USDA
United States Department of Agriculture

Texas' Forests, 2013

Kerry Dooley and Joe McCollum

Forest Service

Southern
Research Station

Resource Bulletin
SRS–225

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All photos by Kerry Dooley unless otherwise noted.

Front cover: top left, the higher elevations and arid environment of west Texas offers unique beauty; top right, cypress knees in Jones State Forest. (photo courtesy of Texas A&M Forest Service); bottom, woodland species, like mesquite, do not contribute greatly to forest industry volumes. But they do contribute to the biomass totals. (photo courtesy of Texas A&M Forest Service). Back cover: top left, east Texas is home to more typical southern trees and forests, such as these bald cypress with Spanish moss in Caddo Lake. (photo courtesy of Texas A&M Forest Service); top right, the higher elevations and arid environment of west Texas offers unique beauty; bottom, many types of wildlife benefit from the forest lands of Texas.

Texas is home to a variety of exciting wildlife.

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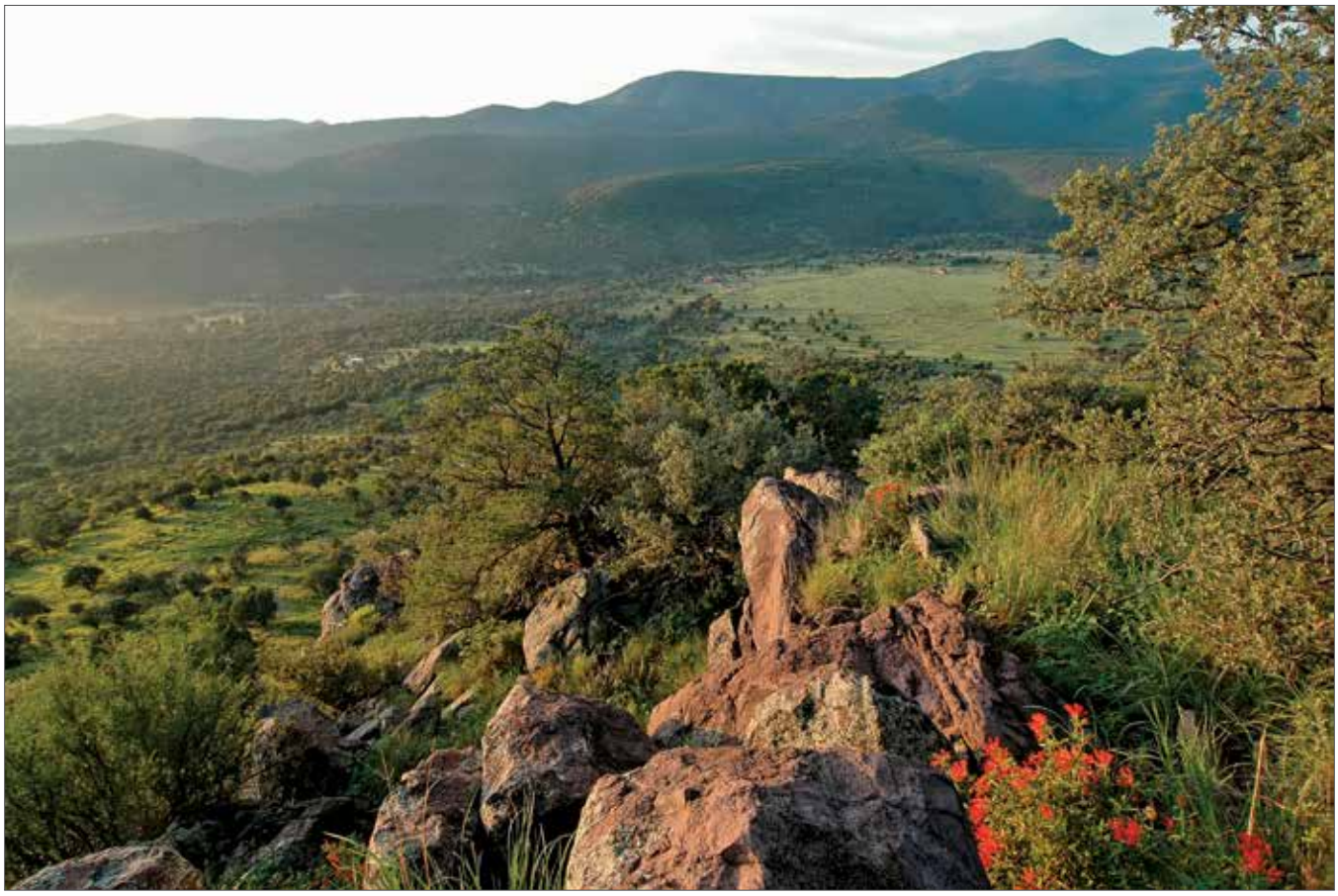

The forests in the Davis Mountains in west Texas contain a mix of woodland forests and those more typical of the western United States. (photo courtesy of Texas A&M Forest Service)

FOREWORD

The U.S. Department of Agriculture Forest Service, Southern Research Station's (SRS) Forest Inventory and Analysis (FIA) research work unit and cooperating State forestry agencies conduct annual forest inventories of resources in the 13 Southern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia), the Commonwealth of Puerto Rico, and the U.S. Virgin Islands. In order to provide more frequent and nationally consistent information on America's forest resources, all research stations and their respective FIA work units conduct annual surveys with a common sample design. These surveys are mandated by law through the Agricultural Research Extension and Education Reform Act of 1998 (Farm Bill).

The primary objective in conducting these inventories is to gather the multi-resource information needed to formulate sound forest policies, provide information for economic development, develop forest programs, and provide a scientific basis to monitor forest ecosystems. These data are used to provide an overview of forest resources that may include, but is not limited to, forest area, forest ownership, forest type, stand structure, timber volume, growth, removals, mortality, management activity, down woody material, and invasive species. The information presented is applicable at the State and survey unit level; although it provides the background for more intensive studies of critical situations, it is not designed to reflect resource conditions at small scales.

More information about Forest Service resource inventories is available in "Forest Resource Inventories: An Overview" (U.S. Department of Agriculture Forest Service 1992). More detailed information about sampling methodologies used in the annual FIA inventories can be found in "The Enhanced Forest Inventory and Analysis Program-National Sampling Design and Estimation Procedures" (Bechtold and Patterson 2005).

Data tables included in FIA reports are designed to provide an array of forest resource estimates, but additional tables can be obtained at http://fia.fs.fed.us/tools-data/default.asp. Additional information about the FIA program can be obtained at http://fia.fs.fed.us/.

Additional information about any aspect of this or other FIA surveys may be obtained from:

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ACKNOWLEDGMENTS

The authors gratefully acknowledge Chris Brown and Rebekah Zehnder who provided reviews and comments on an earlier draft of this report. In addition, the authors would also like to thank Helen Beresford, Chris Edgar, Chris Brown, Burl Carraway, Tom Brandeis, Jason Meade, Ted Ridley, Todd Schroeder, and Jason McHan for their contributions to creating this report. FIA thanks the Texas A&M Forest Service for partnering with our program in conducting data collection for the survey reported here. FIA also thanks other public agencies and the many private landowners who provided access to measurement plots.

The following individuals made field measurements for this survey. Without their dedicated efforts, this report would not be possible. FIA appreciates their hard work and their consistent efforts to obtain high-quality data. The following individuals collected the data presented in this report:

Texas A&M Forest Service

Kevin Coffman
Tony Guajardo
Michael Rasberry
Brad Bailey
Chris Brown
David Cahal
Drew Crocker
Jeremy Davis
Luis Diaz
Trevor DoBell-Carlsson
Linda Drabek
Lee Fleming
Jason Furmaniak
Kyle Harrell
Kari Hines
Justin Kendall
Jy Lutrick
Justin McCullough
Derrick Nahill
David Passauer
Mark Piggott
James Salladay
David Shannon
Charles Stair
Mike Weathers
Ray Wright
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Jonathan Lovelace
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Philip Martindale
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Justin Patton
Ryan Peaslee
Jay Seaton
Stephen Steptoe
Matt Turner
Jack Wallace
Jason Watson
Trey Williams
Justin Wise
Michael Wisniewski
Christopher Wood
Matt Wright
Aaron Wykhuis

U.S. Forest Service

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Kathy Tillman
Marcus Wood
Matthew Woolley

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A tree frog makes its home in the forests of central Texas

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Pictographs in Big Bend National Park.

HIGHLIGHTS FROM THE FIRST COMPLETE FOREST INVENTORY OF TEXAS (Ninth in East Texas)

• Inventory year 2013 marked completion of the first statewide inventory of Texas, and the ninth inventory of east Texas.

• In the cycle ending in inventory year 2013, about 63.1 million acres, or about 37 percent of total Texas area was forested. Timberland, land which is capable of producing at least 20 cubic feet of woody fiber per acre per year, and is not classified as reserved from timber extraction per statute or administrative designation, accounts for about 8 percent of the total land area or 14.1 million acres.

• About 93 percent (58.8 million acres) of Texas's forest land was in private nonindustrial ownership.

• In Texas the most dominant forest-type group was woodland hardwoods, occupying 37 percent or 23.6 million acres. On timberlands, the most common forest-type group was loblolly-shortleaf pine.

There is a variety of non-tree plant life in Texas as well.

• The size class most present on forest lands was small-diameter, occupying about 39 percent of forest land area. Of timberlands, 52 percent of the area was of large-diameter size class.

• An estimated 19.6 billion trees (≥1 inch diameter) were present on forest land in Texas, with honey mesquite being the most common.

• Trees (≥5 inches diameter) on forest land in Texas held a volume of about 31.6 billion cubic feet, with loblolly pine (*Pinus taeda*) holding more than any other species.

• On forest land in east Texas the average annual gross growth was 958.2 million cubic feet, a reduction from the previous survey. Removals averaged 571.9 million cubic feet per year, also decrease from the previous survey. The reported mortality of 343.8 million cubic feet per year during this survey was an increase of 117 percent from the previous survey.

• Weather disturbances affected an average of 539,500 acres annually, with drought alone impacting 372,400 average annual acres.

• At least one silvicultural treatment was applied on 888,800 annual average acres. Cutting or harvesting were the most common silvicultural activities.

• Japanese honeysuckle (*Lonicera japonica*) was the invasive species found most frequently (684 plots) in east Texas, while Chinese tallowtree (*Triadica sebifera*) was the invasive species found with the highest frequency of heavy invasion (>90 percent forested plot coverage).

• Approximately 431.6 million tons of down woody material was present on the forest floor of central and western Texas.

INTRODUCTION

This report is dated 2013, but the data were actually collected over several years using an annual collection method, where a portion of the plots are collected each year. For the two easternmost units (Northeast and Southeast), data were collected over about 5 years starting in 2009. In these two units, 20 percent of the plots are measured each year, so the data analyzed in this report represents a complete remeasurement survey cycle. For the five survey units of central and western Texas, data were collected starting in 2004. These units are on a 10-year cycle, meaning about 10 percent of the plots are allotted for measurement each year. Due to logistical challenges, actual field measurement was completed about 12 years later. Readers will note that because the plots in these central and western units are being measured for the first time, change data—such as growth and removals—is not yet available for those units. Any change data presented in this report will concern only the two eastern most survey units. More information is presented in the Inventory Methods section of this report.

With land and water area covering nearly 172 million acres, Texas is the largest State in the southern FIA region. It is also very diverse. While the transitions from one ecological zone to another are of course gradual, the seven FIA unit boundaries (fig. 1) roughly align with these shifts.

The eastern boundary of Texas and unit 1 (Southeast) begins at Sabine Pass, an 8-mile long shipping and boating channel. To the southwest are wetlands and beaches.

Figure 1—Forest survey units in Texas.

A formerly maintained trail and bridge have reverted to forest.

Upstream from the Sabine Pass, the Texas-Louisiana boundary continues with Sabine Lake. At the western shore of Sabine Lake are the cities of Port Arthur and Beaumont. To the southwest of those cities is the Coastal Prairie, which stretches to metropolitan Houston. The forests in the Coastal Prairie are dominated by the nonnative invasive species Chinese tallowtree (*T. sebifera*). Around the outer southwest boundary of unit 1 is Harris County, dominated by urban land uses due to the city of Houston, and then some pasture along the western edge of the unit with oak-hickory forest stands mixed in. Upstream from Sabine Lake, on the eastern edge of unit 1, is the Sabine River. With the exception of a few oxbows, the Texas boundary continues along the river. The forest changes to loblolly-shortleaf, a forest type group that dominates the unit. More than 120 miles north of Sabine Lake is the Toledo Bend Reservoir. At the western edge of the reservoir is the Sabine National Forest.

North of the reservoir, the Sabine River continues into the unit 2 (Northeast). Loblolly-shortleaf is still the dominant forest type, but trends to oak-hickory toward the western part of the unit, where there is also more land in pasture. At the 32nd parallel the Sabine River continues to the northwest, but the Texas boundary extends due north to the Red River, with the State's northeast boundary occurring just north of the city of Texarkana. The forest types remain similar in the northern part of unit 2.

Ultimately the Sabine River drains from Lake Tawakoni in unit 3 (North Central). The eastern part of unit 3 is mostly pasture, with some cropland and forest mixed in. Where the land is forest, the main forest type is oak-hickory with some elm-ash-cottonwood and eastern redcedar (*Juniperus virginiana*) mixed in. At the northwestern corner of the unit the forest type transitions toward woodland hardwoods, specifically honey mesquite (*Prosopis glandulosa*). Within unit 3, to the south of the first tier of counties along the Red River is the Dallas-Fort Worth metroplex. Naturally, urban land uses dominate, but south of the metroplex, along U.S. Highway 77/Interstate 35, is a band of cropland. The concurrent highway crosses into unit 5 near Waco, TX, then U.S. Highway 77 crosses back into unit 3. Cropland turns to pasture toward the southeastern end of the unit, and to forest at the southwestern end. The forest type is generally oak-hickory which trends to woodland hardwoods (*P. glandulosa*) in the southwest.

East on Interstate 10 is Houston, back in unit 1. From there, Interstate 45 goes into Galveston County and unit 4. Galveston County is primarily surface water and urban. The small forests of Galveston County have an oak-hickory forest type, but *T. sebifera* dominates as it does in the coastal prairie to the northeast. Further to the southwest in unit 4 is a cluster of cropland, intermixed with elm/ash/cottonwood forests. Closer to Corpus Christi, the forests tend toward oak-hickory before turning to woodland hardwoods. At the very south of the unit is another cluster of cropland as well as the urban area of Brownsville-McAllen. The northwestern part of the unit is dominated by woodland hardwood forest, mostly *P. glandulosa*. The landscape becomes much more rural.

Interstate 35 leads from Laredo to San Antonio, Bexar County, and unit 5. Although Bexar County is dominated by urban land uses, the rest of the unit is mostly forest. Pinyon-juniper dominates the eastern and the southwestern part of the unit, while oak-hickory dominates the central part. To the northwest is woodland hardwood, and unit 6.

In unit 6, the forest type is woodland hardwoods, with pockets of pinyon-juniper and elm-ash-cottonwood. Cropland and rangeland dominate in the northwestern part of this unit.

The Texas-New Mexico boundary is roughly the 103rd meridian and the 32nd parallel. Unit 7 begins at roughly the intersection of these lines. The eastern part of the unit is forest (mostly woodland hardwood with some pinyon-juniper), but the western part is rangeland. The western tip is El Paso County, which has a more urban flavor than the rest of the unit.

The southern boundary of Texas is the Rio Grande River, which flows to Brownsville and empties into the Gulf of Mexico. Prevailing westerlies carry the waters to the point of beginning at the Sabine Pass.

FOREST AREA

At approximately 171.9 million acres, Texas is the largest State in the conterminous United States. More than 63 million acres are forested, making up about 37 percent of the total area of Texas. Timberland, land which is capable of producing at least 20 cubic feet of woody fiber per acre per year and is not classified as reserved from timber extraction per statute or administrative designation, accounts for about 22 percent of the forested area or 8 percent of the total land area. These 14.1 million acres of productive timberland are concentrated mostly in the Northeast and Southeast units (fig. 2).

Trends in Forest Area

Because only east Texas had collected data for previous inventory cycles, our review of trends will be limited to the Southeast and Northeast units. Since the last complete survey of east Texas in 2008, very little change in area of either timberland or other forest land was observed: less than one half a percentage from the acres reported in 2008. Looking at each of the two units individually, the Southeast unit showed a slight increase of <1 percent in both timberland and other forest land, while the Northeast unit decreased slightly, reducing about 1½ percent in both forest land and timberland. Tracking acres of timberland going back to the first survey in 1935 we see the area has been quite stable over the long term as well (fig. 3). Readers should note that changes in method and survey design over time may cause some difference in estimated acres which are not actual change (Bechtold and Patterson 2005).

Ownership

The vast majority of both forest land and timberland is owned by private, noncorporate, nonindustrial groups and individuals, at 71 percent (fig. 4) and 59 percent (fig. 5) respectively. Nonindustrial (those outside of forest industry) corporations follow, accounting for 22 and 30 percent of the forest and timberlands, respectively. Meanwhile forest industry accounted for only 1 percent and 2 percent of the forest land and timberland area, respectively.

Some changes in ownership allocation have occurred since the 2008 data. Of particular note are the ownership categories of forest industry which decreased by about 85 percent for both timberland and forest land, and "other corporate" which increased about 90 percent on timberland and over 100 percent on total forest land (table 1). This same pattern has been noted in the

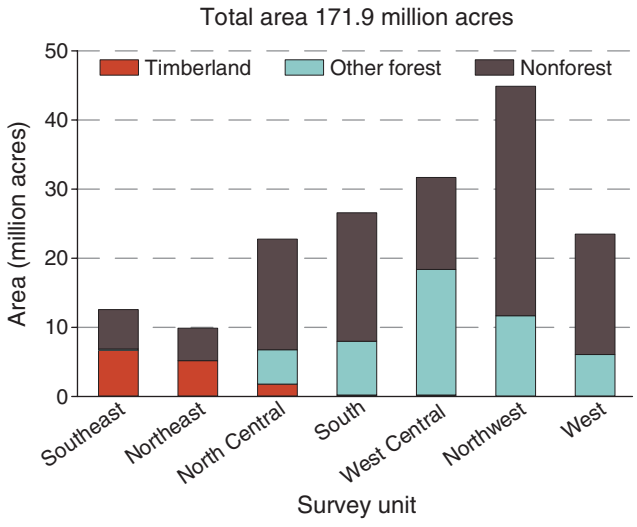

Figure 2—Timberland, other forest land, and nonforest area by survey unit, Texas, 2013.

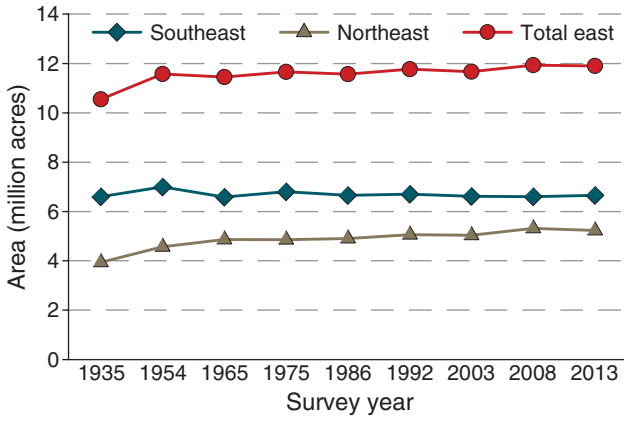

Figure 3—Timberland area by survey unit and year, east Texas, 2013.

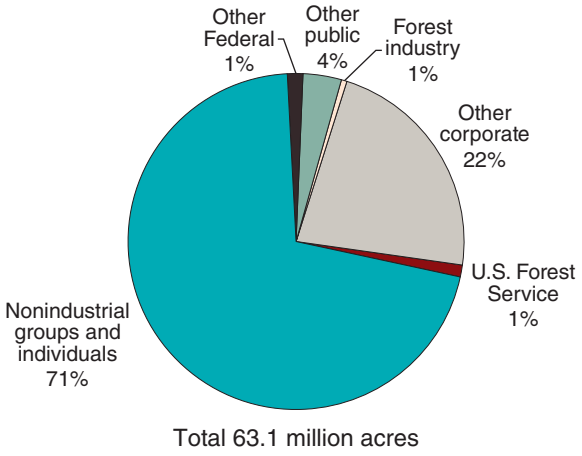

Figure 4—Forest land by ownership class, Texas, 2013.

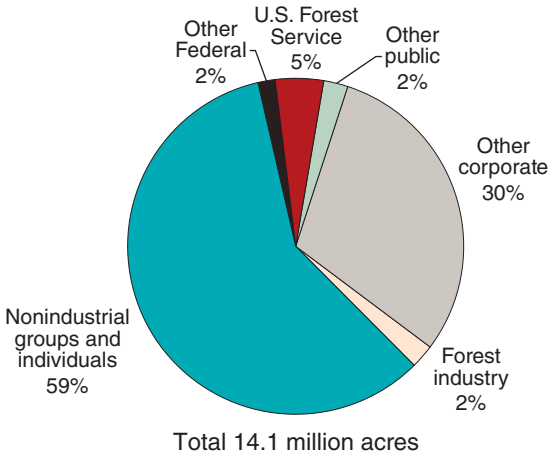

Figure 5—Timberland by ownership class, Texas, 2013.

recent Resource Update factsheets for east Texas (Brandeis 2015, Brandeis and others 2014, Dooley and Brandeis 2014).

Forest-Type Group

By area, woodland hardwoods is the predominant group, making up 37 percent of the 63.1 million total acres of forest land, followed by oak-hickory at 20 percent, and pinyon-juniper at 15 percent (fig. 6). This is due to the inclusion of the western five FIA survey units in the statewide estimate (fig. 1). At the survey unit level only three units have a plurality of woodland hardwood forest types, the others are

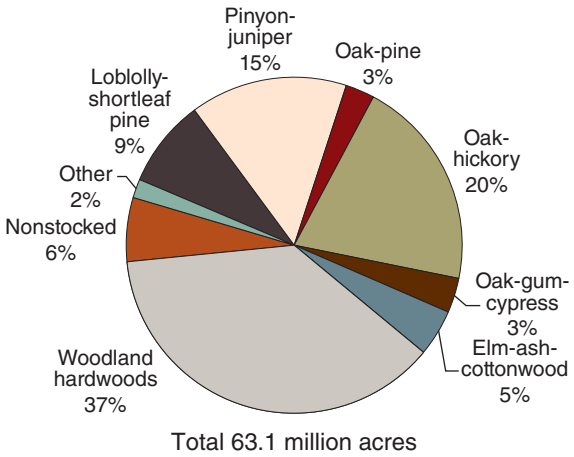

Figure 6—Area of forest land by forest-type group, Texas, 2013.

Table 1—Area change of forest land and timberland, from cycle eight (2008) to cycle nine (2013), by ownership, east Texas

	Land use			
	Forest land		Timberland	
Ownership class	2008	2013	2008	2013
	thousand acres			
U.S. Forest Service	745.8	723.5	677.5	655.5
Other Federal	851.7	941.3	162.4	232.6
Other public	2,047.7	2,335.0	282.5	330.3
Forest industry	2,272.0	340.4	2,272.0	324.8
Other corporate	6,937.9	14,107.9	2,240.4	4,266.2
Nonindustrial private groups and individuals	49,622.9	44,688.1	8,836.6	8,309.9
Total	62,477.9	63,136.2	14,480.0	14,119.3

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

dominated by loblolly-shortleaf pine, oak-hickory, and pinyon-juniper (fig. 7). The area of timberland has quite a different composition and distribution of forest-type groups. Here the loblolly-shortleaf pine group dominates at 38 percent of the 14.1 million acres (fig. 8).

Stand Size and Age

The majority (52 percent) of the timberlands in Texas are of the large-diameter size class (≥11.0 inches for hardwoods, ≥9.0 inches for softwoods), with 25 percent in the medium-diameter size class (5.0–9.0 inches and 11.0 inches), 22 percent in the small-diameter size class (≤5.0 inches), and only 1 percent nonstocked (fig. 9). The total forest land shows a very different composition with only 34 percent in the large-diameter class, 22 percent in the medium-diameter size class, 39 percent in the small-diameter class, and 6 percent nonstocked. This difference between forest land and timberland in size-class distribution is tied to the addition of the five western units to the FIA survey area. In these areas woodlands dominate and timberland is uncommon. These units, particularly the West, Northwest, and West Central units, have greater areas with small diameter or nonstocked forests (fig. 10). On the other hand, timberland is predominantly of the large-diameter size class and mostly found in the eastern two units (figs. 9 and 10).

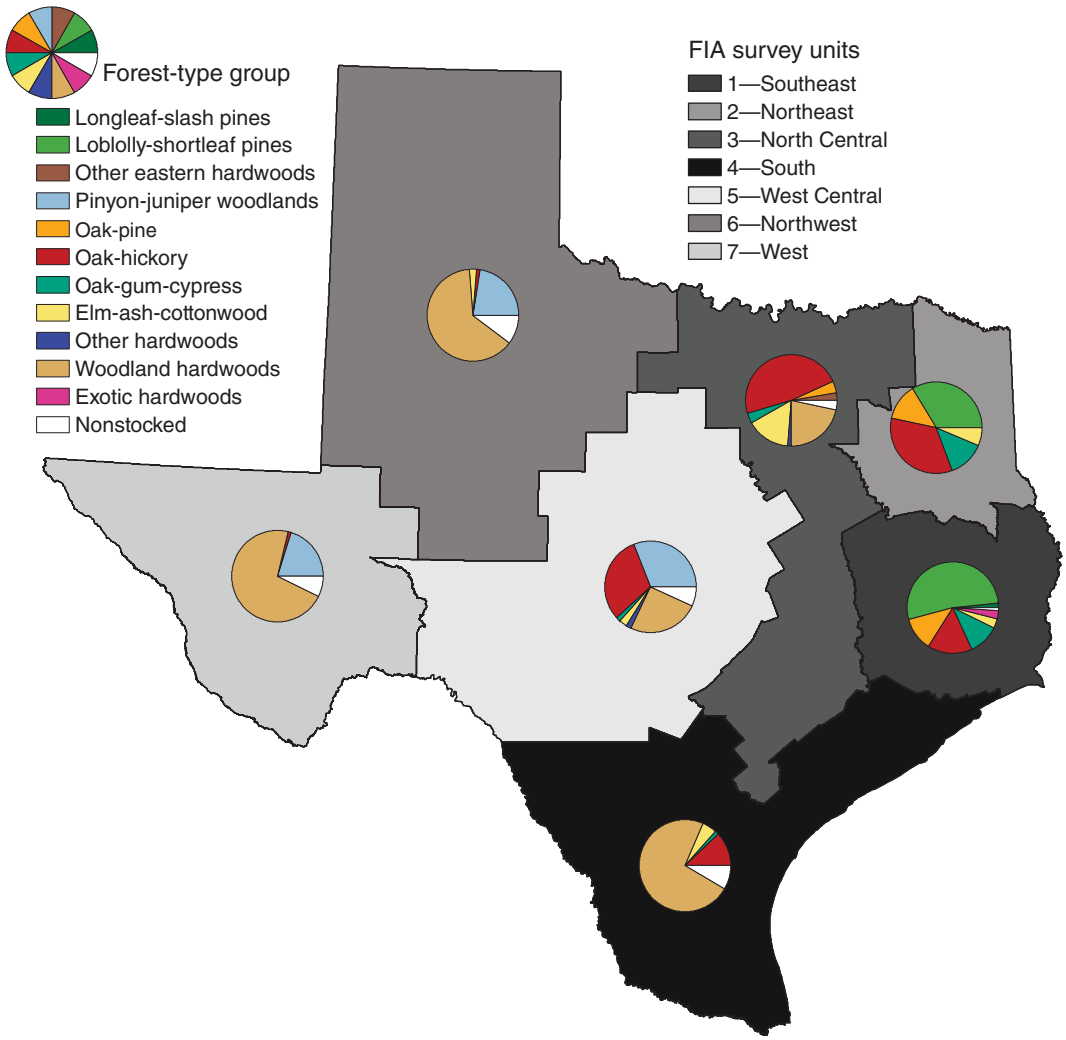

Figure 7—Proportion of forest-type groups by survey unit, Texas, 2013.

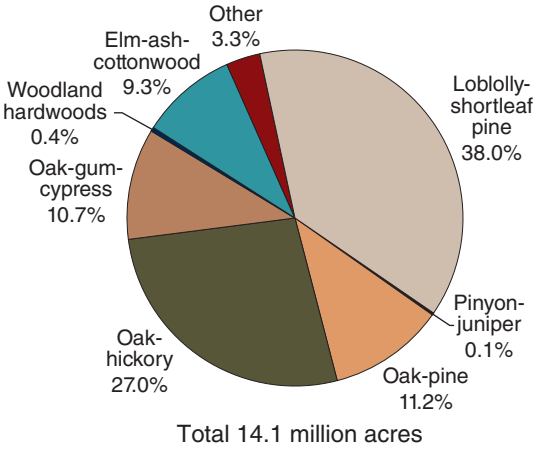

Figure 8—Area of timberland by forest-type group, Texas, 2013.

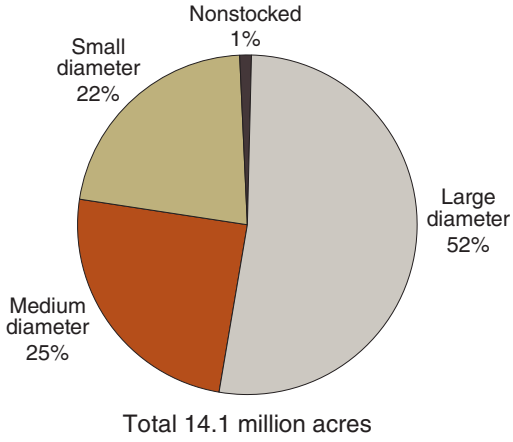

Figure 9—Timberland by stand-size class, Texas, 2013.

Native and exotic animal species call Texas' forests home.

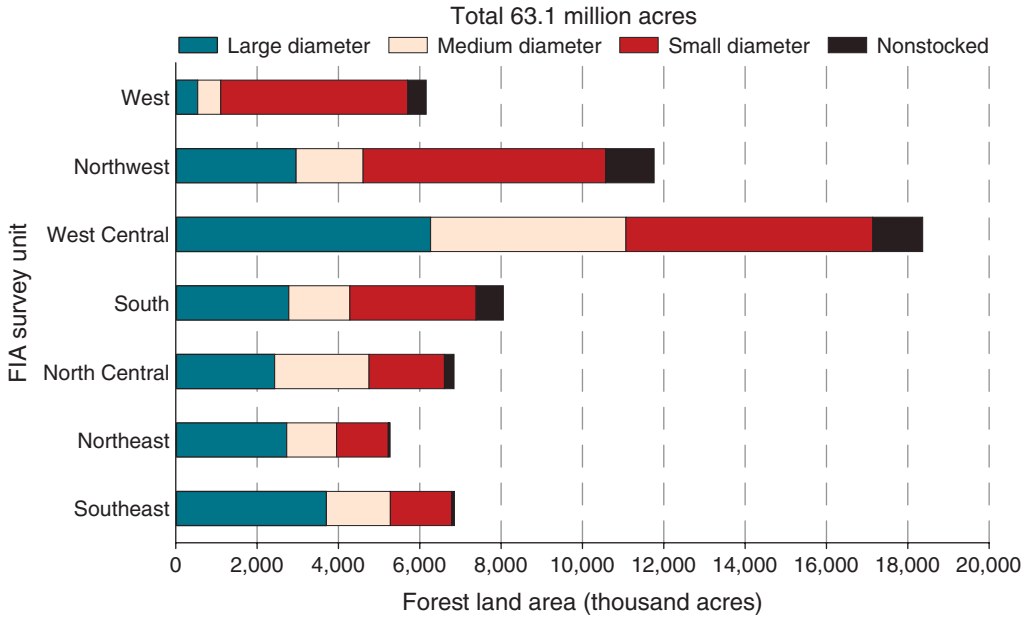

Figure 10—Forest land by stand-size class and survey unit, Texas, 2013.

A pine plantation in east Texas, where artificial regeneration is more common. (photo courtesy of Texas A&M Forest Service)

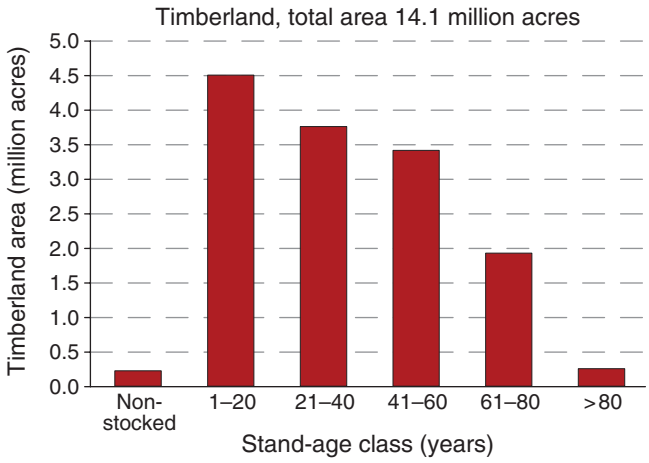

Figure 12—Age class distribution of timberland in Texas, 2013.

For total forest land, area by age class is distributed fairly normally, with the greatest area (31 percent) in age class 21–40 (fig. 11). Though the size distribution of timberlands skewed larger, the age distribution skews younger (fig. 12). Stands aged 1–20 years old account for 32 percent of the 14.1 million acres of timberland in Texas followed by 21–40-year age class at 27 percent. Timberlands inherently provide more productive growing conditions than other forest lands, and they are also more likely to be managed for commercial forestry. These combined factors contribute to the young age but large-size skewing observed on Texas timberlands.

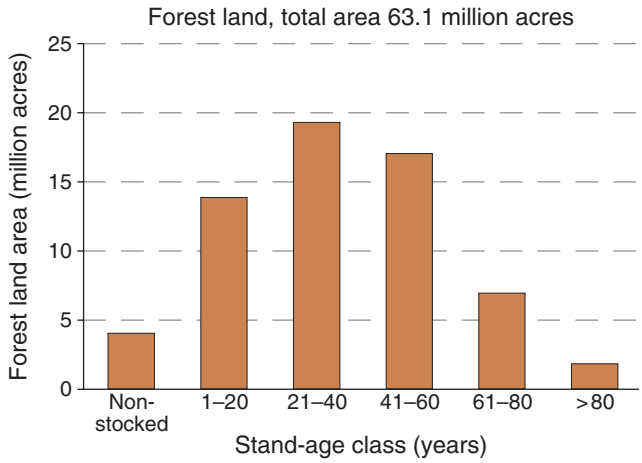

Figure 11—Age class distribution of forest land in Texas, 2013.

Stand Origin

As would be expected, almost all (>99 percent) of the artificial regeneration (e.g., planting trees) takes place on timberlands, where 3.1 million of the 14.1 million acres are artificially regenerated. Of particular note are loblolly-shortleaf pine and longleaf-slash pine species groups, which were artificially regenerated on timberlands 51 and 61 percent of the time, respectively. Loblolly-shortleaf forests alone make up 87 percent of the artificially regenerated timberlands in Texas (fig. 13).

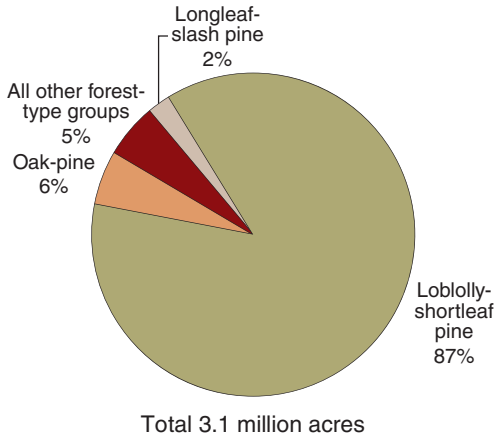

Figure 13—Area of artificially regenerated timberland by forest-type group, Texas, 2013.

NUMBER OF TREES, VOLUME, AND BIOMASS

Computations on the number and volume of trees shift the focus from acres of land to individual trees and tree components. These data provide information on available timber and other woody fiber, as well as species abundance and diversity. Readers will note that with the shift from acres to trees, a new data type is also used. In the previous section, forest type or forest-type group were exclusively used. In this section most of the discussion will be on species or species group. The names for many of the forest-type groups and species groups are similar, but they cannot be used as proxies for one another. While the forest type will be based on the dominant species, each forest type is made up of many tree species. If forest types were used as surrogates for tree species and species groups in the analysis of volume, weight, and number of trees, there would be risk of over- or under-estimating the true measurement (Rose and others 2015).

Number of Trees

Number of trees gives us an estimate of how many live trees of at least 1.0 inch diameter at breast height (d.b.h.) or diameter at root collar (d.r.c.), are present on the forest lands in Texas. The measurement for number of trees is useful for getting a complete picture of how dense and diverse the forest lands are in Texas. There are an estimated 19.6 billion trees, which equates to approximately 310 trees per acre on forest land (U.S. Department of Agriculture Forest Service 2019). These comprise 137 unique species in the State. The most common species was honey mesquite (*Prosopis glandulosa*), which numbers approximately 3.2 billion, followed by Ashe juniper (*Juniperus ashei*) at 2.4 billion (table 2).

A century plant blooms with Mesquite saplings in the background.

Table 2—Most common 20 species on forest land in Texas, 2013, by number of trees ≥1-inch d.b.h.

Species	Number of trees
Honey mesquite	3,184,113,159
Ashe juniper	2,364,947,648
Loblolly pine	1,925,440,814
Sweetgum	1,107,545,331
Texas persimmon	1,079,323,551
Live oak	893,878,053
Winged elm	663,543,647
Water oak	595,083,137
Post oak	587,363,497
Cedar elm	539,481,517
Pinchot juniper	519,200,079
Sugarberry	472,457,276
Chinese tallowtree	400,021,726
Eastern redcedar	391,643,854
Green ash	222,805,126
Redberry juniper	215,663,523
Red maple	211,173,634
Chittamwood, gum bumelia	209,368,083
Blackgum	186,699,519
Netleaf hackberry	179,043,284

D.b.h.=diameter at breast height.

On timberlands there are about 8.4 billion live trees ≥1.0 inch d.b.h./d.r.c., or approximately 594 trees per acre of timberland (Miles 2017). The timberlands comprise 105 distinct species, with loblolly pine (*Pinus taeda*) being most prevalent at 1.9 billion, followed by sweetgum (*Liquidambar styraciflua*) numbering 1.1 billion (table 3).

Volume of Trees

Net merchantable bole volume of trees excludes rotten, missing, and cull defective portions of the trees; it also excludes trees <5.0 inches d.b.h./d.r.c. from the sample. Measuring trees by volume rather than by count emphasizes the role they play in forest products, biomass and carbon, and other volume driven attributes. On timberland, a total net volume of 19.5 billion cubic feet is present. This equates to approximately 1,383 cubic feet per acre on timberlands. Softwoods account for 52.7 percent (10.3 billion cubic feet) of the total volume on timberlands, with 42.3 percent (8.3 billion cubic feet) coming from loblolly pine, the single species contributing the most to volume (table 4). Sweetgum is the greatest contributor to volume of hardwoods, but only 1.4 billion cubic feet, or 7 percent of the total, comes from this species (table 4). Looking at the contributions by species group highlights the importance of loblolly-shortleaf pines in softwood volumes on timberlands (fig. 14) as well as the more balanced distribution of volume among hardwood species on timberlands (fig. 15).

On the broader forest lands, a total net volume of 31.6 billion cubic feet is present, a density of around 500 cubic feet per acre. Hardwoods represent the majority of

Table 3—Most common 20 species on timberland in Texas, 2013, by number of trees ≥1-inch d.b.h.

Species	Count
Loblolly pine	1,914,308,451
Sweetgum	1,101,378,822
Winged elm	602,895,408
Water oak	566,795,168
Chinese tallowtree	381,706,087
Post oak	250,471,088
Eastern redcedar	244,522,858
Sugarberry	204,451,925
Red maple	201,937,746
Green ash	185,388,220
Blackgum	176,827,726
Southern red oak	173,282,015
American hornbeam, musclewood	167,041,339
Willow oak	157,216,614
Eastern hophornbeam	128,046,485
Laurel oak	125,111,789
American holly	121,574,686
Cedar elm	109,297,234
Shortleaf pine	108,253,341
White oak	95,238,689

D.b.h.= Diameter at breast height.

Table 4—Top 20 species (≥5-inches d.b.h.) by net volume on timberland, Texas, 2013

Species	Volume
	cubic feet
Loblolly pine	8,256,941,163
Sweetgum	1,403,909,601
Shortleaf pine	1,222,067,697
Post oak	1,218,457,619
Water oak	1,215,416,158
Southern red oak	614,932,322
Willow oak	434,595,333
Green ash	370,867,897
White oak	326,050,679
Winged elm	308,249,273
Cherrybark oak	268,326,376
Eastern redcedar	266,460,546
Blackgum	264,212,102
Sugarberry	259,972,875
Baldcypress	247,279,152
Slash pine	224,924,512
Cedar elm	221,465,411
Pecan	211,442,923
Overcup oak	173,709,079
American elm	167,051,482

D.b.h. = Diameter at breast height.

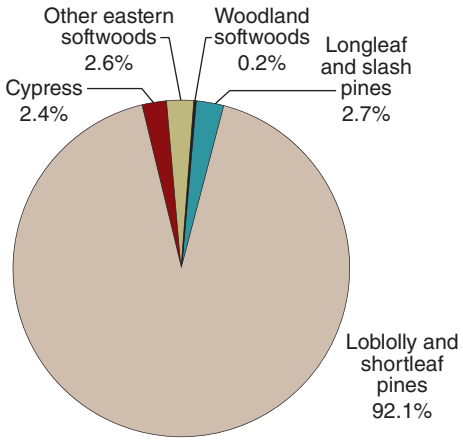

Figure 14—Net volume of softwood species on timberland by species group, Texas, 2013.

contributions with 17.3 billion cubic feet (55 percent). By individual species loblolly pine continues to lead, with 8.4 billion cubic feet, but here it is followed by honey mesquite at 3.3 billion cubic feet (table 5). By species-group, the majority of the volume on forest land still comes from loblolly and shortleaf pines, but it contributes less proportionally than on timberland (fig. 16). The hardwoods on all

Table 5—Top 20 species (≥5-inches d.b.h.) by net volume on forest land, Texas, 2013

Species	Volume
	cubic feet
Loblolly pine	8,447,588,448
Honey mesquite	3,330,714,984
Ashe juniper	2,948,922,413
Post oak	2,132,807,937
Live oak	1,708,473,972
Sweetgum	1,429,257,295
Water oak	1,284,342,197
Shortleaf pine	1,230,295,629
Cedar elm	676,019,009
Southern red oak	634,165,420
Sugarberry	466,644,556
Green ash	465,798,988
Willow oak	444,207,614
Eastern redcedar	414,118,514
Pinchot juniper	393,351,487
Pecan	387,697,709
Winged elm	349,334,642
White oak	332,437,924
Baldcypress	299,259,202
Blackgum	272,673,763

D.b.h. = Diameter at breast height.

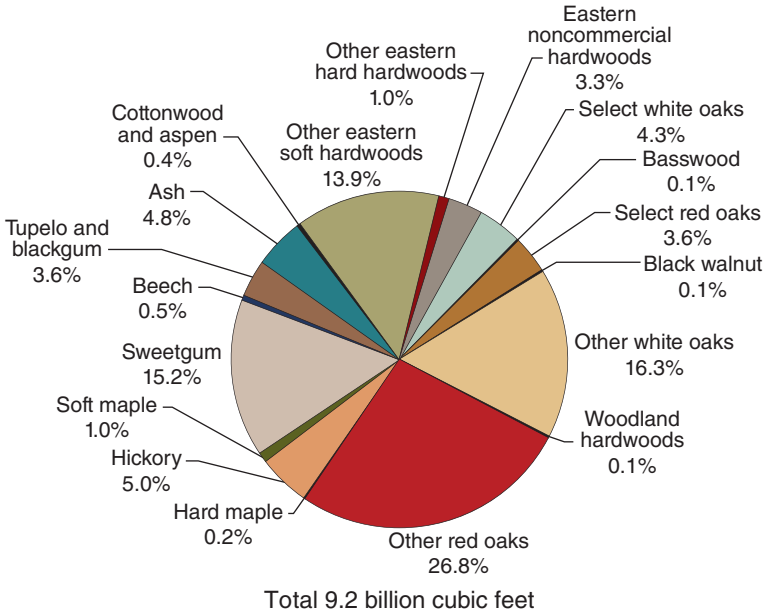

Figure 15—Net volume of hardwood species on timberland by species group, Texas, 2013.

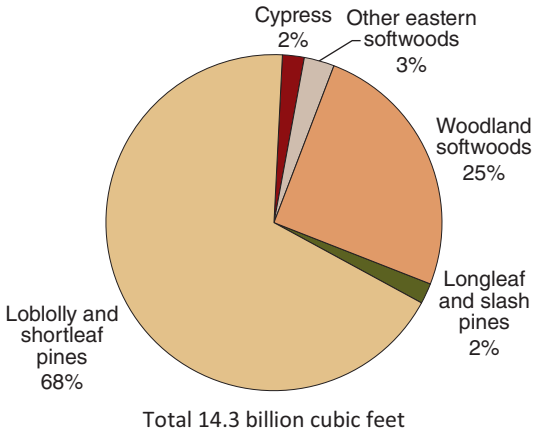

Figure 16—Net volume of softwood species on forest land by species group, Texas, 2013.

Woodland species, like mesquite, do not contribute greatly to forest industry volumes. But they do contribute to the biomass totals. (photo courtesy of Texas A&M Forest Service)

forest land again show a more balanced contribution to volume than seen in softwoods (fig. 17). Here the other-white-oak group is most prevalent, followed by woodland hardwoods, which were almost nonexistent in the timberland volume.

Biomass

Common uses of biomass information include those relating to bioenergy and carbon sequestration. Depending on a user's specific biomass interest, the calculation used will vary—for example, green weight versus dry weight, or all parts of the trees versus select parts (Jenkins and others 2004). FIA databases offer options to suit most inquiries (https://apps.fs.usda.gov/Evalidator/evalidator.jsp). The aboveground, dry weight of live trees (≥1.0 inch d.b.h/d.r.c) on forest land in Texas is 896.5 million short tons, or 14.2 short tons per acre of forest. At 561.3 million short tons, hardwoods account for the majority (63 percent) of the biomass. In the Forest Health (Down Woody Materials) section of this report, there is additional information on biomass and carbon contained in downed trees and on the forest floor.

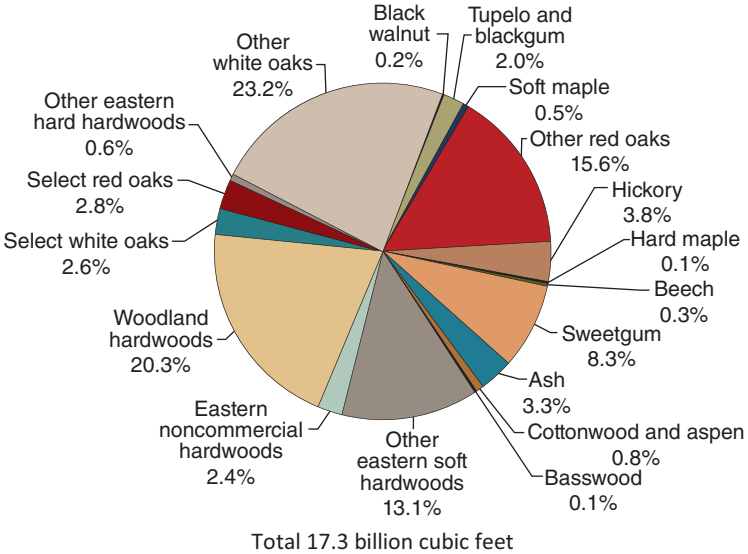

Figure 17—Net volume of hardwood species on forest land by species group, Texas, 2013.

GROWTH, MORTALITY, AND REMOVALS

Forest resource changes and trends are important indicators of sustainability. Comparing volume of growth to that of mortality and removals can show whether forest resources are being over or underutilized, and whether other factors are impacting the survival of trees. Volume change amounts are presented as average annual change. Gross growth is the total volume of growth on live trees (≥ 5.0 inches), net growth is gross growth minus mortality, and net change is net growth minus removals. In addition to harvested trees, removals also include trees taken out of the sample, such as trees formerly part of timberlands volume which are on lands that have moved into a protected category, or a land use change to nonforest; as the name implies, harvest removals isolates the trees removed by harvest activities.

Because this is the first complete survey of the five western units, change data (growth, removals, and mortality) is only available for units 1 (Northeast) and 2 (Southeast). As covered in previous chapters, in these two units most of the forest land is timberland. The specific numbers discussed here refer to total forest areas, but the patterns and trends seen in timberland are nearly identical. In future years, when change data is available for the remaining five units, it is likely that more differences between forest land and timberland changes will be evident.

Growth

On all forest land the average annual gross growth was 958.2 million cubic feet per year, a reduction from the growth of 1,094.6 million cubic feet reported in the previous survey (fig. 18). With mortalities of 343.8 million cubic feet, the net growth (gross growth less mortality) was 614.4 million cubic feet per year.

Loblolly-shortleaf species group showed much more growth than other species groups. (photo courtesy of Texas A&M Forest Service)

Softwoods, particularly the loblolly and shortleaf pine species group, at 458.2 million cubic feet annually, showed much greater net volume growth than hardwoods. This species group also showed the greatest net growth in proportion to total current volume. By ownership group, the greatest overall net volume gain of 567.6 million cubic feet per year, was on nonindustrial private land. However, in proportion to total volume per ownership group, forest industry had the greatest annual net growth.

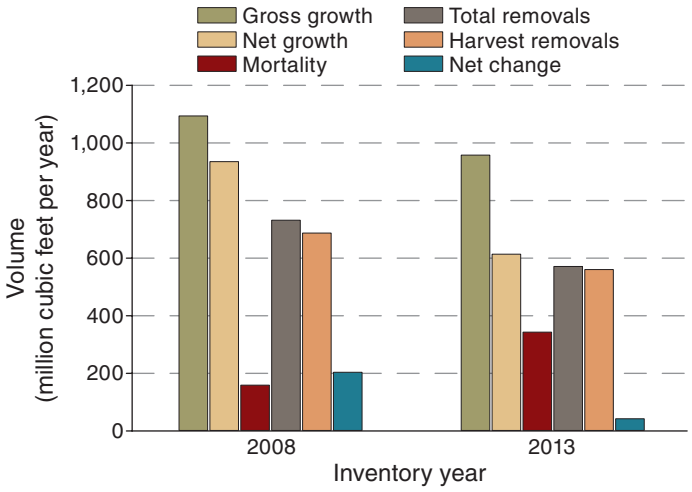

Figure 18—Average annual growth, removals, and mortality on forest land, east Texas, 2008 and 2013.

Mortality

The reported mortality of 343.8 million cubic feet per year during this survey (2009–2014) was an increase of 117 percent from the 2004–2008 survey when mortality averaged 158.7 million cubic feet per year (fig. 18). Crews record the cause of death at a broad level for trees that died since the last survey (mortality trees). Weather caused the greatest proportion of tree deaths, with 60 percent of the mortalities, followed by insects (13 percent) and disease (11 percent) (table 6). As compared to the 2008 data summary, all but insects caused mortality volume to increase (fig. 19). However, weather-caused mortality was an especially striking increase. Weather includes discrete events like tornados or ice storms, as well as long-term or continual events like the record breaking drought Texas experienced in 2011 (National Oceanic and Atmospheric Administration 2011, United States Department of Agriculture Forest Service 2014).

Of the 343.8 million cubic feet per year of mortality, hardwoods contributed greater total average annual volume loss (203.6 million cubic feet, or 3 percent of

Table 6—Mortality volume by cause of death and tree species group, east Texas, 2013

Species group	Insect	Disease	Fire	Animal	Weather	Vegetation	Unsure/ other	Total
	thousand cubic feet per year							
Longleaf and slash pines	813.55	284.01	—	—	6,254.18	433.14	84.58	7,869.45
Loblolly and shortleaf pines	39,231.19	3,946.36	3,105.36	41.62	65,970.37	8,849.97	8,449.90	129,594.79
Cypress	—	—	—	—	247.74	—	—	247.74
Other eastern softwoods	143.77	—	54.03	—	1,776.77	507.99	—	2,482.56
Select white oaks	—	1,071.00	372.57	—	11,264.33	430.21	217.58	13,355.69
Select red oaks	—	1,245.07	—	—	9,169.74	450.47	366.87	11,232.15
Other white oaks	58.15	2,093.22	357.18		6,010.46	735.60	858.43	10,113.04
Other red oaks	756.21	16,553.69	555.82	39.19	62,053.95	2,248.66	5,262.24	87,469.75
Hickory	528.90	937.88	131.73	194.59	5,850.95	1,557.17	292.45	9,493.67
Hard maple	—	—	—	—	94.27	—	—	94.27
Soft maple	64.93	407.06	100.67	46.61	2,347.01	560.23	250.44	3,776.95
Beech	—	58.56	—	—	2,398.48	6.65	—	2,463.70
Sweetgum	376.94	4,295.54	609.67	191.78	9,977.37	2,536.89	646.02	18,634.22
Tupelo and blackgum	—	188.38	9.11	—	1,618.48	293.23	504.77	2,613.97
Ash	547.86	448.60	—	276.84	2,019.75	426.74	7.83	3,727.62
Cottonwood and aspen	—	—	—	—	—	4,439.19	469.27	4,908.47
Basswood	—	23.95	—	—	155.90	86.29	—	266.13
Black walnut	—	—	—	—	—	—	—	—
Other eastern soft hardwoods	793.43	3,150.40	261.84	833.22	11,695.70	3,387.82	1,462.84	21,585.25
Other eastern hard hardwoods	602.26	1,015.88	32.55	—	1,081.03	274.28	428.24	3,434.23
Eastern noncommercial hardwoods	360.36	1,683.66	768.43	80.39	5,328.06	1,494.00	578.49	10,293.38
Woodland hardwoods	—	—	—	—	—	—	121.33	121.33
Total	44,277.55	37,403.26	6,358.95	1,704.24	205,314.55	28,718.53	20,001.29	343,778.37

— = No observations recorded of the damage group on this species group.

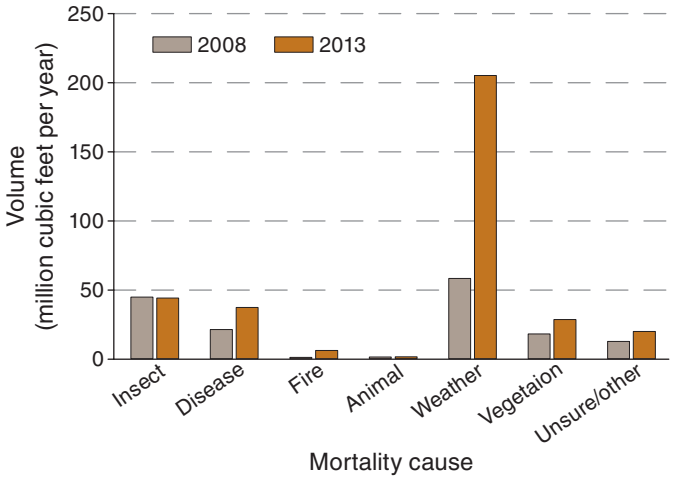

Figure 19—Average annual mortality volume by mortality cause, east Texas, 2008 and 2013.

Table 7—Volume of live and dead standing trees on forest land, Texas, 2013

Unit	Live	Dead
	million cubic feet	
1–Southeast	10,267.8	241.5
2–Northeast	7,447.0	101.6
Total east Texas	17,714.7	343.1
3–North Central	4,038.1	403.5
4–South	2,034.7	140.6
5–West Central	5,977.4	392.2
6–Northwest	1,528.4	114.5
7–West	281.9	25.5
Total central and west Texas	13,860.5	1,076.3
Total	31,575.2	1,419.4

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

current live volume) due to mortality than softwoods (139.8 million cubic feet, or 1 percent of current live volume). Other measures of the effect of weather events on Texas' forest land are discussed in the Forest Health section.

The species group loblolly and shortleaf pines had the greatest annual mortality rate, at 129.6 million cubic feet per year, which is not a surprise as this species group is so prevalent in total volume on forest land in the two units evaluated here. Compared with total volumes of each species group, the rare species groups of cottonwood and aspen, and woodland hardwoods saw greater proportional mortality. By ownership group, the mortality proportions were fairly uniform across the groups.

While we are not able to report specifically on mortality in the western five units (survey units 3–7) crews do record whether standing trees are dead or alive. An estimated 1.1 billion cubic feet of standing dead tree volume was observed in these five units, or about 7 percent of all standing tree volume in the same area (table 7). In the eastern two units, dead trees accounted for approximately 2 percent of standing tree volume.

Removals

Removals averaged 571.9 million cubic feet per year, a decrease from the previous survey (fig. 18). The vast majority were from softwoods (424.6 million cubic feet per year) with the loblolly and shortleaf pines species group alone accounting for 71 percent of the total (403.4 million cubic feet annually). At 533.9 million cubic feet per year, nonindustrial privately owned land accounted for 93 percent of removed volume, but in proportion to the total current volume per ownership, land owned by forest industry had more removals. Removals include any trees removed from the sample. Harvested removals do account for the vast majority of the total removal volume at 560.7 million cubic feet (fig 18).

FOREST HEALTH

Disturbances

Disturbances are outside forces that have an observable effect on the forest. Some of the disturbance groups have the same name as the cause of mortality groups, and we can look at them together to observe broad patterns. But it is important to emphasize key differences between these data groups. Whereas mortality cause is measured on trees, and therefore presented in volume (cubic feet), disturbances are measured at the stand level and presented as area (acres). In addition, disturbances must meet thresholds to be recorded—25 percent of the area is affected or 50 percent of a specific species is affected—where mortality cause is recorded for each tree that died. For example, if a small pocket of trees (about 10 percent of the stand) was killed by insects, those volumes would be included in the mortality cause data but they would not be included in the disturbance data. Conversely, disturbances only need to have an observable effect, where mortality cause would be linked to the death trees. Fire is a good illustration of this difference: often fire can have an observable effect—soil disturbance, understory clearing, light bark charring—but not kill many of the trees; in that case fire would be recorded as a disturbance, but not as a cause of mortality. Also, unlike mortality, disturbance data can be recorded on new plots, like those in the five western survey units, so this information is available for the entire State. For remeasured plots, it is recorded when the disturbance took place since the last measurement; for the new plots it is recorded when the treatment took place within the last 5 years. At the disturbance group level, weather caused more than double any other group of disturbance, averaging 539,500 acres annually (fig. 20). Because this group of disturbances was so much more prevalent, we broke out the specific disturbance classes within weather (fig. 21). Even at this finer level, the disturbance class drought impacted more acres annually than any remaining group of disturbances with an average of 372,400 annual acres during this measurement period. Drought was followed by disturbance group fire and disturbance

Disturbances, like the effect of drought seen on these cedar trees, are recorded on forested plots. (photo courtesy of Texas A&M Forest Service)

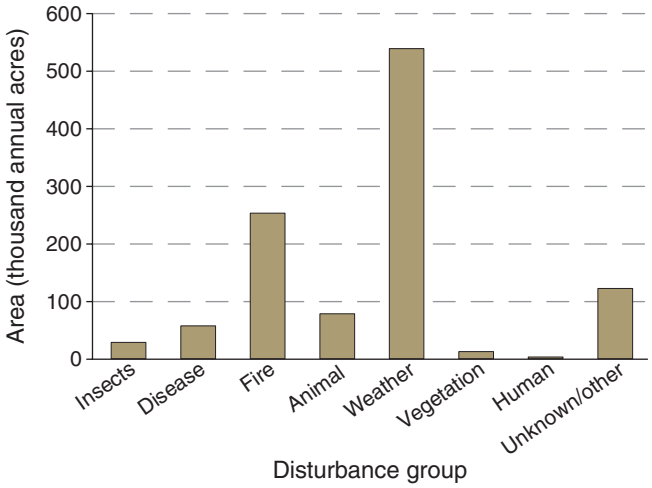

Figure 20—Average annual acres of disturbed forest land by disturbance group, Texas, 2013.

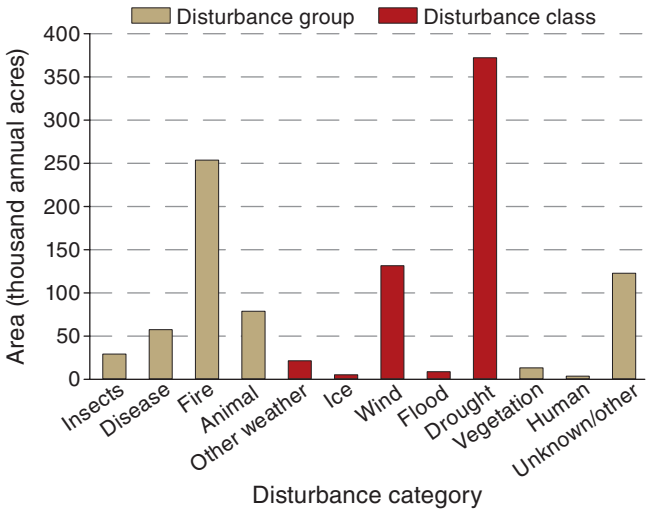

Figure 21—Average annual acres of disturbed forest land, by disturbance group and disturbance class (weather group), Texas, 2013.

class wind, at 254,000 and 131,700 average annual acres, respectively (fig. 21). As noted in the previous section, Texas experienced an extreme drought starting in late 2010 and through 2011 (National Oceanic and Atmospheric Administration 2011). The data for this paper include inventory years 2010–2013 and, due to logistical issues, some plot data was collected as late as January 2016. Therefore it is not surprising that this disturbance agent was so prevalent. The drought was statewide, and drought was recorded as a disturbance in all survey units. However, in both total (annual acres) and as a proportion of forest land (annual acres per forested acre), the West Central region showed significantly more drought disturbance to forests and woodlands (fig. 22).

At 254,000 average annual acres, fire was the second most common disturbance observed (figs. 20 and 21). In the previous section we showed that fire was one of the lowest causes for tree mortality (fig. 19). While some burns, such as the Bastrop County Complex fire in 2011, will kill trees, many fires only burn understory vegetation and do not cause significant harm to trees, and may even reduce the risk for more damaging or catastrophic fires in the future (Martin and others 1989). But observable fire effects are still recorded as a disturbance.

The third most prevalent disturbance recorded was wind (fig. 21). As with drought, wind is a specific disturbance class, rather than a group (groups comprise several classes). So it is quite notable that fire is the only disturbance-group to account for more disturbed acres than wind alone. Unlike drought, which tends to be wide in area and occurring over time, wind is often a

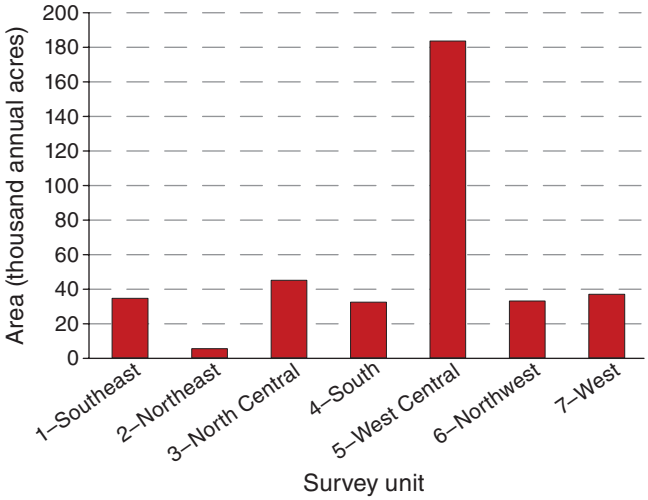

Figure 22—Observed drought disturbance by survey unit, Texas, 2013.

Texas' State reptile, the horned lizard or horny toad, is in decline but can still be found in the woodland forests of west Texas.

discrete event such as a tornado, hurricane, or storm. Of the 131,700 average annual acres of wind disturbance recorded, 123,200 acres were in the Southeast unit (fig. 23). Wind disturbance far out-weighed other disturbances, including drought, in this unit. Hurricanes Rita and Ike both made landfall in this area and are likely associated with much of the recorded wind disturbance (National Oceanic and Atmospheric Administration 2005, 2008).

Silvicultural Treatments

Like disturbance data, silvicultural treatments are presented in area rather than volume. Silvicultural treatments are recorded when they affect at least 25 percent of a forested stand. This data was recorded in all 7 units. For remeasured plots, it is recorded when the treatment took place since the last measurement; for the new plots it is recorded when the treatment took place within the last 5 years. Of the 63.1 million acres of forest in Texas, at least one silvicultural treatment was applied on 888,800 annual average acres. Cutting or harvesting was the most common silvicultural activity, at 502,800 annual acres, followed by other silvicultural treatments, 352,600 annual acres (fig. 24). Site prep and artificial regeneration followed, with natural regeneration being the least common averaging only 49,700 annual acres (Note: the totals add up to >888,800 acres because up to three silvicultural applications may be recorded per site).

The majority of silvicultural activities took place in the Northeast and Southeast units, which is unsurprising as these are the areas of Texas where most of the timberlands are located and also where most forest

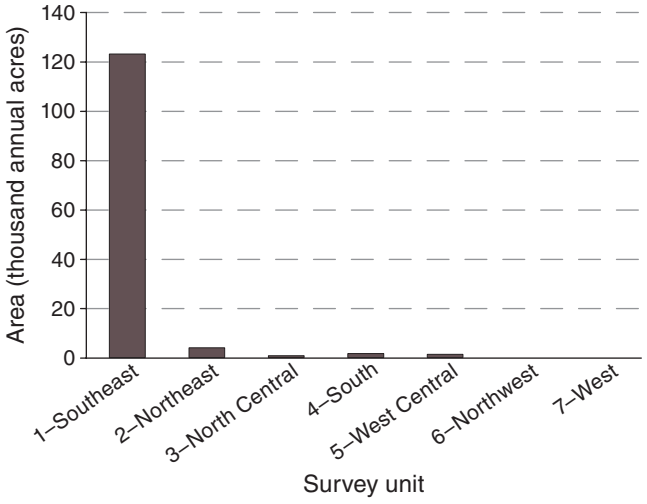

Figure 23—Observed wind disturbance by survey unit, Texas, 2013.

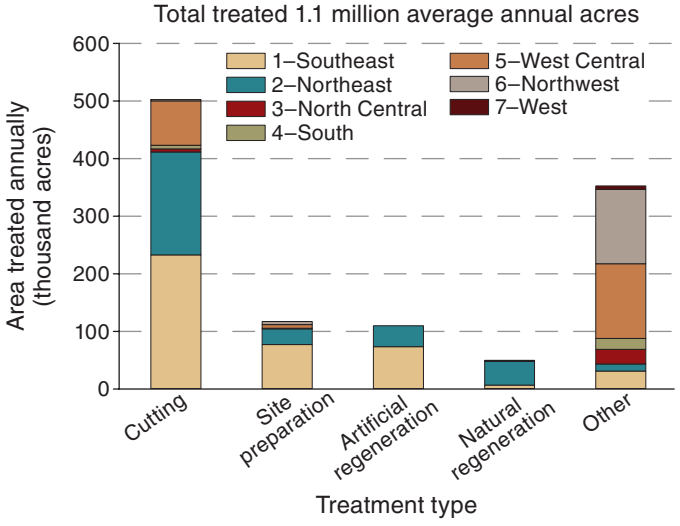

Figure 24—Average annual forest area with silvicultural treatments applied, by treatment type and survey unit, Texas, 2013.

industry and forest management have been located historically. The one exception is other silvicultural treatments, which took place most often in the Northwest and West Central survey units (fig. 24). The other silvicultural treatments can include activities aimed at improving wildlife forage and other nontimber based goals (United States Department of Agriculture Forest Service 2007).

In the Northeast and Southeast units, silvicultural cutting treatments were further sorted by cutting type. In these two units a total of 409,600 annual acres was cut (table 8). As with the larger variable of treatment, up to three cuttings may be recorded on one site, and this total includes each cutting application. Loblolly-shortleaf pine was the most likely to undergo cutting treatments, accounting for 62 percent of all cut forest land, at 252,500 annual acres. However, for three of the cutting types—partial harvest, timber stand improvement, and salvage cutting—loblolly-shortleaf pine was not the most common forest type (table 8). By type of cutting, commercial thinning was the most common, at average annual acres of 161,500 (fig. 25).

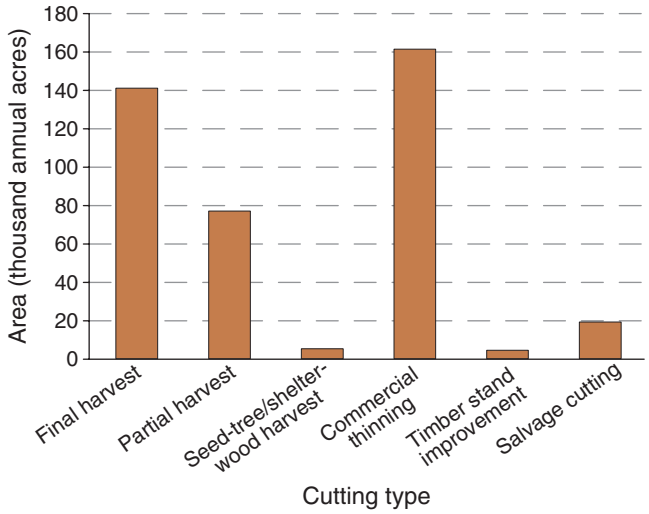

Figure 25—Average annual area on which cutting was conducted, by cutting type, east Texas, 2013.

Invasive Plants

In east Texas (units 1 and 2) crews collected information on invasive plants. The invasive plants on the FIA watch list (appendix A) were selected because they may seriously impact the ecologic and/or economic functions of forest lands in the Southern United States (Miller and others 2013).

Table 8—Area of silvicultural cutting on forest land, in east Texas, 2013, by forest type group and cutting type

	Cutting type					
Forest-type group	Final harvest	Partial harvest	Seed-tree/ shelterwood harvest	Commercial thinning	Timber stand improvement	Salvage cutting
	thousand acres annually					
Longleaf-slash pine	10.5	0.3	0.0	1.3	0.0	0.0
Loblolly-shortleaf pine	89.8	21.4	4.5	131.5	0.2	5.1
Oak-pine	8.9	17.5	0.0	15.2	0.0	1.2
Oak-hickory	22.7	28.5	0.0	9.4	2.0	8.1
Oak-gum-cypress	5.9	5.1	1.0	3.5	1.3	4.6
All others	3.4	4.4	0.0	0.6	1.2	0.3
Total	141.2	77.2	5.5	161.5	4.7	19.3

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

Data on invasive species, such as the Chinese tallowtree, are collected on forested plots. (photo courtesy of Texas A&M Forest Service)

Beginning with the inventory year 2013, updates were made to both the species list and the collection methods used (U.S. Department of Agriculture Forest Service 2007, 2012). As this report covers east Texas survey data from 2009–2013, the changes in invasive species methodology cause some complications with data analysis and presentation. Changes to the collection methods make reporting by acres inconsistent across years; instead of acres, the invasive species data in this report are presented by number of plots. Updates to the species list mean that some species may be underrepresented in the data, because they were only sought in some of the measurement years (in 2009–2012, or in 2013). The authors elected to present what data there is for all of these species rather than omitting the information entirely. However readers should be aware that the species which were only on one version of the species list (noted in all relevant tables) come from a smaller sample. Where possible, the authors did use other available data to contribute to the species population estimations: The tree species Bradford/callery pear (*Pyrus calleryana*) were not added as an invasive species until 2013. However, this species was recorded as part of the standard FIA plot data in previous years. We incorporated information on the size and number of this species tallied as part of the standard data collection, into the invasive estimates for 2009–2012 (noted in all relevant tables). There are limitations with this data source: if the trees were < 5.0 inches in diameter they would only be counted if on the microplot; and only trees rooted within the plot/microplot would be tallied, whereas data collected specifically for invasive species protocols will include any presence of the species on a subplot even if rooted outside the subplot.

In the inventory years 2009–2012, 2,999 plots were examined for invasive species. Of these, 971 plots had at least one invasive species. For inventory year 2013, 278 plots out of the 746 examined had at least one invasive species present.

FIA data provide information on two important aspects of invasive species impact: the spread or range of invasion, and the abundance or severity of infestation (Parker and others 1999). The range of the invasive species is shown as the total count of plots where any amount of the indicated invasive species was found (table 9). Japanese honeysuckle has the widest range, followed by Chinese tallowtree, and Chinese/European privet (*Ligustrum sinense*).

The severity of an invasive species is indicated by what percentage of a subplot-condition was infested at a given location. The species are ranked by number of plots with the greatest coverage on a subplot (≥ 90 percent), then the number of plots with the next coverage level (51–89 percent), and so on (table 10). Incorporating the severity of the infestation moved Chinese tallowtree (popcorn tree) to the top of the list.

Table 9—Forested plot counts with invasive species present in east Texas, 2013

Invasive species		Plot counts		
		Manual version		
Common name	Scientific name	6.x	4.x	Total
Japanese honeysuckle	*Lonicera japonica*	145	539	684
Chinese tallowtree	*Triadica sebifera*	90	381	471
Chinese/European privet	*Ligustrum sinense, L. vulgare, L. obtusifolium*[a]*, L. ovalifolium*[a]	77	246	323
Japanese climbing fern	*Lygodium japonicum*	38	115	153
Chinaberrytree	*Melia azedarach*	10	60	70
Silktree, mimosa	*Albizia julibrissin*	10	32	42
Exotic roses	*Rosa* spp.	7	34	41
Japanese/glossy privet	*Ligustrum japonicum, L. lucidum*	10	19	29
Chinese lespedeza	*Lespedeza cuneata*	4	20	24
Shrubby lespedeza	*Lespedeza bicolor, L. thunbergii*[b]	2	12	14
Monkey grass[b]	*Liriope* spp.[b]	13	N/A	13
Nandina, sacred bamboo	*Nandina domestica*	4	9	13
Trifoliate orange[b]	*Poncirus trifoliata*[b]	5	N/A	5
Wisteria	*Wisteria sinensis, W. floribunda*	1	3	4
Callery pear[a], Bradford pear[a]	*Pyrus calleryana*[a]	3	1	4
Camphortree[b]	*Cinnamomum camphora*[b]	3	N/A	3
Ivy group: English, Atlantic[b], colchis[b]	*Hedera helix, H. hibernica*[b]*, H. colchica*[b]	0	2	2
Bamboo	*Phyllostachys aurea, Bambusa* spp.	1	N/A	1
Bush honeysuckle	*Lonicera* spp.	1	0	1
Tree-of-heaven	*Ailanthus altissima*	1	0	1
Tall fescue[a]	*Lolium arundinaceum*[c]*, Schedonorus phoenix*[b]	0	1	1

N/A = Not applicable.

[a] Definition or method differed between manuals 4.x and 6.x.

[b] Not collected under manual versions 4.x.

[c] Not collected under manual versions 6.x.

Table 10—Forested plots in east Texas, 2013, with each invasive species, ranked by percent of plot covered

	Amount of plot coverage														
	≥90%			51–89%			11–50%			1–10%			<1%		
	Manual version			Manual version			Manual version			Manual version			Manual version		
Common name	6.x	4.x	Total	6.x	4.x	Total	6.x	4.x	Total	6.x	4.x	Total	6.x	4.x	Total
Chinese tallowtree	2	0	2												
Japanese honeysuckle	1	0	1												
Chinese/European privet[a]				5	21	26									
Japanese climbing fern				0	2	2	2	15	17						
Chinaberry tree				0	2	2	0	14	14						
Japanese/glossy privet				0	1	1	2	9	11						
Exotic roses				1	0	1	0	2	2						
Wisteria				0	1	1	0	0	0	1	2	3			
Tall fescue[a]				0	1	1	0	0	0	0	0	0			
Chinese lespedeza							1	3	4						
Monkey grass[b]							3		3						
Mimosa tree							1	1	2	9	25	34			
Trifoliate orange[b]							2		2	4		4			
Shrubby lespedeza group[a]							0	1	1	2	6	8			
Camphor tree[b]							1		1	2	0	2			
Exotic bamboo							1	0	1	0	0	0			
Sacred bamboo, nandina										4	6	10			
Callery or Bradford pear[a]										3	1	4			
Ivy group[a]										0	1	1	0	1	1
Tree of heaven										1	0	1	0	0	0
Bush honeysuckle group										1	0	1	0	0	0

[a] Definition or method differed between manuals 4.x and 6.x.
[b] Not collected under manual versions 4.x.

Down Woody Material

In the western five units (units 3–7) crews collected information on down woody materials (DWM) on all forested plots. These data can provide a variety of ecological data from nutrient cycling to wildlife habitat. Here we report on the biomass and carbon, and wildfire fuel information derived from these data.

The majority of DWM data are collected along transects crossing each subplot (planar intercept method), and data are only collected on accessible forest conditions (U.S. Department of Agriculture Forest Service 2007, Woodall and Monleon 2008, Woodall and Williams 2005). Along transects, coarse woody debris (CWD) and three classes of fine woody debris (FWD) are tallied. The CWD are measured all along the transects; are pieces of woody material of ≥ 3.0 inches diameter at transect intersection and ≥ 3.0 feet in length; and translate to the fuels class 1,000+ hour. There is an exception if the CWD are in piles (e.g., logging residue piles) rather than individual pieces. In these cases they are measured as a pile and these data are categorized as slash in the DWM tables. FWD pieces are counted on a smaller segment of transects. Large FWD are pieces 1.0 inch to 2.9 inches and make up the 100-hour fuels class; medium FWD are 0.25 to 0.9 inch and make up the 10-hour fuels class; and small FWD are 0.01 to 0.24 inch in diameter, comprising the 1-hour fuels class.

A total estimated 81.3 million tons of CWD and FWD were found in the forests of central and western Texas (fig. 26). By forest-type group, oak-hickory (30.6 million tons) had the greatest amount of down woody material, followed by woodland hardwoods (24.6 million tons), with all

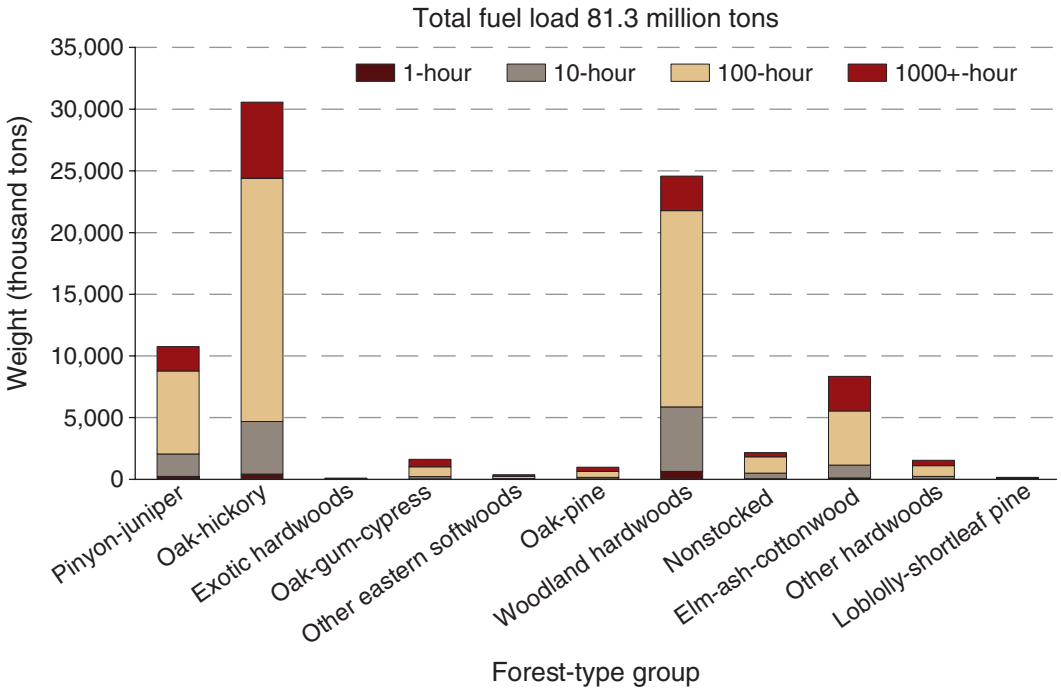

Figure 26—Fuels (weight) on forest land by fuel-hour class and forest-type group, west Texas, 2013.

other forest-type groups contributing substantially less (fig. 26). This is partially correlated to these being the two most common forest-type groups in central and west Texas. Looking at the density of down-woody material changes the ranking significantly: elm-ash-cottonwood has the most tons per acre of woody-material at 3.7 tons per acre, followed by oak-pine (3.5 tons per acre), and other hardwoods (3.1 tons per acre), all surpassing oak-hickory in the ranking (fig. 27), while woodland hardwoods have the least density of fuel load material outside of nonstocked stands.

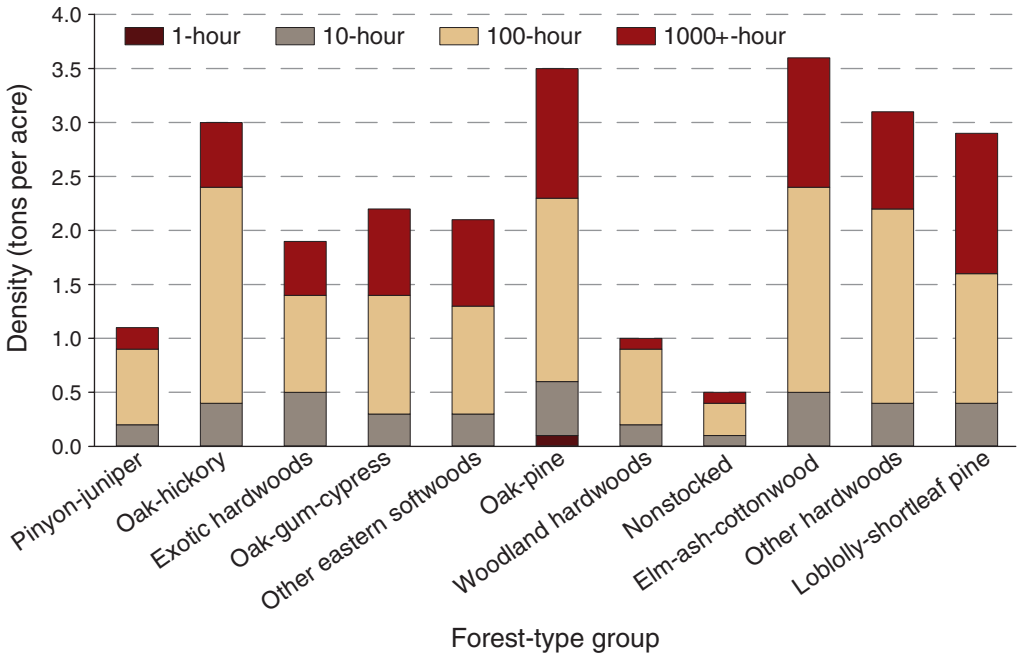

Figure 27—Fuel load density on forest land by fuel-hour class and forest-type group, west Texas, 2013.

Down woody material can provide benefits to wildlife.

Flash fuels are those that burn even faster than 1-hour fuels. Measuring these can inform estimations of fire behavior and effects (U.S. Department of Agriculture Forest Service 2007). These measurements were taken at the end of each transect line, and are categorized as litter or duff. Litter includes detached, but not yet decomposed plant material such as leaves, bark, stems, moss, and small twigs which lay along the forest floor. Plant materials which are decomposed (i.e., cannot be recognized as plant parts anymore) are called duff. Adding litter, duff, and slash to the CWD and FWD brings the total DWM volume to 431.6 million tons (fig. 28). By DWM fuel type, the largest contributors were litter, with 168.4 million tons (39 percent of volume) and slash with 128.8 million tons (30 percent of the total) (fig. 28). Among just the fuel-time categories of woody debris, the 100-hour fuel class held much more than the other three classes.

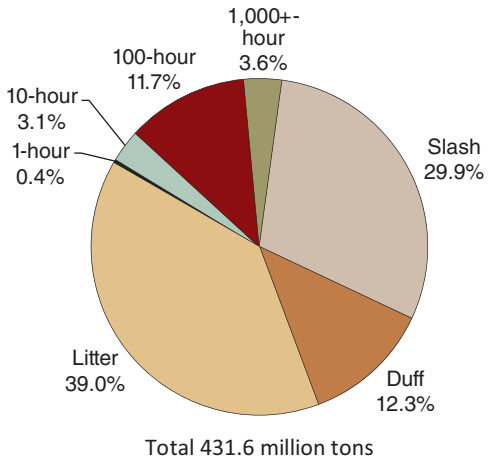

Figure 28—Fuel-type contributions to total fuel load, west Texas, 2013.

In addition to measurements along transects, crews also measured standing fuels on each microplot. Sometimes referred to as ladder fuels, these data help fire modelers predict fire danger on the landscape. It should be noted that due to uncertainties in repeatability of measurements, this data group was only collected on this first cycle of data. Crews evaluated five categories of standing fuels (live shrubs, dead shrubs, live herbaceous, dead herbaceous, and fuel bed/litter) in two ways: maximum height (up to 6.0 feet) and percent coverage by 10-percent class. The percent coverages of the categories are not cumulative, rather they can overlap (e.g., a plot could have 80 percent live herbaceous coverage, as well as 60 percent live shrub coverage), and the heights as well do not build on lower categories (i.e., the height for shrubs is from the ground, not from the height of the tallest herbaceous coverage), therefore the values will not total across the categories (table 11). As all of the amounts presented are averages, the amounts by forest-type group will also not sum to the "all groups" amount. The forest-type group exotic hardwoods had the greatest average coverage for live shrubs, dead shrubs, and dead herbs. However, forest types in this group are rare in central and west Texas, so the sample size may confound the data. For live herbs, oak-gum-cypress had the greatest amounts, while loblolly-shortleaf pine had the highest average litter coverage. The tallest average shrub heights were found on oak-pine forest group. Exotic hardwoods averaged the tallest herbaceous layer as well as fuelbed (litter).

Biomass and carbon data in the standing trees on forest land was covered in an earlier section. In addition to that amount, the DWM can give us estimations of how

Table 11—Mean cover and height of fuels on forested microplots in central and west Texas, 2013

Forest-type group	Cover					Height				
	Live shrub	Dead shrub	Live herb	Dead herb	Litter	Live shrub	Dead shrub	Live herb	Dead herb	Fuel-bed
	percent					*feet*				
Loblolly-shortleaf pine	13.59	0.21	15.00	6.97	96.10	5.18	0.46	0.88	0.82	0.07
Other eastern softwoods	18.92	3.05	18.01	12.78	67.01	3.65	1.72	1.25	1.04	0.46
Pinyon-juniper	11.03	2.97	21.75	19.14	39.55	1.98	0.84	0.92	1.17	0.34
Oak-pine	23.12	4.48	16.39	9.16	76.62	7.66	3.73	1.06	0.90	0.39
Oak-hickory	17.78	4.47	28.62	18.04	56.91	3.95	2.01	1.11	1.21	0.35
Oak-gum-cypress	18.33	4.39	32.70	20.90	64.58	4.15	2.04	1.33	1.28	0.43
Elm-ash-cottonwood	18.75	5.33	32.62	15.39	62.37	5.12	2.70	1.50	1.43	0.40
Other hardwoods	15.66	5.79	23.37	15.55	61.43	3.63	2.09	1.08	1.14	0.36
Woodland hardwoods	13.63	3.83	29.13	23.95	33.32	2.09	0.95	1.10	1.33	0.33
Exotic hardwoods	32.11	7.00	26.89	26.89	76.37	4.90	1.95	1.85	2.28	1.11
Nonstocked	11.80	3.44	28.36	25.31	27.72	1.70	0.85	1.04	1.39	0.37
All groups	14.16	3.85	27.62	21.44	40.81	2.60	1.24	1.08	1.28	0.35

much biomass and carbon is contained in downed trees and on the forest floor. At present, FIA uses a simple conversion for carbon from biomass (biomass/2 = carbon). The western five FIA units in Texas hold an estimated 216.5 million tons of carbon on the forest floor and downed trees (fig. 29). As might be expected, the forest-type groups with the greatest volume of DWM, had the greatest carbon stored in them, specifically, oak-hickory (75.4 million tons), woodland hardwoods (71.5 million tons), and pinyon-juniper (34.6 million tons). Together these three groups account for about 84 percent of the carbon, with the remaining eight groups together holding only about 16 percent (fig. 29). Likewise, the types of DWM that had the greatest volume, also contribute to the largest carbon stocks: litter holds 39 percent of the carbon (84.2 million tons), followed by slash at 30 percent (65.2 million tons) (fig. 30).

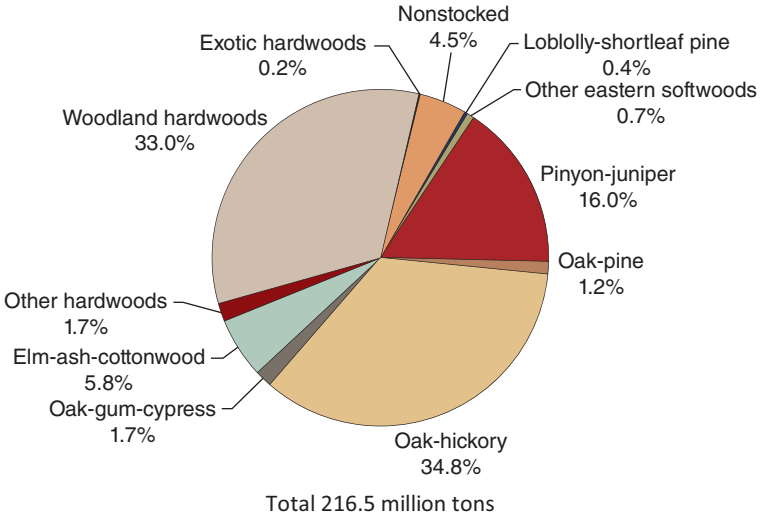

Figure 29—Proportion of carbon stocks in down woody material by forest-type group, west Texas, 2013.

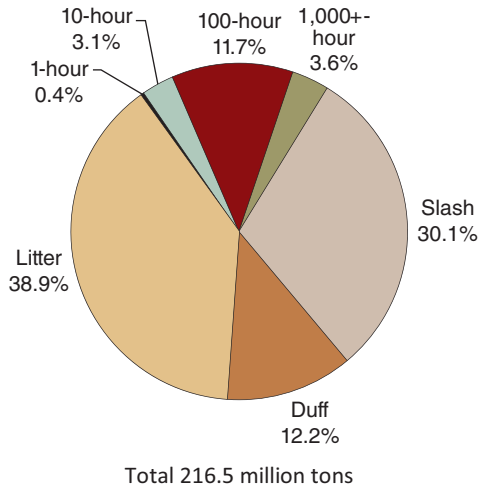

Figure 30—Proportion of carbon stocks in down woody material by down woody material type, west Texas, 2013.

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The forests of west Texas are often open woodlands.

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GLOSSSARY

All-live trees—All living trees including saplings. All size classes, all tree classes, and both saw-log and nonsaw-log species are included. See: FIA tree species list in the field manual.

Average annual mortality—Average annual volume of trees ≥ 5.0 inches d.b.h. that died from human and natural causes during the intersurvey period, excluding those removed by harvesting, cultural operations, land clearing or changes in land use.

Average annual removals—Average annual volume of trees ≥ 5.0 inches d.b.h. 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./d.r.c. without taking into account losses from removals (gross growth minus mortality) during the intersurvey period.

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

Biomass—For the southern region, total aboveground biomass is estimated using allometric equations and is defined as the aboveground weight of wood and bark in live trees ≥ 1.0 inch d.b.h./d.r.c. from the ground to the tip of the tree, excluding all foliage (leaves, needles, buds, fruit, and limbs < 0.5 inch in diameter). Biomass is expressed as oven-dry weight and the units are tons.

Note: the weight of wood and bark in limbs < 0.5 inch in diameter is included in the biomass of small-diameter trees.

Additionally, biomass in the merchantable stem is estimated regionally, where the main and merchantable stems are defined as follows.

Main stem—The central portion of the tree extending from the ground level to the tip for timber species. Woodland species includes from ground level to the tips of all branches of qualifying stems. For timber species trees that fork, the main stem refers to the fork that would yield the most merchantable volume.

Merchantable stem—That portion of the main stem of a timber species tree from a 1-foot stump to a minimum 4-inch top diameter inside or outside bark depending on species. That portion of a woodland species tree from the d.r.c. measurements to the 1.5-inch diameters of all the qualifying stems.

Nationally aboveground and belowground biomass is estimated from each tree's sound volume using a Component Ratio Method that is consistently applied in all FIA regions.

Gross aboveground biomass—Total tree biomass excluding foliage and roots with no deductions made for rotten, missing, or broken-top cubic-foot cull.

Net aboveground biomass—Gross above-ground biomass minus deductions for missing cull, broken-top, and a reduction for a proportion of rotten cull for live or standing dead trees ≥ 5.0 inches d.b.h (Rotten cull will have a factor to reduce specific gravity separately from sound wood). Live and standing dead trees 1.0 to 4.9 inches only have deductions for broken-top cull. Additional deductions are made for dead trees ≥ 1.0 inch using decay class.

Belowground biomass—Coarse roots only.

Further, the total net aboveground biomass estimated using the Component Ratio Method is divided into the following components:

Top—That portion of the main stem of a timber species tree above the 4-inch

top diameter. For woodland species, this component of the biomass is included with branches.

Branches—All the branches of a timber species tree excluding the main stem. That portion of all the branches of qualifying stems of woodland species above the 1.5-inch diameter ends.

Bole—See: Merchantable stem.

Stump—That portion of timber species below 1-foot to ground level. That portion of woodland species from all the d.r.c. measurements to ground level.

Blind check—A reinstallation done by a qualified inspection crew without production crew data on hand. The two datasets are maintained separately. Discrepancies between the two sets of data are not reconciled. See: Quality assurance and quality control.

Bole—Trunk or main stem of a tree. (See: Main stem.)

Census water—See: Land use.

Cold check—An inspection done either as part of the training process, or as part of the ongoing quality control program. The inspector has the completed data in-hand at the time of inspection. The inspection can include the whole plot or a subset of the plot. See: Quality assurance and quality control.

Components of change—Volume increment and decrement values that explain the change in inventory between two points in time. Components of change are usually expressed in terms of growing-stock or all-live merchantable volume. These components can be expressed as average annual values by dividing the component by the number of years in the measurement cycle. FIA inventories are designed to measure net change over time, as well as the individual components of change that constitute net change (e.g., growth, removals, mortality). Change estimates are computed for two sequential measurements of each inventory panel. Upon remeasurement, a new initial inventory is established for remeasurement at the next scheduled inventory. As such, computation of change components is not intended to span more than one inventory cycle. Rather, the change estimation process is repeated cycle by cycle. This simplifies field protocols and ensures that change estimation is based on short and relatively constant time intervals (e.g., 5 years). Change estimates for individual panels are combined across multiple panels in the same manner as panels are combined to obtain current inventory parameters such as total standing volume. FIA recognizes the following components of change as prescribed core variables; they usually are expressed in terms of growing-stock or all-live volume, where t is the initial inventory of a measurement cycle, and $t + 1$ is the terminal inventory:

Cut—The volume of trees cut between time t and time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval (includes cut growth). Tree size at the midpoint is modeled from tree size at time t. Trees felled or killed in conjunction with a harvest or silvicultural operation (whether they are utilized or not) are included, but trees on land diverted from forest to nonforest (diversions) are excluded.

Cut growth—The growth of cut trees between time t and the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time t. This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold prior to being cut.

Diversion—The volume of trees on land diverted from forest to nonforest (or, for some analyses, this may also include land diverted to reserved forest land and other forest land), whether utilized or not, between time t and time $t + 1$. The estimate is based on tree size at the

midpoint of the measurement interval (includes diversion growth). Tree size at the midpoint is modeled from tree size at time *t*.

Diversion growth—The growth of diversion trees from time *t* to the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time *t*. This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold prior to diversion.

Growth on ingrowth—The growth on trees between the time they grow across the minimum d.b.h./d.r.c. threshold and time $t + 1$.

Ingrowth—The volume of trees at the time that they grow across the minimum d.b.h./d.r.c. threshold between time *t* and time $t + 1$. The estimate is based on the size of trees at the d.b.h./d.r.c. threshold which is 1.0 inch for all-live trees and 5.0 inches for growing-stock trees. This term also includes trees that subsequently die (i.e., ingrowth mortality), are cut (i.e., ingrowth, cut), or diverted to nonforest (i.e., ingrowth diversion); as well as trees that achieve the minimum threshold after an area reverts to a forest land use (i.e., reversion ingrowth).

Mortality—The volume of trees that die from human or natural causes between time *t* and time $t + 1$, besides those cut/harvested. The estimate is based on tree size at the midpoint of the measurement interval (includes mortality growth). Tree size at the midpoint is modeled from tree size at time *t*.

Mortality growth—The growth of non-harvested trees that died from human or natural causes between time *t* and the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time *t*. This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold prior to mortality.

Reversion volume—The volume of trees on land that reverts from a nonforest land use to a forest land use (or, for some analyses, land that reverts from any source to timberland) between time *t* and time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time $t + 1$.

Reversion growth—The growth of reversion trees from the midpoint of the measurement interval to time $t + 1$. Tree size at the midpoint is modeled from tree size at time $t + 1$. This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold after reversion.

Survivor growth—The growth on trees tallied at time *t* that survive until time $t + 1$.

The following components of change may be used to further quantify changes in growing-stock (but not all-live) volume:

Cull decrement—The net gain in growing-stock volume due to reclassification of cull trees to growing-stock trees between two surveys. Cull decrement is the volume of trees that were cull at time *t*, but growing stock at time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval. Tree size at the midpoint can be modeled from tree at time *t*, time $t + 1$, or both.

Cull decrement growth—The growth from the midpoint of the measurement interval to time $t + 1$ on trees that were cull at time *t*, but growing stock at time $t + 1$. Tree size at the midpoint can be modeled from tree size at time *t*, time $t + 1$, or both.

Cull increment—The net reduction in growing-stock volume due to reclassification of growing stock trees to cull trees between two surveys. Cull increment is the volume of trees that were growing stock at time *t*, but cull at time $t + 1$. The estimate is based on tree size at the midpoint of the measurement

interval (includes cull increment growth). Tree size at the midpoint can be modeled from tree size at time *t*, time *t* + 1, or both.

Cull increment growth—The growth to the midpoint of the measurement interval between time *t* and *t* + 1 of trees that were growing stock at time *t*, but cull trees at time *t* + 1. Tree size at the midpoint can be modeled from tree size at time *t*, time *t* + 1, or both.

Condition class—The combination of discrete landscape and forest attributes that identify, define, and stratify the area associated with a plot. Examples of such attributes include forest type, stand origin, stand size, owner group, reserve status and stand density.

Crown—The part of a tree or woody plant bearing live branches or foliage.

Crown dieback—Recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Dieback is only considered when it occurs in the upper and outer portions of the tree. Dead branches in the lower live crown are not considered as part of crown dieback, unless there is continuous dieback from the upper and outer crown down to those branches.

Cull—Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect. Cull is further categorized as the following:

Broken-top cubic-foot cull—The broken-top proportion of a timber species tree's merchantable portion from the break to the actual or projected 4-inch top diameter outside bark, or to where the central stem forks, where all forks are <4.0 inches diameter. For trees 1.0 to 4.9 inches diameter this is the proportion of the main stem missing due to a broken-top.

Form board-foot cull—The part of the tree's saw-log portion that is sound but not usable for sawn wood products due to sweep, crook, forking, or other physical culls.

Percent board-foot cull—Percentage of sound and unsound board-foot volume, to the nearest 1 percent.

Rotten/missing cull—The proportion of a tree's merchantable portion that is in a decayed state and/or the proportion of a tree's merchantable portion that is missing or absent. Does not include any cull deductions above actual length for broken-top timber trees. Does include cull deductions above actual length for broken-top woodland species. Trees with d.b.h./d.r.c. < 5.0 inches have a null value in this field.

Total board-foot cull—The proportion of a timber specie tree's saw-log portion, sound or unsound, but not useable for sawn wood products due to sweep, crook, forking, or other physical defects (form board-foot cull). Softwoods < 9.0 inches d.b.h. and hardwoods < 11.0 inches d.b.h. have a null value in this field.

Cull tree—Live trees that are unsuitable for the production of some roundwood products, now or prospectively. Cull trees can include those with decay (rotten cull) or poor form, limbiness, or splits (rough cull). Rough cull is suitable for pulpwood and other fiber products.

Cycle—One sequential and complete set of panels.

Diameter at breast height (d.b.h.)—The diameter for tree stem, located at 4.5 feet above the ground (breast height) on the uphill side of a tree. The point of diameter measurement may vary on abnormally formed trees.

Diameter at root collar (d.r.c.)—The diameter of a tree or stem measured at the ground line or stem root collar, measured outside of the bark. This method is used for woodland species; each stem is measured and the measurements of all stems are mathematically combined for the total tree d.r.c.

Diameter class—A classification of trees based on diameter outside bark, measured at breast height (d.b.h.) above the ground or at root collar (d.r.c.). Note: Diameter classes are commonly in 2-inch increments, beginning with 2-inches. Each class provides a range of values with the class name being the approximate midpoint. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.

Disturbance—Natural or human-caused disruption that is ≥1.0 acre in size and results in mortality and/or damage to 25 percent of all trees in a stand or 50 percent of an individual species' count or, in the case when the disturbance does not initially affect tree growth or health (e.g. grazing, browsing, flooding, etc.), affects 25 percent of the soil surface or understory vegetation. For initial forest plot establishment the disturbance must be within the last 5 years. For remeasured plots only those disturbances that have occurred since the previous inventory are recognized.

Diversion—See: Components of change.

Dry weight—The oven-dry weight of biomass.

Federal land—An ownership class of public lands owned by the U.S. Government. See: Ownership.

Fixed-radius plot—A circular sampled area with a specified radius in which all trees of a given size, shrubs, or other items are tallied.

Forest industry land—See: Ownership.

Forest land—Land that is at least 10 percent stocked by forest trees of any size, or land formerly having such tree cover, and is not currently developed for a nonforest use. The minimum area for classification as forest land is 1 acre and must also be at least 120 feet wide. Unimproved roads and trails, streams and other bodies of water, or natural clearings in forested areas shall be classified as forest, if <120 feet in width or 1.0 acre in size. Forest land is divided into timberland, reserved forest land, and other forest land.

Forest type—A classification of forest land based upon and named for the tree species that forms the plurality of live-tree stocking. A forest-type classification for a field location indicates the predominant live-tree species cover for the field location; hardwoods and softwoods are first grouped to determine predominant group, and forest type is selected from the predominant group.

Forest-type group—A combination of forest types that share closely associated species or site requirements.

Growing-stock trees—Live large-diameter timber species trees with one-third or more of the gross board-foot volume in the entire saw-log portion meeting grade, soundness, and size requirements or the potential to do so for medium-diameter and small-diameter trees. A growing-stock tree must have one 12-foot log or two noncontiguous 8-foot merchantable logs, now (large diameter) or prospectively (medium diameter and small diameter), to qualify as growing stock.

Hardwoods—Tree species belonging to the botanical divisions Magnoliophyta, Ginkgophyta, Cycadophyta, or Pteridophyta, usually angiospermic, dicotyledonous, broad-leaved and deciduous.

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

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

Hot check—An inspection done as part of the training or quality assurance processes. The inspector is present on the plot with the cruiser and provides immediate feedback regarding data quality. Hot checks can be

done on training plots or production plots. See: Quality assurance and quality control.

Land—The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains.

Land cover—For lands with at least 10 percent coverage by vegetation, the dominant vegetation. For lands with less than 10 percent vegetative cover, other kind of material that covers the land surface. A given land cover may have many land uses and vice versa.

Land use—The purpose of human activity on the land; it is often, but not always, related to land cover.

Current southern regional land use categories are as follows:

Accessible timberland—Land that is within the population of interest, has access permitted, is on a subplot that can be occupied at subplot center, can safely be visited, and meets the criteria for forest land (see: forest land).

Accessible other forest land—Land that meets the definition of accessible forest land, but is incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions because of inferior site conditions. Inferior conditions include sterile soils, dry climate, poor drainage, high elevation, steepness and soil rockiness.

Agricultural land—Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width). This land use includes cropland, pasture (improved through cultural practices), idle farmland, orchard, Christmas tree plantation, maintained wildlife opening, and windbreak/shelterbelt.

Rangeland—Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least ≥1.0 acre in size and ≤120 feet wide.

Developed—Land used primarily by humans for purposes other than forestry or agriculture. This land use includes cultural (business, industrial/commercial, residential, and other places of intense human activity), rights-of-way (improved roads, railway, power lines, maintained canal), recreation (parks, skiing, golf courses), and mining.

Other—Land parcels ≥1.0 acre in size and ≥120 feet wide, which do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. This land use includes nonvegetated, wetland, beach, and nonforest-chaparral.

Census water—Rivers and streams that are >200 feet wide and lakes, reservoirs, and similar bodies of water ≥4.5 acres in size.

Noncensus water—Lakes, reservoirs, ponds and similar bodies of water ≥1.0 acre but <4.5 acres in size; and rivers, streams, canals and similar that are ≥30 feet wide, but ≤200 feet wide.

Nonsampled—Not sampled due to denied access, hazardous conditions, being outside the U.S. or other reasons.

Large-diameter trees—Softwoods ≥9.0 inches d.b.h./d.r.c. and hardwoods ≥11.0 inches d.b.h./d.r.c. These trees were called sawtimber-sized trees in prior surveys. See: Stand-size class.

Main stem—The central portion of the tree extending from the ground level to the tip for timber species. For woodland species the main stem extends from the ground level to the tips of all branches of qualifying stems. For timber species trees that fork, the main stem follows the fork that would yield the most merchantable volume.

Measurement quality objective (MQO)—A data user's estimate of the precision, bias, and completeness of data necessary to satisfy a prescribed application (e.g., Resource Planning Act, assessments by State foresters, forest planning, forest health analyses). Describes the acceptable tolerance for each data element. MQOs consist of two parts: a statement of the tolerance and a percentage of time when the collected data are required to be within tolerance. MQOs can only be assigned where standard methods of sampling or field measurements exist, or where experience has established upper or lower bounds on precision or bias. MQOs can be set for measured data elements, observed data elements, and derived data elements.

Medium-diameter tree—Softwood timber species 5.0 to 8.9 inches d.b.h./d.r.c. and hardwood timber species 5.0 to 10.9 inches d.b.h./d.r.c. These trees were called poletimber-sized trees in prior surveys. See: Stand-size class.

Microplot—A circular, fixed-radius plot with a radius of 6.8 feet (0.003 acre) that is used to sample trees < 5.0 inches d.b.h./d.r.c. Point center is 90 degrees and 12 feet offset from point center of each subplot.

Mortality—See: Components of change.

National forest land—See: Ownership.

Noncensus water—See: Land use.

Nonforest land—Land that does not support or has never supported, forests, and lands formerly forested where use for timber management is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and noncensus water.

Nonindustrial private forest land—See: Ownership.

Operability—The viability of operating logging equipment in the vicinity of the condition. Operability classes are as follows:

No problems.

Seasonal access due to water conditions in wet weather.

Mixed wet and dry areas typical of multichanneled streams punctuated with dry islands.

Broken terrain, cliffs, gullies, outcroppings, etc., which would severely limit equipment, access, or use.

Year-round water problems (includes islands).

Slopes 20 to 40 percent.

Slopes > 40 percent.

Other forest land—Forest land other than timberland and reserved forest land. It includes available and reserved forest land that is incapable of producing 20 cubic feet per acre per year of wood under natural conditions because of adverse site conditions such as sterile soils, dry climate, poor drainage, high elevation, steepness, or rockiness.

Other public land—See: Ownership.

Other removals—The 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—A legal entity having control of a parcel or group of parcels of land. An ownership may be an individual; a combination of persons; a legal entity such as corporation, partnership, club, or trust; or a public agency.

Phase 1 (P1)—FIA activities related to remote sensing, the primary purpose of which is to label plots and obtain stratum weights for population estimates.

Phase 2 (P2)—FIA activities conducted on the network of ground plots. The primary purpose is to obtain field data that enable classification and summarization of area, tree, and other attributes associated with forest land uses.

Phase 3 (P3)—A subset of Phase 2 plots where additional attributes related to forest health are measured.

Plantation—Stands that currently show evidence of being planted or artificially seeded.

Poletimber-sized tree—Softwood timber species 5.0 to 8.9 inches d.b.h. and hardwood timber species 5.0 to 10.9 inches d.b.h. Now referred to as medium-diameter trees.

Private land—See: Ownership.

Productivity class—A classification of forest land in terms of potential annual cubic-foot volume growth per acre at culmination of mean annual increment (MAI) in fully stocked natural stands.

Quality assurance (QA)—The total integrated program for ensuring that the uncertainties inherent in FIA data are known and do not exceed acceptable magnitudes, within a stated level of confidence. Quality assurance encompasses the plans, specifications, and policies affecting the collection, processing, and reporting of data. It is the system of activities designed to provide program managers and project leaders with independent assurance that total system quality control is being effectively implemented.

Quality control (QC)—The routine application of prescribed field and laboratory procedures (e.g., random check cruising, periodic calibration, instrument maintenance, use of certified standards, etc.) in order to reduce random and systematic errors and ensure that data are generated within known and acceptable performance limits. Quality control also ensures the use of qualified personnel; reliable equipment and supplies; training of personnel; good field and laboratory practices; and strict adherence to standard operating procedures.

Reserved forest land—Forest land where management for the production of wood products is prohibited through statute or administrative designation. Examples include national forest wilderness areas and national parks and monuments.

Reversion—Land that reverts from a nonforest land use to a forest land use. See: Components of change.

Sapling—Live trees 1.0 to 4.9 inches d.b.h./d.r.c.

Seedling—Live trees <1.0 inch d.b.h./d.r.c. that are ≥ 6.0 inches in height for softwoods and ≥ 12.0 inches in height for hardwoods and >0.5 inch d.b.h./d.r.c. at ground level for longleaf pine.

Site index—The average total height that dominant and codominant trees in fully-stocked, even-aged stands will obtain at key ages (usually 25 or 50 years).

Small-diameter trees—Trees 1.0 to 4.9 inches in d.b.h./d.r.c. These were called sapling-seedling sized trees in prior surveys. See: Stand-size class.

Softwoods—Tree species belonging to the botanical division Coniferophyta, usually evergreen having needles or scale-like leaves.

Species group—A collection of species used for reporting purposes.

Stand—Vegetation or a group of plants occupying a specific area and sufficiently uniform in species composition, age arrangement, structure, and similar factors as to be distinguished from the vegetation on adjoining areas.

Stand age—A stand descriptor that indicates the average age of the live dominant and codominant trees in the predominant stand-size class of a condition.

Standing dead tree—A dead tree ≥ 5.0 inches d.b.h./d.r.c. that has a bole which has an unbroken actual length of at least 4.5 feet (1.0 feet for woodland species), and lean < 45 degrees from vertical as measured from the base of the tree to 4.5 feet.

Stand origin—A classification of forest stands describing their means of growth 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. See definitions of large-, medium-, and small-diameter trees.

Large-diameter stands—Stands at least 10 percent stocked with live trees, with ½ or more of total stocking in large- and medium-diameter trees, and with large-diameter tree stocking at least equal to medium-diameter tree stocking.

Medium-diameter stands—Stands at least 10 percent stocked with live trees, with ½ or more of total stocking in medium- and large-diameter trees, and with medium-diameter tree stocking exceeding large-diameter tree stocking.

Small-diameter stands—Stands at least 10 percent stocked with live trees, in which small-diameter trees account for at least ⅔ of total stocking.

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

Stand structure—The predominant canopy structure for the condition, only considering the vertical position of the dominant and codominant trees in the stand and not considering trees that are intermediate or overtopped. As a general rule, a different story should comprise 25 percent of the stand.

Nonstocked—The condition is <10 percent stocked.

Single-storied—Most of the dominant/codominant tree crowns form a single canopy (i.e., most of the trees are approximately the same height).

Multistoried—Two or more recognizable levels characterize the crown canopy. Dominant/codominant trees of many sizes (diameters and heights) for a multilevel canopy.

State, county, and municipal land—See: Ownership.

Stocking—1) At the tree level, stocking is the density value assigned to a sampled tree (usually in terms of numbers of trees or basal area per acre), expressed as a percent of the total tree density required to fully utilize the growth potential of the land. 2) At the stand level, stocking refers to the sum of the stocking values of all trees sampled.

Subplot—A circular area with a fixed horizontal radius of 24.0 feet (1/24 acre), primarily used to sample trees ≥ 5.0 inches at d.b.h./d.r.c.

Survivor tree—A sample tree alive at both the current and previous inventories.

Timberland—Forest land that is producing or capable of producing 20 cubic feet per acre or more per year of wood at culmination of MAI. Timberland excludes reserved forest lands.

Treatment—Forestry treatments are a form of human disturbance. The term treatment further implies that a silvicultural application has been prescribed. This does not include occasional stumps of unknown origin or sparse removals for firewood,

Christmas trees, or other miscellaneous purposes. The area affected by any treatment must be at least 1.0 acre in size.

None—No observable treatment.

Cutting—The removal of trees from a stand. SRS FIA cutting categories are the following:

Clearcut harvest—The removal of the majority of the merchantable trees in a stand; residual stand stocking is under 50 percent.

Partial harvest—Removal primarily consisting of highest quality trees. Residual consists of lower quality trees because of high grading or selection harvest (e.g. uneven aged, group selection, high grading, species selection).

Seed-tree/shelterwood harvest—Crop trees are harvested leaving seed source trees either in a shelterwood or seed tree. Also includes the final harvest of the seed trees.

Commercial thinning—The removal of trees (usually of medium-diameter) from medium-diameter stands leaving sufficient stocking of growing-stock trees to feature in future stand development. Also included are thinning in large-diameter stands where medium-diameter trees have been removed to improve quality of those trees featured in a final harvest.

Timber stand improvement (cut trees only)—The cleaning, release, or other stand improvement involving noncommercial cutting applied to an immature stand that leaves sufficient stocking.

Salvage cutting—The harvesting of dead or damaged trees or of trees in danger of being killed by insects, disease, flooding, or other factors in order to save their economic value.

Site preparation—Clearing, slash burning, chopping, disking, ripping, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.

Artificial regeneration—Following a disturbance or treatment (usually cutting), a new stand where at least 50 percent of the live trees present resulted from planting or direct seeding.

Natural regeneration—Following a disturbance or treatment (usually cutting), a new stand where at least 50 percent of the live trees present (of any size) were established through the growth of existing trees and/or natural seeding or sprouting.

Other silvicultural treatment—The use of fertilizers, herbicides, girdling, pruning, or other activities designed to improve the commercial value of the residual stand, or chaining, which is a practice used on woodlands to encourage wildlife forage.

Tree—A woody perennial plant, typically large, carrying a more or less definite crown; sometimes defined as attaining a minimum diameter of 3 inches and a minimum height of 15 feet at maturity. For FIA, any plant on the tree list in the current field manual is measured as a tree.

Tree class—An assessment of the general quality of a tree.

Cull species—Species measured at d.r.c. and timber species (measured at d.b.h.) that would not produce saw-logs. See national list of nonsaw-log species.

Growing stock—Live large-diameter timber species (excludes nonsaw-log species) trees with one-third or more of the gross board-foot volume in the entire saw-log portion meeting grade, soundness, and size requirements or the potential to do so for medium-diameter trees. A growing-stock tree must have one 12-foot log or two noncontiguous 8-foot merchantable logs, now (large-diameter) or prospectively (medium-diameter), to qualify as growing stock.

Eastern Texas has a species mix more typical of the southeast United States, including maple and loblolly pines.

Rough cull—Trees that do not contain at least one 12-foot saw log or two 8-foot logs now or prospectively, primarily because of roughness or poor form. Less than ⅓ of its gross board-foot volume meets size, soundness, and grade requirements and < ½ of the cubic-foot cull is rotten or unsound.

Rotten cull—Trees that do not contain at least one 12-foot saw log or two 8-foot logs now or prospectively and/or do not meet grade specifications for percent sound primarily because of rot. All species not having ⅓ or more of its gross board-foot volume meeting size, soundness, and grade requirements, and over ½ of the cubic-foot cull is rotten or unsound.

Tree grade—A classification of the saw-log portion of large-diameter 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.

Volume—A measure of the solid content of the tree stem used to measure wood quantity.

Gross board-foot volume—Total board-foot volume of wood inside bark without deductions for total board-foot cull.

Gross cubic-foot volume—Total cubic-foot volume of wood inside bark without deductions for rotten, missing, or broken-top cull.

Net board-foot volume—Gross board-foot volume minus deductions for total board-foot cull.

Net cubic-foot volume—Gross cubic-foot volume minus deductions for rotten, missing, and broken-top cull.

INVASIVE SPECIES WATCH LIST

Common Name	Scientific Name
Tree/tree-form	
Tree-of-heaven	*Ailanthus altissima*
Silktree, mimosa	*Albizia julibrissin*
Paper mulberry	*Boussonetia papyrifera*
Camphortree[a]	*Cinnamomum camphora*
Chinese parasol tree[a]	*Firmiana simplex*
Glossy buckthorn[a]	*Frangula alnus*
Chinaberry	*Melia azedarach*
Princesstree, royal paulownia	*Paulownia tomentosa*
Trifoliate orange[a]	*Poncirus trifoliate*
Bradford pear[b]	*Pyrus calleryana*
Brazilian pepper	*Schinus terebinthifolious*
Tamarix group: saltcedar	*Tamarix* spp.
Tallowtree, popcorntree	*Triadica sebifera*
Tungoil tree[b]	*Vernicia fordii*
Shrub	
Coral ardisia, hen's eyes[a]	*Ardisia crenata*
Japanese barberry[a]	*Berberis thunbergii*
Silverthorn, thorny olive	*Elaeagnus pungens*
Olive group: autumn olive, Russian olive[c]	*Elaeagnus umbellate, E. angustifolia*
Winged burning bush	*Euonymus alatus*
Lespedeza group: shrubby lespedeza, Thunberg's lespedeza	*Lespedeza bicolor, L. thunbergii*
Privet group 1: Japanese privet, glossy privet	*Ligustrum japonicum, L. lucidum*
Privet group 2: Chinese privet, European privet, Border privet, California privet	*Ligustrum sinsense, L. vulgare, L. obtusifolium, L. ovalifolium*
Bush honeysuckle group: Tatarian honeysuckle, amur honeysuckle, Morrow's honeysuckle, sweet-breath-of-sprint, Bell's honeysuckle	*Lonicera tatarica, L. maackii, L. morrowii, L. fragrantissima, Lonicera* x *bella*
Leatherleaf mahonia[a]	*Mahonia bealei*
Sacred bamboo, nandina	*Nandina domestica*
Japanese knotweed[a]	*Polygonum cuspidatum*
Rose group: multiflora rose, Macartney rose, Cherokee rose, other nonnative roses	*Rosa multiflora, R. bracteata, R. laevigata, Rosa* spp.
Japanese meadowsweet[a]	*Spiraea japonica*

(continued)

INVASIVE SPECIES WATCH LIST *(continued)*

Common Name	Scientific Name
Vine	
Five-leaf akebia, chocolate vine[a]	*Akebia quinata*
Amur peppervine[a]	*Ampelopsis brevipedunculata*
Oriental bittersweet	*Celastrus orbiculatus*
Yam group: air yam, Chinese yam, water yam	*Dioscorea bulbifera, D. oppositifolia, D. alata*
Winter creeper	*Euonymus fortunei*
Ivy group: English ivy, Atlantic ivy, colchis ivy	*Hedera helix, H. hibernica, H. colchica*
Japanese honeysuckle	*Lonicera japonica*
Kudzu	*Pueraria Montana*
Vinca group: common periwinkle, bigleaf periwinkle	*Vinca minor, V. major*
Wisteria group: Chinese wisteria, Japanese wisteria	*Wisteria sinensis, W. floribunda*
Grass	
Giant reed[d]	*Arundo donax*
Weeping lovegrass[a]	*Eragrostis curvula*
Cogongrass	*Imperata cylindrical*
Nepalese browntop	*Microstegium vimineum*
Chinese silvergrass	*Miscanthus sinensis*
Bamboo group: golden bamboo, bamboo spp.	*Phyllostachys aurea, Bambusa* spp.
Tall fescue	*Schedonorus phoenix*
Fern	
Japanese climbing fern	*Lygodium japonicum*
Herb	
Garlic mustard	*Alliaria petiolata*
Chinese lespedeza	*Lespedeza cuneata*
Liriope group: big blue lilyturf, monkey grass[a]	*Liriope muscari, L. spicata*
Crownvetch[a]	*Securigera varia*
Tropical soda apple[d]	*Solanum viarum*

[a] Plants only included in 6.x inventory years.
[b] In 4.x, were measured as part of tree data but not as invasive species.
[c] Russian and autumn olive measured separately in 4.x, as one group in 6.x.
[d] Plants only included in 4.x inventory years.

INVENTORY METHODS

The Texas 2013 inventory was a three-phase, fixed-plot design conducted on an annual basis. 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 aid in the assessment of forest health. The three phases of the sampling method are based on a hexagonal-grid design, with successive phases being sampled with less intensity. There are 16 P2 hexagons for every P3 hexagon. P2 and P3 hexagons represent about 6,000 and 96,000 acres, respectively. However, factors such as number of non-sampled plots (hazardous or denied access for example) can affect the expansion factors, meaning that a plot may end up representing a greater area.

Under the annual inventory system, each plot is assigned a panel, that is, the year within a cycle that it is intended to be measured. In Texas, 10 percent of plots are measured in the western units (units 3–7), resulting in 10 panels and 20 percent are measured in the eastern units (units 1 and 2), five panels. 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. In most cases, the sixth (units 1 and 2) or 11th (units 3–7) year the plots that were measured in the first panel are remeasured. This marks the beginning of the next cycle of data collection. However, with the attempt to spatially balance plots within a panel, a plot might be measured in Panel 1 in Cycle 8, but Panel 5 in Cycle 9, or vice versa. The average remeasurement period in east Texas (units 1 and 2) was 5.14 years, with a standard deviation of 0.42 years, and a range of 1.1 to 8.0 years. Because the western five units are all initial plot installation, this year's measurements do not have a remeasurement period yet.

It can be hard to determine from imagery whether vegetation is shrubs and other low-lying plant life, or woodland forests. Crews ground-truth sites in question.

However, the last plots were entered into the database in January, 2016. So, we may see variable remeasurment periods appearing at the end of the next west Texas cycle, inventory year 2023.

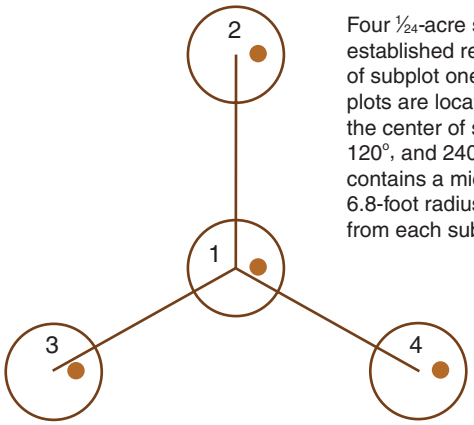
Phase 1

For East Texas, Phase 1 was based on the National Land Cover Database (NLCD) Land Cover Layer. For west Texas, Phase 1 was based on the NLCD Percent Canopy layer and a public/private ownership layer. Surface area for the 2008 report was based on the Census Bureau's TIGER 2000. For the 2013 report, area was based on

TIGER 2012 in Units 1 and 2. This resulted in a change of a few hundred acres in each unit. Stratification of forest and nonforest was performed at the unit level. Area estimation of all lands and ownerships was based on the probability of selection of P2 plot locations. 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 Forest Inventory and Analysis (FIA). These numbers could differ substantially for very small areas.

Phase 2

Bechtold and Patterson (2005) describe 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. B.1). Each point is the center of a circular subplot with a fixed 24-foot radius. Trees ≥ 5.0 inches diameter at breast height (d.b.h.), or diameter at root collar (d.r.c.) for woodland species, are measured in these subplots. Each subplot in turn contains a circular microplot, located 12 feet from the subplot center, at 90 degrees, with a fixed 6.8-foot radius. Trees 1.0 to 4.9 inches d.b.h. and seedlings (<1.0 inch d.b.h.) are measured in these microplots.



Four 1/24-acre subplots are established relative to the center of subplot one. The 24-foot radius plots are located 120 feet from the center of subplot one at 0°, 120°, and 240°. Each subplot contains a microplot with a 6.8-foot radius, 12 feet (at 90°) from each subplot center.

Figure B.1—FIA survey plot layout.

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 one of these variables changes during plot measurement.

Phase 3

Data on forest health variables (P3) are collected on about 1/16th of the P2 sample plots, and are not covered in this report.

Summary

Users wishing to make rigorous comparisons of data between surveys should be aware of any changes in methodologies between measurements. 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. 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.

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 error and sampling error.

Measurement Error

There are two elements of measurement error. The first is systematic error. These errors tend to reoccur in the same way, for example instruments of moderate precision or which have not been properly calibrated. The second is random error. Random errors are accidental, and generally do not reoccur in the same way, such as errors caused by human error in measuring and compiling.

Total measurement error may be propagating, where the errors compound, or compensating, where the errors cancel out. For each species, For any given tree, if a measurement of diameter is too high, the measurement of height might be too low, in which case the errors would be compensating; if not, the errors would be propagating.

FIA uses a combination of field collected data and models to produce the numbers in this report. Volume and biomass of trees are modeled based on their diameters as measured by the field crews (Jenkins and others 2004). Other variables such as height, basal area, and site index may be added to the model. Acres are determined from TIGER and NLCD (Phase 1), and in some cases, condition boundaries drawn by the field crews (Phase 2). Field crews go to county courthouses to determine ownership. Forest type and stand size for plot pieces larger than a subplot are determined by algorithm. The forest type algorithm is a function of the several tree species on the plot (by stocking) and the physiographic class of the plot; the stand size algorithm is a function of the tree diameters and crown classes on the plot (again by stocking). For small plot pieces, the field crew assigns a forest type and a stand size, on the theory that the trees on such a small piece may not be representative of the overall stand. Stand age, stand origin, and tree status (whether alive, dead, or cut) are estimated by the field crews, as are the silvicultural treatments. Growth is estimated by comparing this cycle's volume to the previous cycle's volume. Field crews also

Foresters determine if there is enough crown cover for an area to be considered forest. (photo courtesy of Texas A&M Forest Service)

A sparse landscape in the Davis Mountains of west Texas. (photo courtesy of Texas A&M Forest Service)

estimate disturbances on each condition, identify invasive species, and measure down woody material. Algorithms then compute population totals for down woody material (Woodall and Monleon 2008, Woodall and Williams 2005). Field crews measure many other variables as well, but the ones cited are those most mentioned in this report.

All of the errors are held to a minimum by the Forest Inventory and Analysis (FIA) quality assurance (QA) program. The goal of the QA program is to provide a framework of quality control procedures to assure the production of complete, accurate, and unbiased forest assessments for given standards. These methods include use of nationally standardized field manuals; use of portable data recorders with data check programing; entry-level training, periodic review training, supervision, and use of check plots; editing checks, and data processing reviews; and an emphasis on careful work. Additionally, data quality is assessed and documented by 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 the program's quality objectives.

Each variable collected by FIA is assigned a measurement quality objective (MQO) and a measurement tolerance level. The MQOs are documented in the FIA National Field Manual (U.S. Department of Agriculture Forest Service 2007, 2012). 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 crews' ability to make repeatable measurements or observations within the assigned MQO.

Evaluation of data repeatability is accomplished by calculating the differences between data collected by the field crew and data 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 are within the tolerance level. Tables C.1–C.13 show the results of various blind checks for Texas.

Table C.1—Observation report for east Texas, 2013

Variable	Matched observations	Observations found by just cruiser	Observations found by just quality assurance forester
Orphaned conditions	25	0	0
Missed or added trees	864	2	4
All damage codes	4	4	32
Bark beetles damage codes	0	0	1
Boring insects damage codes	0	0	4
Root/butt diseases damage codes	0	0	8
Cankers damage codes	0	1	5
Stem decay damage codes	1	2	9
Stem rusts damage codes	0	0	2
Wild animals damage codes	2	0	2
Human activities damage codes	0	1	0
Other damage codes	1	0	1
Missed or added seedlings	110	0	8
Invasive species	9	1	4

Table C.2—Results of blind checks (quality assurance) for east Texas on plot-level variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Plot nonsampled reason	0	—	—
Distance to road	17	15	88
Water on plot	17	17	100
Latitude-longitude	3	3	100
Plot in correct county	20	20	100
Corrected county	0	—	—
Plot accessibility	20	18	90

— = No sample for the cell.

Table C.3—Results of blind checks (quality assurance) for east Texas on condition-level variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Condition status	85	85	100
Reserved status	56	56	100
Owner group	56	56	100
Field forest type	55	53	96
Field forest type group	55	54	98
Stand size class	56	53	95
Regeneration status	56	56	100
Tree density	56	56	100
Artificial regeneration species	16	16	100
Owner class	56	53	95
Stand age	55	45	82
Disturbance 1	56	53	95
Disturbance year 1	4	4	100
Disturbance 2	4	4	100
Disturbance year 2	1	1	100
Disturbance 3	1	1	100
Disturbance year 3	0	—	—
Treatment 1	56	52	93
Treatment year 1	14	13	93
Treatment 2	14	10	71
Treatment year 2	7	7	100
Treatment 3	7	6	86
Treatment year 3	2	2	100
Physiographic class	56	54	96
Present land use	56	56	100
Total acres	47	44	94
Percent forest	47	41	87
Stand structure	56	55	98
Operability	56	55	98
Site class	7	6	86
Chaining	25	25	100
Harvest type 1	56	55	98
Harvest type 2	5	5	100
Live canopy	21	17	81
Live and missing canopy	21	20	95
Land cover class	25	20	80

— = no sample for the cell.

Table C.4—Results of blind checks (quality assurance) for east Texas on subplot-level variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Subplot nonsampled reason	0	—	—
Subplot center condition	80	80	100
Microplot center condition	80	80	100
Subplot slope	45	45	100
Subplot aspect	45	38	84
Snow/water depth	45	44	98

— = no sample for the cell.

Table C.5—Results of blind checks (quality assurance) for east Texas on boundary variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Existence of change	17	15	88
Boundary change	5	4	80
Contrasting condition	17	16	94
Left azimuth	5	5	100
Right azimuth	5	4	80
Existence of corner	5	5	100
Corner azimuth	0	—	—
Corner distance	0	—	—

— = no sample for the cell.

Table C.6—Results of blind checks (quality assurance) for east Texas on tree-level variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Condition number	864	853	99
Azimuth	700	687	98
Horizontal distance	667	662	99
Present tree status	863	859	100
Reconcile	150	150	100
Standing dead	132	131	99
Species	864	846	98
Genus	864	859	99
Live d.b.h.	579	445	77
Live d.b.h.: both diameter checks = 0	159	113	71
Live d.b.h.: both diameter checks > 0	0	—	—
Live d.b.h.: mixed diameter checks	6	—	—
Sound dead d.b.h.	21	15	71
Decayed dead d.b.h.	9	9	100
Live rotten/missing cull	28	26	93
Dead rotten/missing cull	17	14	82
Number of d.r.c. stems	0	—	—
Diameter root collar	0	—	—
Total length	588	529	90
Live tree actual length	10	10	100
Dead tree actual length	17	12	71
Crown class	588	537	91
Compacted crown ratio	588	563	96
Uncompacted crown ratio	0	—	—
Cause of death	2	0	0
Mortality year	2	2	100
Decay class	132	129	98
Tree Class	489	471	96
Tree grade	180	167	93
Board foot cull	180	175	97
Dieback severity	403	401	100
Utilization class	138	132	96
Abnormal termination	589	589	100

— = no sample for the cell.

D.b.h. = diameter at breast height; d.r.c. = diameter at root collar.

Table C.7—Results of blind checks (quality assurance) for east Texas on seedling variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Species	110	104	95
Genus	110	108	98
Count	110	98	89

Table C.8—Results of blind checks (quality assurance) for east Texas on invasive species variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Invasive cover	9	9	100

Table C.9—Results of blind checks (quality assurance) for east Texas on down woody species variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Duff/litter method	16	16	100
Litter depth	16	16	100
Duff depth	16	16	100
Fine woody debris	0	—	—
Segment matches	8	8	100
Small count	8	8	100
Medium count	8	8	100
Large count	8	8	100
Coarse woody debris	0	—	—
Found by both crews	9	9	100
Condition	9	9	100
Horizontal distance	9	9	100
Decay class	9	9	100
Transect diameter	9	9	100
Length > 3 feet	9	9	100
Hollow diameter	8	8	100

— = no sample for the cell.

Table C.10—Observation report for west Texas, 2013

Variable	Observations found by both	Observations found by just cruiser	Observations found by just quality assurance
Orphaned conditions	149	0	0
Missed/added trees	593	3	3
Missed/added seedlings	163	0	9

Table C.11—Results of blind checks (quality assurance) for west Texas on condition-level variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Condition status	149	149	100
Reserved status	102	102	100
Owner group	102	102	100
Field forest type	102	99	97
Field forest type group	102	101	99
Stand size class	102	93	91
Regeneration status	102	102	100
Tree density	102	102	100
Artificial regeneration species	0	—	—
Owner class	102	93	91
Stand age	102	54	53
Disturbance 1	102	95	93
Disturbance year 1	6	6	100
Disturbance 2	6	5	83
Disturbance year 2	0	—	—
Disturbance 3	0	—	—
Disturbance year 3	0	—	—
Treatment 1	102	101	99
Treatment year 1	4	4	100
Treatment 2	4	4	100
Treatment year 2	0	—	—
Treatment 3	0	—	—
Treatment year 3	0	—	—
Physiographic class	102	90	88
Present land use	102	100	98
Total acres	95	95	100
Stand structure	102	102	100
Operability	102	102	100
Site class	102	101	99
Chaining	0	—	—
Harvest type 1	102	102	100
Harvest type 2	0	—	—
Harvest type 3	0	—	—
Live canopy	0	—	—
Live and missing canopy	0	—	—
Number of stems	0	—	—

— = no sample for the cell.

Table C.12—Results of blind checks (quality assurance) for west Texas on tree-level variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Condition number	593	588	99
Azimuth	593	555	94
Horizontal distance	593	499	84
Present tree status	593	590	99
Standing dead	20	20	100
Species	593	589	99
Genus	593	590	99
Live d.b.h.	145	125	86
Sound dead d.b.h.	1	1	100
Decayed dead d.b.h.	11	10	91
Live rotten/missing cull	0	—	—
Dead rotten/missing cull	0	—	—
Number of d.r.c. stems	399	399	100
Diameter root collar	399	0	0
Total length	570	501	88
Live tree actual length	1	1	100
Dead tree actual length	12	6	50
Crown class	570	505	89
Compacted crown ratio	570	450	79
Decay class	20	20	100
Tree class	440	435	99
Dieback severity	495	495	100
Utilization class	0	—	—
Abnormal termination	166	166	100

— = no sample for the cell.

D.b.h. = diameter at breast height; d.r.c. = diameter at root collar.

Table C.13—Results of blind checks (quality assurance) for west Texas on seedling-level variables, 2013

Variable	Number of observations	Number within tolerance	Percent within tolerance
Species	163	158	97
Genus	163	163	100
Count	163	146	90

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. That is, there is a 68.27-percent probability that the confidence interval given for each sample estimate will cover the true population mean.

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 having a smaller variance.

Just as there are some cases where a smaller area may not have proportionally larger sampling error, there are some cases where a large area may have a larger than expected sampling error. As explained in the first paragraph of this section, in cases where there are a large number of non-sampled plots, the plots that are sampled will represent a large area. Estimates and standard errors were computed under the assumption that responses were missing at random within strata. This is not always the case however (Patterson and others, 2012). The pattern of nonresponse across the State is shown in figure C.1. Nonresponse ranges from <1 percent in Unit 2 to over 30 percent in Unit 4. At the county level, non-sampled amounts range from 0 percent in 28 counties to almost 65 percent in Zapata County.

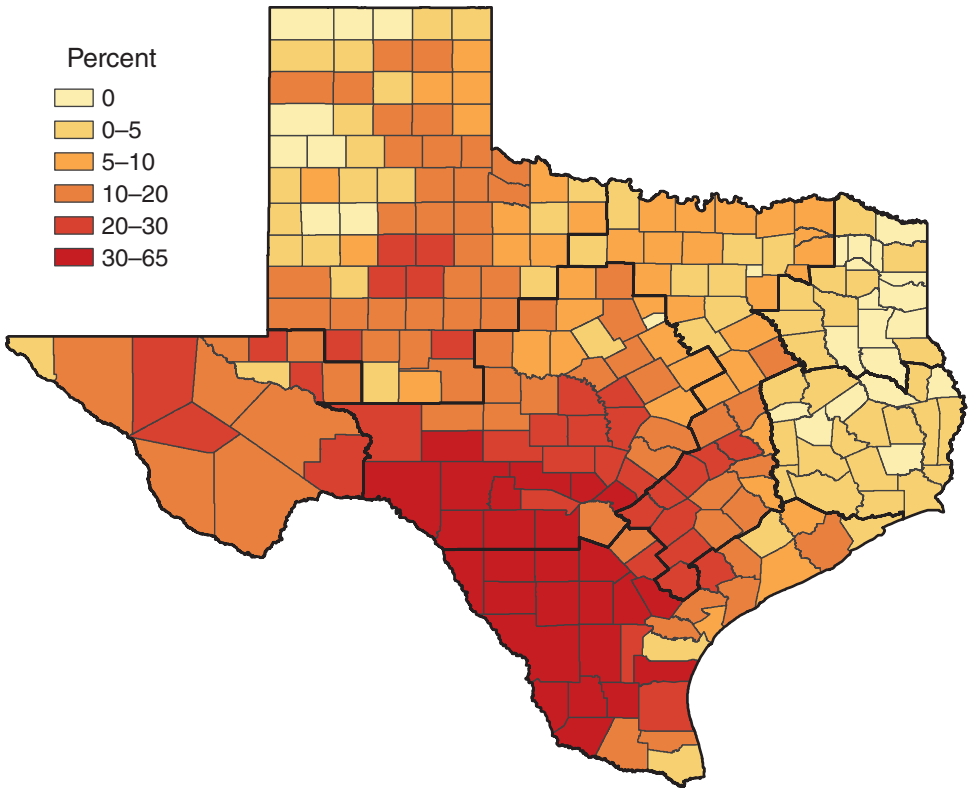


Figure C.1—Non-sampled plot proportions in Texas.

Over 98 percent of the time, the reason for non-sample plots was that the landowner had denied access. On more than 98 percent of plots having denied access, the entire plot was denied access. By comparison, in almost 40 percent of the cases where only part of the plot was non-sampled, the reason was due to a hazardous situation.

For specific post-defined strata the sampling error can be calculated by using the following formula. Sampling errors obtained by this method are only approximations of reliability because this process assumes constant variance across all subdivisions of totals.

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

where

SE_s = sampling error for subdivision of survey unit or State total

SE_t = sampling error for survey unit or State total

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

X_t = total area or volume for survey unit or State

For example, the net merchantable bole volume for live trees on forest land in this survey is 31.6 billion cubic feet, with a sampling error of 1.28 percent (confidence level 68 percent). We can also get estimates of volume at the county level, but these will generally have higher sampling errors than the whole state. Here we calculated the sampling error for Nacogdoches County:

$SE_t = 1.28$

$X_s = 770{,}544{,}208$ cubic feet

$X_t = 31{,}575{,}213{,}343$ cubic feet

$$SE_s = 1.28\left[\frac{\sqrt{31{,}575{,}213{,}343}}{\sqrt{770{,}544{,}208}}\right] = 8.19$$

So, the sampling error for volume of trees in Nacogdoches County is 8.19 percent. For counties with less forest land, the sampling error percent will be even greater.

Table D.1—Area by survey unit and land status, Texas, 2013

Unit	Total area	All forest	Unreserved			Reserved			Nonforest land	Census water
			Total	Timberland	Unproductive	Total	Productive	Unproductive		
			thousand acres							
Southeast	12,500.7	6,830.3	6,679.5	6,668.4	11.1	150.7	150.7	0.0	5,026.9	643.5
Northeast	9,917.3	5,256.1	5,244.2	5,238.1	6.1	11.9	11.9	0.0	4,355.9	305.4
North Central	22,777.5	6,820.0	6,804.6	1,817.9	4,986.7	15.5	8.3	7.2	15,469.1	488.4
South	26,625.6	8,031.8	7,940.8	225.2	7,715.6	90.9	0.0	90.9	15,438.1	3,155.7
West Central	31,604.1	18,315.2	18,289.0	167.3	18,121.7	26.3	0.0	26.3	12,997.2	291.7
Northwest	44,939.2	11,735.7	11,720.1	11.6	11,708.6	15.6	0.0	15.6	33,031.3	172.2
West	23,526.5	6,139.6	6,087.0	8.5	6,078.4	52.7	0.0	52.7	17,354.3	32.6
All survey units	171,891.0	63,128.8	62,765.2	14,137.0	48,628.2	363.5	170.9	192.6	103,672.9	5,089.4

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 D.2.0—Area of forest land by forest-type group and ownership group, Texas, 2013

Forest-type group	All ownerships	U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
			thousand acres			
Softwood types						
Longleaf-slash pine	119.9	12.0	0.0	0.0	0.0	107.9
Loblolly-shortleaf pine	5,360.8	553.1	45.2	65.3	236.9	4,460.3
Other eastern softwoods	219.1	0.0	14.8	12.9	0.0	191.5
Pinyon-juniper	9,555.0	0.0	135.2	402.7	6.1	9,011.0
Total softwoods	15,254.9	565.1	195.2	481.0	243.0	13,770.6
Hardwood types						
Oak-pine	1,767.0	60.8	59.7	49.1	9.2	1,588.2
Oak-hickory	12,852.1	58.8	266.5	182.2	25.3	12,319.3
Oak-gum-cypress	2,109.1	17.9	111.7	55.5	45.4	1,878.7
Elm-ash-cottonwood	2,833.8	14.3	91.0	157.9	0.0	2,570.6
Other hardwoods	539.3	5.0	12.4	0.0	0.0	521.9
Woodland hardwoods	23,624.0	0.0	139.4	1,264.7	9.5	22,210.5
Exotic hardwoods	256.5	0.0	5.5	22.5	0.0	228.5
Total hardwoods	43,981.8	156.9	686.2	1,731.8	89.5	41,317.5
Nonstocked	3,892.1	1.5	53.9	122.3	8.0	3,706.4
All groups	63,128.8	723.5	935.3	2,335.0	340.4	58,794.5

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.

Table D.2.1—Area of timberland by forest-type group and ownership group, Texas, 2013

Forest-type group	All ownerships	U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
			thousand acres			
Softwood types						
Longleaf-slash pine	119.9	12.0	0.0	0.0	0.0	107.9
Loblolly-shortleaf pine	5,302.6	517.1	27.4	65.3	236.9	4,455.9
Other eastern softwoods	87.2	0.0	5.1	6.4	0.0	75.8
Pinyon-juniper	11.1	0.0	0.0	0.0	0.0	11.1
Total softwoods	5,520.7	529.1	32.4	71.7	236.9	4,650.6
Hardwood types						
Oak-pine	1,566.8	60.8	15.5	40.7	9.2	1,440.6
Oak-hickory	3,783.2	37.7	85.1	51.8	25.3	3,583.3
Oak-gum-cypress	1,503.4	12.1	46.2	44.0	45.4	1,355.7
Elm-ash-cottonwood	1,301.3	14.3	49.2	98.2	0.0	1,139.6
Other hardwoods	23.3	0.0	0.0	0.0	0.0	23.3
Woodland hardwoods	53.5	0.0	0.0	0.0	0.0	53.5
Exotic hardwoods	227.8	0.0	4.3	13.5	0.0	210.1
Total hardwoods	8,459.3	124.9	200.2	248.2	80.0	7,806.0
Nonstocked	157.0	1.5	0.0	10.3	8.0	137.2
All groups	14,137.0	655.5	232.6	330.3	324.8	12,593.8

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 D.3—Area of forest land by forest-type group and stand-size class, Texas, 2013

Forest-type group	All classes	Stand-size class			
		Large diameter	Medium diameter	Small diameter	Nonstocked
	thousand acres				
Softwood types					
Longleaf-slash pine	119.9	85.3	22.7	11.9	0.0
Loblolly-shortleaf pine	5,360.8	2,949.4	1,495.3	916.1	0.0
Other eastern softwoods	219.1	94.2	62.8	62.1	0.0
Pinyon-juniper	9,555.0	4,488.5	2,272.7	2,793.9	0.0
Total softwoods	15,254.9	7,617.4	3,853.5	3,784.0	0.0
Hardwood types					
Oak-pine	1,767.0	941.3	384.6	441.1	0.0
Oak-hickory	12,852.1	3,754.5	4,593.0	4,504.6	0.0
Oak-gum-cypress	2,109.1	1,176.6	286.4	646.1	0.0
Elm-ash-cottonwood	2,833.8	1,151.8	749.3	932.6	0.0
Other hardwoods	539.3	97.6	196.8	244.9	0.0
Woodland hardwoods	23,624.0	6,573.2	3,486.8	13,564.0	0.0
Exotic hardwoods	256.5	18.3	54.6	183.6	0.0
Total hardwoods	43,981.8	13,713.4	9,751.5	20,516.9	0.0
Nonstocked	3,892.1	0.0	0.0	0.0	3,892.1
All groups	63,128.8	21,330.8	13,604.9	24,300.9	3,892.1

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 D.4—Area of forest land by forest-type group and stand-age class, Texas 2013

Forest-type group	All classes	Stand-age class (years) 1–20	21–40	41–60	61–80	81–100	101–120	121–140	141–160	161–180	181–200	201+	Non-stocked
						thousand acres							
Softwood types													
Longleaf-slash pine	119.9	34.0	61.7	3.2	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	5,360.8	2,291.8	1,734.1	780.3	451.9	74.2	0.0	0.0	0.0	11.8	0.0	0.0	16.6
Other eastern softwoods	219.1	19.9	87.5	62.2	27.9	5.1	16.6	0.0	0.0	0.0	0.0	0.0	0.0
Pinyon-juniper	9,555.0	1,032.2	3,281.2	3,353.9	1,420.0	359.3	42.4	19.5	7.9	0.0	0.0	7.9	30.6
Total softwoods	15,254.9	3,377.9	5,164.5	4,199.6	1,920.9	438.6	59.0	19.5	7.9	11.8	0.0	7.9	47.3
Hardwood types													
Oak-pine	1,767.0	562.3	377.0	565.8	232.7	23.2	0.0	0.0	0.0	0.0	0.0	0.0	6.0
Oak-hickory	12,852.1	1,748.8	3,146.7	4,844.8	2,225.5	644.0	68.1	27.2	70.0	0.0	13.0	0.0	64.0
Oak-gum-cypress	2,109.1	385.6	421.1	666.8	520.8	81.7	3.7	7.9	6.3	7.6	7.6	0.0	0.0
Elm-ash-cottonwood	2,833.8	495.8	917.3	823.3	528.0	46.6	0.0	3.8	6.0	0.0	9.9	0.0	3.2
Other hardwoods	539.3	48.9	174.7	175.3	96.9	27.1	7.6	1.3	7.4	0.0	0.0	0.0	0.0
Woodland hardwoods	23,624.0	7,094.3	9,056.6	5,772.4	1,424.2	171.4	15.2	20.6	12.9	0.0	0.0	0.0	56.5
Exotic hardwoods	256.5	163.9	59.5	17.2	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	43,981.8	10,499.7	14,152.9	12,865.7	5,044.0	993.8	94.6	60.7	102.6	7.6	30.5	0.0	129.7
Nonstocked	3,892.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,892.1
All groups	63,128.8	13,877.5	19,317.4	17,065.3	6,964.9	1,432.4	153.6	80.2	110.5	19.4	30.5	7.9	4,069.0

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.

Table D.5—Area of timberland by forest-type group and stand origin, Texas, 2013

Forest-type group	Total	Stand origin	
		Natural stands	Artificial regeneration
	thousand acres		
Softwood types			
Longleaf-slash pine	119.9	46.3	73.6
Loblolly-shortleaf pine	5,302.6	2,584.6	2,717.9
Other eastern softwoods	87.2	87.2	0.0
Pinyon-juniper	11.1	11.1	0.0
Total softwoods	5,520.7	2,729.2	2,791.5
Hardwood types			
Oak-pine	1,566.8	1,395.0	171.8
Oak-hickory	3,783.2	3,695.4	87.7
Oak-gum-cypress	1,503.4	1,476.2	27.2
Elm-ash-cottonwood	1,301.3	1,291.0	10.2
Other hardwoods	23.3	23.3	0.0
Woodland hardwoods	53.5	53.5	0.0
Exotic hardwoods	227.8	217.3	10.5
Total hardwoods	8,459.3	8,151.9	307.4
Nonstocked	157.0	123.9	33.0
All groups	14,137.0	11,005.0	3,132.0

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.

Table D.6—Area of forest land disturbed annually by forest-type group and disturbance class, Texas, 2013

Forest-type group[b]	Disturbance class[a]							
	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Human	Other natural
	thousand acres							
Softwood types								
Longleaf-slash pine	0.0	0.0	4.1	1.2	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	1.2	0.0	53.5	17.9	3.0	1.2	0.0	0.0
Other eastern softwoods	0.0	0.0	2.2	0.0	0.0	0.7	0.0	0.0
Total softwoods	1.2	0.0	59.9	19.1	3.0	1.8	0.0	0.0
Hardwood types								
Oak-pine	0.9	0.0	23.9	6.3	0.0	1.2	0.0	0.0
Oak-hickory	0.3	1.3	39.7	7.0	0.0	1.3	1.2	0.0
Oak-gum-cypress	0.0	0.0	62.9	0.0	0.0	3.3	0.0	1.1
Elm-ash-cottonwood	0.0	0.0	6.9	0.0	1.0	0.9	0.0	1.0
Other hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Woodland hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	0.0	0.0	4.4	0.0	0.0	0.2	0.9	0.0
Total hardwoods	1.2	1.3	137.8	13.3	1.0	7.1	2.0	2.1
Nonstocked	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0
All groups	2.4	1.3	198.9	32.4	4.1	8.9	2.0	2.1

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] Based on current conditions.

[b] Based on past conditions.

Table D.7—Area of timberland cut (silvicultural treatment) annually by forest-type group and treatment class, Texas, 2013

Forest-type group[b]	Total treated	Treatment class[a]					
		Final harvest	Partial harvest	Seed-tree/ shelterwood harvest	Commercial thinning	Timber stand improvement	Salvage cutting
	thousand acres						
Softwood types							
Longleaf-slash pine	12.1	10.5	0.3	0.0	1.3	0.0	0.0
Loblolly-shortleaf pine	252.6	89.8	21.4	4.5	131.5	0.2	5.1
Other eastern softwoods	0.3	0.0	0.0	0.0	0.3	0.0	0.0
Total softwoods	265.0	100.3	21.7	4.5	133.2	0.2	5.1
Hardwood types							
Oak-pine	42.8	8.9	17.5	0.0	15.2	0.0	1.2
Oak-hickory	70.7	22.7	28.5	0.0	9.4	2.0	8.1
Oak-gum-cypress	21.6	5.9	5.1	1.0	3.5	1.3	4.6
Elm-ash-cottonwood	6.7	1.7	3.8	0.0	0.0	1.2	0.0
Other hardwoods	0.3	0.0	0.0	0.0	0.0	0.0	0.3
Woodland hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	1.9	1.6	0.3	0.0	0.0	0.0	0.0
Total hardwoods	144.0	40.9	55.2	1.0	28.1	4.5	14.3
Nonstocked	0.6	0.1	0.3	0.0	0.3	0.0	0.0
All groups	409.6	141.3	77.2	5.5	161.5	4.7	19.4

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] Based on current conditions.

[b] Based on past conditions.

Table D.8—Area of timberland treated (noncutting treatments) annually by forest-type group and treatment class, Texas, 2013

Forest-type group[a]	Treatment class[a]			
	Site preparation	Artificial regeneration	Natural regeneration	Other silvicultural
	thousand acres			
Softwood types				
Longleaf-slash pine	1.2	0.0	0.0	2.2
Loblolly-shortleaf pine	70.8	80.2	5.9	30.1
Other eastern softwoods	0.0	0.0	0.0	0.0
Total softwoods	72.0	80.3	5.9	32.4
Hardwood types				
Oak-pine	13.9	14.4	5.1	1.2
Oak-hickory	10.0	7.6	28.2	5.9
Oak-gum-cypress	1.8	3.9	0.6	3.4
Elm-ash-cottonwood	0.6	0.6	3.2	0.0
Other hardwoods	0.0	0.0	0.0	0.0
Woodland hardwoods	0.0	0.0	0.0	0.0
Exotic hardwoods	1.0	1.0	0.0	0.0
Total hardwoods	27.4	27.6	37.1	10.4
Nonstocked	5.4	2.1	2.7	0.6
All groups	104.8	109.9	45.8	43.4

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] Based on current conditions.

Table D.9—Number of live trees on forest land by species group and diameter class, Texas, 2013

Species group	All classes	Diameter class (inches) 1.0–2.9	3.0–4.9	5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0+
						million trees						
Softwood												
Longleaf and slash pines	53.3	22.7	9.1	6.4	6.3	4.0	2.0	1.3	0.8	0.5	0.2	0.0
Loblolly and shortleaf pines	2,034.0	776.0	448.2	319.8	218.7	116.0	61.3	35.6	22.6	14.5	8.8	12.5
Cypress	17.8	5.2	2.2	1.7	2.3	2.0	1.4	0.8	0.4	0.3	0.5	1.0
Other eastern softwoods	392.4	224.2	94.7	34.8	18.4	10.8	4.5	2.7	1.5	0.5	0.3	0.1
Woodland softwoods	3,154.6	1,378.5	732.3	425.2	256.1	156.4	91.3	56.4	28.2	14.9	7.8	7.5
Total softwoods	5,652.2	2,406.6	1,286.5	787.8	501.9	289.1	160.4	96.8	53.5	30.7	17.7	21.1
Hardwood												
Select white oaks	133.8	88.2	17.8	9.7	5.6	3.4	2.9	1.9	1.5	0.6	0.8	1.4
Select red oaks	217.6	107.4	43.9	28.4	17.2	9.1	4.8	2.5	1.9	0.9	0.6	1.0
Other white oaks	1,500.2	453.2	354.8	281.1	181.0	98.6	53.0	32.4	17.1	9.9	7.3	11.6
Other red oaks	1,239.6	768.9	243.3	89.4	50.7	28.0	18.9	13.2	10.0	6.7	3.3	7.3
Hickory	240.3	152.4	34.1	17.0	11.1	7.9	5.9	4.3	2.5	1.7	1.4	2.0
Hard maple	24.4	18.9	3.1	1.4	0.4	0.3	0.1	0.1	0.0	0.0	0.0	0.0
Soft maple	211.2	164.1	30.2	8.5	4.7	1.9	0.7	0.6	0.3	0.0	0.0	0.0
Beech	7.5	3.6	1.3	0.5	0.4	0.5	0.3	0.1	0.3	0.1	0.3	0.1
Sweetgum	1,107.5	771.2	184.0	68.0	35.8	20.3	12.4	7.0	3.9	2.1	1.1	1.6
Tupelo and blackgum	190.9	121.3	38.2	11.8	7.0	4.8	2.5	2.1	0.9	0.9	0.6	0.7
Ash	320.4	209.0	49.1	26.7	12.8	9.0	5.3	3.6	1.6	1.4	0.9	1.0
Cottonwood and aspen	7.4	2.6	0.9	0.7	0.7	0.5	0.3	0.3	0.3	0.2	0.2	0.6
Basswood	4.3	2.7	0.5	0.3	0.3	0.2	0.1	0.0	0.1	0.0	0.0	0.0
Black walnut	6.9	2.0	1.6	0.8	1.0	0.4	0.3	0.2	0.2	0.2	0.0	0.0
Other eastern soft hardwoods	2,448.9	1,592.9	468.2	183.2	93.6	50.2	27.8	14.9	8.4	4.7	2.0	2.7
Other eastern hard hardwoods	391.6	303.9	60.2	17.2	6.2	2.2	0.9	0.5	0.2	0.2	0.0	0.1
Eastern noncommercial hardwoods	2,358.9	1,995.4	249.4	69.7	26.7	10.4	3.3	2.3	1.0	0.4	0.2	0.1
Woodland hardwoods	3,514.9	1,587.6	897.6	455.3	259.6	142.1	79.3	41.5	23.4	13.5	7.9	7.2
Total hardwoods	13,926.1	8,345.3	2,678.2	1,269.7	714.9	389.9	218.8	127.6	73.5	43.8	26.6	37.8
All species	19,578.3	10,751.9	3,964.6	2,057.6	1,216.8	679.0	379.2	224.5	127.0	74.5	44.3	59.0

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.

Table D.10—Net[a] volume of live trees on forest land by species group and ownership group, Texas, 2013

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Longleaf and slash pines	283.0	51.8	0.0	0.0	6.6	224.6
Loblolly and shortleaf pines	9,677.9	1,926.7	160.5	176.4	290.8	7,123.5
Cypress	299.3	0.0	29.1	65.2	0.4	204.5
Other eastern softwoods	415.1	1.0	19.7	17.9	0.2	376.3
Woodland softwoods	3,583.1	0.0	132.2	119.2	3.2	3,328.5
Total softwoods	14,258.3	1,979.4	341.6	378.7	301.3	11,257.4
Hardwood						
Select white oaks	444.1	48.9	40.1	6.0	8.8	340.2
Select red oaks	554.2	20.1	16.7	13.5	37.1	466.8
Other white oaks	4,019.5	48.7	81.6	69.9	14.4	3,804.9
Other red oaks	2,699.3	84.9	119.5	55.7	24.2	2,415.0
Hickory	665.8	20.1	12.6	25.1	4.2	603.8
Hard maple	14.1	0.9	0.0	0.0	0.1	13.1
Soft maple	93.6	4.6	6.1	0.8	2.1	80.1
Beech	48.2	3.1	1.9	0.0	1.9	41.3
Sweetgum	1,429.3	80.3	57.8	23.0	29.9	1,238.2
Tupelo and blackgum	351.6	21.4	25.1	5.1	7.3	292.7
Ash	568.6	26.3	27.9	31.7	1.8	481.0
Cottonwood and aspen	130.1	0.2	9.1	0.0	0.0	120.8
Basswood	9.3	0.0	0.5	0.0	0.9	7.9
Black walnut	29.4	0.0	0.0	2.9	0.0	26.4
Other eastern soft hardwoods	2,277.4	37.4	85.2	118.5	6.5	2,029.8
Other eastern hard hardwoods	112.6	3.4	4.8	5.2	2.2	96.9
Eastern noncommercial hardwoods	412.7	5.3	25.9	14.4	3.8	363.3
Woodland hardwoods	3,521.6	0.0	28.4	98.5	1.2	3,393.6
Total hardwoods	17,381.2	405.8	543.1	470.4	146.4	15,815.6
All species	31,639.6	2,385.2	884.7	849.1	447.7	27,073.0

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] Excludes rotten, missing, and form cull defects volume.

Table D.11—Net[a] volume of live trees on forest land by species group and diameter class, Texas, 2013

Species group	All classes	Diameter class (inches) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
							million cubic feet							
Softwood														
Longleaf and slash pines	283.0	20.3	42.8	51.1	39.4	42.2	36.6	26.5	15.8	3.6	4.7	0.0	0.0	0.0
Loblolly and shortleaf pines	9,677.9	746.8	1,309.8	1,336.3	1,206.1	1,067.7	962.4	852.0	659.5	934.1	406.4	126.8	69.8	0.0
Cypress	299.3	6.1	15.6	23.8	24.1	21.2	14.9	16.8	31.1	10.4	52.8	15.2	20.9	46.3
Other eastern softwoods	415.1	69.0	80.7	84.8	57.9	48.7	37.8	17.9	14.3	4.1	0.0	0.0	0.0	0.0
Woodland softwoods	3,583.1	408.9	515.3	558.6	527.4	506.5	360.2	267.2	180.7	172.1	49.2	17.7	10.7	8.4
Total softwoods	14,258.3	1,251.2	1,964.3	2,054.6	1,855.0	1,686.3	1,412.0	1,180.4	901.4	1,124.3	513.1	159.7	101.4	54.7
Hardwood														
Select white oaks	444.1	22.1	31.7	35.1	50.3	47.8	51.3	28.2	46.2	66.0	31.1	15.5	19.0	0.0
Select red oaks	554.2	57.8	74.7	71.7	62.5	54.1	52.1	40.3	30.3	44.8	23.5	22.7	6.0	13.7
Other white oaks	4,019.5	462.6	584.8	571.3	496.8	446.8	329.1	246.8	235.4	299.1	165.0	81.7	29.9	70.2
Other red oaks	2,699.3	207.7	257.0	257.7	278.7	292.9	302.1	267.6	179.2	285.8	192.6	96.8	42.4	38.9
Hickory	665.8	29.1	49.1	66.3	78.9	86.0	64.7	58.1	61.5	64.8	45.0	24.4	15.0	22.9
Hard maple	14.1	3.1	2.3	3.5	2.4	1.6	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Soft maple	93.6	21.4	24.6	15.2	9.8	10.0	8.4	1.4	0.7	2.0	0.0	0.0	0.0	0.0
Beech	48.2	1.3	2.1	5.7	5.3	2.5	6.3	5.2	14.6	0.0	5.4	0.0	0.0	0.0
Sweetgum	1,429.3	142.2	199.3	222.3	220.6	184.3	137.8	108.6	66.3	91.1	46.4	7.1	0.0	3.2
Tupelo and blackgum	351.6	27.9	37.0	48.3	37.5	50.7	28.9	33.3	29.7	35.2	13.6	8.5	0.0	1.1
Ash	568.6	61.7	62.6	79.8	79.8	73.6	47.3	55.2	41.1	35.9	20.4	0.0	11.2	0.0
Cottonwood and aspen	130.1	1.5	2.5	5.0	5.3	7.2	8.1	8.5	8.1	5.8	25.1	26.5	9.4	17.0
Basswood	9.3	1.0	1.3	2.0	1.4	1.1	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Black walnut	29.4	1.6	3.4	2.2	2.3	2.9	5.9	4.5	1.0	1.8	0.0	3.8	0.0	0.0
Other eastern soft hardwoods	2,277.4	344.5	381.8	365.4	329.5	256.7	193.5	144.5	81.1	110.5	34.3	11.0	21.9	2.8
Other eastern hard hardwoods	112.6	35.7	28.3	18.1	10.0	6.3	4.9	5.3	1.6	2.5	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	412.7	124.1	104.2	75.3	34.1	34.8	20.1	10.3	4.9	5.0	0.0	0.0	0.0	0.0
Woodland hardwoods	3,521.6	441.4	539.2	555.8	525.6	422.2	340.5	250.5	196.0	162.2	52.1	18.5	6.9	10.7
Total hardwoods	17,381.2	1,986.7	2,385.8	2,400.6	2,230.7	1,981.4	1,603.3	1,269.4	997.6	1,212.6	654.5	316.6	161.5	180.5
All species	31,639.6	3,237.9	4,350.1	4,455.1	4,085.6	3,667.7	3,015.3	2,449.8	1,899.0	2,336.9	1,167.6	476.3	262.9	235.2

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.

[a] Excludes rotten, missing, and form cull defects volume.

Table D.12—Aboveground dry weight of live trees on forest land by ownership class and land status, Texas, 2013

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timber-land	Unpro-ductive	Total	Produc-tive	Unpro-ductive
	thousand tons						
U.S. Forest Service							
National forest	55,415.0	52,110.0	52,110.0	0.0	3,304.9	3,304.9	0.0
National grassland	899.9	899.9	348.9	551.0	0.0	0.0	0.0
Total	56,314.9	53,009.9	52,458.9	551.0	3,304.9	3,304.9	0.0
Other Federal							
National Park Service	5,833.1	0.0	0.0	0.0	5,833.1	5,612.1	220.9
Bureau of Land Management	23.2	23.2	0.0	23.2	0.0	0.0	0.0
U.S. Fish and Wildlife Service	3,361.7	0.0	0.0	0.0	3,361.7	1,922.8	1,438.9
Dept. of Defense/Dept. of Energy	14,876.8	14,876.8	9,715.9	5,160.8	0.0	0.0	0.0
Other Federal	56.7	56.7	56.7	0.0	0.0	0.0	0.0
Total	24,151.4	14,956.6	9,772.6	5,184.0	9,194.7	7,534.9	1,659.8
State and local government							
State	12,621.3	12,621.3	8,070.5	4,550.8	0.0	0.0	0.0
Local	10,907.7	10,907.7	5,545.8	5,361.9	0.0	0.0	0.0
Other nonfederal public	287.3	287.3	147.2	140.1	0.0	0.0	0.0
Total	23,816.2	23,816.2	13,763.4	10,052.8	0.0	0.0	0.0
Forest industry							
Corporate	11,322.9	11,322.9	11,322.9	0.0	0.0	0.0	0.0
Individual	661.8	661.8	548.3	113.4	0.0	0.0	0.0
Total	11,984.7	11,984.7	11,871.2	113.4	0.0	0.0	0.0
Nonindustrial private							
Corporate	202,181.7	202,181.7	146,510.0	55,671.7	0.0	0.0	0.0
Conservation/natural resources organization	3,718.5	3,718.5	1,650.8	2,067.6	0.0	0.0	0.0
Unincorporated local partnership/association/club	25,737.3	25,737.3	8,628.3	17,109.0	0.0	0.0	0.0
Native American	1,645.5	1,645.5	1,192.9	452.6	0.0	0.0	0.0
Individual	548,249.9	548,249.9	285,359.3	262,890.5	0.0	0.0	0.0
Total	781,532.8	781,532.8	443,341.3	338,191.5	0.0	0.0	0.0
All classes	897,799.9	885,300.3	531,207.6	354,092.7	12,499.7	10,839.8	1,659.8

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 D.13—Total carbon[a] of live trees on forest land by ownership class and land status, Texas, 2013

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timber-land	Unpro-ductive	Total	Produc-tive	Unpro-ductive
	thousand tons						
U.S. Forest Service							
National forest	27,707.5	26,055.0	26,055.0	0.0	1,652.5	1,652.5	0.0
National grassland	449.9	449.9	174.4	275.5	0.0	0.0	0.0
Total	28,157.4	26,505.0	26,229.5	275.5	1,652.5	1,652.5	0.0
Other Federal							
National Park Service	2,916.5	0.0	0.0	0.0	2,916.5	2,806.1	110.5
Bureau of Land Management	11.6	11.6	0.0	11.6	0.0	0.0	0.0
U.S. Fish and Wildlife Service	1,680.8	0.0	0.0	0.0	1,680.8	961.4	719.5
Dept. of Defense/Dept. of Energy	7,438.4	7,438.4	4,858.0	2,580.4	0.0	0.0	0.0
Other Federal	28.3	28.3	28.3	0.0	0.0	0.0	0.0
Total	12,075.7	7,478.3	4,886.3	2,592.0	4,597.4	3,767.4	829.9
State and local government							
State	6,310.6	6,310.6	4,035.2	2,275.4	0.0	0.0	0.0
Local	5,453.8	5,453.8	2,772.9	2,680.9	0.0	0.0	0.0
Other nonfederal public	143.6	143.6	73.6	70.0	0.0	0.0	0.0
Total	11,908.1	11,908.1	6,881.7	5,026.4	0.0	0.0	0.0
Forest industry							
Corporate	5,661.4	5,661.4	5,661.4	0.0	0.0	0.0	0.0
Individual	330.9	330.9	274.2	56.7	0.0	0.0	0.0
Total	5,992.3	5,992.3	5,935.6	56.7	0.0	0.0	0.0
Nonindustrial private							
Corporate	101,090.8	101,090.8	73,255.0	27,835.9	0.0	0.0	0.0
Conservation/natural resources organization	1,859.2	1,859.2	825.4	1,033.8	0.0	0.0	0.0
Unincorporated local partnership/association/club	12,868.7	12,868.7	4,314.1	8,554.5	0.0	0.0	0.0
Native American	822.8	822.8	596.5	226.3	0.0	0.0	0.0
Individual	274,124.9	274,124.9	142,679.7	131,445.3	0.0	0.0	0.0
Total	390,766.4	390,766.4	221,670.7	169,095.7	0.0	0.0	0.0
All classes	448,900.0	442,650.1	265,603.8	177,046.4	6,249.8	5,419.9	829.9

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] Estimates of carbon calculated by multiplying aboveground dry tree biomass by 0.5. Calculations based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT.

Table D.14—Average annual net growth of live trees by ownership class and land status, east Texas 2013 (2004–2008 to 2009–2013)

Ownership class[a]	Timberland	Forest land
	million cubic feet per year	
U.S. Forest Service		
National forest	10.1	10.8
Total	10.1	10.8
Other Federal		
National Park Service	-0.1	-3.1
U.S. Fish and Wildlife Service	-0.5	-1.0
Dept. of Defense/Dept. of Energy	8.2	4.8
Other Federal	-1.1	-1.1
Total	6.5	-0.3
State and local government		
State	1.9	1.9
Local	6.5	6.5
Other nonfederal public	0.1	0.1
Total	8.4	8.4
Forest industry		
Corporate	27.7	27.7
Individual	0.5	0.5
Total	28.1	28.1
Nonindustrial private		
Corporate	270.5	268.9
Conservation/natural resources organization	1.1	1.1
Unincorporated partnership/ association/club	9.7	9.7
Native American	-0.2	-0.2
Individual	288.7	287.8
Total	569.8	567.3
All classes	623.0	614.4

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

[a] Based on current conditions.

Table D.15—Average annual net growth of live trees on forest land by species group and ownership group, east Texas 2013 (2004–2008 to 2009–2013)

Species group	All ownerships	Ownership group[a]				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet per year					
Softwood						
Longleaf and slash pines	13.4	0.6	0.0	0.0	0.1	12.7
Loblolly and shortleaf pines	533.8	10.4	-0.3	6.8	27.9	489.1
Cypress	2.1	0.0	0.2	0.2	0.0	1.6
Other eastern softwoods	5.3	0.0	0.1	0.1	0.0	5.1
Total softwoods	554.5	11.0	0.0	7.2	28.0	508.4
Hardwood						
Select white oaks	-2.5	-0.6	0.1	-0.1	0.4	-2.3
Select red oaks	0.7	0.3	0.2	0.1	-2.2	2.3
Other white oaks	8.8	0.2	0.6	0.4	-0.2	7.8
Other red oaks	13.8	0.2	-1.2	1.0	0.9	12.8
Hickory	-3.3	-0.1	-0.5	0.1	-0.1	-2.7
Hard maple	0.5	0.0	0.0	0.0	0.0	0.5
Soft maple	0.3	-0.2	0.0	-0.1	0.1	0.5
Beech	-1.8	-0.1	-0.2	0.0	-0.2	-1.3
Sweetgum	20.4	0.2	0.0	0.4	0.6	19.2
Tupelo and blackgum	3.6	0.0	0.1	-0.1	0.2	3.3
Ash	5.4	0.2	0.1	0.4	0.0	4.6
Cottonwood and aspen	-4.1	0.0	0.0	0.0	0.0	-4.2
Basswood	0.0	0.0	0.0	0.0	0.0	0.0
Black walnut	0.3	0.0	0.0	0.0	0.0	0.3
Other eastern soft hardwoods	13.1	-0.2	0.5	-0.7	0.3	13.1
Other eastern hard hardwoods	-0.3	-0.1	0.0	0.0	0.0	-0.2
Eastern noncommercial hardwoods	5.1	0.0	-0.2	-0.1	0.2	5.3
Woodland hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	59.9	-0.1	-0.3	1.3	0.2	58.9
All species	614.4	10.8	-0.3	8.4	28.1	567.3

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] Based on current conditions.

Table D.16—Average annual mortality of live trees on forest land by species group and ownership group, east Texas, 2013 (2004–2008 to 2009–2013)

Species group	All ownerships	Ownership group[a]				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet per year					
Softwood						
Longleaf and slash pines	7.9	0.0	0.0	0.0	0.0	7.8
Loblolly and shortleaf pines	129.6	39.4	5.4	1.5	1.5	81.8
Cypress	0.2	0.0	0.0	0.0	0.0	0.2
Other eastern softwoods	2.5	0.0	0.0	0.1	0.0	2.4
Total softwoods	140.2	39.4	5.4	1.6	1.5	92.2
Hardwood						
Select white oaks	13.4	1.2	0.6	0.1	0.0	11.5
Select red oaks	11.2	0.4	0.2	0.0	3.1	7.6
Other white oaks	10.1	0.4	0.1	0.1	0.5	9.0
Other red oaks	87.5	2.3	3.8	1.1	0.9	79.3
Hickory	9.5	0.3	0.7	0.0	0.1	8.5
Hard maple	0.1	0.0	0.0	0.0	0.0	0.1
Soft maple	3.8	0.6	0.1	0.1	0.2	2.8
Beech	2.5	0.2	0.3	0.0	0.0	2.0
Sweetgum	18.6	1.0	1.1	0.2	0.2	16.2
Tupelo and blackgum	2.6	0.3	0.1	0.0	0.0	2.3
Ash	3.7	0.1	0.2	0.0	0.0	3.4
Cottonwood and aspen	4.9	0.0	0.0	0.0	0.0	4.9
Basswood	0.3	0.0	0.0	0.0	0.0	0.2
Black walnut	0.0	0.0	0.0	0.0	0.0	0.0
Other eastern soft hardwoods	21.6	1.1	0.6	2.1	0.4	17.4
Other eastern hard hardwoods	3.4	0.2	0.0	0.1	0.0	3.0
Eastern noncommercial hardwoods	10.3	0.2	0.9	0.6	0.1	8.5
Woodland hardwoods	0.1	0.0	0.0	0.0	0.0	0.1
Total hardwoods	203.6	8.1	8.6	4.5	5.5	176.9
All species	343.8	47.5	14.0	6.1	7.1	269.1

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] Based on current conditions.

Table D.17—Average annual mortality of live trees by ownership class and land status, east Texas, 2013 (2004–2008 to 2009–2013)

Ownership class[a]	Timberland	Forest land
	million cubic feet per year	
U.S. Forest Service		
National forest	44.6	47.5
Total	44.6	47.5
Other Federal		
National Park Service	0.3	7.1
U.S. Fish and Wildlife Service	0.8	1.9
Dept. of Defense/Dept. of Energy	3.5	3.7
Other Federal	1.3	1.3
Total	5.9	14.0
State and local government		
State	4.4	4.4
Local	1.7	1.7
Total	6.1	6.1
Forest industry		
Corporate	6.8	6.8
Individual	0.3	0.3
Total	7.1	7.1
Nonindustrial private		
Corporate	96.6	96.8
Conservation/natural resources organization	0.2	0.2
Unincorporated partnership/ association/club	5.2	5.2
Native American	0.4	0.4
Individual	166.3	166.6
Total	268.7	269.1
All classes	332.4	343.8

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

[a] Based on current conditions.

Table D.18—Average annual net removals of live trees by ownership class and land status, east Texas 2013 (2004–2008 to 2009–2013)

Ownership class[a]	Timberland	Forest land
	million cubic feet per year	
U.S. Forest Service		
National forest	1.7	1.7
Total	1.7	1.7
Other Federal		
National Park Service	1.6	0.0
U.S. Fish and Wildlife Service	3.0	0.0
Dept. of Defense/Dept. of Energy	1.5	1.5
Total	6.2	1.5
State and local government		
State	3.4	3.4
Local	0.9	0.9
Total	4.3	4.3
Forest industry		
Corporate	30.5	30.5
Total	30.5	30.5
Nonindustrial private		
Corporate	283.4	283.4
Unincorporated partnership/ association/club	8.3	8.3
Individual	242.8	242.2
Total	534.5	533.9
All classes	577.2	571.9

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] Based on current conditions.

Table D.19—Average annual removals of live trees on forest land by species group and ownership group, east Texas, 2013 (2004–2008 to 2009–2013)

Species group	All ownerships	Ownership group[a]				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet per year					
Softwood						
Longleaf and slash pines	19.8	0.0	0.0	0.0	0.0	19.8
Loblolly and shortleaf pines	403.4	1.6	0.9	2.4	25.6	373.0
Cypress	0.0	0.0	0.0	0.0	0.0	0.0
Other eastern softwoods	1.3	0.0	0.0	0.0	0.0	1.3
Total softwoods	424.6	1.6	0.9	2.4	25.6	394.1
Hardwood						
Select white oaks	5.5	0.0	0.0	0.0	0.1	5.4
Select red oaks	7.7	0.0	0.1	0.0	0.0	7.6
Other white oaks	19.7	0.0	0.5	0.0	0.4	18.8
Other red oaks	48.6	0.0	0.0	1.7	1.6	45.3
Hickory	3.2	0.0	0.0	0.0	0.2	3.0
Hard maple	0.5	0.0	0.0	0.0	0.0	0.5
Soft maple	2.0	0.0	0.0	0.0	0.4	1.6
Beech	0.0	0.0	0.0	0.0	0.0	0.0
Sweetgum	29.9	0.0	0.0	0.0	0.9	29.1
Tupelo and blackgum	2.5	0.0	0.0	0.0	0.3	2.2
Ash	5.5	0.0	0.0	0.0	0.1	5.3
Cottonwood and aspen	0.5	0.0	0.0	0.0	0.0	0.5
Basswood	0.0	0.0	0.0	0.0	0.0	0.0
Black walnut	0.2	0.0	0.0	0.0	0.0	0.2
Other eastern soft hardwoods	16.1	0.0	0.0	0.2	1.0	14.9
Other eastern hard hardwoods	1.0	0.0	0.0	0.0	0.0	1.0
Eastern noncommercial hardwoods	4.4	0.0	0.0	0.1	0.1	4.2
Woodland hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	147.4	0.1	0.6	1.9	4.9	139.8
All species	571.9	1.7	1.5	4.3	30.5	533.9

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] Based on current conditions.

Dooley, Kerry; McCollum, Joe. 2019. Texas' forests, 2013. Resour. Bull. SRS–225. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 72 p.

The principal findings of the first forest inventory for the full State of Texas and the ninth inventory for east Texas are presented. Trends between the 2008 and 2013 surveys for east Texas are examined, along with current data for the entire State. Topics described include forest area, volume, biomass, number of trees, growth, mortality, removals, forest health, silvicultural treatments, invasive species, ownership, and crown characteristics.

Keywords: FIA, forest health, forest inventory, forest ownership, forest survey, trend analysis, Texas, woodlands, down woody material, species dominance, invasive species.

December 2019

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