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Incidence and Impact of Damage to Georgia's Timber, 1982

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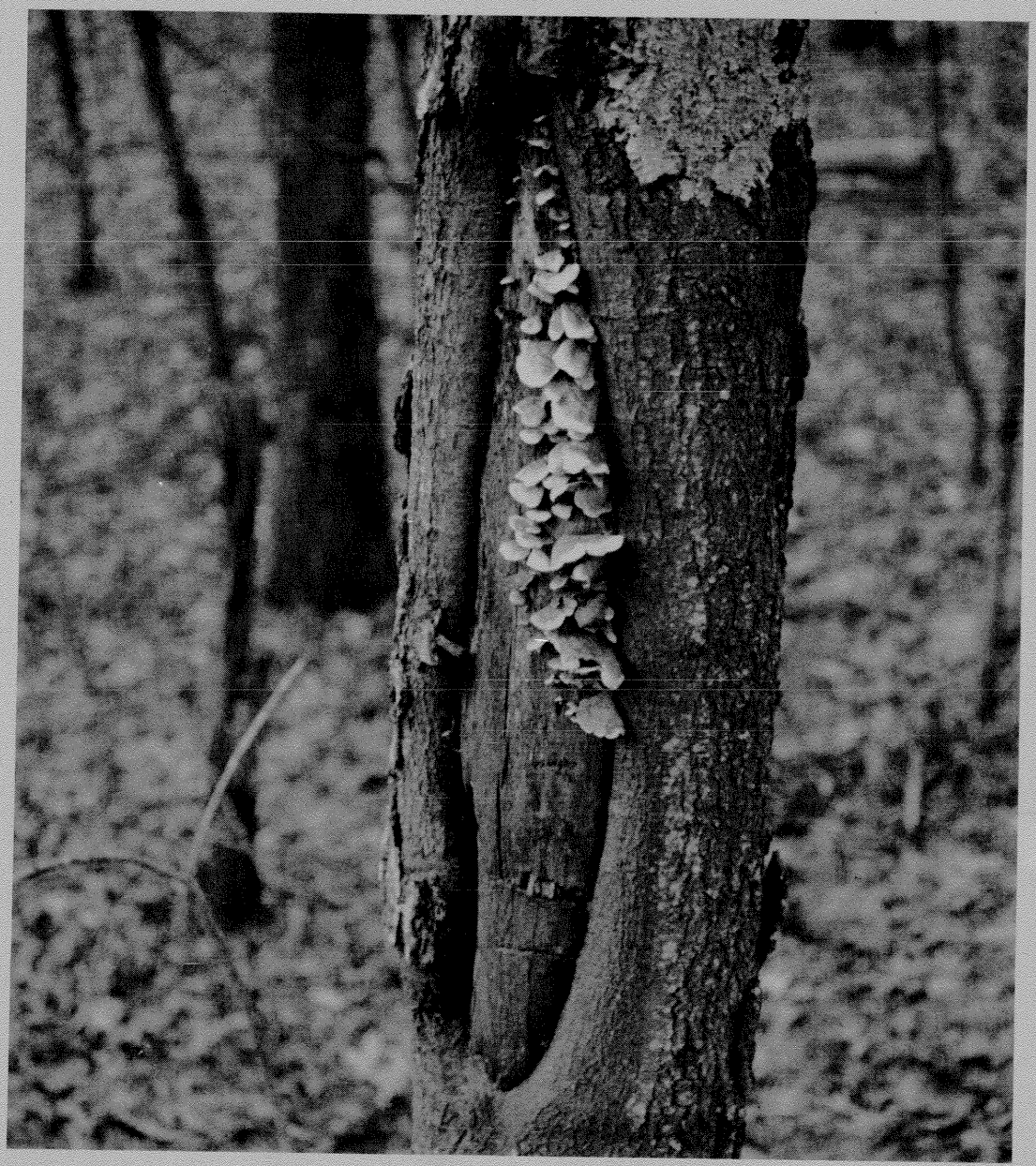

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Southeastern Forest Experiment Station
200 Weaver Boulevard
Asheville, North Carolina 28804

Incidence and Impact of Damage to Georgia's Timber, 1982

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Contents

Foreword

This Bulletin reports survey data on agents damaging trees in Georgia's forests. Data were collected in 1980, 1981, and 1982 by the Forest Inventory and Analysis 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 for this inventory than in the previous data collections, which makes possible the publication of this specialized report on timber damage, as well as reports on forest resources other than timber.

The Southeastern Forest Experiment Station in Asheville, NC, periodically inventories and evaluates forest resources in Florida, Georgia, North Carolina, South Carolina, and Virginia. The Region 8, State and Private Forestry, Forest Pest Management Staff Unit, headquartered in Atlanta, GA, 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 Georgia requiring technical assistance with forestry problems on State and private land should contact:

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Introduction

During the fifth inventory of Georgia's forests in 1980-1983, damage to live 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 but at any time 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 recognized agents are listed in "Definitions."

Before the field survey, qualified people from Region 8, State and Private Forestry, Forest Pest Management, trained the field crews in the use of a damage-identification handbook, which was used throughout the survey. During the survey, they field-checked data collected by crews to ensure accuracy and consistency. It should be recognized that the data reported here were gathered by people trained and experienced in forest inventory, not entomology and pathology. Crew members received specimen kits and forms to help them identify types of damage.

Georgia is the fifth 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 brownspot and trees of all sizes with damage such as defoliation (which is not apparent in winter) are not accounted for in this report.

There are three reasons why this report cannot accurately access the incidence and impact of all damage that occurred in Georgia's forests. First, damage is caused by a wide variety of agents, some of which are easily recognized, and others which are more difficult to identify. The data presented here for damaging agents which are easily identified and persistent, such as fusiform rust, are very reliable. The data for damaging agents which are more difficult to recognize, such as root rot, are underestimated.

Second, certain types of damage can only be observed during part of the year and have not been included in this survey. For example, defoliation caused by insects and diseases is only evident at the time of year the trees are supposed to have leaves. Since the survey crews work year around, defoliation is one type of damage which cannot be considered. Consequently, we have no information on incidence and impact of defoliation in this report.

Third, some damaging agents cause trees to die rapidly, and dead trees are recorded in a mortality category. For instance, trees attacked by bark beetles in summer tend to die rapidly. If the survey crew found bark beetles, there is a good chance the trees would be dead and tallied as such. The bark beetle "damaged" trees would not show up in a listing of damaged trees.

In spite of these problems, the survey gives a good picture of the relative incidence and impact of damaging agents which are easily recognized and persist year around. This is the context in which the report should be read.

Acres of forest types, timber removals, and mortality by species and size class are taken from the Resource Bulletin "Georgia's Forests" (Sheffield and Knight 1984). The remaining data were analyzed by Forest Pest Management to develop the tables presented here.

Sampling Procedure

The sampling procedure used for the inventory was 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:

- Initial estimates of forest and nonforest acreages were developed from the classification of 118,600 sample clusters systematically spaced on the latest aerial photographs available.

Field crews checked a subsample of 11,503 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 photograph and for photo misclassifications.

• For the entire State, estimates of timber volume and forest classifications were based on measurements recorded at 7,084 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 delineated with a basal area factor of 37.5 square feet per acre were systematically spaced within a single forest condition at 5 of the 10 cluster points. Trees less than 5.0 inches d.b.h. were tallied on fixed- radius plots around the point centers.

• Equations developed from detailed measurements of standing trees in Georgia 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 101 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 6,134 permanent sample plots established in the 1972 inventory. A 1980 survey of timber products output, conducted by the Georgia Forestry Commission, along with the annual pulpwood production study in the South, provided additional information for a breakdown of removals, by product.

All field data were sent to Asheville for editing and were entered into disk and magnetic-tape storage for processing. Final estimates were based on statistical summaries of the data. As each of the five Survey Units in Georgia 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 5.0 inches d.b.h.; softwood poles, 5.0 to 9.0 inches d.b.h.; hardwood poles, 5.0 to 11.0 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 measurements of standing and felled trees in Georgia 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 listed in "Definitions." 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 for sawtimber trees but did not qualify 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 quality losses 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 Georgia in 1982.

Incidence of Damaging Agents and Associated Cull

Georgia has 23,733,684 acres of commercial forest, and most of the acreage is in the oak-hickory, loblolly pine, slash pine, oak-gum-cypress, and oak-pine forest types. Table 1 shows the acreage in the various stand-size classes and forest types. The remaining tables in this report show how much of the timber resource is damaged and the agents responsible for the damage. Remember, the term "damage" refers to an injury the tree has suffered. A damaged tree is still alive.

Overall, hardwoods had more damage than softwoods, and more saplings were damaged than poletimber or sawtimber. Loblolly pine and slash pine are the most abundant softwood species in Georgia, and 30 percent or more of both poletimber- and sawtimber-size trees were damaged. Shortleaf pine, the third most abundant softwood, had the least damage of any of the major pine species. Only 16 percent of the poletimber and 10 percent of the sawtimber were damaged.

The percentage of saplings damaged was generally much higher for hardwoods than softwoods. In most hardwood species, 40 to 66 percent of the saplings were damaged. The most frequently damaged saplings were black cherry and ash. Hardwood poletimber was damaged less often than saplings or sawtimber. The most frequently damaged hardwood sawtimber trees were black cherry, soft and hard maples, and beech. More than 50 percent of the trees in these species were damaged.

Tables 2 and 3 show percentages of trees damaged, by size class and tree species.

Table 4 shows damage incidence and associated cull for softwoods. The most common causes of softwood damage were suppression and stagnation, weather, logging, and form. All softwood species exhibited signs of these types of damage. The damaging agent with the highest incidence, when it occurred, was fusiform rust. Loblolly, slash, longleaf, and pond pines, in all size classes, were affected by this disease. In these tree species, fusiform rust was the most damaging agent and was associated with high volume losses. 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. Turpentining contributed to the greatest cull loss on longleaf and slash pines. Basal defect, branch stubs, dieback, and suppression and stagnation were associated with high cull losses on baldcypress and pondcypress.

The incidence of bark beetle damage on live softwood trees is very low. Bark beetles are the greatest insect pest of pine in the Southeast, and yet they do not show up as a significant damaging agent for most softwood species. The main reason for this is that the survey reports damage to living trees, and most often bark beetles are associated with dead trees. Therefore, bark beetle infested trees would be considered damaged only when they were newly attacked and not yet dead. Bark beetle outbreaks also occur in cycles, so it is highly probable that a survey may not coincide with a beetle outbreak. In fact, this happened with the present survey of Georgia, which was conducted just after a major beetle outbreak.

Reported incidence and associated cull due to insect damage on both hardwoods and softwoods were very low. Insect damage, however, is significantly underestimated due to the difficulty in diagnosing and evaluating incidence and severity of many types of insect-caused damage.

Table 5 shows damage incidence and associated cull for hardwoods. The most common damage problems observed in hardwoods were basal defect, dieback, weather, suppression and stagnation, logging, and form. Form damage had the highest incidence, and it occurred in saplings. Saplings of all species had some degree of form damage but ash was the worst, with 47 percent of the trees damaged. There is much less form damage in poletimber and sawtimber because saplings either grow out of the form damage, die, or become suppressed. Saplings also had a high incidence of damage due to suppression and stagnation. Although many hardwood species are attacked by terminal shoot and stem borers, this was observed only on hickory where 18 percent of the saplings were damaged.

Black cherry had particularly high damage incidence in all size classes. Black knot, a disease which would come under the "other diseases" category, probably contributed to the high incidence of damage found in black cherry saplings and poletimber. This disease is very easy to identify by the elongated black swellings it causes on the twigs and branches. Black cherry also has thin bark which makes it vulnerable to fire and logging damage. Basal defect, dieback, and weather account for a large portion of the damage to sawtimber-size trees. Black cherry is particularly susceptible to top breakage during storms because it typically towers above the general canopy in mixed stands.

The largest loss in hardwoods was due to basal defect. Beech, cottonwood, basswood, bay and magnolia each had basal defect in more than 20 percent of the sawtimber-size trees. Basal defect is usually associated with past logging or fire.

High cull losses on all hardwood species were associated with basal defect, dieback, and branch stubs. Branch stubs of the size recorded in this survey are normally decayed. This explains why there was a high degree of associated cull. Branch stubs are normally associated with thinning operations or storm damage and are more common in understocked stands.

Mortality, Losses to Cull, Quality Loss, and Economic Impact

Annual mortality of all live softwood timber was about 211 million cubic feet and 151 million cubic feet for hardwood timber. Softwood mortality was more than 19 percent of the annual harvest, and hardwood mortality was 48 percent of the harvest. Approximately 52 percent of softwood mortality and 64 percent of hardwood mortality occurred in sawtimber-size trees. The mortality figures shown in table 6 are the total for the resource and do not reflect any discounting for trees whose death represented no economic loss. Table 6 also shows the estimated volumes of cull and quality loss for the major species groups in Georgia. Annual harvest figures are given to place the volume losses in perspective.

The volume lost due to cull is much greater in hardwoods than softwoods. The annual accumulated cull for hardwoods is 18 percent of annual hardwood mortality, while cull in softwoods is less than 1 percent of softwood mortality. Quality loss was also greater in hardwoods than softwoods. Quality loss of trees occurs with the shift from the sawtimber to poletimber category because of particular types of damage. It should be noted that mortality figures are on an annual basis, whereas annual accumulated cull and quality loss were determined by dividing total accumulated cull and quality loss by 10, so that losses were distributed over a 10-year period.

The economic impact of damaging agents is greatest in softwood sawtimber, which showed an annual loss of $96,313,904 (table 7). The annual loss for hardwood sawtimber, although greater in cubic feet, is only $41,301,590 because hardwood stumpage value is considerably less than that of softwood. In poletimber, the $28,336,540 softwood loss exceeded that of hardwoods ($2,806,558) by 10 times.

Overall, 77 percent of all economic impact occurs in softwoods, and about 82 percent of the total economic impact is in sawtimber-size trees.

Past Disturbance

In stands that have been significantly disturbed since the last survey, the cause of the disturbance and any needed corrective treatment are determined by the survey crew. Table 8 summarizes these observations. Diseases, insects, and weather were the most prevalent damaging disturbances encountered. Stands which had insect, disease, or weather damage most often required no corrective treatment. However, when corrective treatment was prescribed it was usually thinning, cleaning, salvage, harvest, or regeneration. All of these indicate that the stand is overmature, crowded, or growing under stress, and these are the usual conditions under which insects and diseases become problems.

Definitions

Damaging Agents and Tree Defects and Their Symptoms

Diseases

Fusiform rust.--Slash, loblolly, pitch, pond, and shortleaf pines. Spindle-shaped galls form on the stem or on branches within 12 inches of the bole. Older galls appear as cankers with sunken, rotten centers encircled by a callus ridge. Witches'-broom is common at galls. Bright orange spores are produced on the galls in the spring.

Hardwood cankers.--All hardwoods. Dead, sunken area on the stem, frequently with annual callus ridges around the dead area.

Littleleaf disease.--Shortleaf and loblolly pines, but shortleaf is more susceptible. Affected trees occur in groups. Short, yellow needles; reduced shoot growth; and large crops of undersized cones are typical symptoms. Littleleaf disease usually occurs in trees growing on heavy soils with poor internal drainage.

Pitch canker.--Most southern pines, but primarily slash, loblolly, and shortleaf. Symptoms are flagging at branch ends, pitch flow from affected area, slight swelling on affected stems and twigs, crooks in main stem, and wilting of current candles.

Root rots.--All species. Diseased trees often with thin, tufted crowns, frequently occur in groups that usually contain dead or windthrown trees. Conks (fruiting bodies) of various fungi may be present on or near the base of diseased trees. Root rots are more frequent in trees of reduced vigor, thinned stands, and in trees with butt or root injury. Trees with root rots are often attacked by bark beetles.

Other diseases.--All species. All damage caused by diseases not identified in separate categories (e.g., red heart of pine, brown spot, and leaf diseases). Trees showing degrade caused by diseases and not identified elsewhere are included in this category.

Growth Defects

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.).

Basal defect.--All species. Butt swelling, curls, V-shaped stump sprouts, frost seams, and low stubs below d.b.h. are symptoms of basal defect.

Dieback.--All hardwoods. Tips of the branches die back. Initially, only a few branches are affected, but in advanced stages, entire branches die. Tree mortality may result. Dieback is frequently associated with stress caused by an unfavorable environment.

Suppression and stagnation.--All species. Suppressed and stagnated trees are characterized by poor form and small crowns. Suppressed trees are overtopped and receive indirect sunlight. Stagnated trees have thin foliage and receive some direct sunlight. Stagnation is usually associated with poor growing sites or overstocked stands.

Form (damaging).--All species. All trees 5.0 inches d.b.h. and larger that are deformed due to unknown causes.

Natural Phenomena

Fire.--All species. Fire scars are usually at the base of stem and are widespread in the stand. The scars are usually on the uphill side of the tree, and signs of charring are generally present on the stem.

Flooding.--All species. Yellowing and curling downward of leaves, premature leaf fall, branch and top dieback, tree mortality, and high water and silt marks on tree boles are the most common effects of flooding.

Lightning.--All species. Lightning causes bark stripping or cracking, with damage running from the strike point to the ground in a straight line or spirally. Often, the foliage will fade due to root damage or top breakage. Bark beetles often invade struck trees.

Weather.--All species. Windthrow, ice, frost cracks, broken tops, broken branches, marginal leaf burn, and winter burn are the common symptoms.

Animals and Birds

Beaver.--All species. Beavers leave toothmarks and remove the bark from the bole of the tree. Trees are often flooded by water impoundment.

Other animals.--All species. Branches clipped off or broken, bark removed, holes in the stem, and tears and toothmarks in the wood are all common signs of animal activity.

Sapsucker.--All species. Horizontal rows of small holes that may encircle the tree's bole. Bark below the hole is usually streaked or stained by oozing sap.

Insects

Bark beetles.--All pines. Symptoms include pitch tubes, bark beetle galleries on the inner bark surface and the surface of the sapwood, exit holes, and loose bark. Streaks caused by blue stain fungi are often evident on the sapwood. Foliage of infested trees gradually yellows and then turns red.

Hardwood borers.--All hardwoods. The initial symptom is a dark sap spot on the bark surface, often mixed with frass. Eventually, coarse boring particles appear in bark cracks and crevices beneath the point of attack. Old damage appears as knobby overgrowths or scars on the bark surface.

Terminal shoot and stem borers.--All species. Fresh attacks show boring dust and frass at the entrance holes, which are most often located at the base of leaf petioles and buds. Resin globs may be present at points of attack. Dieback results from larval tunneling within terminal shoots and branches. Foliage on the shoots turns yellow, red, and finally brown.

Other insects.--All species. All damage caused by insects not identified in separate categories. Includes hardwood defoliators (e.g., orangestriped oakworm and fall cankerworm), pine defoliators (e.g., redheaded pine sawfly), and pine weevils.

Human Activities

People.--All species. Initials in bark, nails in tree, lantern burn, bark stripped, wire around stem, and ax marks are signs of damage by people.

Logging and related.--All species. Logging scars on the stem will have callus ridges within 1 to 2 years after wounding. Trees with logging damage are scattered in stands and show no charring. Broken limbs and scars on the stem near the crown will occur from the felling of other trees. Skid trails, stumps, or other evidence of logging will be present.

Turpentining.--Longleaf, slash, and loblolly pines. Damage is seen as exposed wood with V-shaped scars and heavy pitch flow.

Forest Survey Terms

Acceptable trees.--Growing-stock trees of commercial species that meet specified standards of size and quality, but do not qualify 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 in square feet 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.

Cleaning.--An intermediate cutting made in a stand, not past the sapling stage, in order to eliminate undesirable trees of the same age which overtop or are likely to overtop the best trees in the stand.

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 a damaging agent.

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

Rotten trees.--Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of rot or missing sections, and with less than one-third of the gross tree volume in sound material.

Rough trees.-- (a) Live trees of commercial species that do not contain at least one saw log or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of roughness, poor form, splits, and cracks, and with less than one-third of the gross tree volume in sound material. (b) All live trees of miscellaneous species.

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 d.b.h. and hardwoods at least 11.0.

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

Species groups.--Sets of tree species pooled together for standard reporting.

Other red oaks: Scarlet, southern red, laurel, water, willow and black.

Select red oaks: Cherrybark, northern red, and shumard.

Other white oaks: Overcup, chestnut, post and live.

Select white oaks: White, swamp chestnut, and chinkapin.

Other eastern hardwoods: Buckeye, birch, hackberry, dogwood, persimmon, honeylocust, silverbell, holly, butternut, cucumbertree, mulberry, scrub oaks, willow, and noncommercial species.

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.

Susceptible trees.--All living trees. Includes desirable and acceptable trees, as well as rough and rotten trees.

References

This publication reports incidence and impact of damaging agents on Georgia'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:	
Sawtimber	9,508,717
Poletimber	7,721,620
Saplings-seedlings	5,809,798
Nonstocked areas	693,549
All stand sizes	23,733,684
Forest type:	
Oak-hickory	5,458,754
Loblolly pine	5,130,233
Slash pine	4,057,766
Oak-gum-cypress	3,069,475
Oak-pine	2,959,550
Shortleaf pine	914,704
Longleaf pine	676,444
Elm-ash-cottonwood	460,483
Virginia pine	380,955
Southern scrub oak	308,521
Pond pine	141,448
White pine-hemlock	81,429
Chestnut oak	37,982
Sand pine	21,335
Eastern redcedar	19,658
Pitch pine	14,947
All types	23,733,684

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

Host	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		- - - - - Percent - - - - -		
Loblolly pine	1,905,510	42	40	36
Slash pine	1,463,825	29	30	33
Shortleaf pine	577,011	32	16	10
Pondcypress	280,270	15	12	16
Virginia pine	224,055	39	23	22
Longleaf pine	136,582	25	24	24
Eastern redcedar	57,134	25	14	26
Pond pine	46,744	45	36	30
Eastern white pine	37,752	0	0	0
Baldcypress	19,601	39	7	16
Pitch pine	4,757	67	26	19
Sand pine	4,645	25	0	a
Spruce pine	4,147	45	36	20
Table Mountain pine	566	a	22	0

[a] There were no trees of this size class in the sample, therefore measures of trees damaged could not be made.

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

Host	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		- - - - - - Percent - - - - - -		
Other eastern hardwoods	2,563,936	45	29	32
Sweetgum	1,700,579	43	22	29
Tupelo & blackgum	1,615,797	57	33	40
Other red oaks	1,589,145	40	23	30
Soft maple	1,133,634	62	37	54
Hickory	553,697	57	29	30
Bay & magnolia	324,654	45	32	55
Select white oaks	322,197	39	15	15
Yellow-poplar	309,087	25	18	25
Elm	241,371	62	22	30
Black cherry	240,171	66	40	75
Other white oaks	235,630	59	26	37
Ash	201,489	66	32	32
Chestnut oak	126,988	0	0	0
Select red oaks	69,688	40	15	22
Hard maple	39,569	57	30	52
Beech	20,192	48	34	51
Sycamore	7,132	32	20	29
Black locust	6,181	0	0	0
Basswood	5,519	51	44	30
Black walnut	4,025	30	10	31
Cottonwood	1,231	0	44	46

Table 4.--Damage incidence and associated cull in softwoods in Georgia, 1982

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 (1,905,510,000 susceptible trees)								
Fusiform rust	23	29	27	<1	<1	174	1,069	9,314
Pitch canker	<1	<1	<1	0	0	0	0	0
Root rot	<1	<1	<1	0	0	0	0	0
Other diseases	<1	<1	<1	0	<1	0	105	0
Basal defect	<1	0	<1	0	6	0	354	0
Dieback	<1	<1	<1	0	3	0	35	0
Suppression & stagnation	8	2	<1	0	<1	0	22	321
Form	3	<1	<1	0	0	0	0	0
Fire	<1	<1	<1	0	<1	0	58	0
Flooding	<1	<1	0	0	0	0	0	0
Lightning	0	<1	<1	5	2	17	189	1,544
Weather	4	4	3	<1	1	354	815	1,062
Beaver	0	0	<1	0	0	0	0	0
Other animals	<1	<1	<1	0	0	0	0	0
Sapsucker	<1	<1	<1	0	0	0	0	0
Bark beetles	<1	<1	1	0	0	0	0	767
Terminal shoot and stem borers	1	<1	<1	0	0	0	0	0
Other insects	<1	<1	<1	0	0	0	0	0
People	<1	<1	<1	3	3	117	802	366
Logging & related	2	2	2	<1	0	63	0	0
Turpentining	0	<1	<1	0	0	0	0	0
SLASH PINE (1,463,825,000 susceptible trees)								
Fusiform rust	15	24	20	<1	<1	299	217	2,405
Pitch canker	<1	1	<1	0	0	0	0	0
Root rot	<1	0	<1	0	0	0	0	0
Other diseases	<1	<1	<1	0	0	0	0	0
Basal defect	0	<1	<1	7	7	36	137	293
Dieback	<1	<1	<1	0	0	0	0	0
Suppression & stagnation	7	1	<1	<1	0	11	0	0
Form	1	<1	<1	0	0	0	0	0
Fire	1	1	1	0	<1	0	39	0
Flooding	<1	<1	0	0	0	0	0	0
Lightning	0	<1	<1	0	2	0	60	0
Weather	1	1	1	1	2	100	444	0
Beaver	0	<1	<1	0	0	0	0	0
Other animals	<1	0	<1	0	0	0	0	0
Sapsucker	<1	<1	1	0	0	0	0	0
Bark beetles	<1	<1	<1	0	0	0	0	0
Terminal shoot and stem borers	<1	<1	0	0	0	0	0	0
Other insects	<1	<1	<1	0	0	0	0	0
People	<1	<1	<1	0	2	0	103	0
Logging & related	1	1	2	<1	0	24	0	0
Turpentining	0	<1	6	0	<1	0	903	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in Georgia, 1982--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					$M\ ft^3$		
SHORTLEAF PINE (577,011,000 susceptible trees)								
Littleleaf disease	1	1	1	0	0	0	0	0
Pitch canker	0	<1	<1	0	0	0	0	0
Root rot	0	0	<1	0	0	0	0	0
Other diseases	3	1	1	0	0	0	0	0
Basal defect	0	0	<1	0	5	0	34	0
Dieback	<1	0	0	0	0	0	0	0
Suppression & stagnation	15	5	1	0	0	0	0	0
Form	5	<1	<1	0	0	0	0	0
Fire	<1	<1	1	0	0	0	0	0
Lightning	0	0	<1	0	0	0	0	0
Weather	5	4	2	1	1	156	133	0
Beaver	0	<1	<1	0	0	0	0	0
Other animals	<1	0	0	0	0	0	0	0
Sapsucker	0	0	1	0	0	0	0	0
Bark beetles	<1	<1	1	0	0	0	0	0
Terminal shoot and stem borers	<1	0	0	0	0	0	0	0
Other insects	<1	<1	<1	0	0	0	0	0
People	<1	0	<1	0	4	0	166	0
Logging & related	2	2	2	0	0	0	0	0
PONDCYPRESS (280,270,000 susceptible trees)								
Other diseases	<1	1	1	2	6	66	103	232
Branch stubs	0	<1	1	27	11	109	262	240
Basal defect	<1	2	7	7	13	447	2,605	2,864
Dieback	1	2	2	7	8	370	396	529
Suppression & stagnation	6	2	<1	3	5	151	23	0
Form	4	1	1	0	0	0	0	0
Fire	1	1	2	4	1	95	36	0
Flooding	0	1	0	0	0	0	0	0
Lightning	0	<1	1	0	1	0	22	0
Weather	1	1	1	6	2	150	72	0
Other animals	<1	<1	<1	0	0	0	0	0
Other insects	<1	0	<1	0	25	0	82	327
People	<1	0	<1	0	0	0	0	0
Logging & related	1	1	1	7	0	230	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in Georgia, 1982--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					$M\ ft^3$		
VIRGINIA PINE (224,055,000 susceptible trees)								
Eastern gall rust	8	6	8	0	0	0	0	0
Pitch canker	2	1	2	0	0	0	0	0
Other diseases	4	3	3	0	0	0	0	0
Basal defect	0	0	<1	0	5	0	47	0
Dieback	1	0	0	0	0	0	0	0
Suppression & stagnation	13	2	0	0	0	0	0	0
Form	6	2	2	0	0	0	0	1,360
Fire	0	1	1	0	0	0	0	0
Lightning	0	<1	0	0	0	0	0	0
Weather	5	5	3	0	1	0	79	0
Other animals	<1	0	0	0	0	0	0	0
Sapsucker	<1	0	0	0	0	0	0	0
Bark beetles	0	<1	2	0	0	0	0	725
Other insects	0	<1	0	0	0	0	0	0
People	0	1	<1	0	0	0	0	0
Logging & related	1	1	2	0	0	0	0	0
LONGLEAF PINE (136,582,000 susceptible trees)								
Fusiform rust	4	9	6	<1	0	33	0	0
Pitch canker	0	<1	<1	0	0	0	0	0
Root rot	0	0	<1	0	0	0	0	0
Other diseases	0	0	<1	0	0	0	0	0
Dieback	1	0	0	0	0	0	0	0
Suppression & stagnation	6	1	0	0	0	0	0	0
Form	3	1	<1	0	0	0	0	0
Fire	2	4	3	0	<1	0	51	0
Weather	5	2	1	0	0	0	0	0
Other animals	<1	0	<1	0	0	0	0	0
Sapsucker	0	2	4	0	0	0	0	0
Bark beetles	0	0	1	0	0	0	0	0
Terminal shoot and stem borers	0	<1	0	0	0	0	0	0
Other insects	0	1	<1	0	0	0	0	0
People	0	0	<1	0	0	0	0	0
Logging & related	3	3	3	0	0	0	0	0
Turpentining	0	0	5	0	1	0	768	626
EASTERN REDCEDAR (57,134,000 susceptible trees)								
Other diseases	<1	0	0	0	0	0	0	0
Basal defect	0	0	14	0	15	0	227	65
Suppression & stagnation	5	0	0	0	0	0	0	0
Form	7	0	6	0	0	0	0	0
Fire	0	2	0	0	0	0	0	0
Weather	4	6	0	4	0	40	0	0
Beaver	0	0	6	0	0	0	0	0
People	1	1	0	5	0	15	0	0
Logging & related	8	5	0	0	0	0	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in Georgia, 1982--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					$M ft^3$		
POND PINE (46,744,000 susceptible trees)								
Fusiform rust	14	23	16	1	<1	77	17	550
Pitch canker	2	0	1	0	0	0	0	0
Other diseases	2	0	<1	0	0	0	0	0
Basal defect	0	0	1	0	5	0	53	0
Dieback	2	1	<1	0	0	0	0	0
Suppression & stagnation	12	4	<1	0	0	0	0	0
Form	6	1	1	0	0	0	0	0
Fire	2	1	2	0	2	0	81	0
Lightning	0	0	<1	0	5	0	17	0
Weather	2	2	3	0	1	0	29	0
Sapsucker	0	<1	2	0	0	0	0	0
Bark beetles	0	0	1	0	0	0	0	0
Terminal shoot and stem borers	0	1	0	0	0	0	0	0
Other insects	1	0	<1	0	5	0	52	0
Logging & related	3	4	2	5	0	88	0	0
Turpentining	0	0	<1	0	0	0	0	0
BALDCYPRESS (19,601,000 susceptible trees)								
Other diseases	0	0	<1	0	0	0	0	0
Branch stubs	0	0	1	0	19	0	454	86
Basal defect	0	3	9	5	27	65	4,841	6,874
Dieback	0	1	<1	0	12	0	204	267
Suppression & stagnation	11	0	<1	0	20	0	54	0
Form	23	0	1	0	0	0	0	0
Weather	2	0	1	0	6	0	144	0
Beaver	2	0	<1	0	0	0	0	0
Sapsucker	0	0	<1	0	0	0	0	0
Other insects	0	0	1	0	0	0	0	0
People	0	0	<1	0	3	0	37	0
Logging & related	2	4	2	0	0	0	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in Georgia, 1982--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					$M\ ft^3$		
PITCH PINE (4,757,000 susceptible trees)								
Suppression & stagnation	17	5	0	0	0	0	0	0
Form	51	0	5	0	0	0	0	605
Lightning	0	0	2	0	0	0	0	0
Weather	0	0	6	0	0	0	0	0
Sapsucker	0	0	2	0	0	0	0	0
Bark beetles	0	21	3	0	0	0	0	0
Logging & related	0	0	2	0	0	0	0	0
SAND PINE (4,645,000 susceptible trees)								
Form	17	0	0	0	0	0	0	0
Terminal shoot and stem borers	8	0	0	0	0	0	0	0
SPRUCE PINE (4,147,000 susceptible trees)								
Eastern gall rust	14	16	1	0	0	0	0	0
Other diseases	0	0	5	0	0	0	0	0
Dieback	0	0	2	0	0	0	0	0
Suppression & stagnation	16	0	0	0	0	0	0	0
Form	7	0	1	0	0	0	0	0
Beaver	0	0	1	0	0	0	0	0
Sapsucker	0	0	2	0	0	0	0	0
People	0	20	1	0	0	0	0	0
Logging & related	8	0	8	0	0	0	0	0
TABLE MOUNTAIN PINE (566,000 susceptible trees)								
People	0	22	0	0	0	0	0	0

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982

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 (1,700,579,000 susceptible trees)				
Hardwood cankers	<1	0	<1	0	1	0	32	0
Other diseases	<1	<1	1	2	1	58	73	0
Branch stubs	<1	<1	1	19	15	189	1,033	1,742
Basal defect	<1	2	6	14	16	1,730	10,558	18,539
Dieback	1	2	2	1	2	226	372	537
Suppression & stagnation	15	3	<1	<1	0	26	0	1,009
Form	16	3	3	0	<1	0	131	1,080
Fire	1	1	1	1	0	62	0	0
Weather	3	4	5	4	2	1,552	1,088	1,480
Beaver	<1	2	5	0	<1	0	80	516
Other animals	<1	<1	1	0	0	0	0	0
Sapsucker	0	<1	1	0	0	0	0	0
Hardwood borers	<1	<1	<1	0	0	0	0	0
Other insects	<1	<1	0	0	0	0	0	0
People	<1	<1	1	5	3	176	388	0
Logging & related	6	6	3	2	1	1,077	318	567
				TUPELO & BLACKGUM (1,615,797,000 susceptible trees)				
Hardwood cankers	<1	2	2	1	1	148	329	4,633
Other diseases	<1	1	1	1	4	180	589	2,174
Branch stubs	<1	<1	2	14	10	599	2,828	7,969
Basal defect	<1	7	15	12	19	7,938	31,997	58,932
Dieback	3	3	3	6	6	2,177	2,479	5,243
Suppression & stagnation	11	3	<1	1	4	131	149	426
Form	33	5	5	<1	<1	33	152	875
Fire	1	2	1	3	3	477	512	1,828
Flooding	0	<1	<1	0	0	0	0	0
Lightning	0	0	<1	0	10	0	44	0
Weather	3	4	6	6	10	2,608	8,213	14,736
Beaver	<1	1	2	<1	1	31	166	1,044
Other animals	<1	<1	<1	3	0	53	0	0
Sapsucker	0	<1	<1	0	0	0	0	0
Hardwood borers	<1	<1	<1	0	0	0	0	0
Other insects	<1	<1	<1	0	0	0	0	0
People	<1	<1	<1	6	6	146	275	889
Logging & related	4	3	2	2	2	567	533	3,651

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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					$M ft^3$		
OTHER RED OAKS (1,589,145,000 susceptible trees)								
Hardwood cankers	<1	1	2	1	1	90	642	2,550
Root rot	0	0	<1	0	0	0	0	0
Other diseases	<1	<1	1	2	5	136	1,993	5,155
Branch stubs	0	<1	2	10	16	406	8,004	17,551
Basal defect	<1	1	7	11	19	1,760	31,157	64,178
Dieback	1	2	2	2	7	387	2,097	4,551
Suppression & stagnation	8	2	<1	<1	0	24	0	0
Form	22	2	2	0	1	0	309	233
Fire	2	3	1	1	4	217	928	3,140
Flooding	<1	<1	<1	0	0	0	0	0
Lightning	0	<1	<1	6	12	45	414	1,118
Weather	2	3	5	2	5	1,021	4,576	9,353
Beaver	<1	<1	<1	0	2	0	58	0
Other animals	<1	<1	<1	0	0	0	0	0
Sapsucker	<1	<1	1	0	0	0	0	327
Hardwood borers	1	4	4	0	<1	0	248	2,418
Terminal shoot and stem borers	<1	0	0	0	0	0	0	0
Other insects	<1	<1	<1	0	0	0	0	0
People	<1	<1	1	3	3	119	471	1,911
Logging & related	3	4	2	2	3	853	1,076	2,710
SOFT MAPLE (1,133,634,000 susceptible trees)								
Hardwood cankers	1	1	1	4	2	107	216	3,040
Root rot	0	<1	0	0	0	0	0	0
Other diseases	1	1	2	6	2	335	197	3,565
Branch stubs	0	2	3	8	11	589	1,791	8,906
Basal defect	<1	4	14	16	22	2,664	12,306	30,425
Dieback	1	3	3	9	16	1,084	1,999	6,749
Suppression & stagnation	8	2	<1	0	2	0	20	400
Form	42	6	8	0	<1	0	48	424
Fire	1	2	2	2	5	160	632	1,823
Flooding	<1	1	1	5	17	154	624	2,073
Weather	3	8	9	7	10	2,269	3,957	11,039
Beaver	0	<1	<1	15	0	136	0	0
Other animals	<1	<1	<1	0	0	0	0	0
Sapsucker	0	1	2	0	<1	0	40	2,083
Hardwood borers	1	2	4	1	1	73	227	1,518
Other insects	<1	<1	<1	0	0	0	0	0
People	<1	<1	1	6	7	141	411	416
Logging & related	3	5	3	4	2	726	218	1,665

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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 (553,697,000 susceptible trees)								
Hardwood cankers	<1	<1	<1	0	0	0	0	0
Other diseases	<1	0	1	0	0	0	0	0
Branch stubs	0	<1	1	5	7	16	489	244
Basal defect	0	4	8	10	16	1,117	5,686	7,348
Dieback	1	1	1	1	3	25	111	596
Suppression & stagnation	10	2	0	1	0	44	0	0
Form	16	2	3	0	0	0	25	0
Fire	2	4	2	4	6	277	468	627
Flooding	0	0	<1	0	0	0	0	0
Weather	3	3	3	1	3	63	528	2,584
Beaver	0	0	<1	0	0	0	0	0
Other animals	<1	<1	0	0	0	0	0	0
Sapsucker	0	2	8	0	<1	0	164	0
Hardwood borers	1	<1	<1	0	0	0	0	0
Terminal shoot and stem borers	18	6	2	0	0	0	0	0
Other insects	1	<1	<1	0	0	0	0	0
People	<1	<1	<1	2	2	22	64	0
Logging & related	5	5	1	1	2	76	111	0
BAY & MAGNOLIA (324,654,000 susceptible trees)								
Hardwood cankers	<1	1	2	0	<1	0	24	0
Other diseases	<1	<1	2	0	0	0	0	0
Branch stubs	0	2	1	12	24	271	589	903
Basal defect	1	5	22	9	15	755	5,719	12,847
Dieback	1	3	3	2	13	121	383	1,577
Suppression & stagnation	10	2	0	0	0	0	0	0
Form	27	3	7	0	0	0	0	570
Fire	2	1	2	0	<1	0	23	409
Flooding	0	<1	0	0	0	0	0	0
Weather	2	5	7	4	7	409	813	2,742
Beaver	0	<1	0	0	0	0	0	0
Other animals	<1	1	1	0	0	0	0	948
Sapsucker	0	2	4	0	2	0	116	756
Hardwood borers	<1	1	3	1	<1	17	22	0
Other insects	0	<1	<1	0	0	0	0	0
People	<1	0	0	0	0	0	0	0
Logging & related	2	3	1	4	4	140	79	316

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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					$M\ ft^3$		
SELECT WHITE OAKS (322,197,000 susceptible trees)								
Hardwood cankers	<1	<1	1	0	6	0	444	2,075
Other diseases	<1	<1	1	0	0	0	0	0
Branch stubs	0	0	1	0	12	0	1,392	1,489
Basal defect	<1	1	1	14	22	237	2,716	5,764
Dieback	1	<1	1	0	<1	0	21	0
Suppression & stagnation	11	3	<1	0	0	0	0	0
Form	19	2	2	0	0	0	0	1,017
Fire	1	1	2	0	8	0	641	934
Lightning	0	0	<1	0	40	0	244	611
Weather	2	2	2	1	4	41	516	1,343
Beaver	0	<1	0	0	0	0	0	0
Other animals	0	0	<1	0	0	0	0	0
Sapsucker	0	1	2	0	0	0	0	0
Hardwood borers	<1	1	<1	0	0	0	0	0
Other insects	0	<1	<1	0	0	0	0	0
People	<1	<1	1	5	1	18	125	0
Logging & related	4	4	2	<1	1	15	92	264
YELLOW-POPLAR (309,087,000 susceptible trees)								
Hardwood cankers	<1	0	<1	0	3	0	147	210
Other diseases	<1	1	1	0	3	0	271	561
Branch stubs	0	<1	<1	30	14	118	809	427
Basal defect	<1	1	5	9	14	366	8,176	10,681
Dieback	1	1	1	3	0	42	0	540
Suppression & stagnation	11	3	<1	0	0	0	0	0
Form	8	1	1	0	0	0	0	0
Fire	1	1	1	0	2	0	185	530
Flooding	0	<1	<1	0	9	0	42	444
Lightning	0	0	1	0	4	0	236	96
Weather	2	4	4	<1	2	17	1,008	472
Beaver	0	<1	<1	0	0	0	0	0
Other animals	<1	0	<1	0	0	0	0	0
Sapsucker	0	<1	2	0	<1	0	64	0
Hardwood borers	1	1	4	0	<1	0	33	0
Other insects	0	<1	<1	0	0	0	0	0
People	<1	<1	<1	3	2	40	73	0
Logging & related	2	4	3	2	1	171	318	378

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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					$M\ ft^3$		
ELM (241,371,000 susceptible trees)								
Other diseases	<1	<1	1	0	0	0	0	800
Branch stubs	0	<1	4	5	11	5	600	1,972
Basal defect	<1	2	5	17	16	358	720	2,802
Dieback	<1	0	2	0	2	0	32	0
Suppression & stagnation	15	3	<1	0	0	0	0	0
Form	34	4	3	0	0	0	0	0
Fire	<1	1	0	0	0	0	0	0
Flooding	<1	3	<1	0	0	0	0	0
Weather	3	2	4	4	1	141	39	0
Beaver	<1	0	<1	0	0	0	0	0
Other animals	0	<1	0	0	0	0	0	0
Sapsucker	0	1	8	0	0	0	0	0
Hardwood borers	<1	0	1	0	0	0	0	0
Other insects	<1	0	0	0	0	0	0	0
People	<1	1	1	0	5	0	126	0
Logging & related	8	4	1	0	0	0	0	0
BLACK CHERRY (240,171,000 susceptible trees)								
Hardwood cankers	2	3	0	0	0	0	0	0
Other diseases	10	12	3	<1	0	27	0	0
Branch stubs	0	2	5	8	5	53	39	427
Basal defect	0	2	10	13	16	153	326	1,160
Dieback	1	4	12	1	2	16	22	0
Suppression & stagnation	8	1	0	0	0	0	0	0
Form	37	3	7	0	0	0	0	0
Fire	1	2	4	3	0	12	0	0
Weather	1	8	19	5	0	266	0	0
Beaver	<1	0	0	0	0	0	0	0
Other animals	<1	0	0	0	0	0	0	0
Sapsucker	0	0	7	0	0	0	0	0
Hardwood borers	<1	<1	0	0	0	0	0	0
People	0	0	4	0	5	0	31	0
Logging & related	5	5	5	5	0	114	0	0

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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					$M\ ft^3$		
OTHER WHITE OAKS (235,630,000 susceptible trees)								
Hardwood cankers	<1	2	1	0	4	0	148	989
Other diseases	<1	2	2	0	0	0	0	2,362
Branch stubs	0	<1	2	10	10	35	1,059	6,313
Basal defect	<1	2	8	13	14	379	4,617	19,460
Dieback	2	1	1	2	5	27	159	529
Suppression & stagnation	12	2	<1	3	0	79	0	498
Form	37	3	5	0	0	0	0	0
Fire	2	4	5	<1	1	18	137	4,876
Lightning	0	0	<1	0	0	0	0	0
Weather	2	2	4	2	8	68	1,149	5,790
Other animals	0	1	0	0	0	0	0	0
Sapsucker	0	1	3	0	1	0	129	3,094
Hardwood borers	<1	1	1	0	1	0	121	0
Other insects	0	0	<1	0	0	0	0	202
People	<1	<1	1	35	4	120	200	2,319
Logging & related	4	6	4	1	2	98	158	1,563
ASH (201,489,000 susceptible trees)								
Hardwood cankers	<1	0	1	0	5	0	68	0
Other diseases	0	0	<1	0	0	0	0	0
Branch stubs	0	1	3	12	12	90	446	1,947
Basal defect	1	3	8	18	19	518	2,510	6,189
Dieback	1	4	2	9	20	275	456	1,206
Suppression & stagnation	11	3	0	1	0	18	0	0
Form	47	5	4	0	0	0	0	0
Flooding	<1	1	0	0	0	0	0	0
Weather	3	4	5	7	9	337	833	517
Beaver	1	6	7	0	2	0	287	289
Other animals	<1	1	1	0	0	0	0	0
Sapsucker	0	2	1	0	0	0	0	0
Hardwood borers	<1	1	<1	0	0	0	0	0
People	0	<1	1	7	0	63	0	0
Logging & related	2	2	1	8	26	136	213	364

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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					$M\ ft^3$		
SELECT RED OAKS (69,688,000 susceptible trees)								
Hardwood cankers	1	2	0	0	0	0	0	0
Other diseases	<1	0	1	0	10	0	408	633
Branch stubs	0	0	2	0	19	0	2,402	3,955
Basal defect	0	1	4	0	17	0	1,911	3,997
Dieback	2	<1	2	0	0	0	0	0
Suppression & stagnation	9	1	1	0	0	0	0	0
Form	22	2	3	0	0	0	0	763
Fire	0	2	1	0	0	0	0	0
Lightning	0	<1	<1	0	2	0	47	0
Weather	2	5	4	2	2	133	267	771
Hardwood borers	1	1	1	0	0	0	0	0
People	0	0	1	0	1	0	31	0
Logging & related	2	1	2	2	0	34	0	0
HARD MAPLE (39,569,000 susceptible trees)								
Hardwood cankers	1	0	0	0	0	0	0	0
Other diseases	1	1	0	35	0	87	0	0
Basal defect	0	6	5	10	5	68	31	624
Dieback	0	3	0	0	0	0	0	0
Suppression & stagnation	4	0	13	0	0	0	0	0
Form	40	0	0	0	0	0	0	0
Fire	2	0	4	0	70	0	189	270
Weather	4	10	14	0	49	0	425	876
Sapsucker	0	3	15	0	2	0	20	0
Hardwood borers	1	0	0	0	0	0	0	0
Logging & related	4	6	0	0	0	0	0	0

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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					$M\ ft^3$		
BEECH (20,192,000 susceptible trees)								
Other diseases	0	3	0	0	0	0	0	0
Branch stubs	0	0	2	0	21	0	527	1,948
Basal defect	0	0	30	0	21	0	4,211	9,763
Suppression & stagnation	11	5	0	0	0	0	0	0
Form	31	2	6	0	0	0	0	0
Fire	0	2	4	0	25	0	657	1,132
Lightning	0	0	1	0	75	0	141	188
Weather	4	12	2	0	18	0	271	290
Hardwood borers	0	7	0	0	0	0	0	0
People	0	0	3	0	2	0	79	0
Logging & related	1	4	2	0	14	0	195	558
SYCAMORE (7,132,000 susceptible trees)								
Branch stubs	0	0	1	0	5	0	32	0
Basal defect	0	4	6	5	13	69	286	581
Dieback	0	4	0	0	0	0	0	0
Suppression & stagnation	20	0	0	0	0	0	0	0
Form	12	2	9	0	0	0	0	0
Weather	0	10	13	8	4	48	133	0
BASSWOOD (5,519,000 susceptible trees)								
Basal defect	0	0	21	0	13	0	130	105
Dieback	0	0	5	0	20	0	116	0
Suppression & stagnation	19	0	0	0	0	0	0	0
Form	26	0	0	0	0	0	0	0
Weather	0	26	2	0	45	0	320	712
Sapsucker	0	18	0	0	0	0	0	0
Hardwood borers	5	0	1	0	0	0	0	0

Continued

Table 5.--Damage incidence and associated cull in hardwoods in Georgia, 1982--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 (4,025,000 susceptible trees)								
Basal defect	0	0	15	0	50	0	83	166
Dieback	9	0	0	0	0	0	0	0
Form	12	0	0	0	0	0	0	0
Weather	0	5	8	0	0	0	0	0
Animal	10	0	0	0	0	0	0	0
People	0	5	8	5	5	26	31	0
COTTONWOOD (1,231,000 susceptible trees)								
Other diseases	0	0	8	0	0	0	0	0
Basal defect	0	0	23	0	30	0	158	528
Dieback	0	14	16	0	0	0	0	0
Sapsucker	0	8	0	0	0	0	0	0
People	0	16	0	5	0	19	0	0
Logging & related	0	6	0	0	0	0	0	0
OTHER EASTERN HARDWOODS (2,563,936,000 susceptible trees)								
Hardwood cankers	<1	1	<1	6	8	193	372	890
Other diseases	<1	1	1	2	15	120	566	2,197
Branch stubs	<1	1	2	12	14	873	2,136	6,741
Basal defect	<1	5	10	14	20	3,838	10,195	33,935
Dieback	1	2	1	5	9	773	714	5,433
Suppression & stagnation	7	2	1	1	2	82	71	1,547
Form	28	2	3	<1	0	22	0	4,920
Fire	1	3	1	2	3	352	219	2,166
Flooding	<1	<1	0	6	0	23	0	0
Lightning	0	0	<1	0	9	0	146	418
Weather	3	7	8	4	5	1,599	2,545	11,430
Beaver	<1	<1	1	0	0	0	0	533
Other animals	<1	<1	0	29	0	129	0	0
Sapsucker	<1	1	1	0	<1	0	22	1,995
Bark beetles	0	0	<1	0	0	0	0	0
Hardwood borers	<1	<1	<1	0	4	0	103	932
Terminal shoot and stem borers	0	0	<1	0	0	0	0	0
Other insects	<1	<1	0	0	0	0	0	0
People	<1	<1	<1	2	5	76	81	477
Logging & related	3	4	2	3	1	723	202	3,694

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 poletimber
			Annual mortality		Annual accumulated cull		
	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	M ft^3						
SOFTWOODS							
Loblolly pine	99,781	371,859	46,578	58,366	72	345	1,337
Slash pine	116,804	254,983	29,982	17,373	47	190	270
Longleaf pine	12,261	83,419	1,124	4,758	3	82	63
Shortleaf pine	31,270	80,361	17,838	18,813	16	33	0
Pond pine	2,592	12,941	771	1,679	16	25	55
Virginia pine	5,940	10,042	3,857	4,826	0	13	208
Pondcypress	1,145	2,673	896	647	162	360	419
Spruce pine	634	2,284	0	430	0	0	0
Eastern white pine	0	2,284	0	926	-	-	-
Baldcypress	0	1,040	0	202	6	573	723
Pitch pine	0	534	557	862	0	0	60
Eastern redcedar	430	120	0	449	6	23	6
Table Mountain pine	0	0	0	0	0	0	0
Sand pine	0	0	0	0	0	0	0
Total	270,857	822,540	101,603	109,331	328	1,644	3,141
HARDWOODS							
Other red oaks	32,562	54,937	14,261	34,119	506	5,197	11,520
Sweetgum	23,351	38,073	8,036	11,098	510	1,407	2,547
Yellow-poplar	6,415	34,130	2,956	4,931	75	1,136	1,434
Tupelo & blackgum	6,217	19,491	4,181	9,579	1,509	4,827	10,240
Select white oaks	4,608	13,114	526	1,593	31	619	1,350
Hickory	5,307	10,693	2,011	3,748	164	765	1,140
Soft maple	4,543	7,896	5,169	7,772	844	2,269	7,413
Other white oaks	3,595	7,193	1,397	1,410	82	788	4,800
Other eastern hardwoods	6,799	5,626	8,213	6,489	880	1,737	7,731
Select red oaks	547	4,924	2,073	5,187	17	507	1,012
Chestnut oak	807	3,790	997	2,233	-	-	-
Ash	1,480	3,587	1,533	2,594	144	481	1,051
Elm	1,392	2,837	623	1,827	50	152	557
Bay & magnolia	1,491	2,461	1,139	1,888	171	777	2,107
Sycamore	666	1,926	0	0	12	45	58
Beech	125	1,570	276	430	0	608	1,388
Black cherry	833	1,092	857	313	64	42	159
Hard maple	0	395	0	306	16	67	177
Black walnut	205	162	0	0	3	11	17
Black locust	192	0	307	481	-	-	-
Basswood	182	0	79	87	0	57	82
Cottonwood	0	0	0	381	2	16	53
Total	101,317	213,897	54,634	96,466	5,080	21,508	54,836

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	114,116	844.00	96,313,904
Poletimber	101,931	278.00	28,336,818
Hardwoods			
Sawtimber	172,810	239.00	41,301,590
Poletimber	59,714	47.00	2,806,558
All species			
Sawtimber	286,926		137,615,494
Poletimber	161,645		31,143,376
Total	448,571		168,758,870

Table 8.--Treatment needed as related to past disturbance, by number of sample stands

Past disturbance	None	Salvage	Harvest	Thinning		Cleaning	Stand conversion	Artificial regeneration		Total
				Commercial	Precomm.			No site prep.	Site prep.	
	Number of sample stands									
Disease	306	42	14	101	3	35	5	0	31	537
Insects	180	18	19	20	1	39	3	0	29	309
Weather and other natural destructive agents	101	10	55	11	2	20	4	0	45	248
Grazing	100	1	14	15	1	10	2	0	26	169
Construction of fences, roads, firebreaks, trash pits, etc.	36	0	2	4	1	11	0	0	22	76
Wildfire	31	4	5	1	1	2	1	0	15	60
Salvage cut	13	0	1	0	0	4	0	0	10	28
Turpentining	16	0	2	0	0	1	1	0	5	25
Man-caused flooding	1	1	0	0	0	0	0	0	1	3

Huber, Cindy M.; McClure, Joe P.; Cost, Noel D. Incidence and impact of damage to Georgia's timber, 1982. Resour. Bull. SE-75. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1984. 27 pp.

Annual losses to forest pests in Georgia are estimated to be over $168 million per year. Tables are presented showing losses by major timber species and damaging agent.

KEYWORDS: Forest insects, forest diseases, damage assessment.

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