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Incidence and Impact of Damage to and Mortality Trends of Georgia's Timber, 1989

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Foreword

The damage information presented here was gathered during the fifth and sixth inventories of the State's forest resources. More information was gathered in this latest inventory than in previous ones. This information makes it possible to estimate damage incidence and trends in mortality.

The Southeastern Forest Experiment Station, headquartered in Asheville, NC, periodically inventories and evaluates forest resources in Florida, Georgia, North Carolina, South Carolina, and Virginia. The Southern Region, 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.

This Bulletin describes damage incidence and mortality trends, but does not recommend specific prevention measures. Residents of Georgia who need technical assistance with forestry problems on State and private land should contact:

State Forester
Georgia Forestry Commission
P. O. Box 819
Macon, GA 31298-4599

Abstract

On Georgia's 23.6 million acres of forest land, 329 million cubic feet of timber were lost annually to mortality and cull between 1982 and 1989, at an estimated annual cost of $167.8 million. Among broad management types–natural pine, planted pine, oak-pine, upland hardwoods, and bottomland hardwoods–the greatest loss occurred in natural pine stands. Approximately three-fourths of the loss occurred in nonindustrial private forests. Fusiform rust caused the greatest damage to pines, but littleleaf disease and bark beetles also contributed to volume losses. *Ips* beetle populations, combined with off-site conditions and drought stress may have increased slash pine sawtimber mortality. A significant increase in mortality of both upland and bottomland hardwoods was attributed to a complex of factors that included stand dynamics and weather conditions.

Keywords: Insect damage, disease damage, fusiform rust, bark beetles, forest insects, forest diseases.

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During the fifth (1982) and sixth (1989) inventories of Georgia's forests, field crews noted damage to and mortality of sample trees. Where possible, they identified causes of mortality and damaging agents. This Bulletin reports the damage and mortality observed during the sixth survey, the associated costs, and the changes in mortality between the two surveys. It was not possible to compare damage trends between the two surveys because new damage categories were added in the sixth survey.

Inventory Procedures

Inventory procedures are described in detail by the USDA Forest Service (1985). Some of them influence the kinds of information that can be compiled and the ways in which data can be interpreted. This Bulletin describes procedures and definitions that affect the understanding of survey results.

In each inventory, plots are visited only once, and the visit may take place at any time of year. This limits recordkeeping to those agents that produce symptoms or signs in all seasons. Other limitations were that damaging agents or damage must be easily identifiable, and that the survey only include trees at least one inch in diameter at breast height (d.b.h.). Effects of seedling diseases (for example, brown-spot needle blight of longleaf pine) and of hardwood defoliation (which is not apparent in winter) were not included in this Bulletin. On the basis of these limitations, the following damaging agents were recognized in the 1989 survey:

Diseases
Basal defects
Branch stubs
Fusiform rust
Other rusts
Hardwood cankers
Littleleaf disease
Root rots
Other diseases

Weather
Flooding
Lightning

Fire

Insects
Bark beetles
Hardwood borers
Other insects

Animals
Beaver
Sapsucker

Other damaging agents
Dieback
Form (damaging)
Damage caused by people
Suppression and stagnation
Turpentining
Logging and related

Symptoms and signs associated with each category are described in the "Definitions" section of this Bulletin.

Prior to the field survey, Forest Pest Management trained the crews in the use of a damage identification handbook that was used throughout the survey. During the survey, data collected by the crews were field checked to ensure accuracy and consistency. Crew members also received specimen kits and forms to help them identify types of damage. Nevertheless, it is important to recognize that the data reported here were gathered by people experienced in forest inventory, rather than by entomologists and pathologists.

There are three factors that cause the incidence and impact of damage to Georgia's timber to be understated. First, as explained previously, certain types of damages, such as hardwood defoliators, are excluded. Second, the damage caused by some agents, such as root decay organisms, is extremely difficult to identify. Third, some damaging agents, such as southern pine beetles, cause trees to die rapidly, and inventory crews may be unable to determine the cause of death. As a result, mortality estimates are accurate, but the numbers of deaths that can be attributed to specific agents are underestimated.

In spite of these problems, the data reported here are important. They show that losses are significant, and they can help managers plan forest protection programs.

Sampling Procedures

The inventory employs a sampling procedure designed to provide reliable statistics primarily for the entire State, for large groups of counties, and for tree species with relatively large total volumes in the State. Accordingly, errors associated with relatively minor species like cottonwood exceed those for major species like loblolly pine. Procedures are documented in "Georgia's Forests" (Sheffield and Knight 1984).

Computations

Tree-size sampling categories 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 d.b.h. and above; and hardwood sawtimber, 11.0 inches d.b.h. and above.

Volume measurements of standing and felled trees in Georgia and similar measurements of other trees throughout the Southeast were the basis of the volume prediction equations that were used to compute merchantable and total cubic volumes.

The "Definitions" section lists the symptoms used to identify the cause of damage to living trees on the sampled plots. The percentage of incidence and the volume of cull associated with each damage class were determined for each species. Damage entries do not imply total tree loss. The volume loss was determined by totaling the volume of cull associated with each damaging agent, by species. Only a part of the volume lost (due to cull) would fail to qualify for firewood or other commercial uses.

Although mortality of individual trees often could not be attributed to a specific agent, the volume loss from mortality was accurate for each tree species on each plot. By using total mortality by tree species, it was possible to calculate total volume loss for poles and sawtimber by species.

This Bulletin presents an economic analysis of mortality and cull losses in both tabular and graphic form. For each class of ownership (national forest, other public, forest industry, and nonindustrial private), broad management classes (natural and planted pine, oak-pine, and upland and bottomland hardwood) are displayed by total volume of loss and by present value of loss, segmented by cull and mortality.

To estimate the value of the loss, an average age of harvest was calculated from Forest Inventory and Analysis (FIA) "removal" data by age, ownership, and species category. For each age class and type of loss, FIA volume loss data in thousand cubic feet were converted to volumes per acre and "grown" to the assumed rotation age, based on the growth factors obtained from "The South's Fourth Forest: Alternatives for the Future" (USDA Forest Service 1988). This process treats each age and ownership class as a group of acres in that class and estimates future volume affected by mortality with species-growth factors. Because large areas are involved, estimation in volume growth may be quite variable. The assumption was that overestimates of volume due to the slow growth of trees in fully stocked stands are canceled by underestimates of volume in trees of a particular age class in understocked stands.

If the age class for volume loss was greater than the assumed rotation age, growth was not calculated; it was assumed that the damaged trees could be harvested immediately. The resulting future harvest volumes were converted to thousand board feet and cords, with divisor factors of 200 cubic feet per thousand board feet and 90 cubic feet per cord.

Average Statewide stumpage prices for the species and year of the FIA survey were taken from Timber Mart-South (Norris 1987) and were increased from the year of the survey to 2030 by the real rates of increase for hardwood and softwood stumpage estimated in "The South's Fourth Forest: Alternatives for the Future." No further real increase in stumpage was assumed to occur after 2030. The resulting future stumpage values were multiplied by the estimated harvest volumes at rotation age.

All ownership categories except forest industry are assumed to have a sawtimber product at rotation. For industry, a proportion of the softwood volume less than 25 years old, and hardwood volume less than 30 years old is calculated as a cordwood product. Each age class future value was discounted to the present at a 4 percent real rate of interest and a time factor that equaled the difference between the assumed rotation age and the age class. Values of loss do not assume that there are demand-supply adjustments in price; in other words, it is assumed that there would be a market available for the lost timber.

The analysis excluded timber on steep slopes where the cost of logging may be extreme or prohibitive, thereby producing expected volume losses that are understated in all categories. Timber is assumed to have value only in areas where logging is economically feasible. Furthermore, the analysis ignored the possibilities of ingrowth that would result from trees dying, and the assumption that mortality would increase the growth rate of residual stems.

Volumes and present values for mortality and cull loss are for the entire period between remeasurements, 6.8 years for the Georgia survey. To convert to an annual basis, volume was divided by 6.8, and the annuity amount was calculated for the present value of loss over the 6.8 years.

Mortality can be assumed to have occurred between surveys; however, cull loss is often a cumulative volume, and incremental loss between survey periods cannot be estimated until two survey periods are compared. For Georgia, methods used for the fifth and sixth survey periods do not allow direct comparisons between these surveys. Data exhibited in the chart and the accompanying graphs are based on annual averages.

Nature of Results

The survey results are presented in detailed tables that report mortality and cull by broad management class, ownership class, tree species, and damaging agent. Interpreting some of the numbers presented in these tables requires information on forest acreage by broad management class and forest type. Table 1 provides these acreages for 1982 and 1989. Figures 1-5 show the geographic distribution of broad management classes across the State.

In 1989, Georgia had 23.6 million acres of timberland - 0.5 percent less than in 1982. Between surveys, the area of planted pine increased from 3.6 to 5.0 million acres, while the area of natural pine decreased from 7.8 to 6.0 million acres. Oak-pine acreage increased by 3 percent, upland hardwood acreage by 2 percent, and bottomland hardwood acreage remained the same from 1982 to 1989. These changes must be considered when damage totals in the two surveys are compared.

Table 2 shows the percentage of trees damaged and volume of associated cull, by broad management class and tree size. The volume of associated cull is that which is caused solely by damaging agents that result in cubic or form cull. In individual management classes, the proportion of saplings with damage ranged from 20 to 25 percent. As one might expect, the proportion of damaged trees increased with size, ranging from 28 to 32 percent for poletimber and from 30 to 39 percent for sawtimber trees. Thirty-nine percent of the sawtimber in the planted pine areas suffered damage, due primarily to fusiform rust. Incidence of cull was highest in bottomland hardwoods, where basal defects caused by fire are often the largest damage factor.

Table 3 shows the percentage of trees damaged in each broad management class, by tree species and type of damage. A type of damage was entered in the table only if at least 3 percent of the trees in one of the size classes displayed that type of damage. Form damage, suppression, and stagnation were excluded from table 3 because they seldom indicate a serious problem. In a dense stand, some suppression of overtopped trees must be expected.

Fusiform rust was the most serious damaging agent in plantations and natural stands of loblolly and slash pine and in oak-pine stands (figure 6). Natural pond pine showed remarkably high percentages of rust damage across the size classes. Littleleaf disease was found on approximately five percent of the shortleaf pine sawtimber trees in plantations. The incidence of bark beetle damage was low due to the exclusive reporting of live trees. Bark beetle attacks result in rapid deterioration of the trees, and these surveys cannot capture such events.

The most frequently damaged hardwood species in the sawtimber size class were maple and blackgum. The main problems for hardwoods appeared to be basal defect and logging and related activities. The defects and scars were most likely caused by fire and mechanical injuries. Insect stem borers and weather also caused considerable damage to hardwoods. Sapling and pole-sized hickory in the oak-pine management class showed noteworthy borer presence, as did pole-sized and sawtimber red oak. Weather damage may be attributed to storm and ice distribution, as well as to the composition of tree species susceptible to breakage. Damage appeared uniform across size classes and management classes as a whole.

Table 4 shows number of trees, total volume, and cull volume by broad management class and species for 1989.

Table 5 shows mortality and annual harvest, by broad management type and species for 1982 and 1989. With the exception of softwood poletimber, there was an overall increase in mortality between surveys, even after changes in forest acreage were taken into account. Removal figures will not add back to the reported State totals, as the removals in this report do not include land clearing, timberland reclassified to reserved status, or silvicultural improvements. The mortality figures will not add back to the reported State totals because of rounding discrepancies.

The overall high mortality for pine may be caused by bark beetles. Slash pine in both the planted pine and oak-pine management types showed significant increases in sawtimber mortality between 1982 and 1989. Possible causes include drought conditions in the previous years, offsite factors that stressed the trees, and an increase in *Ips* beetle populations. In the natural pine management type, both Virginia pine and water oak showed substantial increases in sawtimber mortality. The oak-pine management type showed mortality increases in black oak, laurel oak, scarlet oak, and red maple sawtimber mortality. In the past, explanations for these increases in mortality were found in site and weather conditions.

In upland hardwoods, fusiform rust was the primary cause of increases in shortleaf pine sawtimber mortality. Noteworthy increases of mortality in yellow-poplar, beech, and hickory sawtimber may have been drought-stress induced. Increased sawtimber mortality of laurel oak, post oak, water oak, and white oak may have been site- and age-related. For bottomland hardwoods, mortality increased significantly for lowland blackgum, hackberry, sweetbay, and laurel oak. A complex of factors, including moisture conditions, may explain the general increase in mortality for a large number of species.

Economic Losses

From 1982 to 1989 the average annual loss to cull and mortality was estimated to be 328.8 million cubic feet of timber. The estimated value of the loss was $167.8 million per year when averaged across the 6.8 year remeasurement period, or about $6.50 per acre[1] when averaged over the 24.8 million acres of commercial timberland.

[1]The difference between the tabular value (table 1) and the economic value of the total commercial timberland acreage for Georgia is due to a rounding discrepancy.

About 75 percent of the volume and value loss occurred on nonindustrial private forests (figure 7). The next greatest loss occurred on forest industry land where volume and value loss were about 19 percent. Among the broad ownership classes, losses were greatest in natural pine stands (figure 8). Thirty-three percent of the volume loss occurred in natural pine stands, but 56 percent of the value loss was in these stands. Bottomland hardwoods accounted for 25 percent of the volume loss but for only 15 percent of the value loss. Upland hardwoods had similar percentages as bottomland hardwoods for volume and value loss. Other management classes accounted for relatively small percentages of the volume and value losses.

Figures 9-12 stratify losses by management class and ownership category. Natural pine had the greatest percentage of dollar loss across all ownership categories. On forest industry land, however, pine plantations also had significant dollar losses.

Table 6 shows the average annual losses for volume and value, by ownership and broad management class. About $126.6 million was lost annually in nonindustrial private forests, and $94.0 million was lost in natural pine stands across all ownership categories.

Definitions

Damaging Agents and Their Symptoms

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.

Bark beetles. All pines. Cream to yellow and pinkish globs of resin resembling popped corn appear on the bark surface. If the infestation is well established and some trees still retain their foliage, tunnels or egg galleries are evident on the inner-bark surface and on the sapwood surface. Streaks caused by blue stain fungi are often evident on sapwood. Foliage gradually yellows, then reddens.

Terminal shoot and stem borers. All species. Fresh attacks show boring dust and frass at entrance holes, which are most often located at the base of leaf petioles and buds. White to pinkish globs of resin may appear at attack points. Attacks lead to terminal or branch dieback. Shoots turn yellow, then red, and finally brown (dead).

Other insects. All tree species. All damage caused by insects not identified separately are included in this category, which covers hardwood defoliators (such as variable oak leaf caterpillars) and pine defoliators (such as redheaded pine sawfly and pine weevils).

Fusiform rust. Slash, loblolly, pitch, pond, and longleaf pines. These rusts typically cause the formation of spindle-shaped galls on the stem or branches; many older galls appear as cankers with sunken rotten centers encircled by a callus ridge. Witches'-broom is common at galls. The fungi fruit in the spring, producing bright-orange spores. Report all stem cankers, but only those branch cankers that occur within 12 inches of the bole.

Other rusts. Shortleaf and other pine species. Galls appear globose (round) rather than spindle-shaped. Otherwise, characteristics are similar to fusiform rust.

Root rots. All species. Look for groups of dead or windthrown trees, trees with tufted, thin crowns that may be yellowing. Conks (fruiting bodies) of various fungi may appear on or near the base of affected trees. Root rot is more frequent in trees of reduced vigor, in thinned stands, and in trees with butt or root injury. Bark beetles often attack weakened trees.

Littleleaf disease. Shortleaf and loblolly pines, with shortleaf more susceptible. Affected trees occur in groups. Typically seen are yellow needles, reduced shoot growth, and large crops of undersized cones. This disease usually occurs on sites where heavy soils produce poor internal drainage.

Hardwood cankers. All hardwoods. Affected trees have dead sunken areas on the stem, frequently surrounded by annual callus ridges.

Branch stubs. All species. Branch holes or stubs are more than 4 inches in diameter on the stems of trees 5.0 inches d.b.h. and larger, and more than 1 inch in diameter on the stems of smaller trees.

Basal defects. All species. Symptoms include butt swelling, curls, V-shaped stump sprouts, frost seams, and branch stubs below d.b.h. Conks of decay fungi are often associated with defect.

Pitch canker. Primarily slash, shortleaf, and loblolly pines, but also Virginia, longleaf, eastern white, Scotch, Table Mountain, and pitch pines. Symptoms include flagging at the ends of branches, pitch flow from the affected area, slight swelling on affected stems and twigs, crooks in main stems, and wilting of new shoots. In early stages, there is a slight bark depression.

Other diseases. All species. All damage caused by diseases not separately identified are included in this category. Examples are red heart of pine, brown spot, and leaf diseases.

Fire. All species. Fire scars are usually at the base of the stem. Occurrence is widespread throughout the stand. On slopes, look for fire scars on the uphill sides of the tree. Signs of charring are generally present on the stem.

Animal. All tree species. Signs include chopped off or broken branches, removed bark, holes in the stem, and tears and toothmarks in the wood.

Beaver. All species. Beavers leave toothmarks and remove bark from the bole of the tree. Trees that are upstream from beaverdams often suffer from flooding.

Sapsucker. All species. Look for horizontal rows of small holes that may encircle the bole of the tree. The bark below the holes is usually streaked or stained by oozing sap.

Weather. All species. Severe weather causes windthrow, ice damage, frost crack (above d.b.h. for this Bulletin), broken tops, broken branches, marginal leaf burn, and winter burn.

Flooding. All species. Flooding causes yellowing and/or curling downward of leaves, premature leaf-fall, branch and top dieback, tree mortality, and high water and silt marks on tree boles.

Lightning. All species. Lightning causes bark stripping or cracks. Damage runs from the strike point to the ground, spirally or in straight lines. Tops break, or they fade after root damage. Bark beetles often invade struck trees.

Suppression and stagnation. All species. Suppressed and stagnated trees have poor form. Because small crown-suppressed trees are overtopped, they receive only indirect sunlight and develop thin foliage. Stagnation usually occurs on poor growing sites or in overstocked stands.

Damage caused by people. All species. Examples are initials in bark, embedded nails, lantern burns, stripped bark, callused roots, wire around stems, and axe marks.

Logging and related. All species. Logging scars on the stem develop callus ridges within 1 to 2 years. They are scattered in the stand and show no charring. Limb breakage and/or stem scars near the crown are indicators of impact from the logging of neighboring trees. Also look for skid trails and stumps.

Form (damaging). All species. All trees with form damage that cannot be separately classified are included in this category.

Dieback. All hardwoods. The tips of branches are dead. At first, only a few branches are affected, but entire branches die in advanced stages. Tree death may occur.

Forest Inventory 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 times the percent cull times the volume for the species.

Associated cull. Percentage of affected trees that contain cull associated with the indicated 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 as square feet of basal area per acre.

Commercial species. Tree species presently or potentially suitable for industrial wood products.

Desirable trees. Growing-stock trees of commercial species with relatively high vigor and without serious defects in quality that would limit use for timber products, or pathogens that would 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). Two-inch diameter classes are commonly used by FIA, with even-numbered whole inches serving as the approximate midpoints for classes. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.

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, defect, and length, at least 8 feet long, sound and straight, and a minimum inside-bark diameter of 6 inches for softwoods (8 inches for hardwoods).

Sawtimber trees. Live trees of commercial species containing at least one 12-foot saw log or two noncontiguous saw logs (each 8 feet or longer) with at least a third of the gross board-foot volume between the 1-foot stump and minimum saw log being sound. Softwood must be at least 9.0 inches and hardwoods at least 11.0 inches in diameter at breast height.

Sawtimber volume. Net volume of the saw-log portion of live sawtimber in board-feet based on the 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, spruce pine, and pond 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 that cover 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 sawtimber stocking.

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.

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

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Table 1--Distribution of timberland, by broad management class and forest type in Georgia, 1982 and 1989

Broad management class and forest type	1989	1982
	Acres	Acres
Planted pine		
Loblolly pine	2,633,501	1,373,109
Longleaf pine	26,311	11,073
Shortleaf pine	4,120	5,446
Slash pine	2,312,964	2,160,706
Sand pine	36,076	21,335
Virginia pine	20,824	13,458
Other planted pine	2,830	2,575
All planted pine	5,036,626	3,587,702
Natural pine		
Loblolly pine	3,119,772	3,757,124
Longleaf pine	493,551	665,371
Shortleaf pine	540,115	909,258
Slash pine	1,345,209	1,897,060
Pitch pine	11,778	14,947
Pond pine	96,805	138,873
Virginia pine	354,609	367,497
Table mountain pine	4,167	0
White pine-hemlock	74,444	76,976
Red cedar	9,072	19,658
All natural pine	6,049,522	7,846,764
Oak-pine		
All oak-pine	3,063,856	2,959,550
Upland hardwoods		
Oak-hickory	5,606,856	5,458,754
Chestnut oak	48,536	37,982
Southern scrub oak	262,500	308,521
All upland hardwoods	5,917,892	5,805,257
Bottomland hardwoods		
Oak-gum-cypress	3,245,126	3,069,475
Elm-ash-cottonwood	318,436	460,483
All bottomland hardwoods	3,563,562	3,529,958
Total	23,631,458	23,729,231

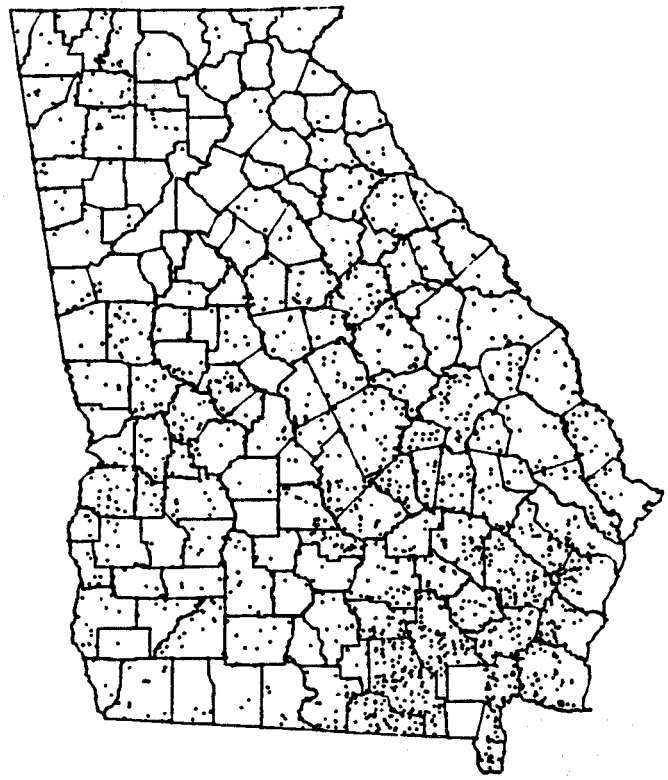
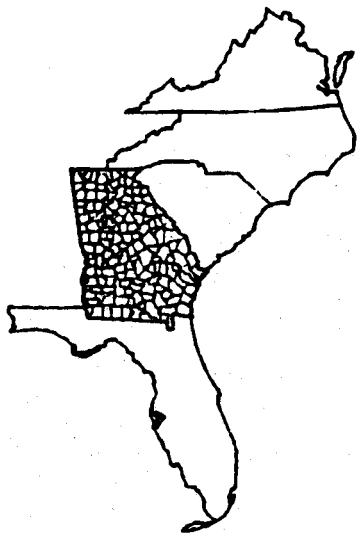


Figure 1-Distribution of planted pine plots in Georgia, 1989.



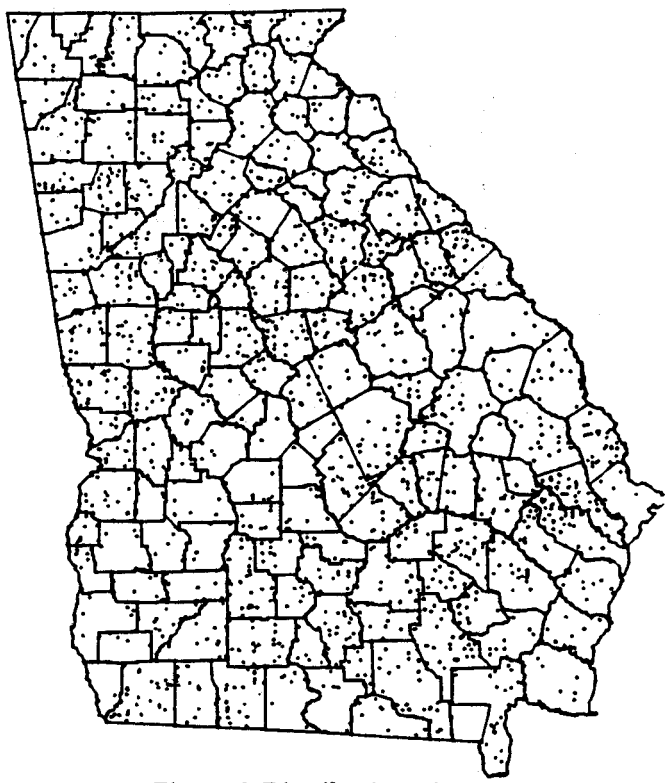


Figure 2-Distribution of natural pine plots in Georgia, 1989.

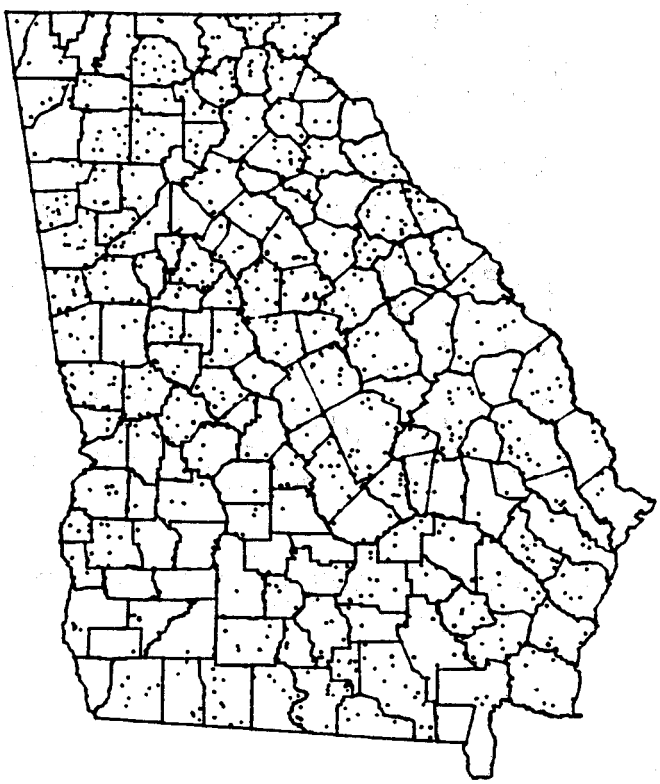


Figure 3-Distribution of oak-pine plots in Georgia, 1989.

Figure 4-Distribution of upland hardwood plots in Georgia, 1989.

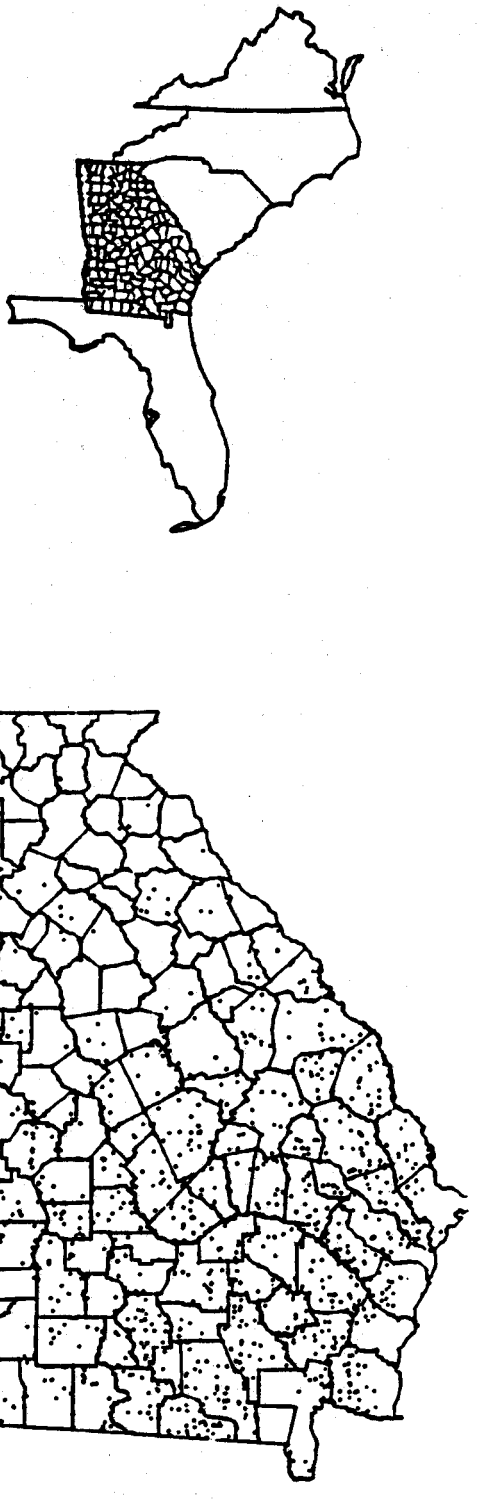


Figure 5-Distribution of bottomland hardwood plots in Georgia, 1989.

Table 2--Percentage of susceptible all-live trees damaged and volume of associated cull, by broad management class and tree size in Georgia, 1982 and 1989

Management class	Total population		Trees damaged			Volume of associated cull	
			Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber
	1989	1982	1989	1989	1989	1989	1989
	Thousands of trees		Percent			Thousand cubic feet	
Planted pine	2,426,028	1,732,906	20	32	39	853	2,140
Natural pine	4,082,488	5,437,493	24	28	30	8,033	26,098
Oak-pine	2,248,222	2,184,062	21	29	33	11,601	35,404
Upland hardwood	3,581,169	3,768,910	25	31	35	27,791	142,305
Bottomland hardwood	2,530,317	2,780,219	21	32	38	45,339	215,105
Total	14,868,224	15,903,590	23	30	34	93,617	421,052

Table 3--Incidence of damage by broad management class, host species, and type of damage in Georgia, 1989

Broad management class, host species, and damage type	Trees damaged		
	Sapling	Pole	Sawtimber
		Percent	
Planted pine			
Loblolly pine			
Fusiform rust	19	34	39
Longleaf pine			
Other insects	3	0	0
Fusiform rust	3	11	6
Sapsucker	0	3	8
Weather	7	2	1
People	5	0	0
Turpentining	0	0	11
Shortleaf pine			
Rusts	2	5	5
Littleleaf disease	0	0	5
People	0	0	3
Logging & related	0	5	0
Slash pine			
Fusiform rust	22	27	31
Virginia pine			
Other diseases	12	0	10
Rusts	0	5	8
Weather	0	11	0
Total softwoods			
Rusts	19	29	34
Total hardwoods			
Hardwood borers	3	4	3
Basal defects	0	1	19
Fire	2	6	8
Sapsucker	0	1	4
Weather	1	3	0
Logging & related	1	6	16
Natural pine			
Loblolly pine			
Fusiform rust	15	24	27
Weather	2	3	2
Logging & related	1	3	3
Longleaf pine			
Fusiform rust	1	6	6
Fire	3	4	4
Sapsucker	0	1	3
Logging & related	1	2	4
Turpentining	0	0	3

Continued

Table 3--Incidence of damage by broad management class, host species, and type of damage in Georgia, 1989--Continued

Broad management class, host species, and damage type	Trees damaged		
	Sapling	Pole	Sawtimber
	- - - - - - - Percent - - - - - - -		
Shortleaf pine			
Bark beetles	1	1	3
Rusts	1	3	1
Weather	3	4	2
Logging & related	1	2	3
Slash pine			
Fusiform rust	11	13	12
Logging & related	1	3	2
Turpentining	0	0	4
Pond pine			
Rusts	17	21	22
Dieback	4	5	0
Weather	6	2	1
Logging & related	0	5	3
Spruce pine			
Other insects	0	0	23
Total softwoods			
Rusts	10	15	17
Logging & related	1	3	3
Weather	2	3	2
Total hardwoods			
Hardwood borers	3	3	4
Basal defects	0	2	9
Fire	1	3	1
Dieback	1	1	3
Weather	3	3	5
Logging & related	2	4	3
Oak-pine			
Loblolly pine			
Fusiform rust	12	18	22
Weather	2	4	2
Logging & related	2	5	5
Slash pine			
Fusiform rust	15	15	12
Logging & related	4	4	5
Turpentining	0	0	3

Continued

Table 3--Incidence of damage by broad management class, host species, and type of damage in Georgia, 1989--Continued

Broad management class, host species, and damage type	Trees damaged		
	Sapling	Pole	Sawtimber
	Percent		
Shortleaf pine			
Bark beetles	2	2	7
Rusts	3	4	0
Sapsucker	0	1	3
Weather	4	4	3
Logging & related	6	2	3
Longleaf pine			
Fusiform rust	0	11	9
Fire	0	5	2
Sapsucker	0	0	8
Logging & related	9	0	6
Total softwoods			
Rusts	8	11	12
Weather	2	3	3
Logging & related	3	4	4
Total hardwoods			
Hardwood borers	3	4	5
Basal defects	0	3	10
Sapsucker	0	1	3
Weather	3	4	5
Logging & related	4	6	3
Upland hardwoods			
Maple			
Hardwood borers	10	6	2
Branch stubs	0	0	3
Dieback	0	1	3
Basal defects	0	4	20
Fire	0	4	3
Sapsucker	0	2	3
Weather	4	8	7
Logging & related	6	7	3
Sweetgum			
Basal defects	0	2	7
Dieback	1	3	3
Beaver	0	1	3
Weather	4	5	5
Logging & related	9	11	8
Red oaks			
Hardwood borers	6	11	11
Basal defects	0	2	8
Weather	2	5	8
Logging & related	4	6	3

Continued

Table 3--Incidence of damage by broad management class, host species, and type of damage in Georgia, 1989--Continued

Broad management class, host species, and damage type	Trees damaged		
	Sapling	Pole	Sawtimber
	Percent		
White oaks			
Hardwood borers	4	2	2
Basal defects	0	1	4
Weather	3	5	6
Logging & related	4	5	3
Hickory			
Terminal shoot & stem borers	24	20	8
Basal defects	0	2	6
Sapsucker	0	2	6
Weather	4	4	5
Logging & related	7	4	2
Yellow-poplar			
Hardwood borers	2	3	9
Basal defects	0	2	6
Sapsucker	0	0	3
Weather	4	7	10
Logging & related	3	4	2
Total softwoods			
Bark beetles	0	2	3
Other diseases	3	2	3
Rusts	8	9	14
Weather	2	6	3
Logging & related	4	2	4
Total hardwoods			
Hardwood borers	3	4	5
Basal defects	0	2	8
Weather	3	5	7
Logging & related	6	7	3
Bottomland hardwoods			
Water tupelo			
Other diseases	2	1	4
Basal defects	1	10	17
Dieback	1	3	7
Beaver	6	3	3
Weather	1	2	6
Logging & related	4	4	1

Continued

Table 3--Incidence of damage by broad management class, host species, and type of damage in Georgia, 1989--Continued

Broad management class, host species, and damage type	Trees damaged		
	Sapling	Pole	Sawtimber
	- - - - - - - Percent - - - - - - -		
Blackgum			
Hardwood cankers	1	2	3
Basal defects	1	7	22
Dieback	2	5	8
Weather	3	4	9
Logging & related	3	3	10
Cypress			
Basal defects	0	1	7
Logging & related	2	4	2
Red oaks			
Hardwood borers	5	12	14
Basal defects	0	2	8
Dieback	1	4	3
Weather	2	4	4
Logging & related	4	3	3
White oaks			
Hardwood borers	2	6	5
Basal defects	0	4	7
Dieback	0	1	3
Sapsucker	0	4	12
Weather	2	5	1
Logging & related	7	4	2
Ash			
Branch stubs	0	2	3
Basal defects	0	1	15
Dieback	1	3	6
Beaver	1	8	12
Sapsucker	0	2	4
Weather	1	8	12
Logging & related	1	2	4
Sweetgum			
Basal defects	0	2	5
Dieback	1	2	5
Beaver	1	6	11
Sapsucker	0	1	3
Weather	3	4	7
Logging & related	3	6	12

Continued

Table 3--Incidence of damage by broad management class, host species, and type of damage in Georgia, 1989--Continued

Broad management class, host species, and damage type	Trees damaged		
	Sapling	Pole	Sawtimber
	Percent		
Maple			
Hardwood borers	4	5	10
Branch stubs	0	2	5
Basal defects	0	6	16
Dieback	1	4	7
Weather	2	8	16
Logging & related	4	7	5
Total softwoods			
Rusts	10	12	12
Sapsucker	0	0	4
Logging & related	3	8	2
Turpentining	0	0	3
Total hardwoods			
Hardwood borers	2	2	4
Basal defects	0	5	14
Dieback	1	4	5
Beaver	1	2	3
Weather	2	5	8
Logging & related	3	4	6

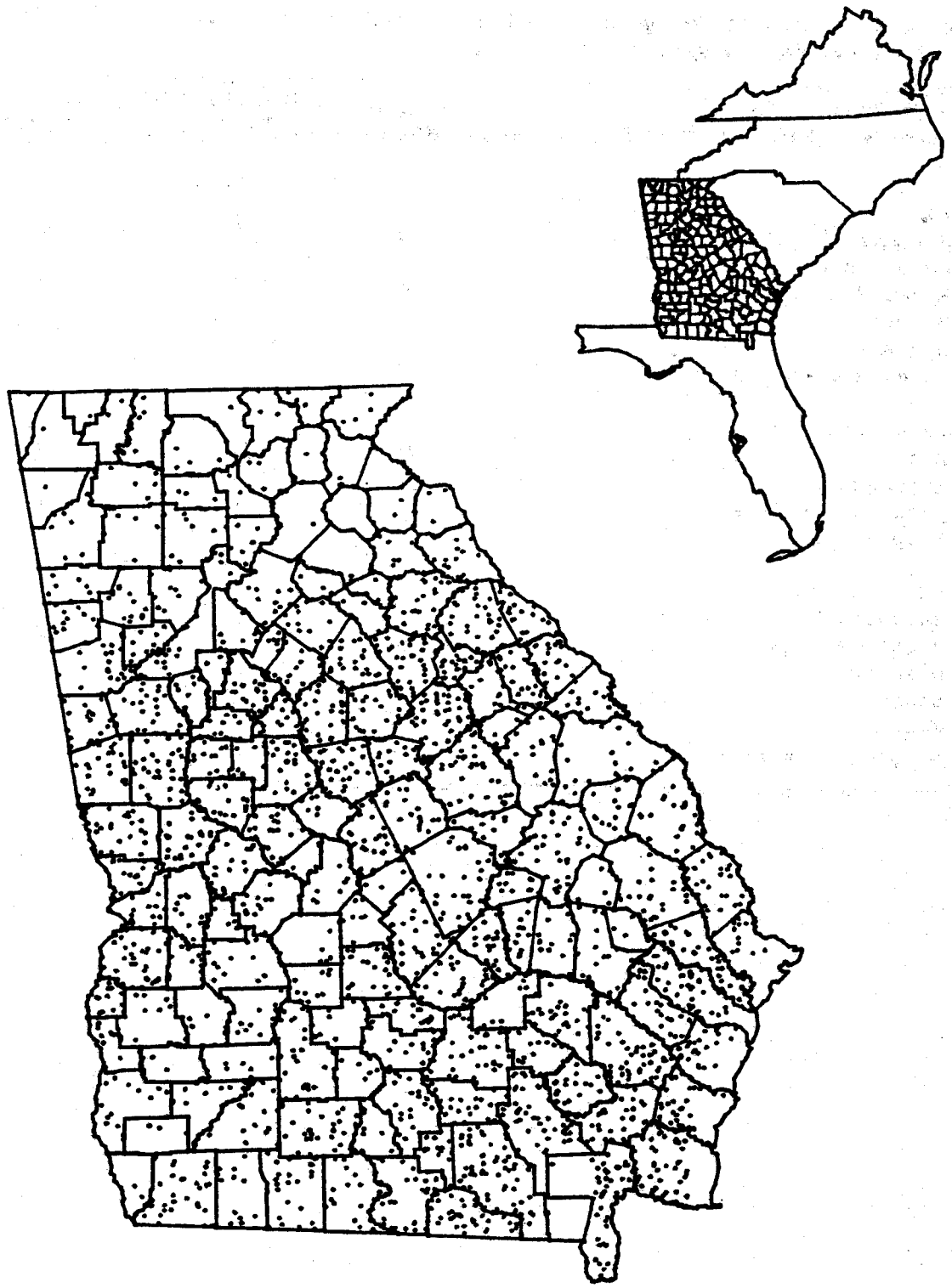


Figure 6-Distribution of plots with 10 percent or greater fusiform rust in Georgia, 1989.

Table 4--Number of all-live trees, total volume, and cull volume in Georgia by broad management class and species, 1989

Broad management class and host species	Number of trees	Total volume	Cull volume	
			Poletimber	Sawtimber
	Thousand	- - - -Thousand cubic feet - - - -		
Planted Pine				
Loblolly pine	840,231	1,203,610	161	230
Longleaf pine	9,130	35,411	22	0
Shortleaf pine	14,128	23,861	0	31
Slash pine	715,251	1,611,806	150	11
Sand pine	12,073	6,256	0	0
Virginia pine	19,417	30,192	0	0
White pine	1,790	1,131	0	0
Total softwoods	1,621,958	2,917,452	333	272
Total hardwoods	804,070	107,904	520	1,868
Natural Pine				
Loblolly pine	994,884	4,619,915	215	2,863
Longleaf pine	73,195	743,584	15	576
Shortleaf pine	259,212	1,053,428	0	334
Slash pine	350,782	1,827,839	269	999
Pitch pine	1,436	18,453	0	0
Spruce pine	852	3,551	0	0
Pond pine	20,555	136,406	74	142
Total softwoods	1,911,146	9,171,904	854	5,656
Total hardwoods	2,171,342	1,446,734	7,179	20,442
Oak-pine				
Loblolly pine	240,148	792,415	0	543
Slash pine	66,403	323,171	33	366
Shortleaf pine	65,938	308,952	0	100
Longleaf pine	12,116	75,116	0	0
Total softwoods	517,059	1,854,691	726	2,760
Total hardwoods	1,731,163	1,975,198	10,875	32,644
Upland hardwoods				
Maple	265,069	261,802	3,307	14,324
Sweetgum	446,364	837,499	5,119	14,624
Red oaks	609,273	2,215,379	6,064	42,496
White oaks	309,996	1,640,273	2,116	24,658
Hickory	309,547	741,777	794	7,718
Yellow-poplar	141,585	821,143	986	12,438
Total softwoods	149,630	663,608	122	693
Total hardwoods	3,431,539	7,306,613	27,669	141,612

Continued

Table 4--Number of all-live trees, total volume, and cull volume in Georgia by broad management class and species, 1989--Continued

Broad management class and host species	Number of trees	Total volume	Cull volume	
			Poletimber	Sawtimber
	Thousand	- - - - Thousand cubic feet - - - -		
Bottomland hardwoods				
Water tupelo	33,975	274,143	1,482	19,453
Blackgum	753,124	1,804,372	16,652	60,211
Cypress	152,594	751,664	704	22,249
Red oaks	188,302	875,974	2,992	32,666
White oaks	20,811	176,811	36	5,475
Ash	127,188	257,341	1,391	8,546
Sweetgum	238,068	796,388	2,113	7,055
Maple	370,942	680,943	9,592	26,646
Total softwoods	179,977	1,072,292	704	22,779
Total hardwoods	2,350,340	6,086,017	44,635	192,326

Table 5--Annual poletimber and sawtimber removals and mortality, by broad management type and tree species, Georgia, 1982 and 1989

(In thousand cubic-feet)

Broad management type and species	Removals				Mortality			
	Poletimber		Sawtimber		Poletimber		Sawtimber	
	1989	1982	1989	1982	1989	1982	1989	1982
Planted pine								
Loblolly pine	29,334	29,922	30,646	9,220	7,965	6,366	1,685	921
Longleaf pine	1,134	910	1,807	2,462	0	139	119	211
Shortleaf pine	1,213	2,122	837	658	162	81	0	0
Slash pine	101,288	71,892	57,404	14,640	10,642	12,853	2,516	834
All softwoods	133,425	104,965	90,882	27,634	18,769	19,523	4,320	1,965
All hardwoods	1,531	92	398	221	540	341	170	185
Natural pine								
Loblolly pine	70,270	79,736	203,352	144,225	23,953	34,833	28,357	19,878
Longleaf pine	6,583	12,706	36,467	42,625	840	1,110	2,760	2,692
Pitch pine	227	0	108	406	87	165	150	632
Pond pine	3,053	2,809	6,962	3,793	371	503	914	409
Shortleaf pine	19,059	19,950	37,769	32,571	9,946	11,261	9,873	5,529
Slash pine	54,654	62,658	91,116	86,498	5,630	12,579	5,514	5,763
Virginia pine	6,351	3,146	7,515	3,330	2,991	2,887	5,151	1,735
Black cherry	167	77	0	0	82	163	0	0
Blackgum (bottomland)	1,059	370	1,682	707	287	210	410	270
Elm	50	75	103	0	118	46	0	0
Red maple	479	327	222	323	41	290	45	147
Sweetgum	4,331	3,885	2,112	2,528	1,567	1,416	340	297
Yellow-poplar	913	1,276	3,100	2,445	217	507	113	0
Dogwood	99	0	0	0	72	928	0	0
Hickory	392	329	96	654	197	134	299	0
Black oak	63	0	0	0	359	162	122	174
Chestnut oak	123	0	0	0	0	95	82	0
Laurel oak	865	246	408	115	304	200	118	447
Post oak	586	179	320	573	342	129	83	0
Northern red oak	0	255	377	177	0	0	142	0
Scarlet oak	0	301	162	573	193	84	554	390
Southern red oak	855	549	1,960	893	911	371	426	0
Water oak	1,237	863	2,191	550	1,384	1,000	1,310	274

Continued

Table 5--Annual poletimber and sawtimber removals and mortality, by broad management type and tree species, Georgia, 1982 and 1989--Continued

(In thousand cubic-feet)

Broad management type and species	Removals				Mortality			
	Poletimber		Sawtimber		Poletimber		Sawtimber	
	1989	1982	1989	1982	1989	1982	1989	1982
White oak	1,212	655	1,201	648	206	137	118	0
Willow oak	0	348	143	0	45	0	283	0
Scrub oak	102	158	148	0	81	0	57	0
All softwoods	161,296	181,270	384,510	313,389	44,219	63,521	52,997	36,798
All hardwoods	12,704	10,146	14,256	10,186	7,176	6,324	5,022	2,497
Oak-pine								
Loblolly pine	4,556	9,841	29,891	30,848	3,364	6,328	3,548	6,411
Longleaf pine	294	1,228	3,275	3,973	173	0	446	129
Pond pine	52	189	802	1,482	63	190	70	249
Shortleaf pine	3,913	3,043	7,634	10,037	3,447	4,705	1,733	3,066
Slash pine	3,796	4,179	13,220	10,406	803	1,288	1,026	285
Spruce pine	0	0	87	813	102	327	0	0
Virginia pine	340	539	580	1,274	665	696	731	739
Redcedar	455	0	0	0	102	0	50	0
White pine	0	0	2,177	1,738	0	0	0	282
Black cherry	122	0	0	79	97	34	31	113
Blackgum (lowland)	445	679	2,220	806	85	296	401	262
Elm	74	0	242	106	465	0	0	137
Red maple	90	94	308	331	258	503	341	0
Sweetgum	4,382	2,166	3,609	2,667	1,338	1,306	771	798
Willow	0	0	0	0	235	214	93	110
Yellow-poplar	456	767	2,243	2,806	814	754	84	455
Ash	0	91	100	0	44	0	0	0
Beech	0	101	0	177	0	0	173	0
Dogwood	76	0	0	0	95	73	0	87
Hickory	695	436	523	1,017	0	56	228	441
Black oak	0	817	0	254	142	751	495	70
Chestnut oak	109	0	109	832	53	306	91	108
Laurel oak	492	119	1,212	647	962	288	490	42

Continued

Table 5--Annual poletimber and sawtimber removals and mortality, by broad management type and tree species, Georgia, 1982 and 1989--Continued

(In thousand cubic-feet)

Broad management type and species	Removals				Mortality			
	Poletimber		Sawtimber		Poletimber		Sawtimber	
	1989	1982	1989	1982	1989	1982	1989	1982
Post oak	556	220	868	551	163	79	52	355
Northern red oak	569	180	540	601	590	174	0	224
Scarlet oak	0	140	539	826	494	246	1,406	816
Southern red oak	2,607	769	1,763	1,166	947	1,361	766	708
Water oak	1,608	1,416	1,932	2,034	1,079	1,198	905	814
White oak	1,346	1,092	1,512	1,405	115	0	128	207
Willow oak	0	50	445	341	58	0	79	163
Scrub oak	101	173	0	52	613	735	125	122
All softwoods	13,905	19,019	58,188	61,167	9,301	13,710	8,046	11,454
All hardwoods	13,987	9,599	18,563	17,276	9,814	9,091	7,063	6,304
Upland hardwoods								
Loblolly pine	1,630	1,543	14,377	11,930	1,109	1,294	2,071	2,747
Longleaf pine	377	470	1,695	1,170	0	0	293	69
Pitch pine	0	0	0	0	0	84	219	0
Pond pine	71	0	0	84	0	0	0	105
Shortleaf pine	700	1,990	3,340	3,091	1,384	2,266	2,245	973
Slash pine	500	523	1,364	1,537	196	382	176	590
Spruce pine	0	0	142	205	0	0	179	0
Virginia pine	142	412	763	1,091	185	294	738	172
Eastern white pine	0	0	840	0	0	0	226	234
Black cherry	323	151	201	0	544	575	105	0
Blackgum (lowland)	291	235	473	2,336	328	262	487	966
Blackgum (upland)	395	247	275	421	266	132	587	361
Elm	918	0	1,004	355	620	0	483	89
Magnolia	94	113	165	384	86	0	0	145
Red maple	1,475	142	1,554	1,639	996	1,058	1,167	1,438

Continued

Table 5--Annual poletimber and sawtimber removals and mortality, by broad management type and tree species, Georgia, 1982 and 1989--Continued

(In thousand cubic-feet)

Broad management type and species	Removals				Mortality			
	Poletimber		Sawtimber		Poletimber		Sawtimber	
	1989	1982	1989	1982	1989	1982	1989	1982
Sweet bay	0	0	0	212	115	138	143	118
Sweetgum	8,120	3,929	14,070	5,925	3,058	3,154	1,732	1,611
Sycamore	0	0	0	0	123	0	137	0
Willow	0	0	0	0	227	169	0	0
Yellow-poplar	1,102	2,493	12,630	7,827	845	785	1,899	835
Ash	382	0	271	524	180	71	219	233
Beech	0	0	656	399	60	229	988	168
Birch (except yellow)	0	0	170	0	0	209	0	308
Black locust	0	0	0	0	325	163	125	399
Black walnut	117	122	0	131	116	0	0	0
Dogwood	0	36	0	0	265	348	0	0
Hickory	3,035	2,623	5,742	2,858	2,101	1,512	3,507	1,407
Holly	97	0	0	0	107	34	0	0
Mulberry	0	0	0	0	150	0	0	0
Persimmon	0	55	0	0	195	335	0	208
Black oak	435	278	2,758	1,760	2,137	1,198	1,693	2,381
Cherrybark oak	0	0	278	185	0	0	0	195
Chestnut oak	1,266	84	3,710	1,621	692	1,057	1,136	1,109
Laurel oak	2,289	1,569	5,484	1,670	2,379	687	4,860	1,817
Live oak	338	117	251	0	69	229	295	0
Post oak	571	669	834	228	997	572	865	114
Northern red oak	882	239	3,298	377	941	1,566	2,373	2,514
Scarlet oak	1,480	513	2,349	2,335	1,249	2,265	4,331	3,482
Shumard oak	219	0	0	479	0	0	0	287
Southern red oak	2,960	1,571	4,453	1,670	1,648	1,169	1,476	791
Swamp chestnut oak	271	87	312	66	0	0	95	0
Water oak	6,392	2,088	8,316	3,580	3,878	1,551	5,556	1,425
White oak	7,512	2,019	10,926	4,662	1,176	435	1,928	905
Willow oak	489	127	1,136	290	135	208	469	434

Continued

Table 5--Annual poletimber and sawtimber removals and mortality, by broad management type and tree species, Georgia, 1982 and 1989--Continued

(In thousand cubic-feet)

Broad management type and species	Removals				Mortality			
	Poletimber		Sawtimber		Poletimber		Sawtimber	
	1989	1982	1989	1982	1989	1982	1989	1982
Scrub oak	144	386	0	113	1,788	998	153	201
All softwoods	3,420	4,938	22,522	19,363	2,874	4,320	6,224	4,889
All hardwoods	41,736	20,138	81,482	42,366	28,927	21,704	37,124	24,181
Bottomland hardwoods								
Loblolly pine	86	1,757	4,995	4,380	145	225	1,251	762
Longleaf pine	72	0	210	315	0	126	0	0
Pond pine	120	0	543	1,330	36	111	340	296
Slash pine	1,105	1,803	6,807	5,887	245	968	1,700	484
Baldcypress	66	0	2,126	659	97	0	361	154
Pondcypress	1,084	0	5,089	120	488	635	328	271
Black cherry	0	83	0	113	40	84	0	0
Blackgum (lowland)	6,728	1,901	12,956	5,088	4,804	2,249	5,781	4,602
Boxelder	101	0	0	0	239	189	65	78
Cottonwood	0	0	0	0	108	0	110	315
Elm	298	300	1,811	1,214	852	469	1,630	1,287
Hackberry	480	0	1,630	918	620	114	1,138	274
Loblolly-bay	213	0	223	0	626	185	301	103
Magnolia	186	0	294	296	0	0	0	0
Red maple	2,508	549	4,660	2,175	4,049	3,041	4,988	3,770
Sweet bay	1,396	455	1,413	633	2,330	685	2,025	890
Sweetgum	4,670	4,427	14,779	8,093	3,338	3,359	4,465	3,896
Sycamore	119	464	654	1,097	124	0	141	0
Water tupelo	0	58	1,130	1,360	640	447	827	638
Willow	296	0	644	0	964	869	990	849
Yellow-poplar	2,143	895	9,343	6,386	1,140	1,273	1,767	1,841
Ash	1,217	388	2,078	727	1,649	1,624	1,151	1,368

Continued

Table 5--Annual poletimber and sawtimber removals and mortality, by broad management type and tree species, Georgia, 1982 and 1989--Continued

(In thousand cubic-feet)

Broad management type and species	Removals				Mortality			
	Poletimber		Sawtimber		Poletimber		Sawtimber	
	1989	1982	1989	1982	1989	1982	1989	1982
Beech	0	0	112	325	44	0	271	188
Birch	234	122	860	687	429	767	638	933
Dogwood	0	0	0	0	32	0	0	0
Florida maple	0	0	0	0	201	0	108	253
Hickory	117	94	1,111	449	93	493	411	727
Holly	55	0	0	0	81	67	0	0
Mulberry	43	0	0	0	334	65	95	94
Persimmon	0	0	81	103	71	79	0	280
Black oak	0	0	213	0	0	0	0	0
Cherrybark oak	0	0	432	0	0	0	0	0
Laurel oak	1,834	729	10,464	4,305	1,594	988	8,255	6,332
Live oak	44	0	218	0	0	97	52	0
Overcup oak	0	0	1,169	886	116	103	498	535
Post oak	327	0	373	0	0	0	0	66
Northern red oak	0	96	280	0	0	0	0	0
Scarlet oak	0	0	0	0	278	0	136	0
Southern oak	45	0	0	0	75	47	0	235
Swamp chestnut oak	57	0	653	0	43	0	402	0
Water oak	883	1,443	3,375	4,462	1,859	1,544	3,250	2,969
White oak	204	158	554	612	0	70	0	0
Willow oak	171	0	1,178	455	0	368	564	319
All softwoods	2,534	3,559	20,287	13,411	1,010	2,065	4,333	2,232
All hardwoods	34,491	12,162	72,725	41,177	28,322	20,483	40,727	33,952

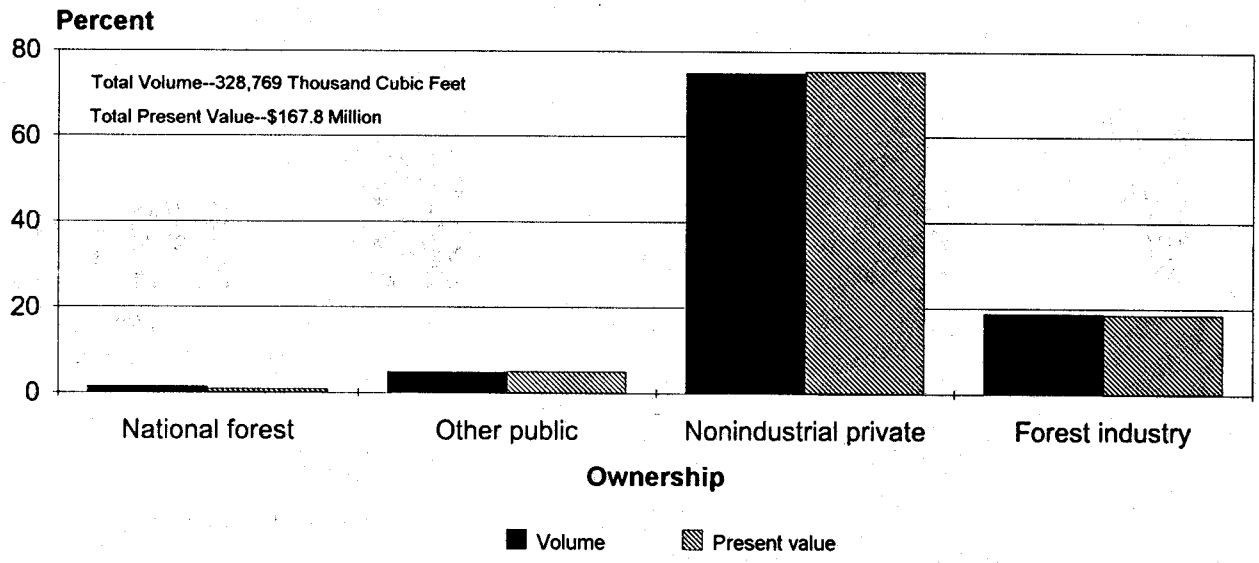


Figure 7-Percentage of volume affected and present value of loss by ownership, Georgia, 1982-1989.

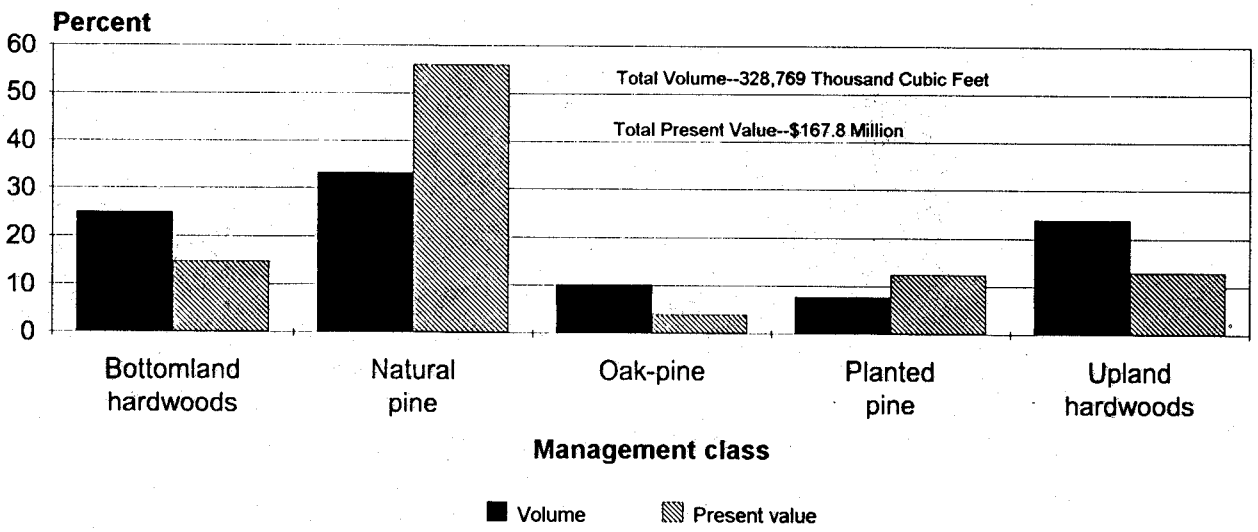


Figure 8-Percentage of annual volume affected and present value of loss, over all ownership classes, Georgia, 1982-1989.

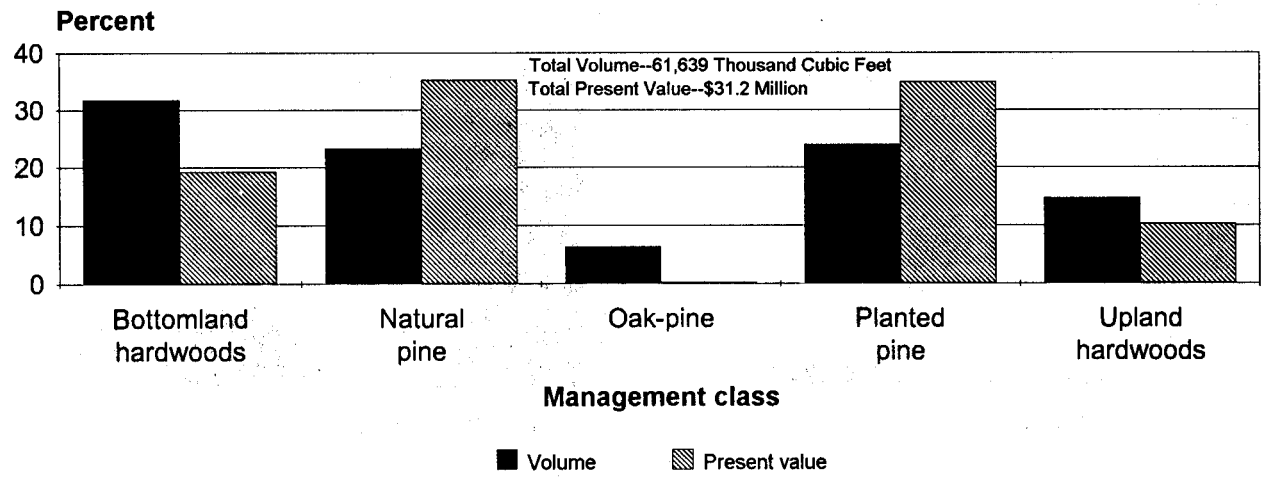


Figure 9-Percentage of annual affected volume and present value of loss, for forest industry, Georgia, 1982-1989.

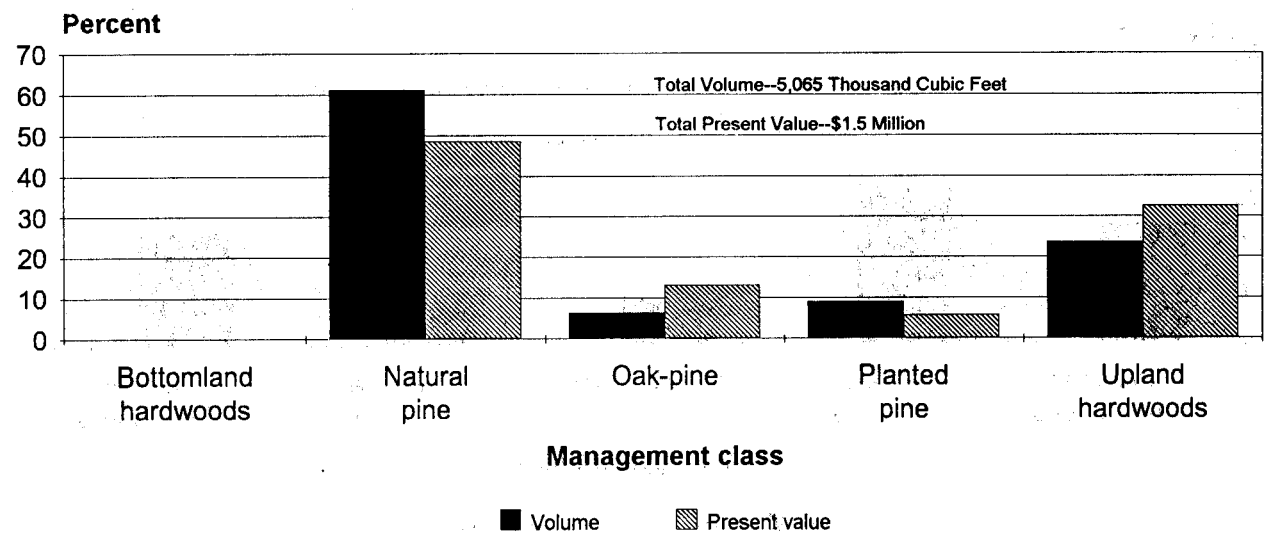


Figure 10-Percentage of annual affected volume and present value of loss, for national forests, Georgia, 1982-1989.

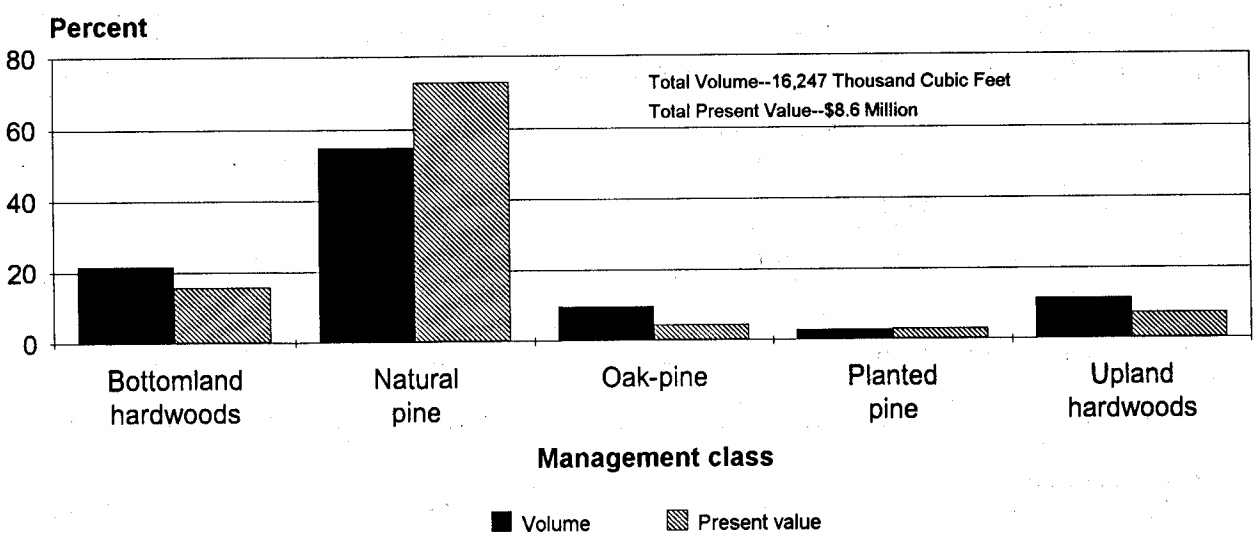


Figure 11-Percentage of annual affected volume and present value of loss, for other public forests, Georgia, 1982-1989.

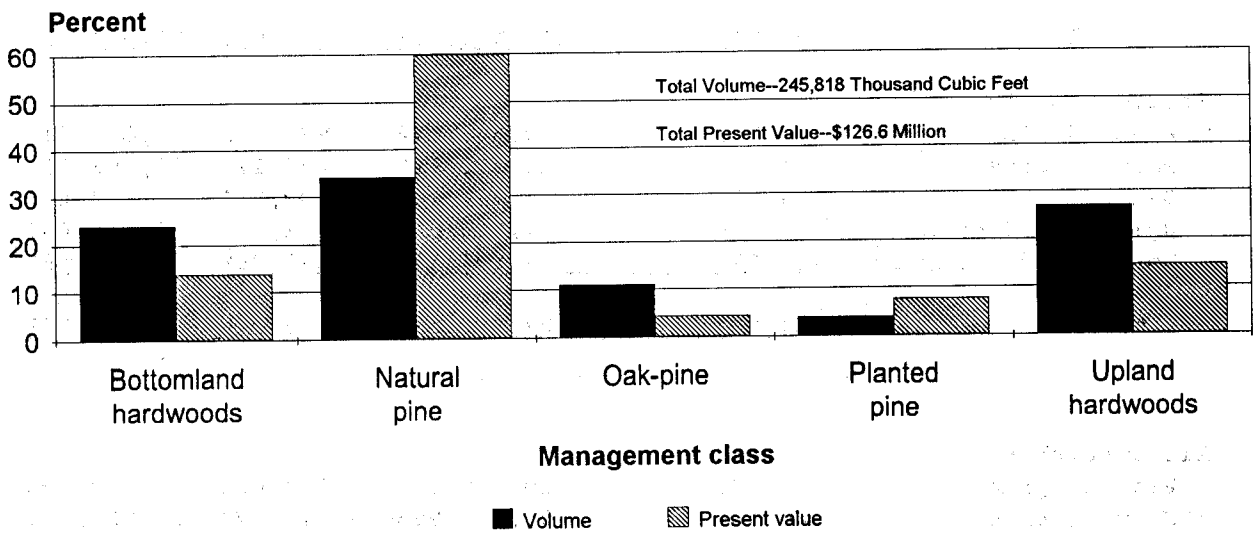


Figure 12-Percentage of annual affected volume and present value of loss, for nonindustrial private forests, Georgia, 1982-1989.

Table 6--Volume and value of timber damaged or killed annually, by ownership and broad management class, Georgia, 1983-1989

Ownership and management class	Average annual volume affected	Average annual present value		
		Mortality	Cull	Total
	Thousand cubic feet	------Dollars------		
National forest				
Planted pine	287	134,571	0	134,571
Natural pine	2,462	851,501	57,888	909,389
Oak-pine	664	78,379	15,446	93,825
Upland hardwoods	1,652	212,370	138,148	350,518
Bottomland hardwoods	0	0	0	0
Total	5,065	1,276,821	211,482	1,488,303
Other public				
Planted pine	454	247,368	0	247,368
Natural pine	8,885	6,025,748	264,460	6,290,208
Oak-pine	1,551	309,338	60,858	370,196
Upland hardwoods	1,828	485,072	137,649	622,721
Bottomland hardwoods	3,529	783,709	306,574	1,090,283
Total	16,247	7,851,235	769,541	8,620,776
Nonindustrial private				
Planted pine	9,829	8,828,240	769,499	9,597,739
Natural pine	83,774	73,520,118	2,313,697	75,833,815
Oak-pine	26,959	4,702,022	716,968	5,418,990
Upland hardwoods	66,051	14,445,966	3,719,813	18,165,779
Bottomland hardwoods	59,205	12,944,187	4,601,085	17,545,272
Total	245,818	114,440,533	12,121,062	126,561,595
Forest industry				
Planted pine	14,701	9,888,314	985,102	10,873,416
Natural pine	14,288	10,712,926	286,126	10,999,052
Oak-pine	3,911	774,709	99,696	874,405
Upland hardwoods	9,065	1,956,746	481,684	2,438,430
Bottomland hardwoods	19,674	4,294,197	1,673,299	5,967,496
Total	61,639	27,626,892	3,525,907	31,152,799
All ownerships				
Planted pine	25,271	19,098,493	1,754,601	20,853,094
Natural pine	109,409	91,110,293	2,922,171	94,032,464
Oak-pine	33,085	5,864,448	892,968	6,757,416
Upland hardwoods	78,596	17,100,154	4,477,294	21,577,448
Bottomland hardwoods	82,408	18,022,093	6,580,958	24,603,051
Total	328,769	151,195,481	16,627,992	167,823,473

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Incidence and impact of 22 damage types and mortality trends to the forest resources of Georgia in 1989 are described. Acres affected, volume losses, geographic distribution, and economic impact are discussed. About 329 million cubic feet of timber are lost per year from 1982 to 1989, with an estimated annual dollar loss of $167.8 million.

Keywords: Insect damage, disease damage, fusiform rust, bark beetles, forest insects, forest diseases.

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The Forest Service, U.S. Department of Agriculture, is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.