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Forest Service
State & Private Forestry
Southeastern Area

Forest Insect and Disease Conditions in the South, 1980

David M. Webb

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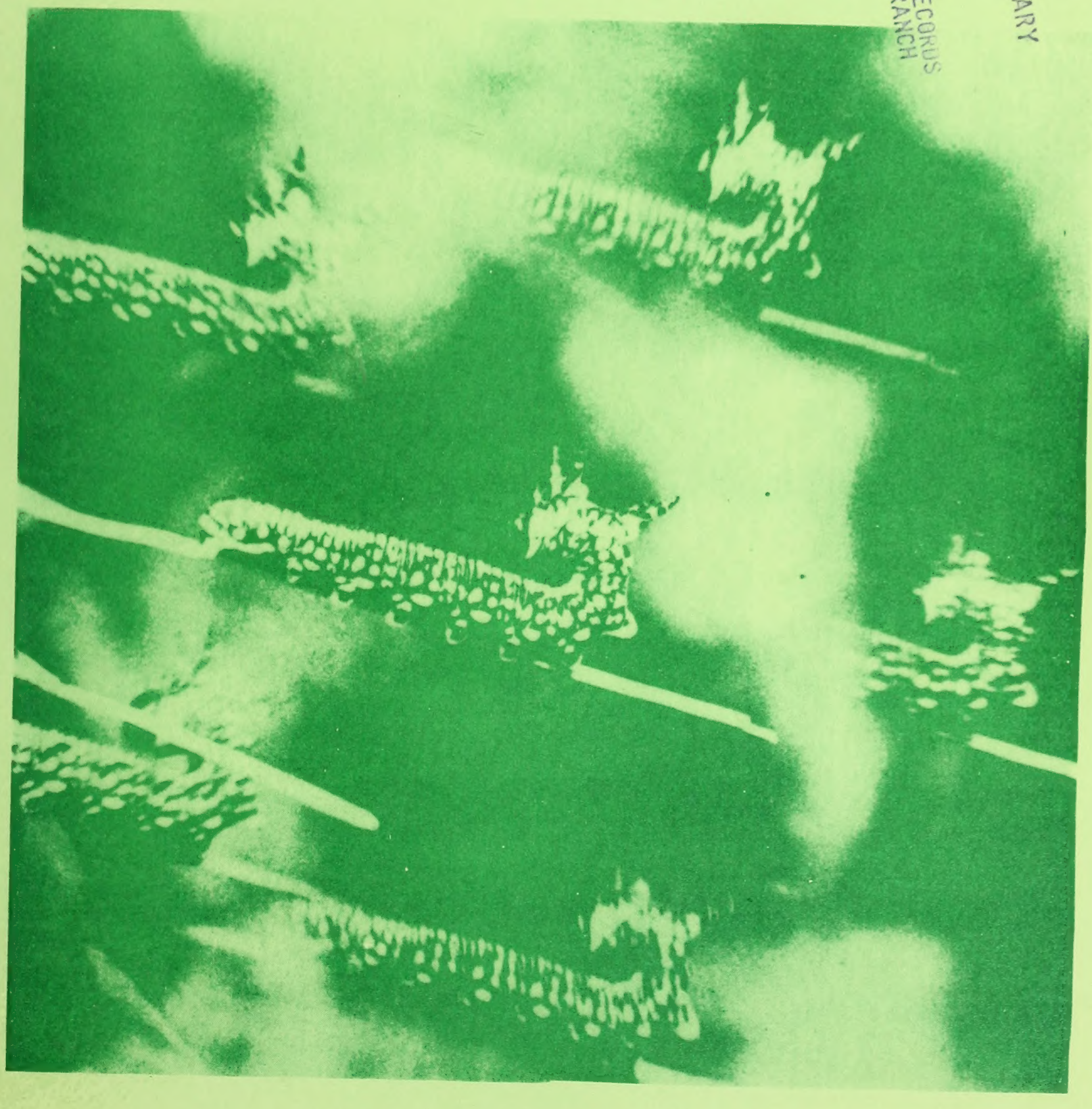

FOREST INSECT AND DISEASE CONDITIONS IN THE SOUTH, 1980

by

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PREFACE

This report documents the major forest insect and disease activity occurring in the South in 1980. It was compiled by the Forest Pest Management staff, State and Private Forestry, Southeastern Area, USDA Forest Service.

Pest management is an integral part of forest management because pest-caused damages can significantly affect management objectives. A major role of the pest management specialist is to help the forest manager make decisions about prevention, suppression, and long-term plans.

Forest entomologists and pathologists emphasize the use of integrated pest management strategies in dealing with forest pests. Integrated pest management involves the use of one or a combination of strategies to reduce the impact of a forest pest and restore it to natural levels within the forest environment. This can be accomplished through silvicultural, chemical, or biological means.

Proper forest management is the key to reducing losses caused by forest pests. Whenever possible, recommendations for prevention--usually through silvicultural means--are incorporated into the initial stages of the forest planning process. However, prevention is not always possible, even in carefully planned forests, because of the dynamic nature of forest pests.

When outbreaks occur, suppression alternatives are evaluated by the Forest Pest Management staff from the standpoint of environmental safety, effectiveness, and economic efficiency. Forest managers consider these recommendations, plus suggestions from other specialists, when selecting the most suitable alternatives. Forest pest management specialists then provide technical assistance to accomplish the selected alternatives.

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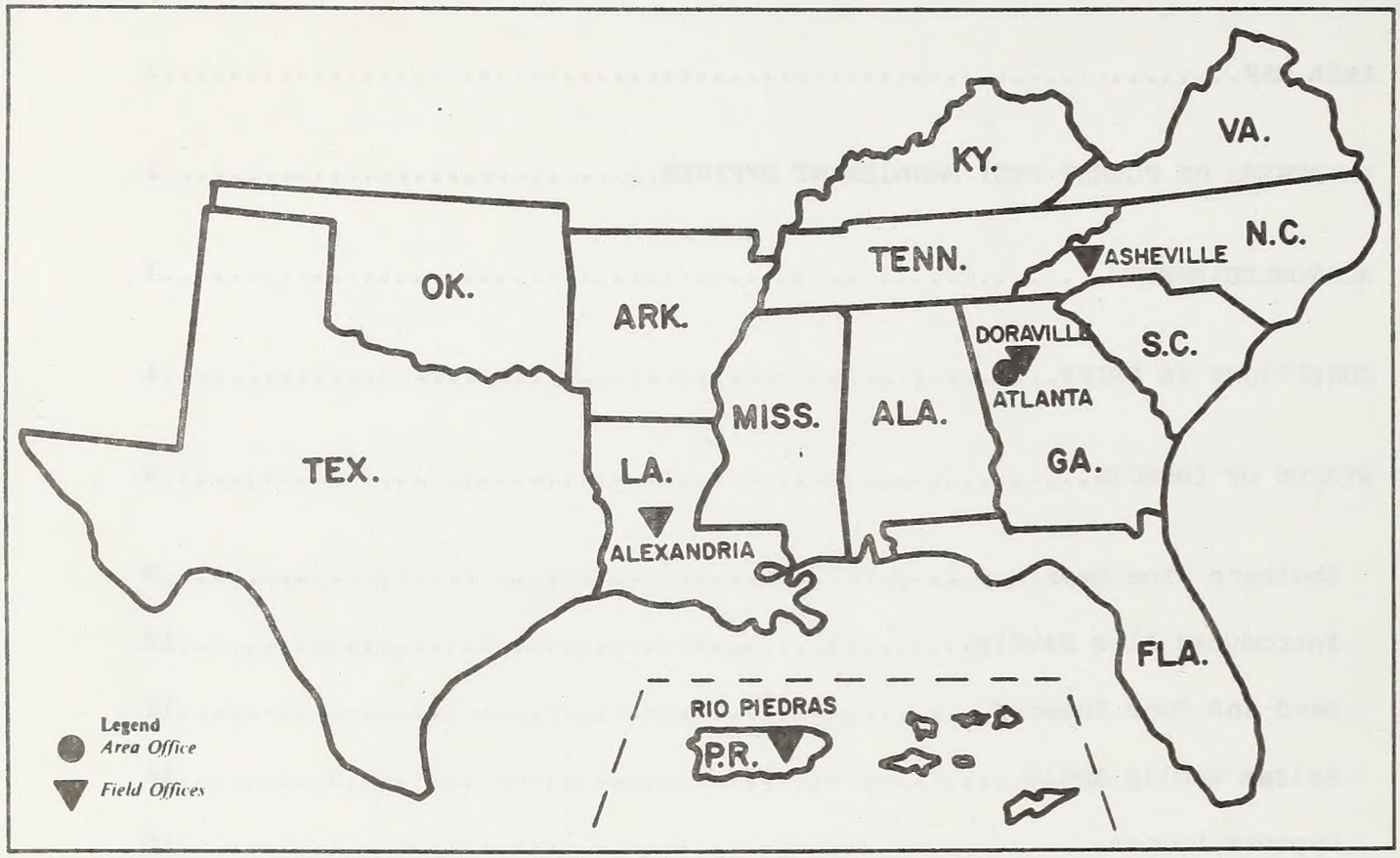

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CONDITIONS IN BRIEF

The southern pine beetle (SPB) continued to be the most damaging insect to southern forests. SPB-caused timber losses in Georgia, Alabama, Mississippi, and South Carolina decreased dramatically when compared to the 1979 damage level. However, populations continued to be active in these states at a static to decreasing level.

Population activity in Central Georgia declined most markedly. Activity increased in the coastal plain and piedmont areas of North Carolina and Virginia. Louisiana and Texas experienced very low activity. Epidemic areas were western South Carolina and the central parts of Georgia, Alabama, and Mississippi. A total of 245 counties experienced southern pine beetle activity. An estimated 290,522,000 cubic feet were killed, of which 160,217,000 cubic feet were salvaged on 246,488 acres.

Scattered losses attributable to other bark beetles were found throughout the South. An increasing number of small, multiple tree infestations, caused by the black turpentine beetle and Ips. spp., were reported.

The introduced pine sawfly caused severe defoliation of white pine within the insect's new range in the southern Appalachians. With the use of pheromone survey traps, the insect was detected in two separate outbreaks covering one million acres in Virginia and 3.8 million acres in Tennessee and North Carolina. In areas where repeated heavy defoliation occurred, branch and top dieback, as well as occasional mortality, were common.

Two parasites were reared and released in the areas of highest sawfly populations. A total of 143,500 parasites were reared for release this year. Monitoring of parasitized pupae indicated a reduction in sawfly populations. Parasitism increased from 4 percent to 45 percent at release sites.

Seed and cone insects caused substantial losses to pine seed orchards from which superior growing stock is obtained to regenerate forest lands in the South. The webbing coneworm, Dioryctria disclusa, severely damaged loblolly pine cone crops in southern seed orchards from Virginia to Alabama. Damage was especially high in Virginia and North Carolina, where up to 90 percent of the crop was destroyed. A southwide damage evaluation survey indicated a total cone crop loss valued at nearly $3.5 million.

Other coneworm species caused additional damage to orchards which escaped the spring outbreak of D. disclusa. Many orchards reported coneworm losses exceeding 50 percent. Dioryctria amatella Hurst, and D. clarioralis Walker, were the principle insects responsible for mid and late season cone mortality. Preventive control efforts in seed orchards were targeted at epidemic populations of coneworms and seedbugs. Control efforts generally reduced expected losses from these pests.

The cypress looper, an insect native to the United States, caused extensive defoliation for the first time on record. Sixty thousand acres of mature cypress in the Big Cypress National Preserve in Florida were defoliated. Due to the physiology of the trees, the insect feeding caused complete defoliation, even when only partial damage occurred.

The Balsam woolly aphid continued to kill Fraser fir within its range in North Carolina and Tennessee.

Forest tent caterpillars caused lighter than usual defoliation on 815,000 acres of bottomland hardwood forests in southern Alabama and Louisiana.

Natural stands of cottonwoods and willow (20,000 acres) located in the Atchafalaya and Mississippi River basins were heavily defoliated by the poplar tentmaker.

Complexes of hardwood defoliators--including spring and fall cankerworms, linden loopers, orange striped oakworms, eastern tent caterpillars, walkingsticks, and elm leaf beetles--caused light defoliation in localized areas throughout the Southeast.

Town ants killed approximately 300,000 pine seedlings in Louisiana and eastern Texas. Losses were heaviest in one-year-old plantations and caused considerable economic impact in regeneration areas.

Fusiform rust continued to be the most serious disease of slash and loblolly pines. The disease was most severe in a wide land corridor from central Louisiana to South Carolina.

Annual losses attributed to fusiform rust were estimated at 562 million board feet of sawtimber and 194 million cubic feet of growing stock. Annual economic losses were estimated at $110 million. On about 3.8 million acres in the South, at least 50 percent of the trees had main stem or potential main stem cankers (branch cankers within 12 inches of the stem).

Annosus root rot continued to be a problem, primarily in thinned plantations. Based on survey results, three percent of the loblolly and slash pines in the South are dying or dead as a result of annosus root rot.

Sand pine root disease was found throughout the range of sand pine in Florida, and as far north as South Carolina. The disease destroyed a seed orchard valued at $250,000 and annual losses in Florida alone were estimated at about $7 million per year. About 331,100 acres were infected in Florida.

Drought caused serious problems in the South during the summer. The drought intensified the effect of Hypoxylon spp. in both urban and forest situations.

The pine wood nematode has become widespread throughout the Southeast. The overall impact of this newly discovered nematode is not known.

Pitch canker was detected in two nurseries at high levels (more than 30 percent of the trees diseased), but in the nine other orchards surveyed it was found to be at low to undetectable levels.

Decays and rots continued to be reported, although no exceptional damage seems to have occurred in conjunction with the drought.

STATUS OF INSECTS

Southern Pine Beetle

The current distribution of the southern pine beetle, Dendroctonus frontalis Zimm., in the South is shown in figure 1.

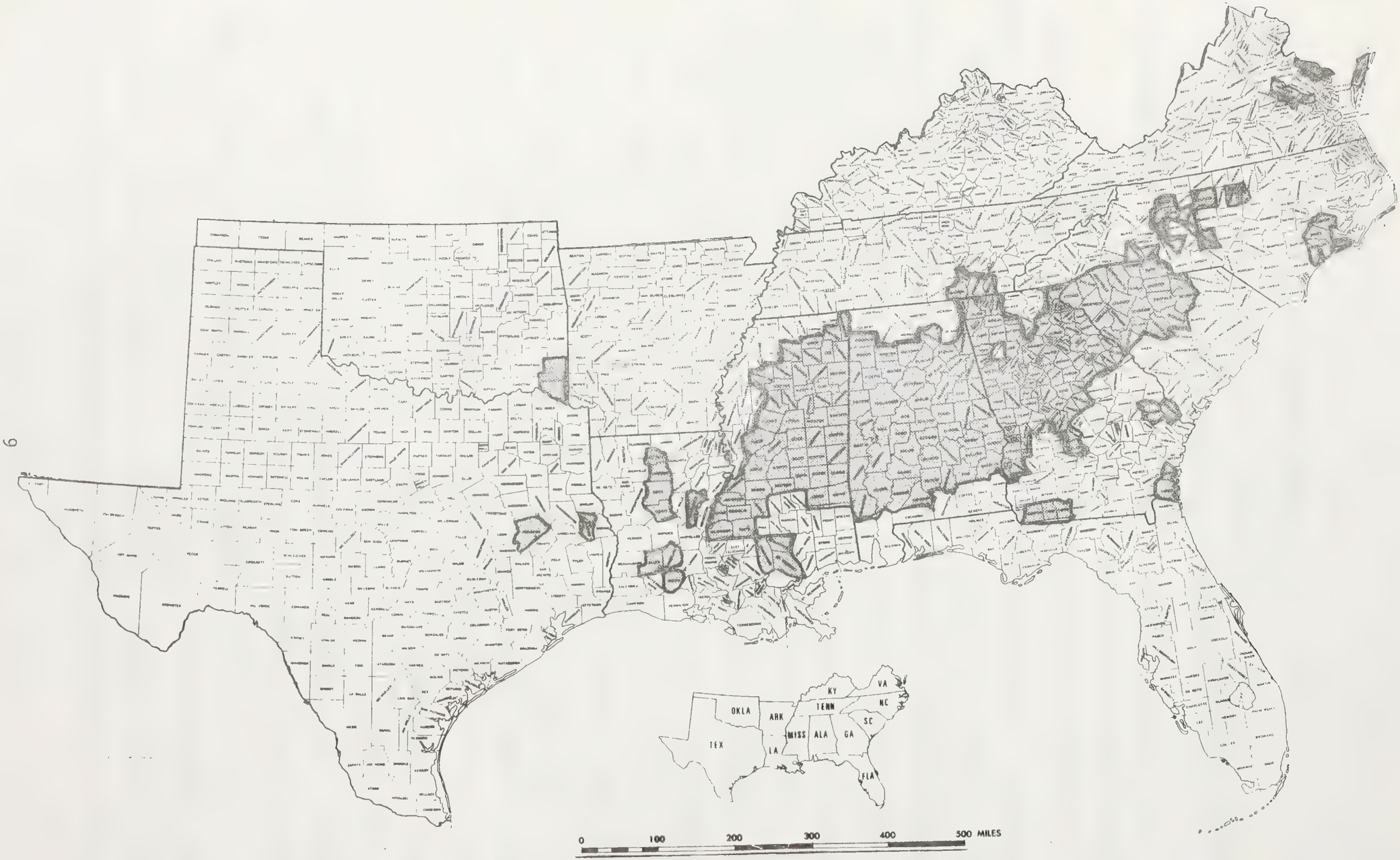
Southern pine beetle (SPB) infestations in the South have generally decreased. Following the 1979 epidemic, more emphasis was placed upon salvage removal of SPB-killed timber. The states of Georgia, Alabama, and South Carolina reported an economic return to landowners of $24.7 million, with over 50 percent of SPB-killed timber salvaged. Southern pine beetle suppression projects were conducted in five states during 1980.

In Alabama, SPB populations declined dramatically during the summer of 1980. About 10,000 spots (78 percent of the total spots) were detected the previous winter. About 2,800 spots (22 percent of the total spots) were detected during the summer, reflecting a decline in beetle activity during this period. Southern pine beetles killed $17.5 million worth of timber from July through October. State salvage operations on 94,763 acres minimized timber losses by $11.7 million. In addition, salvage operations on national forests resulted in the salvage removal of 3,775,000 cubic feet of beetle-killed timber.

These suppression projects salvaged 49 percent of the estimated total volume killed and protected an additional 139,755,000 cubic feet from potential loss if suppression activities had not been conducted.

In Georgia, southern pine beetle activity remained high during the first half of 1980, but showed a decline from the previous year. The heaviest beetle damage continued in the northeastern section of the state. The state of Georgia salvaged 69,798,000 cubic feet of pulpwood. The area treated

Figure 1--Counties with southern pine beetle activity during 1980.



through salvage was 107,382 acres, while 195 acres received chemical treatment. The SPB control project on the Oconee National Forest was very successful. An excellent effort was made to salvage as much beetle-infested timber as possible. The forest salvaged 2,284,400 cubic feet of pulpwood and 10,546,000 board feet of sawtimber on approximately 6,325 acres.

The Corps of Engineers in Georgia on West Point Lake salvaged 14,000 cubic feet of pulpwood and mechanically treated 2,600 cubic feet of pulpwood with the cut-and-leave method. They also chemically treated 250 trees on approximately 28 acres.

Mississippi suffered statewide losses from southern pine beetles. Aerial surveys detected 3,524 spots in April, 1,954 spots in July, and 2,327 spots in August. Beetle populations continued to increase in the northern part of the state. The remainder of the state experienced a gradual decline in activity, except the east central area, which showed increases in August. State salvage volumes totaled 45,463,000 board feet--66 percent salvaged between January and May and the remainder between June and October. Additional salvage operations on national forests removed 20,690,000 board feet of beetle-killed timber.

In eastern Oklahoma, southern pine beetle activity was at an endemic level. Only 31 spots were detected, containing 30,000 board feet of beetle-killed timber, and approximately 20 percent of this timber was salvaged.

South Carolina again saw heavy activity in 1980, principally in the northwestern third of the state. On state and private lands, 102,260,000 board feet were salvaged. On national forest land, losses were down substantially from 1979, with only 95,000 cubic feet salvaged throughout the state. Additional damage occurred on a wilderness area of the Andrew Pickens District in extreme northwestern South Carolina, but this timber was not salvaged.

In North Carolina, beetle activity increased significantly in the late summer in several coastal counties. The Camp Lejeune Marine Corps Base salvaged 184,000 cubic feet of pulpwood on 230 acres of land through its SPB control project.

Louisiana reported approximately 238,500 board feet of beetle-killed timber. Thirty one percent of this infested timber was salvaged during 1980.

Losses in Texas and Arkansas were negligible with salvage operations removing approximately 30,000 board feet of timber.

Table 1 summarizes the acreages of pine susceptible to SPB attack in states with suppression projects.

Table 1--Acres of host type in the southern pine beetle outbreak areas, apportioned by ownership class (1980).

State	All Ownership	National Forest	Other Public	Industrial Private	Other Private
Ga.	4,539,636	94,388	203,629	889,311	3,352,313
S.C.	3,366,965	241,896	95,787	517,269	2,512,013
N.C.	1,538,984	94,400	1,141,986	278,785	1,023,813
Ala.	10,411,690	306,390	151,500	2,070,610	7,883,190
Miss.	2,408,400	104,995	92,066	266,596	1,944,743
TOTAL	22,265,675	842,069	1,684,968	4,022,571	16,716,072

Introduced Pine Sawfly

The introduced pine sawfly, Diprion similis Hartig, continued to cause severe defoliation of white pine within the insect's new range in the southern Appalachians (figure 2). With the use of pheromone survey traps, the insect was detected in two separate outbreaks covering a total of 4,810,000 acres in North Carolina, Tennessee, and Virginia. In areas where repeated heavy defoliation occurred, branch and top dieback and occasional mortality were common.

A biological suppression pilot project begun by the USDA Forest Service in 1979 was accelerated with the establishment of a parasite rearing lab in Linville Falls, N.C. Two multiple parasite hymenoptera--Monodontomerus dentipes Dalman and Dahlbominus fuscipennis Zett.--were released in the areas of highest sawfly populations. A total of 143,500 parasites were reared for release. Monitoring of parasitism has indicated success in the reduction of sawfly populations, with parasitism increasing from less than 3 percent before release to over 40 percent.

Seed and Cone Insects

During 1979, only 5,587 pounds of seed were produced by Federal seed orchards in the South. This represents approximately 34 percent of the projected seed required to regenerate national forest lands with superior growing stock. Insect pests caused a substantial portion of these losses.

Seed and cone damage levels during 1980 increased from levels experienced in 1979. Coneworms (all Dioryctria spp.) damaged approximately 30 to 50 percent of the cones in untreated seed orchards. Generally, less than 60

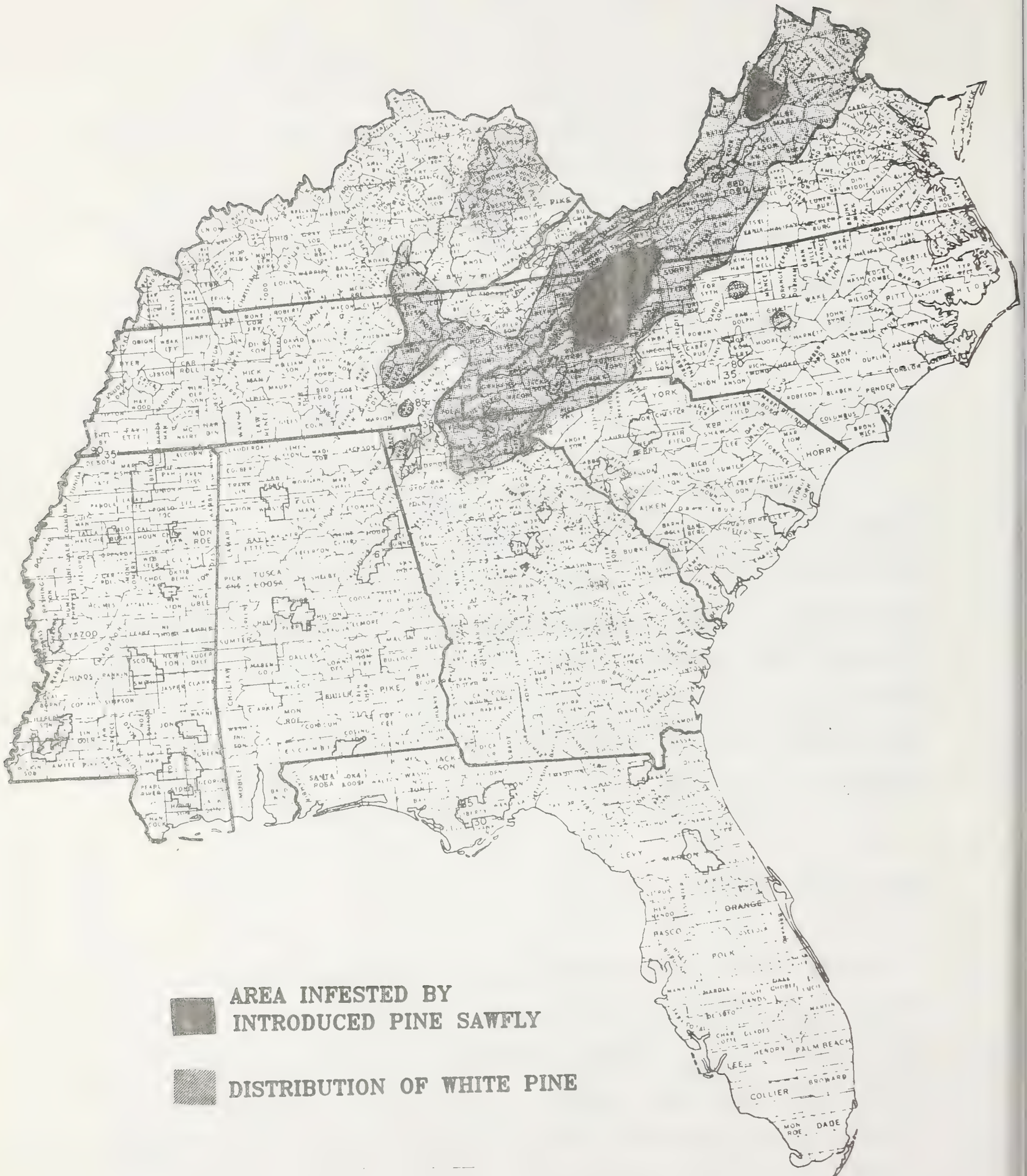


Figure 2--Areas under attack by the introduced pine sawfly in 1980.

percent of the cones and conelets present in the spring of 1980 survived to harvest. Table 2 illustrates coneworm and seedbug suppression project activities in Federal seed orchards in 1980.

Table 2--Coneworm and seedbug suppression projects in Federal seed orchards, 1980.

Seed Orchard	State	Material(s) applied	Time	Seed source	Acreage
Beech Creek	N.C.	Furadan (10G)	Jan-Feb	white pine shortleaf pine	120.0
Francis Marion	S.C.	Furadan (10G)	Jan-Feb	loblolly pine shortleaf pine	45.0
Ocala	Fla.	Furadan (10G)	Jan	sand pine	18.5
Erambert	Miss.	Guthion	4 treat-ments		128.0
Ouachita	Ark.	Furadan Guthion	3 treat-ments	shortleaf pine	170.0 230.0
Stuart	La.	Guthion	4 treat-ments	shortleaf slash, loblolly, & longleaf pine	188.0

The webbing coneworm, Dioryctria disclusa Heinrich, severely damaged loblolly pine cone crops in southern seed orchards from Virginia to Alabama. Estimates of damage were especially high in Virginia and North Carolina, where up to 90 percent of the crop was destroyed (figure 3). A southwide damage evaluation survey indicated a total cone crop loss valued at nearly $3.5 million.

Correct timing of an insecticide application is essential for control of this coneworm. In an aerial application pilot project at the John P. Weyerhauser Seed Orchard near Washington, N.C., untreated trees lost 90 percent of the cone crop to the webbing coneworm. In comparison, losses on trees treated with Guthion and Pydrin were 2 and 14 percent, respectively.

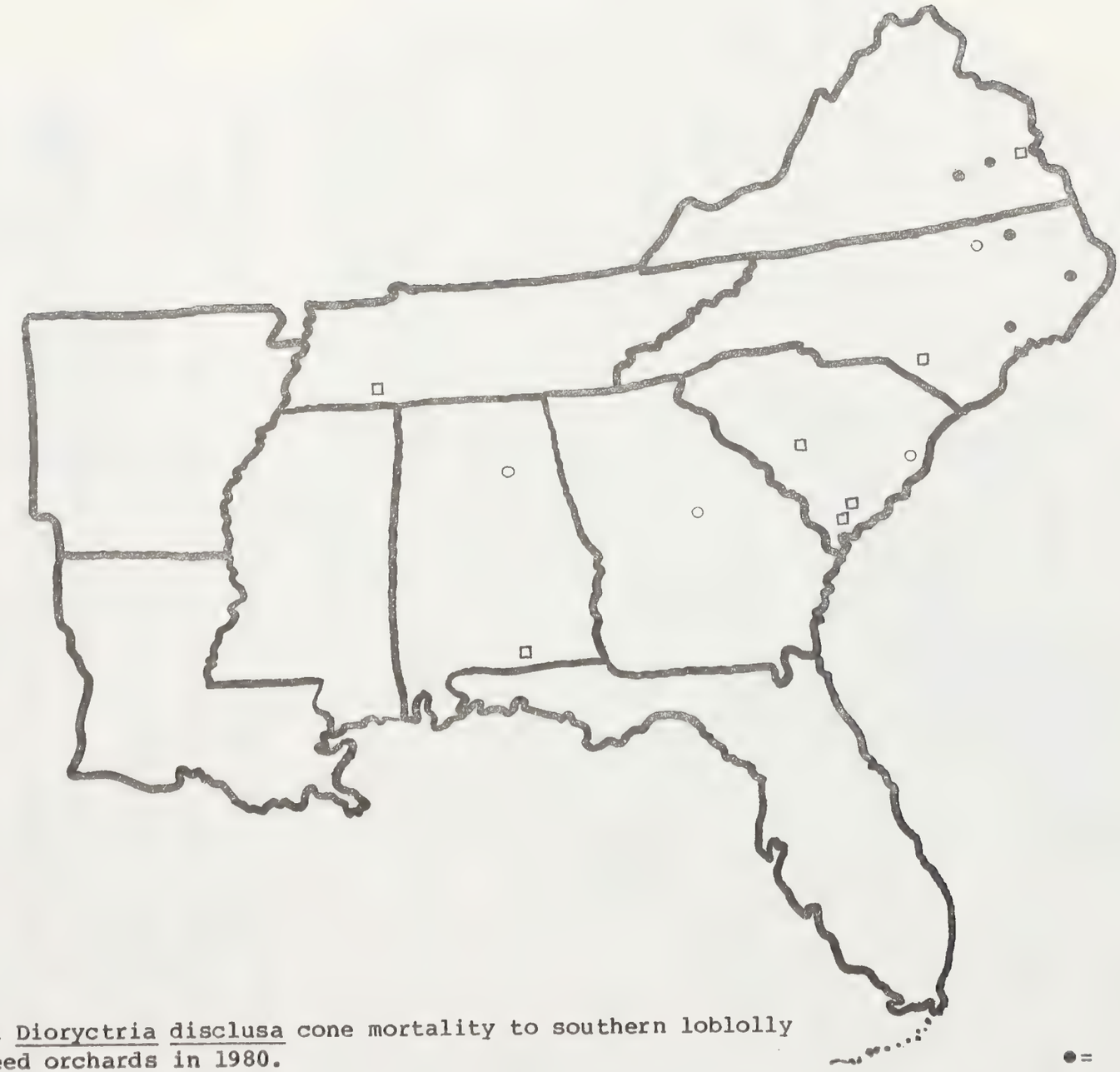


Figure 3--Percent Dioryctria disclusa cone mortality to southern loblolly pine seed orchards in 1980.

The pheromone for webbing coneworms was identified and field tested. Results of preliminary field tests were encouraging. The pheromone will be used to predict coneworm activity to determine the timing of insecticide application for most effective control.

Other coneworm species caused additional damage on orchards escaping the spring outbreak of D. disclusa. The principle insects causing mid and late season cone mortality were, Dioryctria amatella Hurst, and D. clarioralis Walker. Many orchards reported losses exceeding 50 percent.

Balsam Woolly Aphid

The balsam woolly aphid, Adelges piceae Ratz., caused extensive mortality throughout the range of Fraser fir in North Carolina and Tennessee. All natural stands of Fraser fir are now infested. The aphid was also found and confirmed in June 1980 on Cabin Ridge in the Mount Rogers National Recreation area of Virginia.

Cypress Looper

During 1980, approximately 60,000 acres of baldcypress and pondcypress in the Big Cypress National Preserve (near Ochopee, Fla.) were defoliated by the cypress looper, Anacamptodes pergracilis Hulst. The looper is a native but relatively obscure geometrid, and little is known about its biology. In some areas where heavy defoliation occurred during July and August, the trees refoliated and suffered a second defoliation as the looper population continued to build.

Initially, parasitism seemed incapable of reducing the population, however, later investigations showed a rapid buildup in parasite populations. Dieback of branch tips was observed in heavily defoliated areas. Forest Pest Management, in cooperation with the Florida Division of Forestry and the National Park Service, is continuing to monitor the outbreak.

OTHER INSECTS

Bark Beetles
(Except Southern Pine Beetle)

Insect	Host(s)	Counties or States	Remarks
Black turpentine beetle, *Dendroctonus terebrans* (Oliver)	Southern pines	Southwide	Low levels of infestation during the early summer, with moderate increased activity during mid and late summer. Usually associated with weakened timber. This year associated with drought throughout the South. Widespread activity in Va. piedmont and coastal plain.
Ips engraver beetle, *Ips* spp.	Southern pines	Southwide	Ips engraver beetle activity increased throughout the summer and was primarily associated with trees which were stressed by drought, fire, flooding, and salt water intrusion.

Seed and Cone Insects

Insect	Host(s)	Counties or States	Remarks
Slash pine flower thrips, Gnophothrips fuscus (Morgan)	Slash pine	Ala., Fla., Ga., La., Miss., Tex.	Thrips continued to damage developing flowers in slash pine seed orchards throughout the southern states. Flower losses on untreated orchards often exceeded 15 percent.

Defoliating Insects

Insect	Host(s)	Counties or States	Remarks
Oak leaf tier, Croesia semipurpurana (Kearfott)	Scarlet oak	Augusta Co., Va.	Scattered over 500 acres near Waynesboro, Va., in the foothills of the Blue Ridge.
Fall canker-worm, Alsophila pometaria (Harr.)	Various species of hardwood, particularly the red oak group	Grayson, Wise, Scott, Powell, & Severt Co.'s, Va.	Defoliation was considered light compared to the last three previous years. Heavy defoliation (90%) was observed over a 300 acre area on Pine Mt.
		Harlan Co., Ky.	Defoliation was severe for the past two years on Black Mt. near Cumberland.
Eastern tent caterpillar, Malacosoma americanum (F.)	Cherry, plum, & apple	Central Piedmont of Va., & north central Fla.	Unusually heavy.
		Statewide in Ky., N.C., Tenn., Ga. S.C.	Widespread. Unsightly defoliation and tent webs in high use areas.

Defoliating Insects (Continued)

Insect	Host(s)	Counties or States	Remarks
Forest tent caterpillar, Malacosoma disstria (Hübner)	Various hardwoods	Fredrick Co., Va.	Light to moderate defoliation occurred again this year in the Great Dismal Swamp.
		Floyd & Estill Co.'s, Ky.	Defoliation was light to moderate.
		La. & Ala.	Light to moderate defoliation on 815,000 acres of bottom-land hardwoods.
Redheaded pine sawfly, Neodiprion lecontei (Fitch)	Southern pines	Ky. & Tenn.	Defoliation ranged from light to severe on single or small groups of pine throughout these states.
		Cleveland Co., N.C.	Light defoliation.
		Montgomery Co., Va.	Light defoliation.
		Conecuh & Butler Co.'s, Ala.	Low population levels.
Virginia pine sawfly, Neodiprion pratti pratti (Dyar)	Virginia, loblolly, & shortleaf	Various parts of Va., N.C., Tenn., & eastern Ky.	Early spring defoliation ranged from light to severe for areas in the mid-south
Loblolly pine sawfly, Neodiprion taeda linearis (Fitch)	Loblolly & shortleaf pine	Western Ky.	Caused severe defoliation to loblolly pines.
		La.	Partial defoliation in the Georgetown area.

Defoliating Insects (Continued)

Insect	Host(s)	Counties or States	Remarks
Gypsy moth, Lymantria dispar (Linnaeus)	Various hardwoods	Avery Co., & along the outer banks of N.C.	In Avery county, no spray operations were conducted in 1980, however, male moths were again trapped. Over 1500 male moths were trapped along the outer banks.
		Floyd Co., Va., & the eastern shore & northern counties adjacent to Md. & W.Va.	Male moth trapping catches in Va. were concentrated in the northern counties adjacent to Md. & W. Va. and the eastern shore. Catches were also heavy in and around Floyd Co.s where the 1980 spray program was conducted.
Hetrick's sawfly, Neodiprion hetricki (Ross)	Loblolly pine	Westmoreland & Ashland Co.'s, Tenn.	Low to moderate populations on loblolly pine of pole size and larger.
		Aylett, Va.	Thirty acres defoliated.
Japanese beetle, Papillia japonica	Hardwoods	N.C. & Va.	Scattered defoliation to mixed hardwoods.
Pine looper, Lambdina athasaria pellucidaria (G & R)	Loblolly, Virginia & Shortleaf pine	Suffolk, King, Matthews, New Kent, Gloucester, Essex, & Queen Co.'s,	Light to moderate defoliation for the last two years.
		The coast of N.C.	Light defoliation.
Variable oak leaf caterpillar, Heterocampa manteo (Doubleday)	Oak group	Va., N.C., Ga., & Tenn.	Scattered defoliation, mostly localized. Most obvious on shade and yard trees.

Defoliating Insects (Continued)

Insect	Host(s)	Counties or States	Remarks
Elm leaf beetle, *Pyrrhalta luteola* (Muller)	Chinese & winged elm	Buncombe Co., N.C.	Heavy defoliation scattered throughout county.
		Jefferson, Graves, Fayette, & Hopkins Co.'s, Ky.	Moderate defoliation levels reported. Defoliation heavy in urban areas.
		Lauderdale, Colbert, Morgan, Autauga & Jefferson Co.'s Ala.	Sporadic low level populations.
Larger elm leaf beetle, *Monocesta coryli* (Say)	Elm	Washington Co., N.C.	Severe defoliation.
Bagworm, *Thyridopteryx ephemeraeformis* (Haworth)	Arborvitae & red cedar	Hyde & Rowan Co.'s, N.C.,	Defoliated cedar.
		Dekalb, Dallas, Escambia & Morgan Co.'s, Ala.	Low population levels.
		Ky.	Widespread defoliation.
Pine webworm, *Tetralopha robustella* (Zellar)	Southern pines	Dekalb, Ala. Henry & Franklin Co.'s, Va.	Low population levels.
Spring cankerworm, *Paleacrita vernata* (Peck)	Various hardwoods	Okla.	Heavy defoliation for last 4 years in central part of state.

Defoliating Insects (Continued)

Insect	Host(s)	Counties or States	Remarks
Walkingstick, *Diapheromera femorata* (Say)	Various hardwoods	Leflore Co., Okla., & Ark.	Heavy to moderate defoliation.
Orange stripped oakworm, *Anisota senotoria*	Oak	Forsyth Co., N.C.	Countywide defoliaton.
Fall webworm, *Hyphantria cunea* (Drury)	Various hardwoods	Geneva Co., Ala.,	Low level populations.
		Va. & Ky.	Statewide light defoliation.
		Durham Co., N.C.	Severe damage.
Linden looper, *Erannis tiliaria* (Harr.)	Various hardwoods	Morgan Co., Ala.	Populations collapsed.
		Ky.	Scattered light defoliation.
Poplar tentmaker, *Clostera inclusa* (Hübner)	Cottonwood & willow	Mississippi Atchafalaya River Basins, La.	Moderate to heavy defoliation in natural stands on 20,000 acres.
Locust leaf miner, *Odontota dorsalis* (Thunberg)	Black locust	Va.	Damage generally static to increasing.
		Central & extreme eastern Tenn., northwestern N.C., & Ky.	Severe.

Defoliating Insects (Continued)

Insect	Host(s)	Counties or States	Remarks
Mountain ash sawfly, *Pristiphora geniculata* (Hartig)	Ash & various hardwoods	Christian Co., Ky.	Heavy defoliation on several thousand acres.

Bark Girdlers

Insect	Host(s)	Counties or States	Remarks
Pales weevil, *Hylobius pales* (Herbst.)	Various pines	Sumter Co., Ala.	Low population levels.

Sucking Insects

Insect	Host(s)	Counties or States	Remarks
Pine bark aphid, *Pineus strobi* (Htg.)	White pine	Eastern Ky.	Light.
		Wythe Co., Va. & western N.C.	Very heavy in three Va. locations. Common throughout western N.C., with some problems in white pine nurseries.
Aphids, *Cinara* spp.	Various pines	Ark., & Colbert & Morgan Co.'s, Ala.	Locally heavy populations.

Sucking Insects (Continued)

Insect	Host(s)	Counties or States	Remarks
Pine spittlebug, Aphrophora parallela (Say)	Various pines	Northern & eastern Va., statewide in N.C., S.C., Ga. & Tenn.	Infestations very obvious in parts of each state, but impact of this insect was negligible.
		Lauderdale, Morgan, & Cherokee Co.'s, Ala.	Low population levels.
Pine leaf chermid, Pineus pinifoliae (Fitch)	White pine & red spruce	Macon, Jackson, Mitchell & Madison Co.'s, N.C.	Caused shoot dieback & yellowing. Foliage drooping of white pine.
Spruce gall aphid, Adelges spp.	Spruce	Va.	Infested spruce on Shenandoah National Park.

Twig, Shoot and Stem Borers

Insect	Host(s)	Counties or States	Remarks
Nantucket pine tip moth, Rhyacionia frustrana (Comstock)	Various pines	Morgan & Jefferson Co.'s., Ala.	Moderate sporadic populations.
		Okla. & northeastern Tex. & Ark.	In seed orchards.
Locust borer, Megacyllene robiniae (Forst.)	Black locust	Central & west Okla.	Damage mostly on stressed trees.

Insects Causing Damage to Seedlings

Insect	Host(s)	Counties or States	Remarks
White pine weevil, *Pissodes strobi* (Peck)	White pine	Montgomery Co., Va. & Forsyth & Transylvania Co.'s, N.C.	Severe damage to planted areas.
Town ants, *Atta texana* (Buckl.)	pine seedlings	La. & Tex.	Severe damage with considerable economic impact in regeneration areas. Over 300,000 seedlings destroyed.

STATUS OF DISEASES

Fusiform Rust

Fusiform rust, caused by Cronartium quercuum (Berk.) Miy. ex Shirai f. sp. fusiforme, continued to be the most serious disease of slash and loblolly pines. The disease was most severe in a wide land corridor from central Louisiana to South Carolina.

Annual losses attributed to fusiform rust were estimated at 562 million board feet of sawtimber and 194,000 cubic feet of growing stock valued at $110 million. About 3.8 million acres in the South had at least 50 percent of the trees with main stem or potential main stem cankers (branch canker within 12 inches of the stem). Acreage with at least 10 percent of slash and loblolly pines with stem or potential stem cankers was estimated at 13.8 million (table 3).

This disease is expected to be a serious problem for many years. But losses can be reduced substantially through an integrated approach to breeding for resistance, careful selection of site and species, and close monitoring of plantations.

An integrated approach to reducing losses caused by fusiform rust was finalized in 1980 and published as a management decision chart in Forestry Bulletin SA-FB/P24, by the USDA Forest Service, Southeastern Area.

Table 3--State-by-State summary of slash and loblolly pine acres with at least 10 percent of the trees having main stem or potential main stem fusiform infections.

State	Ownership				
	National Forest	Other Federal	State	Private	Total
Alabama	61,900	20,100	20,100	1,938,900	2,041,000
Arkansas	6,500	1,200	850	50,400	58,950
Florida	47,000	28,400	22,500	1,020,200	1,118,100
Georgia	78,500	71,600	14,800	3,871,700	4,036,600
Louisiana	61,300	15,700	31,400	1,461,700	1,570,100
Miss.	86,500	6,700	6,800	1,585,200	1,685,200
N.C.	28,700	9,600	9,700	1,296,300	1,344,300
S.C.	82,200	32,000	47,900	1,322,000	1,484,100
Texas	36,500	1,300	1,400	461,800	501,000
Virginia	-	-	-	6,016	6,016
Total	489,100	186,600	155,450	13,014,216	13,845,366

Annosus Root Rot

Annosus root rot, caused by Heterobasidion annosum (Fr.) Bref., is a damaging disease in the southeastern United States. The disease, which affects all commercial species of southern yellow pine and many other non-commercial or ornamental species, continued to be a problem, primarily in thinned plantations. According to surveys, 3 percent of the loblolly and slash pines in the South were dead or dying as a result of annosus root rot.

There is a definite correlation between soil type and annosus hazard. Areas with low water tables and 12 inches or more of sandy or loamy soil above clay are high hazard. The majority of annosus damage occurs on these soil types.

Recognizing this correlation, a map was developed to identify large land areas in the South with high hazard soil types (figure 4). This map can serve as a guide to regional hazard areas, but is not site specific. Land managers in all areas should evaluate soil type in each management area prior to thinning or regenerating stands.

During 1980 a system was formalized to help land managers prescribe treatments to reduce losses caused by annosus root rot. The system is published in Forestry Report SA-FR 9 by the USDA Forest Service, Southeastern Area.

Sand Pine Root Disease

Sand pine root disease has been found throughout the range of sand pine in Florida, and as far north as South Carolina. The disease destroyed one $250,000 seed orchard, and annual losses in Florida alone were estimated at about $7 million per year. About 330,700 acres were infected in Florida (national forests, 137,800; other public lands, 43,000; private lands, 149,900).

There are apparently two different pathological problems occurring in Florida sand pine. The first is in plantations, where it seems that *Phytophthora cinnamomi* Rand., is transferred from the plant nursery to the

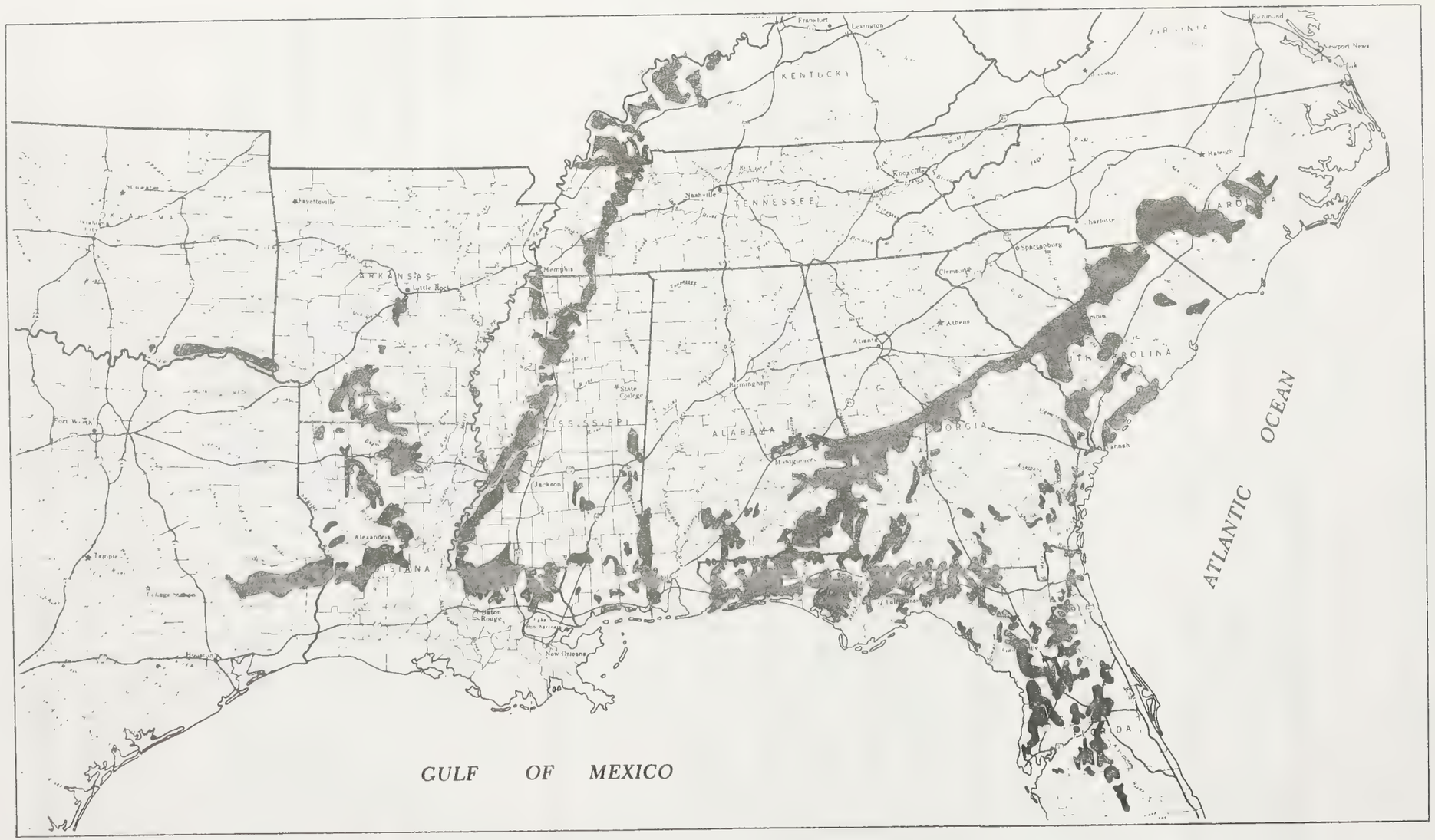


Figure 4--Major areas of high hazard soils for annosus infection. This map represents the high hazard soil types, not the actual annosus infection pattern in the South. (Soil maps are unavailable for Virginia).

planting site. The root disease organism kills a large number of seedlings in the first two years and may continue killing trees for several years.

The second problem is in natural stands, where little mortality occurs for the first 10 to 15 years, but annual losses become substantial and increase as the stands get older.

Inonotus circinatus (Fr.) Gilbs, Phaeolus schweinitzii (Fr.) Pat., Verticicladrella procera Kendrick, and Armillariella tabescens (Fr.) Singer, all cause root disease in these natural stands and in older plantations, and appear to work together in causing sand pine root disease. Significant mortality from these organisms occurred in both Ocala and Choctawhatchee races, with higher losses in the Ocala race.

Results from the 1980 survey of sand pine in Florida showed that: 37 percent of the sand pine trees in Florida had root disease, suppressed and non-suppressed trees were equally affected, and site did not influence the disease as long as there was pure sand to a depth of at least 4 feet. Crown thinning, resin flowing from the bark, and root sprung trees are the best symptoms to use in a survey.

OTHER DISEASES

Anthracnose, Blight, Decline, or Wilt

Disease	Host(s)	Counties or States	Remarks
Sycamore anthracnose *Gnomonia platani* (Edg.)	American sycamore	Throughout range of sycamore in the South.	Light to severe defoliation with branch dieback. Mortality occurred only in stressed trees.
Walnut anthracnose, *Gnomonia leptostyla* (Fr.) Ces. & de Not.	Black walnut	Throughout walnut range.	Light to moderate defoliation.
Oak wilt, *Ceratocystis fagacearum* (Bretz) Hunt	Oak	N.C., S.C., Tenn., Ky., Va., Ark., Okla., & Tex.	Several new infection centers were found throughout the range. Texas continued to report infection in urban areas.
Dutch elm disease, *Ceratocystis ulmi* Buism.) C. Mor.	Elm	Ga., Ky., N.C., S.C., Tenn., Va., Ala., Ark. & Okla.	Continued to intensify and move south. Mortality was more severe in northern part of region. In Okla., pockets of the disease were found along drainages.
Mimosa wilt, *Fusarium oxysporum* (Schl.) em Snyd. & Hans.	Mimosa	Throughout range of mimosa in the South.	Mimosa has almost been eliminated in some areas such as western N.C. Losses seemed to be increasing as the disease became more severe in areas such as western Tenn.
White pine root decline, *Verticicladiella procera* (Kend.)	Eastern white pine	Ky., N.C., Va., & S.C.	Scattered dying of white pine, primarily on wet sites. Christmas tree plantings seemed to be the most severely damaged.

Anthracnose, Blight, Decline or Wilt (Continued)

Disease	Host(s)	Counties or States	Remarks
Littleleaf, Phytophtora cinnamomi (Rands.)	Shortleaf	Ala., Ga., & S.C.	Several thousand acres affected. Continued to stress trees & contributed to southern pine beetle outbreak activity.
Elm phloem necrosis, virus disease	Winged elm	Southwide.	Scattered single trees or groups--primarily urban.
Oak decline caused by drought, insects insects & a variety of disease organisms	Oak	Southwide.	Mortality was especially high this year. Primarily a problem on older trees on poor sites. The severe drought seemed to be the major contributing factor.

Canker or Rot

Disease	Host(s)	Counties or States	Remarks
Root rot, Armillariella mellea (Fr.) Karst. Armillariella tabescens (Fr.) Singer Phaeolus schweinitzii (Fr.) Pat. Phytophthora spp.	All species	Southwide.	Losses were higher due to drought stress on root damaged trees.

Canker or Rot (Continued)

Disease	Host(s)	Counties or States	Remarks
Black knot, *Dibotryon morbosum* (Schw.) Th. and Syd.	Black cherry	Ga., Ky., S.C., Tenn. & N.C.	Light to moderate losses. Mainly reproduction & small size trees affected.
Root rot, *Ganoderma tsugae* Murr.	Loblolly pine	Ala.	Continued to cause serious damage in one seed orchard.
G. lucidum (Leys. ex Fr.) Karst.	Oak	Ala., Miss, & La.	Most common on disturbed urban sites.
White pine blister rust, *Cronartium ribicola* (Fisch)	Eastern white pine	N.C. & Va.	Low incidence throughout host range in the South. A 1980 survey of all federal land in Va. showed infection remained low even though ribes eradication had been stopped.
Comandra rust, *Cronartium comandrae* Pk.	Loblolly pine	Eastern Tenn.	Moderate to light infection.
Eastern gall rust, *Cronartium quercuum* (Berk.) Miy. ex Shirai f. sp. *quercuum*	Virginia pine	Ky., S.C., Tenn., Va. & N.C.	Low occurrence.
Hypoxylon canker, *Hypoxylon atropunctatum* (Schw. ex Fr.) Cke.	Red oak group	Ga., N.C., S.C., Tenn., Miss., La., Ark., Okla. & Ala.	Severe problem, with scattered mortality of weakened trees. Especially severe in 1980 because of drought. Okla. reported 100,000 trees affected in the central & eastern part of the state.

Canker or Rot (Continued)

Disease	Host(s)	Counties or States	Remarks
Butternut canker, *Sirococcus* spp.	Butternut	Ky., N.C., Tenn. & Va.	Most of the sapling and larger trees were dead or infected.
Fusarium canker, *Fusarium solani* (Mart.) App. & Wr. em. Snyd. and Hans.	Yellow poplar, black walnut & sweetgum	Ky., N.C., S.C. & Tenn.	Caused losses primarily in high value stands such as seed orchards. Especially severe when found in combination with insect vectors.
Sweet fern blister rust, *Cronartium comptoniae* (Arth.)	Loblolly pine	Okla.	Continued to be sporadic problem in urban areas.
Cytospora canker, *Cytospora chrysosperma* (Pers.) Fr.	Cottonwood	Okla.	Possibly affecting 100,000 acres of shelterbelt trees in the panhandle area. Severity undetermined.
Chestnut blight, *Endothia parasitica* (Murr.) P.J. and H.W. And.	American chestnut	Throughout chestnut range.	Almost complete mortality of older trees. The hypovirulent strains do not seem to be working well in controlling the disease.

Canker or Rot (Continued)

Disease	Host(s)	Counties or States	Remarks
Pitch canker, *Fusarium moniliforme* var. *subglutinans* (Wr. & Reink)	Virginia, slash, shortleaf, longleaf, eastern white, scotch, sand, tablemountain, pitch & Monterey pines	Fla., Ga., N.C., S.C., Tenn. & Va.	Seemed especially severe in certain seed orchards and in the northern part of Fla. The disease had not intensified much on the Apalachicola National Forest.
		Ala., Miss., La. & Tex.	Found in four of eleven seed orchards. Greatest damage in two orchards previously damaged by weather (hurricane) & tornado).
		La.	Found in urban areas in south-central part of the state.
Decay, primarily fungi in the family Polyporaceae	Hardwoods	Southwide.	The most damaging agent to hardwoods, causing substantial losses. Especially severe where hardwoods had been burned or thinned.

Environment or Pollution

Other	Host(s)	Counties or States	Remarks
Drought	Maple, oak, black gum, yellow poplar, dogwood, pines, cottonwood, American chestnut	Southwide.	Caused wilting, leaf fall, and death of thousands of severely stressed trees. Created opportunity for many facultative pathogens (e.g. *Hypoxylon* spp.) to cause damage. In Tex., estimated drought loss in areas regenerated during the winter of 1979-80 was 60 percent of the trees planted on 125,000 acres.

Environment or Pollution (Continued)

Other	Host(s)	Counties or States	Remarks
Ice	Hardwoods	Va.	Severe damage in western Va. In some cases the damage was severe enough to warrant salvage operations. Increased opportunity for decay in damaged hardwoods.
Tornado	All species	Va.	Severe losses in one county.
Ozone pollution	Eastern white pine	N.C., S.C., Va. & Tenn.	Scattered browning of about 10 percent of the trees.

Leaf or Needle Diseases

Disease	Host(s)	Counties or States	Remarks
Melampsora rust, *Melampsora medusae* (Thum.)	Poplars	Throughout poplar range.	Locally severe defoliation.
Pine needle rust, *Coleosporium* spp.	Hard pines	Throughout region.	Little damage, but widespread.
Brown spot, *Scirrhia acicola* (Dearn.) Sigg.	Longleaf, Eastern white & slash pines	N.C., Fla., Ga., S.C., Ala. & Miss.	Light damage in most areas with severe losses in localized longleaf stands.
Actinopelte leaf spot, *Actinopelte dryina* (Sacc.) Hoehn.	Red oaks	N.C.	Light damage on individual trees.

Leaf or Needle Diseases (Continued)

Disease	Host(s)	Counties or States	Remarks
Needle cast *Lophodermium* spp.	All southern yellow pines	Va., Ala. & Miss.	Locally severe, causing partial defoliation of affected trees. An extremely noticeable problem. Impact unknown.

Other Problems

Disease	Host(s)	Counties or States	Remarks
Eucalyptus leaf & stem disease, *Gloeosporium* spp. *Cylindrocladium scoparium* Morg., *Alternaria* spp., *Pestalotia* spp.& *Diaporthe* spp.	Eucalyptus	Southern Fla.	Damage was very light. Exact cause unknown. Impact on nursery stock very light.
Seed & cone diseases, cause unknown.	Longleaf pine	N.C. & S.C.	Early conelet mortality in seed orchards was severe. Research has shown this may be a physiological problem.
Slime flux, *Erwinia nimipressuralis* (Cart.)	Oak	Northern Ga., Ky., N.C., Va., S.C. & Tenn.	About 0.1 percent of the oaks appeared affected. Usually associated with decay or an injury.
Pine wood nematode, *Bursaphelenchus lignicolus* Mam. & Kiyo	Scotch, loblolly, slash, & Japanese pines	See figure 5.	Newly discovered pest in U.S. Severity and range uncertain, but found in 26 states on 16 species of pine. Several states conducting large scale surveys.

Figure 5--Distribution of the pine wood nematode in the Southeast in 1980.

Nursery Diseases

Disease	Host(s)	Counties or States	Remarks
Root rot, *Pythium* spp. *Fusarium* spp. and *Rhizoctonia* spp.	Southern yellow pines	Ark., La., Ala. & Miss.	Low level damage found in several nurseries.
Damping off, cause unknown.	Southern yellow pines	La.	Resulted in the loss of 800,000 to one million seedlings in two state nurseries.
Root rot, cause uncertain.	Southern yellow pines	Ala.	Infection rate varied from 0 to 30 percent within nursery in each of three state nurseries. Fumigation reduced the percentage from the previous summer.
Fusiform rust, *Cronartium quercuum* (Berk.) Miy. ex Shirai f. sp. *fusiforme*.	Slash pine	La.	Two nurseries lost approximately 500,000 trees.
Tip blight, *Diplodia* spp. and *Phomopsis* spp.	Loblolly and slash pine	Tex., Ark. & Miss.	Caused scattered seedling dieback in several nurseries. Damage far less than previous year.

FOREST INSECT AND DISEASE DETECTION AND EVALUATION

The Forest Pest Management (FPM) staff of the USDA Forest Service, Southeastern Area, is responsible for providing detection, evaluation, and technical assistance concerning forest pest outbreaks to land managers on all Federal lands in thirteen southeastern states, Puerto Rico and the Virgin Islands. In addition, they cooperate and provide assistance to state and private forest entomologists and pathologists.

Detection Surveys

One of the main responsibilities of the Forest Pest Management unit is to detect and monitor insect and disease outbreaks and infestations. This is accomplished through both aerial and ground survey techniques. Aerial surveys are used to detect new outbreaks, monitor ongoing infestations, and determine the extent and location of the damage. Aerial surveys are the most practical and economical method to accomplish these tasks, especially over extensive forest lands in remote areas. These surveys are conducted from low flying aircraft in an organized and systematic manner in order to detect all visible damage.

In 1980, over 29 million acres were aerially surveyed in the South by the FPM Aerial Survey Team. Following these aerial surveys, forty-two detection reports were issued describing the findings and initiating biological evaluations, if warranted. Aerial detection survey acreage, arranged by state and land ownership, is shown in table 4.

Table 4--Aerial Detection Survey Acreage Flown by FPM, Aerial Survey Team, 1980

State	Ownership	Acres
Alabama		
	National Forest	-------
	National Park	-------
	Other Federal	26,000
	State & Private	-------
	Total	26,000
Florida		
	National Forest	368,100
	National Park	125,000
	Other Federal	-------
	State & Private	-------
	Total	493,100
Georgia		
	National Forest	-------
	National Park	1,000
	Other Federal	55,000
	State & Private	-------
	Total	56,000
Kentucky		
	National Forest	1,896,529
	National Park	53,311
	Other Federal	-------
	State & Private	1,306,686
	Total	3,256,526
Louisiana		
	National Forest	1,022,703
	National Park	-------
	Other Federal	-------
	State & Private	-------
	Total	1,022,703
Mississippi		
	National Forest	-------
	National Park	33,000
	Other Federal	-------
	State & Private	14,517,200
	Total	14,550,200

Table 4--Aerial Detection Survey Acreage Flown by FPM, Aerial Survey Team, 1980

State	Ownership	Acres
North Carolina		
	National Forest	1,716,305
	National Park	257,378
	Other Federal	150,610
	State & Private	-------
	Total	2,124,293
South Carolina		
	National Forest	128,741
	National Park	34,218
	Other Federal	438,000
	State & Private	-------
	Total	600,959
Tennessee		
	National Forest	-------
	National Park	261,422
	Other Federal	60,000
	State & Private	-------
	Total	321,422
Texas		
	National Forest	1,759,994
	National Park	-------
	Other Federal	-------
	State & Private	-------
	Total	1,759,994
Virginia		
	National Forest	1,796,078
	National Park	190,420
	Other Federal	-------
	State & Private	3,000,000
	Total	4,986,498
Southeastern Area		
	National Forest	8,688,450
	National Park	955,749
	Other Federal	729,610
	State & Private	18,823,886
	Total	29,197,695

Field Surveillance

An updated Field Surveillance Program was initiated in the Southeastern Area to supplement routine detection surveys by the Aerial Survey Team. Field surveillance is the observation of forest insect and disease damage by land managers and forest workers as they conduct their normal field activities. Prompt reporting of unusual insect or disease activity is necessary for early detection of potential problems.

The Doraville field office has responsibility for initiating and carrying out the program on all Federal lands, except national forest lands, in the Southeastern Area. The Asheville and Pineville field offices are responsible for surveillance activities in their respective zones on national forest lands.

Field surveillance kits and new FS 3400-1 "Detection Report for Forest Insect and Disease Damage" booklets are distributed to federal land managers in the Southeastern Area. Land managers and forest workers collect representative samples and briefly describe the observed damage. The reporting booklet facilitates the collection of information which may be needed to identify the causal agent and the extent of damage. Specimens are diagnosed by the responsible Forest Pest Management office, and identifications and recommendations are given to the initiating land manager. The updated Field Surveillance Program is operational in the South on National Park Service and Fish and Wildlife lands of the Department of Interior.

Evaluation and Assistance

Another major responsibility of Forest Pest Management--in addition to informing land managers of existing problems--is providing assistance, through evaluations and recommendations, on how to manage pest problems through a program of integrated pest management. Twenty-nine biological evaluations were conducted on major forest pests in 1980.

SPECIAL PROJECTS

Forest Pest Management entomologists and pathologists were involved in several new and continuing projects aimed at providing information for survey and control strategies. Eventually these strategies will be implemented on an operational basis.

Attack:Emergence Ratio Project

A method to predict the activity of the southern pine beetle (SPB) within a spot was evaluated. SPB population status can be predicted to increase, remain static, or decrease by determining the ratio of attacking beetles to emerging beetles on a small sample of trees within a spot.

Southern Pine Beetle Infestation and Decline

A southern pine beetle spot growth evaluation was conducted in Mississippi, Alabama, and South Carolina. This project evaluated the effectiveness of using existing spot growth models throughout the South. Verification of these models will provide more accurate spot growth factors for benefit-cost analyses. It will also indicate which SPB spots are most likely to grow larger. Probable timber losses can then be considered when setting priorities for spot treatment.

Loran-C Radio Navigation Project

New and improved radio aids to navigation were evaluated to assist aircraft and ground crews in locating and evaluating forest pest activity. The Loran-C radio navigation system was found to be ideally suited for SPB aerial surveys and aerial photographic missions. Additional applications of radio guidance systems are under investigation for other forestry applications.

Aerial Photography Acquisition

Aerial photography continues to supply the forest entomologist, pathologist, and cooperating land managers with an efficient and cost effective method to evaluate forest resources and the impact of forest pests upon these resources. Increased skills and equipment in aerial photographic interpretation and the availability of the Loran-C aircraft guidance system have greatly increased the utilization of, and the ability to acquire, aerial photography. Forty-nine aerial photographic missions were completed, covering a total of 8,536,000 acres.

Strategies for Aerial Applications

An evaluation of strategies for aerial application of pesticides in seed orchards was conducted by FPM and several cooperators at the Withlacoochee State Forest Seed Orchard in Florida. Helicopters and fixed wing aircraft were used to study airspeed, deposition height, and other variables, as they relate to spray penetration and coverage.

Southern Pine Beetle Impact

Methodology to determine the impact of the southern pine beetle on a large area was evaluated. Aerial photographic sampling procedures, aerial photographic interpretation methods, and aerial photographic volume tables were developed to analyze losses due to the SPB over areas of 3 million acres or larger.

Aerial Spray Pilot Project

In the Beauregard Seed Orchard in Louisiana and the Washington Seed Orchard in North Carolina, two 5-acre blocks were sprayed monthly with Guthion and Pydrin. Applications were made by helicopter on six occasions, beginning in April. Cone worm and seedbug damage were significantly reduced by both pesticide treatments. Environmental residue monitoring was conducted following each of the six applications.

Field Test of Insecticides for Controlling Coneworms and Seedbugs in Seed Orchards

Forest Pest Management cooperated with the Southeastern Forest Experiment Station to conduct a field test using hydraulic application of four insecticides to control coneworms and seedbugs on a slash pine seed orchard at DeRidder, La. Different rates of Pydrin, Ambush, Imidan, and Guthion were compared. Only the higher rates of Pydrin, Ambush, and Guthion significantly reduced coneworm damage.

Pheromone Pilot Project

Dioryctria amatella pheromone traps were placed in untreated trees and monitored monthly from April through September. Cones and conelets from the trees were sampled periodically during this period for insect damage.

In addition, the pheromone for *D. disclusa* was evaluated in three orchards in Virginia and North Carolina.

Practical Application of Ectomycorrhizae in Southern Forest Tree Nurseries

This project was initiated in four southern nurseries in the spring of 1980. It was designed to determine the most effective and efficient rate and method of applying *Pisolithus tinctorius* (P.t.) inoculum to nursery seed beds.

In September 1980, mid-season evaluations were made. *P. t.* formation was good at two nurseries, moderate at one, and poor at another. (The poor results were attributed to a batch of *P. t.* with low viability.)

The National Pisolithus tinctorius Nursery Evaluation

In 1978, a project was begun to evaluate the growth and survival of *P.t.*-infected seedlings outplanted from nurseries. Annual survival and growth measurements of the outplanting will be conducted for ten years. Both nursery seedling and field outplanting results continue to look promising and applicable to southern forestry.

Southern Pine Beetle Risk Rating

Kisatchie National Forest personnel are now using the SPB risk rating system developed by the Southern Forest Experiment Station. Stand risk rating has helped the National Forest managers identify areas that are susceptible to bark beetle problems. The approach is being used to aid in the selection of stands to be thinned or regenerated during the 10-year period, 1984 to 1993.

Forest Pest Management has played an integral part in implementing this system, which was developed under a grant from the Expanded Southern Pine Beetle Research and Applications Program. Forest Pest Management has also monitored SPB activity and related this to the risk rating system.

SOUTHEASTERN AREA FOREST PEST MANAGEMENT NUMBERED REPORTS

Number	Title	Author(s)
80-1-1	Biological Evaluation of Southern Pine Beetle Infestations on the Croatan National Forest, N.C.	Barry, Hoffard
80-1-2	Fusiform Rust: Acres of Slash and Loblolly Pine with at Least 10 Percent of the Trees with Fusiform Rust	Anderson, Cost Hubbard, McClure, Mistretta
80-1-3	Biological Evaluation of Southern Pine Beetle Infestations on the Chattahoochee National Forest, Ga.	Hoffard
80-1-4	White Pine Blister Rust Evaluation, Jefferson National Forest	Bowling, Fisher, Anderson, Cordell
80-1-5	Evaluation of Conelet Abortion in Two Longleaf Seed Orchards and Three Natural Stands in N.C. and S.C.	Lee, Warlick, Sites
80-1-6	New Topsoil Pretransplant Fertilization Evaluation Developmental Test 229-78	Young, Hubbard
80-1-7	Detection and Evaluation Survey of the Balsam Woolly Adelgid Infestations on Mount Rogers, Va., 1979	Lambert, Morgan, Johnson
80-1-8	How to Photograph Tree Diseases in the Field: An Illustrated Guide	Wee, Anderson
80-1-9	An Illustrated Guide to Some Common Errors in Scientific Photography and How to Solve Them	Wee, Hoffard, Anderson
80-1-10	Biological Evaluation of Southern Pine Beetle Infestations on the Oconee National Forest	Hoffard
80-1-11	Disease Survey of Trees on the DeSoto National Forest; Range Evaluation Plot	Durdin, Sites
80-1-12	Biological Evaluation of Southern Pine Beetle Infestations on the Uwharrie National Forest, N.C.	Hoffard
80-1-13	Status and Post Suppression Evaluation of Balsam Woolly Aphid Infestations on Roan Mountain, Toecane Ranger District, Pisgah National Forest, N.C.	Johnson, Barry, Lambert

SOUTHEASTERN AREA FOREST PEST MANAGEMENT NUMBERED REPORTS (Cont.)

Number	Title	Author(s)
80-1-14	Biological Evaluation of Southern Pine Beetle Infestations on Hartwell Lake, S.C. and Ga.	Hoffard
80-1-15	Biological Evaluation of Southern Pine Beetle Infestations on Clark Hill Lake, S.C. and Ga.	Hoffard, Lambert
80-1-16	Biological Evaluation of Southern Pine Beetle Infestations on West Point Lake, Ga. and Ala.	Hoffard
80-1-17	Biological Evaluation of Southern Pine Beetle Infestations on Camp Lejeune Marine Corps Base, N.C.	Barry
80-1-19	Evaluation of Defoliation on Mammoth Cave National Park, Ky.	Ghent, Dorsett, Carothers, Mitchell
80-1-20	Distribution, Incidence, and Damage Caused by the Pitch Canker Fungus on Slash Pine, Apalachicola National Forest, Fla. 1980	Fisher, Anderson
80-1-21	Biological Evaluation of Southern Pine Beetle Infestations in the Proposed Persimmon Mountain Wilderness Area, Andrew Pickens Ranger District of the Sumter National Forest	Hoffard, Wilson, Carothers
80-1-22	Resistance Screening Center Status Report.	Hubbard
80-1-23	Biological Evaluation of Southern Pine Beetle Infestations on the Croatan National Forest, N.C.	Hoffard, Lambert
80-1-23A	Resistance Screening Center Test 105-79	Hubbard
80-1-24	Resistance Screening Center Test 103-80	Hubbard
80-1-25	Biological Evaluation of Southern Pine Beetle, Croatan National Forest, N.C.	Hoffard, Lambert
80-1-26	Resistance Screening Center Test 104-80	Hubbard

Number	Title	Author(s)
80-1-28	Projected Impact of Southern Pine Beetle Infestations Within the Proposed Persimmon Mountain Wilderness Area, Andrew Pickens Ranger District, Sumter National Forest	Hoffard, St. Clair, Ianniello
80-1-30	Evaluation of Slash Pine Mortality on Ft. Pickens Unit, Gulf Island National Seashore, Fla.	Hoffard, Oak
80-1-31	White Pine Blister Rust Evaluation, George Washington National Forest, 1980	Anderson, Fisher, Cordell
80-1-32	Biological Evaluation of Southern Pine Beetle Infestations on Chattooga, Tallulah & Oconee Ranger Districts, Chattahoochee & Oconee National Forests, Ga.	Hoffard, Lambert
80-2-1	Biological Evaluation of the Southern Pine Beetle on the Talladega & Tuskegee National Forests in Ala.	Smith
80-2-2	Biological Evaluation of the Southern Pine Beetle on the Bankhead National Forest in Ala.	Smith
80-2-3	Biological Evaluation of the Southern Pine Beetle on the Homochitto National Forest in Miss.	Connor
80-2-4	Biological Evaluation of the Southern Pine Beetle on the Holly Springs National Forest in Miss.	Connor
80-2-5	Evaluation of Southern Pine Beetle Infestations in the Sandy Creek Area, Homochitto National Forest in Miss.	Connor
80-2-6	Timber Damage Caused by Hurricane Frederic in Ala. & Miss.	Oliveria, Mistretta
80-2-7	Evaluation of Southern Pine Beetle Infestations on the Natchez Trace Parkway in Miss.	Connor
80-2-8	Southern Pine Beetle Post Project Evaluation for the Bankhead National Forest in Ala.	Connor

SOUTHEASTERN AREA FOREST PEST MANAGEMENT NUMBERED REPORTS (Cont.)

Number	Title	Author(s)
80-2-9	Southern Pine Beetle Postsuppression Evaluation for the Tombigbee & Bienville National Forests in Miss.	Connor
80-2-10	Application of Southern Pine Beetle Risk/Hazard & Determination of Basal Area, Kisatchie National Forest	Smith
80-2-11	Pine Webworm & Pine Tip Moth Damage in One Year Old Pine Plantation, Ouachita National Forest	Oliveria
80-2-12	Biological Evaluation of Southern Pine Beetle Infestations in Proposed Wilderness Areas on the National Forests in Ala.	Smith
80-2-13	Evaluation of Southern Pine Beetle Infestations in the Four Notch Proposed Wilderness Study Area on the National Forests in Tex.	Smith
80-3-1	Aerial Detection Survey of Southern Pine Beetle Infestations, Chattahoochee National Forest, Ga.	Carothers, Hammond, Russell
80-3-2	Aerial Detection Survey of the Southern Pine Beetle Infestations on the Natchez Trace Parkway, Miss.	Bassett, Russell
80-3-3	Aerial Detection Survey of the Southern Pine Beetle Infestations on Armuchee Ranger District, Chattahoochee National Forest, Ga.	Bassett, Russell, Neal
80-3-4	Aerial Detection Survey of Forest Insect & Disease Activity, Kennesaw Mountain National Battlefield, Ga.	Bassett
80-3-5	Aerial Detection Survey of Forest Insect & Disease Activity, Chattahoochee River National Recreation Area, Ga.	Bassett, Russell
80-3-6	Aerial Detection Survey of Forest Insect & Disease Activity, Kings Mountain National Military Park, S.C.	Bassett, Baron
80-3-7	Aerial Detection Survey of Forest Insect & Disease Activity, Uwharrie National Forest, N.C.	Bassett, Davis

SOUTHEASTERN AREA FOREST PEST MANAGEMENT NUMBERED REPORTS (Cont.)

Number	Title	Author(s)
80-3-8	Aerial Detection Survey of Forest Insect & Disease Activity, Clark Hill Reservoir, S.C.	Wilson, Carothers
80-3-9	Aerial Detection Survey of Southern Pine Beetle Activity, Department of the Navy, Camp LeJeune Military Reservation, N.C.	Carothers, Bassett, Black
80-3-10	Aerial Detection Survey of Forest Insect & Disease Activity, Department of Interior, Cape Romain National Wildlife Range, S.C.	Carothers, Wilson
80-3-11	Aerial Detection Survey of Forest Insect & Disease Activity, Savannah River Plant, Department of Energy, S.C.	Carothers, Reid, Buckner, Allison
80-3-12	Aerial Detection Survey of Forest Insect & Disease Activity, Corps of Engineers, Lake Hartwell & Vicinity, Ga. and S.C.	Bassett
80-3-13	Results of Mississippi Cooperative Southern Pine Beetle Aerial Detection Survey	Dull, Brant, Collins, Carothers, Wilson, Bassett, Munday, McLary, Godbold
80-3-14	Aerial Detection Survey of Forest Insect & Disease Activity, Corps of Engineers, Walter F. George Reservoir & Lake George W. Andrews, Ga. and Ala.	Wilson, Roe
80-3-15	Detection of Southern Pine Beetle Activity, U.S. Army Corps of Engineers, West Point Lake, Ga. and and Ala.	Wilson, Carothers, Dean
80-3-16	Aerial Detection Survey of Forest Insect & Disease Activity, Chattahoochee River National Recreation Area, Ga.	Bassett
80-3-17	Aerial Detection Survey of Forest Insect & Disease Activity, Lake Allatoona, Ga.	Bassett, Day
80-3-18	Aerial Detection Survey of Forest Insect & Disease Activity, Apalachicola National Forest, Fla.	Dull, Carothers

SOUTHEASTERN AREA FOREST PEST MANAGEMENT NUMBERED REPORTS (Cont.)

Number	Title	Author(s)
80-3-19	Aerial Detection Survey of Forest Insect & Disease Activity, Sam Houston National Forest, Tex.	Bassett, Nettleton
80-3-20	Aerial Detection Survey of Forest Insect & Disease Activity, State and Private Lands, Ky.	Dorsett, Ghent, Mitchell, Carothers
80-3-21	Aerial Detection Survey of Forest Insect & Disease Activity, Mammoth Cave National Park, Ky.	Strange, Liscomb, Bachlund, Ghent, Carothers
80-3-22	Aerial Detection Survey of Forest Insect & Disease Activity, Sabine National Forest, Tex.	Bassett, Russell
80-3-23	Aerial Detection Survey of Forest Insect & Disease Activity, Angelina National Forest, Tex.	Bassett, Russell
80-3-24	Aerial Detection Survey of Forest Insect & Disease Activity, Davy Crockett National Forest, Tex.	Bassett, Russell
80-3-25	Aerial Detection Survey of Southern Pine Beetle Activity, Croatan National Forest, N.C.	Wilson, Bassett
80-3-26	Aerial Detection Survey of Forest Insect & Disease Activity, Chickamauga & Chattanooga National Military Parks, Tenn. and Ga.	Wilson
80-3-27	Aerial Detection Survey of Forest Insect & Disease Activity, Kisatchie National Forest, La.	Bassett, Nettleton, Vallery
80-3-28	Aerial Detection Survey of Forest Insect & Disease Activity, Northern Va.	Dull, Russell, Rife
80-3-29	Aerial Detection Survey of Forest Insect & Disease Activity, Shenandoah National Park, Va.	Dull, Russell, Phillips
80-3-30	Aerial Detection Survey of Forest Insect & Disease Activity, Daniel Boone National Forest, Ky.	Wilson, Russell
80-3-31	Aerial Detection Survey of Forest Insect & Disease Activity, George Washington National Forest, Va.	Dull, Wilson