South	4,324.0	2,822.4	2,810.1	2,810.1	0.0	12.3	12.3	0.0	974.0	527.6
Southwest North	4,392.9	3,708.8	3,708.8	3,708.8	0.0	0.0	0.0	0.0	635.1	49.1
Southeast	9,145.3	6,288.6	6,288.6	6,282.8	5.9	0.0	0.0	0.0	2,689.7	167.0
West Central	4,407.2	3,432.2	3,432.2	3,432.2	0.0	0.0	0.0	0.0	936.1	39.0
North Central	6,635.7	4,446.2	4,421.8	4,421.8	0.0	24.4	24.4	0.0	2,002.3	187.2
North	4,642.9	2,116.9	2,082.5	2,082.5	0.0	34.5	34.5	0.0	2,398.3	127.7
Total	33,548.0	22,815.1	22,744.0	22,738.2	5.9	71.1	71.1	0.0	9,635.4	1,097.5

Numbers in rows and columns may not sum to totals due to rounding.

0.0 = no sample for the cell or a value of >0.0 but <0.05.

(fig. 2). Only one county, Limestone, had <30 percent of its land area in forested conditions. Madison County was the second lowest with 33 percent total forest area. All other counties had over one-third of their land base covered in forests. The counties with the densest concentrations of forests are Clarke and Choctaw, both of which have just over 90 percent of their area in forests. A general statewide trend exists where the densest counties lie in the southwest, and the least dense in the north-northeast. Three exceptions are Mobile and Baldwin Counties in the southwest and Jackson County in the northeast. Mobile and Baldwin Counties lie along the Gulf of Mexico and therefore contain coastlines and developed areas associated with coasts. Jackson County is on the southern tip of the Appalachian mountain range, and the topography, soils, and other characteristics of this mountain range impacts land use.

Total area of forest land in Alabama has steadily increased since 1936. In fact, the State's timberland base has grown almost 21 percent since that initial survey. The majority of the additional acreage was added between 1936 and 1963. Since 1963, total timberland area has never fluctuated by >1.0 million acres. The 2010 estimate of 22.8 million acres is the second highest statewide estimate of forest land ever recorded for Alabama (fig. 3).

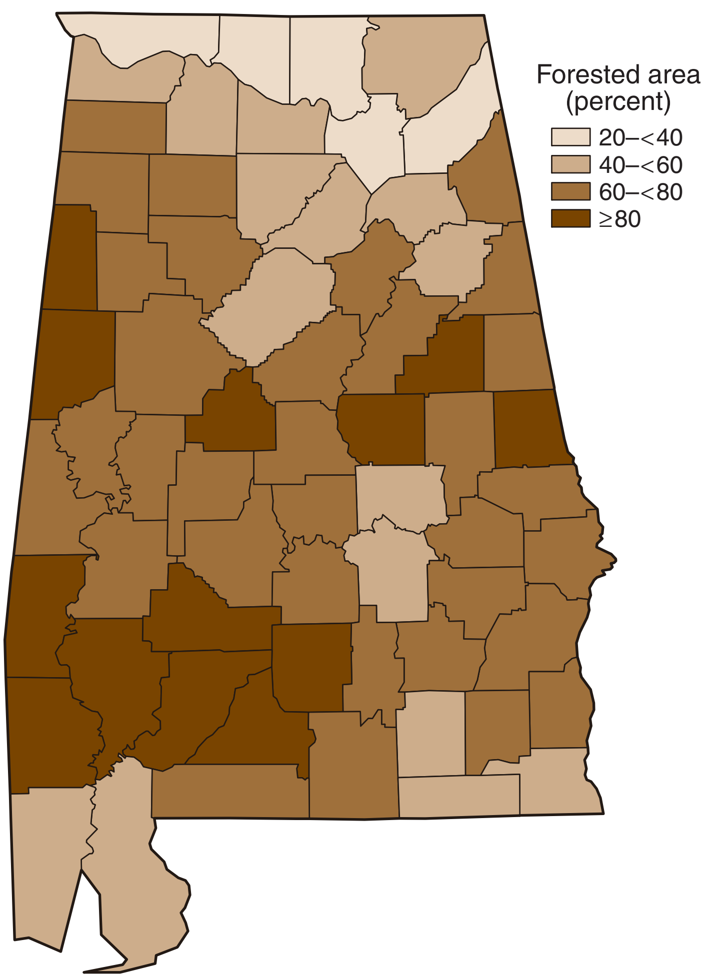


Figure 2—Percent of county in forest land, Alabama, 2010.

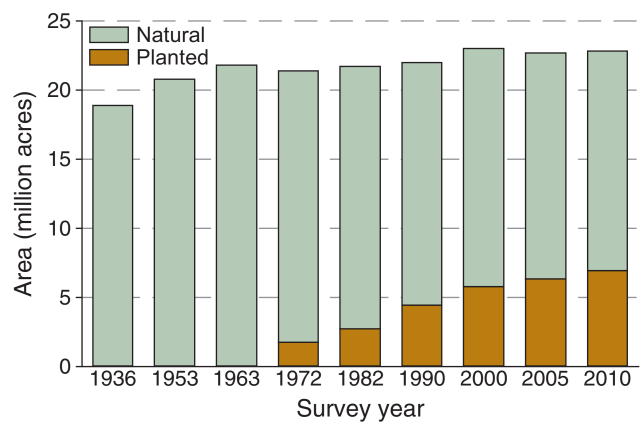


Figure 3—Area of Alabama forest land by survey period and stand origin.

While total forest land area has remained stable since 1963, the area of planted stands has increased substantially. Planted stands were first identified as a separate classification during the 1972 survey. At that time, they accounted for 1.7 million acres, or about 8 percent of Alabama's timberland base. In 2010, more than one-quarter of Alabama's timberland area is in plantations. These stands currently occupy 6.9 million acres or 30 percent of timberland statewide.

The increased prominence of planted pine forests in Alabama has impacted forest-type distribution in the State. Many of the State's natural stands have been converted to planted stands, particularly natural pine and oak-pine. Additionally, many lands that were under agriculture have been planted in pines and converted to forests. The area of natural loblolly pine stands has decreased almost 50 percent since 1972, while the area of oak-pine stands has dropped 41 percent over the

A 9-year old longleaf pine plantation in Randolph County, Alabama. (photo by David Stephens, Bugwood.org)

same period (fig. 4). Conversely, the area of planted loblolly pine forests has increased fivefold over the last 30 years. Oak-hickory forests have increased as well. There were 5.7 million acres of oak-hickory forests across the State in 1972. Today, there are 7.3 million, an increase of >28 percent.

The loss in oak-gum-cypress forests and gain in elm-ash-cottonwood types are linked. Changes in FIA methodology and definitions often confound long-term analysis, and this is one such case. Earlier surveys typed almost all bottomland types as oak-gum-cypress. Current procedures type many of these stands as elm-ash-cottonwood. Therefore, it is often best to combine data for these two types when considering bottomland forest types. In 1972, these two types combined represented 2.5 million acres of Alabama's forests. Today, they account for 2.7 million acres. Thus, there has been little overall change in area for Alabama's bottomland forests.

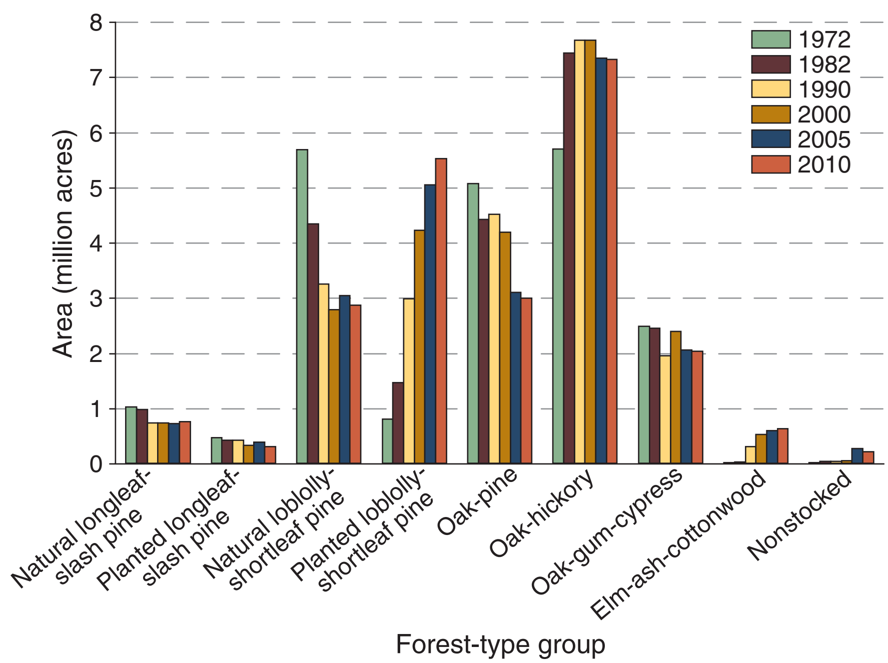


Figure 4—Area of Alabama forest land by forest-type group and survey year.

Ownership

The National Woodland Owner Survey (NWOS) (Butler 2008) conducted by the Forest Service is a nationwide effort to identify landowner opinions, goals, management styles, and concerns involving forest land in private ownership. Private landowners are important in Alabama because they own 94 percent of the State's forest area (table 2). The NWOS employed mail-out questionnaires and telephone surveys to obtain information about a sample of forest landowners. The objective was to better understand what is important to the owners of family forests, i.e., private individual forest ownerships, in the United States.

The NWOS sampled family forest owners in Alabama between 2002 and 2006. The following results are a summary of the 834 family forest owners who participated in the study. Family forests were found to account for 14.8 million acres or 65 percent of the State's forest land. Businesses were found to own 29 percent and various Federal, State, and local government agencies the remaining 6 percent (table 2).

NWOS findings indicate that 399,000 family forest owners owned the 14.8 million acres of family forest in the State. Only 179,000 family forest owners owned at least 10 acres each, but these owners controlled 95 percent of the family forest land in Alabama. Only 58,000 family forest owners owned at least 50 acres each, but such tracts accounted for 79 percent of the State's family owned forest acreage (table 3).

Table 2—Area of forest land by ownership, Alabama, 2006

Ownership	Forest land	
	Acres	SE
	thousand	*percent*
Private		
Family	14,792	1.3
Other private	6,471	2.4
Total	21,264	1.1
Public		
Federal	986	6.5
State	330	11.4
Local	113	19.6
Total	1,429	5.4
Total	22,693	1.1

Sums may not add to total, due to different methodology.
SE = sampling error.

Table 3—Area and number of family forests by size of forest landholdings, Alabama, 2006

Size of forest landholdings	Area		Owners	
	Acres	SE	Number	SE
acres	*thousand*	*percent*	*thousand*	*percent*
1–9	673	31.2	220	21.0
10–19	806	28.4	69	19.6
20–49	1,606	16.1	52	12.1
50–99	1,706	15.4	27	11.4
100–199	2,038	13.5	16	10.6
200–499	2,538	11.2	9	9.4
500–999	1,660	15.8	3	13.2
1,000–4,999	2,734	10.7	2	17.9
5,000–9,999	511	42.3	<1	22.3
10,000+	520	36.0	<1	28.0
Total	14,792	1.3	399	11.8

Sums may not add to total, due to different methodology.
SE = sampling error.

Forested hills and agricultural valleys are a common sight throughout the southeastern United States.

Reasons for owning family forests in the State were varied. Acreage held for inheritance was ranked first, followed by acreage held for investment and acreage held for esthetics/beauty. Acreage owned for firewood and for nontimber production were the two smallest groups (table 4). These are fairly consistent with recent (within the past 5 years) activities and management practices conducted on these forests. Private recreation and timber harvest are ranked as the two highest activities. These are consistent with the stated goals of investment and enjoying the esthetics of family owned forests. This indicates that the economic impacts of land investment and harvesting timber play a large role in landowner decisions (table 5).

Table 4—Area and number of family forests by reason for owning forest land, Alabama, 2006

Reason[a]	Area		Owners	
	Acres	SE	Number	SE
	thousand	*percent*	*thousand*	*percent*
To enjoy beauty or scenery	8,909	3.8	257	14.3
To protect nature and biologic diversity	7,492	4.6	232	15.5
For land investment	9,238	3.6	171	14.3
Part of home or vacation home	7,048	5.2	259	16.1
Part of farm or ranch	5,163	6.9	109	17.0
Privacy	7,163	4.8	250	14.5
To pass land on to children or other heirs	10,422	3.1	231	14.4
To cultivate/collect nontimber forest products	1,548	16.7	27	29.1
For production of firewood or biofuel	1,248	19.9	19	30.9
For production of saw logs, pulpwood or other timber products	8,175	4.1	62	13.5
Hunting or fishing	7,284	4.7	117	20.2
For recreation other than hunting or fishing	4,509	7.3	117	24.3
No answer	221	79.9	1	49.6

SE = sampling error.

[a] Categories are not exclusive.

Table 5—Area and number of family forests by recent (past 5 years) forestry activity, Alabama, 2006

Activity[a]	Area		Owners	
	Acres	SE	Number	SE
	thousand	*percent*	*thousand*	*percent*
Timber harvest	6,958	5.0	52	23.1
Collection of NTFP	925	26.3	25	53.5
Site preparation	4,856	6.7	67	40.1
Tree planting	5,889	5.7	46	17.6
Fire hazard reduction	4,433	7.3	32	29.0
Application of chemicals	4,095	7.8	57	40.5
Road/trail maintenance	6,372	5.3	51	21.6
Wildlife habitat improvement	4,823	6.8	43	26.0
Posting land	5,541	6.5	52	25.5
Private recreation	8,317	4.3	139	19.3
Public recreation	1,297	20.0	5	41.8
None of the above	2,180	13.0	129	23.2

SE = sampling error; NTFP = nontimber forest products.

[a] Categories are not exclusive.

Standing Inventory

The State's total growing-stock volume has increased dramatically since the 1953 survey. Part of this increase may be attributed to changes in the methods used to compute tree volumes that occurred between the 1990 and 2000 surveys. Preliminary analyses indicate that that would account for only a -5 to 15-percent change in volume, depending on the species and size class. However, data from 2000, 2005, and 2010 have been reprocessed under the same system. Therefore, changes that occurred between the last three surveys, and any large changes between the current inventory and older surveys, are indicative of real changes in Alabama's forest structure (fig. 5). Growing-stock volume on timberland is the traditional measure used, as this denotes the amount of commercially viable timber species that were available for commercial uses, and the earliest surveys focused on this metric.

Softwood growing-stock volume on timberland increased 163 percent since 1953, while hardwood volume rose 146 percent. The largest jump in softwood volume occurred between 1953 and 1972, as 56 percent of the volume increase between 1953 and 2010 occurred prior to 1972. Softwood growing-stock volume has increased 10 percent over the last 5 years. Softwood growing-stock inventory has steadily risen since 1990.

Hardwood growing-stock volume peaked in 2000 at 15.2 billion cubic feet statewide. Hardwood volume increased 149 percent from 1953 to 2000. There was a slight decline in hardwood volume during the 2005 survey. Hardwood growing-stock volume appears to have leveled off since 2000. The latest estimate of 15 billion cubic feet is only 1 percent higher than 2005.

While growing-stock volume on timberland is the traditional measure used by FIA, a more accurate depiction of Alabama's forests is revealed by investigating all-live volume on forest lands, as this measure includes all tree species and size classes on all forest lands, commercial or not. Currently there are >34 billion cubic feet of all-live volume within the State (table 6). Ninety percent of this volume occurs on nonindustrial private forests (NIPF), while almost 5 percent is found on forests owned by the U.S. Forest Service. A majority of this volume (66 percent) is concentrated in two forest-type groups, loblolly-shortleaf and oak-hickory, as these two forest types

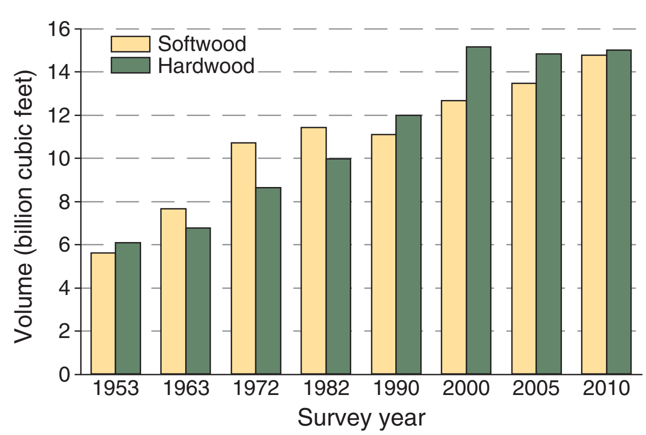


Figure 5—Total growing-stock volume on timberland by survey year and major species group, Alabama.

Table 6—Volume of all-live species by forest-type group and ownership group, Alabama, 2010

Forest-type group	All owners	Ownership group: Forest Service	Other Federal	State and local	NIPF
	million cubic feet				
White-red-jack pine	24.2	11.1	0.0	0.0	13.1
Longleaf-slash pine	1,587.9	328.8	10.2	65.6	1,183.2
Loblolly-shortleaf pine	12,050.1	385.0	150.3	175.5	11,339.4
Other eastern softwoods	30.4	0.0	0.0	0.0	30.4
Oak-pine	4,112.4	359.8	93.6	86.4	3,572.6
Oak-hickory	10,387.0	510.3	137.4	315.8	9,423.4
Oak-gum-cypress	4,789.8	59.9	175.7	277.3	4,276.8
Elm-ash-cottonwood	1,049.6	—	45.1	26.4	978.1
Maple-beech-birch	26.8	26.8	0.0	0.0	0.0
Other hardwoods	4.8	0.0	0.2	0.0	4.6
Exotic hardwood	3.4	0.0	0.0	0.0	3.4
Nonstocked	13.1	0.0	0.0	0.3	12.8
Total	34,079.3	1,681.7	612.5	947.4	30,837.8

NIPF = nonindustrial private forest.

Numbers in rows and columns may not sum to totals due to rounding.

— = negligible; 0.0 = no sample for the cell or a value of >0.0 but <0.05.

contain 35 and 30 percent of the States all-live volume respectively. Curiously, the only maple-beech-birch forest types found in the State occur on U.S. Forest Service lands.

All-live softwood volume in the lower diameter classes has jumped considerably the past three surveys. Between the 1990 and 2010 inventories, volume in the 8- and 10-inch diameter classes rose 50 and 44 percent, respectively. This increase in volume for softwood species <14 inches in diameter can be attributed directly to the establishment of pine plantations (fig. 6).

Compared to the estimate of volume from the 2000 inventory, the volume in the middle-to-upper diameter classes, 14 to 28 inches, has remained fairly constant.

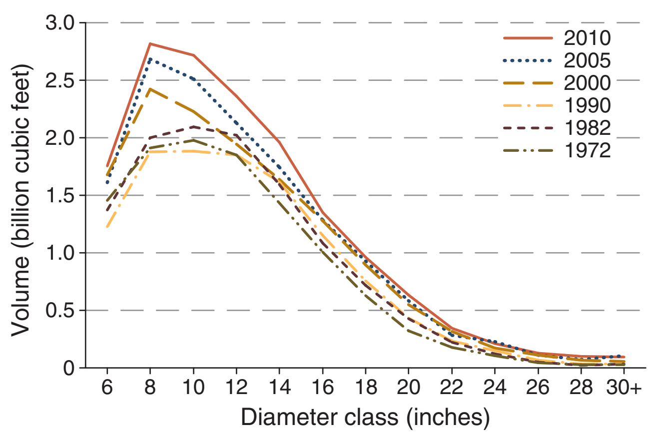


Figure 6—Total all-live volume of softwoods on forest land by diameter class and survey period, Alabama.

However, the data indicate that, over long term, there is now more volume in these diameter classes than ever before. The 2010 estimates indicate greater live softwood volume for each size class except the 24-inch category, where the 2005 estimates were 7 percent lower.

All-live hardwood volume of Alabama's forests has risen as well. However, unlike softwood volume, which has a spike in the lower diameter classes, hardwood volume has been increasing over all diameter classes for the last 30 years. This increase is proportional to tree size. For example, 2010 hardwood volume in the 12-inch class is 54 percent higher than in 1972. The 2010 inventory volumes in the 16-, 20-, and 24-inch classes were 101, 183, and 287 percent greater, respectively, than the corresponding 1972 estimates (fig. 7).

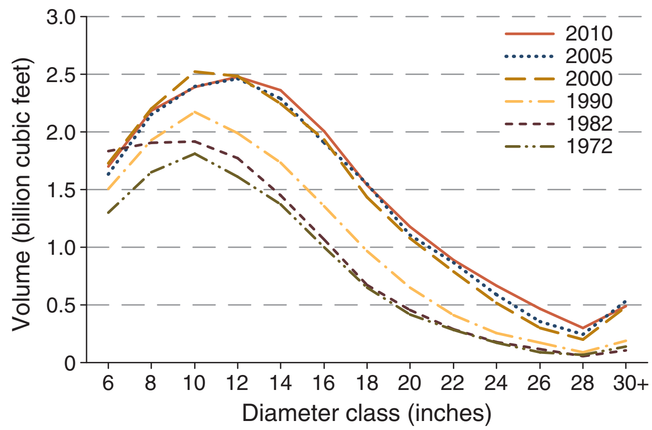


Figure 7—Total all-live volume of hardwoods on forest land by diameter class and survey period, Alabama.

A forest trail beckons to be explored.

The 2010 inventory estimate of hardwood volume largely mirrors the 2000 and 2005 inventory numbers. The 2010 inventory estimates of volume in the 10-inch diameter classes is slightly (<1 percent) lower than the corresponding estimates from the 2005 inventory. The two lines converge at the 12-inch class and roughly follow each other from that point on. The 2010 inventory volume estimates are slightly higher for all diameter classes >20 inches.

At the time of the 2010 inventory, all-live softwood volume was distributed unevenly across the State. It was greatest in the southwest portion of the State, and lowest in the northern counties. The counties with the most all-live softwood volume were Clarke, Washington, Baldwin, and Choctaw. The counties with the least amount of live softwood volume were Limestone and Lauderdale (fig. 8).

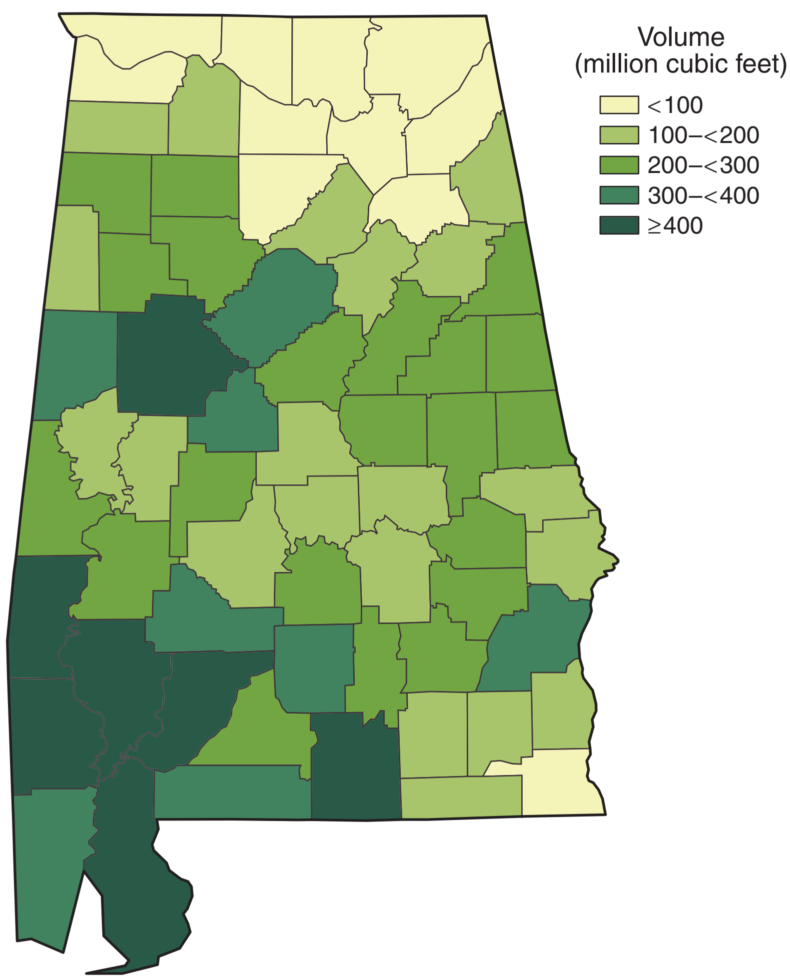
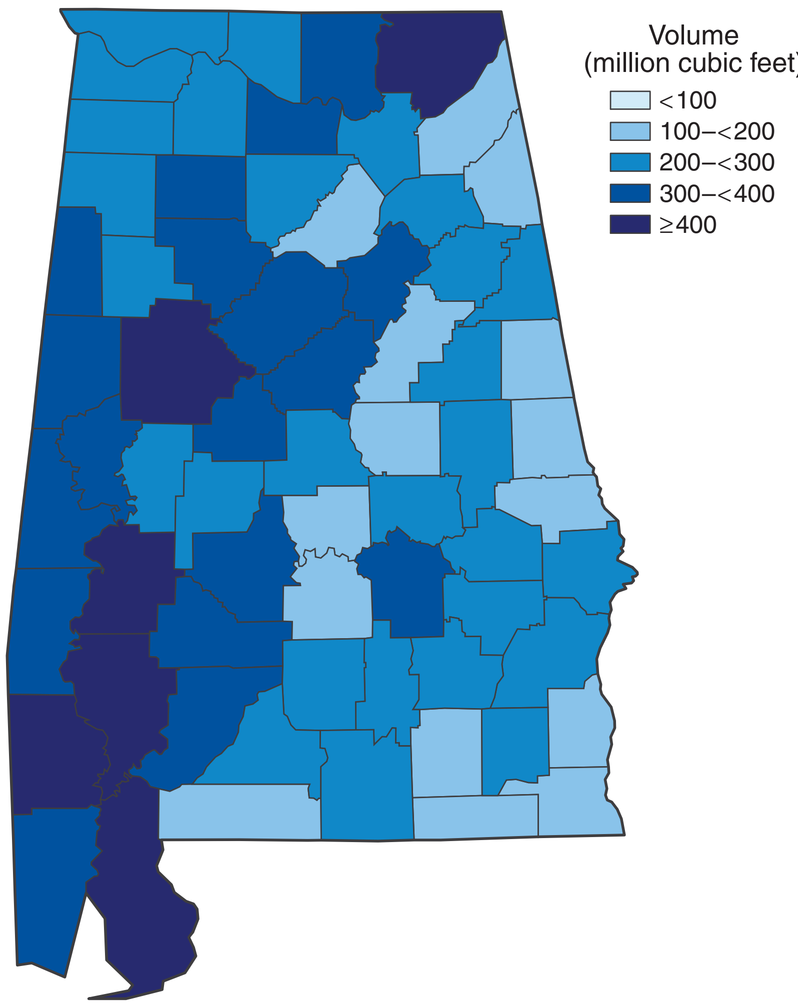


Figure 8—Total all-live softwood volume on forest land by county, Alabama, 2010.

Hardwoods occur throughout the State. All-live hardwood volume increased slightly from east to west and south to north, however these trends are small. The counties with the highest all-live hardwood volume were Jackson and Tuscaloosa. The counties with the lowest amount of standing hardwood volume were Coffee and Escambia (fig. 9).



Species

Loblolly pine (*Pinus taeda*) is the predominant softwood species in Alabama, accounting for almost 12 billion cubic feet, or 75 percent, of all-live softwood volume (table 7). The amount of volume in this one species is 13 times greater than the second ranked softwood species, longleaf pine (*P. palustris*). The current inventory of loblolly pine is three times as great as that of all other softwoods combined. Loblolly pine and cypress (*Taxodium* spp.) are the only softwood species that have increased in volume substantially over the last 10 years, with loblolly pine increasing 29 percent and cypress gaining 33 percent over their 2000 estimates. Volumes of all other softwood species either declined or remained constant (fig. 10).

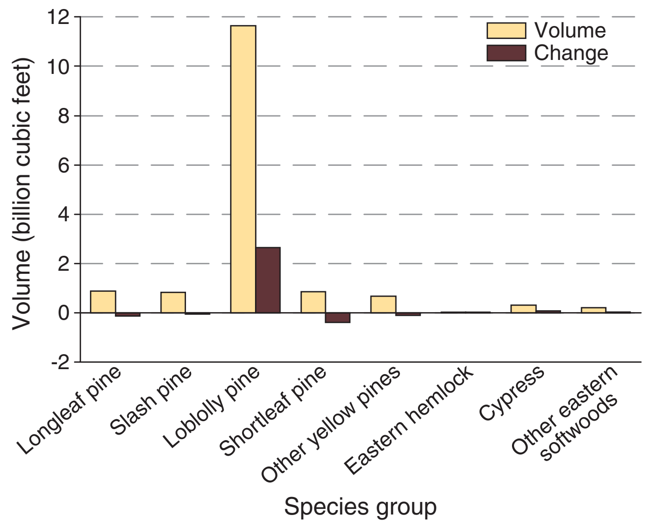


Figure 10—Volume of all-live softwood on forest land by species group, Alabama, 2010, and change since 2000.

Table 7—Top 50 tree species based on ranking by live-tree volume on forest land, common name, and scientific name, Alabama, 2010

Common name	Scientific name	Volume	Common name	Scientific name	Volume
		million cubic feet			*million cubic feet*
Loblolly pine	*Pinus taeda*	11,631.0	Scarlet oak	*Q. coccinea*	255.1
Sweetgum	*Liquidambar styraciflua*	2,811.7	American beech	*Fagus grandifolia*	237.6
Water oak	*Quercus nigra*	1,870.4	Shagbark hickory	*Carya ovata*	201.3
Yellow-poplar	*Liriodendron tulipifera*	1,741.6	Eastern redcedar	*Juniperus virginiana*	194.7
White oak	*Q. alba*	1,368.2	Black cherry	*Prunus serotina*	161.4
Longleaf pine	*P. palustris*	874.8	Spruce pine	*Pinus glabra*	156.5
Shortleaf pine	*P. echinata*	867.8	American sycamore	*Platanus occidentalis*	154.6
Slash pine	*P. elliottii*	822.5	Sourwood	*Oxydendrum arboreum*	153.1
Southern red oak	*Q. falcata*	817.5	Winged elm	*Ulmus alata*	137.7
Chestnut oak	*Q. prinus*	792.6	Sugarberry	*Celtis laevigata*	126.3
Blackgum	*Nyssa sylvatica*	631.3	American elm	*U. americana*	115.4
Red maple	*Acer rubrum*	629.3	Hackberry	*C. occidentalis*	109.0
Pignut hickory	*Carya glabra*	623.4	White ash	*Fraxinus mericana*	100.7
Laurel oak	*Q. laurifolia*	536.9	Rver birch	*Betula nigra*	88.8
Virginia pine	*P. virginiana*	504.6	Overcup oak	*Q. lyrata*	84.9
Mockernut hickory	*C. tomentosa*	496.4	Chinkapin oak	*Q. muehlenbergii*	69.9
Sweetbay	*Magnolia virginiana*	480.3	American hornbeam, musclewood	*Carpinus caroliniana*	69.2
Post oak	*Q. stellata*	425.1	Southern magnolia	*Magnolia grandiflora*	67.6
Swamp tupelo	*Nyssa biflora*	425.0	Florida maple	*A. barbatum*	66.4
Cherrybark oak	*Q. falcata* var. *pagodaefolia*	365.2	Swamp chestnut oak	*Q. michauxii*	63.0
Water tupelo	*N. aquatica*	338.5	American basswood	*Tilia americana*	48.4
Green ash	*Fraxinus pennsylvanica*	327.3	Common persimmon	*Diospyros virginiana*	47.8
Willow oak	*Q. phellos*	313.7	Pecan	*Carya illinoensis*	46.9
Baldcypress	*Taxodium distichum*	284.4	Flowering dogwood	*Cornus florida*	46.6
Northern red oak	*Q. rubra*	266.1	Total		33,311.5
Black oak	*Q. velutina*	262.9			

The species with the greatest loss in volume is shortleaf pine (*P. echinata*). The current estimate of 868 million cubic feet is 384 million cubic feet less than the 2000 estimate. Longleaf pine ranked second in softwood volume loss. The volume of longleaf pine fell from 1.0 billion cubic feet to 875 million cubic feet in just 10 years, a decline of 13 percent.

Unlike its softwoods resource, Alabama's hardwood resource is not dominated by a single species. The other red oak (*Quercus rubra*) group contains the most all-live volume, 4.1 billion cubic feet, followed by sweetgum (*Liquidambar styraciflua*) with 2.8 billion cubic feet. Yellow-poplar (*Liriodendron tulipifera*), select white oak (*Q. alba*), and hickory (*Carya* spp.) form a third tier, with the volume of these species ranging from 1.4 to 1.7 billion cubic feet (fig. 11).

Only the select white oak group declined in all-live volume since 2000, and this amount is statistically insignificant. The yellow-poplar group experienced the greatest increase, rising 1.5 percent over the last 10 years. Almost all other species groups had <1-percent change in all-live volume over the same timeframe.

The spatial distribution of 16 common species were aggregated by county and plotted on maps to illustrate the regions of the State that they prefer. Figures 12–17 reveal the distribution of the six most abundant softwood species in

Loblolly pine is the most abundant tree species in Alabama. (photo by David Stephens, Bugwood.org)

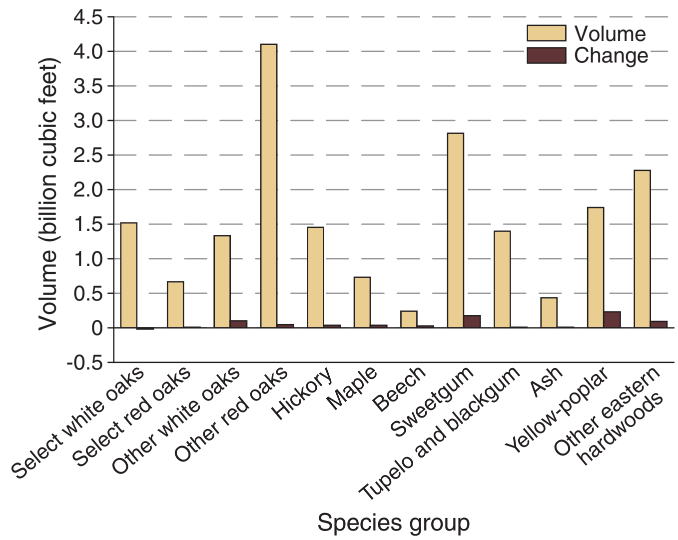


Figure 11—Volume of all-live hardwood on forest land by species group, Alabama 2010, and change since 2000.

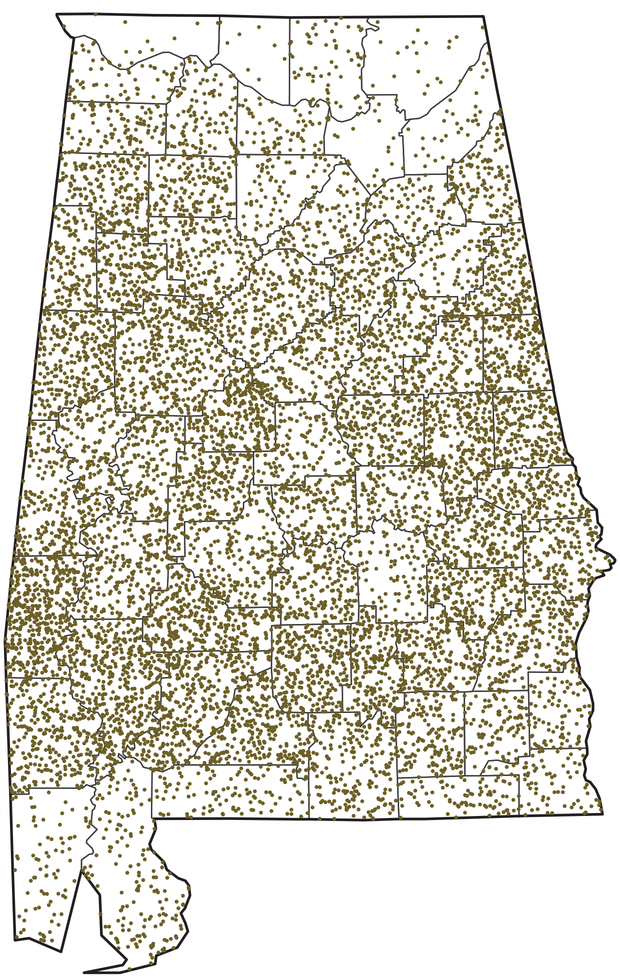


Figure 12—Loblolly pine volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

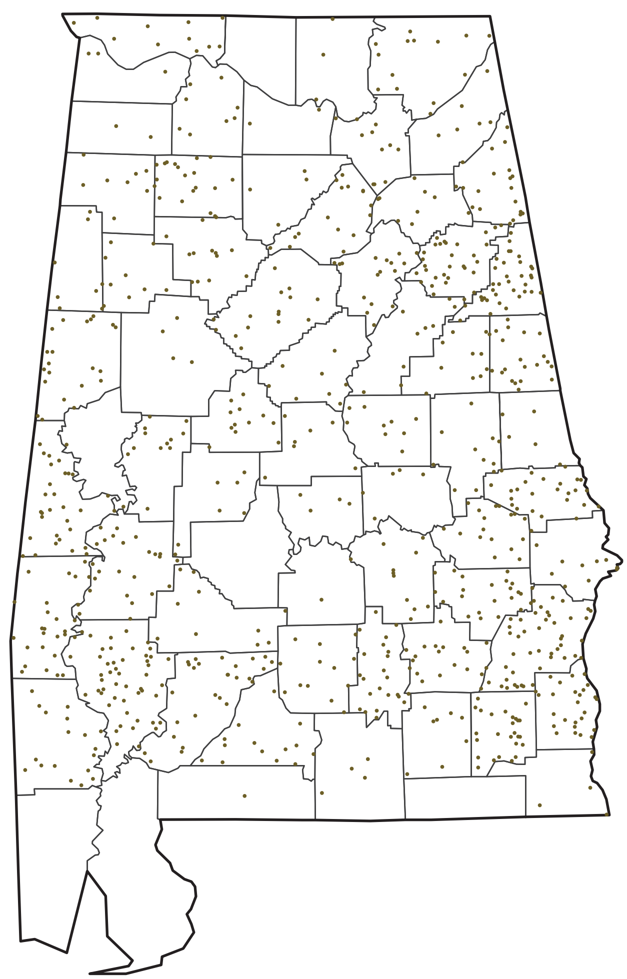


Figure 13—Shortleaf pine volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

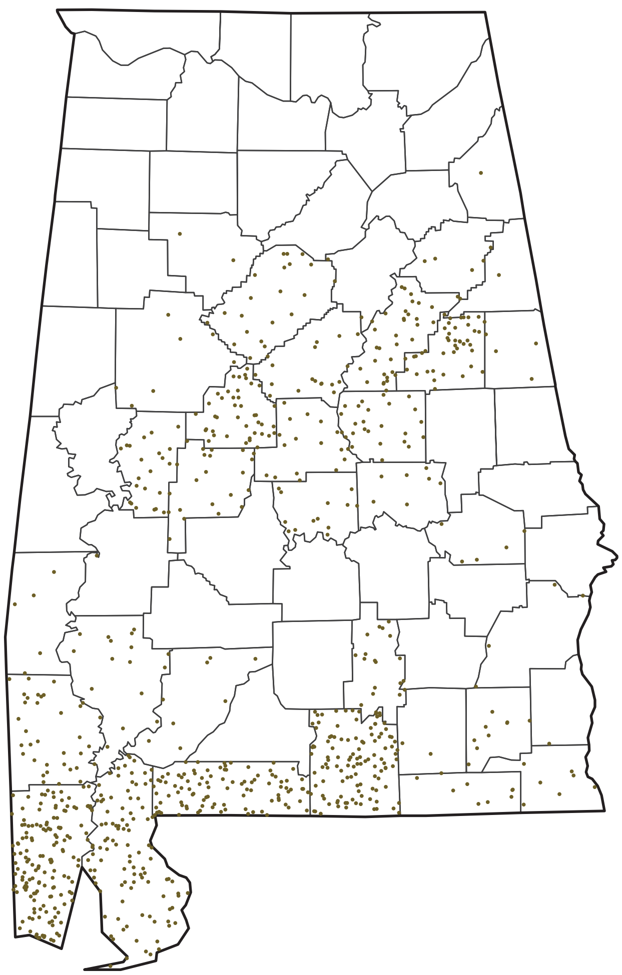


Figure 14—Longleaf pine volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

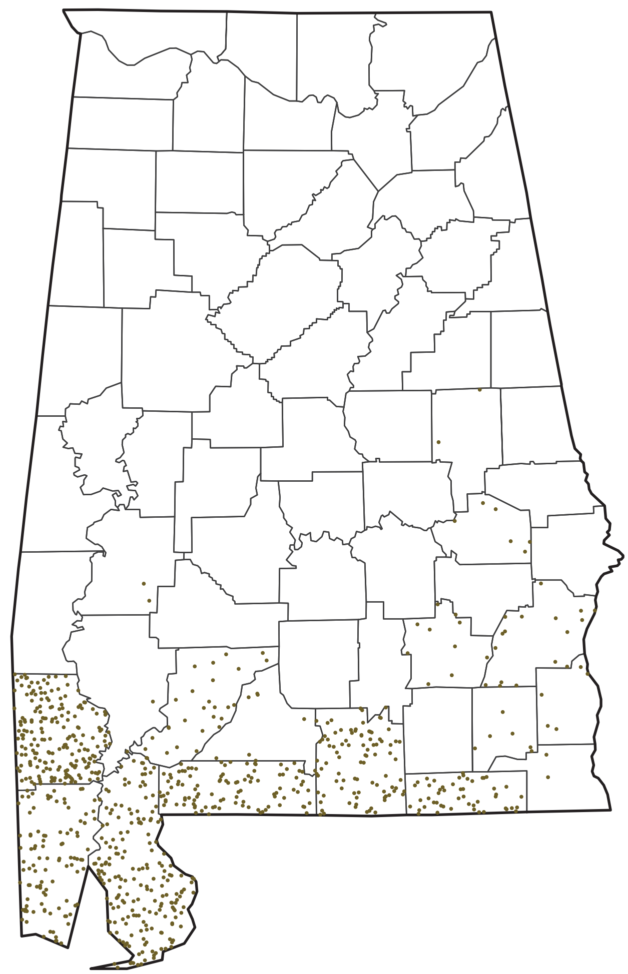


Figure 15—Slash pine volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

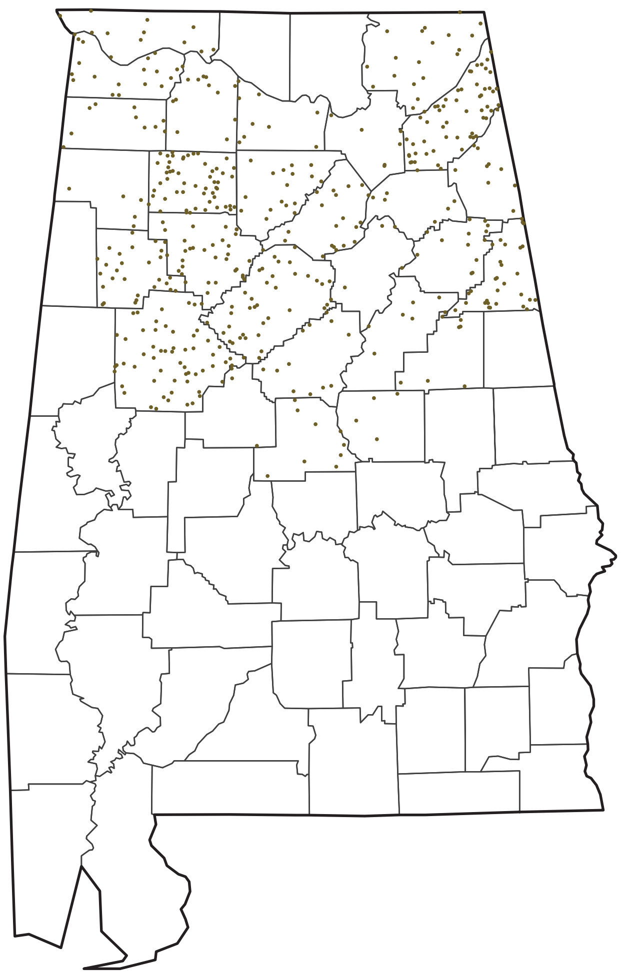


Figure 16—Virginia pine volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

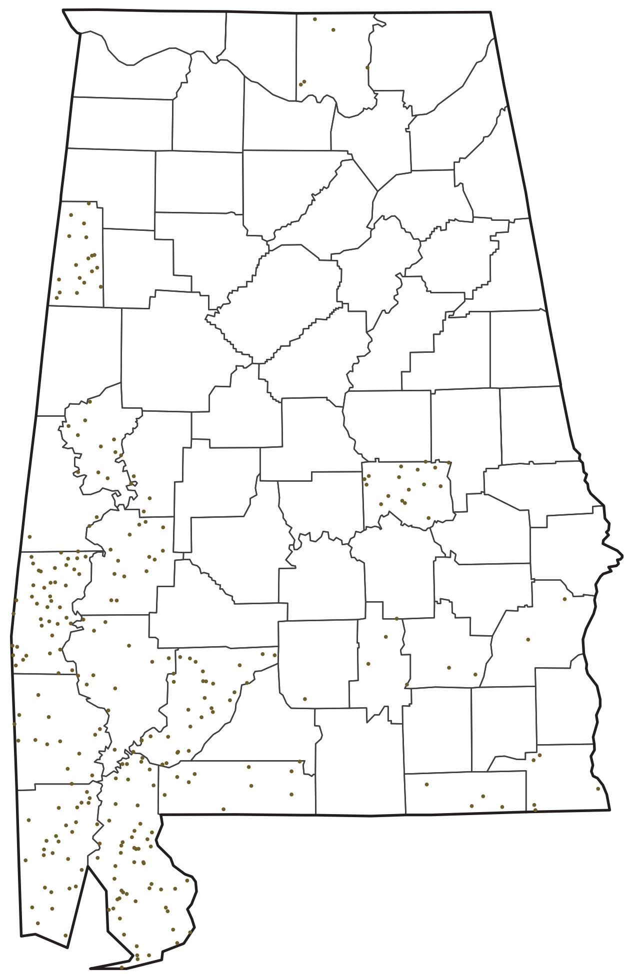


Figure 17—Bald cypress volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

Alabama, while figures 18–27 pertain to the 10 most abundant hardwood species. Blackgum (*Nyssa sylvatica*) and water tupelo (*N. aquatic*) have been combined into a single category, as these two species are so closely related. These 16 species account for 79 percent of the State's entire live tree volume.

Loblolly pine is Alabama's most abundant tree species, and it is distributed fairly evenly across the State. The few exceptions are the northern most counties and the two southern counties, where loblolly is not as concentrated. Likewise, shortleaf pine is found throughout the State, just in lower volumes than loblolly pine.

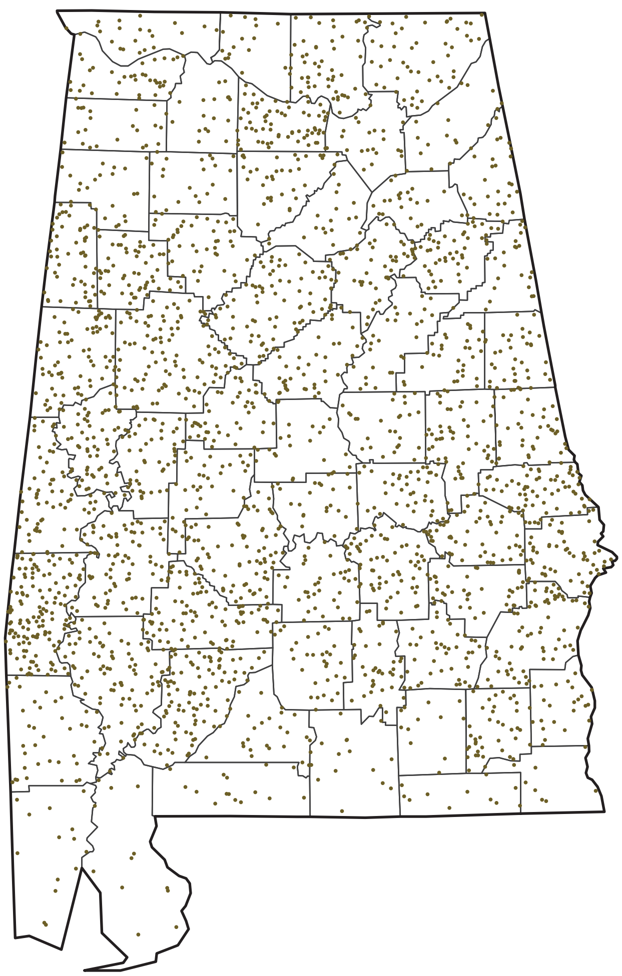


Figure 18—Sweetgum volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

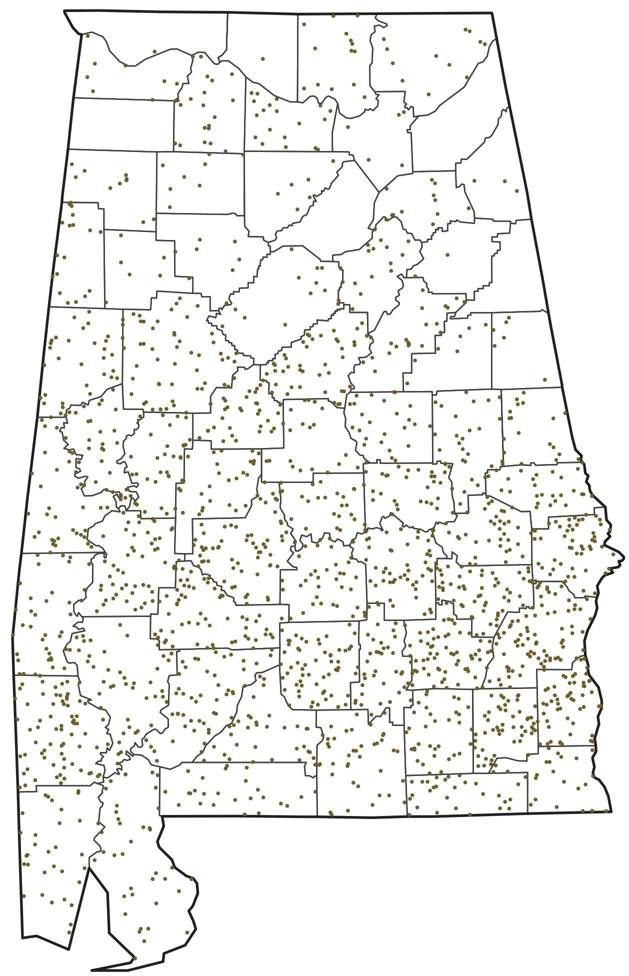


Figure 19—Water oak volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

The other four softwood species display specific affinities for particular regions in Alabama. Slash pine (*P. elliottii*) and cypress prefer the southern portion of the State, along with longleaf pine which is primarily found in the middle portion of the State as well as the southern counties. Conversely, Virginia pine (*P. virginiana*) is more common in the northern counties of Alabama.

The 10 top ranked hardwoods were comprised of five oaks, sweetgum, yellow-poplar, red maple (*Acer rubrum*), blackgum/tupelo, and pignut hickory (*C. glabra*). Sweetgum, yellow-poplar, and southern red oak (*Q. falcata*) can be found throughout the State. Water oak (*Q. nigra*), white oak, and blackgum/tupelo are also distributed across Alabama, but appear to have a slight affinity for the southern portion of

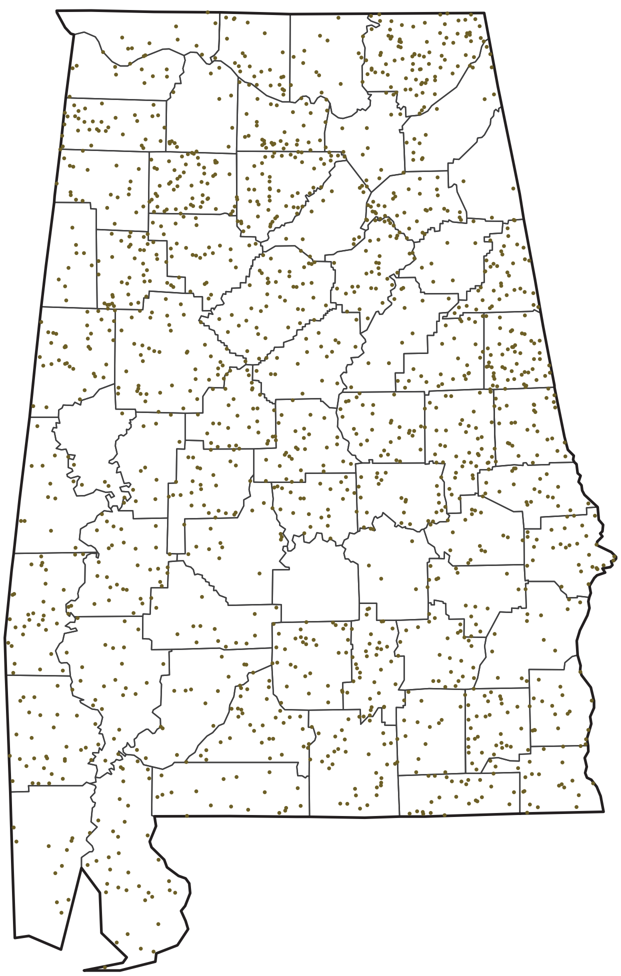


Figure 20—Yellow-poplar volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

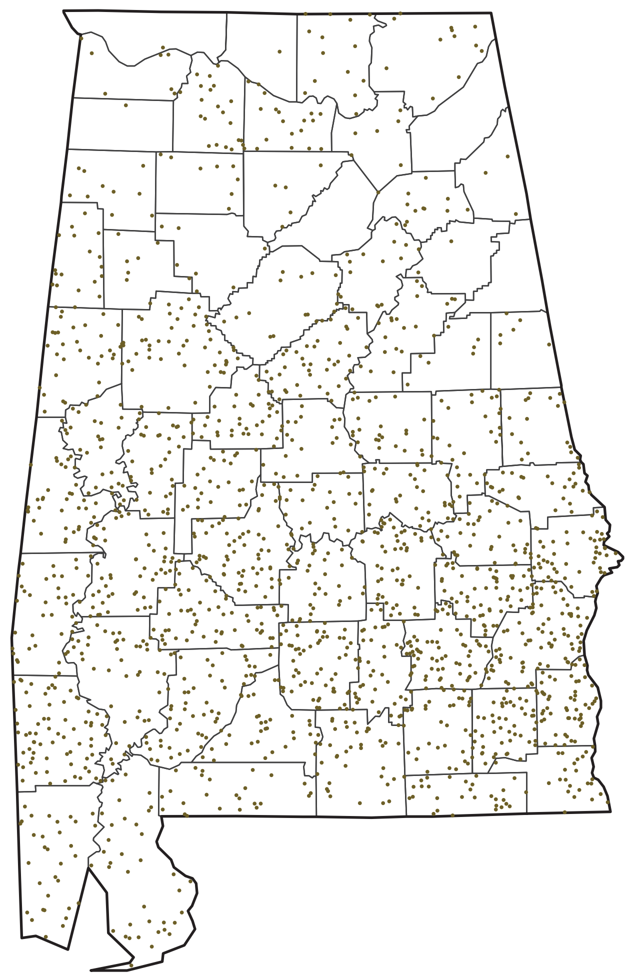


Figure 21—White oak volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

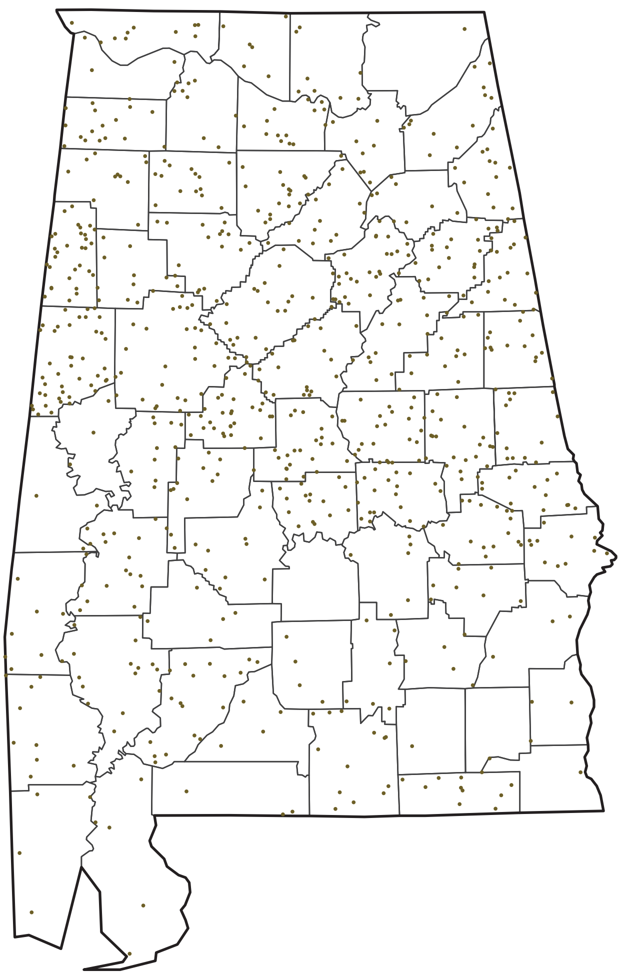


Figure 22—Southern red oak volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

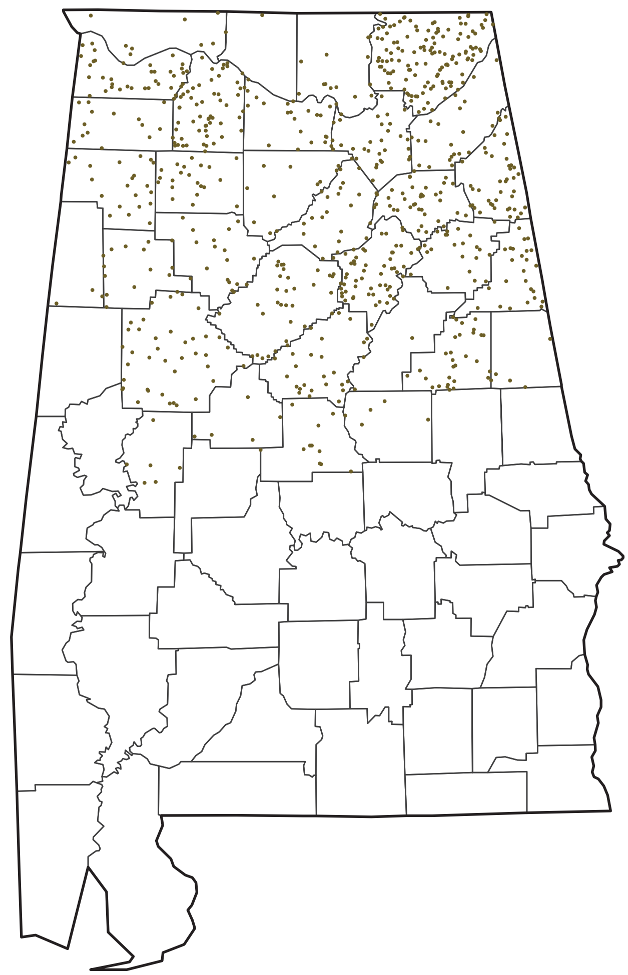


Figure 23—Chestnut oak volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

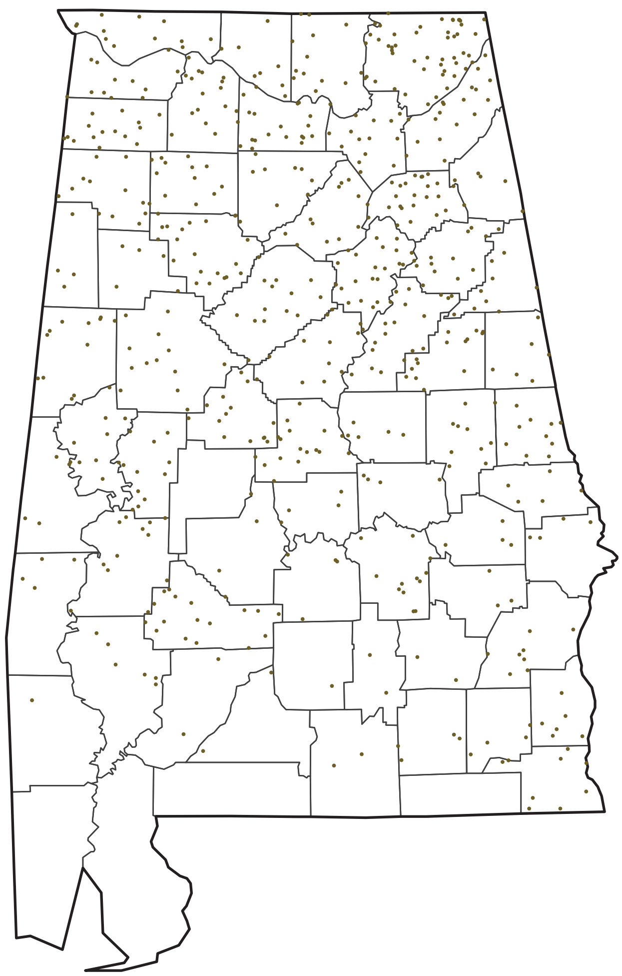


Figure 24—Pignut hickory volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

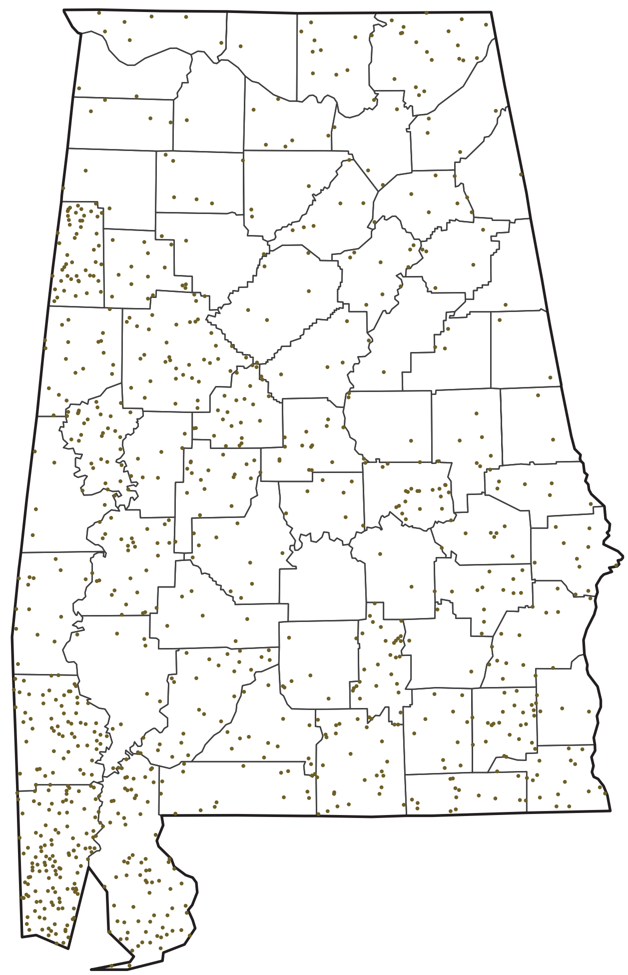


Figure 25—Tupelos and blackgum volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

the State. Conversely, pignut hickory is also found across the State, but has higher concentrations in the northern counties. Only two of the top 10 hardwood species exhibited a strong affinity for a specific portion of the State. These two species are laurel oak (*Q. laurifolia*), which exists in the southern half of the State, and chestnut oak (*Q. prinus*), which occurs only in the northern portion of Alabama.

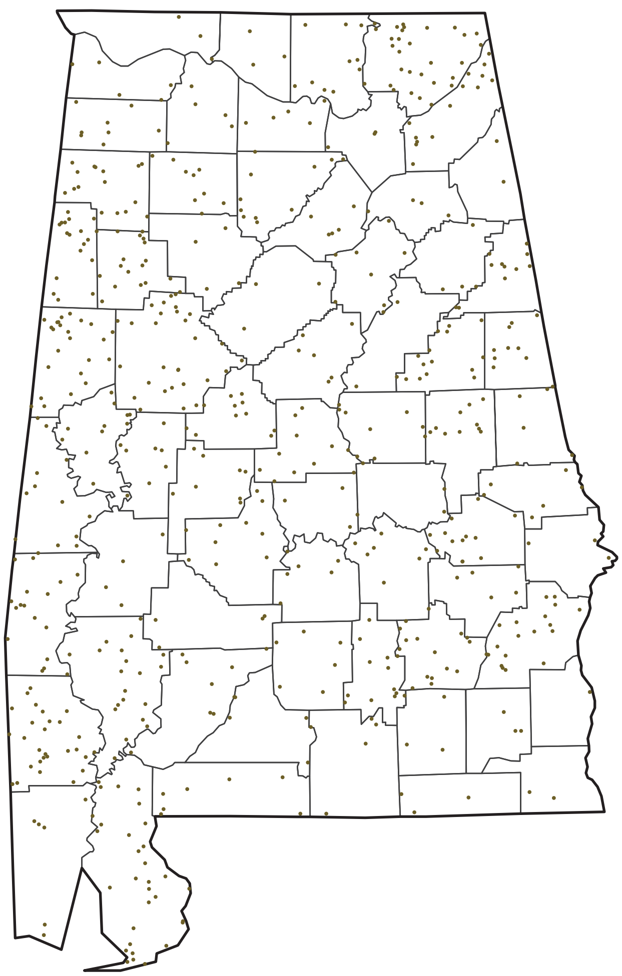


Figure 26—Red maple volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

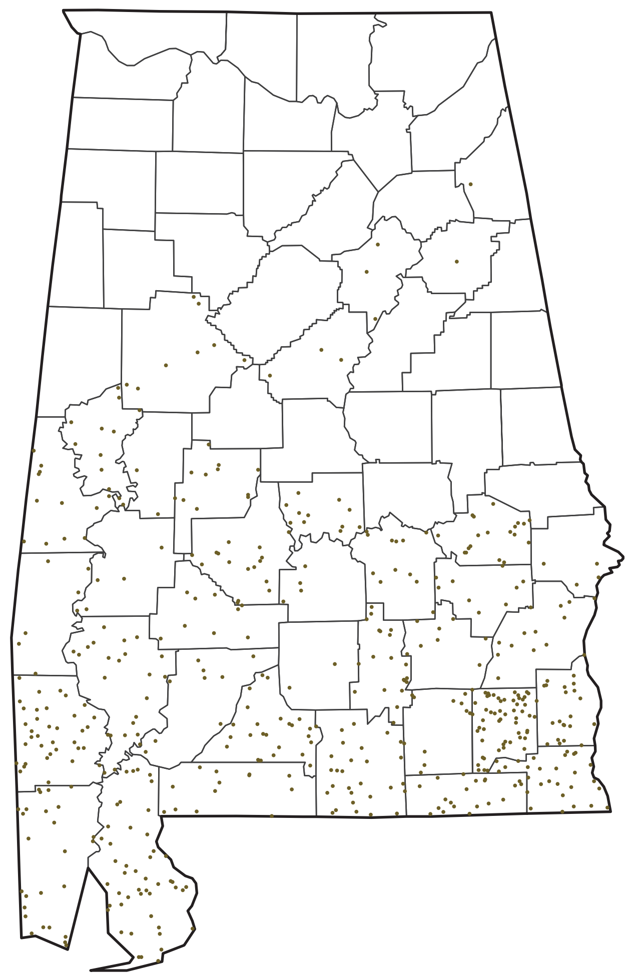


Figure 27—Laurel oak volume, Alabama, 2010. Each dot represents 1 million cubic feet of live-tree volume. See methods section for map methodology.

Growth and Removals

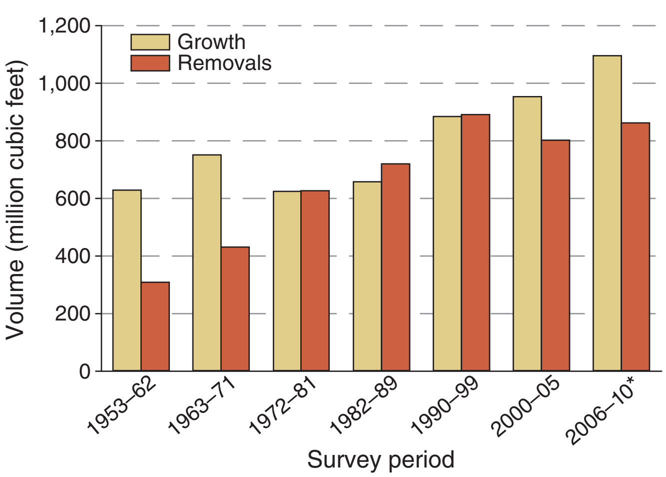
Analysis of Growing Stock

Softwoods—Currently, 1.1 billion cubic feet of softwood volume is produced each year in Alabama, a 15-percent increase in annual volume increment over the prior inventory period. Conversely, 860.4 million cubic feet are removed each year in timber harvest operations, a 7-percent decline from the earlier survey. The 2005 survey marked the first time that average annual growing stock growth-to-removals ratio for softwoods exceeded one in >30 years. While the current estimate of average annual removals is higher than 2005, it is still lower than 2000 (fig. 28).

Alabama is growing 74 percent more softwood volume each year than it grew during the 1953–62 period. Most of this production is due to the establishment of pine plantations. Softwood removals have risen 178 percent over the same timeframe.

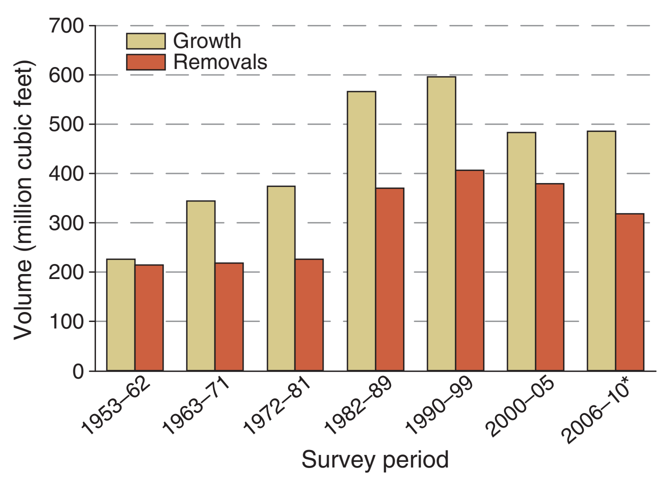
Hardwoods—Alabama's forests have historically produced more hardwood growing stock volume than has been removed. The latest survey results are no different. Presently, 486 million cubic feet of hardwood is grown each year in Alabama, while 319 million cubic feet is removed. Until the 2005 survey, each inventory period reported increases in hardwood growth. Hardwood removals increased with each succeeding survey up to the 2000 survey. The current results show a decrease in annual removals for the last two survey periods (fig. 29). Again, FIA methodology in calculating average annual growth and removals changed for the 2000–05 survey period, making direct comparisons difficult.

The current growth-to-removals ratio for the State's hardwoods is 1.5, indicating that for every cubic foot of hardwood cut, 1.5 cubic feet is grown. This ratio had steadily decreased with each successive inventory between 1972–81 and 2000–05. The current growth-to-removals ratio for Alabama hardwoods has reversed this trend and is as at a 30-year high.



*Seventy-five percent of the data is from the 2006–10 survey, the remaining 25 percent is from the 2001–05 survey. See Appendix A—Inventory Methods for more details.

Figure 28—Average annual net growth and average annual removals of softwood growing-stock trees on timberland by survey period, Alabama.



*Seventy-five percent of the data is from the 2006–10 survey, the remaining 25 percent is from the 2001–05 survey. See Appendix A—Inventory Methods for more details.

Figure 29—Average annual net growth and average annual removals of hardwood growing-stock trees on timberland by survey period, Alabama.

Average annual growth of all-live trees—Between 2006 and 2010, Alabama forests grew at a rate of 1.7 billion cubic feet of all-live trees per year. Softwood growth was nearly twice as much as hardwood growth: 1.1 billion versus 0.58 billion cubic feet per year (table 8). Ninety-two percent of the softwood growth was accounted for by one species group, loblolly and shortleaf pine. The top ranked hardwood species group was other red oaks, which represents 23 percent of the total annual live

Table 8—Average net annual growth and removals of live trees on forest land by species group, Alabama, 2010

Species group	Net growth	Net removals
	million cubic feet	
Softwood		
Longleaf and slash pines	55.7	96.6
Loblolly and shortleaf pines	1,051.6	776.5
Other yellow pines	17.6	24.4
Eastern hemlock	1.3	0.0
Cypress	7.7	2.5
Other eastern softwoods	6.4	1.9
Total softwoods	1,140.4	901.8
Hardwood		
Select white oaks	45.3	26.9
Select red oaks	17.1	7.6
Other white oaks	37.5	16.5
Other red oaks	133.7	112.7
Hickory	29.0	26.8
Yellow birch	0.0	0.0
Hard maple	2.6	1.2
Soft maple	18.6	8.4
Beech	4.5	1.5
Sweetgum	109.2	84.2
Tupelo and blackgum	32.8	15.3
Ash	11.5	5.8
Cottonwood and aspen	2.9	0.0
Basswood	1.2	0.2
Yellow-poplar	76.2	35.6
Black walnut	2.0	0.5
Other eastern soft hardwoods	34.3	21.4
Other eastern hard hardwoods	2.4	4.6
Eastern noncommercial hardwoods	18.6	10.0
Total hardwoods	579.4	379.2
All species	1,719.7	1,281.0

Numbers in rows and columns may not sum to totals due to rounding.

0.0 = no sample for the cell or a value of >0.0 but <0.05.

A Morbark sheer in loblolly pine stand. (photo by James H. Miller, USDA Forest Service, Bugwood.org)

hardwood growth, followed by sweetgum and yellow-poplar. These three hardwood species account for >55 percent of all hardwood growth in the State.

As loblolly and shortleaf pine, other red oaks, and sweetgum account for the most growth amongst species groups, one would expect that forest types that contain these species would have the most annual growth. This proves to be true as the 970 million cubic feet of live growth occurs on the loblolly-shortleaf forest type, 56 percent of all growth (table 9). Oak-hickory and oak-pine are the next two largest types in terms of average annual growth.

The majority of annual live tree growth in Alabama occurs on NIPF. Seventy-eight percent of softwood growth and 87 percent of hardwood growth occurs on NIPF lands (table 10). NIPF accounts for >81 percent of all-live growth across the State. Forest industry ranks second amongst the ownership groups. Industry controlled lands grew 259 million cubic feet of live trees per year between 2006 and 2010.

Average annual removals of all-live trees—Total all-live removals in Alabama were 1.3 billion cubic feet per year. Almost 902 million cubic feet per year was in softwood species, while the remaining 379 million cubic feet per year was in hardwood species. Loblolly and shortleaf pine were the highest ranked species, followed by other red oaks and sweetgum (table 8).

Table 9—Average net annual growth and removals of live trees on forest land by forest-type group, Alabama, 2010

Forest-type group	Net growth			Net removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	million cubic feet					
Softwood type						
White-red-jack pine	0.3	0.1	0.2	0.0	0.0	0.0
Longleaf-slash pine	60.1	53.0	7.1	77.1	72.7	4.4
Loblolly-shortleaf pine	969.8	888.3	81.5	763.7	705.6	58.1
Other eastern softwoods	1.8	1.5	0.3	0.1	0.1	0.0
Total softwoods	1,032.0	942.9	89.1	840.9	778.5	62.4
Hardwod type						
Oak-pine	195.4	119.2	76.2	152.0	87.8	64.2
Oak-hickory	355.6	60.4	295.2	195.7	28.1	167.6
Oak-gum-cypress	96.6	15.7	80.9	77.4	6.3	71.1
Elm-ash-cottonwood	32.0	-0.7	32.7	13.0	1.2	11.8
Maple-beech-birch	1.6	0.6	1.0	0.0	0.0	0.0
Other hardwoods	2.3	0.2	2.1	0.3	0.0	0.3
Exotic hardwood	0.5	0.1	0.4	1.3	0.0	1.3
Total hardwoods	684.0	195.6	488.5	439.7	123.2	316.5
Nonstocked	3.7	1.9	1.8	0.3	0.2	0.1
All groups	1,719.7	1,140.4	579.4	1,281.0	901.8	379.2

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table 10—Average net annual growth and removals of live trees on forest land by ownership class and major species group, Alabama, 2010

Ownership class	Net growth			Net removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	million cubic feet					
National forest	30.4	10.7	19.7	3.6	3.1	0.5
Other public	31.6	12.4	19.2	13.7	9.9	3.8
Forest industry	258.9	223.8	35.1	225.5	190.8	34.7
NIPF	1,398.9	893.5	505.3	1,038.1	698.0	340.1
Total	1,719.7	1,140.4	579.4	1,281.0	901.8	379.2

NIPF = nonindustrial private forest.
Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Softwood removals occur across the State, but the highest concentrations occur in the southwest portion of the State (fig. 30). Hardwood removals exhibit a similar pattern; however, it is not as strong as in softwoods (fig. 31).

Just as with average annual growth, the forest types with the highest amount of removals were those that had the three highest removed species groups in them. An average of 764 million cubic feet per year were removed from loblolly-shortleaf forests, followed by oak-hickory and oak-pine with 196 and 152 million cubic feet, respectively, removed yearly (table 9).

The NIPF ownership group accounted for 81 percent of all annual removals. Ninety percent of all hardwood harvested between 2006 and 2010 came from NIPF lands. Forest industry removals account for 18 percent of all removals in Alabama. Only 1.4 percent of all statewide removals occurred on publically owned forests (table 10).

Annual growth-to-removals ratios—Average annual growth exceeds removals for all but three species groups. Removals of longleaf and slash pines, 96.6 million cubic feet per year, are 1.73 times higher than annual growth (table 8). Longleaf pine has been in decline for decades across the

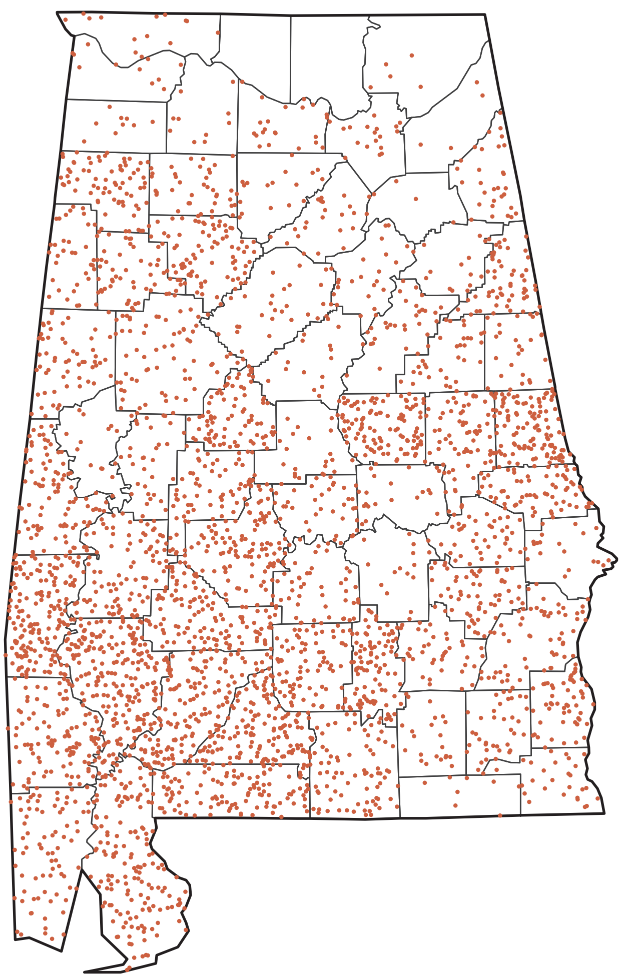


Figure 30—Softwood removals volume, Alabama, 2010. Each dot represents 250,000 cubic feet of softwood live-tree volume removed each year on forest land. See methods section for map methodology.

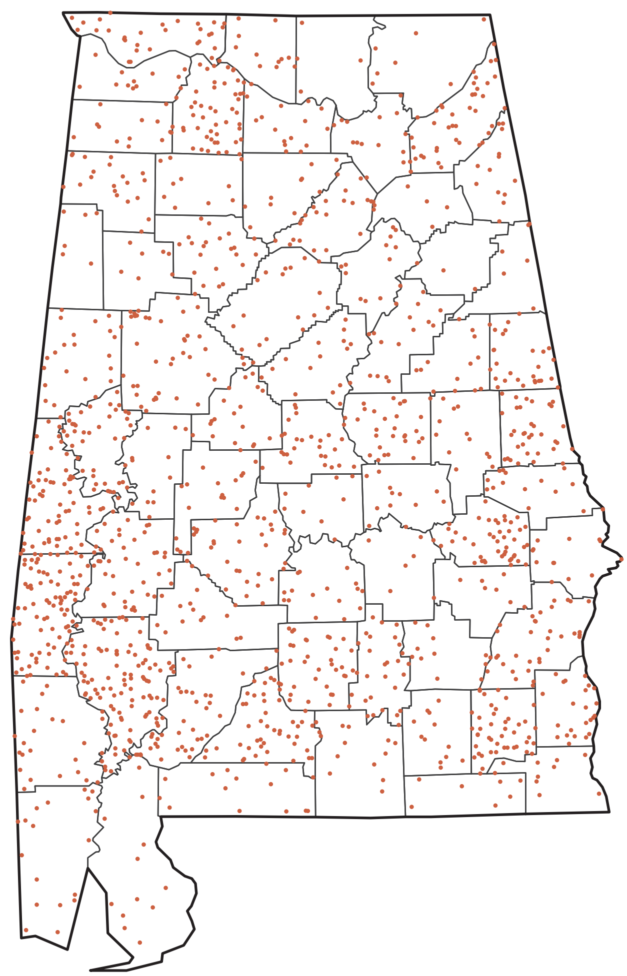


Figure 31—Hardwood removals volume, Alabama, 2010. Each dot represents 250,000 cubic feet of hardwood live-tree volume removed each year on forest land. See methods section for map methodology.

South, and a primary cause for this decline is the replacement of other tree species in lieu of regenerating harvested stands back to longleaf. These numbers indicate that this is continuing to occur in Alabama. Other yellow pines and other eastern hard hardwoods are the other two species groups where annual removals exceed growth.

Twenty counties had removals exceeding growth of softwood species (fig. 32). Most of these counties were in the southwest region of the State. This is an increase from the previous survey period when only two counties had growth-to-removals ratios less than one. Seven of these counties have a growth-to-removals ratio >0.9, which is close to unitary (one-to-one). The county with the lowest growth-to-removals ratio, Marshall, contains very little softwood volume and therefore it is very sensitive to any change in average annual removals. This is also the case for Lauderdale and Morgan Counties. The softwood growth-to-removals ratios for these counties are based on a small amount of softwood volume within the counties and therefore subject to large fluctuations.

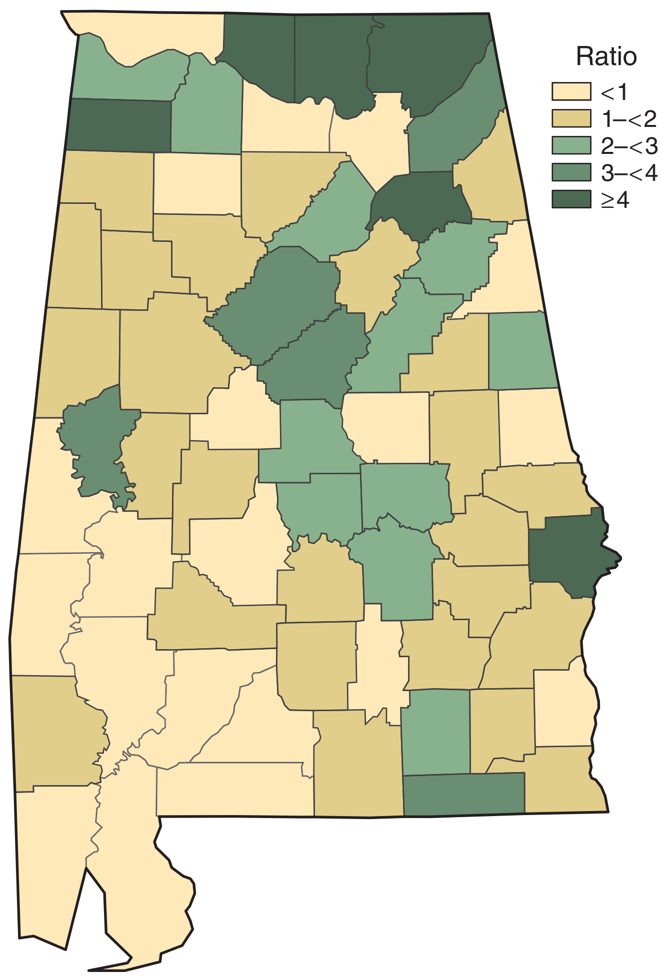


Figure 32—All-live softwood growth-to-removals ratio on forest land, Alabama, 2010.

The counties with the highest growth-to-removals ratios were in the northern portion of the State, where average annual removals of softwood species are low. In fact, no softwood removals occurred in Madison and Limestone Counties. Therefore, their corresponding growth-to-removals rations are exceedingly high.

Average annual live hardwood removals exceeded growth in 14 Alabama counties between 2006 and 2010 (fig. 33). Two of these counties had ratios ≥0.9, and thus close to unity. Escambia County had the lowest ratio, followed by Monroe and Choctaw Counties. The counties with the largest growth-to-removals ratios were Montgomery, Jackson, Madison, and Calhoun Counties. Like with softwoods, there is a trend with hardwood growth-to-removals ratios where the lowest ranked counties occur in the southwest and the highest are in the northeast.

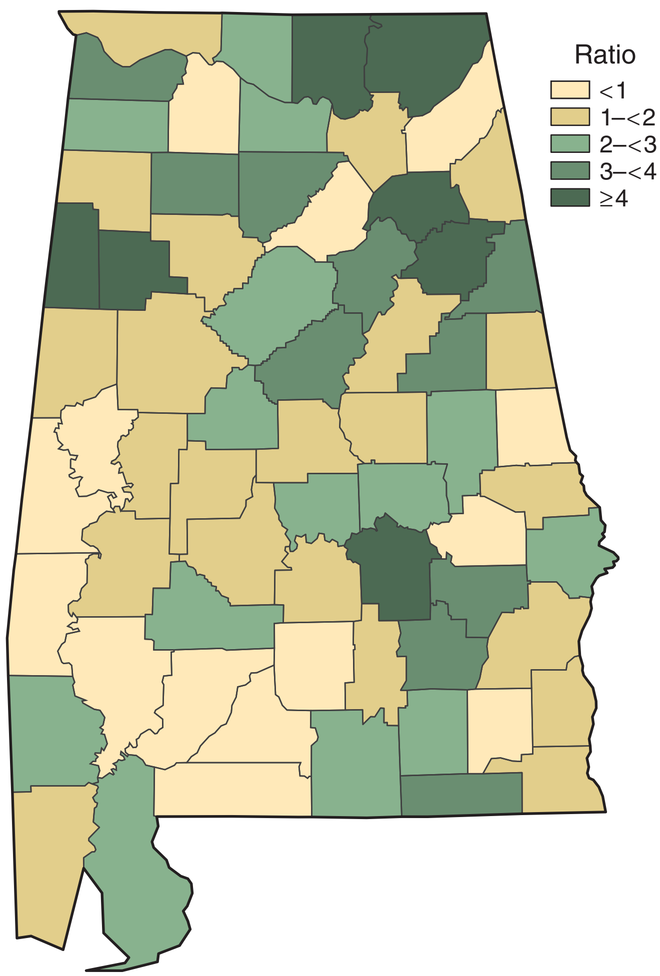


Figure 33—All-live hardwood growth-to-removals ratio on forest land, Alabama, 2010.

This 35-year old loblolly pine stand in Chambers County is typical of many of the planted stands in Alabama. (photo by David Stephens, Bugwood.org)

Plantations

Stands classified as plantations currently account for >30 percent of Alabama's forest area (fig. 3). The long-term consequences of southern pine plantation forestry are a topic of debate among environmentalists, industrialists, academics, and professional land managers. FIA data can be used to quantify the impacts and benefits that this type of forest management has on the State's natural resources.

How productive are Alabama's southern pine plantations? While southern-yellow pine plantations occupy only 26 percent of the forest area of the State (fig. 4), they contain 42 percent of the State's all-live softwood volume. Moreover, plantations account for 68 percent of the annual growth and 63 percent of the annual removals of softwood species. Thus, plantations increase the efficiency of timber production statewide (table 11).

Species diversity is lower in planted stands than in natural pine stands, so replacement of natural pine stands by planted stands is a subject of environmental concern. Loblolly pine is the predominant species in planted stands, accounting for 86.5 percent of the all-live volume in planted stands. Ninety-four percent of the softwood volume in plantations can be attributed to this one species.

Conversely, 68 percent of the all-live volume in natural stands is from hardwood species. Natural stands account for 97 percent of the State's hardwood volume and 91 percent of the average annual hardwood growth. Other red oaks represent the largest species group in this category, representing 22 percent of the total hardwood volume in natural stands. Sweetgum is second at 15 percent.

These stands are not dominated by deciduous trees alone. Fifty-six percent of the State's softwood volume is found in natural stands. Almost all of the shortleaf and longleaf pine stands occur in these forests, as well as hemlock, cypress, and other softwood species.

Plantations may be more efficient at growing pines, particularly loblolly, but are they more vulnerable to disease and pests? In fact, plantation management is very effective in reducing tree mortality. Annual mortality-to-volume ratios for both management regimes are low, but the mortality-to-volume ratio for loblolly pine in plantations is 0.008, compared to 0.02 in natural stands.

Another topic of heated discussion is the contrast between diameter distributions in natural stands and in plantations. In planted stands, all-live softwood volume peaks in the 8-inch class, at >1.9 billion cubic feet, and declines sharply thereafter. Seventy percent of the all-live softwood volume in planted stands is in the 6-, 8-, and 10-inch diameter classes. Only 14.2 percent of the total softwood volume in plantations is in the ≥14-inch classes. No softwood trees in classes ≥26-inches were recorded in planted stands during the 2010 survey period (fig. 34).

All-live softwood volume in natural stands is more broadly distributed across diameter classes and peaks around 1.4 billion cubic feet in the 14-inch diameter class. Fifty-six percent of the live softwood volume in natural stands occurs in the ≥14-inch classes. This is quite a contrast with the 14.2 percent for planted stands.

As described earlier, almost all of Alabama's hardwood trees are found in natural stands. Therefore, comparing hardwood volume in plantations with that in natural stands may be unnecessary. Volume peaks around the 12-inch class. Fifty-three percent of hardwood volume occurs in ≥14-inch classes (fig. 35).

Table 11—Standing volume, average annual growth, removals, and mortality of all-live trees on forest land by species group and stand origin, Alabama, 2010

	Natural				Planted			
Species group	Volume	Growth	Removals	Mortality	Volume	Growth	Removals	Mortality
				million cubic feet				
Softwood								
Shortleaf pine	833.5	15.3	36.0	20.9	34.3	4.3	28.3	1.0
Slash pine	572.8	13.7	25.5	12.5	249.7	20.8	29.7	2.9
Longleaf pine	829.8	15.8	24.9	11.6	45.0	5.2	13.8	0.3
Loblolly pine	5,209.5	286.4	227.8	77.3	6,421.5	743.1	463.6	52.9
Other yellow pines	641.6	13.4	8.5	18.7	29.6	3.6	10.5	1.1
Eastern hemlock	34.5	1.3	0.0	0.0	—	—	—	—
Cypress	305.4	7.6	2.5	1.2	3.2	0.1	0.0	0.0
Other eastern softwoods	186.7	5.8	1.0	3.0	14.4	0.6	0.5	0.3
Total	8,613.8	359.3	326.2	145.2	6,797.7	777.7	546.4	58.5
Hardwood								
Select white oaks	1,475.4	43.3	16.5	11.9	39.1	2.0	9.1	0.8
Select red oaks	654.0	16.3	5.2	7.2	9.6	0.9	2.4	0.1
Other white oaks	1,309.9	36.5	11.0	7.2	19.8	1.0	3.9	0.4
Other red oaks	3,953.2	122.5	69.6	67.7	143.5	10.7	36.9	2.9
Hickory	1,403.1	26.7	14.7	14.0	42.9	2.1	7.2	0.1
Yellow birch	—	0.0	0.0	0.0	—	—	—	—
Hard maple	101.0	2.4	0.6	0.6	0.7	0.1	0.6	0.0
Soft maple	607.1	17.1	5.2	10.2	23.5	1.5	2.5	0.5
Beech	234.6	4.3	1.1	2.7	3.0	0.2	0.4	0.0
Sweetgum	2,669.6	93.1	48.6	20.9	142.1	15.6	30.0	1.3
Tupelo and blackgum	1,380.1	31.7	7.3	7.4	14.7	1.0	6.9	0.1
Ash	421.0	10.8	4.7	4.7	8.5	0.6	0.5	0.1
Cottonwood and aspen	44.0	2.8	0.0	0.2	0.8	0.1	0.0	0.0
Basswood	69.42	1.2	0.2	0.6	—	-0.0	0.0	0.0
Yellow-poplar	1,647.6	67.1	20.0	13.2	94.1	8.5	13.0	0.7
Black walnut	32.3	1.9	0.0	0.1	1.9	0.1	0.5	0.0
Other eastern soft hardwoods	1,050.6	29.7	13.2	22.6	50.9	4.3	5.7	0.8
Other eastern hard hardwoods	169.0	1.8	2.6	5.6	7.1	0.6	1.9	0.1
Eastern noncommercial hardwoods	821.7	18.0	6.3	16.7	21.9	0.4	2.1	1.2
Total	18,043.7	527.2	226.8	213.1	624.1	49.5	123.4	9.0
Total	26,657.5	886.5	552.9	358.4	7,421.9	827.2	669.8	67.5

Numbers in columns may not sum to totals due to rounding.

— = negligible; 0.0 = no sample for the cell or a value of >0.0 but <0.05.

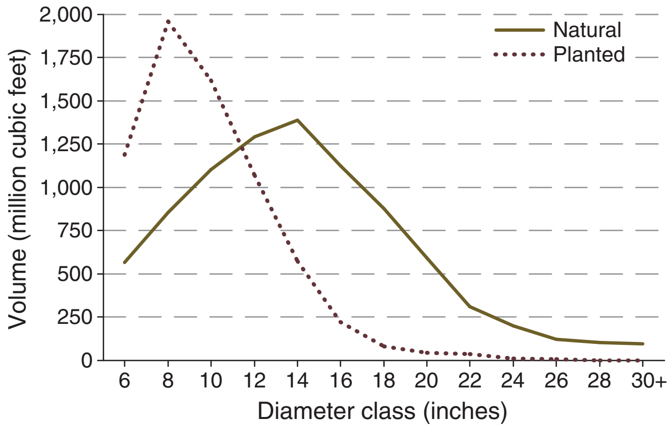


Figure 34—Volume of all-live softwoods on forest land by diameter class and stand origin, Alabama, 2010.

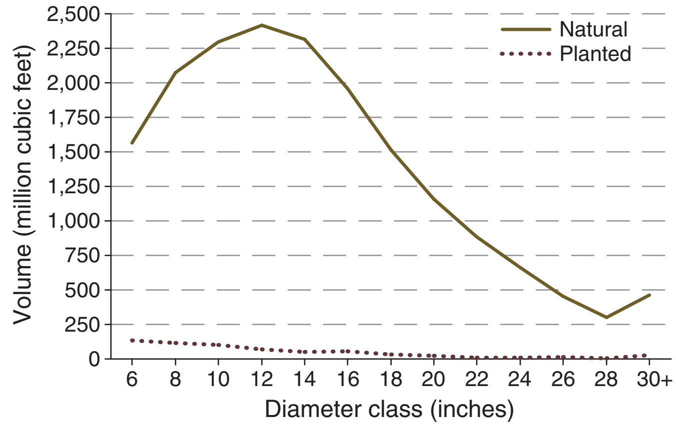


Figure 35—Volume of all-live hardwoods on forest land by diameter class and stand origin, Alabama, 2010.

Prescribed fire is a tool used to control fuel loads and understory vegetation in southern pine plantations. (photo by David Stephens, Bugwood.org)

Planted stands first appeared in a significant amount in 1972. While they were found across the State, the highest densities occurred in the southwestern portion of the State (fig. 36). This pattern holds true today; however, the concentration has increased dramatically over the last 40 years (fig. 37).

Planted stands in Alabama are composed almost entirely of loblolly pine. These plantations contain and produce more volume than natural stands, and have a lower mortality-to-volume ratio. Natural stands tend to have a greater variety of species, especially hardwoods, and have a greater proportion of their trees in larger diameter classes.

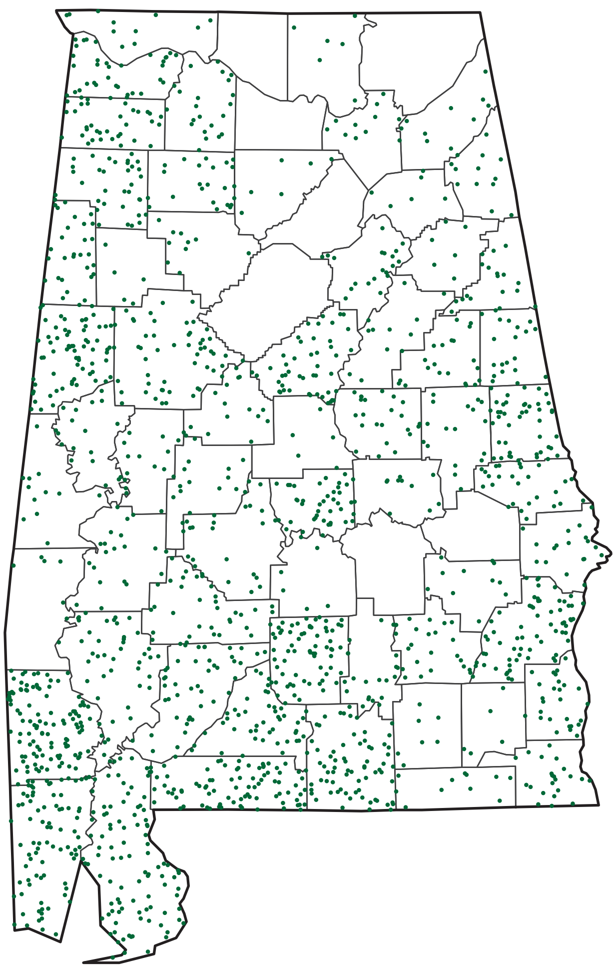


Figure 36—Plantation area, Alabama, 1972. Each dot represents 1,000 acres of planted stands. See methods section for map methodology.

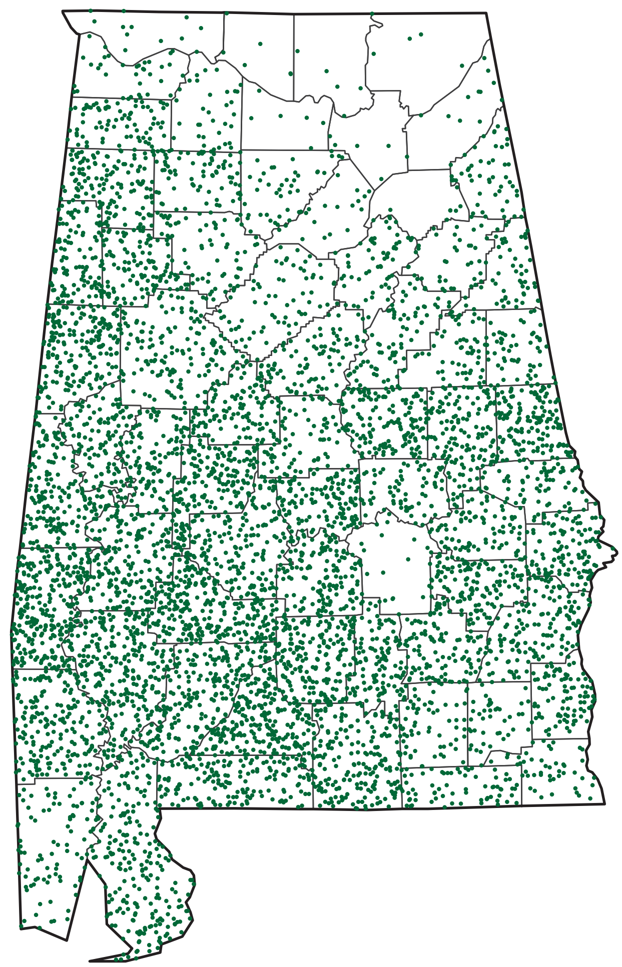


Figure 37—Plantation area, Alabama, 2010. Each dot represents 1,000 acres of planted stands. See methods section for map methodology.

Timber Product Output

Timber Products

A diverse forest products industry in Alabama is made-up by a variety of mills, ranging from small- to large-sized softwood and hardwood sawmills, pole, and post mills to the very large pulp mills. In 2005, there were 145 primary wood using mills with a loss of one mill in 2007. However, in 2009, the total declined to 120 sawmills, pulpwood mills, and other primary wood-processing plants distributed across the State.

This section presents estimates from industry surveys conducted in 2005, 2007, and 2009 used to determine the output for timber products and plant byproducts (Bentley and others 2008, Schiller and Hendricks 2009; Bentley and others 2011). Data used for this section was compiled from the timber product output (TPO) database and can be found at: http://srsfia2.fs.fed.us (U.S. Department of Agriculture Forest Service 2010).

Estimates of TPO and plant residues were obtained from canvasses (questionnaires) sent to all primary wood-using mills in the State. The canvasses are used to determine the types and amount of roundwood or timber (i.e., saw logs, pulpwood, plywood and veneer, poles, etc.) received by each mill, the county of origin, the species used, and how the mills disposed of the bark and wood residues produced. The canvasses were conducted every 2 years by personnel from the SRS and the Alabama Forestry Commission. These data are used to augment the FIA annual inventory of all-live timber removals by giving some idea of the proportions that are used for timber products. Individual TPO studies, or industry surveys, are necessary to track trends and capture changes in product output levels.

In 2005, volume harvested and delivered for products (including residential fuelwood) from all sources totaled 1.2 billion cubic feet (41.6 million green tons) (table 12.). Output volumes slightly declined in 2007 to 1.1 billion cubic feet (40.1 million green tons) and further declined in 2009 to 835.9 million cubic feet (29.9 million green tons). Volume harvested for softwood products in 2005 totaled 881.7 million cubic feet (30.8 million green tons) and accounted for 76 percent of the total product volume, while the volume decreased in 2007 to 830.7 million cubic feet (29.1 million green tons). In 2009, there was again a decline from the 2007 output softwood volume totals to 601.3 million cubic feet (21.0 million green tons). Hardwood output volume followed a different trend showing an increase in output from 283.1 million cubic feet (10.8 million green tons) in 2005 to 291.0 million cubic feet (11.1 million green tons) in 2007, with a decline to 234.5 million cubic feet (8.9 million green tons) in 2009.

The total number of sawmills remained stable at 93 from 2005 to 2007 and decreased to 78 in 2009. Saw-log output decreased from 425.3 million cubic feet in 2005 to 413.0 million cubic feet in 2007 with the largest decrease, 45 percent, from 2007 totals to 228.3 million cubic feet in 2009. At 187.9 million cubic feet (6.6 million green tons) softwoods accounted for 82 percent of saw-log output volume while hardwood output volume totaled 40.4 million cubic feet (1.5 million green tons) in 2009.

Table 12—Output of industrial roundwood products by product, species group, and year, Alabama

Product and species group	2005	2007	2009	2005	2007	2009
	- - - - - - - thousand cubic feet - - - - - -			*- - - - - - - - - - - - green tons - - - - - - - - - - - -*		
Saw logs						
Softwood	371,660	354,977	187,930	13,001,938	12,418,310	6,574,026
Hardwood	53,636	58,030	40,352	2,038,903	2,205,935	1,533,481
Total	425,296	413,007	228,282	15,040,841	14,624,245	8,107,508
Veneer logs						
Softwood	74,444	60,069	21,166	2,604,306	2,101,419	740,413
Hardwood	18,824	15,100	7,861	715,570	574,007	298,739
Total	93,268	75,169	29,027	3,319,876	2,675,426	1,039,152
Pulpwood						
Softwood	372,736	374,966	360,279	13,039,580	13,117,593	12,603,010
Hardwood	190,046	199,131	154,809	7,224,352	7,569,707	5,883,146
Total	562,782	574,097	515,088	20,263,933	20,687,300	18,486,156
Other industrial[a]						
Softwood	59,868	38,083	27,638	2,094,387	1,332,274	966,812
Hardwood	1,569	1,710	3,282	59,644	65,003	124,725
Total	61,437	39,793	30,920	2,154,031	1,397,278	1,091,537
Total industrial						
Softwood	878,708	828,095	597,013	30,740,211	28,969,595	20,884,261
Hardwood	264,075	273,971	206,304	10,038,469	10,414,653	7,840,090
Total	1,142,783	1,102,066	803,317	40,778,680	39,384,248	28,724,352
Residential fuelwood						
Softwood	2,973	2,617	4,329	104,006	91,552	151,434
Hardwood	19,062	17,069	28,238	724,617	648,856	1,073,118
Total	22,035	19,686	32,567	828,623	740,408	1,224,552
Total						
Softwood	881,681	830,712	601,342	30,844,217	29,061,147	21,035,695
Hardwood	283,137	291,040	234,542	10,763,086	11,063,509	8,913,208
Total	1,164,818	1,121,752	835,884	41,607,303	40,124,656	29,948,904

Numbers in columns may not add to totals due to rounding.

[a] Includes poles, posts, and composite panels.

Pulpwood production in 2005 totaled 562.8 million cubic feet (20.3 million green tons) increasing 2 percent to 574.1 million cubic feet (20.7 million green tons) in 2007 and declined 10 percent in 2009 to 515.1 million cubic feet (18.5 million green tons). During the 2005, 2007, and 2009 surveys, pulpwood was the leading product produced in the State. The 13 pulpmills in the 2009 survey accounted for 62 percent of the 835.9 million cubic feet total product output. In 2005, softwood pulpwood production totaled 372.7 million cubic feet (13.0 million green tons) with an increase of 1 percent in 2007 to 375.0 million cubic feet (13.1 million green tons). However in 2009, softwood pulpwood production decreased 4 percent to 360.3 million cubic feet (12.6 million green tons) or 70 percent of the total pulpwood volume produced. Hardwood pulpwood production in 2005 totaled 190.0 million cubic feet (7.2 million green tons) with an increase shown in 2007 to 199.1 million cubic feet (7.6 million green tons). Hardwood pulpwood production decreased 22 percent from 2007 to 154.8 million cubic feet in 2009.

Volume harvested for veneer products in 2005 totaled 93.3 million cubic feet (3.3 million green tons) with a decline of 19 percent in 2007 to 75.2 million cubic feet (2.7 million green tons). In 2009, volume harvested for veneer dropped 61 percent from 2007 totals to 29.0 million cubic feet (1.0 million green tons) and only accounted for 3 percent of total products for the State. Veneer output showed the largest decline for the period of 2007–09.

Volume harvested for other industrial products such as poles, posts, composite panels, and mulch in 2005 totaled 61.4 million cubic feet (2.2 million green tons), or 5 percent of the State's total product output. In 2007, other industrial products volume declined 35 percent to 39.8 million cubic feet (1.4 million green tons) and decreased another 22 percent in 2009 to 30.9 million cubic feet (1.1 million green tons). Softwood accounted for the majority of volume in 2005 and 2007, while it represented 89 percent of the volume harvested for other industrial products which totaled 27.6 million cubic feet (966,800 green tons) occurring in 2009.

Volume used for residential fuelwood totaled 22.0 million cubic feet (828,600 green tons) and accounted for nearly 2 percent of total product output in 2005. During 2007 residential fuelwood saw a slight decline to 19.7 million cubic feet (740,400 green tons) and increased 65 percent to 32.6 million cubic feet (1.2 million green tons) in 2009. At 28.2 million cubic feet (1.1 million green tons), hardwoods accounted for 87 percent of the 2009 residential fuelwood production. Of all production, residential fuelwood was the only product that showed an increase from the period of 2007–09 and an overall increase of 48 percent from 2005 through 2009.

Mill Residue

Mill or plant residues are defined as wood material generated in the production of timber products from roundwood at primary manufacturing plants. This material falls into three main categories:

1. coarse residues, or material, such as slabs, edgings, trim, veneer cores and ends, which is suitable for chipping,
2. fine residues, or material, such as saw-dust, shavings, and veneer residue, which is not suitable for chipping, and
3. bark which is used mainly for industrial fuel.

For many years, most mill residue produced in Alabama has been utilized either for primary products such as pulp or in secondary products such as mulch and animal bedding, or as fuel at wood product mills.

A drive-to-tree feller-buncher felling trees in a loblolly pine plantation. (photo by Jacob Sprinkle, USDA Forest Service, Bugwood.org)

Table 13 depicts the disposal of mill residue or how it was utilized. Data on mill residue production and disposal generated from the 2005, 2007, and 2009 forest industry surveys indicated 431.8 million cubic feet of wood and bark residue was generated from primary processors in 2005. This total declined 12 percent since 2005 to 379.1 million cubic feet in 2007 with a sharp decline of 43 percent to 216.8 million cubic feet in 2009. The most recent survey in 2009 showed sawmills generated the majority of the mill residue produced totaling 136.9 million cubic feet. In 2005 bark accounted for 143.7 million cubic feet (33 percent), coarse residues accounted for 161.4 million cubic feet (37 percent), and sawdust and shavings accounted for 126.7 million cubic feet (29 percent) of mill residue produced. Mill residue decreased to 134.4 million cubic feet for bark, 134.6 million cubic feet for coarse residues, 82.0 million cubic feet for sawdust, and 28.0 million cubic feet for shavings in 2007. Residue totals showed the largest decline, 43 percent, for all residue types for the period of 2007 through 2009. During that time, sawdust residue decreased 49 percent, down from 82.0 million cubic feet to 42.1 million cubic feet. Overall, roundwood residue declined 50 percent from the 2005 total of 431.8 million cubic feet to 216.8 million cubic feet in 2009.

In 2005 nearly 229.9 million cubic feet, or 53 percent, of mill residue produced was used for industrial fuel either at pulpmills for boiler fuel or at sawmills for dry kiln operations (table 14.). From 2005 to 2007, this total decreased 7 percent to 213.0

Table 13—Primary mill residue volume by roundwood type, species group, residue type, and year, Alabama

Roundwood type and species group	All types			Bark			Coarse			Sawdust			Shavings		
	2005	2007	2009	2005	2007	2009	2005	2007	2009	2005	2007	2009	2005	2007	2009
	thousand cubic feet														
Saw logs															
Softwood	239,478	199,778	114,640	35,081	30,079	16,923	112,767	92,021	53,950	58,382	50,055	28,163	33,248	27,623	15,604
Hardwood	29,677	33,857	22,305	6,189	6,866	4,313	11,755	13,969	9,875	11,365	12,608	7,920	368	414	197
Total	269,155	233,635	136,945	41,270	36,945	21,236	124,522	105,990	63,825	69,747	62,663	36,083	33,616	28,037	15,801
Veneer logs															
Softwood	46,512	38,038	9,204	6,458	5,466	1,374	22,455	17,675	4,084	17,599	14,897	3,746	0	0	0
Hardwood	12,348	9,638	5,408	2,147	1,697	897	4,652	3,555	2,195	5,549	4,386	2,316	0	0	0
Total	58,860	47,676	14,612	8,605	7,163	2,271	27,107	21,230	6,279	23,148	19,283	6,062	0	0	0
Pulpwood															
Softwood	34,011	37,265	37,124	34,011	37,265	37,124	0	0	0	0	0	0	0	0	0
Hardwood	32,693	33,214	25,074	32,693	33,214	25,074	0	0	0	0	0	0	0	0	0
Total	66,704	70,479	62,198	66,704	70,479	62,198	0	0	0	0	0	0	0	0	0
Other industrial[a]															
Softwood	36,704	26,920	2,974	26,829	19,436	2,287	9,730	7,415	687	145	69	0	0	0	0
Hardwood	363	384	85	337	365	85	19	14	0	7	5	0	0	0	0
Total	37,067	27,304	3,059	27,166	19,801	2,372	9,749	7,429	687	152	74	0	0	0	0
Total															
Softwood	356,705	302,001	163,942	102,379	92,246	57,708	144,952	117,111	58,721	76,126	65,021	31,909	33,248	27,623	15,604
Hardwood	75,081	77,093	52,872	41,366	42,142	30,369	16,426	17,538	12,070	16,921	16,999	10,236	368	414	197
Total	431,786	379,094	216,814	143,745	134,388	88,077	161,378	134,649	70,791	93,047	82,020	42,145	33,616	28,037	15,801

Numbers in rows and columns may not add to totals due to rounding.

[a] Includes poles, pilings, posts, and other industrial products.

Table 14—Disposal of residue at primary wood-using plants by product, species group, type of residue, and year, Alabama

Product and species group	All types			Type of residue: Bark			Coarse			Sawdust			Shavings		
	2005	2007	2009	2005	2007	2009	2005	2007	2009	2005	2007	2009	2005	2007	2009
	thousand cubic feet														
Fiber products															
Softwood	129,251	104,125	57,278	0	0	0	129,005	104,125	57,278	227	0	0	19	0	0
Hardwood	14,169	15,404	9,838	0	0	0	14,169	15,404	9,838	0	0	0	0	0	0
Total	143,420	119,529	67,116	0	0	0	143,174	119,529	67,116	227	0	0	19	0	0
Particleboard															
Softwood	21,271	17,956	9,321	0	0	0	0	0	0	6,073	4,742	1,940	15,198	13,214	7,381
Hardwood	24	536	600	0	0	0	0	0	60	0	536	540	24	0	0
Total	21,295	18,492	9,921	0	0	0	0	0	60	6,073	5,278	2,480	15,222	13,214	7,381
Sawn products															
Softwood	2,975	2,925	533	0	0	0	2,975	2,925	533	0	0	0	0	0	0
Hardwood	266	52	0	0	0	0	266	52	0	0	0	0	0	0	0
Total	3,241	2,977	533	0	0	0	3,241	2,977	533	0	0	0	0	0	0
Industrial fuel															
Softwood	171,067	155,021	88,945	89,063	82,726	53,698	11,446	9,158	709	60,646	54,367	28,980	9,912	8,770	5,558
Hardwood	58,834	58,017	41,328	40,184	40,482	30,099	1,931	1,704	2,110	16,400	15,511	8,949	319	320	170
Total	229,901	213,038	130,273	129,247	123,208	83,797	13,377	10,862	2,819	77,046	69,878	37,929	10,231	9,090	5,728
Miscellaneous															
Softwood	32,019	21,956	7,770	13,289	9,517	3,933	1,451	893	187	9,160	5,907	985	8,119	5,639	2,665
Hardwood	1,723	2,809	1,004	1,141	1,474	251	40	315	14	517	926	712	25	94	27
Total	33,742	24,765	8,774	14,430	10,991	4,184	1,491	1,208	201	9,677	6,833	1,697	8,144	5,733	2,692
Not used															
Softwood	122	18	95	27	3	77	75	10	14	20	5	4	0	0	0
Hardwood	65	275	102	41	186	19	20	63	48	4	26	35	0	0	0
Total	187	293	197	68	189	96	95	73	62	24	31	39	0	0	0
All products															
Softwood	356,705	302,001	163,942	102,379	92,246	57,708	144,952	117,111	58,721	76,126	65,021	31,909	33,248	27,623	15,604
Hardwood	75,081	77,093	52,872	41,366	42,142	30,369	16,426	17,538	12,070	16,921	16,999	10,236	368	414	197
Total	431,786	379,094	216,814	143,745	134,388	88,077	161,378	134,649	70,791	93,047	82,020	42,145	33,616	28,037	15,801

Numbers in rows and columns may not add to totals due to rounding.

million cubic feet and decreased another 39 percent to 130.3 million cubic feet in 2009. Bark and sawdust, at 83.8 and 37.9 million cubic feet, respectively, accounted for 93 percent of mill residue utilized for industrial fuel in 2009 which was an increase from 90 percent in 2005 and 91 percent in 2007. In 2009, 95 percent of bark residue produced was utilized for fuel, with the remainder of the utilized bark going for miscellaneous products. Mill residue produced in Alabama for the 2005, 2007, and 2009 surveys was predominately used for industrial fuel. During 2005 and 2007, 89 percent of the coarse residue produced was utilized for fiber products while in 2009 there was an increase to 95 percent (67.1 million cubic feet). Bark and wood residues not utilized accounted for less than one-tenth of 1 percent of all residues produced in 2005, 2007, and 2009.

Land Use Removals

Land use removals (land clearing or set aside forest land), or removal volume attributed to land use change, accounted for 8 percent of total removals with 125.8 million cubic feet in 2005, remaining stable at 8 percent in 2007 with 119.7 million cubic feet (table 15). In 2009, the percentage of land use change removals increased to 10 percent, totaling 122.4 million cubic feet. The merchantable (growing stock) portion of live trees accounted for 78 percent (98.7 million cubic feet) of land use change removals for 2005, decreasing to 65 percent (78.4 million cubic feet) in 2007, only to increase in 2009 to 70 percent (86.0 million cubic feet). The hardwood species group accounted for 94.6 million cubic feet, 75 percent, of the land use change removals in 2005. Decreases in 2007 showed the hardwood species group accounted for 67 percent (80.0 million cubic feet) of total land use change removals and again decreased to 40 percent (48.8 million cubic feet) in 2009.

Logging Residue

The merchantable (growing stock) portions of trees cut and left onsite are underutilized removals by FIA merchantability standards, while the nonmerchantable (nongrowing stock) portions of trees (part of the 1-foot stump or volume in tops <4 inches in diameter) used for products are considered overutilized removals by FIA merchantability standards. With this in mind, under- and over-utilization factors used to determine average annual logging residue estimates used in this section were derived from estimates in the 2008 Alabama harvest and utilization study (Bentley and Johnson 2008). Logging residue has been considered a possible source for bioenergy and other timber products during recent years. It is important to keep in mind that logging residue, traditionally, has not had a marketable value. Retrieval of logging residue is a matter of economics and markets. If markets are available and a willingness to pay a reasonable price exists, then more total tree volume (including what has been left as logging residues) is utilized for products.

Most loggers are setup to merchandise the main bole of the tree or the merchantable portion of the tree (from a 1-foot stump to a 4-inch diameter top). The current conventional logging system in Alabama is a feller buncher, working with one or two rubber tired grapple skidders, a delimbing gate or pull-through delimber at the deck, a knuckleboom loader, and the appropriate number of tractor trailers to haul the volume harvested. The improved mechanization and equipment capabilities have dramatically increased productivity and utilization across the South. These systems are typically capable of producing, on average, about 10 loads per day of tree-length wood.

Table 15—Volume of timber removals by year, species group, removals class, and source, Alabama

Year and species group	Roundwood products			Logging residues			Land use removals			All removals		
	Growing stock	Nongrowing stock	All sources	Growing stock	Nongrowing stock	All sources	Growing stock	Nongrowing stock	All sources	Growing stock	Nongrowing stock	All sources
	thousand cubic feet											
2005												
Softwood	791,679	90,002	881,681	36,874	84,024	120,898	13,642	17,536	31,178	842,195	191,562	1,033,757
Hardwood	266,215	16,922	283,137	76,581	85,304	161,885	85,061	9,561	94,622	427,857	111,787	539,644
Total	1,057,894	106,924	1,164,818	113,455	169,328	282,783	98,703	27,097	125,800	1,270,052	303,349	1,573,401
2007												
Softwood	758,131	72,581	830,712	40,573	104,331	144,904	28,535	11,136	39,671	827,239	188,048	1,015,287
Hardwood	266,306	24,734	291,040	53,779	81,172	134,951	49,831	30,154	79,985	369,916	136,060	505,976
Total	1,024,437	97,315	1,121,752	94,351	185,504	279,855	78,366	41,290	119,656	1,197,155	324,108	1,521,263
2009												
Softwood	569,340	32,002	601,342	31,040	79,817	110,857	54,744	18,879	73,623	655,124	130,698	785,822
Hardwood	193,167	41,375	234,542	36,183	76,905	113,088	31,238	17,587	48,825	260,588	135,867	396,455
Total	762,507	73,377	835,884	67,223	156,722	223,945	85,982	36,466	122,448	915,712	266,565	1,182,277

Numbers in rows and columns may not add to totals due to rounding.

Woody material typically left on a logging site includes:

1. whole trees, ≥5 inches diameter at breast height (d.b.h.), or portions of the merchantable boles of severed trees broken and left during the felling operation (merchantable),
2. small trees, <5 inches d.b.h., damaged or killed during harvesting operations (nonmerchantable), and
3. residual stump portions, tops, and limbs or forks not utilized because of insufficient size or quality to fit on the trailers (nonmerchantable).

This wood material left on the site is known as merchantable and nonmerchantable logging residues. FIA calculates the merchantable portion of logging residue in a two stage process. First, for those plots that were classified as timberland during the previous inventory and stayed in timberland for the current inventory cycle, the volume of whole trees cut and not utilized are identified by FIA field crews during the remeasurement phase of the inventory. A removal volume is derived for trees that are classified in this category. Second, underutilization factors derived from felled-tree utilization studies are applied to the volume classified as utilized by field crews for the remainder of the merchantable portion of logging residue.

The reader must remember that total removal volume is made-up of volume from the merchantable and nonmerchantable portions of removal trees. Overutilization factors from the utilization studies were used to determine how much of the nonmerchantable portion of removals was used for timber products. The nonmerchantable volume is calculated for the land use change removal estimate and added to the merchantable volume for a total land use change removal volume. With the nonmerchantable portion of timber products and land use change values calculated and subtracted from total nonmerchantable removals volume the remainder is the volume of nonmerchantable logging residues.

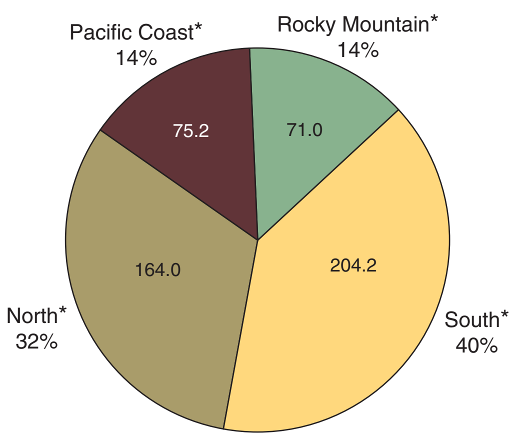
With this in mind, the logging residue volume in Alabama for 2005 totaled 282.8 million cubic feet showing a decrease to 279.9 million cubic feet in 2007 and again decreasing to 223.9 million cubic feet in 2009 (table 15). This volume accounted for <20 percent of total timber removals for the previously stated survey years. During 2005, logging residue from the merchantable portion of all-live removals totaled 113.5 million cubic feet, or 40 percent of total logging residue, declining to 94.3 million cubic feet (34 percent of total logging residue) in 2007. There was a further decline for the 2009 survey in logging residue from the merchantable portion of all-live removals resulting in 67.2 million cubic feet (30 percent of total logging residue). It is interesting to note that while total logging residue accounted for about 18 to 19 percent of total removals in 2005, 2007, and 2009, the merchantable portion of logging residue for both softwood and hardwood combined accounted for about 6 to 7 percent of total live removals for those survey periods. For softwoods, the merchantable portion of logging residue accounted for 4 percent of the total softwood all-live tree removals for the 2005, 2007, and 2009 surveys. The merchantable portion of hardwood logging residue accounted for 14 percent (76.6 million cubic feet) of all-live hardwood removals which amounted to 539.6 million cubic feet in 2005. In 2007, the merchantable portion of hardwood logging residue declined to 11 percent (53.8 million cubic feet) of all-live removals and once again decreased in 2009 to 9 percent (36.2 million cubic feet). Nonmerchantable sources (such as the residual stump, forks, tops, and limbs) accounted for 169.3 million cubic feet, or 60 percent of total logging residue in 2005. This percentage increased in 2007 showing 66 percent (185.5 million cubic feet) of logging residue came from nonmerchantable sources and further increased to 70 percent (156.7 million cubic feet) in 2009.

National, Regional, and Economic Impacts

National Perspective

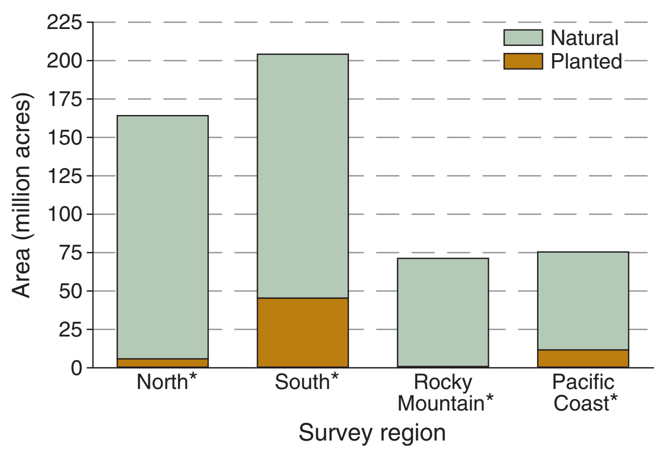
The southern region of the United States is often referred to as the "wood basket" of the Nation, but how accurate is this statement? If southern forests are vital to the Nation, what role does Alabama play, both nationally and regionally? The recently completed 2010 Resource Planning Act (RPA) assessment titled Forest Resources of the United States, 2007 (Smith and others 2009) provides a means to answer these questions. The publication and accompanying dataset has detailed information on each State and region. The following analysis replaces the Alabama data used in the RPA document (2007 data) with the latest data used in this report (2010). Only updates in Alabama data have been performed. All other State and region totals are the same as the RPA publication. All regional and statewide comparisons are based on timberland and growing stock designations.

The majority of the Nation's timberlands, 72 percent, exist in the eastern half of the country. The South contains 40 percent or 204 million acres of the Nation's timberlands (fig. 38). The North has the second highest total with 164 million acres, representing 32 percent of the United States' total. Additionally, the South contains 72 percent of all planted stands, an indicator of forest management and harvesting activity (fig. 39). In total, there are >45 million acres of planted acres across the South.



*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 38—Area of timberland in the United States by survey region, 2007 (numbers in slices are in million acres).



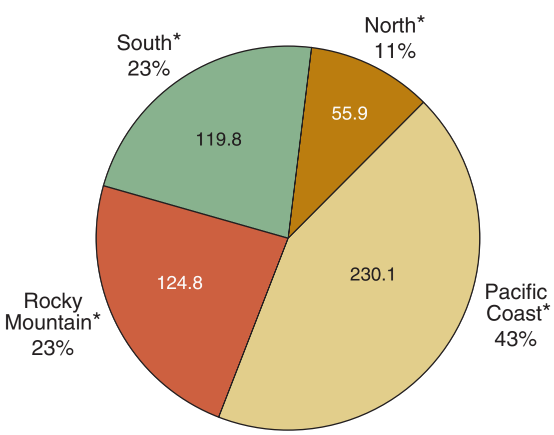
*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 39—Area of timberland in United States by survey region and stand origin. 2007.

The eastern dominance in timberland area does not correspond directly with standing timber volumes. While the East contains most of the timberland area, the West accounts for a majority of standing growing stock softwood volume. Sixty-six percent of the country's softwood volume occurs in the Western States. Southern timberlands currently contain 120 billion cubic feet of the Nation's 530 billion cubic feet of softwood growing-stock inventory (fig. 40).

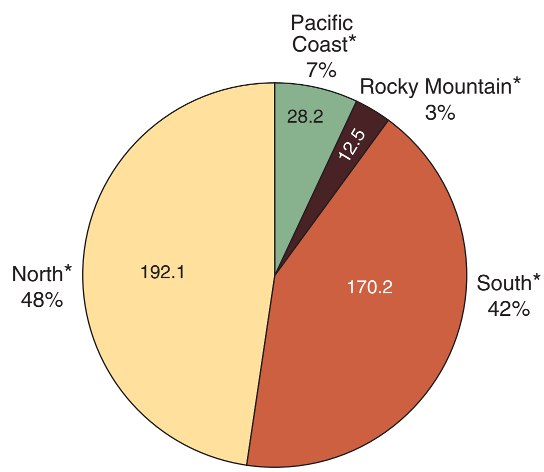
Conversely, almost the entire hardwood inventory is found in the East. All but 10 percent of the country's hardwood volume grows in the eastern regions (fig. 41). Almost one-half, 48 percent, of the hardwood volume occurs in the North, while 42 percent is found in southern forests. In total, 170 billion cubic feet of hardwood volume can be found in the South.

The West's dominance in standing softwood inventory does not correlate with average annual softwood growth and average annual removals. The South is the Nation's leader in softwood growth and removals. Fifty percent of the country's softwood net growth occurs on southern timberlands, along with 64 percent of the Nation's annual amount of softwood



*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 40—Total softwood growing-stock volume on timberland by survey region, United States, 2007 (numbers in slices are in billion cubic feet).



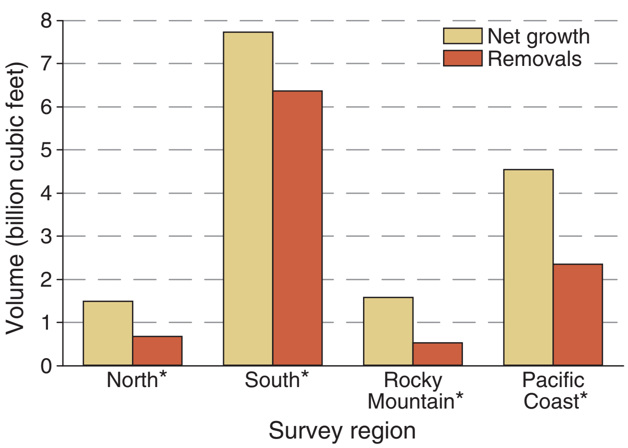
*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 41—Total hardwood growing-stock volume on timberland by survey region, United States, 2007 (numbers in slices are in billion cubic feet).

removals (fig. 42). This is remarkable considering that only 23 percent of the softwood volume is found in this region. A total of 6.4 billion cubic feet of softwoods are removed each year in the South, while 7.7 billion cubic feet are added by growth. This gives the South a growth-to-removals ratio that is greater than one. The primary driver for softwood growth and removals in this region is pine plantations. As was discussed earlier in this report, planted stands produce more annual growth and removals than natural stands; and, the majority of plantations occur on southern timberlands.

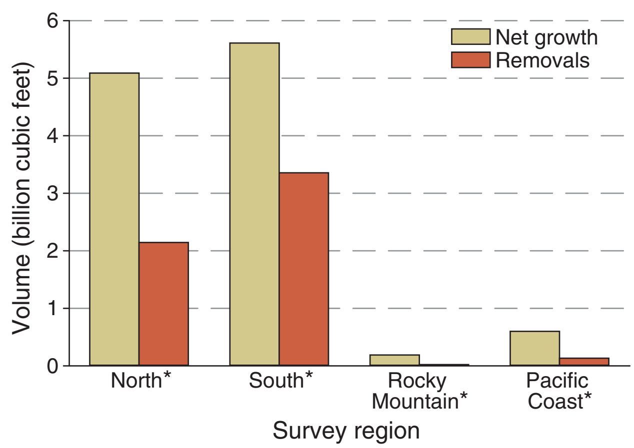
The southern region also produces more hardwood. Forty-nine percent of the Nation's annual hardwood growth and 59 percent of the annual hardwood removals occur on southern timberlands (fig. 43). Each year a total of 5.6 billion cubic feet of hardwood is grown throughout the South, while 3.3 billion cubic feet are removed. The northern portion of the United States ranks second nationally in both hardwood annual growth and removals. The Rocky Mountain and Pacific Coast regions provide little to the annual hardwood growth and removals estimates for the United States.

In summation, while southern forests only contain 40 percent of the Nation's timberlands, they account for about one-third of the country's growing-stock volume, and a majority of the average annual growth and removals for both hardwood and softwood species. It is also the home to almost three-quarters of the U.S. plantation acreage. It is from these planted stands that much of the growth and removals occur, thus allowing the South to live up to its reputation of being the Nation's "wood basket."



*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 42—Average annual net growth and average annual removals of softwood growing-stock trees on timberland by survey region, United States, 2007.



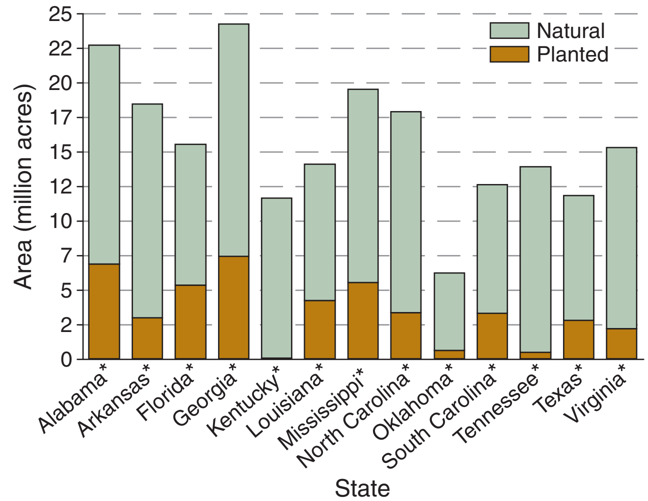
*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 43—Average annual net growth and average annual removals of hardwood growing-stock trees on timberland by survey region, United States, 2007.

Alabama's roadways provide motorists with splendid views of native forests.

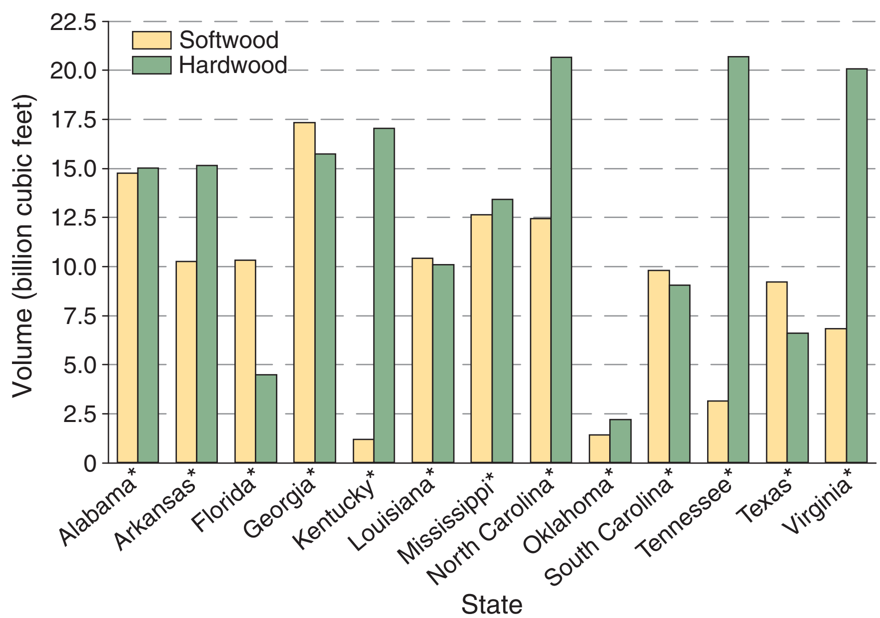
Alabama's Contribution to Southern Forests

Alabama contributes greatly to the southern forests that enrich the country. Of the 13 States that makeup the southern region, Alabama ranks second in total forest area and area of planted stands. Alabama accounts for 11 percent of the South's total timberland area, while 15 percent of the regions planted stands occur within its State borders (fig. 44). In fact, 11 percent of the U.S. plantation acreage can be found within Alabama. Only Georgia ranks higher in both timberland and plantation area. The yellow-hammer State also ranks second in total softwood growing-stock volume (fig. 45) and average annual softwood growth and removals (fig. 46). Hardwood forests dominate the landscape of other Southern States, particularly Tennessee and North Carolina. Therefore, Alabama is not ranked as high in hardwood volume (fig. 45) and average annual growth and removals of hardwood species (fig. 47). Six Southern States have more hardwood inventory, while four grow more and three remove more of this species group each year.



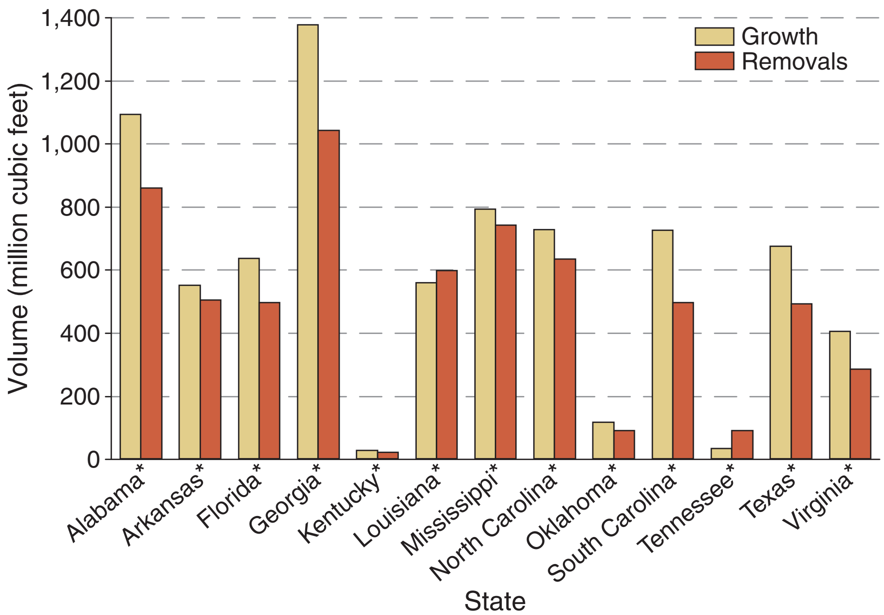
*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 44—Area of southern timberlands by State and stand origin, 2007.



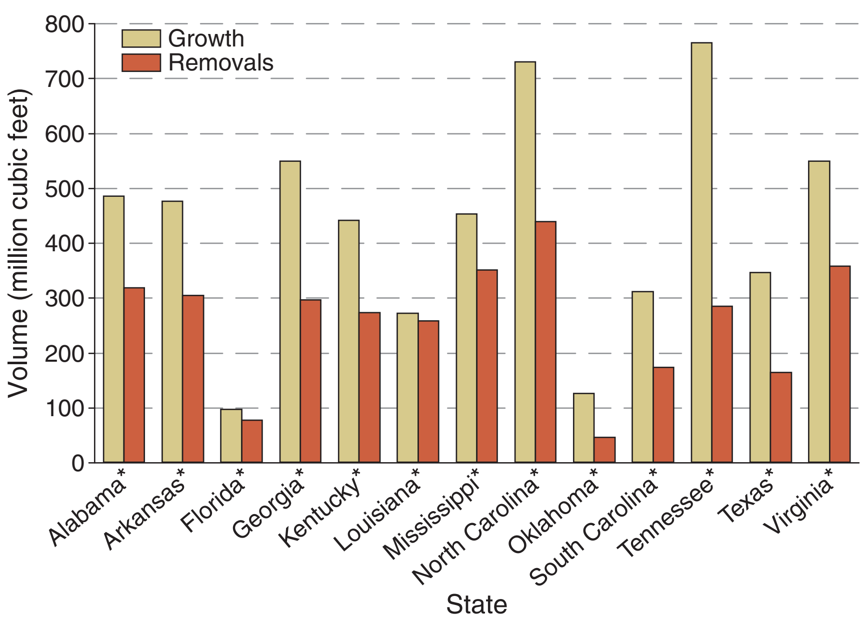
*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 45—Total growing-stock volume on southern timberlands by State and major species group, 2007.



*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 46—Average annual net growth and average annual removals of softwood growing-stock trees on southern timberland by State, 2007.



*Alabama is 2010 data, all other States use 2007 data (Smith and others 2009).

Figure 47—Average annual net growth and average annual removals of hardwood growing-stock trees on southern timberland by State, 2007.

Economic Benefits of Southern Forests

Forests play a vital role in the economies of many Southern States. Recent (2005–present) economic conditions have accelerated and accentuated the mill closings and the attendant job losses, and, associated economic multipliers. A recent study (Brandeis and others 2012) quantifies the impact the forest sector has on the southern economy and details the latest impacts and changes. The data in the following section are based on the results of this report.

Economic analysis was performed by use of the IMpact analysis for PLANning (IMPLAN) version 3.0 economic modeling tools and associated datasets for 2004, 2006, 2007, 2008, and 2009 (Minnesota IMPLAN Group, Inc. 2009). All estimated dollar values are shown in 2010 dollars. IMPLAN's built-in economic multipliers are used to assess an industry's direct, indirect, and induced economic impacts. Direct effects for the sector analysis indicate total sales by the forest industry. Likewise, in the present setting, indirect effects should be interpreted as total sales by the sector's supply chain. Induced effects involve the impacts resulting from the changes in household expenditures caused by the change in production from the direct effects (changes in household income). Total effects represent the entire contribution of the forest sector industries to the study area.

Impacts on job, incomes, and production—As of 2009, the southern forest sector provided 425,125 direct and 963,015 total employment for the region. Alabama accounted for 9.2 percent of each classification (table 16). Texas had the highest employment, followed by Georgia and North Carolina.

Between 2004 and 2009, the South lost 26 percent of full- and part-time jobs (direct employment), resulting in an estimated 20-percent loss in total jobs associated with the wood products industry (direct, indirect, and induced employment) (table 16). All Southern States showed direct job losses, varying from a low of 15 percent in South Carolina to a high of 35 percent in North Carolina. These job losses had a correspondingly negative effect on labor income for the Southern States. Total employment in Alabama dropped from 112,600 jobs to 88,700 jobs between 2004 and 2009, a 21 percent loss (table 16). The associated effects of income associated with this labor fell from $5.4 billion to $4.4 billion over the same time period (table 17). The primary drivers of this loss are the collapses of the housing market and economy that began at the end of 2007 (Brandeis and others 2012).

In 2004, the total economic value of production of the South's forest primary and secondary products industries was estimated at $250.7 billion, of which $168.9 billion came directly from the goods produced by forest industry (table 18). By 2009, the value of the sector's contribution to States' economies had decreased by 20 and 24 percent, respectively. As of 2009, Alabama's contribution to the regions forest primary and secondary products industries was $12.7 billion and $19.0 billion respectively. This accounts for >9 percent of the regions total for 2009 (table 18).

Table 16—Forest sector direct and total effect in employment by State and year

State and effect	2004	2006	2007	2008	2009	Change	Change
	number of jobs (full- and part-time)						*percent*
Alabama							
Direct	53,675	55,826	53,836	53,480	39,279	-14,396	-27
Total	112,551	113,773	114,056	106,589	88,667	-23,885	-21
Arkansas							
Direct	35,341	34,520	32,446	33,145	27,041	-8,300	-23
Total	78,105	75,166	65,793	65,119	54,488	-23,617	-30
Florida							
Direct	47,520	51,103	43,955	43,521	32,788	-14,733	-31
Total	112,282	122,729	111,086	112,133	86,343	-25,939	-23
Georgia							
Direct	65,208	66,980	63,679	64,514	49,114	-16,094	-25
Total	149,521	151,472	151,273	146,322	123,429	-26,092	-17
Kentucky							
Direct	30,463	30,932	30,681	29,893	23,848	-6,615	-22
Total	58,684	58,350	57,702	55,264	46,137	-12,546	-21
Louisiana							
Direct	24,721	25,169	24,691	24,819	19,213	-5,508	-22
Total	59,494	57,098	55,357	53,813	43,592	-15,901	-27
Mississippi							
Direct	28,747	30,299	29,543	29,925	21,704	-7,043	-24
Total	57,953	59,249	54,949	54,762	40,580	-17,374	-30
North Carolina							
Direct	77,177	74,167	70,135	67,559	50,108	-27,069	-35
Total	144,657	142,181	146,590	137,041	108,010	-36,647	-25
Oklahoma							
Direct	10,204	10,330	9,863	9,994	7,530	-2,674	-26
Total	24,794	24,663	20,879	20,478	16,759	-8,035	-32
South Carolina							
Direct	31,432	32,654	31,767	32,897	26,660	-4,772	-15
Total	66,995	69,487	72,903	72,553	64,134	-2,861	-4
Tennessee							
Direct	44,655	45,979	43,222	43,873	34,058	-10,597	-24
Total	98,670	101,237	98,700	97,035	83,928	-14,742	-15
Texas							
Direct	73,753	78,713	74,724	77,310	59,501	-14,252	-19
Total	152,339	158,545	165,387	166,553	138,483	-13,856	-9
Virginia							
Direct	50,341	50,603	46,932	47,465	34,282	-16,059	-32
Total	90,743	91,783	91,304	88,125	68,465	-22,279	-25
All States							
Direct	573,237	587,274	555,475	558,394	425,125	-148,111	-26
Total	1,206,788	1,225,734	1,205,980	1,175,786	963,015	-243,773	-20

Source: IMpact analysis for PLANning (IMPLAN) V3.0.

Table 17—Forest sector direct and total effect in labor income by State and year

State and effect	2004	2006	2007	2008	2009	Change	Change
	millions of dollars						*percent*
Alabama							
Direct	$3,176	$3,392	$3,203	$3,218	$2,409	-767	-24
Total	5,462	5,696	5,656	5,394	4,395	-1,067	-20
Arkansas							
Direct	1,849	1,830	1,659	1,695	1,489	-361	-20
Total	3,416	3,332	2,964	3,005	2,652	-764	-22
Florida							
Direct	2,530	2,846	2,342	2,355	1,736	-794	-31
Total	5,042	5,651	5,260	5,171	4,049	-993	-20
Georgia							
Direct	3,923	4,083	3,698	3,751	3,039	-883	-23
Total	7,805	7,913	7,934	7,648	6,558	-1,247	-16
Kentucky							
Direct	1,499	1,561	1,492	1,495	1,220	-279	-19
Total	2,627	2,684	2,596	2,562	2,152	-475	-18
Louisiana							
Direct	1,581	1,605	1,546	1,570	1,309	-272	-17
Total	2,903	2,821	2,832	2,841	2,343	-560	-19
Mississippi							
Direct	1,499	1,568	1,491	1,539	1,154	-345	-23
Total	2,514	2,589	2,404	2,437	1,860	-654	-26
North Carolina							
Direct	3,888	3,967	3,576	3,535	2,739	-1,149	-30
Total	6,674	6,791	6,842	6,522	5,229	-1,445	-22
Oklahoma							
Direct	533	528	485	510	416	-117	-22
Total	1,060	1,055	941	965	809	-251	-24
South Carolina							
Direct	1,936	2,188	2,041	2,073	1,753	-182	-9
Total	3,314	3,620	3,695	3,686	3,239	-75	-2
Tennessee							
Direct	2,795	2,973	2,639	2,950	2,226	-569	-20
Total	5,223	5,494	5,221	5,458	4,522	-701	-13
Texas							
Direct	4,200	4,631	4,391	4,639	3,371	-829	-20
Total	7,830	8,450	8,960	9,081	7,166	-664	-8
Virginia							
Direct	2,572	2,703	2,396	2,484	1,910	-662	-26
Total	4,431	4,642	4,645	4,542	3,652	-779	-18
All States							
Direct	31,981	33,874	30,960	31,814	24,771	-7,209	-23
Total	58,301	60,737	59,951	59,313	48,625	-9,676	-17

Source: IMpact analysis for PLANning (IMPLAN) V3.0.

Table 18—Forest sector direct and total effect in production output by State and year

State and effect	2004	2006	2007	2008	2009	Change	Change
	millions of dollars						*percent*
Alabama							
Direct	$16,840	$17,490	$17,098	$16,379	$12,726	-4,115	-24
Total	24,228	25,133	24,915	23,457	18,956	-5,273	-22
Arkansas							
Direct	11,636	11,404	10,793	10,714	8,917	-2,719	-23
Total	16,609	16,406	14,812	14,665	12,351	-4,258	-26
Florida							
Direct	12,695	13,762	11,961	11,675	9,026	-3,669	-29
Total	19,785	21,700	20,478	19,860	15,534	-4,252	-21
Georgia							
Direct	21,573	22,087	21,062	20,786	16,592	-4,981	-23
Total	33,275	33,819	33,624	32,490	26,830	-6,445	-19
Kentucky							
Direct	8,098	8,190	8,154	8,048	6,556	-1,543	-19
Total	11,734	11,941	11,605	11,395	9,399	-2,335	-20
Louisiana							
Direct	9,065	9,124	9,019	8,599	6,627	-2,438	-27
Total	13,524	13,418	13,243	12,796	9,949	-3,574	-26
Mississippi							
Direct	8,531	8,938	8,486	8,081	5,607	-2,924	-34
Total	11,753	12,359	11,298	10,887	7,772	-3,982	-34
North Carolina							
Direct	19,385	19,586	18,570	17,763	13,647	-5,738	-30
Total	28,017	28,669	28,459	26,804	20,872	-7,145	-26
Oklahoma							
Direct	3,091	3,072	3,034	3,065	2,442	-649	-21
Total	4,737	4,739	4,515	4,531	3,692	-1,045	-22
South Carolina							
Direct	10,837	11,634	11,474	11,797	9,940	-897	-8
Total	15,234	16,269	16,543	16,769	14,414	-820	-5
Tennessee							
Direct	14,238	14,908	14,205	14,432	11,710	-2,528	-18
Total	21,803	22,991	21,949	22,188	18,546	-3,257	-15
Texas							
Direct	19,920	20,962	20,497	20,344	15,812	-4,107	-21
Total	31,371	33,517	34,887	34,738	27,873	-3,498	-11
Virginia							
Direct	12,987	13,311	12,661	12,400	9,294	-3,693	-28
Total	18,633	19,328	19,335	18,691	14,369	-4,264	-23
All States							
Direct	168,896	174,470	167,013	164,084	128,896	-40,000	-24
Total	250,703	260,291	255,663	249,270	200,556	-50,147	-20

Source: IMpact analysis for PLANning (IMPLAN) V3.0.

Forest Health

The health and condition of America's forests have always been of major concern to the Forest Service, as well as the scientific community and the public at large. The Forest Health Monitoring (FHM) program was created to study the condition and long-term health of this country's forest lands. FHM was merged with FIA in 2000, as both programs shared many features. FHM information is collected on a subset of FIA plots. About 1 out of 16 FIA plots is selected for additional forest health sampling. Information from both sets of data, FIA and FHM, can be used to make inferences about the health of the State's forests.

Mortality

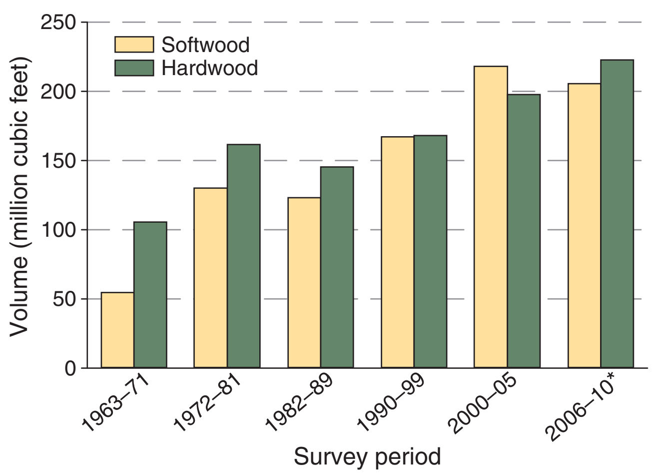
Average annual mortality, collected on all remeasured FIA plots, is the metric used to describe trees that die from natural causes such as insects, disease, fire, competition, weather, or old age. The average annual mortality of all-live hardwood and softwood trees in Alabama has generally increased with each successive survey, except for the 1990 survey. During the most recent survey period, annual mortality of softwood and annual mortality of hardwood trees averaged 205.2 and 222.3 million cubic feet, respectively (table 19). Mean annual mortality of hardwoods was up 12 percent since the previous survey, and softwood mortality was down 6 percent. Since 1972, Alabama softwood and hardwood mortality have increased 278 and 111 percent, respectively (fig. 48).

This 20-year old pine stand in Randolph County, Alabama was damaged by tropical storms. (photo by David Stephens, Bugwood.org)

Table 19—Average annual mortality of all-live trees on forest land by agent, survey period, and species group, Alabama

	Survey period								
	1991–2000			2001–05			2006–10		
Agent	All species	Softwood	Hardwood	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	million cubic feet								
Insect	38.8	38.0	0.7	115.1	114.4	0.7	81.2	80.7	0.5
Disease	95.5	36.3	59.2	106.3	28.6	77.8	62.7	17.0	45.8
Fire	4.8	2.1	2.7	4.2	1.2	3.0	5.3	2.4	2.9
Animal	5.7	0.6	5.2	10.8	1.7	9.1	12.1	1.5	10.7
Weather	113.6	52.8	60.8	75.7	29.0	46.7	183.6	72.3	111.3
Vegetation	32.4	21.0	11.4	44.0	18.3	25.7	42.1	18.2	23.9
Other/unknown	44.0	16.2	27.9	61.1	26.3	34.8	40.4	13.2	27.2
Total	334.7	166.9	167.8	417.2	219.4	197.8	427.5	205.2	222.3

Numbers in rows and columns may not sum to totals due to rounding.



*Seventy-five percent of the data is from the 2006–10 survey, the remaining 25 percent is from the 2001–05 survey. See Appendix A—Inventory Methods for more details.

Figure 48—Average annual mortality of all-live trees on forest land by survey period and major species group, Alabama.

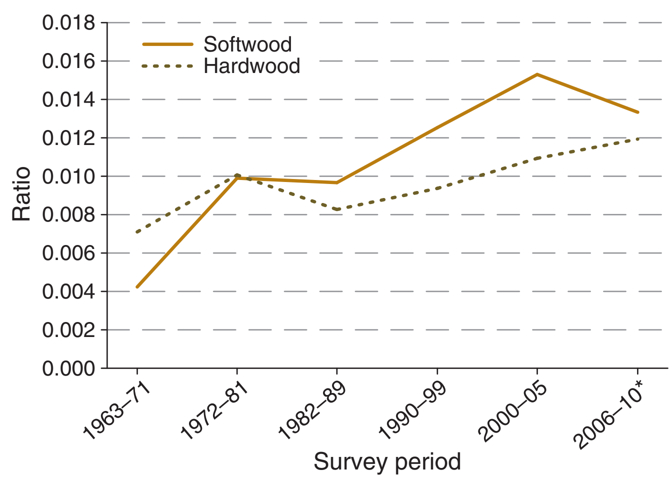
The 2001–05 survey was the first time that softwood mortality exceeded mortality of hardwoods. The latest survey reverses that trend and continues with the historical pattern of hardwood mortality exceeding softwood (fig. 48).

The previous figure highlighted the fact that total average annual mortality of all-live species was rising in Alabama. However, how much of this is due to the increase in live-tree volume and how big is the impact of these losses? The best way to answer these questions is to compute the volume-to-mortality ratio for the State. This ratio describes the impact that average annual mortality has upon the current standing volume of trees, and to what degree this mortality impacts the forest resources of the State.

The current volume-to-mortality ratios for softwoods and hardwoods in Alabama are 1:0.013 and 1:0.011, respectively. Thus, just over 1.3 percent of the standing volume of softwoods and 1.1 percent of the volume of hardwoods die each year (fig. 49).

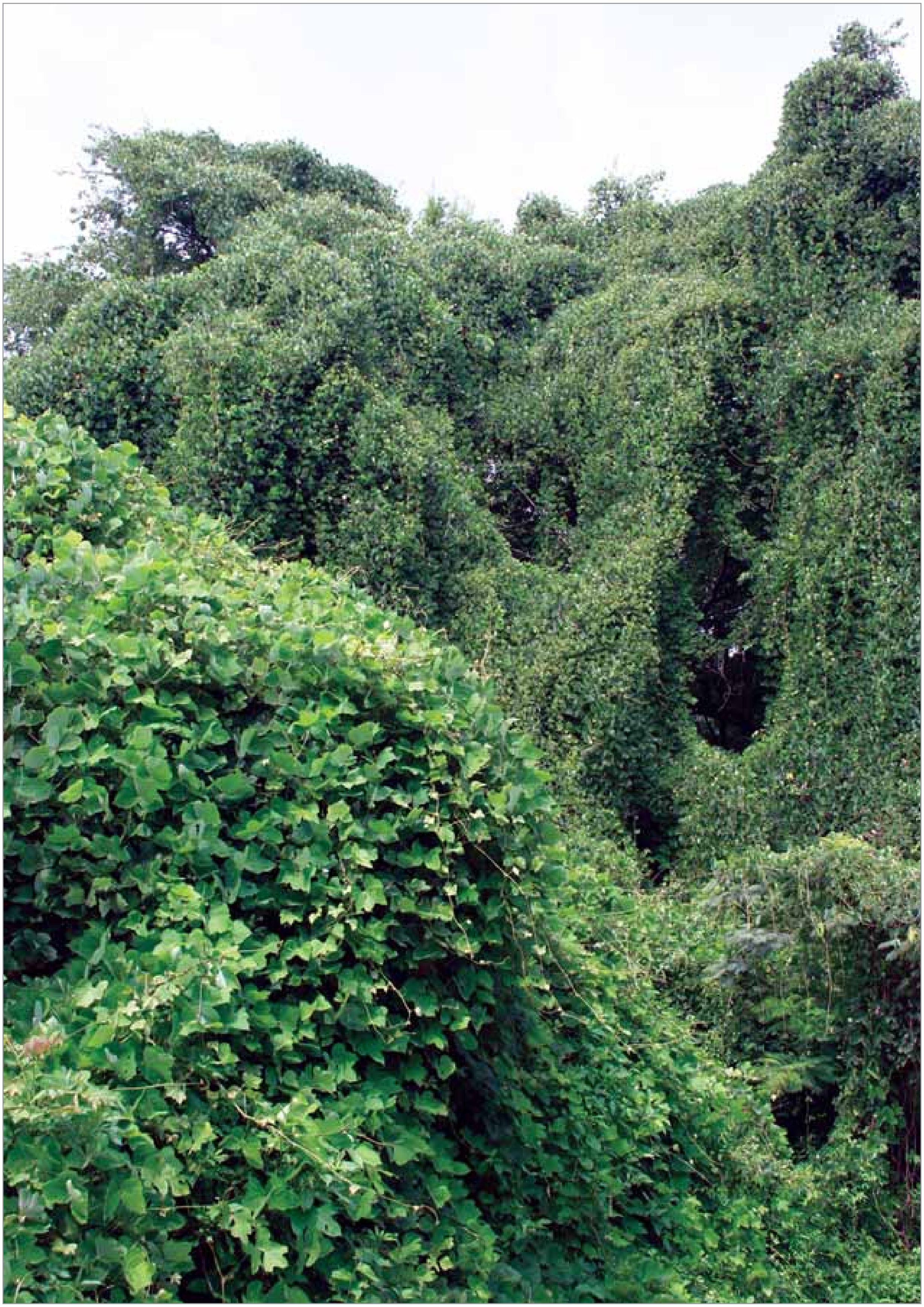
Although the all-live volume of the State's forests has increased since 1972, the average annual mortality has increased at a greater rate. The reasons for this are unknown. Older stands may have been understocked while current stands may be suffering from the effects of competition. Many factors may be influencing these results, including the impacts of human activity and development. The FHM plots recently established provide a baseline of data regarding the health of Alabama's forests. Future reports will provide trend analyses to help describe the state of health for Alabama's forests.

Average annual mortality of all-live trees on Alabama's forests has increased almost 2.5 percent over the last 5 years, from 417.2 to 427.5 million cubic feet per year. Weather was the primary reason for this rise in tree mortality, as average annual mortality due to weather rose nearly 143 percent, from 75.7 to >183 million cubic feet per year. Much of this can be attributed to the hurricanes (Katrina) and storms in 2005. While these storms occurred in the last survey, most of the data had not been collected by the time the 2005 report was produced. The current survey more accurately describes the impact of this event. The storms had a particularly large impact on hardwood species, as almost one-half of the entire State's hardwood mortality can be attributed to weather. Losses due to insects and disease contributed an additional 81 and 63 million cubic feet each over the last 5 years (table 19).



*Seventy-five percent of the data is from the 2006–10 survey, the remaining 25 percent is from the 2001–05 survey. See Appendix A—Inventory Methods for more details.

Figure 49—Average annual mortality to volume ratios of all-live trees on forest land by survey period and major species group, Alabama.



Contrary to poplar belief, Kudzu is not the dominat invasive species found in the State's forests.

Invasive Plants

The increasing spread of nonnative species of plants, animals, and other organisms are thought to be responsible for 42 percent of the decline of native species now listed as endangered or threatened (Hassan and others 2005). These invasive species have the potential to pose losses in biodiversity and ecosystem processes, as well as displace native species. A SRS e-Science update by Oswalt and Oswalt (2012) discusses the status of these nonnative species within the State. The information in the following section is based on these findings. It is important to note that the data used by Oswalt and Oswalt (2012) are based on data collected up to 2009, and do not include 2010 plot information. Therefore, the plot counts listed will not match those in other sections.

Japanese honeysuckle (*Lonicera japonica*) is the most frequently detected invasive plant species in Alabama as it occurs on >58 percent of the plots visited by field crews between 2001 and 2009 (table 20). Chinese and European privets (*Ligustrum sinense/L. vulgare*) combined to form a group that was the second most frequently recorded species.

Table 20—Invasive species detected on forest land with frequency of plot detections and percentage of total plot detections by common name and scientific name, Alabama, 2009

Common name	Scientific name	Plot detections[a]	Plots detections[b]
		- - - number - - -	*- - - percent - - -*
Japanese honeysuckle	*Lonicera japonica*	2,444	58.3
Chinese/European privet	*Ligustrum sinense/L. vulgare*	1,235	29.4
Japanese climbing fern	*Lygodium japonicum*	191	4.6
Silktree	*Albizia julibrissin*	126	3.0
Japanese/glossy privet	*Ligustrum japonicum/L. lucidum*	121	2.9
Chinese lespedeza	*Lespedeza cuneata*	97	2.3
Tallowtree	*Triadica sebifera*	84	2.0
Nonnative roses	*Rosa* spp.	76	1.8
Kudzu	*Pueraria montana* var. *lobata*	71	1.7
Chinaberry	*Melia azedarach*	63	1.5
Cogongrass	*Imperata cylindrica*	63	1.5
Nepalese browntop	*Microstegium vimineum*	42	1.0
Shrubby lespedeza	*Lespedeza bicolor*	34	0.8
Sacred bamboo, Nandina	*Nandina domestica*	22	0.5
Chinese/Japanese wisteria	*Wistera sinensis/W. floribunda*	16	0.4
Tree-of-heaven	*Ailanthus altissima*	10	0.2
Tall fescue	*Lolium arundinaceum*	10	0.2
Princesstree, Royal paulownia	*Paulownia tomentosa*	9	0.2
English ivy	*Hedera helix*	5	0.1
Tropical soda apple	*Solanum viarum*	5	0.1
Nonnative climbing yams-air yam/Chinese yam	*Dioscorea bulbifera/D. oppositifolia*	4	0.1
Nonnative bamboos	*Phyllostachys* spp., *Bambusa* spp.	4	0.1
Nonnative vincas, Periwinkles	*Vinca minor/V. major*	3	0.1
Autumn olive	*Alaeagnus umbellate*	1	0.0
Bush honeysuckles	*Lonicera* spp.	1	0.0
Giant reed	*Arundo donax*	1	0.0

[a] Plot refers to the forested portion of all subplots measured. If a species was detected on more than one subplot, it is only counted once.
[b] Percent is based on 4,196 plots visited between 2001 and 2009.

Japanese honeysuckle is the most frequently occurring invasive plant found in the State's forests.

Southern Pine Beetle

Southern pine beetle (SPB) (*Dendroctonus frontalis*) is one of the most destructive insects in forested ecosystems in the southern gulf coastal plain of the United States. Previously this section noted that insects destroy 80.7 million cubic feet of softwoods each year. Most of this can be attributed to SPB and their associates. This figure is lower than the previous survey period, indicating that SPB infestations were in decline between 2005 and 2010. This is corroborated by reports produced by the Alabama Forestry Commission[1] and U.S. Department of Agriculture Forest Service, Forest Health Protection between 2006 and 2010. The Forest Health Highlight reports also note low infestation levels of SPB during this time period. Infestation rates dropped 32 and 48 percent in 2006 and 2007, respectively, and remained at these low levels until the 2010 report.

Just because current Alabama SPB infestation levels are low does not mean that the forests are not at risk. Changes in weather and other environmental factors could lead to stresses in southern yellow pine forests that would place them at risk of

[1] Alabama Forestry Commission. Forest Health Highlights by year. http://fhm.fs.fed.us/fhh/sregion.shtml. [Date accessed: December 6, 2011].

infestation. The National Insect and Disease Risk Map produced by the Forest Health Enterprise Team in Ft. Collins, Colorado (Krist and others 2010) displays the areas of the State that are at risk (fig. 50). Preferred SPB hosts are shortleaf, loblolly, and Virginia pines. Landowners with stands of these species near areas with high SPB ratings index are advised to manage their stands in a way to mitigate or lower the risk of SPB outbreaks and reduce the possibility of future infestations.

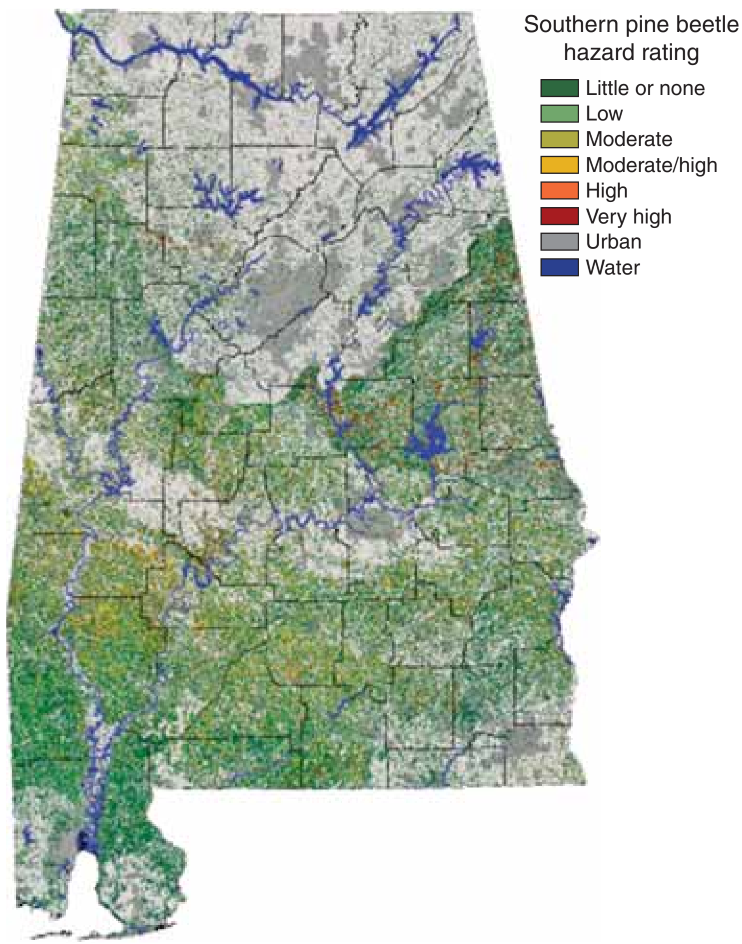


Figure 50—Southern pine beetle hazard rating, Alabama. Produced by U.S. Forest Service Forest Health Protection, Forest Health Enterprise Team (Krist and others 2010).

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Alabama's rural landscape is a mosaic of forests, agricultural lands, and small lakes and ponds such as this one.

Glossary

Afforestation—Area of land previously classified as nonforest that is converted to forest by planting trees or by natural reversion to forest.

Average annual mortality—Average annual volume of trees 5.0 inches diameter at breast height (d.b.h.) and larger that died from natural causes during the intersurvey period.

Average annual removals—Average annual volume of trees 5.0 inches d.b.h. and larger removed from the inventory by harvesting, cultural operations (such as timber-stand improvement), land clearing, or changes in land use during the intersurvey period.

Average net annual growth—Average annual net change in volume of trees 5.0 inches d.b.h. and larger in the absence of cutting (gross growth minus mortality) during the intersurvey period.

Basal area—The area in square feet of the cross section at breast height of a single tree or of all the trees in a stand, usually expressed in square feet per acre.

Biomass—The aboveground fresh weight of solid wood and bark in live trees 1.0 inch d.b.h. and larger from the ground to the tip of the tree. All foliage is excluded. The weight of wood and bark in lateral limbs, secondary limbs, and twigs under 0.5 inch in diameter at the point of occurrence on sapling-size trees is included but is excluded on poletimber and sawtimber-size trees.

Bole—That portion of a tree between a 1-foot stump and a 4-inch top diameter outside bark (d.o.b.) in trees 5.0 inches d.b.h. and larger.

Census water—Streams, sloughs, estuaries, canals, and other moving bodies of water 200 feet wide and greater, and lakes, reservoirs, ponds, and other permanent bodies of water 4.5 acres in area and greater.

Commercial species—Tree species currently or potentially suitable for industrial wood products.

Composite panels—Roundwood products manufactured into chips, wafers, strands, flakes, shavings, or sawdust and then reconstituted into a variety of panel and engineered lumber products.

CRP—The Conservation Reserve Program, a major Federal afforestation program authorized by the 1985 Farm Bill.

D.b.h.—Tree diameter in inches (outside bark) at breast height (4.5 feet aboveground).

Diameter class—A classification of trees based on tree d.b.h. Two-inch diameter classes are commonly used by Forest Inventory and Analysis, with the even inch as the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.

D.o.b. (diameter outside bark)—Stem diameter including bark.

Down woody material—Woody pieces of trees and shrubs that have been uprooted (no longer supporting growth) or severed from their root system, not self-supporting, and are lying on the ground. Previous named down woody debris.

Forest land—Land at least 10 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. The minimum area considered for classification is 1 acre. Forested strips must be at least 120 feet wide.

Forest management type—A classification of timberland based on forest type and stand origin.

Pine plantation—Stands that (1) have been artificially regenerated by planting or direct seeding, (2) are classed as a pine or other softwood forest type, and (3) have at least 10 percent stocking.

Natural pine—Stands that (1) have not been artificially regenerated, (2) are classed as a pine or other softwood forest type, and (3) have at least 10 percent stocking.

Oak-pine—Stands that have at least 10 percent stocking and classed as a forest type of oak-pine.

Upland hardwood—Stands that have at least 10 percent stocking and classed as an oak-hickory or maple-beech-birch forest type.

Lowland hardwood—Stands that have at least 10 percent stocking with a forest type of oak-gum-cypress, elm-ash-cottonwood, palm, or other tropical.

Nonstocked stands—Stands <10 percent stocked with live trees.

Forest type—A classification of forest land based on the species forming a plurality of live-tree stocking. Major eastern forest-type groups are:

White-red-jack pine—Forests in which eastern white pine, red pine, or jack pine, singly or in combination, constitute a plurality of the stocking. (Common associates include hemlock, birch, and maple.)

Spruce-fir—Forests in which spruce or true firs, singly or in combination, constitute a plurality of the stocking. (Common associates include maple, birch, and hemlock.)

Longleaf-slash pine—Forests in which longleaf or slash pine, singly or in combination, constitute a plurality of the stocking. (Common associates include oak, hickory, and gum.)

Loblolly-shortleaf pine—Forests in which loblolly pine, shortleaf pine, or other southern yellow pines, except longleaf or slash pine, singly or in combination, constitute a plurality of the stocking. (Common associates include oak, hickory, and gum.)

Oak-pine—Forests in which hardwoods (usually upland oaks) constitute a plurality of the stocking but in which pines account for 25 to 50 percent of the stocking. (Common associates include gum, hickory, and yellow-poplar.)

Oak-hickory—Forests in which upland oaks or hickory, singly or in combination, constitute a plurality of the stocking, except where pines account for 25 to 50 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, elm, maple, and black walnut.)

Oak-gum-cypress—Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, constitute a plurality of the stocking, except where pines account for 25 to 50 percent, in which case the stand would be classified oak-pine. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Elm-ash-cottonwood—Forests in which elm, ash, or cottonwood, singly or in combination, constitute a plurality of the stocking. (Common associates include willow, sycamore, beech, and maple.)

Maple-beech-birch—Forests in which maple, beech, or yellow birch, singly or in combination, constitute a plurality of the stocking. (Common associates include hemlock, elm, basswood, and white pine.)

Nonstocked stands—Stands <10 percent stocked with live trees.

Forested tract size—The area of forest within the contiguous tract containing each Forest Inventory and Analysis sample plot.

Fresh weight—Mass of tree component at time of cutting.

Fuelwood—Roundwood harvested to produce some form of energy, e.g., heat and steam, in residential, industrial, or institutional settings.

Gross growth—Annual increase in volume of trees 5.0 inches d.b.h. and larger in the absence of cutting and mortality. (Gross growth includes survivor growth, ingrowth, growth on ingrowth, growth on removals before removal, and growth on mortality before death.)

Growing-stock trees—Living trees of commercial species classified as sawtimber, poletimber, saplings, and seedlings. Trees must contain at least one 12-foot or two 8-foot logs in the saw-log portion, currently or potentially (if too small to qualify), to be classed as growing stock. The log(s) must meet dimension and merchantability standards to qualify. Trees must also have, currently or potentially, one-third of the gross board-foot volume in sound wood.

Growing-stock volume—The cubic-foot volume of sound wood in growing-stock trees at least 5.0 inches d.b.h. from a 1-foot stump to a minimum 4.0-inch top d.o.b. of the central stem.

Hardwoods—Dicotyledonous trees, usually broadleaf and deciduous.

Soft hardwoods—Hardwood species with an average specific gravity of 0.50 or less, such as gums, yellow-poplar, cottonwoods, red maple, basswoods, and willows.

Hard hardwoods—Hardwood species with an average specific gravity >0.50 such as oaks, hard maples, hickories, and beech.

Industrial wood—All roundwood products except fuelwood.

Land area—The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river floodplains (omitting tidal flats below mean high tide), streams, sloughs, estuaries, and canals <200 feet wide, and lakes, reservoirs, and ponds <4.5 acres in area.

Live trees—All living trees. All size classes, all tree classes, and both commercial and noncommercial species are included.

Log grade—A classification of logs based on external characteristics indicating quality or value.

Logging residues—The unused merchantable portion of growing-stock trees cut or destroyed during logging operations.

Net annual change—Increase or decrease in volume of live trees at least 5.0 inches d.b.h. Net annual change is equal to net annual growth minus average annual removals.

Noncommercial species—Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Nonforest land—Land that has never supported forests and land formerly forested where timber production is precluded by development for other uses.

Nonstocked stands—Stands <10 percent stocked with live trees.

Other forest land—Forest land other than timberland and productive reserved forest land. It includes available and reserved forest land which is incapable of producing annually 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 removals—The growing-stock volume of trees removed from the inventory by cultural operations such as timber stand improvement, land clearing, and other changes in land use, resulting in the removal of the trees from timberland.

Ownership—The property owned by one ownership unit, including all parcels of land in the United States.

National forest land—Federal land that has been legally designated as national forests or purchase units, and other land under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III land.

Forest industry land—Land owned by companies or individuals operating primary wood-using plants.

Nonindustrial private forest land—Privately owned land excluding forest industry land.

Corporate—Owned by corporations, including incorporated farm ownerships.

Individual—All lands owned by individuals, including farm operators.

Other public—An ownership class that includes all public lands except national forests.

Miscellaneous Federal land—Federal land other than national forests.

State, county, and municipal land—Land owned by States, counties, and local public agencies or municipalities or land leased to these governmental units for 50 years or more.

Plant residues—Wood material generated in the production of timber products at primary manufacturing plants.

Coarse residues—Material, such as slabs, edgings, trim, veneer cores and ends, suitable for chipping.

Fine residues—Material, such as sawdust, shavings, and veneer chippings, not suitable for chipping.

Plant byproducts—Residues (coarse or fine) used in the manufacture of industrial products for consumer use, or as fuel.

Unused plant residues—Residues (coarse or fine) not used for any product, including fuel.

Poletimber-size trees—Softwoods 5.0 to 8.9 inches d.b.h. and hardwoods 5.0 to 10.9 inches d.b.h.

Primary wood-using plants—Industries receiving roundwood or chips from roundwood for the manufacture of products, such as veneer, pulp, and lumber.

Productive-reserved forest land—Forest land sufficiently productive to qualify as timberland but withdrawn from timber utilization through statute or administrative regulation.

Pulpwood—A roundwood product that will be reduced to individual wood fibers by chemical or mechanical means. The fibers are used to make a broad generic group of pulp products that includes paper products, as well as fiber-board, insulating board, and paperboard.

Reforestation—Area of land previously classified as forest that is regenerated by planting trees or natural regeneration.

Rotten trees—Live trees of commercial species not containing at least one 12-foot saw log, or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of rot or missing sections, and with less than one-third of the gross board-foot tree volume in sound material.

Rough trees—Live trees of commercial species not containing at least one 12-foot saw log, or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of roughness, poor form, splits, and cracks, and with less than one-third of the gross board-foot tree volume in sound material; and live trees of noncommercial species.

Roundwood (roundwood logs)—Logs, bolts, or other round sections cut from trees for industrial or consumer uses.

Roundwood chipped—Any timber cut primarily for pulpwood, delivered to nonpulpmills, chipped, and then sold to pulpmills as residues, including chipped tops, jump sections, whole trees, and pulpwood sticks.

Roundwood products—Any primary product such as lumber, poles, pilings, pulp, or fuelwood, that is produced from roundwood.

Salvable dead trees—Standing or downed dead trees that were formerly growing stock and considered merchantable. Trees must be at least 5.0 inches d.b.h. to qualify.

Saplings—Live trees 1.0 to 5.0 inches d.b.h.

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

Saw-log portion—The part of the bole of sawtimber trees between a 1-foot stump and the saw-log top.

Saw-log top—The point on the bole of sawtimber trees above which a conventional 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-size trees—Softwoods 9.0 inches d.b.h. and larger and hardwoods 11.0 inches d.b.h. and larger.

Sawtimber volume—Growing-stock volume in the saw-log portion of sawtimber-size trees in board feet (International ¼-inch rule).

Seedlings—Trees <1.0 inch d.b.h. and >1 foot tall for hardwoods, >6 inches tall for softwood, and >0.5 inch in diameter at ground level for longleaf pine.

Select red oaks—A group of several red oak species composed of cherrybark, Shumard, and northern red oaks. Other red oak species are included in the "other red oaks" group.

Select white oaks—A group of several white oak species composed of white, swamp chestnut, swamp white, chinkapin, Durand, and bur oaks. Other white oak species are included in the "other white oaks" group.

Site class—A classification of forest land in terms of potential capacity to grow crops of industrial wood based on fully stocked natural stands.

Softwoods—Coniferous trees, usually evergreen, having leaves that are needles or scalelike.

Yellow pines—Loblolly, longleaf, slash, pond, shortleaf, pitch, Virginia, sand, spruce, and Table Mountain pines.

Other softwoods—Cypress, eastern redcedar, white-cedar, eastern white pine, eastern hemlock, spruce, and fir.

Stand age. The average age of dominant and codominant trees in the stand.

Stand origin—A classification of forest stands describing their means of origin.

Planted—Planted or artificially seeded.

Natural—No evidence of artificial regeneration.

Stand-size class—A classification of forest land based on the diameter class distribution of live trees in the stand.

Sawtimber stands—Stands at least 10 percent stocked with live trees, with one-half or more of total stocking in sawtimber and poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands—Stands at least 10 percent stocked with live trees, of which one-half or more of total stocking is in poletimber and sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands—Stands at least 10 percent stocked with live trees of which more than one-half of total stocking is saplings and seedlings.

Nonstocked stands—Stands < 10 percent stocked with live trees.

Stocking—The degree of occupancy of land by trees, measured by basal area or the number of trees in a stand and spacing in the stand, compared with a minimum standard, depending on tree size, required to fully utilize the growth potential of the land.

Density of trees and basal area per acre required for full stocking

D.b.h. class	Trees per acre for full stocking	Basal area
inches		*square feet per acre*
Seedlings	600	—
2	560	—
4	460	—
6	340	67
8	240	84
10	155	85
12	115	90
14	90	96
16	72	101
18	60	106
20	51	111

— = not applicable.

Timberland—Forest land capable of producing 20 cubic feet of industrial wood per acre per year and not withdrawn from timber utilization.

Timber products—Roundwood products and byproducts.

Tree—Woody plants having one erect perennial stem or trunk at least 3 inches d.b.h., a more or less definitely formed crown of foliage, and a height of at least 13 feet (at maturity).

Tree grade—A classification of the saw-log portion of sawtimber trees based on: (1) the grade of the butt log or (2) the ability to produce at least one 12-foot or two 8-foot logs in the upper section of the saw-log portion. Tree grade is an indicator of quality; grade 1 is the best quality.

Upper-stem portion—The part of the main stem or fork of sawtimber trees above the saw-log top to minimum top diameter 4.0 inches outside bark or to the point where the main stem or fork breaks into limbs.

Veneer log—A roundwood product either rotary cut, sliced, stamped, or sawn into a variety of veneer products such as plywood, finished panels, veneer sheets, or sheathing.

Volume of live trees—The cubic-foot volume of sound wood in live trees at least 5.0 inches d.b.h. from a 1-foot stump to a minimum 4.0-inch top d.o.b. of the central stem.

Volume of saw-log portion of sawtimber trees—The cubic-foot volume of sound wood in the saw-log portion of sawtimber trees. Volume is the net result after deductions for rot, sweep, and other defects that affect use for lumber.

Many of the State's oak forests sprung from acorns such as these.

Appendix A—Inventory Methods

The following is a general description of the sample design and methods used to derive forest resource estimates provided in this report. Current procedures were implemented during the 2000 and 2005 surveys. Readers wishing to learn about how current methodology differs from the older surveys should refer to the inventory methods section of the 2000 and 2005 State reports (Hartsell and Johnson 2009). The only exception pertains to changes in plot population over time. Recent research reveals that there were significant changes in plot population between 1990 and 2010. These changes are discussed below. All other evolutions in sample design, data collection, and processing are covered in the older State reports. These changes necessitate caution when making long-term comparisons with previous forest resource estimates.

The current inventory is a three-phase, fixed-plot design conducted on an annualized basis. Annualized means that a portion of the entire sample population (a cycle) is collected each year until all plots have been measured. Phase 1 (P1) provides the area estimates for the inventory. Phase 2 (P2) involves on-the-ground measurements of sample plots by field personnel. Phase 3 (P3) is a subset of the P2 plot system where additional measurements are made by field personnel to assess unique forest health indicators, many of which are not measured on the P2 plot. These data were processed with the National Inventory and Monitoring System version 5.0 software.

Sample Design Overview

All surveys of Alabama prior to 2000 were periodic; all plots were measured at one time period; this took 1 to 2 years depending on budget and manpower constraints. The periodic design provided an estimate of the forest resources in the State during a small time window.

The current, annual inventory design was implemented to provide more up-to-date information about forest resources and comparability from State-to-State across the Nation. Under the annual inventory system, a predesignated percentage of plots are measured each year. The percentage used depends on the cycle length chosen for that inventory. For example, the eighth survey was based on a 5-year cycle, therefore 20 percent, or one-fifth, of the plots in the State were measured each year. This 1-year sample is called a panel or subcycle. Each panel of plots is selected on a subgrid which is slightly offset from the previous panel, so that each panel covers essentially the same sample area (both spatially and in intensity) as the prior panel. After 5 years, field measurements were completed, and a cycle of data was available for the 5-year report. This process occurred between 2000 and 2005. The subsequent report titled Alabama's Forests 2005 (Hartsell and Johnson 2009) provides a synopsis of the eighth survey of Alabama. Because of logistics, economics, and sample implementation protocols, the dataset consists of data that are <1-year old (the most recently collected data) as well as data up to 5 years old (the data collected at the beginning of the cycle).

After the eighth survey was completed in 2005, Alabama switched to a 7-year cycle with seven subcycles of data. Thus one-seventh of the plots, 14 percent, would be measured each year. To ensure that spatial and temporal intensity was maintained across the State, some plots were placed into new subcycles. Changing to a 7-year cycle and repaneling of the ninth survey brought about two issues that readers should be aware of. The first is that this report does not represent a full cycle of data. This report is produced to meet the requirements of the Farm Bill which stipulates a report every 5 years. Only five-sevenths, or 71 percent, of the plots have been remeasured at the time of this writing. The remaining 29 percent of the plots used to complete the dataset are from the prior survey. Thus, estimates in this report contain a mixture of eighth and ninth survey data. Readers should consider this when making comparisons to the 2005 report.

The second issue is that the plots were repaneled based on spatial location, not time of last remeasurement. Therefore, the dates of the dataset range from 2001 to 2010, with 29 percent of the plots being plots from the eighth survey (table A.1).

One of the major impacts on data interpretation and analysis of switching to the annual inventory design is the length of time for data collection (5 or 7 years versus 1 or 2 years). Data collected over a longer period have a higher probability of sampling a specific event, e.g., a hurricane or fire, but with only a small proportion of the sample. However, data collected over a shorter timespan, such as data collected in the periodic survey, may miss an event entirely until the next periodic measurement takes place, at which time all the sample plots would reflect the event.

Changes in plot population over time— Accurate status and trend information is derived from revisiting the same plots at both ends of the survey cycle. The plot population remained fairly constant from 1963 to 2000. The only changes came about from field staff who could not find an old plot, or new plots being established due

Table A.1—Survey year and number of plots with at least one forested condition, Alabama

Survey year	Plots: Current[a]	Plots: Change variables[b]
	number	
2002	24	15
2003	24	24
2004	251	220
2005	758	709
2006	606	572
2007	596	553
2008	590	555
2009	581	539
2010	629	592
Total	4,205	3,903

[a] Number of plots used for all current estimates of acres and tree numbers and volumes.

[b] Number of plots used for all estimates of change (average annual growth, removals, and mortality).

to afforestation. Each of these typically accounted for <3 percent each survey period. The 2000 survey was based on the same sample grid that was established in 1953. Field crews for the 2000 inventory remeasured 5,790 of the 5,827 plots that existed in 1990. This represents both forest and nonforest plots. A total of 195 plots were added and 37 plots were dropped. This represented a 4 percent change in the 1990 plot population.

Moving forward into the 2005 survey, the plot population changed in order to ensure that there was only one P2 plot in each hexagonal unit. At this time, the cycle eight survey was composed of 5,040 forest and nonforest plots that were remeasured from the prior inventory. Additionally, 659 plots were added and 945 plots were dropped from the plot list. This is a 27-percent change in the plot list. An alteration of this magnitude has the potential to impact results and confound trend analysis.

The data in this report are based on 5,687 phase 2 plots. Of these, 5,294 plots are remeasured from the older cycle, while 393 plots were added and 405 plots dropped. This is a total change of 14 percent, not as high as the prior inventory, but it still clouds trend analysis.

Sample design phases—The three phases (P1, P2, and P3) of the current sampling method are based upon a hexagonal-grid design for sample placement on the ground; successive phases are sampled with less intensity. In general, the P1 phase involves area estimation, the P2 and P3 phases involves placement of sample plots on the ground, where measurement of variable attributes are made. The grid ensures a systematic placement of P2 and P3 plots on the ground. There are 16 P2 hexagons for every P3 hexagon. The P2 and P3 hexagons represent about 6,000 and 96,000 acres, respectively. To ensure systematic coverage of the sample domain (a State), the goal is to place one P2 plot in every hexagonal grid cell.

Plot design—Bechtold and Patterson (2005) describe the current P2 and P3 ground plots and explain their use. These plots are clusters of four points arranged so that one point is central and the other three lie 120 feet from it at azimuths of 0, 120, and 240 degrees (fig. A.1). Each point is the center of a circular subplot with a fixed 24-foot radius. Trees ≥5.0 inches in diameter at breast height (d.b.h.) are measured in these subplots. Each subplot in turn contains a circular 1/300-acre

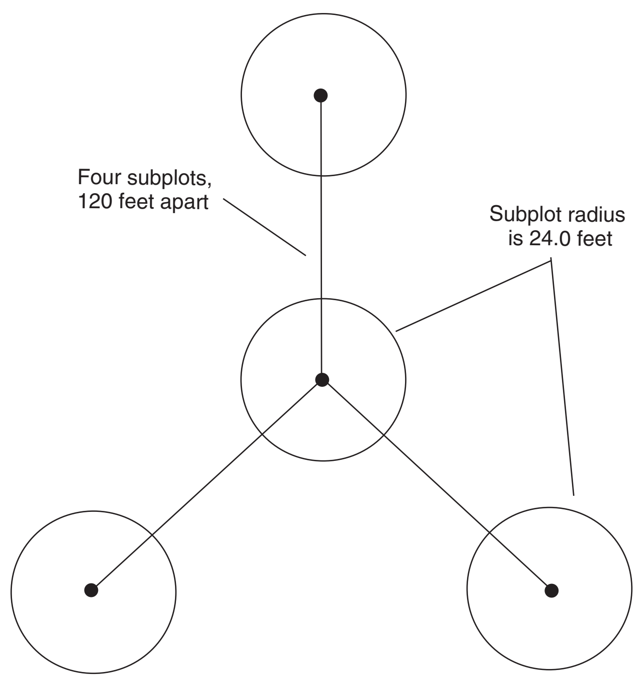

Figure A.1—Annual inventory fixed-plot design (the P2 plot).

microplot with a fixed 6.8-foot radius (fig. A.2). Trees 1.0 to 4.9 inches in d.b.h. and seedlings (<1.0 inch in d.b.h.) are measured on these microplots. Sometimes a plot cluster straddles two or more land use or forest condition classes (Bechtold and Patterson 2005). There are seven condition-class variables that require mapping of a unique condition on a plot: land use, forest type, stand size, ownership, stand density, regeneration status, and reserved status. A new condition is defined and mapped each time the aerial extent of one of these variables is encountered during plot measurement. The process of mapping any of these conditions on a plot changes the plot size for a respective condition, i.e., the condition size will be smaller than a full-plot complement and this may increase the variance of the estimate.

Data on forest health variables (P3) are collected on about 1/16th of the P2 sample plots. P3 data are coarse descriptions, and are meant to be used as general indicators of overall forest health over large geographic areas. P3 data collection includes variables pertaining to tree crown health, down woody material (DWM), foliar ozone injury, lichen diversity, and soil composition. Tree crown health, DWM, and soil composition measurements are collected using the same plot design used during P2 data collection (fig. A.3).

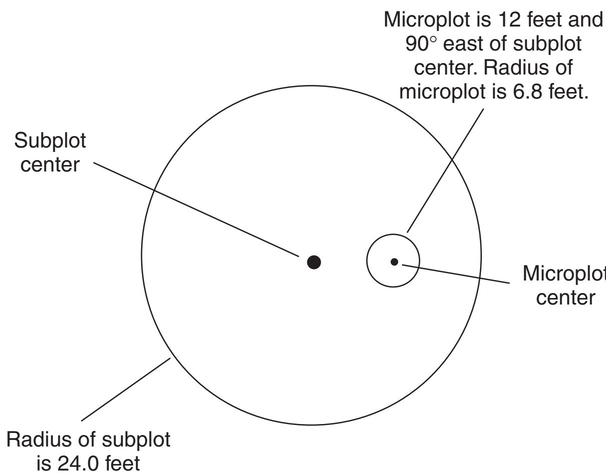

Figure A.2—Subplot and microplot layout.

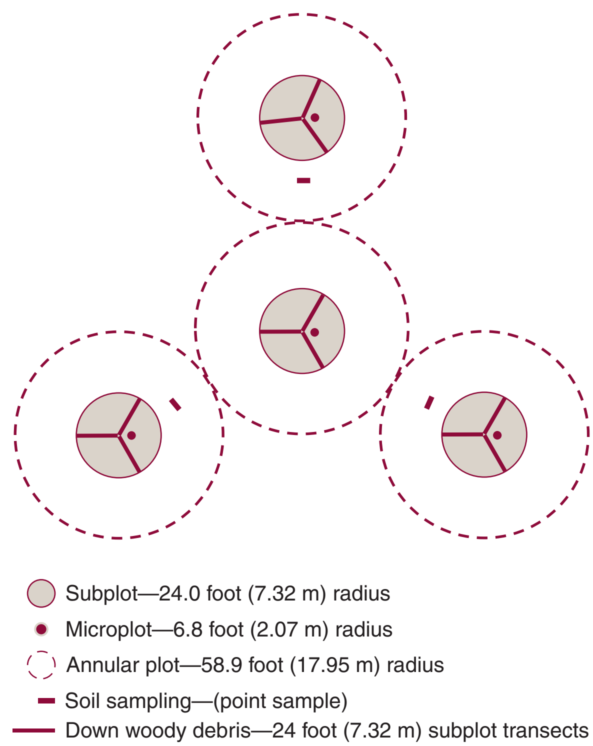

Figure A.3—Layout of the fixed-radius plot design illustrating where the P3 variables were collected.

Area Estimation

The current approach in the determination of forest area applies a stratification technique to improve the precision of the estimate, i.e., it reduces the variance of the estimate. With this method, the placement (on the ground) and subsequent classification (by land use) of the P2 plot carries much of the weight in determining forest area. The area of control was the survey unit. Forest Inventory and Analysis (FIA) used National Land Cover Data (NLCD) for the stratification platform. The NLCD has a land classification produced by the U.S. Geological Survey, derived from Landsat Thematic Mapper data. Using this data, FIA identifies four strata to improve the variance of the area estimate. These strata are identified by a pixel classification according to four types of placement: (1) pixels in forest, (2) pixels in nonforest, (3) pixels in nonforest but within a 2-pixel width of a forest edge, and (4) pixels in a forest area but within a 2-pixel width of a forest edge. The estimation of forest area is then the sum across all strata from respective pixel counts (based on placement within the above strata) and the mean area from the P2 plots. This type of approach places more weight on the P2 plot in area determination than with previous aerial-photo dot count methods. The 2000 NLCD data was used for both 2005 and 2010 surveys. Users need to be aware of this fact, as the NLCD form the basis from which area computations are performed.

Change in Assessing National Forest and Reserved Lands

Current area estimation of all lands and ownerships was based on the probability of selection of P2 plot locations. There was no enumeration of any ownership (no use of known areas of ownership to determine area and plot expansion factors). As a result, the known forest land area (for specific ownerships) does not always agree with area estimates based on probability of selection. For example, the acreage of national forests, published by the National Forest System, will not agree exactly with the statistical estimate of national forest land derived by FIA. These numbers may differ substantially for very small areas.

Volume Estimation

Tree volumes for each individual tally tree were derived by a linear regression model. The general form of the model involves two tree measurements from sample trees: d.b.h. and total height. This equation estimated gross cubic foot volume from a 1-foot stump to a 4-inch upper diameter for each sample tree. Separate equation coefficients for 77 species or species groupings were utilized. The volume in forks in the central bole and the volume in limbs outside of the main bole were excluded. Net cubic foot volume was derived by subtracting the estimate of rotten or missing wood for each sample tree. Volume of the saw-log portion (expressed in International ¼-inch board feet) of sample trees was derived by using board foot-to-cubic foot ratio equations. All equations and coefficients were developed from standing and felled tree volume studies conducted by FIA across several Southern States. For more detailed and specific information regarding volume models and coefficients, contact the Southern Research Station, FIA work unit.

Growth, Removals, and Mortality Estimation

Growth, removals, and mortality (GRM) estimates were determined from the remeasurement of sample plots measured in the prior inventory. The Beers and Miller (1964) estimator technique was used to determine gross growth, net growth, removals, mortality, and net change of the inventory. Ingrowth was derived from new trees on the microplot (fig. A.2). This method required personnel to account only for previously tallied trees. Estimates in this report are based on remeasurement of both 2000 and 2005 surveys, depending on each plots panel. Table A.1 reveals that 3,903 plots where used in calculating measures of change. Twenty-eight percent of these plots contain data from the 2000–05 survey period.

Dot Map Methodology

Dot maps are a valuable tool to portray the areal distribution of volumetric data. In forestry these data may be tree volume, tree growth, forest area, etc. They are especially useful in displaying relative densities of resource attributes across State regions. There are three factors that affect the usefulness and accuracy of dot maps: (1) the size of the dots, (2) the value assigned to each dot, and (3) the placement of the dots on a map (Robinson and others 1984). The choices of values for factors (1) and (2) are mostly arbitrary but the important function of the maps was to show relative densities of resource attributes across the State of Alabama.

Regarding factor three, placement of the dots, the area of control was the county. A minimum volumetric value (cubic-foot volume or area) for a species (or forest type group) was needed in a given county for it to be represented on the map. For example, in order for one dot to be placed in a county representing loblolly pine volume, there had to be a minimum of 1.0 million cubic feet of loblolly pine in that county. For two dots, 2.0 million cubic feet were needed and so on. The dots were placed randomly in each county by geographic information system software, so that means there was no location accuracy inside any particular county. However, there was adequate accuracy at the regional (survey unit) and State level of scale to portray specific species distributions and relative densities.

Summary

Users wishing to make rigorous comparisons of data between surveys should be aware of the significant differences in plot designs and variable assessments. Assuming there is no bias in plot selection or maintenance of plot integrity, the most valuable and powerful trend information is obtained when the same plots are revisited from one survey to the next and measured in the same way. This is also the only method that yields reliable components of change estimation (GRM) especially by specific attributes such as species. This approach reduces the noise that is present in data for natural forest stands and increases the level of confidence in assessments of trends. However, if sample designs change, there can never be a high level of certainty that the trends in the data are real and not due to procedural changes. Even though both designs may be judged statistically valid, the naturally occurring noise in the data hinders confident and rigorous assessments of trend over time. Determining the strength of a trend, or determining the level of confidence associated with a trend, is difficult or impossible when sampling methods change over time.

Appendix B—Data Reliability

A relative standard of accuracy has been incorporated into the forest survey. This standard satisfies user demands, minimizes human and instrumental sources of error, and keeps costs within prescribed limits. The two primary types of error are measurement and sampling error.

Measurement Error

Measurement error is also called nonsampling or data acquisition error. These are errors that arise in the acquisition, recording, or editing of statistical data (Burt and Barber 1996). There are three elements of measurement error: (1) biased error, caused by instruments not properly calibrated; (2) compensating error, caused by instruments of moderate precision; and (3) accidental error, caused by human error in measuring, recording, and compiling. All of these are held to a minimum by a system (the Forest Inventory and Analysis (FIA) quality assurance (QA) program), that incorporates training, check plots, and editing and checking for consistency. The goal of the QA program is to provide a framework to assure the production of complete, accurate, and unbiased forest assessments for given standards.

One of the objectives of the FIA program is to include data quality documentation in all nationally available reports including State reports and national summary reports. The following is a summary of some of the phase 2 variables and measurement quality objective (MQO) analyses from FIA blind check measurements.

It is not possible to determine measurement error statistically but it is held to a minimum level through a number of quality control procedures. These methods include use of nationally standardized field manuals, use of portable data recorders (PDRs), thorough entry-level training, periodic review training, supervision, use of check plots, editing checks, and an emphasis on careful work. Additionally, data quality is assessed and documented using performance measurements and post survey assessments. These assessments are then used to identify areas of the data collection process that need improvement or refinement in order to meet quality objectives of the program. Editing checks in the PDR and office check for logical and data entry inconsistencies and errors for all plots. Use of PDRs also helps ensure that specified procedures are followed. The minimum national standards for annual training of field crews are: (1) a minimum of 40 hours for new employees, and (2) a minimum of 8 hours for returning employees. Field crew members are certified on a test plot. All crews are required to have at least one certified person present on the plot at all times.

Field audits consist of hot checks, cold checks, and blind checks. A hot check is an inspection normally done as part of the training process. The inspector is present with the crew to document crew performance as plots are measured. The recommended intensity for hot checks is 2 percent of the plots installed.

Cold checks are done at regular intervals throughout the field season. The crew that installed the plot is not present at the time of inspection and does not know when or which plots will be remeasured. The inspector visits the completed plot, evaluates the crew's data collection, and notes corrections where necessary. The recommended intensity for cold checks is 5 percent of the plots installed.

A blind check is a complete reinstallation measurement of a previously completed plot. However, the QA crew performs the remeasurement without the previously recorded data. This type of blind measurement provides a direct, unbiased observation of measurement precision from two independent crews. Plots selected for blind checks are chosen to be a representative subsample of all plots measured and are randomly selected. Blind checks are planned to take place within 2 weeks of the date of the field measurement. The recommended intensity for blind checks is 3 percent of the plots installed.

Each variable collected by FIA is assigned an MQO and a measurement tolerance level. The MQOs are documented in the FIA national field manual (U.S. Department of Agriculture Forest Service 2007a, U.S. Department of Agriculture Forest Service 2007b). In some instances the MQOs are a "best guess" of what experienced field crews should be able to consistently achieve. Tolerances are somewhat arbitrary and are based on the ability of crews to make repeatable measurements or observations within the assigned MQO. Based on review and analysis, these tolerances improved over time.

Evaluation of field crew performance is accomplished by calculating the differences between data collected by the field crew and that collected by the QA crew on blind-check plots. Results of these calculations are compared to the established MQOs. In the analysis of blind-check data, an observation is within tolerance when the difference between the field crew observation and the QA crew observation does not exceed the assigned tolerance for that variable. For many categorical variables, the tolerance is "no error" allowed, so only observations that are identical with the standard are within the tolerance level. Tables B.1 and B.2 show the percentage of observations that were within the program tolerances for plot- and tree-level conditions, respectively. At this time, only the blind-check results for plot- and tree-level variables are presented.

Table B.1—Results of plot-level blind checks for Alabama and the Southern Region, 2006–10

Variable	MQO requirements	Tolerance	Percent within tolerance		Number of observations	
			Alabama	Region	Alabama	Region
	- - percent - -		*- - - - - percent - - - - -*		*- - - - - number - - - - -*	
Distance road	90.0	No tolerance	94.4	72.2	18	252
Water on plot	90.0	No tolerance	94.4	84.9	18	252
Latitude	99.0	± 2.3 degrees	100.0	100.0	18	270
Longitude	99.0	± 2.3 degrees	100.0	100.0	18	270
Elevation	99.0	No tolerance	16.7	17.2	18	262
Elevation with tolerance	99.0	± 5 feet	27.8	32.4	18	262

MQO = measurement quality objective.

Table B.2—Results of tree-level blind checks for Alabama and the Southern Region, 2006–10

Variable	MQO requirements	Tolerance	Percent within tolerance: Alabama	Percent within tolerance: Southern Region	Number of observations: Alabama	Number of observations: Southern Region
	- - percent - -		*- - - - - percent - - - - -*		*- - - - - - number - - - - - -*	
Condition number	95.0	No tolerance	100.0	100.0	280	4,314
D.b.h.	90.0	± 0.1/20 in.	88.8	84.7	269	3,729
Azimuth	90.0	± 10 degrees	95.9	97.9	269	4,041
Horizontal distance	90.0	± 0.2/1.0 ft	94.4	95.1	269	4,041
Species	95.0	No tolerance	94.3	94.9	280	4,314
Genus	99.0	No tolerance	98.2	98.8	280	4,314
Tree status	95.0	No tolerance	99.3	98.7	280	4,314
Reconcile	95.0	No tolerance	98.1	97.1	108	646
Total length	90.0	± 10 percent	62.2	64.4	249	3,628
Actual length	90.0	± 10 percent	81.3	57.6	16	158
Compacted crown ratio	80.0	± 10 percent	85.5	79.0	269	3,861
Crown class	85.0	No tolerance	81.0	82.3	269	3,861
Decay class	90.0	± 1 class	100.0	96.9	21	293
Standing dead	99.0	No tolerance	100.0	99.7	28	610
Cause of death	80.0	No tolerance	93.8	95.1	32	670
Mortality year	70.0	± 1 year	96.9	96.0	32	670
Regional variables						
Azimuth	90.0	± 3 degrees	86.6	90.0	269	4,041
Tree class	90.0	No tolerance	91.4	90.2	266	3,698
Tree grade	90.0	No tolerance	88.2	70.1	34	652
Utilization class	90.0	No tolerance	98.8	99.4	251	3,232
Board foot cull	90.0	± 10 percent	99.2	97.2	261	3,423
Cubic foot cull	80.0	± 10 percent	99.2	97.6	247	3,188
Fusiform rust/ dieback incidence	80.0	No tolerance	98.0	98.5	244	2,973
Fusiform rust/ dieback severity	80.0	No tolerance	98.8	99.3	247	3,188

MQO = measurement quality objective; d.b.h. = diameter at breast height.

Sampling Error

Sampling error is associated with the natural and expected deviation of the sample from the true population mean. This deviation is susceptible to a mathematical evaluation of the probability of error. Sampling errors for State totals are based on one standard deviation unless otherwise noted. That is, at one standard deviation there is a 68.27 percent probability that the confidence interval given for each sample estimate will cover the true population mean (table B.3).

Table B.3—Sampling errors, at one standard error, for estimates of area, volume, average net annual growth, removals, and mortality, Alabama, 2010

Item	Component total	SE
	number	*percent*
Timberland estimates		
Forest land area[a]	22,815.1	0.5
Timberland area[a]	22,738.1	0.5
Total live trees on forest land[b]		
Volume	34,079.3	1.3
Average net annual growth	1,719.7	2.1
Average annual removals	1,281.0	4.1
Average annual mortaility	427.5	4.7
Softwood live trees on forest land[b]		
Volume	15,411.6	2.0
Average net annual growth	1,140.4	2.7
Average annual removals	901.8	4.4
Average annual mortality	205.2	7.3
Hardwood live trees on forest land[b]		
Volume	18,667.8	2.0
Average net annual growth	579.4	3.3
Average annual removals	379.2	7.1
Average annual mortality	222.3	5.7
Total growing stock on timberland[b]		
Volume	29,771.3	1.4
Average net annual growth	1,580.7	2.1
Average annual removals	1,179.0	4.1
Average annual mortality	337.9	5.2
Softwood growing stock on timberland[b]		
Volume	14,758.1	2.0
Average net annual growth	1,094.9	2.7
Average annual removals	860.4	4.5
Average annual mortality	185.2	7.6
Hardwood growing stock on timberland[b]		
Volume	15,013.2	2.2
Average net annual growth	485.7	3.4
Average annual removals	318.6	7.4
Average annual mortality	152.7	7.1

SE = sampling error.
[a] Thousand acres.
[b] Million cubic feet.

The size of the sampling error generally increases as the size of the area examined decreases. Also, as area or volume totals are stratified by forest type, species, diameter class, ownership, or other subunits, the sampling error may increase and be greatest for the smallest divisions. However, there may be instances where a smaller component does not have a proportionately larger sampling error. This can happen when the post-defined strata are more homogeneous than the larger strata, thereby resulting in a smaller variance. For specific post-defined strata the sampling error can be calculated using the following formula.

$$SE_s = SE_t \frac{\sqrt{X_t}}{\sqrt{X_s}}$$

where

SE_s = sampling error for subdivision of State's total

SE_t = sampling error for State total

X_s = sum of values for the variable of interest (area or volume) for subdivision of State

X_t = total value for State

For example, the estimate of the sampling error for softwood live-tree volume on forest industry timberland is computed as:

$$SE_s = 1.98 \frac{\sqrt{15{,}411.6}}{\sqrt{2{,}807.4}} = 4.64$$

Thus, the sampling error is 4.64 percent, and the resulting 68.27 percent confidence interval for softwood live-tree volume on forest industry timberland is 2,807.4 ± 130.2 million cubic feet.

Sampling errors obtained by this method are only approximations of reliability because this process assumes constant variance across all subdivisions of totals. The resulting errors derived by this approximation method should be considered very liberal, i.e., it usually produces sampling errors much better than those derived by the actual random sampling formula. Users are free to use more conservative variance estimators based on their specific applications.

Longleaf pine forest. (photo by David Stephens, Bugwood. org)

Table C.1—Common name, scientific name, FIA species code, and count of tree species ≥1.0 but <5.0 inches d.b.h. occuring in the FIA sample, Alabama, 2010

Common name	Scientific name	FIA species code	Trees tallied
			number
Atlantic white-cedar	*Chamaecyparis thyoides*	43	2
Southern redcedar	*Juniperus silicicola*	67	3
Eastern redcedar	*J. virginiana*	68	274
Sand pine	*Pinus clausa*	107	2
Shortleaf pine	*P. echinata*	110	181
Slash pine	*P. elliottii*	111	91
Spruce pine	*P. glabra*	115	50
Longleaf pine	*P. alustris*	121	270
Loblolly pine	*P. taeda*	131	4,956
Virginia pine	*P. virginiana*	132	611
Baldcypress	*Taxodium distichum*	221	16
Pondcypress	*T. ascendens*	222	4
Eastern hemlock	*Tsuga canadensis*	261	7
Florida maple	*Acer barbatum*	311	197
Boxelder	*A. negundo*	313	84
Red maple	*A. rubrum*	316	2,019
Silver maple	*A. saccharinum*	317	9
Sugar maple	*A. saccharum*	318	32
Chalk maple	*A. leucoderme*	323	8
Yellow buckeye	*Aesculus octandra*	332	8
Ailanthus	*Ailanthus altissima*	341	2
Mimosa, silktree	*Albizia julibrissin*	345	28
Serviceberry spp.	*Amelanchier* spp.	356	46
Pawpaw	*Asimina triloba*	367	5
Yellow birch	*Betula alleghaniensis*	371	1
River birch	*B. nigra*	373	21
Chittamwood, gum bumelia	*Sideroxylon lanuginosum*	381	2
American hornbeam, musclewood	*Carpinus caroliniana*	391	681
Water hickory	*Carya aquatica*	401	10
Bitternut hickory	*C. cordiformis*	402	17
Pignut hickory	*C. glabra*	403	435
Pecan	*C. illinoensis*	404	25
Nutmeg hickory	*C. myristiciformis*	406	1
Shagbark hickory	*C. ovata*	407	51
Black hickory	*C. texana*	408	2
Mockernut hickory	*C. tomentosa*	409	536
Sand hickory	*C. pallida*	410	3
Red hickory	*C. ovalis*	412	3
Allegheny chinkapin	*Castanea pumila*	422	4
Catalpa spp.	*Catalpa* spp.	450	2
Southern catalpa	*C. bignonioides*	451	3
Sugarberry	*Celtis laevigata*	461	79
Hackberry	*C. occidentalis*	462	47
Eastern redbud	*Cercis canadensis*	471	150
Flowering dogwood	*Cornus florida*	491	1,125

continued

Table C.1—Common name, scientific name, FIA species code, and count of tree species ≥1.0 but <5.0 inches d.b.h. occuring in the FIA sample, Alabama, 2010 (continued)

Common name	Scientific name	FIA species code	Trees tallied
			number
Hawthorn spp.	*Crataegus* spp.	500	69
Common persimmon	*Diospyros virginiana*	521	291
American beech	*Fagus grandifolia*	531	180
White ash	*Fraxinus americana*	541	78
Green ash	*F. pennsylvanica*	544	340
Pumpkin ash	*F. profunda*	545	1
Honeylocust	*Gleditsia triacanthos*	552	2
Loblolly-bay	*Gordonia lasianthus*	555	2
Silverbell spp.	*Halesia* spp.	580	4
Carolina silverbell	*H. carolina*	581	15
American holly	*Ilex opaca*	591	433
Butternut	*Juglans cinerea*	601	2
Black walnut	*J. nigra*	602	4
Sweetgum	*Liquidambar styraciflua*	611	4,332
Yellow-poplar	*Liriodendron tulipifera*	621	962
Osage-orange	*Maclura pomifera*	641	15
Cucumbertree	*Magnolia acuminata*	651	23
Southern magnolia	*M. grandiflora*	652	99
Sweetbay	*M. virginiana*	653	657
Bigleaf magnolia	*M. macrophylla*	654	85
Umbrella magnolia	*M. tripetala*	658	9
Southern crabapple	*Malus angustifolia*	662	7
White mulberry	*Morus alba*	681	7
Red mulberry	*M. rubra*	682	49
Water tupelo	*Nyssa aquatica*	691	25
Blackgum	*N. sylvatica*	693	997
Swamp tupelo	*N. biflora*	694	142
Eastern hophornbeam	*Ostrya virginiana*	701	456
Sourwood	*Oxydendrum arboreum*	711	442
Paulownia, empress-tree	*Paulownia tomentosa*	712	3
Bay spp.	*Persea* spp.	720	3
Redbay	*P. borbonia*	721	83
American sycamore	*Platanus occidentalis*	731	26
Eastern cottonwood	*Populus deltoides*	742	12
Cherry and plum spp.	*Prunus* spp.	760	4
Pin cherry	*P. pensylvanica*	761	15
Black cherry	*P. serotina*	762	724
American plum	*P. americana*	766	39
Oak spp.	*Quercus* spp.	800	2
White oak	*Q. alba*	802	504
Scarlet oak	*Q. coccinea*	806	69
Durand oak	*Q. durandii*	808	4
Southern red oak	*Q. falcata*	812	447
Cherrybark oak	*Q. falcata* var. *pagodifolia*	813	61

continued

Table C.1—Common name, scientific name, FIA species code, and count of tree species ≥1.0 but <5.0 inches d.b.h. occuring in the FIA sample, Alabama, 2010 (continued)

Common name	Scientific name	FIA species code	Trees tallied
			number
Turkey oak	*Quercus laevis*	819	44
Laurel oak	*Q. laurifolia*	820	585
Overcup oak	*Q. lyrata*	822	24
Bur oak	*Q. macrocarpa*	823	1
Blackjack oak	*Q. marilandica*	824	83
Swamp chestnut oak	*Q. michauxii*	825	25
Chinkapin oak	*Q. muehlenbergii*	826	23
Water oak	*Q. nigra*	827	2,226
Nuttall oak	*Q. nutallii*	828	14
Willow oak	*Q. phellos*	831	102
Chestnut oak	*Q. prinus*	832	207
Northern red oak	*Q. rubra*	833	70
Shumard oak	*Q. shumardii*	834	1
Post oak	*Q. stellata*	835	276
Black oak	*Q. velutina*	837	111
Live oak	*Q. virginiana*	838	31
Dwarf post oak	*Q. margaretta*	840	4
Dwarf live oak	*Q. minima*	841	4
Bluejack oak	*Q. incana*	842	8
Camphortree	*Cinnamomum camphora*	858	8
Black locust	*Robinia pseudoacacia*	901	8
Black willow	*Salix nigra*	922	65
Sassafras	*Sassafras albidum*	931	204
American basswood	*Tilia americana*	951	13
White basswood	*T. heterophylla*	952	3
Carolina basswood	*T. caroliniana*	953	3
Winged elm	*Ulmus alata*	971	556
American elm	*U. americana*	972	124
Slippery elm	*U. rubra*	975	46
September elm	*U. serotina*	976	3
Chinaberry	*Melia azedarach*	993	33
Chinese tallowtree	*Triadica sebifera*	994	31
Other or unknown live tree	Tree unknown	999	2

FIA = Forest Inventory and Analysis; d.b.h. = diameter at breast height.

Table C.2—Common name, scientific name, FIA species code, and count of tree species ≥5.0 inches d.b.h. occuring in the FIA sample, Alabama, 2010

Common name	Scientific name	FIA species code	Trees tallied
			number
Atlantic white-cedar	*Chamaecyparis thyoides*	43	17
Southern redcedar	*Juniperus silicicola*	67	5
Eastern redcedar	*J. virginiana*	68	819
Sand pine	*Pinus clausa*	107	8
Shortleaf pine	*P. echinata*	110	1,675
Slash pine	*P. lliottii*	111	1,861
Spruce pine	*P. glabra*	115	206
Longleaf pine	*P. palustris*	121	1,593
Pond pine	*P. serotina*	128	1
Loblolly pine	*P. aeda*	131	38,188
Virginia pine	*P. virginiana*	132	1,543
Baldcypress	*Taxodium distichum*	221	294
Pondcypress	*T. ascendens*	222	43
Eastern hemlock	*Tsuga canadensis*	261	61
Florida maple	*Acer barbatum*	311	250
Boxelder	*A. negundo*	313	178
Red maple	*A. rubrum*	316	2,366
Silver maple	*A. saccharinum*	317	7
Sugar maple	*A. saccharum*	318	87
Chalk maple	*A. leucoderme*	323	5
Yellow buckeye	*Aesculus octandra*	332	20
Ailanthus	*Ailanthus altissima*	341	14
Mimosa, silktree	*Albizia julibrissin*	345	45
Serviceberry spp.	*Amelanchier* spp.	356	2
Sweet birch	*Betula lenta*	372	2
River birch	*B. nigra*	373	176
Chittamwood, gum bumelia	*Sideroxylon lanuginosum*	381	2
American hornbeam, musclewood	*Carpinus caroliniana*	391	519
Water hickory	*Carya aquatica*	401	67
Bitternut hickory	*C. cordiformis*	402	44
Pignut hickory	*C. glabra*	403	1,238
Pecan	*C. illinoensis*	404	60
Shellbark hickory	*C. laciniosa*	405	16
Nutmeg hickory	*C. myristiciformis*	406	1
Shagbark hickory	*C. ovata*	407	386
Black hickory	*C. texana*	408	2
Mockernut hickory	*C. tomentosa*	409	1,248
Sand hickory	*C. pallida*	410	12
Red hickory	*C. ovalis*	412	20
Southern shagbark hickory	*C. carolinae-septentrionalis*	413	1
Allegheny chinkapin	*Castanea pumila*	422	1
Catalpa spp.	*Catalpa* spp.	450	1
Southern catalpa	*C. bignonioides*	451	10
Sugarberry	*Celtis laevigata*	461	291
Hackberry	*C. occidentalis*	462	242

continued

Table C.2—Common name, scientific name, FIA species code, and count of tree species ≥5.0 inches d.b.h. occuring in the FIA sample, Alabama, 2010 (continued)

Common name	Scientific name	FIA species code	Trees tallied
			number
Eastern redbud	*Cercis canadensis*	471	44
Flowering dogwood	*Cornus florida*	491	627
Hawthorn spp.	*Crataegus* spp.	500	7
Common persimmon	*Diospyros virginiana*	521	225
American beech	*Fagus grandifolia*	531	385
White ash	*Fraxinus americana*	541	239
Black ash	*F. nigra*	543	1
Green ash	*F. pennsylvanica*	544	752
Pumpkin ash	*F. profunda*	545	5
Carolina ash	*F. caroliniana*	548	1
Waterlocust	*Gleditsia aquatica*	551	1
Honeylocust	*G. triacanthos*	552	27
Kentucky coffeetree	*Gymnocladus ioicus*	571	1
Silverbell spp.	*Halesia* spp.	580	3
Carolina silverbell	*H. carolina*	581	3
American holly	*Ilex opaca*	591	234
Butternut	*Juglans cinerea*	601	6
Black walnut	*J. nigra*	602	82
Sweetgum	*Liquidambar styraciflua*	611	7,834
Yellow-poplar	*Liriodendron tulipifera*	621	2,882
Osage-orange	*Maclura pomifera*	641	104
Cucumbertree	*Magnolia acuminata*	651	35
Southern magnolia	*M. grandiflora*	652	178
Sweetbay	*M. virginiana*	653	1,465
Bigleaf magnolia	*M. acrophylla*	654	126
Umbrella magnolia	*M. tripetala*	658	3
Apple spp.	*Malus* spp.	660	2
White mulberry	*Morus alba*	681	1
Red mulberry	*M. rubra*	682	118
Water tupelo	*Nyssa aquatica*	691	462
Ogeechee tupelo	*N. ogeche*	692	1
Blackgum	*N. sylvatica*	693	1,855
Swamp tupelo	*N. biflora*	694	936
Eastern hophornbeam	*Ostrya virginiana*	701	231
Sourwood	*Oxydendrum arboreum*	711	1,040
Paulownia, empress-tree	*Paulownia tomentosa*	712	17
Redbay	*Persea borbonia*	721	31
Water-elm, planertree	*Planera aquatica*	722	9
American sycamore	*Platanus occidentalis*	731	163
Eastern cottonwood	*Populus deltoides*	742	35
Swamp cottonwood	*P. heterophylla*	744	1
Cherry and plum spp.	*Prunus* spp.	760	1
Pin cherry	*P. ensylvanica*	761	1
Black cherry	*P. serotina*	762	843
American plum	*P. americana*	766	5

continued

Table C.2—Common name, scientific name, FIA species code, and count of tree species ≥5.0 inches d.b.h. occuring in the FIA sample, Alabama, 2010 (continued)

Common name	Scientific name	FIA species code	Trees tallied
			number
White oak	*Quercus alba*	802	2,345
Swamp white oak	*Q. bicolor*	804	4
Scarlet oak	*Q. coccinea*	806	380
Durand oak	*Q. durandii*	808	18
Southern red oak	*Q. falcata*	812	1,498
Cherrybark oak	*Q. falcata* var. *pagodifolia*	813	268
Turkey oak	*Q. laevis*	819	67
Laurel oak	*Q. laurifolia*	820	1,041
Overcup oak	*Q. lyrata*	822	96
Blackjack oak	*Q. marilandica*	824	195
Swamp chestnut oak	*Q. michauxii*	825	114
Chinkapin oak	*Q. muehlenbergii*	826	163
Water oak	*Q. nigra*	827	3,866
Nuttall oak	*Q. nuttallii*	828	16
Willow oak	*Q. phellos*	831	301
Chestnut oak	*Q. prinus*	832	1,362
Northern red oak	*Q. rubra*	833	389
Shumard oak	*Q. shumardii*	834	32
Post oak	*Q. stellata*	835	1,076
Black oak	*Q. velutina*	837	500
Live oak	*Q. virginiana*	838	71
Dwarf post oak	*Q. margaretta*	840	14
Dwarf live oak	*Q. minima*	841	5
Bluejack oak	*Q. incana*	842	5
Black locust	*Robinia pseudoacacia*	901	33
Willow spp.	*Salix* spp.	920	7
Black willow	*S. nigra*	922	160
Sassafras	*Sassafras albidum*	931	85
American basswood	*Tilia americana*	951	67
White basswood	*T. heterophylla*	952	14
Carolina basswood	*T. caroliniana*	953	32
Winged elm	*Ulmus alata*	971	603
American elm	*U. americana*	972	255
Slippery elm	*U. rubra*	975	89
September elm	*U. serotina*	976	13
Chinaberry	*Melia azedarach*	993	74
Chinese tallowtree	*Triadica sebifera*	994	52
Smoketree	*Cotinus obovatus*	996	2
Other or unknown live tree	Tree unknown	999	8

FIA = Forest Inventory and Analysis; d.b.h. = diameter at breast height.

Hartsell, Andrew J.; Cooper, Jason A. 2013. Alabama's forests, 2010. Resour. Bull. SRS–193. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 87 p.

The principle findings of the ninth forest survey of Alabama (2010) and changes that have occurred since the previous surveys are presented. Topics examined include forest area, ownership, forest-type groups, stand structure, basal area, timber volume, growth removals, and mortality. Alabama's contribution to the Nation's forest resources and regional comparisons are detailed.

Keywords: FIA, forest health, forest inventory, forest survey, forest trends, plantations, wood-processing plants.

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Alabama's forests envelop many backwoods roads with views of splendor.

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