Forest Resources of the Lower Mississippi Alluvial Valley

Sonja N. Oswalt

United States Department of Agriculture

Forest Service

Southern Research Station

GTR-SRS-177

The Author:

Sonja N. Oswalt is a Forest Resource Analyst with the U.S. Department of Agriculture Forest Service, Southern Research Station, Forest Inventory and Analysis Research Work Unit, Knoxville, TN 37919.

Errata: An error occurred during the production of this General Technical Report. To correct the error, Figure 7(A) on page 9 was replaced September 24, 2013.

Cover Photographs:

From top left: Flooded bottomland hardwood forest in Arkansas (photographer unknown, U.S. Fish and Wildlife Service public domain image (http://digitalmedia.fws.gov/cdm/singleitem/collection/natdiglib/id/12933/rec/4), Diamondback water snake on Kisatchie National Forest (photo by Steve Shively, U.S. Forest Service). Nuttall oak (*Quercus nuttallii*, also known as *Quercus texana*) acorn and branch in Mississippi (photo by Dean S. Elsen, U.S. Forest Service Find-a-Photo). On back cover: Man with Nuttall oak (*Quercus nuttallii*, also known as *Quercus texana*) acorns in Mississippi (photo by Dean S. Elsen, U.S. Forest Service Find-a-Photo).

June 2013

Southern Research Station
200 W.T. Weaver Blvd.
Asheville, NC 28804

www.srs.fs.usda.gov

Forest Resources of the Lower Mississippi Alluvial Valley

Sonja N. Oswalt

ABSTRACT

At one time, the Lower Mississippi Alluvial Valley was covered by almost 25 million acres of forest. By the mid-1980s, all that remained of the valley's forested land was roughly 6.6 million acres. This report addresses a gap in data about this land by providing, for the first time since 1986, comprehensive new estimates of forest area, volume, carbon, and tree species stocking change.

Keywords: Bottomland hardwoods, Forest Inventory and Analysis, Lower Mississippi Alluvial Valley, stocking.

INTRODUCTION

The greater Mississippi Alluvial Valley (MAV) extends from Cairo, IL, to the confluence of the Mississippi River with the Gulf of Mexico in Louisiana. Prior to European settlement, forests occupied about 24.7 million acres of the MAV landscape (King and others 2006). The historic landscape was frequently altered by Native Americans who used fire and other techniques to manipulate the forest and flush out wildlife (Gardiner and Oliver 2005). The arrival of presettlement Europeans introduced diseases that took a dramatic toll on Native American populations. With far less Native American influence on the forested landscape, the MAV forests began to change, and by the time the MAV was settled by Europeans in the late 1700s and early 1800s, much of the landscape consisted of closed-canopy forest (Fredrickson 2005). Settlers began to assert more influence over the MAV in the mid- to late-1800s as more people migrated from the East to the Great Plains and the west coast. These settlers soon recognized the quality of the rich soils created through periodic inundation by Mississippi floodwaters, particularly in the Lower Mississippi Alluvial Valley (LMAV) and the Mississippi Delta. Additionally, the value of the Mississippi River and its tributaries for transporting lumber was undeniable. Thus, widespread clearing for both agricultural production and timber harvest coupled to reduce forest land area further (Fredrickson 2005, King and others 2005).

Agricultural production and plantation settlement throughout the Delta spurred the need for protection from devastating floods. Engineers were trying to tame the mighty Mississippi and had already altered hundreds of miles of tributaries through levees and channelization efforts when the Great Flood of 1927 occurred. Following the devastating flood and the passage of the 1928 Flood Control Act, unprecedented efforts were made to levee and channelize the Mississippi River and nearly all of its tributaries (Interagency Floodplain Management Review Committee 1994). Those efforts were largely successful in decreasing flooding and stabilizing the channel of the river—but with incalculable impacts to the floodplain environment. The lack of periodic flooding meant that nutrients were no longer introduced into the soil bed. In some cases, floodwaters that escaped the levees became trapped and stagnated, causing soils to become hypoxic and hindering tree regeneration. In short, the river and its floodplain were disconnected, and as a result, ecological functions were disrupted.

Simultaneously, soybean prices began to rise. World War II was devastating for China's soybean production. The United States stepped in to fill the gap, and the U.S. soybean crop grew from 9 million bushels in 1920 to 78 million bushels in 1940 (U.S. Soybean Export Council 2006). The fertile soils of the LMAV Delta were ideal for cultivating the bean, and farmers were quick to convert forest land to lucrative soybean fields. By the 1950s, farmers had realized the potential for soy as a cheap protein source in livestock feed (U.S. Soybean Export Council 2006). Soybean production grew even more, and corn, wheat, and soybean crop prices reached all-time highs in the 1960s and 1970s, as U.S. soybean industries grew and Japanese soy processing industries expanded with imports from the United States (U.S. Soybean Export Council 2006). By the time Rudis and Birdsey completed their initial study of forest resources in the LMAV in the 1980s (using data from the Forest Inventory and Analysis (FIA) Program of the U.S. Forest Service, U.S. Department of Agriculture), forest area had declined from 11.8 million acres to an estimated 6.6 million acres (Rudis and Birdsey 1986).

While the 1960s and 1970s were a time of economic growth for farms of the LMAV, the 1980s were quite the opposite. Rising interest rates resulted in widespread declines in land value, and farmers were forced into foreclosure. Since the Great Depression, the U.S. government has provided farm subsidies to cushion against erratic shifts in supply and demand; in the 1980s, new government programs offered additional support through conservation incentives to farmers willing to convert or revert agricultural land into forest or wetland. The Food Security Act of 1985 (Public Law 99–198, also called the 1985 Farm Bill) created the Swampbuster and Conservation Reserve Programs (CRP). The Swampbuster program denied subsidies to farmers who knowingly converted wetlands to farmland, while the CRP offered rental payments and cost-share assistance to farmers who voluntarily established “resource conserving cover” on eligible land. In many cases, the practice of resource conserving cover included allowing fallow fields to revert to forest, or establishing forest land on previously farmed fields. Similarly, the Wetland Reserve Program (WRP), established as part of the 1990 Farm Bill (Public Law 101–624), offered incentives for farmers who restore, enhance, and protect wetlands, including bottomland hardwood (BLH) forests, on their marginal cropland.

Along with shifts in governmental programs, there emerged in the 1970s and 1980s a renewed concern for the environment. Land managers began to see how decades of manipulation and exploitation had hurt LMAV land resources, including how the loss of forest and wetland affected migratory songbird and waterfowl populations, and such endangered species as the Louisiana black bear (Lower Mississippi Valley Joint Venture Office Forest Resource Conservation Working Group 2007). The North American Waterfowl Management Plan, developed in 1986, called for the establishment of cooperatives to address concerns over dwindling wildlife habitat and species. To address the habitat needs of at-risk species, Federal agencies and nonprofit organizations formed several joint venture partnerships, including the Migratory Bird and the Lower Mississippi Valley Joint Ventures, both organized in 1987. Such partnerships established priority wildlife species and habitat objectives, and provided guidance for the management of BLH forests and other habitats, with the goal of meeting the specified objectives over time.

Unquestionably, the WRP, CRP, and joint venture programs have helped land management agencies, nonprofit organizations, and landowners work together in addressing LMAV land management priorities. Between 1992 and 2011, the WRP enrolled 646,672 acres, represented by 1,857 agreements, in Arkansas, Louisiana, and Mississippi (U.S. Department of Agriculture Natural Resources Conservation Service 2012).

Researchers have noted gains in ecosystem services from WRP lands (valued at as much as $300 million annually) and in afforestation of BLH forests (Jenkins and others 2010, King and others 2005, Schoenholtz and others 2001) and much site- and subject-specific research has been conducted in the LMAV. However, resource data at a regional level has not been updated in a comprehensive, consistently collected manner since Rudis and Birdsey (1986), which used FIA data collected from 1932 to 1984. Our report updates and expands on the work of Rudis and Birdsey (1986) and provides current comprehensive resource information to professionals, landowners, and laypeople with interests in the LMAV.

Figure 1—Map of the Lower Mississippi Alluvial Valley as defined by Rudis and Birdsey (1986) and used for analysis in this publication.

METHODS

Study Area

In our report, the LMAV was defined in the same manner as in Rudis and Birdsey (1986), and includes counties in Arkansas, Louisiana, and Mississippi (fig. 1). Some parishes along Louisiana’s gulf coast were either combined or not sampled in previous surveys because of the relatively small forested acreage within their boundaries; these parishes (Plaquemines, St. Bernard, and Jefferson) are not included in analyses that compare current estimates to previous estimates. The 2010 sample included 1,353 forested or partially forested plots. All plots with forest are included in the resources estimates in our report, with the exception of basal area calculations, which included only plots where forested conditions occupied >10 percent of the plot (otherwise, over-inflation of values occurs, resulting in extreme outliers). Thus, basal area was calculated for 1,344 plots.

Forest Inventory and Analysis Program in the Lower Mississippi Alluvial Valley

The Forest Service has conducted resource inventories since the early 1930s, first under the program name of Forest Survey, then later (and currently) under the program name of Forest Inventory and Analysis. The FIA program has evolved over the past 80 years, from a periodic sampling regime of surveying forests in each State at about 10-year

Table 1—Reference period and corresponding FIA survey date from which data was compiled for each State in the analysis

	FIA survey date		
Reference period	Arkansas	Louisiana	Mississippi
1930	1935	1935	1932
1950	1950	1954	1957
1960	1969	1964	1967
1970	1978	1974	1977
1980	1988	1984	1987
1990	1995	1991	1994
2010	2010	2010	2010

intervals to annual inventories, with numbers compiled to produce a "moving average" of estimates from year to year. Until about 15 years ago, FIA data were collected only on sites considered "productive timberland," forest land capable of producing more than 20 cubic feet of wood per acre in a year. This definition of timberland excluded reserved land, i.e., any land excluded from timber harvest by statute or administrative designation. Plot designs were regionally developed and implemented, and varied across the country. In the 1980s and 1990s, questions about the timeliness, quality, and relevance of the information collected in the periodic system led to a series of pilot studies that culminated in the inclusion of FIA in the 1998 Farm Bill (Public Law 105–185). The Farm Bill called for the development of a national FIA program with a nationally consistent design and a complete, systematic annual sample in each State (Bechtold and Patterson 2005). The information in this report includes data collected by the older (pre-1998) periodic method of collection as well as data collected by the current, annual method of collection. Appendix B provides details on survey procedures.

Analysis Years

Statistics for early inventories (1930s through 1960s) were obtained from Rudis and Birdsey (1986), Rosson (2001, 2002), and Rosson and others (1988). Statistics for 1970, 1980, 1990, and 2010 were calculated from data in the FIA database (FIADB) (accessed between June 4, 2012 and July 24, 2012). Data are publicly available from Miles (2012). Table 1 shows the State reporting years that were combined to produce decadal estimates; these estimates were necessary because historical data were not collected in each State in the same year.

Relative Stocking Procedures

The most numerous 20 species for each of two reference periods, 1980s and 2010, were selected for relative stocking calculations. Lists were combined and duplicates were eliminated. Species collected in only one of the two time periods were eliminated, as were combined species groups. The resulting list consisted of 21 species. Plaquemines, St. Bernard, and Jefferson parishes in Louisiana were eliminated from the analysis because they were either combined or not surveyed in at least one of the two time periods. Stocking values were calculated using the tree stocking variable produced in the FIADB, which uses species-specific equations developed from normal yield tables and stocking charts. The stocking values produced are a function of diameter. Relative stocking was calculated for each species at the plot level, using equations found in Oswalt and others (2008). Mean species-specific average annual change was calculated for each county and for the entire LMAV, following procedures outlined in Oswalt and others (2008).

RESULTS

Forest Area

The LMAV, as defined in our report, encompasses about 26.7 million acres of total land area. Forests cover about 7.6 million acres of the land area, and all but 36,000 acres are considered available for timber production. Hereafter, the word "forest" is used to refer to the timberland portion, and the 36,000 acres of reserved land is excluded because of the lack of historical data. Therefore, forest area, as described in this report, covers 7.6 million acres and accounts for 28 percent of land area in the LMAV. County-level forest cover ranges from < 3 percent to 70 percent, with the least forested counties primarily in the northern LMAV adjacent the Mississippi River and the coastal parishes of Louisiana (fig. 2).

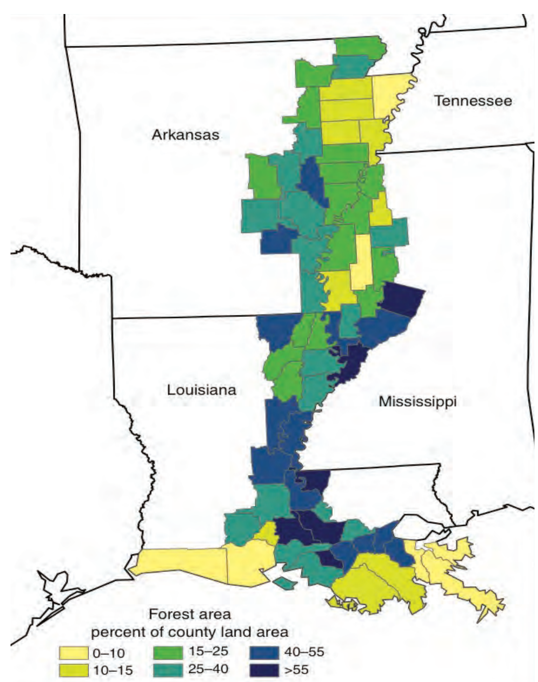


Figure 2—Percent of land area classified as forest by county in the Lower Mississippi Alluvial Valley, 2010.

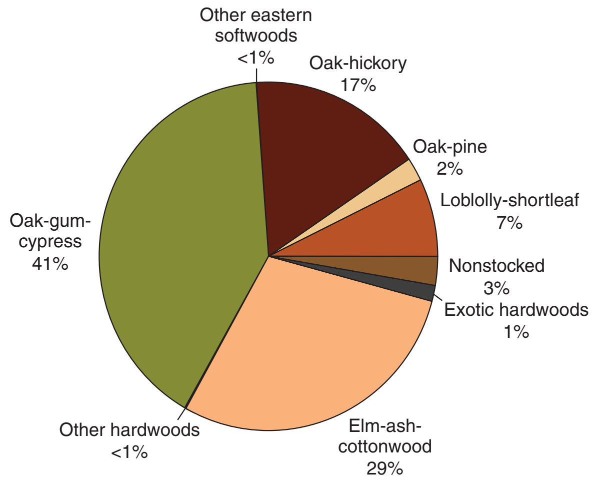


Figure 3—Proportion of forest area by forest-type group, Lower Mississippi Alluvial Valley. Bottomland hardwood area as defined in this publication consists of the oak-gum-cypress and elm-ash-cottonwood forest-type groups, combined.

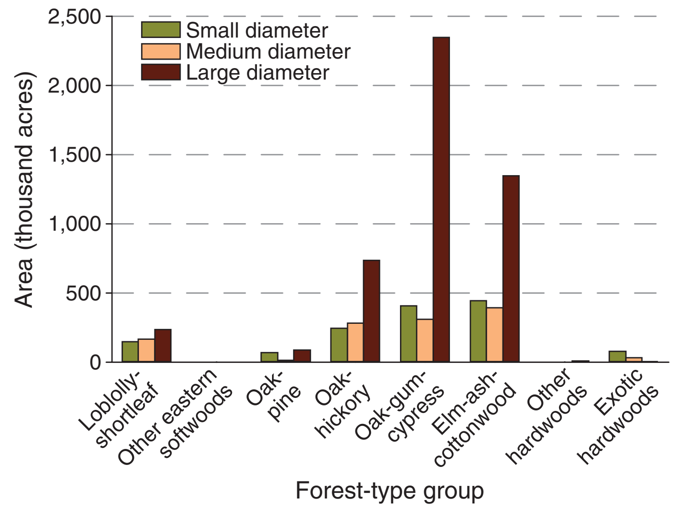


Figure 4—Forest area by forest-type group and stand-size class, Lower Mississippi Alluvial Valley, 2010.

BLH forests (elm-ash-cottonwood and oak-gum-cypress forest-type groups) make up 70 percent (5.2 million acres; table 2) of LMAV forest area (fig. 3). The sugarberry-hackberry-elm-green ash and sweetgum-Nuttall oak-willow oak forest types within those forest-type groups account for close to one-half of LMAV bottomland forest acreage, while baldcypress-tupelo forests occupy 16 percent. Other forest-type groups found in the LMAV include oak-hickory (17 percent of forest area), loblolly-shortleaf (7 percent of forest area), and various mixed forest-type groups (fig. 3).

Eighty-two percent of LMAV forest area is privately owned. Of the remaining 1.3 million acres, 52 percent is owned by State and local governments, 31 percent by the U.S. Fish and Wildlife Service, and the remainder by other Federal agencies.

Naturally regenerated stands constitute 6.7 million acres (89 percent) of forest area. Planted acreage makes up almost one-half of all loblolly-shortleaf pine forest area, and loblolly-shortleaf pine constitutes 43 percent of all LMAV planted forest area, with 353,069 ± 82,971 acres. BLH forests also account for 43 percent of planted forest, or 355,475 ± 121,210 acres. Most planted forest (88 percent) is privately owned.

Sixty-three percent (4.8 million acres) of all LMAV forest area consists of large diameter stands (stands predominately stocked with softwoods ≥ 9.0 inches diameter at breast height (d.b.h.) or hardwoods ≥ 11.0 d.b.h. (fig. 4). An even larger proportion (70 percent) of BLH forest area consists of large diameter stands, with just 16 percent of area in the small diameter size class (stands predominately stocked with trees < 5.0 inches d.b.h.).

Trends in Forest Area 1930–2010

During the 1930 reference period, forest area was estimated at 11.8 million acres, 89 percent of which was BLH. From the 1930s to 2010, forest area declined by a net 37 percent. Most deforestation occurred between 1930 and 1980, when forest area declined by 45 percent. The last three decades (from 1990 to 2010) have shown gradual increases in overall forest cover, including bottomland hardwood forests, though the proportion of forest area considered BLH has continued to decrease (fig. 5). In other words, while BLH forest area is increasing, it is not increasing at a rate proportional with the remainder of forest land (fig. 6), and most of the lag appears to be in the oak-gum-cypress forest-type group. In contrast, the proportion of forest area classified as loblolly-shortleaf has increased by a little over 4 percent since the 1970s, and the proportion of forest classed as oak-hickory has increased by about 2 percent between the 1970 and 1980 surveys.

County-level gains and losses are more complex. County-level estimates were available only from 1950 through the present, and some coastal parishes were not measured or were combined in early surveys because of the relatively small area of forest they contained. From 1950 to 1980, the largest measured loss of forest area (92 percent) occurred in the West Carroll Parish of Louisiana, converting that parish's land cover from 45-percent forested in 1950 to 8-percent forested in 1980; currently, the parish is 18-percent forested. Conversely, St. Mary Parish in Louisiana experienced an increase from 27-percent forested in 1950 to 34-percent forested in 1980, finally measuring at 39-percent forested in 2010. Table 3 contains detailed county area estimates from 1950 through 2010, while figure 7 (A, B, and C) shows gains and losses from 1950 to 1980 and from 1980 to 2010, as well as overall change from 1950 to 2010.

Table 2—Forest area by forest-type group and forest type, 2010

Forest-type group	Forest-type	Forest area
		acres
Loblolly/shortleaf pine	Loblolly pine	532,800
Loblolly/shortleaf pine	Shortleaf pine	12,200
Loblolly/shortleaf pine Total		545,000
Other eastern softwoods	Eastern redcedar	4,100
Oak/pine	Eastern redcedar/hardwood	18,900
Oak/pine	Shortleaf pine/oak	19,300
Oak/pine	Loblolly pine/hardwood	126,800
Oak/pine Total		165,000
Oak/hickory	Post oak/blackjack oak	106,900
Oak/hickory	White oak/red oak/hickory	406,500
Oak/hickory	White oak	32,500
Oak/hickory	Yellow-poplar/white oak/northern red oak	18,700
Oak/hickory	Sassafras/persimmon	65,200
Oak/hickory	Sweetgum/yellow-poplar	214,700
Oak/hickory	Yellow-poplar	2,300
Oak/hickory	Black locust	3,700
Oak/hickory	Chestnut oak/black oak/scarlet oak	2,800
Oak/hickory	Cherry/white ash/yellow-poplar	20,500
Oak/hickory	Elm/ash/black locust	91,800
Oak/hickory	Red maple/oak	9,700
Oak/hickory	Mixed upland hardwoods	284,200
Oak/hickory Total		1,259,500
Oak/gum/cypress	Swamp chestnut oak/cherrybark oak	181,300
Oak/gum/cypress	Sweetgum/Nuttall oak/willow oak	1,267,400
Oak/gum/cypress	Overcup oak/water hickory	571,400
Oak/gum/cypress	Baldcypress/water tupelo	863,500
Oak/gum/cypress	Sweetbay/swamp tupelo/red maple	179,000
Oak/gum/cypress	Baldcypress/pondcypress	200
Oak/gum/cypress Total		3,062,800
Elm/ash/cottonwood	River birch/sycamore	102,900
Elm/ash/cottonwood	Cottonwood	55,500
Elm/ash/cottonwood	Willow	226,600
Elm/ash/cottonwood	Sycamore/pecan/American elm	415,500
Elm/ash/cottonwood	Sugarberry/hackberry/elm/green ash	1,286,800
Elm/ash/cottonwood	Red maple/lowland	43,400
Elm/ash/cottonwood	Cottonwood/willow	50,700
Elm/ash/cottonwood Total		2,181,400
Other hardwoods	Other hardwoods	10,400
Exotic hardwoods	Other exotic hardwoods	111,800
Nonstocked	Nonstocked	202,400
Total		7,542,500

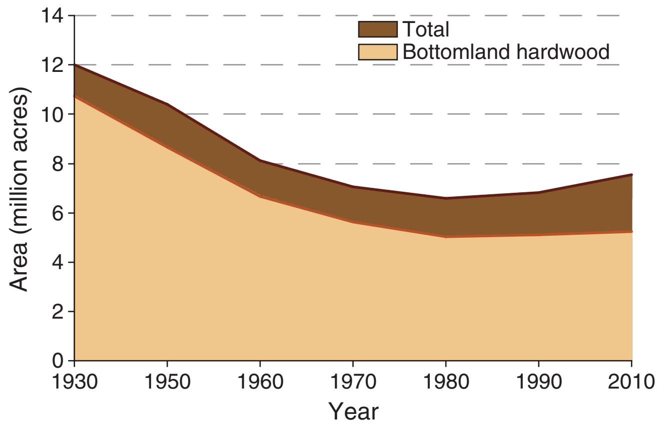


Figure 5—Forest area (total and bottomland hardwoods) by year, Lower Mississippi Alluvial Valley.

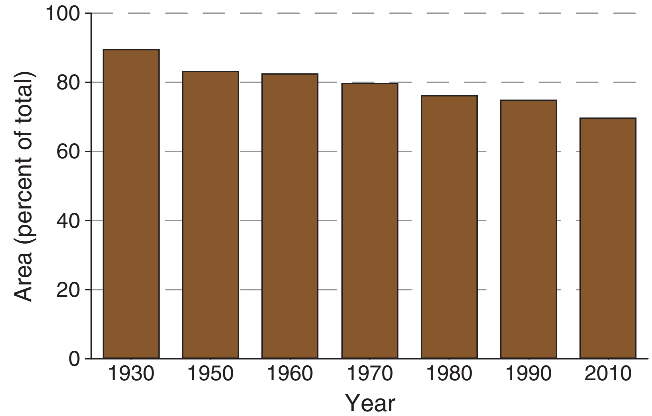


Figure 6—Proportion of bottomland hardwoods relative to total forest area by year, Lower Mississippi Alluvial Valley.

Since 1980, there has been a slight increase in the proportion of small-diameter stands, and subsequent slight decrease in the proportion of large-diameter stands, with the area of forest considered small diameter increasing from 12 percent to 18 percent, and the area considered large diameter decreasing from 69 to 63 percent (fig. 8). This finding is consistent with an increase in planted acreage, particularly loblolly pine and some BLH.

Change matrices are used to examine remeasured plots in the FIA inventory. The matrices are useful in tracking reversions of agricultural land to forest land as well as diversions of forest land to agricultural land, and thus in understanding how changes in land can affect forest area. The sample used to develop a change matrix only includes plots measured at time one and time two. In the LMAV, for the indicated 2000 and 2010 reference periods, 89 percent of current forest area was previously forested, while nearly 9 percent of current forest area was previously in an agricultural land use. Other land uses (development, water, and wetland) individually contributed < 1 percent to current forest area estimates. In contrast, about 1.3 percent of land area previously forested was diverted to agricultural uses, 98 percent of area previously forested remained forested, and about 1 percent of area previously forested was diverted to other land uses (development, water, and wetland). In other words, reverted agricultural land is contributing to forest area growth in the LMAV, but diversions to agriculture are the largest detractions from that overall gain.

Forest Composition

Red maple (*Acer rubrum*) was the most abundant LMAV species in 2010, with an estimated 339 (± 62) million trees (111 ± 20 trees/ha), although sweetgum (*Liquidambar styraciflua*) occurred on more plots. Fewer sweetgum seedlings relative to red maple seedlings persist in the LMAV, a finding that explains the discrepancy between distribution across plots and abundance estimates of red maple and sweetgum. Red maple accounts for 10 percent of the entire estimated tree population in the LMAV. By comparison, it constituted 13 percent of the estimated tree population in the 1980s, with an average of 127 trees/ha. Listed in order of frequency, sweetgum, sugarberry (*Celtis laevigata*), green ash (*Fraxinus pennsylvanica*), and winged elm (*Ulmus alata*) were also among the most commonly detected species in the 2010 reference period (fig. 9). Sugarberry, sweetgum, green ash, and water tupelo (*Nyssa aquatica*) were among the most abundant species in the 1980 survey, following red maple (fig. 10). Although water tupelo was among the top five most abundant species in 1980, by 2010 it was no longer listed among the top 10 most abundant species, overshadowed by loblolly pine (*Pinus taeda*), water oak (*Quercus nigra*), American elm (*U. americana*), Chinese tallowtree (*Triadica sebifera*), boxelder (*A. negundo*), and eastern hophornbeam (*Ostrya virginiana*) (fig. 11).

Species composition in BLH forests in 2010 mirrored the composition across the entire LMAV. Red maple was most abundant, followed by sugarberry, green ash, sweetgum, and winged elm. Water tupelo and baldcypress (*Taxodium distichum*) were the eighth and ninth most abundant species in BLH forests. In contrast, they were fourth and fifth most abundant in BLH forests in 1980.

Loblolly pine was the most abundant species on planted forests, with an estimated 123.2 ± 39.4 million trees. Sixty-five percent of the estimated loblolly pine population occurred on sites with evidence of artificial regeneration. Sweetgum, winged elm, green ash, and water oak were the next most abundant, but the number of loblolly pine trees on planted forests is almost four times that of sweetgum. Coupled with the area estimates of planted forests by forest-type group (table 4), these numbers suggest that planted BLH forests are being populated with a diversity of species, while upland plantations consist primarily of loblolly pine.

Table 3—Total land and forest area estimates in the Lower Mississippi Alluvial Valley by county and reference period

State	County	Total land area	Forest area 1950	1970	1980	1990	2010
			thousand acres				
Arkansas	Arkansas	596.0	270.7	206.5	190.7	228.5	191.5
Arkansas	Chicot	423.7	193.8	67.8	83.7	71.3	122.6
Arkansas	Clay	411.8	201.9	68.4	78.5	79.3	70.8
Arkansas	Craighead	458.3	113.8	48.2	49.0	66.0	57.9
Arkansas	Crittenden	373.8	81.7	35.7	21.0	44.4	38.6
Arkansas	Cross	353.0	157.9	41.3	48.1	45.1	50.0
Arkansas	Desha	455.3	244.5	153.0	150.8	152.8	151.4
Arkansas	Greene	364.7	119.0	50.4	55.7	71.4	102.7
Arkansas	Jackson	451.5	146.0	53.3	63.3	68.8	71.9
Arkansas	Jefferson	603.8	244.0	213.2	218.8	218.4	198.0
Arkansas	Lawrence	404.4	136.0	83.7	84.6	93.4	84.9
Arkansas	Lee	384.3	157.0	87.9	98.4	87.3	91.3
Arkansas	Lincoln	334.6	165.0	135.3	153.2	150.8	142.7
Arkansas	Lonoke	506.7	180.0	78.5	75.8	122.4	116.4
Arkansas	Mississippi	562.0	73.0	20.9	26.3	33.1	28.9
Arkansas	Monroe	394.1	214.0	145.8	140.4	138.4	174.8
Arkansas	Phillips	459.5	168.0	88.1	94.4	105.8	94.6
Arkansas	Poinsett	494.0	172.0	42.9	54.9	56.5	67.8
Arkansas	Prairie	407.6	183.0	76.3	77.6	109.9	105.8
Arkansas	St. Francis	388.6	119.0	62.9	67.1	80.3	79.8
Arkansas	Woodruff	381.8	156.0	68.6	63.9	87.0	114.6
Louisiana	Acadia	438.0	81.5	66.6	82.1	75.9	120.9
Louisiana	Ascension	197.0	94.6	97.2	84.9	90.4	78.8
Louisiana	Assumption	202.1	133.0	139.1	144.0	128.5	107.2
Louisiana	Avoyelles	581.0	321.0	240.4	166.2	147.3	268.4
Louisiana	Catahoula	420.1	364.0	202.6	177.0	157.9	183.9
Louisiana	Concordia	436.1	353.0	218.4	151.0	151.1	195.9
Louisiana	East Carroll	296.0	147.0	52.2	64.8	43.4	58.3
Louisiana	Franklin	412.4	166.0	67.2	72.9	89.3	88.5
Louisiana	Iberia	324.4	118.0	122.5	149.1	115.4	89.6
Louisiana	Iberville	422.1	274.0	279.8	280.2	277.4	293.3
Louisiana	Lafayette	180.2	13.0	7.8	5.1	12.7	21.5
Louisiana	Lafourche	624.6	151.0	177.2	143.7	114.1	83.7
Louisiana	Madison	384.2	296.0	167.8	104.6	118.8	140.7
Louisiana	Morehouse	532.2	343.0	200.7	188.7	181.6	216.8
Louisiana	Pointe Coupee	360.6	204.0	153.2	142.1	134.6	178.2
Louisiana	Richland	348.5	154.0	86.4	32.4	74.5	67.8
Louisiana	St. Charles	172.6	64.0	76.9	58.8	53.5	82.0
Louisiana	St. James	152.0	85.0	86.2	79.3	79.1	80.2
Louisiana	St. John the Baptist	135.7	85.0	99.2	96.0	76.9	59.8
Louisiana	St. Landry	639.9	266.0	220.8	188.8	164.7	225.7
Louisiana	St. Martin	402.7	312.0	304.2	305.4	315.5	253.5
Louisiana	St. Mary	414.2	112.0	148.7	139.4	124.4	162.4
Louisiana	Tensas	389.1	246.0	162.5	114.0	116.4	134.0
Louisiana	Terrebonne	598.7	111.0	112.8	104.8	71.3	80.1

continued

Table 3—(continued) Total land and forest area estimates in the Lower Mississippi Alluvial Valley by county and reference period

State	County	Total land area	Forest area 1950	1970	1980	1990	2010
			thousand acres				
Louisiana	Vermilion	772.4	–	15.5	10.3	25.3	26.1
Louisiana	West Baton Rouge	130.2	71.4	62.0	52.5	49.2	50.5
Louisiana	West Carroll	227.2	101.6	19.8	8.1	12.4	40.4
Louisiana	West Feliciana	286.7	182.8	163.3	158.6	168.5	183.1
Mississippi	Bolivar	591.3	108.0	96.3	66.3	84.8	128.6
Mississippi	Coahoma	362.2	94.0	69.8	56.6	67.9	70.4
Mississippi	Holmes	491.2	223.0	220.1	255.9	269.7	342.2
Mississippi	Humphreys	279.8	101.0	38.4	41.8	36.3	53.1
Mississippi	Issaquena	269.9	161.0	120.5	98.4	116.5	117.2
Mississippi	Leflore	362.2	94.0	69.2	57.9	63.5	75.7
Mississippi	Quitman	262.0	64.0	35.3	32.5	26.5	38.0
Mississippi	Sharkey	290.5	132.0	82.6	72.7	92.8	115.9
Mississippi	Sunflower	436.3	49.0	30.2	32.3	38.1	13.9
Mississippi	Tallahatchie	406.8	151.0	127.6	97.2	114.0	136.5
Mississippi	Tunica	279.6	91.0	52.4	57.8	44.6	68.8
Mississippi	Warren	360.0	233.2	235.8	215.5	253.6	253.7

— = no sample.

Just because a species occurs in an area with clear evidence of artificial regeneration according to FIA data, that species was not necessarily planted but instead may have been recruited into the ecological community prior to or following artificial regeneration.

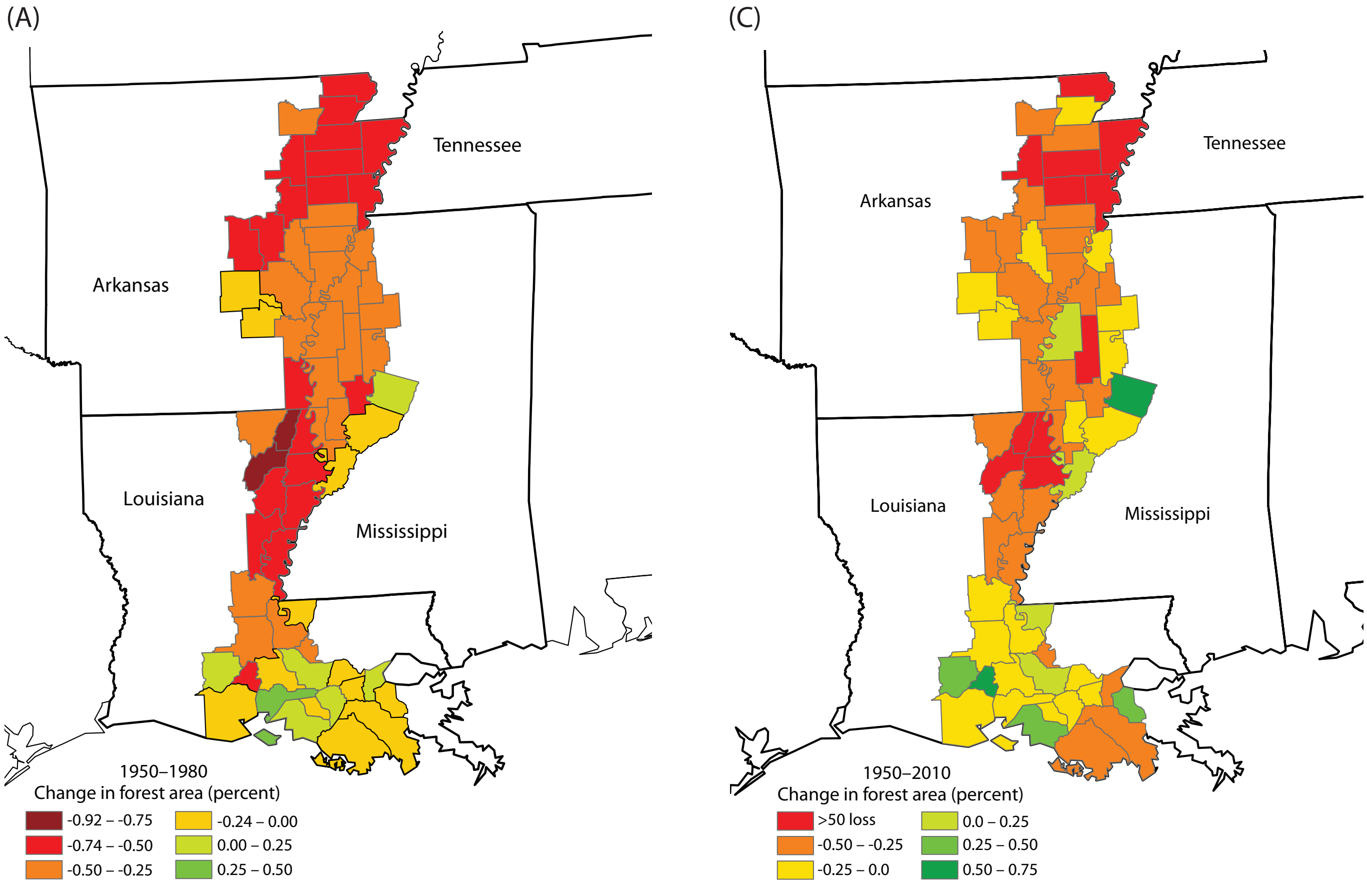
Diameter distributions of baldcypress and water tupelo are of interest because of concerns about the impacts of altered hydrologic regimes on regeneration. The diameter distributions of both of these species in the 2010 survey show that there has been a recent “flush” of saplings in the 1- to 3-inch diameter class (figs. 12 and 13). This suggests that a discrete event or a series of events may have resulted in disturbances that initiated new growth. Given that the data used for this analysis were collected from 2005 through 2010, Hurricanes Katrina and Rita might be influences in the flush of new growth. Diameter distributions in the 1980s do not show the same type of distribution pattern, but rather reflect a reverse “J” curve typical of large-scale inventory diameter distributions. This increase in the number of seedlings in the small diameter classes is of interest given current research regarding declining LMAV cypress regeneration, specifically the Atchafalaya Basin (Faulkner and others 2009). Other species that show this bimodal distribution include loblolly pine, extensively planted in recent years; river birch (*Betula nigra*), a frequent colonizer of disturbed sites; pignut hickory (*Carya glabra*); waterlocust (*Gleditsia aquatica*); American sycamore, (*Platanus occidentalis*) to a small degree; swamp chestnut oak (*Q. michauxii*); and black locust (*Robinia pseudoacacia*). With some of these species, sample size may drive the diameter distribution pattern, i.e., the sample for a species is too small to accurately capture the distribution of the population (e.g., pignut hickory, rare in the LMAV).

Tree size is an important consideration in the management of wildlife habitat, timber species, aesthetics, and water quality issues on LMAV forest land. There are an estimated 14.7 million trees ≥ 25 inches d.b.h. on forests in the LMAV, or < 1 percent of the total estimated population of 3.4 billion live trees.

Species Volume

Baldcypress contributes the largest volume/ha of all species at 16 ± 3 m^3/ha (233.2 ± 40 cubic feet per acre). Sweetgum, water tupelo, green ash, and sugarberry contribute the next largest volumes with 12 ± 2, 10 ± 3, 8 ± 1, and 8 ± 1 m^3/ha (176.8 ± 26.3, 136.8 ± 35.4, 121.0 ± 17.8, and 113.1 ± 15.5 cubic feet per acre), respectively (table 5). Red maple, while the most abundant species, contributes about 3 ± 0.6 m^3/ha (45.5 ± 9 cubic feet per acre) of volume.

Errata: An error occurred during the production of this General Technical Report. To correct the error Figure 7(A) was replaced on September 24, 2013.



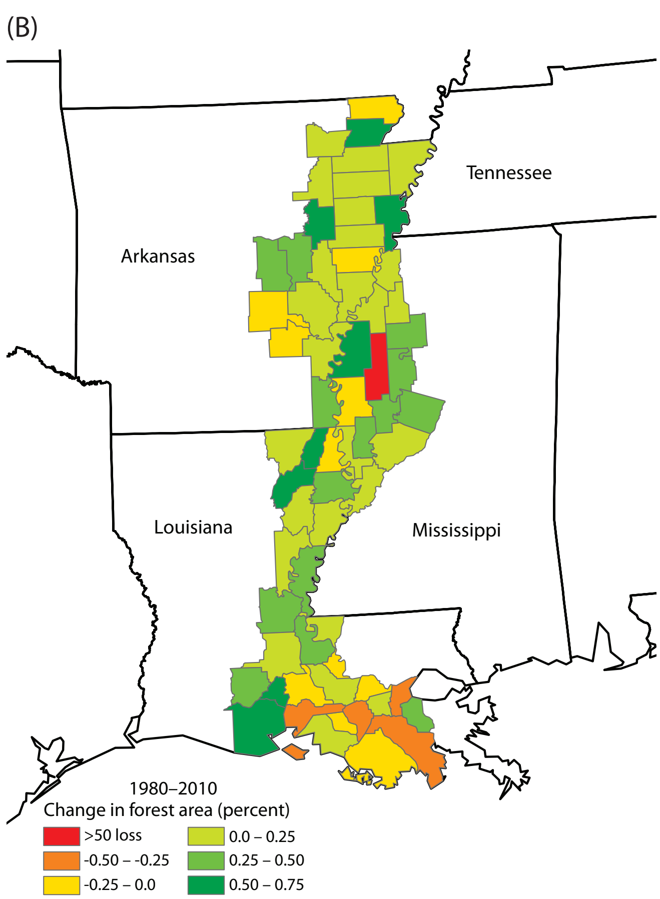


Figure 7—(A) Gains and losses in Lower Mississippi Alluvial Valley forest land from 1950 to 1980 by county, (B) Gains and losses in Lower Mississippi Alluvial Valley forest land from 1980 to 2010 by county, (C) Gains and losses in Lower Mississippi Alluvial Valley forest land from 1950 to 2010 by county.

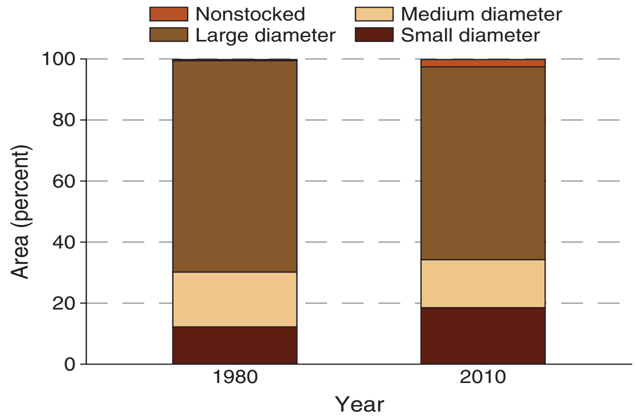


Figure 8—Proportion of forest area by stand-size class and year, Lower Mississippi Alluvial Valley.

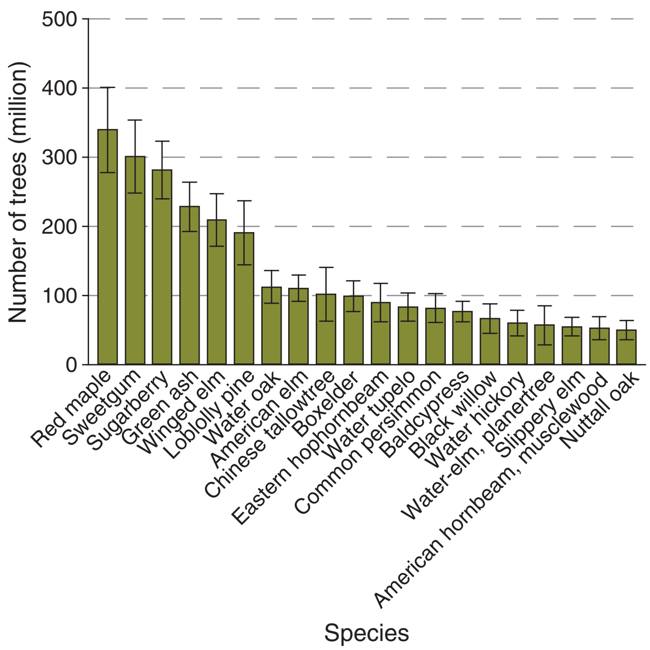


Figure 9—Number of live trees on forest land (± 95 percent confidence interval) by species, Lower Mississippi Alluvial Valley, 2010.

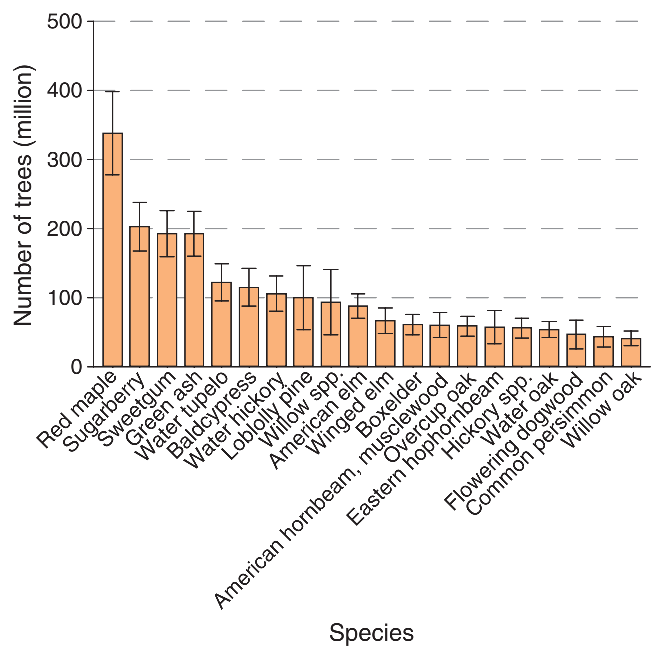


Figure 10—Number of live trees (± 95 percent confidence interval) on forest land by species, Lower Mississippi Alluvial Valley, 1980.

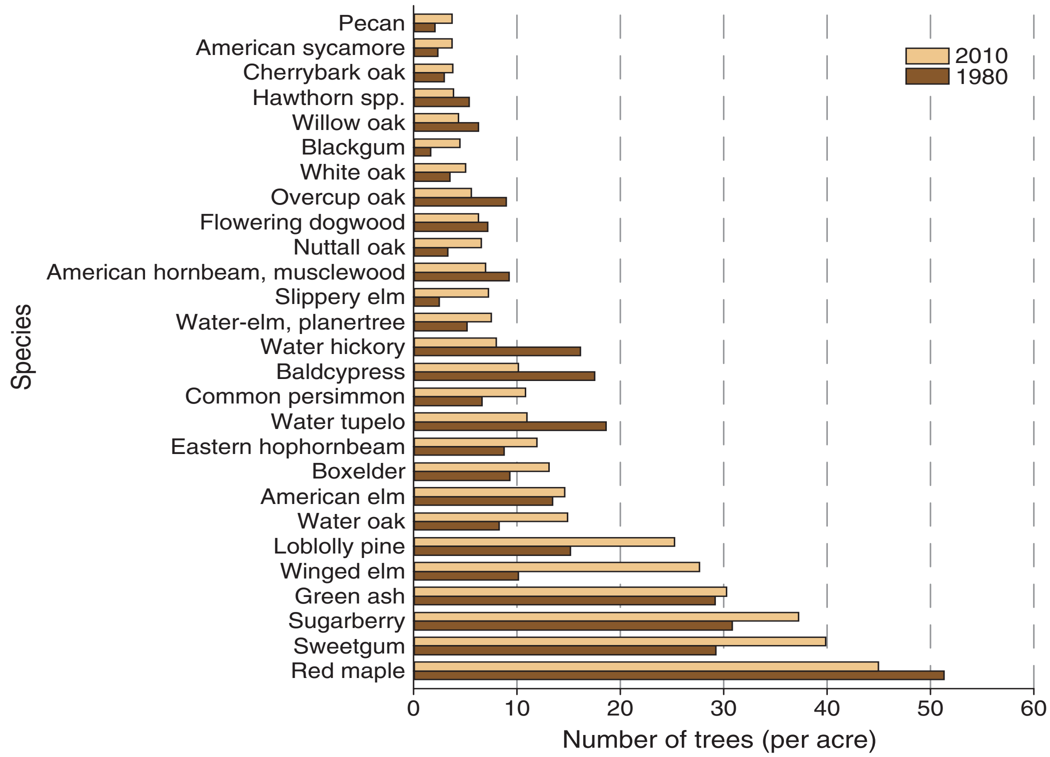


Figure 11—Number of trees per acre for the most common species by year, Lower Mississippi Alluvial Valley, 1980 and 2010.

Table 4—Forest area in the Lower Mississippi Alluvial Valley by forest-type group and stand origin, 2010

	Stand origin					
Forest type group	Total forest area	Total forest area 95% confidence interval	Natural stands	Natural stands 95% confidence interval	Clear evidence of artificial regeneration	Clear evidence of artificial regeneration 95% confidence interval
Total	7,542,521	193,089	6,717,925	182,728	824,595	127,977
Loblolly/shortleaf pine	544,994	99,843	191,925	61,531	353,069	82,971
Other eastern softwoods	4,093	8,268	4,093	8,268	–	–
Oak/pine	164,945	58,193	121,075	49,253	43,870	31,621
Oak/hickory	1,259,567	145,606	1,222,714	143,302	36,853	27,809
Oak/gum/cypress	3,062,865	207,050	2,805,310	194,127	257,555	74,639
Elm/ash/cottonwood	2,181,422	190,220	2,083,503	184,598	97,920	46,571
Other hardwoods	10,400	14,710	10,400	14,710	–	–
Exotic hardwoods	111,798	49,012	111,798	49,012	–	–
Nonstocked	202,436	60,123	167,108	53,775	35,328	27,104

— = no sample.

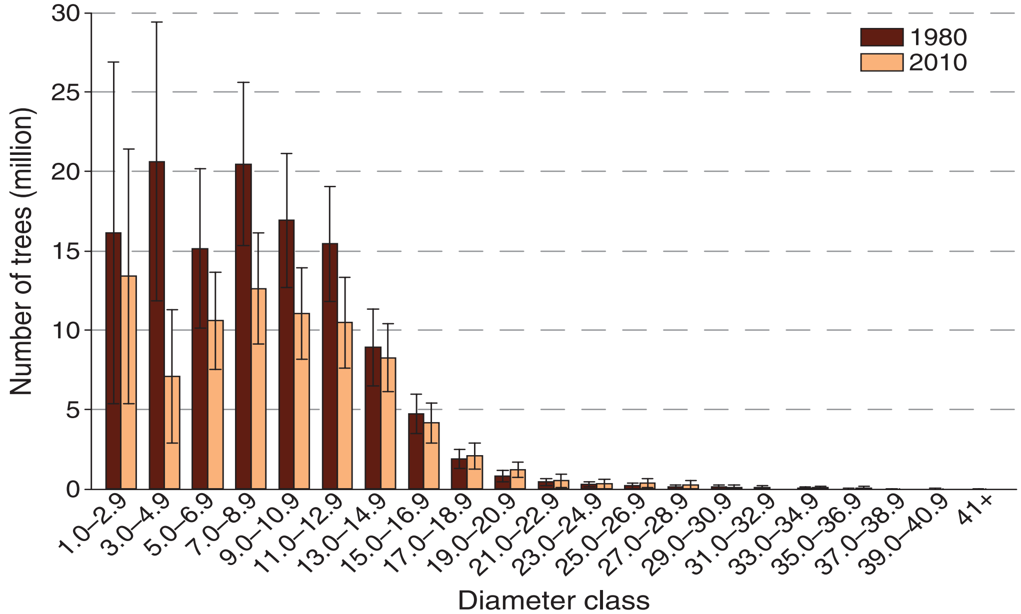


Figure 12—Number of live water tupelo trees (± 95 percent confidence interval) by diameter class and year, Lower Mississippi Alluvial Valley.

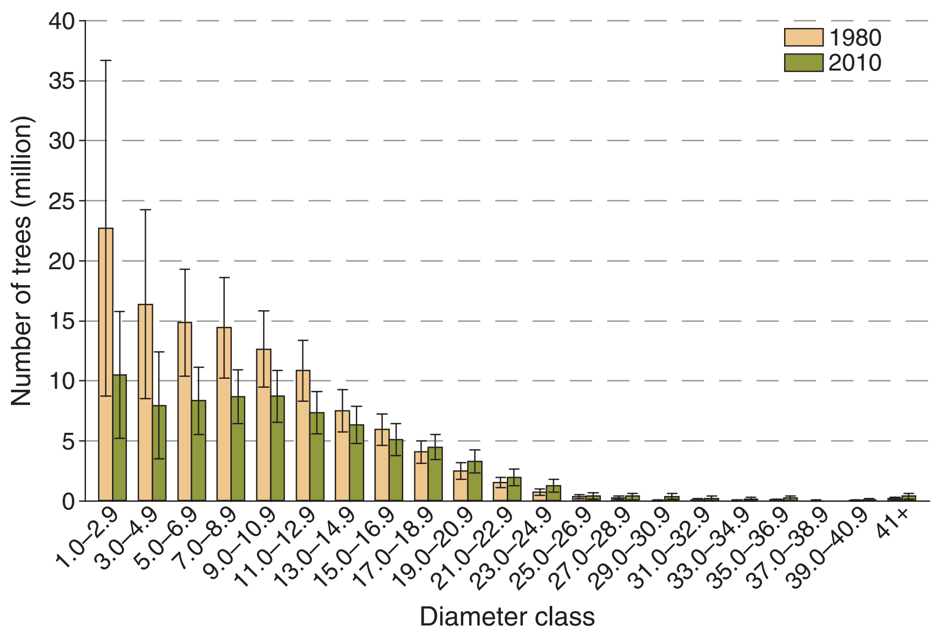


Figure 13—Number of live baldcypress trees (± 95 percent confidence interval) by diameter class and year, Lower Mississippi Alluvial Valley.

Table 5—Per-acre volumes by species in the Lower Mississippi Alluvial Valley, 2010

Species	Volume	95% confidence interval	Species	Volume	95% confidence interval
	cubic feet per acre			*cubic feet per acre*	
			White ash	3.3	1.7
Baldcypress	233.2	39.6	Waterlocust	3.0	1.5
Sweetgum	176.8	26.3	Hackberry	2.9	2.7
Water tupelo	136.8	35.4	Florida maple	2.8	1.7
Green ash	121.0	17.8	American hornbeam, musclewood	2.8	0.9
Sugarberry	113.1	15.5	Silver maple	2.5	2.1
Loblolly pine	102.3	22.5	Willow spp.	2.5	2.2
Overcup oak	87.1	18.9	Bitternut hickory	2.4	1.2
Water oak	79.6	19.3	Sassafras	2.0	1.3
Texas red oak	69.6	15.0	Eastern hophornbeam	2.0	0.6
Black willow	59.6	14.0	Delta post oak	1.6	2.0
Willow oak	55.8	13.6	Live oak	1.5	1.1
Water hickory	54.4	11.6	Chinkapin oak	1.4	1.3
American elm	48.8	8.6	Carolina basswood	1.0	1.0
Cherrybark oak	48.3	12.5	Cucumbertree	0.9	1.0
Red maple	45.5	9.2	Black walnut	0.9	0.8
Pecan	35.8	11.7	Red mulberry	0.8	0.5
White oak	31.8	8.7	Black locust	0.8	0.8
Eastern cottonwood	29.5	11.9	Flowering dogwood	0.8	0.4
American sycamore	29.0	9.4	Chinaberry	0.7	0.8
Southern red oak	27.2	8.8	Swamp white oak	0.5	0.8
Boxelder	23.7	5.2	Cottonwood and poplar spp.	0.5	0.8
Post oak	20.1	7.0	American basswood	0.5	0.7
Slippery elm	13.9	3.7	Blackjack oak	0.4	0.5
Honeylocust	12.6	4.2	Spruce pine	0.4	0.8
Mockernut hickory	11.6	3.7	River birch	0.4	0.5
Winged elm	11.0	2.5	Nutmeg hickory	0.3	0.7
Yellow-poplar	10.8	4.6	Eastern redbud	0.3	0.2
Pignut hickory	9.9	3.9	Southern magnolia	0.3	0.3
American beech	9.3	4.3	Bigleaf magnolia	0.3	0.5
Chinese tallowtree	8.5	3.3	Netleaf hackberry	0.3	0.5
Shortleaf pine	8.4	4.7	Carolina ash	0.2	0.5
Shagbark hickory	8.0	3.5	Chittamwood, gum bumelia	0.2	0.4
Cedar elm	7.9	4.1	Southern redcedar	0.2	0.4
Shumard oak	7.6	3.7	Sourwood	0.2	0.3
Common persimmon	7.5	1.9	Redbay	0.2	0.2
Black oak	6.2	3.3	Shellbark hickory	0.2	0.4
Swamp chestnut oak	6.1	2.9	Hawthorn spp.	0.2	0.1
Blackgum	5.8	2.3	American holly	0.1	0.2
Water-elm, planertree	5.2	2.2	Paulownia, empress-tree	0.1	0.1
Northern red oak	4.6	2.5	Pondcypress	0.1	0.2
Laurel oak	4.5	4.4	Sand hickory	0.1	0.2
Black hickory	4.5	1.7	Sweetbay	0.1	0.1
Black cherry	4.0	1.3	Osage-orange	0.1	0.1
Eastern redcedar	4.0	1.9	Southern catalpa	0.1	0.1
Swamp tupelo	3.7	3.0	Pawpaw	0.1	0.1
			Total	1,847.4	85.0

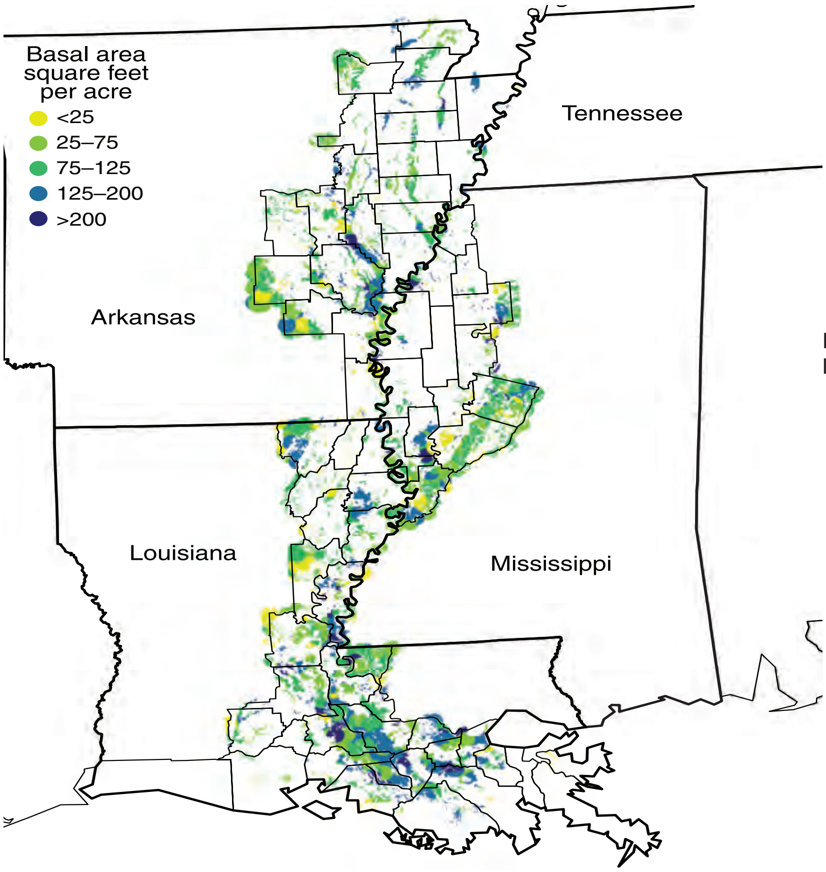


Figure 14—Mean per-acre basal area by county in the Lower Mississippi Alluvial Valley, 2010.

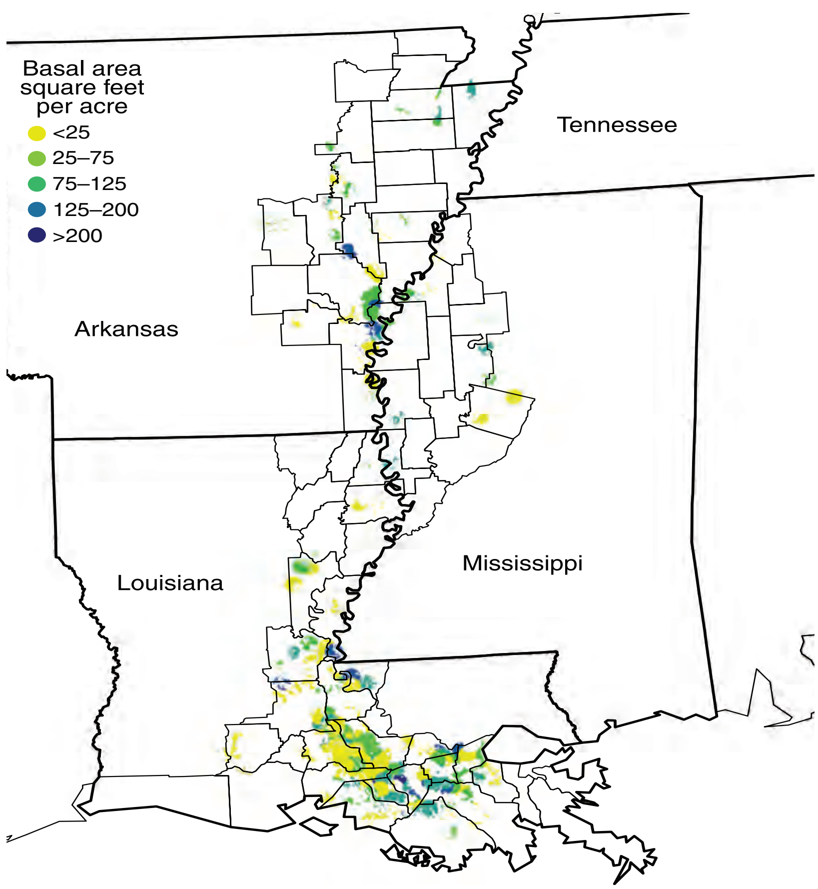


Figure 15—Mean per-acre baldcypress basal area by county in the Lower Mississippi Alluvial Valley, 2010.

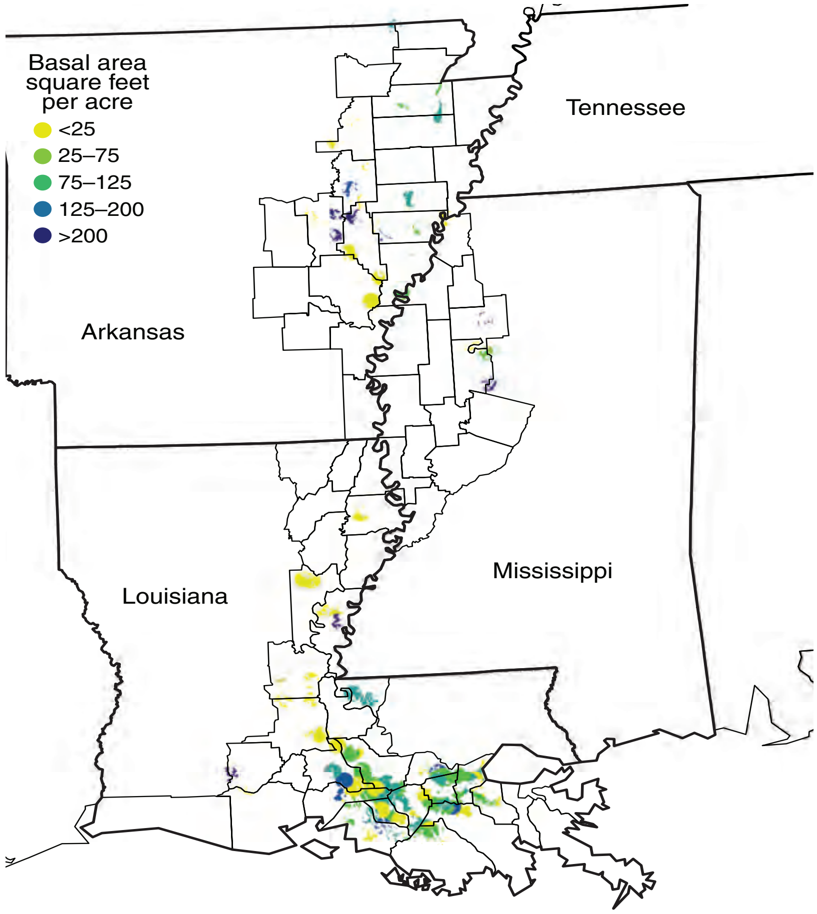


Figure 16—Mean per-acre water tupelo basal area by county in the Lower Mississippi Alluvial Valley, 2010.

Basal Area and Species Richness

The average per-forest-area basal area across 1,344 sampled plots in the LMAV was 21.9 square m/ha (95.3 square feet per acre; fig. 14). Three hundred plots (22 percent) had total basal area values between 60 and 90 square feet per acre. Mean county-level basal area ranged from 7.9 to 41.3 m^2/ha (34.6 to 179.9 square feet per acre). On plots where it occurred, baldcypress basal area averaged 46.6 square feet per acre with a range of 0.5 to 232.0 square feet per acre (fig. 15). On plots where water tupelo occurred, the species averaged 62 square feet per acre with a range of 1.1 to 317.0 square feet per acre (fig. 16). There were 107 species (not including a general "unknown" category) identified on the plots. The number of species (richness) per plot ranged from 1 to 17 with an average of 6 species per plot. There were 18 species with only 1 occurrence, and 9 species with only 2 occurrences.

Standing Dead Trees

There was an average of 13 ± 1 standing dead trees > 5 inches d.b.h./ha (5 ± 0.4 dead trees per acre) across the entire LMAV, although county-level estimates ranged from 0 trees/ha to 53 ± 34 trees/ha (0–22 ± 14 trees per acre) (fig. 17). The average number of standing dead trees ≥ 10 inches diameter was much lower, at 5 stems/ha (2 stems per acre) with a range of 0 to 40 stems/ha (0 to 16 stems per acre).

Change in Relative Stocking from 1980 to 2010

From 1980 to 2010, loblolly pine experienced the largest positive shift in relative stocking, with a mean annual increase of 0.13 percent per year. Other species experiencing increases in relative stocking include green ash, Nuttall oak (*Q. nuttallii*), water oak, and sugarberry (fig. 18).

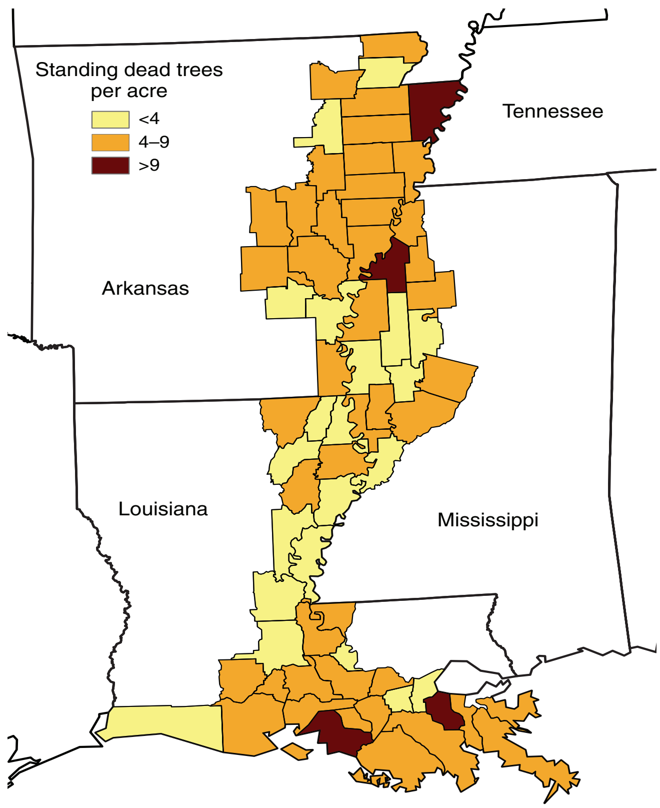


Figure 17—Standing dead trees per acre on forests in the Lower Mississippi Alluvial Valley by county, 2010.

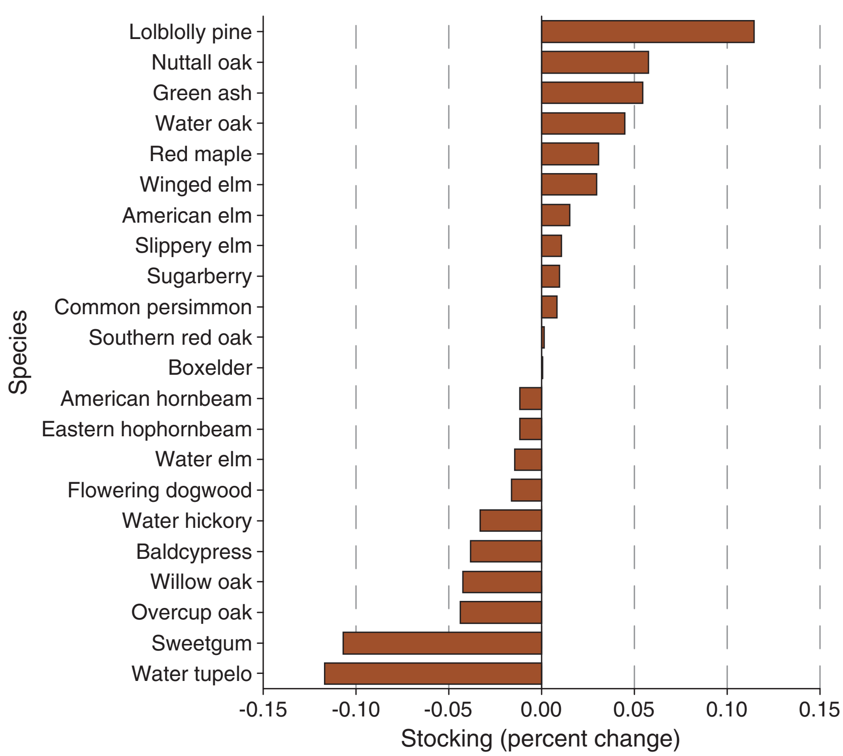


Figure 18—Average annual percent change in relative stocking from 1980 to 2010 by species, Lower Mississippi Alluvial Valley.

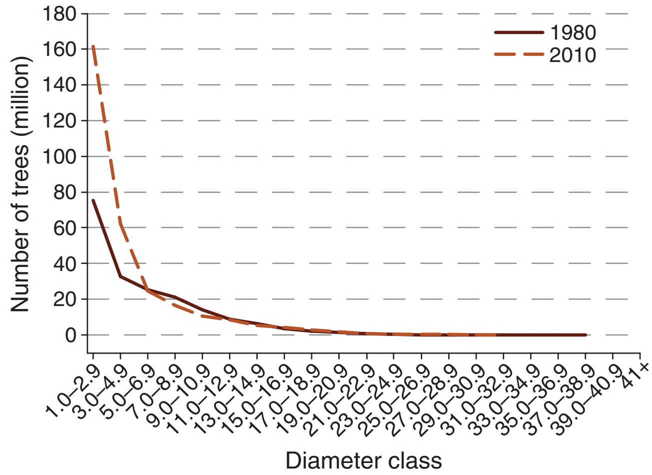


Figure 19—Number of live sweetgum trees by diameter class, Lower Mississippi Alluvial Valley, 1980 and 2010.

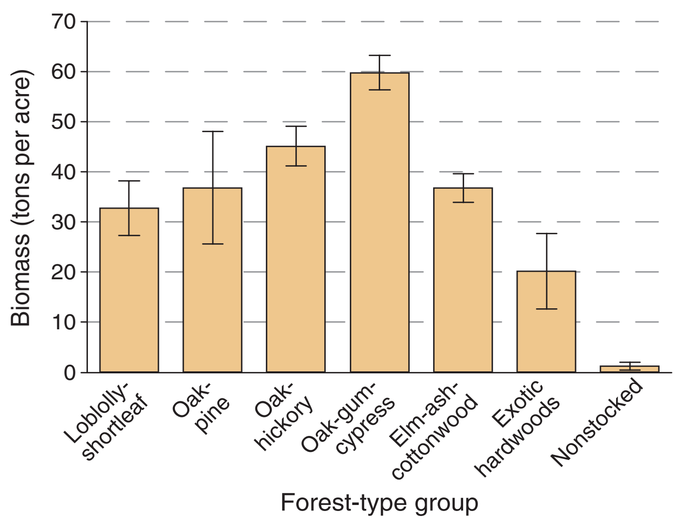


Figure 20—Aboveground biomass per acre of live trees (± 95 percent confidence interval) by forest-type group, Lower Mississippi Alluvial Valley, 2010.

Water tupelo experienced the largest decline in relative stocking, with an average decrease of 0.11 percent per year. Simultaneously, declines occurred in the number of water tupelo/ha of forest land, from 46 to 27 trees/ha across the whole LMAV.

Although the number of sweetgum trees on forest land increased between 1980 and 2010, the relative stocking of sweetgum decreased by an average of 0.10 percent per year (fig. 18). This discrepancy is attributable to the diameter distribution of sweetgum in the LMAV in 2010; the number of small-diameter sweetgums nearly doubled between 1980 and 2010, while trees in the larger diameter classes were far fewer (fig. 19). Other species experiencing relative stocking declines include baldcypress, willow oak (*Q. phellos*), overcup oak (*Q. lyrata*), and water hickory (*C. aquatic*) (fig. 18).

Carbon and Biomass

Aboveground biomass of live trees across the LMAV averages 46 tons per acre. Per-acre biomass values are highest in the oak-gum-cypress and oak-hickory forest-type groups, with 60 tons and 45 tons per acre, respectively (fig. 20). Total aboveground biomass by species group is shown in figure 21. The species group contributing the greatest aboveground biomass, 57 million tons per acre, is "other eastern soft hardwoods," which includes boxelder, many of the birch species (*Betula* spp.), sugarberry and hackberry (*Celtis occidentalis*), magnolia species (*Magnolia* spp.), American sycamore, many willow species (*Salix* spp.), and

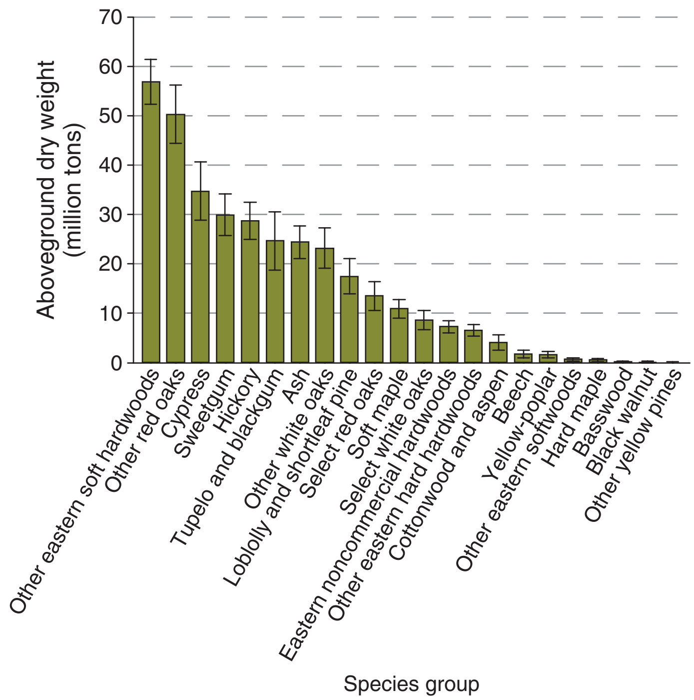


Figure 21—Aboveground total biomass (± 95 percent confidence interval) by species group, Lower Mississippi Alluvial Valley, 2010.

several elms (*Ulmus* spp.). The "other red oaks" and the cypress species groups were next largest contributors of aboveground biomass, with 50 million and 35 million tons per acre, respectively. Above- and belowground carbon in live trees was highest in the oak-gum-cypress group, with 14.6 tons per acre. The volume of standing dead carbon was highest in the oak-gum-cypress and elm-ash-cottonwood forest-type groups, with 4.7 million and 3.4 million tons per acre, respectively.

CONCLUSIONS

The LMAV is an area rich in natural resources that people and wildlife depend on. The BLH forests within the valley provide important habitat to migratory bird species and a host of mammals, reptiles, amphibians, and fish. Over the last century, much of the LMAV forest has been lost to agriculture and development, although recent incentive programs have encouraged afforestation efforts throughout the valley.

Our report attempts to update the 1986 assessment of LMAV forest resources by Rudis and Birdsey and provide a comprehensive overview of current resources. While LMAV forest area has increased overall since the 1980s, the area categorized as "BLH" has not increased proportionally at the same rate. Instead, upland areas have accounted for much of the afforestation, while oak-gum-cypress forests have continued to decline. Changes in the LMAV over the last two to three decades are due mostly to diversions to and reversions from agricultural land, with only a small proportion of change due to development. Species composition remains similar to composition in the 1980s with some notable changes in the abundance of trees that typically occupy frequently flooded sites (e.g., water tupelo, baldcypress, water hickory) and increases in the number of planted loblolly pine trees.

Advances have been made in the afforestation and management of LMAV timber resources since the 1950s, with particularly noticeable progress in terms of increasing forest area since the 1980s. Concern remains over the future of the bottomland resources, however, as demands for flood protection continue to increase and hydrologic regimes continue to change throughout the valley. Continued inventory and monitoring of LMAV resources will aid the management of this important resource.

Appendix A

Distributions of key species in the Lower Mississippi Alluvial Valley according to FIA inventory plots are shown in figures A.1–A.16.

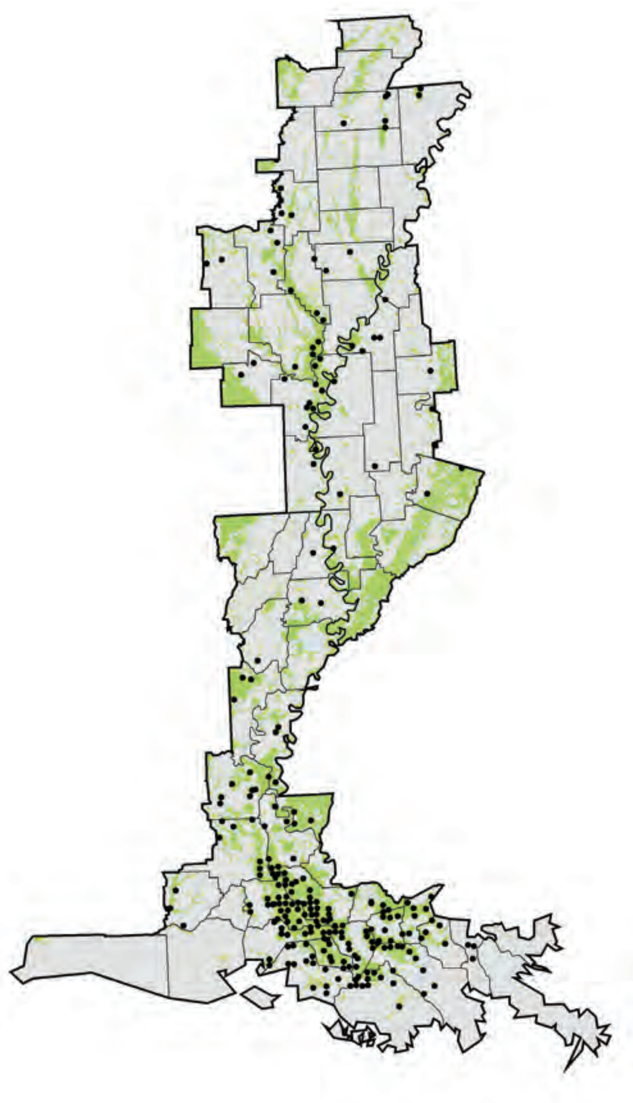


Figure A.1—*Taxodium distichum.*

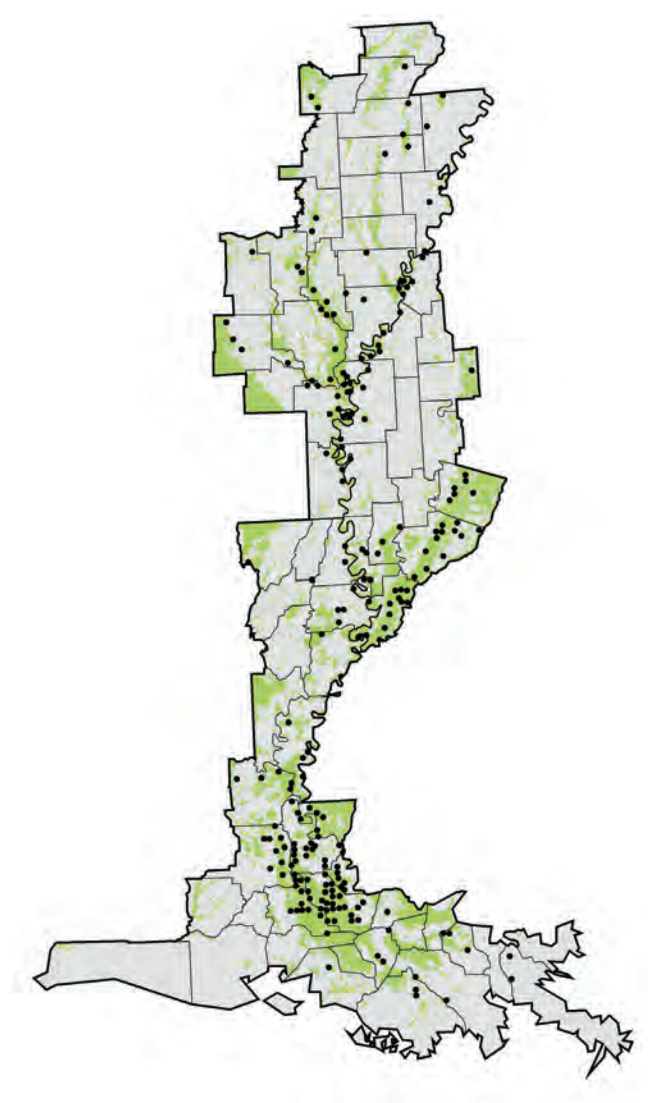


Figure A.2—*Acer negundo.*

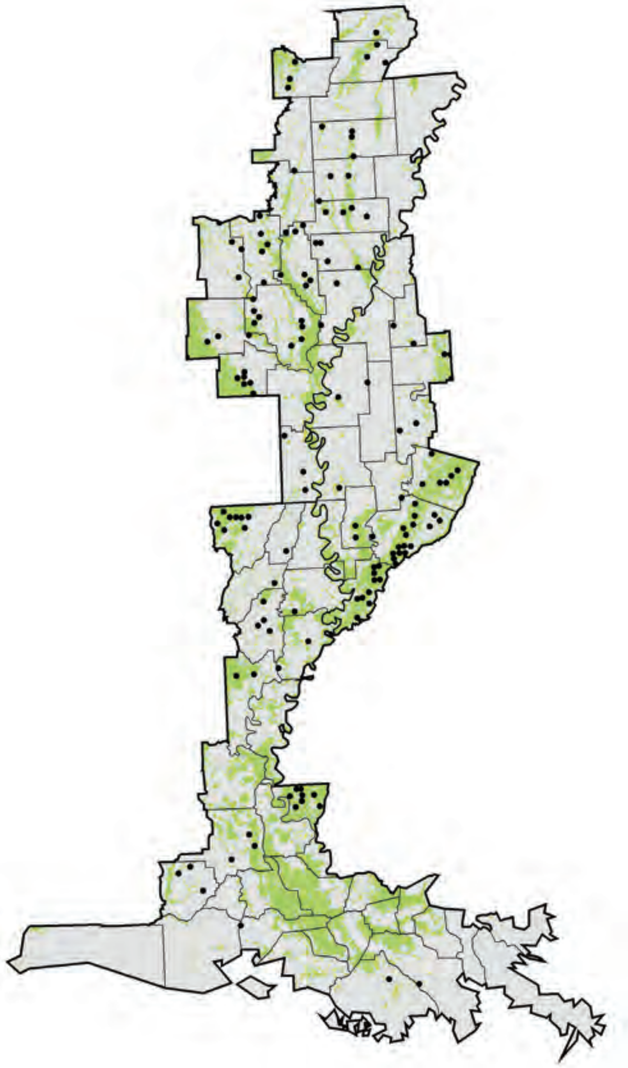


Figure A.3—*Quercus pagoda.*

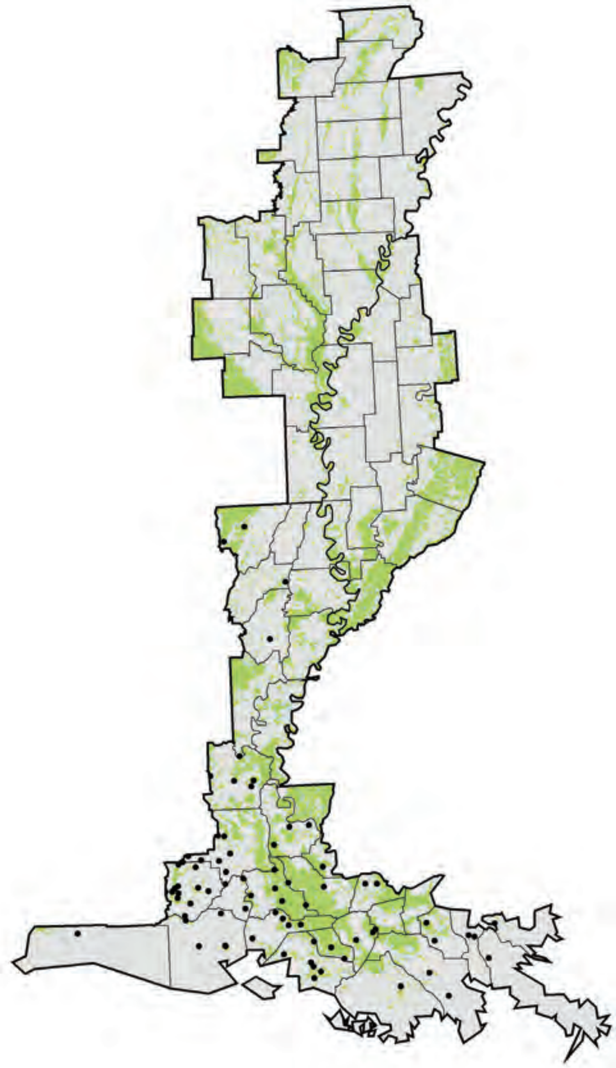


Figure A.4—*Triadica sebifera.*

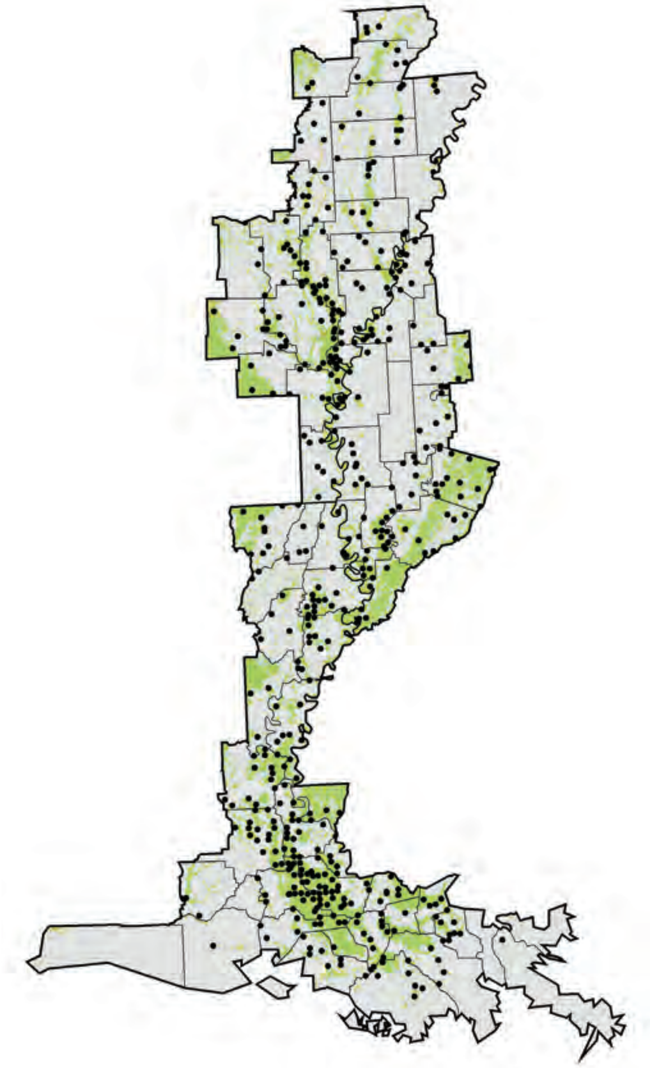


Figure A.5—*Fraxinus pennsylvanica.*

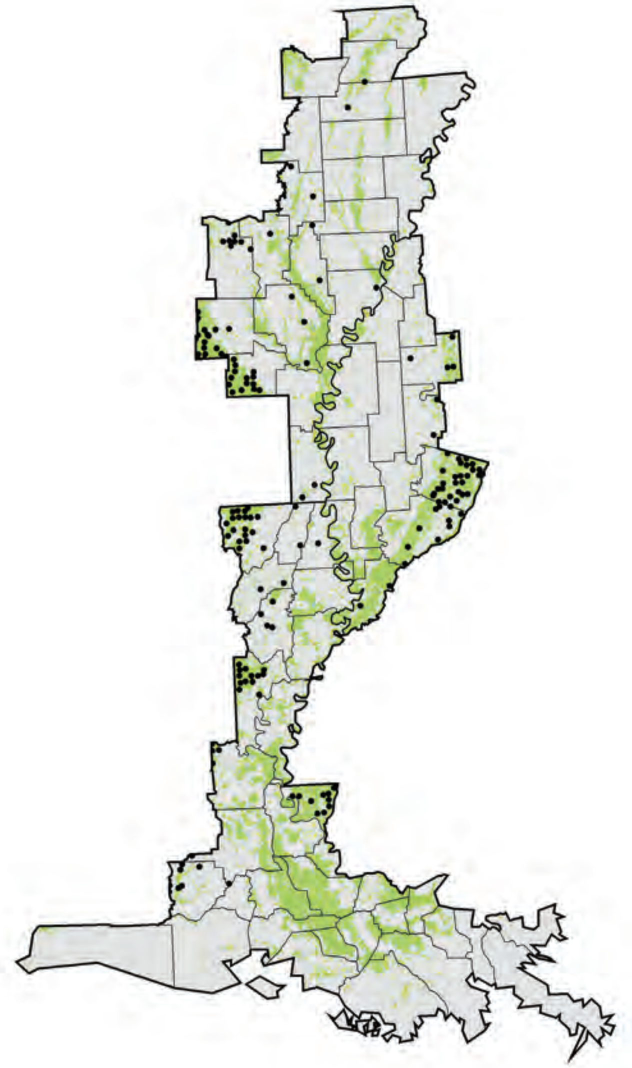


Figure A.6—*Pinus taeda.*

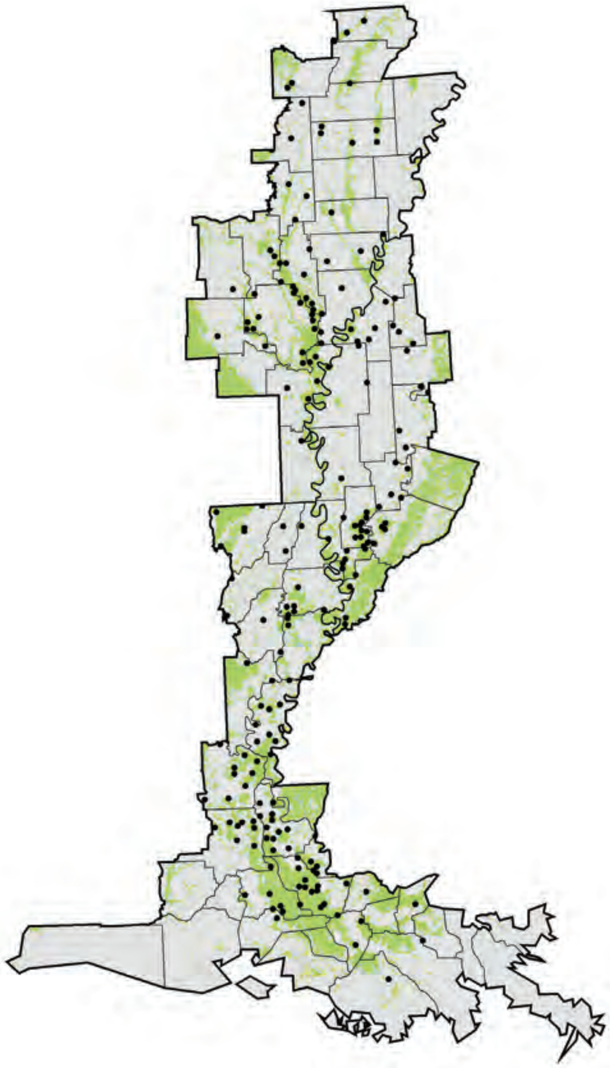


Figure A.7—*Quercus nuttallii.*

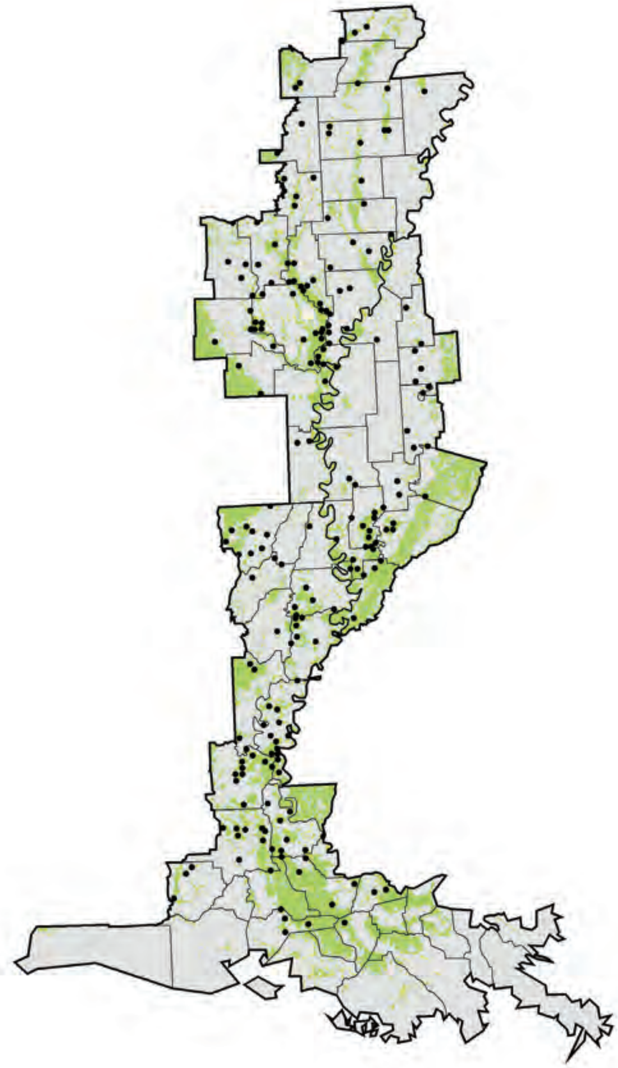


Figure A.8—*Quercus lyrata.*

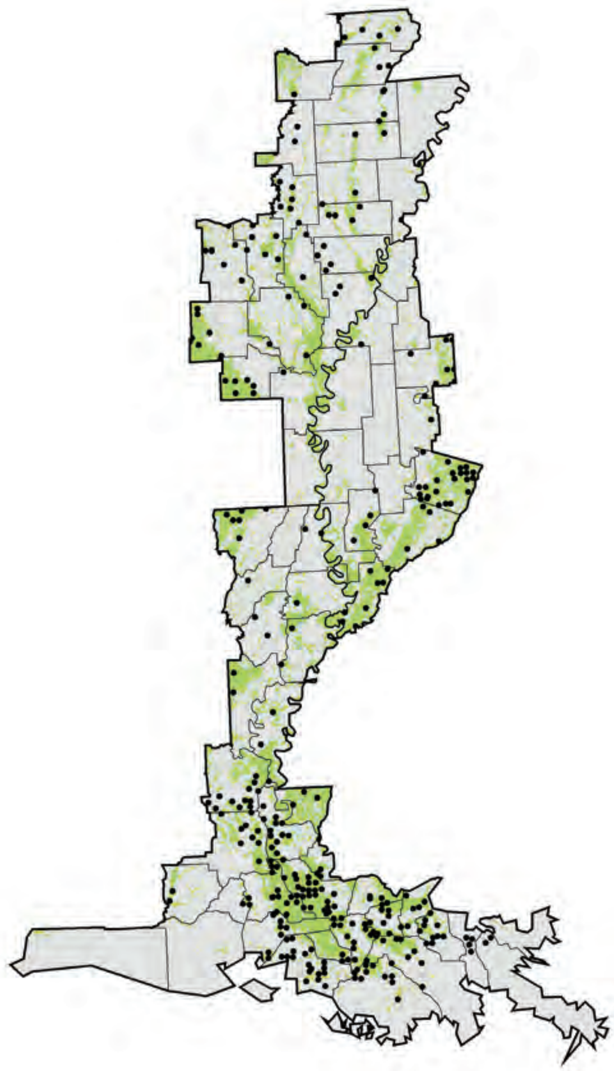


Figure A.9—*Acer rubrum.*

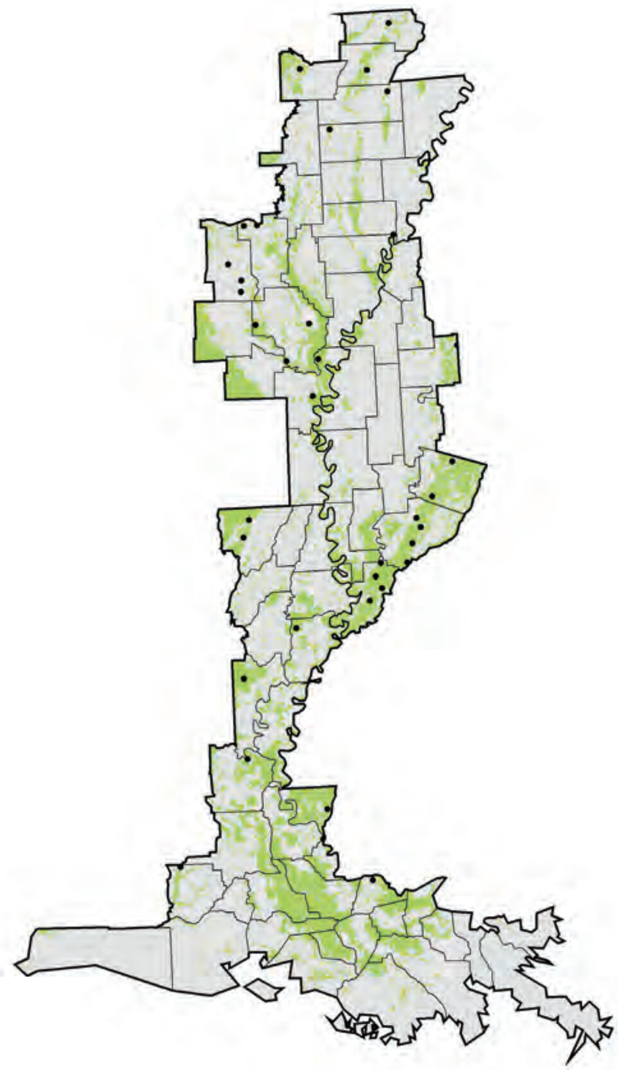


Figure A.10—*Quercus shumardii.*

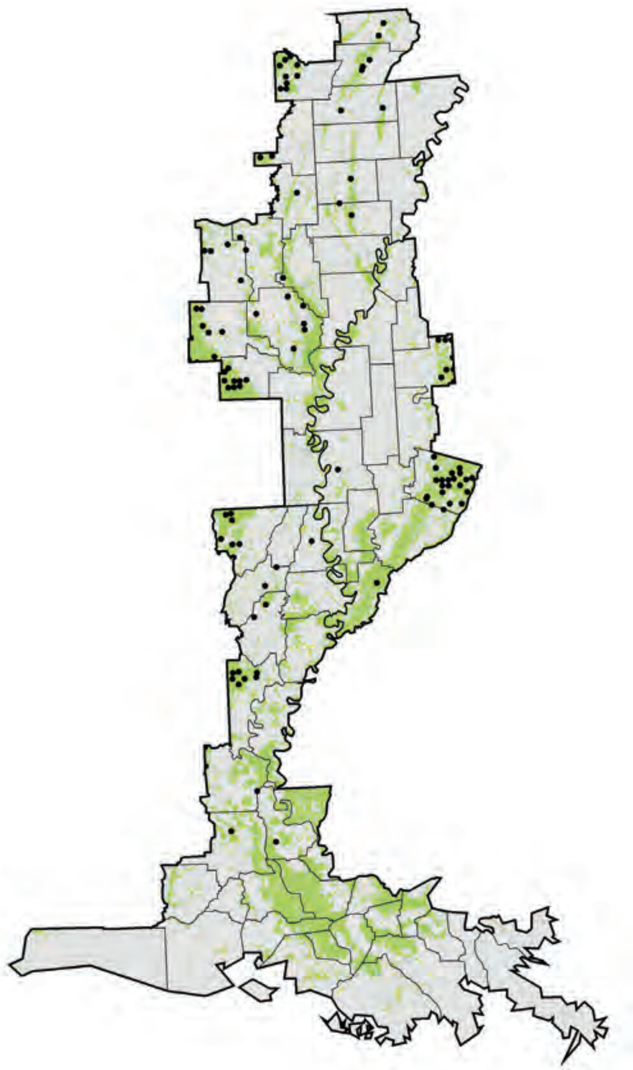


Figure A.11—*Quercus falcata.*

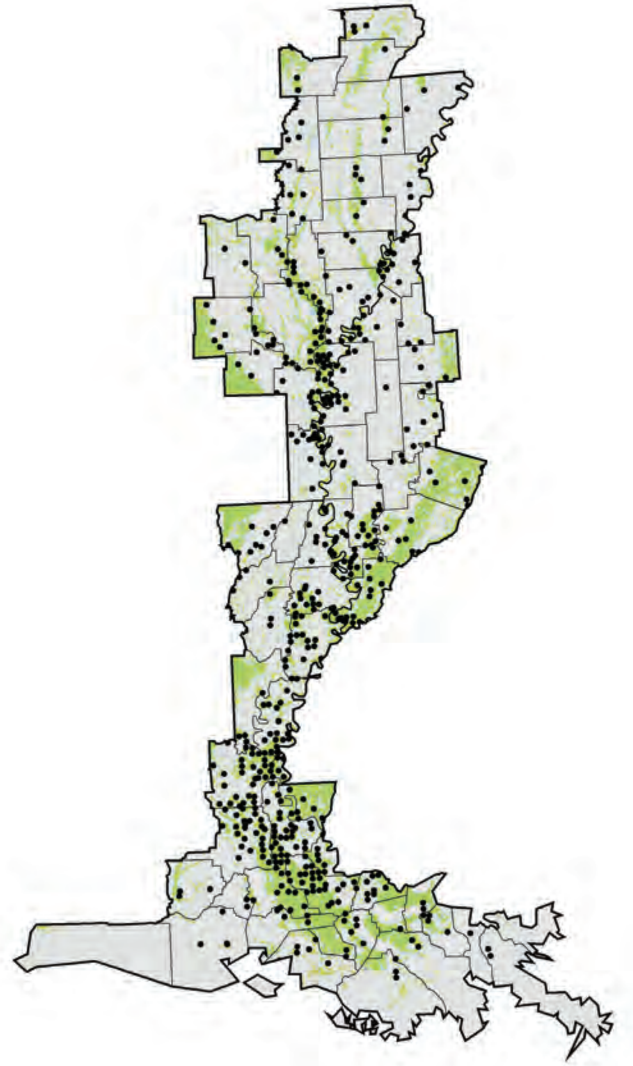


Figure A.12—*Celtis laevigata.*

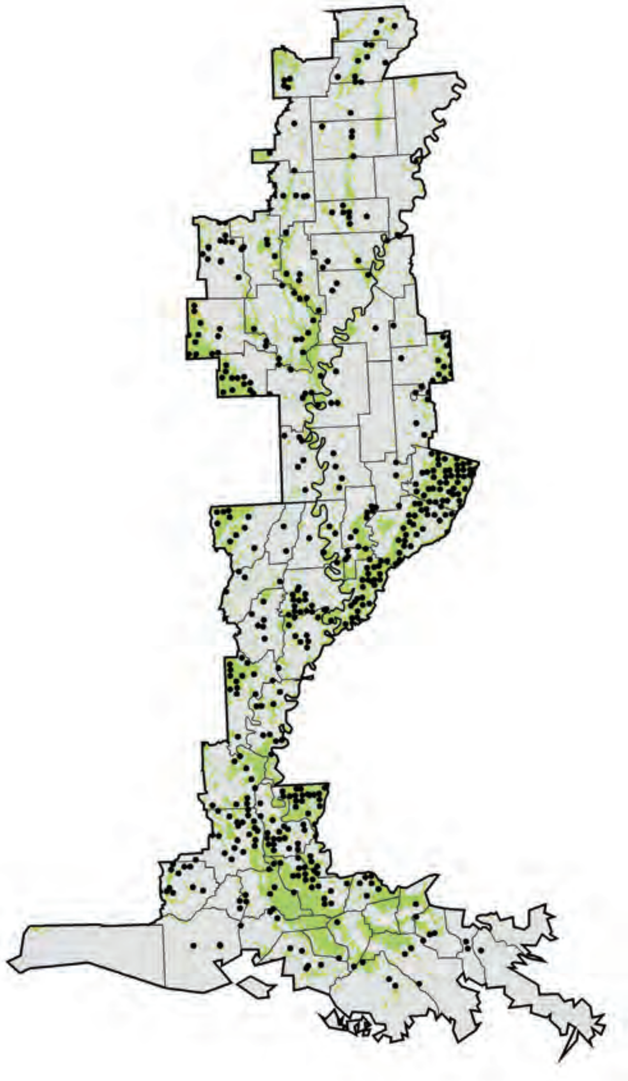


Figure A.13—*Liquidambar styraciflua.*

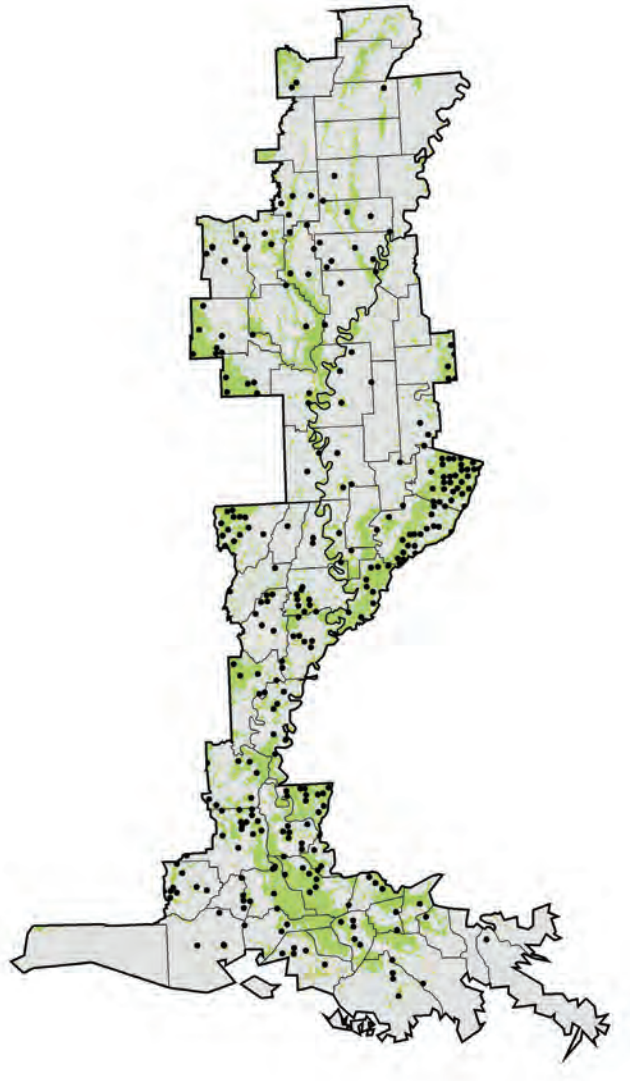


Figure A.14—*Quercus nigra.*

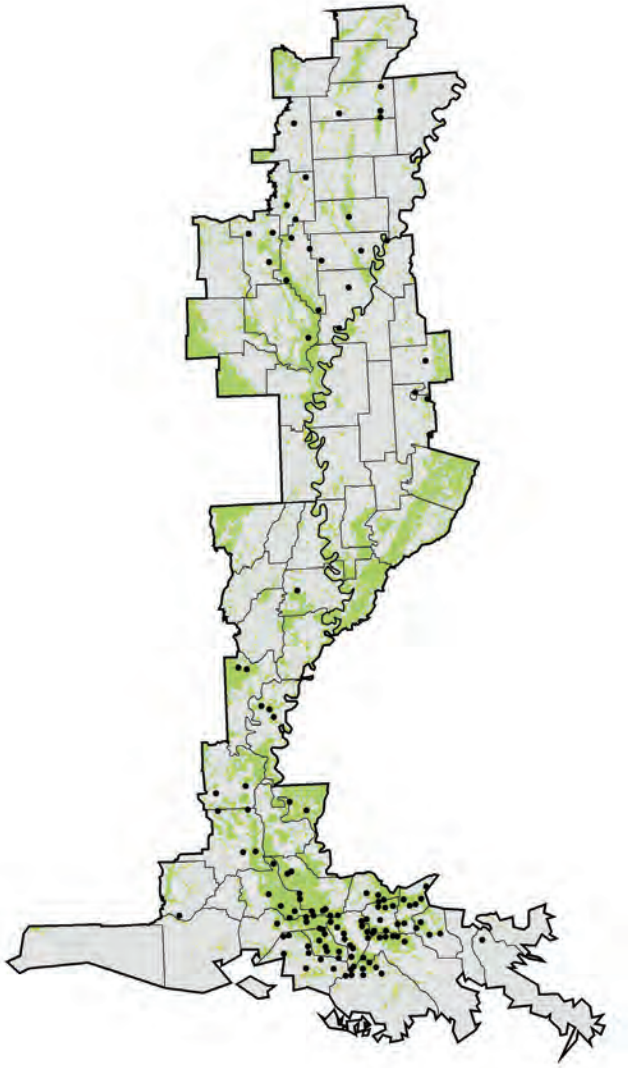


Figure A.15—*Nyssa aquatica.*

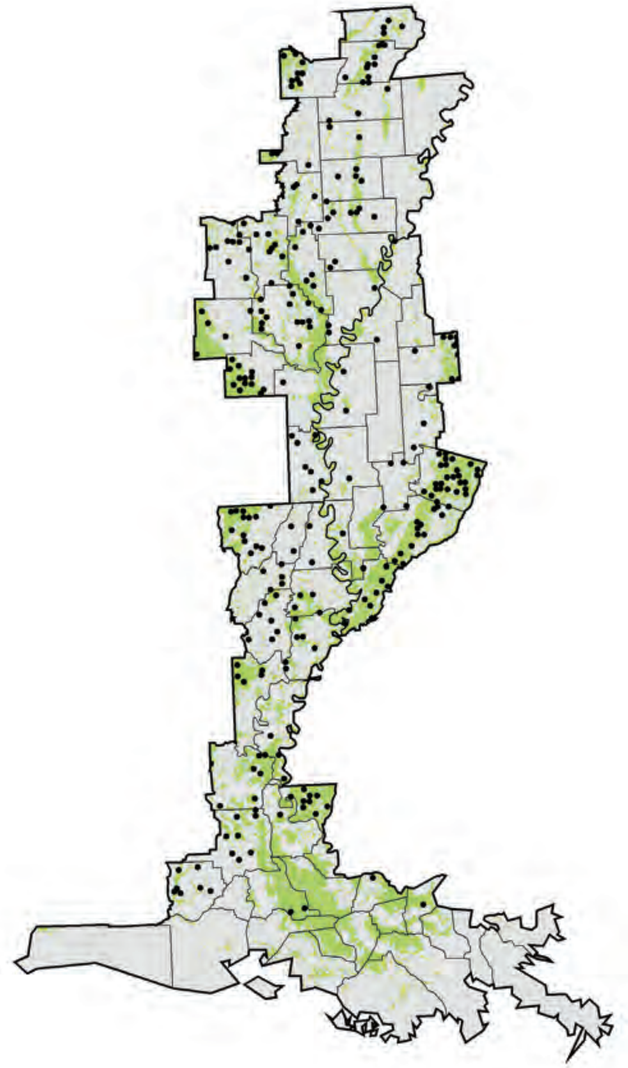


Figure A.16—*Ulmus alata.*

Appendix B

SAMPLING PROCEDURES

Field Methods

For surveys prior to 2005 in the lower Mississippi Alluvial Valley (LMAV), field crews visited all sample locations in a State and measured attributes at those locations in a 1- or 2-year period. The Forest Inventory and Analysis (FIA) Program of the Forest Service, U.S. Department of Agriculture, typically conducted surveys one State at a time. This periodic inventory system was designed to provide updated forest resource estimates for all States every 7 to 10 years. The sample design was based on a two-phase system, whereby forest area was determined using aerial photographs, and stand and tree-level characteristics were determined using on-the-ground mensuration techniques.

Timberland area was determined by overlaying a dot grid on aerial photographs and interpreting each dot as falling on forest or nonforest land. Each dot represented about 230 acres. Dot counts were adjusted by ground checks at permanent sample locations. The ratio of forest to nonforest dots provided the percent forest for each county. This percentage was then applied to data from the U.S. Bureau of the Census statistics to develop an estimate of forest area in each parish. Expansion factors based on the number of forested plots varied by county or parish, but averaged around 6,000 acres per plot.

Stand and tree-level characteristics were measured on plots located on a 3- by 3-mile sample grid. At each sample plot satellite points were spread over approximately 1 acre, with point number one coincident with the corresponding aerial photograph plot location. At each forested sample plot, trees ≥ 5.0 inches diameter at breast height (d.b.h.) were tallied on each of the satellite points using a 37.5-factor prism. Trees ≤ 5.0 inches d.b.h. were tallied on circular 1/275th acre plots.

The FIA inventory today is a three-phase, fixed-plot sample survey (Bechtold and Patterson 2005). The three phases of the current sampling method are arranged on a hexagonal grid design, with each successive phase sampled with less intensity. There are 16 phase 2 (P2) hexagons for every phase 3 (P3) hexagon, and 27 phase 1 (P1) hexagons for every P2 hexagon. P1 hexagons represent about 222 acres, while P2 and P3 hexagons represent roughly 6,000 acres and 96,000 acres, respectively.

Current P1 stratified estimation procedures reduce variance associated with estimates of forest land area and produce more precise estimates than simple random sampling. A statistical estimation technique is used to classify digital satellite imagery and initially stratify the land base as forest or nonforest to assign a representative acreage to each sample plot. Pixels within 60 m (2 pixel widths) of a forest/nonforest boundary form two additional strata: forest edge and nonforest edge. Forest pixels within 60 m of the boundary on the forest side are classified as forest edge while pixels within 60 m of the boundary on the nonforest side are classified as nonforest edge. The estimated population total for the variable is the sum, across all strata, of the product of each stratum's area (from the pixel count) and variable's mean per unit area (from plot measurements) for the stratum.

The P2 sample design utilizes a fixed-radius plot consisting of four subplots spaced 120 feet apart in a triangular fashion. The cumulative sample area of these four subplots is 1/6 of an acre. The cluster plot is a 1.5-acre circle that circumscribes the outer boundary of the three outer subplots. Trees ≥5.0 inches d.b.h. are measured on each subplot. Trees ≥1.0 but <5.0 inches d.b.h. and seedlings (<1.0-inch d.b.h.) are measured on a microplot (1/300 of an acre; 6.8-foot radius) on each of the four subplots. The microplot is offset 12 feet at 90 degrees from the subplot center.

A unique feature of this plot design is in the mapping of different land use and forest conditions that are encountered on the cluster plot. Since the plots are placed on the ground without bias, i.e., systematically but at a scale large enough to be considered random, there is a probability that the cluster plot will straddle more than one type of land use or forest condition. When this does occur, a boundary is drawn across the plot so that the different homogeneous units are identified and isolated. There are two steps in the mapping process. The first step involves identifying forest and nonforest areas on the plot and establishing a boundary line on the plot if both are present. The second step involves identifying homogeneous areas in the forested portion of the plot based on six factors: (1) forest type, (2) stand size, (3) ownership, (4) stand density, (5) regeneration status, and (6) reserved status. These, too, are mapped into separate entities.

P3 procedures involve sampling on a subset ($1/16^{th}$) of the P2 sample locations. P3 measurements are combined with P2 measurements to assess the overall health of forested ecosystems within each State. P3 data is not reported here; therefore, sampling details are not included.

Determining Forest Resource Statistics

The changes in sample design and plot layout have changed the derivation of basic resource statistics, e.g., stocking, growth, removals, and mortality. The following section briefly describes the methods used and explains how they have changed with the transition from the previous to the current inventory system.

Forest type—Forest type is derived via algorithm using a hierarchical (classification tree) decision model. The forest type indicates the predominant live-tree species cover. Hardwoods and softwoods are first aggregated to determine the predominant group, and forest type is selected from the predominant group. Eastern softwood groups have ≥50 percent softwood stocking and contain the named species that constitute a plurality of the stocking; the oak-pine group and hardwood groups have <50 percent softwood stocking. The nonstocked group includes stands <10 percent stocked with live trees.

Under the previous sample design, a single forest type was determined for the entire plot regardless of the number of forest conditions present. The current fixed-radius inventory design identifies a forest type for each forest condition.

Estimating volume—Currently, FIA computes tree volume using a simple linear regression model (D2H) that predicts gross cubic foot volume from a 1-foot stump to a 4-inch upper diameter for each sample tree based on d.b.h. (D) and total height (H). Separate equation coefficients for 77 species or species groupings are used; these are developed from standing and felled tree volume studies conducted across several Southern States (Oswalt and Conner 2011). Volume in forks or limbs outside of the main bole is excluded. FIA derives net cubic foot volume by subtracting a field crew estimate of rotten or missing wood for each sample tree. Volume of the saw-log portion (expressed in International 1/4-inch board feet and in cubic feet) of sample trees is computed using board foot–cubic foot ratio equations. Equations and coefficients were derived from standing and felled-tree volume studies conducted across several Southern States.

Methods used to estimate tree volumes in the previous inventory differed from those described above. FIA derived tree volume from several measurements on each tree tallied on forested sample plots. These measurements included d.b.h., bark thickness, total height, bole length, log length, and up to four upper-stem diameters that defined pole top, pole mid, saw top, and saw mid. Gross tree volumes (cubic and board foot values) were determined by applying the formula for a conic frustum to sections of the bole. The volumes of the sections were then added together to produce a total stem volume. Obtaining net cubic foot volume involved subtracting a field crew estimate of rotten or missing wood for each sample tree. Merchantable volume was calculated from measurements of the bole from a 1-foot stump to an upper-stem stopping point determined by merchantability standards. The upper-stem diameter at this point could be as low as 4 inches but often was larger depending upon the perceived condition and product merchantability of the upper tree bole.

Although both current and previous plot designs are statistically valid, the naturally occurring noise in the data hinders rigorous trend assessments over time. When a design changes or plots are not remeasured, the true impact of such a change on trend analysis is unknown. The only way to quantify this impact with certainty would be to make measurements using both plot designs simultaneously and compare the results of these two independent surveys. Resources were not available to do this.

Literature Cited

Bechtold, W.A.; Patterson, P.L., eds. 2005. The enhanced forest inventory and analysis program—national sampling design and estimation procedures. Gen. Tech. Rep. SRS–80. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 85 p.

Faulkner, S.P.; Bhattarai, P.; Allen, Y. [and others]. 2009. Identifying baldcypress-water tupelo regeneration classes in forested wetlands of the Atchafalaya Basin, Louisiana. Wetlands. 29(3): 809–817.

Fredrickson, L.H. 2005. Contemporary bottomland hardwood systems: structure, function and hydrologic condition resulting from two centuries of anthropogenic activities. In: Fredrickson, L.H.; King, S.L.; Kaminski, R.M., eds. Ecology and management of bottomland hardwood ecosystems: the state of our understanding. Gaylord Memorial Laboratory Special Publication No. 10. Puxico, MO: University of Missouri-Columbia: 19–35.

Gardiner, E.S.; Oliver, J.M. 2005. Restoration of bottomland hardwood forests in the Lower Mississippi Alluvial Valley, U.S.A. In: Stanturf, J.A.; Madsen, P., eds. Restoration of boreal and temperate forests. Restoration of bottomland hardwood forests in the Lower Mississippi Alluvial Valley, U.S.A. Boca Raton, FL: CRC Press: 235–251.

Interagency Floodplain Management Review Committee. 1994. A blueprint for change—sharing the challenge: floodplain management into the 21st century. Final report. 272 p. http://www.floods.org/PDF/Sharing_the_Challenge.pdf. [Date accessed: October 2012].

Jenkins, W.A.; Murray, B.C.; Kramer, R.A.; Faulkner, S.P. 2010. Valuing ecosystem services from wetlands restoration in the Mississippi Alluvial Valley. Ecological Economics. 69: 1051–1061.

King, S.L.; Shepard, J.P.; Ouchley, K.; Neal, J.A. 2005. Bottomland hardwood forests: past, present, and future. In: Fredrickson, L.H.; King, S.L.; Kaminski, R.M., eds. Ecology and management of bottomland hardwood systems: the state of our understanding. Gaylord Memorial Laboratory Special Publication No. 10. Puxico, MO: University of Missouri-Columbia: 1–17.

King, S.L.; Twedt, D.J.; Wilson, R.R. 2006. The role of the wetland reserve program in conservation efforts in the Mississippi River Alluvial Valley. Wildlife Society Bulletin. 34(4): 914-920.

Lower Mississippi Valley Joint Venture Office Forest Resource Conservation Working Group. 2007. Restoration, management, and monitoring of forest resources in the Mississippi alluvial valley: recommendations for enhancing wildlife habitat. Wilson, R.; Ribbeck, K.; King, S.; Twedt. D., eds. Final report. Vicksburg, MS: Lower Mississippi Valley Joint Venture Office. 137 p. http://www.mdwfp.com/media/8855/mavdesiredforestconditionsfinalreport.pdf. [Date accessed: October 2012].

Miles, P.D. 2012. Forest inventory EVALIDator web-application version 1.5.00. St. Paul, MN: U.S. Department of Agriculture Forest Service, Northern Research Station. http://www.fia.fs.fed.us/tools-data/default.asp. [Date accessed: June 4 to July 24, 2012].

Oswalt, C.M.; Conner, R.C. 2011. Southern forest inventory and analysis volume equation user's guide. Gen. Tech. Rep. SRS–138. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 22 p.

Oswalt, C.M.; Stringer, J.A.; Turner, J.A. 2008. Shifts in relative stocking of common tree species in Kentucky from 1975 to 2004. In: Jacobs, D.F.; Michler, C.H., eds. 2008. Proceedings, 16th central hardwood forest conference. Gen. Tech. Rep. NRS–P–24. Newtown Square, PA: U.S. Department of Agriculture Forest Service, Northern Research Station: 194–203.

Rosson, J.F., Jr. 2001. Forest resources of Mississippi, 1994. Resour. Bull. SRS–61. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 78 p.

Rosson, J.F., Jr. 2002. Forest resources of Arkansas, 1995. Resour. Bull. SRS–78. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 82 p.

Rosson, J.F., Jr.; McWilliams, W.H.; Frey, P.D. 1988. Forest resources of Louisiana. Resour. Bull. SO–130. New Orleans: U.S. Department of Agriculture Forest Service, Southern Forest Experiment Station. 81 p.

Rudis, V.A.; Birdsey, R.A. 1986. Forest resource trends and current conditions in the lower Mississippi valley. Resour. Bull. SO–116. New Orleans: U.S. Department of Agriculture Forest Service, Southern Forest Experiment Station. 7 p.

Schoenholtz, S.H.; James, J.P.; Kaminski, R.M. [and others]. 2001. Afforestation of bottomland hardwoods in the lower Mississippi alluvial valley: status and trends. Wetlands. 21(4): 602–613.

U.S. Department of Agriculture Natural Resources Conservation Service. 2012. 2011 WRP cumulative agreement enrollments. http://www.nrcs.usda.gov. [Date accessed: July 17, 2012].

U.S. Soybean Export Council. 2006. U.S. Soy: International buyer's guide. http://www.ussec.org/resources/buyers-guide/. [Date accessed: August 29, 2012].

Oswalt, Sonja N. 2013. Forest Resources of the Lower Mississippi Alluvial Valley. Gen. Tech. Rep. SRS-177. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 29 p.

At one time, the Lower Mississippi Alluvial Valley was covered by almost 25 million acres of forest. By the mid-1980s, all that remained of the valley's forested land was roughly 6.6 million acres. This report addresses a gap in data about this land by providing, for the first time since 1986, comprehensive new estimates of forest area, volume, carbon, and tree species stocking change.

Keywords: Bottomland hardwoods, Forest Inventory and Analysis, Lower Mississippi Alluvial Valley, stocking.