United States
Department of
Agriculture

Forest Service

Southeastern Forest
Experiment Station

Resource Bulletin
SE-64

Incidence and Impact of Damage to Florida's Timber, 1980

May 1983

Southeastern Forest Experiment Station
200 Weaver Blvd., Asheville, NC 28804

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by

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Foreword

This Bulletin reports survey data on agents damaging trees in Florida's forests. Data were collected in 1978, 1979, and 1980 by the Renewable Resources Evaluation Work Unit of the Southeastern Forest Experiment Station. This effort was part of the fifth inventory of the State's forests. Considerably more information was gathered in this than in previous inventories. This additional information makes possible publication of reports on forest resources other than timber, as well as this specialized report on timber damage.

The Southeastern Forest Experiment Station in Asheville, North Carolina, periodically inventories and evaluates forest resources in Florida, Georgia, North Carolina, South Carolina, and Virginia. The Southeastern Area, State and Private Forestry, Forest Pest Management Staff Unit, headquartered in Atlanta, Georgia, provides training and field support and helps evaluate the data on forest insects, diseases, and other damaging agents.

Damage is described here, but appropriate measures for preventing damage are not. Residents of Florida requiring technical assistance with forestry problems on State and private land should contact:

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Introduction

During the fifth inventory of Florida's forests in 1978-1980, damage to trees on sample plots was noted. Where possible, a cause or damaging agent was specified. This Bulletin reports and interprets these observations.

Since plots are visited only once and at all times of the year, it is only possible to keep records on agents that produce symptoms or signs in all seasons. On the basis of these "durable" symptoms and signs, the agents defined on pages 5-6 were recognized.

Prior to the field survey, people from the Southeastern Area, State and Private Forestry, Forest Pest Management, developed a handbook for identifying damage types. During the survey, they field-checked data collected by crews to ensure accuracy and consistency. It should be recognized, however, that the data reported here were not gathered by people with expertise in entomology or pathology. Rather, crew members are trained and experienced in forest inventory. They received training, specimen kits, and forms to help them identify types of damage.

Florida is the fourth Southeastern State to have a damage inventory. Agents selected for the survey were required to be (1) easily identifiable, (2) present year around, and (3) present on trees at least 1 inch in diameter at breast height (d.b.h.). Therefore, small trees with problems such as brown spot and trees of all sizes with damage such as defoliation (which is not apparent in winter) are not accounted for in this report.

Acres of forest types, timber removals, and mortality by species and size class are taken from the Resource Bulletin "Florida's Forests" (Bechtold and Knight 1982). The remaining data were analyzed by Forest Pest Management to develop the tables presented here.

Many damaging agents, such as insects and fusiform rust, are easy to identify; others, such as root rot and littleleaf disease, are sometimes difficult to recognize. Consequently, the data for easily recognizable and persistent damage types are very reliable, whereas the data for damage types that are difficult to recognize are probably underestimated.

Sampling Procedure

The inventory employs a sampling procedure designed to provide reliable statistics primarily for the whole State, for large groups of counties, and for species with relatively large total volumes in the State. Accordingly, the errors associated with relatively minor species, like cottonwood, exceed those for such major species as loblolly pine. Procedures were as follows:

- Except for South Florida, initial estimates of forest and nonforest acreages were developed from the classification of 69,766 sample clusters systematically spaced on the latest aerial photographs available. Field crews checked a subsample of 9,566 of these 16-point clusters on the ground. A linear regression was fitted to the data to develop the relationship between the photo and ground classification of the subsample. This procedure provided a means for adjusting the initial acreage estimates for change in land use since date of photography and for photo misclassifications.
- In South Florida, estimates of forest and nonforest acreages were developed from direct aerial observations along 27 east-west flight lines spaced at 5-mile intervals. The flight lines were selected systematically from a random start and flown perpendicular to the direction of primary drainage. From an altitude of 500 feet above the ground, observers classified the land use at 24,471 sample points along the flight lines. An interval timer was

used to determine the sample points. Because of their unique geographical layout, the Keys were surveyed in a different manner. In the Keys, gross areas were estimated by planimeter on aerial photographs on which U.S. Geological Survey boundaries were transferred from maps. The breakdowns of gross acreage into specific land uses were based upon the ground classification of 45 sample locations.

- For the entire State, estimates of timber volume and forest classifications were based on measurements recorded at 4,680 ground sample locations systematically distributed on commercial forest land. The plot design at each location was based on a cluster of 10 points. In most cases, variable plots were systematically spaced within a single forest condition at 5 of the 10 cluster points using a basal-area factor of 37.5 square feet per acre. Trees less than 5.0 inches d.b.h. were tallied on fixed-radius plots around the point centers.
- Seedlings, shrubs, vines, grasses, forbs, and other lesser vegetation occurring within a 35-foot radius of selected point centers were identified and recorded at each forest sample location.
- Equations developed from detailed measurements of standing trees in Florida and throughout the Southeast were used to compute volumes of individual tally trees. A mirror caliper and sectional aluminum poles were used to measure upper stems of standing trees. In addition, felled trees were measured at 97 active cutting operations to provide utilization factors for the different timber products and species groups and to supplement the standing-tree volume study.
- Growth, removals, and mortality were estimated from the remeasurement of 4,614 permanent sample plots established in the 1970 inventory. A 1979 survey of timber products output, conducted by the Division of Forestry, Florida Department of Agriculture and Consumer Services, along with the annual pulpwood production study in the South, provided additional information for breakdowns of removals by product.

All field data were sent to Asheville for editing, punched on cards, and stored on magnetic tape for computer processing, sorting, and tabulation. Final estimates were based on statistical summaries of the data. As each of the four Survey Units in Florida was completed, special summaries of the information were added to master data files of forest resource statistics maintained in Asheville for the entire Southeast. A Forest Information Retrieval (FIR) program is available for compiling information for any area of interest as a cooperative service.

Computations

1. Limits on size classes of trees were: saplings, 1.0 to 4.9 inches d.b.h.; softwood poles, 5.0 to 8.9 inches d.b.h.; hardwood poles, 5.0 to 10.9 inches d.b.h.; softwood sawtimber, 9.0 inches and above; and hardwood sawtimber, 11.0 inches and above.

2. Volume equations were based on detailed measurement of standing and felled trees in Florida and similar measurements taken from other trees throughout the Southeast. These were used to compute merchantable and total cubic volume.

3. The symptoms that were used to identify the cause of damage to living trees on the sampled plots are presented on pages 5-6. The percent incidence and cull associated with each damage class were estimated. Percentage of species volume and total volume loss attributable to all agents damaging a species were also estimated. Note that data on percent incidence and cull associated damage do not imply total tree loss. Only a part of the volume in associated

cull would fail to qualify for some commercial use, such as firewood. The volume loss was determined by totaling the volume of cull associated with each pest, by species.

4. Quality loss was determined by taking the number of trees that were sufficiently large, but did not qualify as sawtimber trees because of damage. The cubic-foot volume in the saw-log portion of these trees was computed. This volume is taken as the quality loss. Note, however, that the losses in quality in trees that were not damaged enough to be withdrawn from the sawtimber category are excluded.

5. Mortality could not be attributed to damaging agents because it was often impossible to determine the cause of death. In many cases, a tree tallied in the last survey 10 years ago was simply missing. It was possible, however, to determine volume loss to mortality for each tree species on each plot. By using total mortality by tree species, it was possible to arrive at a total volume loss for poles and sawtimber by tree species.

6. Economic impact was determined by multiplying the total wood fiber and quality loss for each tree species by the stumpage value per unit. These dollar estimates were taken from an average of a number of timber sales in Florida in 1980.

Incidence of Damaging Agents and Associated Cull

Detailed tables in this report show numbers of damaged trees and volumes of damaged timber by tree species. In examining these figures, some people may also be interested in the acreages in various forest types and stand-size classes. Table 1 provides these numbers.

Tables 2 and 3 show percentages of trees damaged by size class and tree species. Overall, hardwoods had more damage than softwoods, and saplings had more damage than poletimber or sawtimber. Pond pine and baldcypress were the most frequently damaged softwood saplings; pond pine and cedar were the most frequently damaged softwood poletimber trees; and loblolly pine and cedar were the most frequently damaged softwood sawtimber trees. Spruce pine and slash pine were the least frequently damaged softwood saplings; baldcypress and slash pine were the least frequently damaged poletimber trees; and baldcypress, longleaf pine, and slash pine were the least frequently damaged softwood sawtimber trees. Cottonwood and black walnut were the most frequently damaged, sapling-size hardwoods; sycamore and hard maple were the most frequently damaged hardwood poles; and beech and ash were the most frequently damaged hardwood sawtimber trees. Select red oaks had the least frequent damage for all size classes. Tables 4 and 5 provide a detailed listing of damage by species and damaging agent.

The most common softwood damage problem was form. Cypress, cedar, pond pine, and shortleaf pine were most commonly affected. The second most common problem was fusiform rust, which was common on all size classes of loblolly pine. Slash pine was affected to a lesser degree. Fusiform rust was recorded only if the gall was on or within 12 inches of the main stem. If galls farther out on limbs had been recorded, occurrence of fusiform would have been higher. Other basal defects contributed to the greatest cull loss, especially on cedar and cypress. A variety of damage types, such as insects, other diseases, animals, sapsuckers, weather, top breakage, fire, and logging, were among damage factors showing the least incidence. With the exception of cypress, suppression and stagnation caused the least cull loss.

In hardwoods, too, form was by far the most frequent cause of damage--especially in the sapling class. This

trend held true for all species except cottonwood, where weather was the most frequently cited source of damage. Nevertheless, the greatest general impact among hardwoods was in the "other basal defects" category, with branch stubs also accounting for significant cull volume. Suppression and stagnation, people damage, beavers, and weather were among the least prevalent sources of hardwood damage across the whole range of species. Sapsucker damage incidence was also minimal except in select white oaks, where 10 percent of poles and 7 percent of sawtimber were affected.

Basal defects, which contributed the most significant cull loss, were probably associated with old logging injuries, fire, and fusiform galls. Form damage seemed to be more damaging in the sapling stage, with a decreasing occurrence in poletimber and sawtimber. This decrease is probably accounted for by sapling trees growing out of the form damage, dying, or becoming suppressed. Branch stubs also caused significant cull loss in most hardwood species. To be classified as a "branch stub", the branch holes or stubs had to exceed four inches in diameter on trees 5 inches and larger d.b.h. Branch holes or stubs on trees smaller than 5 inches d.b.h. had to be at least 1 inch in diameter. This size criteria explains why there was a high degree of associated cull, since branch stubs of that size are normally decayed. These branch stubs are normally associated with thinning operations or storm damage and are more common in understocked stands.

Reported incidence and associated cull due to insect damage were very low. Insect damage, however, is probably significantly underestimated due to the difficulty of diagnosing and evaluating incidence and severity of many types of insect-caused damage, especially among borers.

In reviewing the incidence, we see separate patterns for softwoods and hardwoods. Softwoods of all sizes are affected most often by form damage and fusiform rust. Basal defects are the cause of greatest loss to cull. Among hardwood saplings, form is clearly the most serious problem, followed by suppression and stagnation, other basal defects, and branch stubs. This trend continues into poletimber, with branch stubs and basal defects beginning to show increased significance. Hardwood sawtimber was frequently damaged by basal defects and branch stubs. Branch stubs and basal defects also caused significant cull loss. These damaging agents are typical of mature and overmature trees.

Mortality, Associated Cull, and Quality Loss

Table 6 shows estimated volumes of mortality, cull, and quality loss for major species groups in Florida. Annual harvests are also shown to place the volume losses in perspective. The mortality figures (table 6) used in this report are the total for the resource. No discounting has been done for trees whose death represented no economic loss. The accumulated cull is that associated with the damage type and may not have been caused by the damaging agent. The quality loss occurs when a sawtimber tree associated with a damaging agent is dropped from the sawtimber classification.

Annual mortality amounts to about 80.8 million cubic feet of sawtimber and 61.4 million cubic feet of poletimber. Forty-three percent of the sawtimber mortality loss and 47 percent of the poletimber mortality occur in softwoods. Sawtimber mortality is about 21 percent of annual removals, and poletimber is 33 percent (table 6).

Both mortality and cull are heavier in softwoods than in hardwoods. The total accumulated cull of softwood poletimber and sawtimber is only about 1 percent of the softwood sawtimber mortality, while cull in hardwood sawtimber is about 20 percent of the total

hardwood sawtimber mortality. It must be noted that the mortality figures are annual, whereas the cull is the total volume divided by 10. Distributing the cull losses over a 10-year period[3] shows a total annual loss of 3,374,000 cubic feet for poles and 16,321,000 cubic feet for sawtimber.

The quality loss is reported when a tree associated with a particular damage shifts from the sawtimber to nonsawtimber category. Distributing the loss over a 10-year period yields a 5,757,000 cubic-foot annual loss for softwoods and a 43,734,000 cubic-foot loss for hardwoods.

The greatest economic impact occurs in softwood sawtimber, for which the annual loss is $21,360,372 (table 7). The loss for hardwood sawtimber is $21,693,343. In poletimber, the $10,244,850 softwood loss exceeded that of hardwood ($2,191,505) by more than four times. In all, 57 percent of all economic impact occurs in softwoods. About 82 percent of the total economic impact is in sawtimber-size trees.

Past Treatment or Disturbance

In stands that have been significantly disturbed since the last survey, the cause of the disturbance and any needed corrective treatment are noted. Table 8 summarizes these observations. Only those disturbances classified as "damage types" are included. Other disturbances, such as thinning, are excluded.

Diseases head the list of damaging disturbances. Of 62 sample stands with significant disease damage, 9 required salvage, 12 required thinning, and 8 required cleaning. Grazing and natural damage were the second and third most damaging disturbance types. The relative ranking of nine treatment or disturbance types is shown in table 8. Under treatment needed, grazing and wildfire required the greatest amount and largest variety of treatments.

Definitions

Damaging Agents and Their Symptoms

Insect.--All pines. Loose bark, pine bark beetle galleries in inner bark, exit holes, pitch tubes.

Other diseases.--All species. Damage due to diseases not coded. For example, eastern gall rust, brown spot, and red heart on pines.

Fusiform rust.--Slash, loblolly, pitch, and pond pines. Spindle-shaped galls on stem or within 12 inches of stem; canker on stem with sunken, rotten center encircled by callus ridge; witches' broom; orange fruiting structures in the spring.

Annosus and other root rots.--Pines and redcedar. Diseased trees frequently occur in groups (centers) which usually contain dead or windthrown trees; diseased trees with thin, tufted crowns; windthrown trees exhibit stringy, yellowish root rot; perennial shelflike or flat conks against base of trees in litter or under roots of windthrown trees; conks are rubbery with tan to brown upper surface and white pore-bearing undersurface. Disease more frequent in trees of reduced vigor, in sandy soils, in thinned stands, or following butt or root injury; frequently precedes bark beetles.

Littleleaf disease.--Shortleaf pine. Affected trees occur in groups. Short, yellow needles, reduced shoot growth on trees over 20 years old, large crops of undersized cones, usually occur on heavy soils of poor internal drainage.

Hardwood cankers.--All hardwoods. Dead, sunken area on stem, frequently showing annual callus ridges.

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[3] Distributing the loss over a 10-year period is arbitrary. The reader may wish to consider another method for converting total cull to annual cull.

Branch stubs.--All species. Branch holes or stubs greater than 4 inches in diameter on stem (trees 5.0 inches d.b.h. and larger). Branch holes or stubs greater than 1 inch in diameter on stem (trees 1.0-4.9 inches d.b.h.).

Top breakage.--All species. Broken stem greater than 4 inches in diameter in a tree 5.0 inches d.b.h. and larger. Broken stem of any diameter in a tree 1.0-4.9 inches d.b.h.

Other basal defect.--All species. Butt rot due to causes other than fire or logging damage (root rot, parent stump, frost seam, low stubs, butt bulge). Cause of cull is below breast height.

Pitch canker.--All pines. Primarily slash, loblolly, and shortleaf. Flagging at ends of branches; pitch flow from affected area; slight swelling on affected stems and twigs; crooks in main stems; and wilting of current candles.

Fire.--All species. Fire scar usually at base of stem; widespread in stand; usually on uphill side of slope; and charring on reburned stems.

Animal.--All species. Bear, bird, rodent, rabbits, etc.

Beaver.--All species. Teeth marks on bole of tree.

Sapsucker.--All species. Cluster of small holes that encircle tree's bole.

Weather.--All species. Windthrow, lightning strikes, etc.

Suppression and stagnation.--All species. Overtopped trees with poor form.

People.--All species. All people damage, except that related to logging.

Logging and related.--All species. Logging scar on stem; callus ridges within 1 to 2 years after wounding; scattered in stand; no charring; limb breakage or stem scar near crown resulting from tree felling. Skid trails, stumps, or other logging evidence present.

Turpentining.--All pines. Turpentining scars.

Form (damaging).--All species. Deformed due to unknown causes.

Forest Survey Terms

Acceptable trees.--Growing-stock trees of commercial species that meet specified standards of size and quality, but not qualifying as desirable trees.

Accumulated volume loss.--Percentage of trees affected x the percent cull x the volume for the species.

Associated cull.--Percentage of affected trees containing cull associated with the indicated damaging agent.

Associated volume loss from sawtimber to poletimber.--Volume in the sawlog portion of trees sufficiently large to qualify as sawtimber, but unsatisfactory for sawtimber because of damaging agent.

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

Commercial forest land.--Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization.

Commercial species.--Tree species presently or prospectively suitable for products.

Desirable trees.--Growing-stock trees of commercial species having no serious quality defects that limit present or prospective use for timber products, of relatively high vigor, and containing no pathogens that may result in death or serious deterioration before rotation age.

Diameter class.--A classification of trees based on diameter outside bark, measured at breast height (4-1/2 feet above the ground). D.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h., inclusive.

Growing-stock trees.--Live trees of commercial species qualifying as desirable or acceptable trees.

Incidence.--Percentage of susceptible trees affected by the agent.

Poletimber trees.--Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size.

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

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

Sawtimber trees.--Live trees of commercial species containing at least a 12-foot saw log, or two noncontiguous saw logs, each 8 feet or longer, and with at least one-third of the gross board-foot volume between the 1-foot stump and minimum saw-log top being sound. Softwoods must be at least 9.0 inches and hardwoods at least 11.0 inches d.b.h.

Sawtimber volume.--Net volume of the saw-log portion of live sawtimber in board-foot International 1/4-inch rule.

Softwoods.--Coniferous trees, usually evergreen, having needles or scalelike leaves.

Pines.--Yellow pine species, which include loblolly, longleaf, slash, shortleaf, pitch, Virginia, Table Mountain, sand, and spruce pine.

Other softwoods.--White pine, hemlock, cypress, eastern redcedar, white-cedar, spruce, and fir.

Stand-size class.--A classification of forest land based on the size class of growing-stock trees on the area.

Sawtimber stands.--Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.--Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in poletimber and sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.--Stands at least 16.7 percent stocked with growing-stock trees, of which more than half of the stocking is saplings and seedlings.

References

This publication reports incidence and impact of damaging agents on Florida's timber. It does not discuss their identification or control. Some of the references listed below are cited in our discussion. Others are provided to assist those desiring additional information on causal agents.

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Table 1.--Area of commercial forest land, by stand-size class and forest type

Forest classification	Acres
Stand-size class:	
Nonstocked areas	2,011,079
Poletimber	4,119,935
Saplings-seedlings	4,567,087
Sawtimber	4,966,076
All stand sizes	15,664,177
Forest type:	
Spruce pine	9,784
Shortleaf pine	37,206
Elm-ash-cottonwood	66,101
Pond pine	233,028
Loblolly pine	411,759
Sand pine	537,348
Southern scrub oak	1,002,703
Oak-hickory	1,130,568
Longleaf pine	1,242,811
Oak-pine	1,424,133
Oak-gum-cypress	4,271,148
Slash pine	5,297,588
All types	15,664,177

Table 2.--Percent of susceptible softwood trees damaged, by species and size

Host	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		- - - - - Percent - - - - -		
Spruce pine	7,321	17	19	26
Shortleaf pine	14,002	23	19	15
Cedars	30,201	29	25	29
Pond pine	55,769	30	28	27
Baldcypress	98,188	30	8	11
Loblolly pine	122,315	31	24	31
Sand pine	207,667	20	16	23
Longleaf pine	215,537	18	14	14
Pondcypress	839,003	22	16	21
Slash pine	1,848,988	15	13	14

Table 3.--Percent of susceptible hardwood trees damaged, by species and size

Host	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		- - - - - - Percent - - - - -		
Black walnut	255	100	0	0
Cottonwood	346	100	0	30
Select red oaks	534	0	0	12
Sycamore	585	50	100	0
Basswood	2,010	66	14	47
Beech	2,420	67	0	53
Hard maple	8,127	56	44	39
Select white oaks	10,193	45	10	21
Yellow-poplar	16,640	9	18	36
Black cherry	19,276	48	11	5
Elm	38,963	49	32	35
Hickory	43,039	53	22	26
Sweetgum	253,800	43	24	26
Soft maple	286,799	59	32	47
Other white oaks	329,297	85	25	35
Ash	354,756	67	32	50
Other eastern hardwoods	367,531	40	32	25
Bay & magnolia	672,309	50	29	45
Tupelo & blackgum	852,712	54	28	36
Other red oaks	1,624,127	21	24	38

Table 4.--Damage incidence and associated cull in Florida softwoods, 1980

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					$M\ ft^3$		
LONGLEAF PINE (215,537,000 susceptible trees)								
Insect	0	1	3	0	0	0	0	0
Other diseases	0	1	1	0	0	0	0	0
Fusiform rust	1	2	1	0	0	0	0	0
Root rot	0	0	<1	0	0	0	0	0
Top breakage	<1	0	0	0	0	0	0	0
Other basal defect	0	0	<1	0	5	0	21	0
Pitch canker	<1	<1	<1	0	0	0	0	0
Fire	3	3	1	0	<1	0	46	227
Animal	0	<1	<1	0	0	0	0	0
Sapsucker	<1	1	2	0	<1	0	70	0
Weather	1	1	1	0	0	0	0	0
Suppression & stagnation	5	1	0	0	0	0	0	0
People	0	1	<1	1	2	15	68	0
Logging & related	2	1	2	0	0	0	0	0
Turpentining	0	<1	2	1	4	5	1,474	389
Form	6	2	1	0	0	0	0	0
SHORTLEAF PINE (14,002,000 susceptible trees)								
Insect	0	0	2	0	0	0	0	0
Other diseases	0	0	1	0	0	0	0	0
Fusiform rust	0	4	0	0	0	0	0	0
Littleleaf disease	5	0	0	0	0	0	0	0
Fire	0	4	5	0	0	0	0	0
Sapsucker	0	0	3	0	0	0	0	0
Suppression & stagnation	5	8	0	0	0	0	0	0
Logging & related	0	3	1	0	0	0	0	0
Form	13	0	3	0	0	0	0	776
SLASH PINE (1,848,988,000 susceptible trees)								
Insect	<1	<1	1	0	0	0	0	0
Other diseases	<1	<1	1	0	<1	0	13	0
Fusiform rust	4	7	4	<1	<1	16	26	0
Root rot	<1	<1	0	0	0	0	0	0
Top breakage	<1	<1	<1	11	8	48	71	0
Other basal defect	0	<1	<1	5	8	19	239	0
Pitch canker	1	2	1	0	0	0	0	0
Fire	1	1	2	<1	<1	14	144	0
Animal	<1	0	<1	0	0	0	0	0
Sapsucker	0	<1	<1	0	0	0	0	0
Weather	<1	<1	<1	1	<1	37	59	0
Suppression & stagnation	4	1	<1	0	0	0	0	0
People	<1	<1	<1	1	1	28	57	0
Logging & related	1	<1	1	0	2	0	239	0
Turpentining	0	<1	3	0	2	0	1,744	430
Form	4	2	1	0	0	0	0	0

Continued

Table 4.--Damage incidence and associated cull in Florida softwoods, 1980--Continued

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					M ft^3		
LOBLOLLY PINE (122,315,000 susceptible trees)								
Insect	0	<1	<1	0	0	0	0	0
Other diseases	1	0	1	0	2	0	175	0
Fusiform rust	17	17	22	0	<1	0	198	1,801
Top breakage	0	0	<1	0	13	0	138	305
Other basal defect	0	1	<1	15	10	24	67	0
Pitch canker	<1	1	1	0	0	0	0	0
Fire	1	<1	1	0	0	0	0	0
Animal	0	<1	<1	0	0	0	0	0
Sapsucker	0	0	1	0	0	0	0	0
Weather	1	0	2	0	<1	0	37	0
Suppression & stagnation	4	1	<1	0	0	0	0	0
People	0	<1	<1	0	0	0	0	0
Logging & related	1	2	1	0	0	0	0	0
Form	6	2	2	0	0	0	0	0
SPRUCE PINE (7,321,000 susceptible trees)								
Fusiform rust	4	0	1	0	0	0	0	0
Top breakage	0	0	1	0	10	0	55	0
Beaver	0	0	2	0	0	0	0	0
Logging & related	4	19	5	0	0	0	0	0
Form	9	0	17	0	0	0	0	0
POND PINE (55,769,000 susceptible trees)								
Insect	0	0	1	0	0	0	0	0
Other diseases	3	5	7	0	1	0	58	307
Fusiform rust	2	11	8	<1	1	23	123	0
Branch stubs	0	<1	0	5	0	11	0	0
Top breakage	0	1	1	5	21	11	265	568
Pitch canker	1	2	1	0	1	0	12	0
Fire	3	3	1	0	0	0	0	0
Animal	0	1	0	0	0	0	0	0
Sapsucker	0	0	1	0	0	0	0	0
Weather	1	<1	2	0	1	0	34	0
Suppression & stagnation	6	1	1	0	0	0	0	0
Logging & related	0	1	1	0	0	0	0	0
Form	14	3	3	0	0	0	0	0
SAND PINE (207,667,000 susceptible trees)								
Insect	<1	<1	1	0	0	0	0	0
Other diseases	5	5	8	0	0	0	0	1,218
Root rot	<1	1	1	0	0	0	0	0
Top breakage	<1	<1	<1	10	5	59	16	0
Pitch canker	<1	<1	1	0	0	0	0	0
Fire	0	0	1	0	0	0	0	0
Sapsucker	0	0	<1	0	0	0	0	0
Weather	2	4	5	0	1	0	57	1,113
Suppression & stagnation	4	<1	0	0	0	0	0	0
People	<1	<1	1	0	0	0	0	0
Logging & related	<1	1	<1	0	0	0	0	0
Form	9	5	5	0	0	0	0	0

Continued

Table 4.--Damage incidence and associated cull in Florida softwoods, 1980--Continued

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					$M\ ft^3$		
BALDCYPRESS (98,188,000 susceptible trees)								
Insect	<1	0	<1	0	0	0	0	0
Other diseases	<1	0	1	0	10	0	577	438
Branch stubs	0	0	<1	0	20	0	383	772
Top breakage	1	1	1	7	42	71	2,652	4,442
Other basal defect	1	1	5	5	18	55	5,206	7,287
Fire	0	1	1	0	5	0	288	311
Animal	<1	0	0	0	0	0	0	0
Sapsucker	0	0	<1	0	0	0	0	0
Weather	0	0	1	0	4	0	171	238
Suppression & stagnation	6	2	0	0	0	0	0	
Logging & related	1	<1	1	0	1	0	46	0
Form	21	3	1	0	0	0	0	0
PONDCYPRESS (839,003,000 susceptible trees)								
Insect	<1	1	<1	3	0	107	0	1,335
Other diseases	<1	1	1	2	6	181	953	1,133
Branch stubs	0	<1	1	16	12	287	573	1,687
Top breakage	1	1	2	11	19	1,028	3,315	5,481
Other basal defect	<1	4	8	11	12	2,174	10,393	16,018
Fire	1	3	3	2	4	495	1,099	3,160
Animal	<1	0	0	0	0	0	0	0
Sapsucker	0	<1	<1	0	0	0	0	0
Weather	<1	<1	1	0	5	11	554	1,144
Suppression & stagnation	7	2	1	0	4	35	376	1,823
People	0	<1	<1	0	5	0	18	0
Logging & related	<1	<1	<1	0	1	0	28	419
Form	13	4	4	0	1	24	268	1,480
CEDARS (30,201,000 susceptible trees)								
Other diseases	0	0	2	0	4	0	49	65
Branch stubs	0	0	3	0	9	0	154	631
Top breakage	0	0	1	0	10	0	40	0
Other basal defect	0	8	12	29	17	233	944	2,033
Fire	0	0	1	0	0	0	0	0
Animal	1	0	0	0	0	0	0	0
Weather	2	7	5	0	0	0	0	0
Suppression & stagnation	6	3	0	0	0	0	0	0
Logging & related	2	3	5	0	1	0	28	0
Form	18	4	<1	0	0	0	0	0

Continued

Table 5.--Damage incidence and associated cull in Florida hardwoods, 1980

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					M ft^3		
SELECT WHITE OAKS (10,193,000 susceptible trees)								
Top breakage	0	0	2	0	5	0	23	0
Other basal defect	0	0	4	0	11	0	186	491
Sapsucker	0	10	7	0	0	0	0	0
Form	45	0	8	0	0	0	0	0
OTHER WHITE OAKS (329,297,000 susceptible trees)								
Insect	0	0	<1	0	0	0	0	561
Other diseases	0	1	<1	18	12	75	979	2,327
Hardwood cankers	0	<1	1	0	3	0	229	2,834
Branch stubs	<1	1	2	8	9	201	1,925	11,900
Top breakage	1	1	1	12	21	167	1,678	5,600
Other basal defect	<1	3	9	15	17	483	11,601	45,830
Pitch canker	0	0	<1	0	25	0	103	410
Fire	1	2	2	6	6	184	547	7,109
Animal	0	<1	<1	0	0	0	0	442
Sapsucker	0	1	2	0	0	0	0	4,785
Weather	0	2	3	4	2	125	243	5,743
Suppression & stagnation	2	2	0	8	0	137	0	1,025
People	0	<1	<1	0	7	0	155	1,085
Logging & related	<1	2	2	0	3	0	338	8,795
Form	81	10	13	0	<1	0	540	13,803
Beaver	0	<1	0	0	0	0	0	0
SELECT RED OAKS (534,000 susceptible trees)								
Top breakage	0	0	5	0	25	0	70	0
Other basal defect	0	0	7	0	35	0	132	377
OTHER RED OAKS (1,624,127,000 susceptible trees)								
Insect	<1	<1	<1	0	6	0	86	839
Other diseases	<1	1	2	1	7	97	1,379	4,396
Hardwood cankers	<1	1	3	1	1	131	312	5,689
Branch stubs	<1	1	3	11	10	615	3,135	14,327
Top breakage	1	4	6	19	23	3,502	7,802	19,092
Other basal defect	<1	3	12	13	18	2,301	18,767	52,765
Fire	1	2	2	3	6	239	652	4,645
Animal	0	<1	0	0	0	0	0	0
Sapsucker	<1	<1	1	0	<1	0	17	1,116
Weather	<1	1	2	1	6	66	779	5,706
Suppression & stagnation	3	1	<1	0	0	0	0	0
People	<1	<1	<1	4	5	53	24	0
Logging & related	1	2	1	2	4	204	217	402
Form	15	5	6	<1	1	134	527	6,355
Beaver	0	0	<1	0	0	0	0	719

Continued

Table 5.--Damage incidence and associated cull in Florida hardwoods, 1980--Continued

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					M ft^3		
HICKORY (43,039,000 susceptible trees)								
Insect	1	0	1	0	0	0	0	0
Other diseases	0	0	1	0	0	0	0	0
Hardwood cankers	0	0	1	0	2	0	36	0
Branch stubs	0	0	1	0	5	0	71	0
Top breakage	5	0	1	0	17	0	182	183
Other basal defect	1	1	5	5	18	17	783	1,579
Fire	0	3	2	5	21	48	293	866
Sapsucker	0	1	3	0	0	0	0	744
Weather	0	1	1	7	3	20	39	0
Suppression & stagnation	6	0	0	0	0	0	0	0
People	1	2	<1	3	0	15	0	0
Logging & related	1	3	0	0	0	0	0	0
Form	38	11	10	0	0	0	0	0
HARD MAPLE (8,127,000 susceptible trees)								
Top breakage	3	11	8	38	15	161	99	0
Other basal defect	0	18	10	6	5	59	59	0
Fire	0	4	0	60	0	112	0	0
Weather	0	0	4	0	0	0	0	0
Suppression & stagnation	3	0	0	0	0	0	0	0
Form	50	11	17	0	0	0	0	0
SOFT MAPLE (286,799,000 susceptible trees)								
Insect	0	<1	<1	0	2	0	17	338
Other diseases	<1	1	2	10	5	278	272	1,266
Fusiform rust	<1	0	0	0	0	0	0	0
Hardwood cankers	<1	3	3	2	2	121	184	2,882
Top breakage	2	4	5	15	22	1,009	1,963	4,229
Other basal defect	1	5	10	12	15	963	3,822	12,228
Fire	<1	<1	1	0	5	0	108	509
Sapsucker	0	<1	3	0	0	0	0	1,429
Weather	1	4	7	2	1	152	151	5,725
Suppression & stagnation	4	1	0	0	0	0	0	0
Logging & related	1	1	1	2	4	31	141	1,293
Form	50	12	13	<1	1	32	177	1,498
Branch stubs	<1	1	2	10	11	134	923	3,611
BEECH (2,420,000 susceptible trees)								
Top breakage	0	0	6	0	14	0	156	418
Other basal defect	0	0	30	0	39	0	720	1,361
People	0	0	4	0	0	0	0	0
Form	67	0	13	0	0	0	0	0

Continued

Table 5.--Damage incidence and associated cull in Florida hardwoods, 1980--Continued

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					M ft^3		
SWEETGUM (253,800,000 susceptible trees)								
Insect	0	0	<1	0	0	0	0	0
Other diseases	<1	<1	1	0	3	0	96	572
Hardwood cankers	0	1	2	0	2	0	208	478
Branch stubs	<1	0	1	0	5	0	152	0
Top breakage	2	2	5	14	14	501	2,228	3,372
Other basal defect	<1	2	7	7	13	180	2,665	4,264
Beaver	0	<1	1	0	0	0	0	0
Fire	1	1	0	0	0	0	0	0
Animal	<1	<1	<1	0	0	0	0	0
Sapsucker	<1	<1	2	0	2	0	123	0
Weather	1	2	1	0	1	0	43	0
Suppression & stagnation	7	2	<1	0	0	0	0	0
People	<1	<1	0	0	0	0	0	0
Logging & related	2	6	1	1	1	118	25	409
Form	30	8	5	0	0	0	0	0
TUPELO & BLACKGUM (852,712,000 susceptible trees)								
Insect	0	0	<1	0	10	0	41	410
Other diseases	<1	<1	<1	3	9	53	152	278
Hardwood cankers	<1	1	2	<1	<1	18	112	1,845
Branch stubs	<1	1	1	8	8	248	1,550	4,142
Top breakage	3	3	7	11	16	1,900	10,304	18,607
Other basal defect	1	7	13	13	19	4,794	21,077	48,645
Beaver	<1	1	<1	1	0	50	0	0
Fire	<1	1	<1	3	6	75	147	271
Animal	<1	0	<1	0	0	0	0	0
Sapsucker	<1	<1	1	0	0	0	0	1,479
Weather	<1	1	1	1	10	25	884	1,977
Suppression & stagnation	4	1	<1	0	0	0	0	0
People	<1	<1	<1	0	4	0	96	921
Logging & related	1	1	1	3	1	205	69	1,340
Form	44	11	10	<1	<1	41	66	6,985
ASH (354,756,000 susceptible trees)								
Other diseases	<1	1	1	8	24	129	193	371
Hardwood cankers	<1	2	2	2	0	55	0	524
Branch stubs	<1	1	2	10	11	286	563	1,653
Top breakage	2	3	7	16	16	775	2,078	3,571
Other basal defect	1	9	19	14	17	2,087	5,294	14,462
Beaver	0	<1	0	0	0	0	0	0
Fire	<1	0	0	0	0	0	0	0
Animal	0	0	<1	0	0	0	0	0
Sapsucker	0	1	6	0	0	0	0	457
Weather	1	1	1	4	3	102	22	204
Suppression & stagnation	5	1	0	0	0	0	0	0
People	<1	0	0	0	0	0	0	0
Logging & related	<1	1	1	0	9	0	181	603
Form	58	12	11	<1	1	79	129	356

Continued

Table 5.--Damage incidence and associated cull in Florida hardwoods, 1980--Continued

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					M ft^3		
COTTONWOOD (346,000 susceptible trees)								
Other basal defect	0	0	30	0	5	0	32	0
Weather	100	0	0	0	0	0	0	0
BASSWOOD (2,010,000 susceptible trees)								
Branch stubs	0	0	6	0	5	0	20	0
Other basal defect	0	0	12	0	8	0	127	1,054
Sapsucker	0	0	2	0	0	0	0	0
Weather	0	0	6	0	0	0	0	0
Form	66	14	21	1	7	9	91	274
YELLOW-POPLAR (16,640,000 susceptible trees)								
Branch stubs	0	0	3	0	5	0	46	0
Top breakage	4	0	3	0	5	0	46	0
Other basal defect	0	0	8	0	26	0	590	286
Sapsucker	0	0	3	0	0	0	0	0
Weather	0	1	6	5	0	22	0	0
People	0	0	2	0	5	0	33	0
Logging & related	0	0	3	0	0	0	0	0
Form	5	17	8	0	0	0	0	0
BAY & MAGNOLIA (672,309,000 susceptible trees)								
Insect	<1	<1	<1	0	0	0	0	0
Other diseases	<1	1	1	3	11	132	586	1,065
Hardwood cankers	<1	1	2	1	1	28	86	1,400
Branch stubs	<1	1	2	10	9	312	712	1,042
Top breakage	1	2	6	20	21	1,239	3,086	5,213
Other basal defect	<1	4	21	12	14	2,197	10,623	25,127
Beaver	0	<1	0	0	0	0	0	0
Fire	1	1	<1	1	2	42	37	372
Animal	<1	0	<1	0	0	0	0	633
Sapsucker	0	1	1	0	0	0	0	947
Weather	1	2	3	2	4	118	363	3,039
Suppression & stagnation	4	1	0	1	0	12	0	0
People	0	<1	<1	0	5	0	24	0
Logging & related	1	2	<1	2	0	110	0	467
Form	42	13	9	<1	<1	25	139	1,958
BLACK CHERRY (19,276,000 susceptible trees)								
Other diseases	1	0	0	0	0	0	0	0
Top breakage	1	0	0	0	0	0	0	0
Other basal defect	0	0	5	0	40	0	180	449
Animal	1	0	0	0	0	0	0	0
Logging & related	2	0	0	0	0	0	0	0
Form	43	11	0	0	0	0	0	0

Continued

Table 5.--Damage incidence and associated cull in Florida hardwoods, 1980--Continued

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					$M\ ft^3$		
BLACK WALNUT (255,000 susceptible trees)								
Form	100	0	0	0	0	0	0	0
SYCAMORE (585,000 susceptible trees)								
Form	50	100	0	0	0	0	0	0
ELM (38,963,000 susceptible trees)								
Other diseases	1	2	2	0	8	0	119	0
Hardwood cankers	1	1	1	0	35	0	131	374
Branch stubs	1	0	3	0	5	0	75	0
Top breakage	0	2	0	5	0	32	0	0
Other basal defect	0	4	7	8	16	147	580	1,838
Fire	0	1	0	0	0	0	0	0
Sapsucker	0	1	5	0	0	0	0	0
Weather	0	1	1	0	0	0	0	0
Suppression & stagnation	5	2	0	2	0	15	0	0
People	0	2	0	0	0	0	0	0
Logging & related	0	2	2	0	0	0	0	0
Form	41	14	14	0	<1	0	33	726
OTHER EASTERN HARDWOODS (367,531,000 susceptible trees)								
Insect	<1	0	0	0	0	0	0	0
Other diseases	<1	1	1	9	10	52	39	390
Hardwood cankers	<1	0	0	0	0	0	0	0
Branch stubs	<1	2	2	21	10	224	43	431
Top breakage	1	4	4	8	34	203	275	814
Other basal defect	<1	5	6	11	18	177	314	844
Fire	<1	0	0	0	0	0	0	0
Animal	0	0	1	0	0	0	0	0
Weather	<1	4	1	0	0	0	0	275
Suppression & stagnation	5	5	0	0	0	0	0	0
People	0	1	2	5	0	10	0	0
Logging & related	1	2	0	0	0	0	0	0
Form	33	8	8	1	1	39	29	685

Table 6.--Timber removals and wood loss to poletimber and sawtimber

Species	Annual timber removals		Volume loss due to--				Annual quality loss from sawtimber to nonsawtimber
			Annual mortality		Annual accumulated cull		
	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	M ft^3						
SOFTWOODS							
Longleaf pine	14,353	75,637	1,931	5,606	2	167	61
Slash pine	110,642	152,555	14,297	14,573	16	259	43
Shortleaf pine	331	1,630	588	725	0	0	77
Loblolly pine	6,008	46,122	1,821	4,298	2	61	210
Pond pine	2,617	7,083	492	1,292	4	49	87
Spruce pine	0	586	50	253	0	5	0
Sand pine	4,660	7,067	4,141	3,193	5	7	287
Baldcypress	1,312	9,995	686	1,176	12	932	1,348
Pondcypress	5,302	9,994	4,673	3,079	434	1,757	3,368
Cedar	442	976	91	819	0	0	0
Total	145,667	311,645	28,770	35,014	501	3,362	5,757
HARDWOODS							
Select white oaks	112	175	0	368	0	20	49
Select red oaks	130	0	0	0	0	20	37
Chestnut oak	3,309	6,208	1,312	1,841	0	0	0
Other white oaks	10,951	24,150	5,810	12,291	137	1,833	11,224
Other red oaks	0	0	0	0	734	3,369	11,605
Hickory	611	4,188	120	898	10	140	339
Hard maple	3,839	6,219	3,698	4,697	33	15	0
Soft maple	0	0	0	0	272	775	3,500
Beech	0	235	0	369	0	87	227
Sweetgum	7,248	17,317	6,729	11,759	79	554	909
Tupelo & blackgum	0	464	72	254	740	3,449	8,690
Ash	2,013	4,064	2,831	2,094	351	846	2,220
Cottonwood	0	0	0	0	0	3	0
Basswood	136	152	310	246	0	23	132
Yellow-poplar	2,481	6,698	1,540	4,825	2	71	28
Bay & magnolia	1,067	171	1,371	729	421	1,565	4,126
Black cherry	335	0	0	0	0	18	44
Black walnut	0	0	0	0	0	0	0
Sycamore	0	0	0	131	0	0	0
Black locust	0	0	0	0	0	0	0
Elm	6,540	3,372	8,870	4,768	19	93	293
Other eastern hardwoods	0	0	0	423	70	70	343
Total	38,880	74,186	32,663	45,836	2,873	12,959	43,774

Table 7.--Annual economic impact of damage on the timber resource

Species	Annual volume wood fiber loss	Stumpage value per unit	Annual Loss
	M ft^3	- - - - - Dollars	- - - -
Softwoods:			
Sawtimber	44,133	484.00	21,360,372
Poletimber	29,271	350.00	10,244,850
Hardwoods:			
Sawtimber	102,569	211.50	21,693,343
Poletimber	35,536	61.67	2,191,505
All species:			
Sawtimber	146,702		43,053,715
Poletimber	64,807		12,436,355
Total	211,509		55,490,070

Table 8.--Treatment needed as related to past treatment or disturbance, by number of samples

Past treatment or disturbance	None	Salvage	Harvest	Thinning		Cleaning	Stand conversion	Artificial regeneration		Total
				Commercial	Pre-comm.			No site prep.	Site prep.	
Significant wildfire	15	1	4	2	1	1	0	0	51	75
Man-caused flooding	1	1	1	0	0	0	0	0	1	4
Grazing, etc.	56	0	8	1	0	5	1	0	65	136
Construction, etc.	17	0	1	1	0	4	0	0	24	47
Salvage cut	2	0	0	1	0	0	0	0	3	6
Significant disease	62	9	0	12	0	8	0	0	10	101
Significant insects	18	2	3	2	1	2	1	0	6	35
Significant natural	29	3	4	1	0	4	1	0	35	77
All others, including none	2,186	9	179	142	23	262	25	0	1,417	4,302
Total of all samples, including temporary plots[a]	2,386	25	200	162	25	286	28	59	1,612	4,783

[a]Total is not the same as the sum of all columns because all damage disturbances are not used in the table.

Anderson, Robert L.; McClure, Joe P.; Cost, Noel D.; Hoffard, William H.
Incidence and impact of damage to Florida's timber, 1980. Resour. Bull. SE-64. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1983. 20 p.

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KEYWORDS: Forest insects, forest diseases, damage assessment.

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