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Summary Report: Forest Health Monitoring in the South, 1992

John S. Vissage and William H. Hoffard

SUMMARY

In 1990, the USDA Forest Service and the U. S. Environmental Protection **Agency** launched a cooperative program, Forest Health Monitoring, to monitor the health of the Nation's forests. Several indicators of forest health have been measured on permanent plots in 14 States. Data gathered from Alabama, Georgia, and Virginia in 1992 are summarized in this report. Simple percentage distributions of crown ratings and damage data from sample plots do not suggest that there are any widespread problems in these States. Only 1 percent of the sample trees has poor crowns. However, surveys show that insects and diseases continue to cause substantial forest damage in the southern region.

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INTRODUCTION

Forests cover much of the South. They provide timber, wildlife habitat, recreation, and many other benefits. Concern about the effects of air pollution, drought, and other anthropogenic and natural stressors has increased in the past decade. In response to these concerns, the USDA Forest Service and the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) jointly sponsor the Forest Health Monitoring (FHM) program. The State foresters and other State and Federal agencies are key cooperators and partners in the FHM program.

The primary goal of FHM is to monitor, evaluate, and report on the health of the forests at regional and national scales. To accomplish this goal, FHM is organized into three monitoring activities. The first, detection monitoring, establishes baseline conditions and detects unusual deviations or events. In detection monitoring, selected indicators of forest health are sampled on a network of permanent plots. This sampling is referred to as on-frame sampling. Supplemental surveys detect outbreaks of forest insects and diseases and are referred to as off-frame surveys. The second activity, evaluation monitoring, is triggered by unexplained changes in forest health indicators. Evaluation monitoring identifies cause-and-effect relationships, provides information for management responses, and identifies additional research needs. Intensive site ecosystem monitoring, the third activity, studies forest ecosystem processes and their effects on forest health.

Detection monitoring activity began in 1990 in six New England States. In 1991, it began in three mid-Atlantic and three Southern States, and, in 1992, it began in two Western States.

The results of detection monitoring activity in the South in 1992 are summarized in this report. In the first part, data from the plot network in Alabama, Georgia, and Virginia are summarized. All values reported are simply counts or percentages of sample observations. No statements of statistical significance are implied. Statistical treatment of the data is discussed in the Forest Health Monitoring 1992 Annual Statistical Summary (Forest Health Monitoring 1994). The second part of this report is a synopsis of various insect and disease surveys. There was a similar report for detection monitoring activities in 1991 (Bechtold and others 1992).

ON-FRAME ACTIVITIES

The FHM program uses a systematic grid developed by EMAP to choose sample locations. This approach is designed to provide a statistically valid sample of all land categories. Field crews install a FHM plot when any part of it falls in forest land. The FHM plot is a cluster of four 1/24-acre fixed-radius subplots spaced 120 feet apart (fig. 1). Trees 5.0 inches and larger in diameter at breast height (d.b.h.) are recorded if they are within the 24.0-foot radius defining each subplot. Trees with d.b.h.'s from 1.0 through 4.9 inches are recorded if they are in 6.8-foot radius (1/300-acre) microplots offset 12 feet from the center of the subplots. The FHM plots sometime straddle land-use and forest-condition classes, so subplots, microplots, and tally trees are mapped by condition class (Conkling and Byers 1992).

Data collection efforts in 1992 focused on the damage and visual crown rating (VCR) indicators. Data were collected from plots with at least one live tree 1.0 inch or larger in d.b.h. in 1991.

For each tree 5.0 inches or larger in d.b.h., field crews recorded up to three damages in order of severity. Severity was rated on the basis of the likelihood of tree mortality, growth loss, or introduction of damaging agents. Field personnel recorded the location and probable cause for each damage. Only the most severe damage observed for each tree is tabulated for this report.

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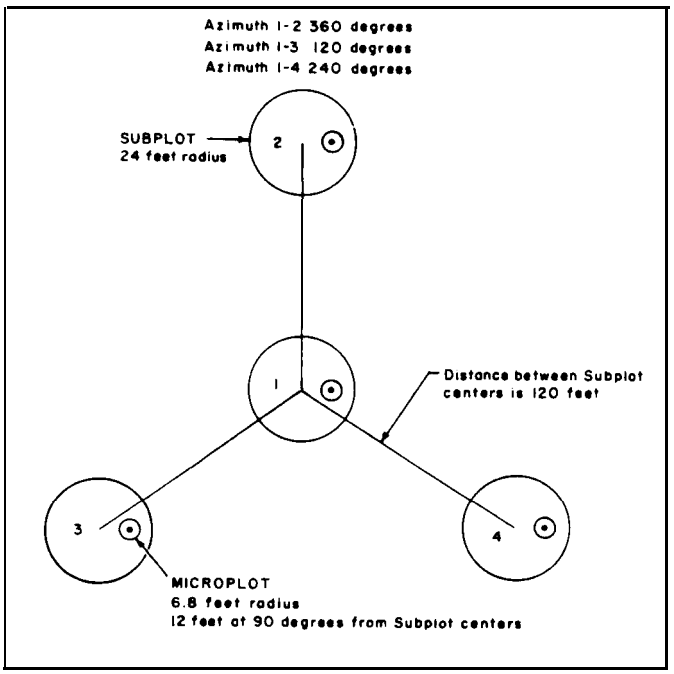

Figure 1.— *National Forest Health Monitoring plot design (from Conkling and Byers 19921.*

The VCR variables for trees 5.0 inches in d.b.h. or larger are live-crown ratio, crown diameter, crown density, foliage transparency, and crown dieback. Additional information about the VCR indicator is available in Anderson and Belanger (1987), Belanger and Anderson (1989), and Millers and others (1992).

Live-crown ratio is the proportion of total tree height that supports live foliage that effectively contributes to tree growth. Dead tops and dead lower branches are excluded. This variable is associated with tree vigor and d.b.h. growth (Millers and others 1992).

Crown diameter is the average of the width of the tree crown at its widest point and the width of the crown 90 degrees from the widest point. This is another indicator of tree vigor (Millers and others 1992).

Crown density is an estimate of the percentage of skylight obstructed by branches, foliage, and reproductive structures. Anderson and Belanger (1987) found that high crown density percentages are positively correlated with radial growth in loblolly and shortleaf pines.

Foliage transparency is the amount of skylight visible through the live, normally foliated portion of the crown. Dead portions of the crown are excluded as are large gaps and holes. This rating is an indicator of the amount of foliage in the crown.

Crown dieback is branch mortality that starts near the terminal and proceeds toward the trunk. Usually, dieback occurs in the upper part of the crown and is a symptom of other problems. Branches in the lower part of the crown that die from competition are not counted as dieback.

Crown-vigor class applies only to trees from 1.0 to 4.9 inches in d.b.h. and is the only VCR datum presented for these trees. This description separates trees in obviously good condition from those in obviously poor condition. A tree must meet three criteria to be classified as good. First, at least one-third of its length must have live foliage. Second, there can be no dieback in the upper half of the crown. Third, at least 80 percent of the foliage must be undamaged. When a tree does not qualify as good, it is rated either as average or as poor. Average and poor trees can have any portion of their length in live foliage and can have any amount of dieback. A tree is classified as poor when at least 80 percent of its foliage is missing or abnormal. A tree is classified as average when 20 to 80 percent of its foliage is normal.

Findings

Field crews visited 349 plots in the three States, and they measured 9,631 trees (table 1). About 24 percent of the trees were from 1.0 through 4.9 inches in d.b.h. and occurred on the microplots. Seventy-four percent of the trees 5.0 inches in d.b.h. and larger were classified as overstory trees. About 49 percent of the overstory trees were softwoods, and 51 percent, hardwoods (table 2).

Ninety-nine percent of the overstory trees had average or good crown density (table 3). Shortleaf pine, other softwoods, and other hardwoods were the only species groups in which more than 2 percent of the overstory trees had poor crown density. The methods used to estimate crown density in 1991 and 1992 differed slightly, so findings for 1991 and 1992 are not directly comparable.

More than 99 percent of the overstory trees were classified as having normal transparency in 1992 (table 4) as compared to 97 percent in 1991. The proportion of shortleaf pine and sweetgum in the normal class decreased whereas proportions of trees with normal crown transparency increased slightly for other species.

Ninety-three percent of the softwoods and 79 percent of the hardwoods had no crown dieback (table 5). In 1991, 98 percent of the softwoods and 85 percent of the hardwoods had no dieback. The proportion of trees with light dieback increased slightly in all species groups except slash pine and hickories. There was little change in the proportion of trees with moderate or severe (21 percent or more) dieback.

Eighty-one percent of all softwoods and about 62 percent of all hardwoods had no damage in 1992 (table 6). Disease was the most common damaging agent for softwoods, and unknown agents caused the highest percentage of damage in hardwoods. Overall, the percentage of trees with damage decreased from 1991 to 1992, and the proportion of slash pine and maples

Table 1.— ***Number of plots and trees measured by State, Southern Forest Health Monitoring Region, 1992***

State	Plots	Trees sampled			
		1.0-4.9 inches in d.b.h.	≥ 5.0 inches in d.b.h.		Total trees
			Understory	Overstory	
		Number			
Alabama	124	850	767	1,753	3,370
Georgia	127	776	495	1,908	3,179
Virginia	98	711	603	1,768	3,082
Total	349	2,337	1,865	5,429	9,631

exhibiting damage was slightly greater in 1991 than in 1992.

More than 90 percent of the saplings had average or good crown vigor (table 7). There were no dramatic shifts in crown-vigor class.

FINDINGS FROM OFF-FRAME ACTIVITIES

The off-plot Forest Health Monitoring data discussed here come from a variety of sources, including the USDA Forest Service (Forest Health Unit and Forest Inventory and Analysis), cooperating State agencies, and non-Forest Service Federal agencies.

Fusiform Rust

In 1992, fusiform rust continued to be the most damaging disease of loblolly and slash pines in the South (table 8). According to the most recent estimates, which are based on data from Forest Inventory and Analysis plots, almost one-third of all loblolly and slash pine acres were infected with at least 10 percent of the loblolly and slash pines having a potentially lethal canker (on or within **12** inches of the stem).

Southern Pine Beetle

Southern pine beetle activity expanded markedly in 1992, with pockets of outbreaks scattered across

Table 2.— ***Number of trees sampled by selected species group, tree size, and crown position, Southern Forest Health Monitoring Region, 1992***

Species group	1.0-4.9 inches in d.b.h.	≥ 5.0 inches in d.b.h.	
		Understory	Overstory
	Number		
Softwoods			
Longleaf pine	7	12	91
Slash pine	25	17	284
Shortleaf pine	28	58	213
Loblolly pine	298	131	1,535
Virginia pine	29	69	365
Other softwoods	39	55	140
All softwoods	426	342	2,628
Hardwoods			
White oaks	90	223	570
Red oaks	323	196	639
Maples	250	210	246
Sweetgum	271	182	349
Yellow-poplar	73	61	303
Blackgum	164	150	182
Hickories	107	121	197
Other hardwoods	633	380	315
All hardwoods	1,911	1,523	2,801
All species	2,337	1,865	5,429

Table 3.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-density class, Southern Forest Health Monitoring Region, 1992*

Species group	Sample size	Crown-density class: Good (>50%)	Average (21–50%)	Poor (1–20%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	91	18.7	80.2	1.1
Slash pine	284	35.6	63.7	0.7
Shortleaf pine	213	21.6	72.8	5.6
Loblolly pine	1,538	26.6	72.6	0.6
Virginia pine	365	21.1	77.5	1.4
Other softwoods	140	25.7	70.7	3.6
All softwoods	2,628	26.1	72.6	1.3
Hardwoods				
White oaks	570	29.3	70.2	1.1
Red oaks	639	26.4	73.2	0.3
Maples	246	34.1	64.6	1.6
Sweetgum	349	38.4	59.9	1.7
Yellow-poplar	303	50.5	49.5	0.0
Blackgum	182	26.4	73.6	0.0
Hickories	197	37.6	61.9	0.5
Other hardwoods	315	34.0	63.5	2.5
All hardwoods	2,801	33.4	65.8	0.8
All species	5,429	29.9	69.1	1.0

*Because of rounding, percentages may not sum to 100.

Table 4.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and foliage-transparency class, Southern Forest Health Monitoring Region, 1992*

Species group	Sample size	Foliage-transparency class: Normal (0–30%)	Moderate (31–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	91	100.0	0.0	0.0
Slash pine	284	100.0	0.0	0.0
Shortleaf pine	213	98.1	0.9	0.9
Loblolly pine	1,535	99.9	0.1	0.0
Virginia pine	365	96.7	2.2	1.1
Other softwoods	140	98.6	0.7	0.7
All softwoods	2,628	99.3	0.5	0.3
Hardwoods				
White oaks	573	100.0	0.0	0.0
Red oaks	639	100.0	0.0	0.0
Maples	246	98.4	0.4	1.2
Sweetgum	349	99.1	0.0	0.9
Yellow-poplar	303	100.0	0.0	0.0
Blackgum	182	100.0	0.0	0.0
Hickories	198	99.5	0.5	0.0
Other hardwoods	315	97.8	0.6	1.6
All hardwoods	2,801	99.5	0.1	0.4
All species	5,429	99.4	0.3	0.3

*Because of rounding, percentages may not sum to 100.

Table 5.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-dieback class, Southern Forest Health Monitoring Region, 1992*

Species group	Sample size	Crown-dieback class: None (0–5%)	Light (6–20%)	Moderate (21–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**			
Softwoods					
Longleaf pine	91	91.2	8.8	0.0	0.0
Slash pine	284	99.7	0.3	0.0	0.0
Shortleaf pine	213	88.3	9.9	1.4	0.4
Loblolly pine	1,535	93.9	5.6	0.0	0.5
Virginia pine	365	89.3	10.1	0.5	0.0
Other softwoods	140	87.1	12.9	0.0	0.0
All softwoods	2,628	93.0	6.5	0.2	0.3
Hardwoods					
White oaks	570	73.3	26.5	0.2	0.0
Red oaks	639	67.6	30.4	1.7	0.3
Maples	246	82.1	14.2	2.4	1.2
Sweetgum	349	83.1	14.3	1.7	0.9
Yellow-poplar	303	95.4	4.6	0.0	0.0
Blackgum	182	85.3	14.8	0.0	0.0
Hickories	198	85.8	13.6	0.0	0.5
Other hardwoods	315	81.6	14.9	1.6	1.9
All hardwoods	2,801	79.0	19.5	1.0	0.5
All species	5,429	85.8	13.2	0.6	0.4

*Because of rounding, percentages may not sum to 100.

the region. With the exception of South Carolina and Mississippi, all States reporting outbreak conditions in 1991 saw significant increases in beetle activity. Total reported spots increased 59 percent, and infested acreage increased by almost one-third (to 14,307,204 acres). Although there was conspicuous activity in the Piedmont, the Gulf States had the heaviest losses. The number of outbreaks in Louisiana and Texas doubled. Almost three-fourths of all infested acreage in the South was in Louisiana, Texas, and Alabama. Table 9 shows the number of spots per State in 1991 and in 1992. Figure 2 shows the number of outbreak acres per State for 1991 and 1992.

As in 1991, the beetle was especially troublesome in designated Texas wilderness areas where its activity threatened colonies of the red-cockaded woodpecker, an endangered species.

Biological evaluations by forest entomologists with the USDA Forest Service and cooperating State agencies predicted that the outbreak should generally intensify in 1993.

Figure 3 shows outbreak counties and parishes (i.e., those with more than one multiple-tree southern pine beetle spot per thousand acres of susceptible forest type) for 1992.

Dogwood Anthracnose

In 1992, dogwood anthracnose occurred in 163 mountain and piedmont counties—a 13.9-percent in-

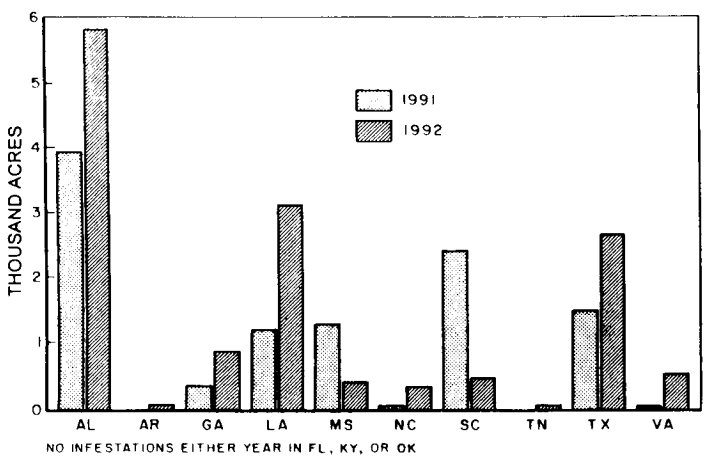

Figure 2.— *Southern pine beetle outbreak by State, 1991 and 1992.*

Table 6.—*Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and cause of damage, Southern Forest Health Monitoring Region, 1992*

Species group	Sample size	None visible	Insects	Disease	Fire	Animal	Weather	Suppression	Logging and related	Other	Unknown
	Number	*Percentage of trees sampled**									
Softwoods											
Longleaf pine	91	91.2	2.2	0.0	0.0	0.0	1.1	0.0	2.2	0.0	3.3
Slash pine	284	80.3	0.0	9.9	0.0	0.0	0.3	0.3	1.4	0.3	7.4
Shortleaf pine	213	77.9	7.0	1.4	0.5	0.0	0.9	1.4	2.8	0.0	8.0
Loblolly pine	1,535	83.0	1.0	9.8	0.0	0.0	0.2	0.5	1.0	0.1	4.6
Virginia pine	365	74.8	2.5	1.9	0.0	0.5	0.8	4.4	0.8	2.2	12.1
Other softwoods	140	75.7	0.7	5.7	0.7	0.0	0.7	3.6	4.3	1.4	7.1
All softwoods	2,632	81.0	1.6	7.5	0.1	0.1	0.4	1.2	1.4	0.5	6.3
Hardwoods											
White oaks	570	50.7	20.5	2.3	0.0	0.0	1.0	7.2	2.3	0.9	15.1
Red oaks	639	67.0	5.6	2.2	0.6	0.3	0.8	4.4	2.7	0.5	16.0
Maples	246	49.2	2.0	18.7	0.4	1.6	0.8	4.5	4.1	0.8	17.9
Sweetgum	349	67.1	0.3	1.7	1.4	2.0	1.1	1.1	4.9	0.9	19.4
Yellow-poplar	303	67.7	2.3	0.7	0.7	0.0	1.3	5.9	3.0	1.0	17.5
Blackgum	182	69.8	0.0	1.1	0.0	0.5	1.7	0.0	4.4	1.1	21.4
Hickories	197	73.6	3.5	2.5	0.0	1.5	0.5	3.5	5.6	0.5	8.6
Other hardwoods	315	58.4	3.5	1.9	0.6	2.5	2.2	5.1	4.1	0.6	21.0
All hardwoods	2,801	61.9	6.6	3.6	0.5	0.9	1.1	4.5	3.5	0.7	17.0
All species	5,429	71.1	4.2	5.3	0.3	0.5	0.8	2.9	2.5	0.6	11.8

*Because of rounding, percentages may not sum to 100.

Table 7.— *Distribution of trees 1.0 to 4.9 inches in d.b.h. by selected species group and crown-vigor class, Southern Forest Health Monitoring Region, 1992*

Species group	Sample size	Crown-vigor class		
		Good	Average	Poor
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	7	0.0	85.7	14.3
Slash pine	25	64.0	28.0	8.0
Shortleaf pine	28	42.9	46.4	10.7
Loblolly pine	298	52.7	37.6	9.7
Virginia pine	29	37.9	48.3	13.8
Other softwoods	39	25.6	64.1	10.3
All softwoods	426	48.4	41.5	10.1
Hardwoods				
White oaks	90	27.8	60.0	12.2
Red oaks	323	36.5	57.6	5.9
Maples	250	25.2	69.6	5.2
Sweetgum	271	42.4	53.1	4.4
Yellow-poplar	73	30.1	64.4	5.5
Blackgum	164	26.8	64.6	8.6
Hickories	107	26.2	64.5	9.3
Other hardwoods	633	27.0	66.5	6.5
All hardwoods	1,911	30.7	62.8	6.5
All species	2,337	33.9	59.0	7.1

*Because of rounding, percentages may not sum to 100.

Table 8.— *Loblolly and slash pine acreage affected by fusiform rust in the South, 1992*

State	Survey year	Acres infected	Percentage of host acres infected
		Acres	*Percent*
Alabama	1982	2,621,271	34
Arkansas	1988	307,378	8
Florida	1987	1,332,314	23
Georgia	1989	4,981,954	53
Louisiana	1984	1,784,550	30
Mississippi	1987	2,018,505	32
North Carolina	1990	1,116,555	29
Oklahoma	1986	22,525	6
South Carolina	1986	1,840,545	40
Texas	1986	624,814	12
Virginia	1986	70,534	4
Total		16,720,945	
Mean			30

crease since 1991. Table 10 shows the increase in cumulative acreage affected by dogwood anthracnose from 1988 to 1992. As of 1992, more than 12 million acres have been affected by this disease.

The disease continued to be more severe above 3,000 feet where most of the dogwoods had died. At elevations between 2,000 and 3,000 feet, dogwoods in the shade were infested and dying. At elevations below 2,000 feet, the damage was most severe in cool, wet, shaded areas. It is too early to predict future losses. Loss of the dogwood is of major concern because of esthetic reasons and because the species is an important source of wildlife food and cover.

Figure 4 shows the locations of counties in which dogwood anthracnose infections were confirmed though laboratory diagnosis.

Oak Decline

Oak decline is a slow-acting disease syndrome involving interactions of several predisposing factors such as climate, microsite, and tree age, stress factors such as drought and insect defoliation, and contributions by secondary organisms such as two-lined chestnut borer and *Armillaria* root disease. Mature overstory trees on poor sites are most commonly affected. Oak decline continued to be a problem in areas where it was a problem in 1991. Figures 5 and 6 show survey sites on which oak decline was confirmed for upland and lowland oaks. The most serious impact was in States with mountainous terrain, probably because such terrain is associated with water stress and adverse microsite conditions. Information about oak decline in Kentucky was not available.

Table 9.— Number of *southern pine beetle spots by year*

State	1991	1992
Alabama	4,605	6,404
Arkansas	20	625
Georgia	4,303	5,640
Louisiana	4,509	8,923
Mississippi	5,628	4,352
North Carolina	475	1,828
South Carolina	1,697	1,518
Tennessee	4	428
Texas	2,755	5,500
Virginia	170	3
Total	24,166	38,346

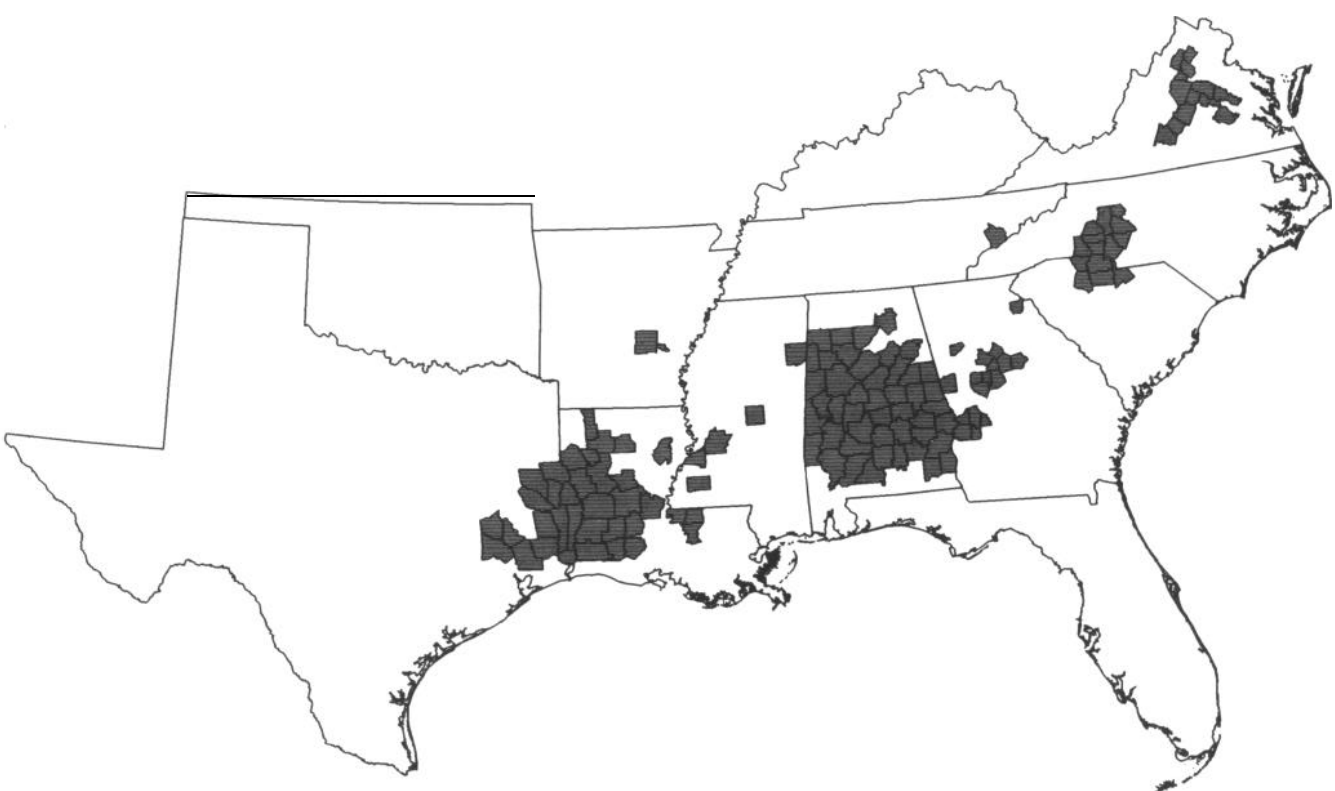

Figure 3.-Counties *with southern pine beetle outbreak,* 1992.

Table *lO.-Cumulative acreage affected by dogwood anthracnose, 1988-1992*

State	1988	1989	1990	1991	1992
			acres		
Alabama*	--	--	--	--	199,144
Georgia	153,875	369,415	832,922	1,059,661	1,265,688
Kentucky*	--	--	--	--	1,436,830
North Carolina	123,507	531,730	1,519,769	1,873,725	1,896,199
South Carolina	158,292	295,675	737,177	804,559	790,479
Tennessee	253,172	655,962	1,313,190	2,043,899	2,918,166
Virginia	13,433	346,473	1,205,054	3,610,279	4,187,352

*Data not available until 1992.

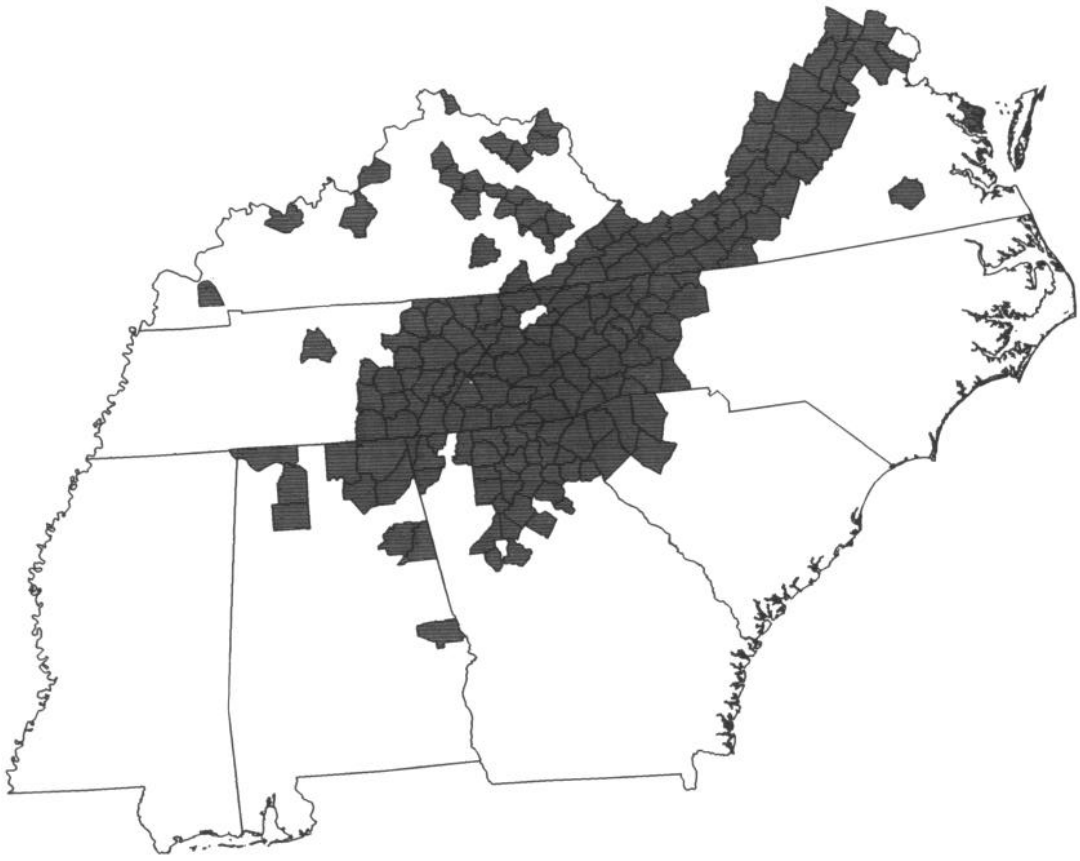

Figure *4.-Counties of the southeastern United States with confirmed dogwood anthracnose infections, 1992.*

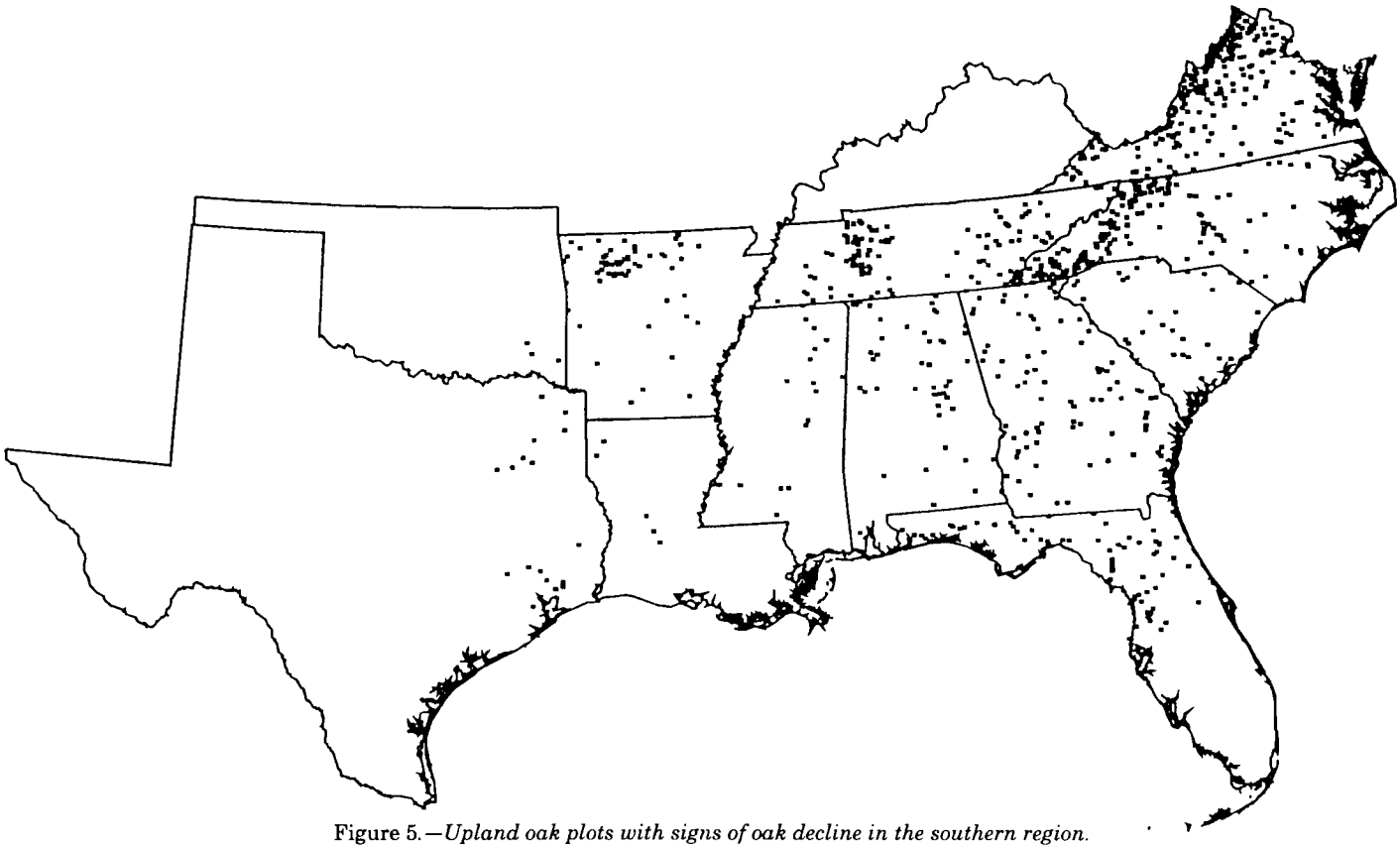

Figure 5.—*Upland oak plots with signs of oak decline in the southern region.*

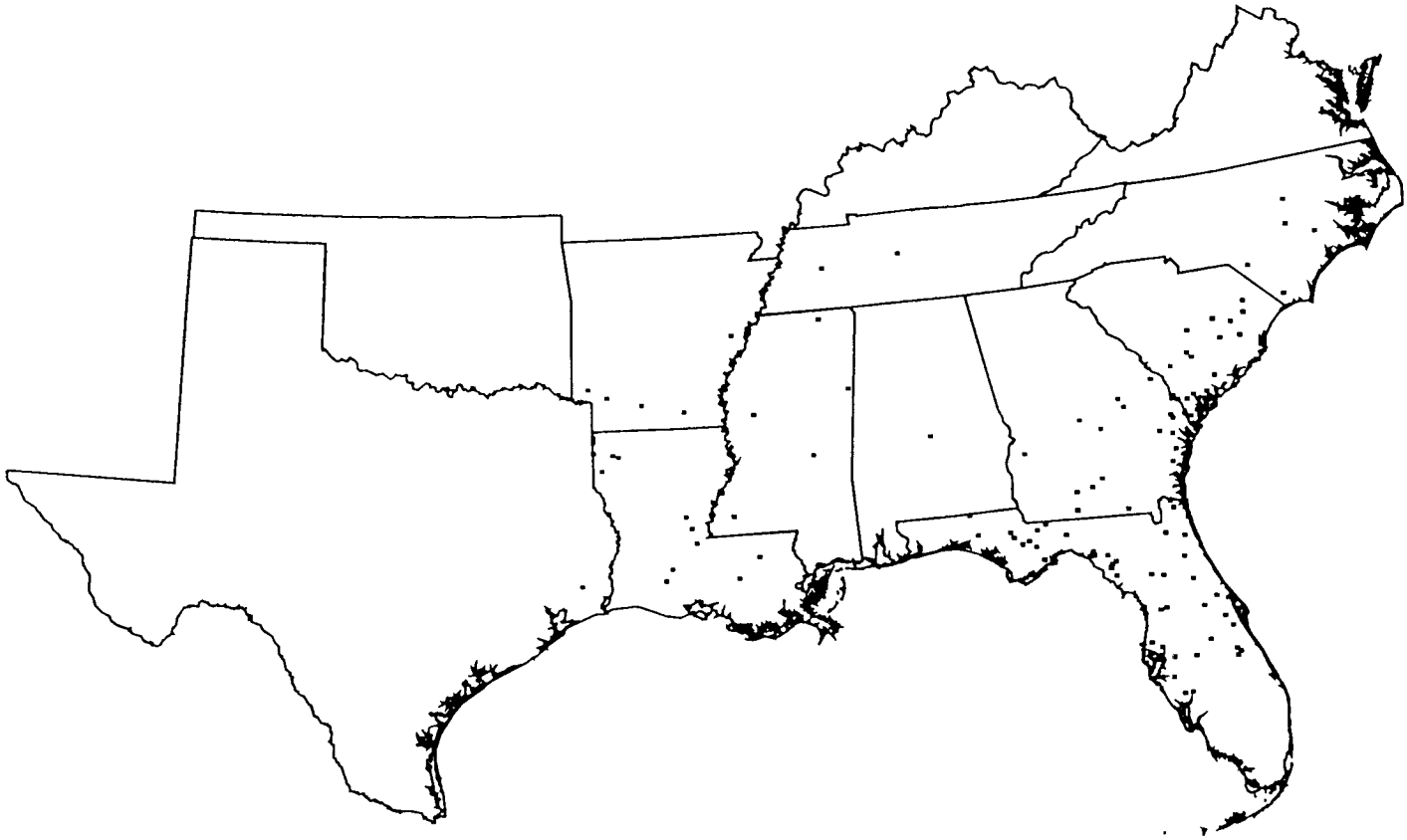

Figure 6.—*Bottomland oak plots with signs of oak decline in the southern region.*

Figure 7. -*Areas defoliated by gypsy moth, Virginia, 1992.*

Gypsy Moth

Gypsy moth continued its steady spread to the south and west, Federal and State records show that gypsy moth defoliated 616,300 acres in 1991 and 748,000 acres in 1992. Forty percent of all defoliation occurred on Federal lands, and one of every four defoliated acres was in the George Washington National Forest in northern Virginia.

Small, isolated infestations were also reported from North Carolina, Tennessee, Arkansas, and Georgia.

Figure 7 shows the location of defoliated areas in Virginia. Figure 8 shows percentages of acreage defoliated in George Washington National Forest, Shenandoah National Park, and all other ownerships.

Balsam Woolly Adelgid

Since its first appearance in the southern Appalachians in the 1950's, the balsam woolly adelgid (BWA) has spread and is now found in virtually every sizable concentration of spruce-fir forest type in the region.

The BWA slowly kills firs, usually within about 15 years. As a result, the age classes for Fraser fir are reduced, stands are smaller than normal, and numbers of red spruce, the other principal component of the spruce-fir forest type, are disproportionately large.

The BWA continues to be a serious concern, particularly because of the damage it does in scenic and recreational areas such as those along the Blue Ridge Parkway. Figure 9 shows the major concentrations of Fraser fir in the southern Appalachian Mountains.

Other Conditions Affecting Southern Forests in 1992

The fall cankerworm defoliated 85,000 acres in localized areas in North Carolina and southwest Virginia.

Forest, tent caterpillar defoliated more than 300,000 acres of water tupelo in Louisiana in the spring. Widespread light defoliation on blackgum was also reported in North Carolina, Virginia, and South Carolina.

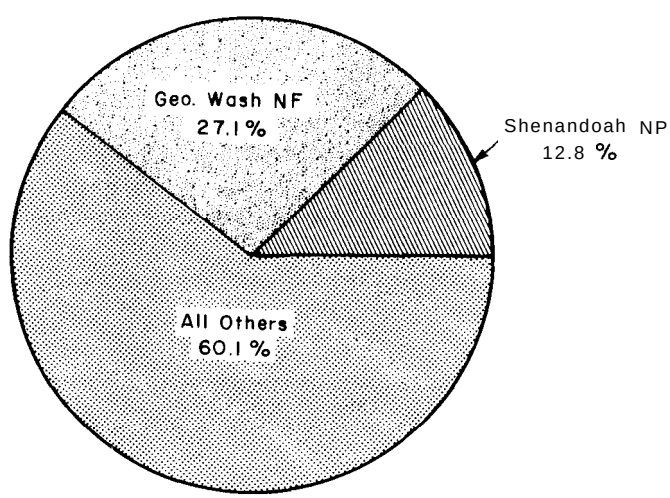

Figure 8.—*Percent of gypsy moth defoliation by Landowner land manager jurisdiction, Virginia, 1992.*

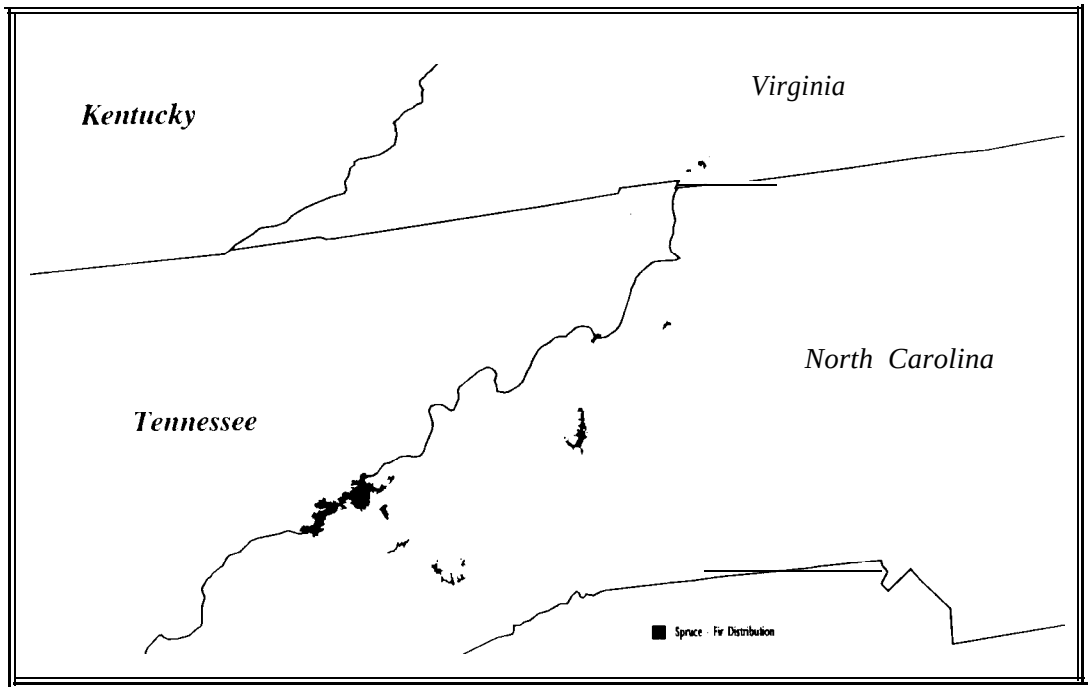

Figure 9. -*Fraser fir concentrations in the southern Appalachians.*

Locust leafminer, normally a relatively inconsequential insect, caused widespread damage in the southern Appalachians, especially in western North Carolina and eastern Tennessee.

Butternut canker continued to spread in the South. The disease had eliminated 77 percent of the butternut throughout the region by 1992.

Anthracnose incidence (various species) was high in 1992 because of unusually wet spring conditions.

Oak wilt intensified in the South in 1992. Particularly hard hit was Texas, where infections occurred in 46 counties. Gypsy moth defoliations complicated oak wilt surveys in Virginia.

In Florida, ocean rise continued to cause widespread mortality of coastal cabbage palms (see 1991 report).

DISCUSSION

The crowns of the great majority of sampled trees appeared normal. Only 1 percent of the sample trees had poor crown density, severe foliage transparency, or moderate to severe crown dieback. These data do not suggest any widespread changes in the crowns since 1991.

On the other hand, the proportion of damaged trees decreased from 37 percent in 1991 to 29 percent in 1992. Much of the decrease was in the hardwood species (52 percent exhibited damage in 1991 and 38 percent exhibited damage in 1992). In 1991, 11.8 percent of the hardwoods had weather damage, but only 1.1 percent exhibited such damage in 1992. Some damaged trees may have died between the two assessments. Also, weather damage increases the susceptibility of trees to insects and diseases, and these may have supplanted weather as the most severe damage in some instances. It is not known whether the amounts of damage or the observed changes are unusual.

The regional patterns also hold for the States where on-frame work was done (Appendix, tables 1-18). Poor crown ratings were assigned to only a very small percentage of overstory trees in each State. The proportion of damaged trees decreased in all States. The incidence of damage followed the same spatial pattern described by Bechtold and others (1992). The proportion of trees damaged in Virginia was 42 percent, compared to 27 percent in Georgia and 18 percent in Alabama.

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APPENDIX

Table 1.— *Number of trees sampled by selected species group, tree size, and crown position, Alabama, 1992*

Species group	1.0–4.9 inches in d.b.h.	≥ 5.0 inches in d.b.h.	
		Understory	Overstory
	Number of stems		
Softwoods			
Longleaf pine	7	9	50
Slash pine	4	0	9
Shortleaf pine	9	26	52
Loblolly pine	91	59	644
Virginia pine	8	29	54
Other softwoods	4	13	42
All softwoods	123	136	851
Hardwoods			
White oaks	40	72	108
Red oaks	123	101	231
Maples	85	60	42
Sweetgum	106	105	156
Yellow-poplar	18	8	70
Blackgum	58	70	91
Hickories	38	56	82
Other hardwoods	259	159	122
All hardwoods	727	631	902
All species	850	767	1,753

Table 2.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-density class, Alabama, 1992*

Species group	Sample size	Crown-density class		
		Good (>50%)	Average (21–50%)	Poor (1–20%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	50	14.0	84.0	2.0
Slash pine	9	11.1	66.7	22.2
Shortleaf pine	52	15.4	76.9	7.7
Loblolly pine	644	11.2	87.6	1.2
Virginia pine	54	13.0	83.3	3.7
Other softwoods	42	16.7	80.9	2.4
All softwoods	851	12.0	85.9	2.1
Hardwoods				
White oaks	108	19.4	78.7	1.9
Red oaks	231	17.3	82.3	0.4
Maples	42	16.7	83.3	0.0
Sweetgum	156	22.4	76.3	1.3
Yellow-poplar	70	25.7	74.3	0.0
Blackgum	91	5.5	94.5	0.0
Hickories	82	13.4	86.6	0.0
Other hardwoods	122	19.7	78.7	1.6
All hardwoods	902	17.8	81.4	0.8
All species	1,753	15.0	83.6	1.4

*Because of rounding, percentages may not sum to 100.

Table 3.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and foliage-transparency class, Alabama, 1992*

Species group	Sample size	Foliage-transparency class: Normal (0–30%)	Moderate (31–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	50	100.0	0.0	0.0
Slash pine	9	100.0	0.0	0.0
Shortleaf pine	52	100.0	0.0	0.0
Loblolly pine	644	100.0	0.0	0.0
Virginia pine	54	96.3	3.7	0.0
Other softwoods	42	97.6	0.0	2.4
All softwoods	851	99.6	0.2	0.1
Hardwoods				
White oaks	108	100.0	0.0	0.0
Red oaks	231	100.0	0.0	0.0
Maples	42	100.0	0.0	0.0
Sweetgum	156	100.0	0.0	0.0
Yellow-poplar	70	100.0	0.0	0.0
Blackgum	91	100.0	0.0	0.0
Hickories	82	100.0	0.0	0.0
Other hardwoods	122	100.0	0.0	0.0
All hardwoods	902	100.0	0.0	0.0
All species	1,753	99.8	0.1	0.1

*Because of rounding, percentages may not sum to 100.

Table 4.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-dieback class, Alabama, 1992*

Species group	Sample size	Crown-dieback class: None (0–5%)	Light (6–20%)	Moderate (21–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**			
Softwoods					
Longleaf pine	50	88.0	12.0	0.0	0.0
Slash pine	9	100.0	0.0	0.0	0.0
Shortleaf pine	52	78.9	21.1	0.0	0.0
Loblolly pine	644	89.9	8.9	0.0	1.2
Virginia pine	54	83.3	16.7	0.0	0.0
Other softwoods	42	80.9	19.0	0.0	0.0
All softwoods	851	88.4	10.7	0.0	0.9
Hardwoods					
White oaks	108	89.8	10.1	0.0	0.0
Red oaks	231	72.3	26.4	1.3	0.0
Maples	42	78.6	19.0	0.0	2.4
Sweetgum	156	85.9	12.8	1.3	0.0
Yellow-poplar	70	95.7	4.3	0.0	0.0
Blackgum	91	84.6	15.4	0.0	0.0
Hickories	82	90.2	9.8	0.0	0.0
Other hardwoods	122	86.1	13.1	0.8	0.0
All hardwoods	902	83.6	15.6	0.7	0.1
All species	1,753	85.9	13.2	0.4	0.5

*Because of rounding, percentages may not sum to 100.

Table 5.—*Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and cause of damage, Alabama, 1992*

Species group	Sample size	None visible	Insects	Disease	Fire	Animal	Weather	Suppression	Logging and related	Other	Unknown
	Number	*Percentage of trees sampled**									
Softwoods											
Longleaf pine	50	94.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0
Slash pine	9	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shortleaf pine	52	88.5	0.0	0.0	1.9	0.0	0.0	0.0	5.8	0.0	3.9
Loblolly pine	644	80.4	1.5	11.5	0.0	0.0	0.3	0.3	0.9	0.0	5.0
Virginia pine	54	83.3	0.0	7.4	0.0	0.0	3.7	1.9	1.9	0.0	1.9
Other softwoods	42	73.8	0.0	4.8	2.4	0.0	2.4	0.0	9.5	0.0	7.1
All softwoods	851	81.8	1.2	9.4	0.2	0.0	0.7	0.4	1.8	0.0	4.6
Hardwoods											
White oaks	108	86.1	0.0	3.7	0.0	0.0	0.0	0.0	3.7	0.0	6.5
Red oaks	231	84.9	0.0	1.7	1.7	0.0	0.4	0.4	1.7	0.0	9.1
Maples	42	73.8	0.0	7.1	2.4	0.0	0.0	0.0	2.4	0.0	14.3
Sweetgum	156	76.9	0.0	1.9	3.2	1.3	0.6	1.3	7.1	0.0	7.7
Yellow-poplar	70	85.7	0.0	0.0	2.9	0.0	2.9	0.0	1.4	0.0	7.1
Blackgum	91	83.5	0.0	0.0	0.0	1.1	3.3	0.0	0.0	0.0	12.1
Hickories	82	91.5	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	6.1
Other hardwoods	122	76.2	0.0	0.8	1.6	0.8	2.5	2.5	3.3	0.8	11.5
All hardwoods	902	82.5	0.0	1.7	1.6	0.4	1.1	0.7	3.0	0.1	9.0
All species	1,753	82.1	0.6	5.4	0.9	0.2	0.9	0.5	2.4	0.1	6.9

*Because of rounding, percentages may not sum to 100.

Table 6.— *Distribution of trees 1.0 to 4.9 inches in d.b.h. by selected species group and crown-vigor class, Alabama, 1992*

Species group	Sample size	Crown-vigor class		
		Good	Average	Poor
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	7	0.0	85.7	14.3
Slash pine	4	0.0	75.0	25.0
Shortleaf pine	9	0.0	88.9	11.1
Loblolly pine	91	58.2	37.4	4.4
Virginia pine	8	75.0	25.0	0.0
Other softwoods	4	50.0	25.0	25.0
All softwoods	123	49.6	43.9	6.5
Hardwoods				
White oaks	40	30.0	57.5	12.5
Red oaks	123	32.5	62.6	4.5
Maples	85	32.9	63.5	3.5
Sweetgum	106	50.9	45.3	3.8
Yellow-poplar	18	38.9	55.6	5.6
Blackgum	58	20.7	69.0	10.3
Hickories	38	31.6	57.9	10.5
Other hardwoods	259	30.9	62.9	6.2
All hardwoods	727	33.7	60.1	6.2
All species	850	36.0	57.8	6.2

*Because of rounding, percentages may not sum to 100.

Table 7.— *Number of trees sampled by selected species group, tree size, and crown position, Georgia, 1992*

Species group	1.0–4.9 inches in d.b.h.	≥ 5.0 inches in d.b.h.	
		Understory	Overstory
	Number of stems		
Softwoods			
Longleaf pine	0	3	41
Slash pine	21	17	275
Shortleaf pine	17	29	134
Loblolly pine	136	57	575
Virginia pine	1	15	66
Other softwoods	7	15	36
All softwoods	182	136	1,127
Hardwoods			
White oaks	27	32	125
Red oaks	143	46	177
Maples	61	57	65
Sweetgum	88	35	128
Yellow-poplar	17	17	82
Blackgum	60	52	84
Hickories	20	16	31
Other hardwoods	178	104	89
All hardwoods	594	359	781
All species	776	495	1,908

Table 8.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-density class, Georgia, 1992*

Species group	Sample size	Crown-density class: Good (>50%)	Average (21–50%)	Poor (1–20%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	41	24.4	75.6	0.0
Slash pine	275	36.4	63.6	0.0
Shortleaf pine	134	21.6	72.4	6.0
Loblolly pine	575	47.3	52.5	0.2
Virginia pine	66	34.9	61.6	4.5
Other softwoods	36	19.4	69.4	11.1
All softwoods	1,127	39.1	59.4	1.4
Hardwoods				
White oaks	125	43.2	56.0	0.8
Red oaks	177	42.4	57.1	0.6
Maples	65	47.7	52.3	0.0
Sweetgum	128	53.9	43.0	3.1
Yellow-poplar	82	68.3	31.7	0.0
Blackgum	84	46.4	53.6	0.0
Hickories	31	61.3	38.7	0.0
Other hardwoods	89	44.9	52.8	2.3
All hardwoods	781	49.0	49.9	1.0
All species	1,908	43.2	57.6	1.3

*Because of rounding, percentages may not sum to 100.

Table 9.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and foliage-transparency class, Georgia, 1992*

Species group	Sample size	Foliage-transparency class: Normal (0–30%)	Moderate (31–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	41	100.0	0.0	0.0
Slash pine	275	100.0	0.0	0.0
Shortleaf pine	134	97.0	1.5	1.5
Loblolly pine	575	99.8	0.2	0.0
Virginia pine	66	86.4	7.6	6.1
Other softwoods	36	100.0	0.0	0.0
All softwoods	1,127	98.8	0.7	0.5
Hardwoods				
White oaks	125	100.0	0.0	0.0
Red oaks	177	100.0	0.0	0.0
Maples	65	100.0	0.0	0.0
Sweetgum	128	98.4	0.0	1.6
Yellow-poplar	82	100.0	0.0	0.0
Blackgum	84	100.0	0.0	0.0
Hickories	31	100.0	0.0	0.0
Other hardwoods	89	96.6	1.1	2.3
All hardwoods	781	99.4	0.1	0.5
All species	1,908	99.0	0.5	0.5

*Because of rounding, percentages may not sum to 100.

Table 10.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-dieback class, Georgia, 1992*

Species group	Sample size	Crown-dieback class: None (0–5%)	Light (6–20%)	Moderate (21–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**			
Softwoods					
Longleaf pine	41	95.1	4.9	0.0	0.0
Slash pine	275	99.6	0.4	0.0	0.0
Shortleaf pine	134	95.5	3.0	0.7	0.7
Loblolly pine	575	97.2	2.8	0.0	0.0
Virginia pine	66	95.5	3.0	1.5	0.0
Other softwoods	36	88.9	11.1	0.0	0.0
All softwoods	1,127	97.2	2.6	0.2	0.1
Hardwoods					
White oaks	125	92.8	7.2	0.0	0.0
Red oaks	177	80.8	17.5	1.1	0.6
Maples	65	92.3	6.1	1.5	0.0
Sweetgum	128	84.4	12.5	1.6	1.6
Yellow-poplar	82	97.6	2.4	0.0	0.0
Blackgum	84	85.7	14.3	0.0	0.0
Hickories	31	93.5	3.2	0.0	3.2
Other hardwoods	89	83.1	12.4	2.3	2.3
All hardwoods	781	87.3	11.0	0.9	0.8
All species	1,908	93.1	6.0	0.5	0.4

*Because of rounding, percentages may not sum to 100.

Table 11.—*Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and cause of damage, Georgia, 1992*

Species group	Sample size	None visible	Insects	Disease	Fire	Animal	Weather	Suppression	Logging and related	Other	Unknown
	Number	*Percentage of trees sampled**									
Softwoods											
Longleaf pine	41	87.8	4.9	0.0	0.0	0.0	0.0	0.0	2.4	0.0	4.8
Slash pine	275	79.6	0.0	10.2	0.0	0.0	0.4	0.4	1.5	0.4	7.6
Shortleaf pine	134	73.9	9.7	2.2	0.0	0.0	0.0	1.5	2.2	0.0	10.5
Loblolly pine	575	78.8	0.0	13.2	0.0	0.0	0.2	0.5	1.4	0.2	5.7
Virginia pine	66	78.8	0.0	1.5	0.0	1.5	0.0	0.0	0.0	9.1	9.1
Other softwoods	36	80.6	0.0	5.6	0.0	0.0	0.0	0.0	5.6	5.6	2.8
All softwoods	1,127	78.9	1.3	9.8	0.0	0.1	0.2	0.5	1.6	1.0	6.8
Hardwoods											
White oaks	125	74.4	3.2	1.6	0.0	0.0	0.8	0.8	1.6	3.2	14.4
Red oaks	177	68.9	9.0	2.3	0.0	1.1	1.1	1.1	3.9	1.7	10.7
Maples	65	56.9	0.0	3.1	0.0	0.0	1.5	0.0	4.6	3.1	30.8
Sweetgum	128	59.4	0.8	1.6	0.0	3.9	0.0	1.6	0.8	1.6	30.5
Yellow-poplar	82	76.8	2.4	2.4	0.0	0.0	0.0	0.0	1.2	3.7	13.4
Blackgum	84	54.8	0.0	1.2	0.0	0.0	0.0	0.0	9.5	2.4	32.1
Hickories	31	80.7	0.0	6.5	0.0	6.5	0.0	0.0	0.0	0.0	6.5
Other hardwoods	89	55.1	2.3	1.1	0.0	7.9	0.0	1.1	5.6	0.0	27.0
All hardwoods	781	65.4	3.2	2.0	0.0	2.0	0.5	0.8	3.5	2.0	20.5
All species	1,908	73.3	2.1	6.6	0.0	0.9	0.3	0.6	2.3	1.4	12.4

*Because of rounding, percentages may not sum to 100.

Table 12.—*Distribution of trees 1.0 to 4.9 inches in d.b.h. by selected species group and crown-vigor class, Georgia, 1992*

Species group	Sample size	Crown-vigor class		
		Good	Average	Poor
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	0	--	--	--
Slash pine	21	76.2	19.1	4.8
Shortleaf pine	17	70.6	17.7	11.8
Loblolly pine	136	55.1	30.9	14.0
Virginia pine	1	0.0	100.0	0.0
Other softwoods	7	42.9	28.6	28.6
All softwoods	182	58.2	28.6	13.2
Hardwoods				
White oaks	27	44.4	55.6	0.0
Red oaks	143	53.1	41.3	5.6
Maples	61	49.2	44.3	6.6
Sweetgum	88	54.5	42.1	3.4
Yellow-poplar	17	76.5	23.5	0.0
Blackgum	60	40.0	51.7	8.3
Hickories	20	50.0	45.0	5.0
Other hardwoods	178	43.8	50.6	5.6
All hardwoods	594	49.0	45.8	5.2
All species	776	51.2	41.7	7.1

*Because of rounding, percentages may not sum to 100.

Table 13.—*Number of trees sampled by selected species group, tree size, and crown position, Virginia, 1992*

Species group	1.0–4.9 inches in d.b.h.	≥ 5.0 inches in d.b.h.	
		Understory	Overstory
	Number of stems		
Softwoods			
Longleaf pine	0	0	0
Slash pine	0	0	0
Shortleaf pine	2	3	27
Loblolly pine	71	15	316
Virginia pine	20	25	245
Other softwoods	28	27	62
All softwoods	121	70	650
Hardwoods			
White oaks	23	119	337
Red oaks	57	49	231
Maples	104	93	139
Sweetgum	77	42	65
Yellow-poplar	38	36	151
Blackgum	46	28	7
Hickories	49	49	84
Other hardwoods	196	117	104
All hardwoods	590	533	1,118
All species	711	603	1,768

Table 14.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-density class, Virginia, 1992*

Species group	Sample size	Crown-density class: Good (>50%)	Average (21–50%)	Poor (1–20%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	0	--	--	--
Slash pine	0	--	--	--
Shortleaf pine	27	33.3	66.7	0.0
Loblolly pine	316	20.6	79.4	0.0
Virginia pine	245	19.2	80.8	0.0
Other softwoods	62	35.5	64.5	0.0
All softwoods	650	22.0	78.0	0.0
Hardwoods				
White oaks	337	27.3	72.7	0.0
Red oaks	231	23.4	76.6	0.0
Maples	139	33.1	64.7	2.2
Sweetgum	65	46.1	53.9	0.0
Yellow-poplar	151	52.3	47.7	0.0
Blackgum	7	57.1	42.9	0.0
Hickories	84	52.4	46.4	1.2
Other hardwoods	104	41.3	54.8	3.9
All hardwoods	1,118	35.1	64.2	0.7
All species	1,768	30.3	69.3	0.5

*Because of rounding, percentages may not sum to 100.

Table 15.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and foliage-transparency class, Virginia, 1992*

Species group	Sample size	Foliage-transparency class: Normal (0–30%)	Moderate (31–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	0	--	--	--
Slash pine	0	--	--	--
Shortleaf pine	27	100.0	0.0	0.0
Loblolly pine	316	100.0	0.0	0.0
Virginia pine	245	99.6	0.4	0.0
Other softwoods	62	98.4	1.6	0.0
All softwoods	650	99.7	0.3	0.0
Hardwoods				
White oaks	337	100.0	0.0	0.0
Red oaks	231	100.0	0.0	0.0
Maples	139	97.1	0.7	2.2
Sweetgum	65	98.5	0.0	1.5
Yellow-poplar	151	100.0	0.0	0.0
Blackgum	7	100.0	0.0	0.0
Hickories	84	98.8	1.2	0.0
Other hardwoods	104	96.1	1.0	2.9
All hardwoods	1,118	99.1	0.3	0.6
All species	1,768	99.3	0.3	0.4

*Percentages may not sum to 100 due to rounding.

Table 16.— *Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and crown-dieback class, Virginia, 1992*

Species group	Sample size	Crown-dieback class: None (0–5%)	Light (6–20%)	Moderate (21–50%)	Severe (>50%)
	Number	*Percentage of trees sampled**			
Softwoods					
Longleaf pine	0	--	--	--	--
Slash pine	0	--	--	--	--
Shortleaf pine	27	70.4	22.2	7.4	0.0
Loblolly pine	316	95.9	4.1	0.0	0.0
Virginia pine	245	89.0	10.6	0.4	0.0
Other softwoods	62	90.3	9.7	0.0	0.0
All softwoods	650	91.7	7.8	0.5	0.0
Hardwoods					
White oaks	337	60.8	38.9	0.3	0.0
Red oaks	231	52.8	44.2	2.6	0.4
Maples	139	78.4	16.5	3.6	1.4
Sweetgum	65	73.9	21.5	3.1	1.5
Yellow-poplar	151	94.0	6.0	0.0	0.0
Blackgum	7	85.7	14.3	0.0	0.0
Hickories	84	78.6	21.4	0.0	0.0
Other hardwoods	104	75.0	19.2	1.9	3.9
All hardwoods	1,118	69.4	28.4	1.4	0.7
All species	1,768	77.6	20.9	1.1	0.5

*Because of rounding, percentages may not sum to 100.

Table 17.—*Distribution of 5.0-inch d.b.h. and larger overstory trees by selected species group and cause of damage, Virginia, 1992*

Species group	Sample size	None visible	Insects	Disease	Fire	Animal	Weather	Suppression	Logging and related	Other	Unknown
	Number	*Percentage of trees sampled**									
Softwoods											
Longleaf pine	0	--	--	--	--	--	--	--	--	--	--
Slash pine	0	--	--	--	--	--	--	--	--	--	--
Shortleaf pine	27	77.8	7.4	0.0	0.0	0.0	7.4	3.7	0.0	0.0	3.7
Loblolly pine	316	25.9	1.6	0.0	0.0	0.0	0.0	0.6	0.3	0.0	1.6
Virginia pine	245	71.8	3.7	0.8	0.0	0.4	0.4	6.1	0.8	0.8	15.1
Other softwoods	62	74.2	1.6	6.5	0.0	0.0	0.0	8.1	0.0	0.0	9.7
All softwoods	650	84.0	2.6	0.9	0.0	0.2	0.5	3.5	0.5	0.3	7.5
Hardwoods											
White oaks	337	30.6	33.5	2.1	0.0	0.0	1.5	11.9	2.1	0.3	18.1
Red oaks	231	47.6	8.7	2.6	0.0	0.0	0.9	10.8	2.6	0.0	26.8
Maples	139	38.1	3.6	29.5	0.0	2.9	0.7	7.9	4.3	0.0	12.9
Sweetgum	65	58.5	0.0	1.5	0.0	0.0	4.6	0.0	7.7	1.5	26.1
Yellow-poplar	151	54.3	3.3	0.0	0.0	0.0	1.3	11.9	4.6	0.0	24.5
Blackgum	7	71.4	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	14.3
Hickories	84	53.6	8.3	3.6	0.0	1.2	1.2	8.3	10.7	1.2	11.9
Other hardwoods	104	40.4	8.7	3.9	0.0	0.0	3.9	11.5	3.9	0.9	26.9
All hardwoods	1,118	42.8	14.2	5.6	0.0	0.4	1.6	10.1	3.9	0.4	20.9
All species	1,768	57.9	9.9	3.9	0.0	0.3	1.2	7.7	2.7	0.3	16.0

*Because of rounding, percentages may not sum to 100.

Table 18.—*Distribution of trees 1.0 to 4.9 inches in d.b.h. by selected species group and crown-vigor class, Virginia, 1992*

Species group	Sample size	Crown-vigor class		
		Good	Average	Poor
	Number	*Percentage of trees sampled**		
Softwoods				
Longleaf pine	0	--	--	--
Slash pine	0	--	--	--
Shortleaf pine	2	0.0	100.0	0.0
Loblolly pine	71	40.9	50.7	8.5
Virginia pine	20	25.0	55.0	20.0
Other softwoods	28	17.9	78.6	3.6
All softwoods	121	32.2	58.7	9.1
Hardwoods				
White oaks	23	4.3	69.6	26.1
Red oaks	57	3.5	87.7	8.8
Maples	104	4.8	89.4	5.8
Sweetgum	77	16.9	76.6	6.5
Yellow-poplar	38	5.3	86.8	7.9
Blackgum	46	17.4	76.1	6.5
Hickories	49	12.2	77.5	10.2
Other hardwoods	196	6.6	85.7	7.7
All hardwoods	590	8.5	83.4	8.1
All species	711	12.5	79.2	8.3

*Because of rounding, percentages may not sum to 100.

Vissage, John S.; Hoffard, William H. 1997. Summary report: forest health monitoring in the South, 1992. Resour. Bull. SO-195. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 27 p.

In 1990, the U.S. Department of Agriculture, Forest Service and the U.S. Environmental Protection Agency launched a cooperative program, Forest Health Monitoring, to monitor the health of the Nation's forests. Several indicators of forest health have been measured on permanent plots in 14 States. Data gathered from Alabama, Georgia, and Virginia in 1992 are summarized in this report. Simple percentage distributions of crown ratings and damage data from sample plots do not suggest any widespread problems in these States. Crown ratings were poor for only 1 percent of the sample trees. A synopsis of forest insect and disease surveys in the southern region shows that these pests continue to cause substantial damage.

Keywords: Detection monitoring, forest damage assessment, visual crown ratings.

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