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Incidence and Impact of Damage to South Carolina's Timber, 1979

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INCIDENCE AND IMPACT OF DAMAGE TO SOUTH CAROLINA'S TIMBER, 1979

by

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CONTENTS

FOREWORD

This Bulletin reports survey data on agents damaging trees in South Carolina's forests. Data were collected in 1977 and 1978 by the Renewable Resources Evaluation Work Unit of the Southeastern Forest Experiment Station.

This effort was part of the fifth inventory of the State's forests. Considerably more information was gathered in this than in previous inventories. This additional information makes possible publication of reports on forest resources other than timber as well as this specialized report on timber damage.

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

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

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P.O. Box 21707
Columbia, South Carolina 29221

INTRODUCTION

During the fifth inventory of South Carolina's forests in 1977 and 1978, damage to trees on sample plots was noted. Where possible, a cause or damaging agent was specified. This Bulletin reports and interprets these observations.

Since plots are visited only once and at all times of year, it is only possible to keep records on agents that produce symptoms or signs in all seasons. On the basis of these "durable" symptoms and signs, the agents defined on pages 4-5 were recognized.

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

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

Acres of forest types, timber removals, and mortality by species and size class are taken from the Resource Bulletin "South Carolina's Forests" (Knight 1979). The remaining data were analyzed by Forest Insect and Disease Management to develop the tables presented here.

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

SAMPLING PROCEDURE

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

1. Initial estimates of forest and nonforest areas were based on the classification of 67,524 sample clusters systematically spaced on the latest aerial photographs available. A subsample of 6,466 of the 16-point clusters was ground-checked, and a linear regression was fitted to the data to determine the relationship between the photo and ground classification of the subsample. This procedure provides a means for adjusting the initial estimates of area for change in land use since date of photography and for photo misclassifications.

2. Estimates of timber volume and forest classifications were based on measurements recorded at 4,038 ground sample locations systematically distributed on forest land. A 10-point cluster of plots, measured with a basal-area factor of 37.5 square feet per acre, was established on an acre at each of these sample locations. Trees less than 5 inches d.b.h. were tallied on a portion of the fixed-radius plots around the point centers.

3. Equations prepared from detailed measurements collected on standing trees in South Carolina, and similar measurements taken throughout the Southeast, were used to compute the volume of individual tally trees. A mirror caliper and sectional aluminum poles were used to obtain the additional measurements on these standing trees required to construct volume equations.

4. Felled trees were measured at 93 active cutting operations. These data were pooled with similar measurements taken in other Southeastern States to supplement the standing-tree volume study and to generate utilization factors for product and species groups to be analyzed at the State level.

5. Estimates of growth, removals, and mortality were determined from remeasurement of 4,231 permanent sample plots which were established in the fourth survey.

COMPUTATIONS

1. All field data were sent to Asheville for editing and were punched into cards and stored for machine computing, sorting, and tabulation. Final estimates were based on statistical summaries of the data.

2. Tree data were categorized as follows: saplings, 1.0 to 4.9 inches d.b.h.; softwood poles, 5.0 to 8.9 inches d.b.h.; hardwood poles, 5.0 to 10.9 inches d.b.h.; softwood sawtimber, 9.0 inches and above; and hardwood sawtimber, 11.0 inches and above.

3. The symptoms that were used to identify the cause of damage to living trees on the sampled plots are presented on pages 4-5. 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. This poletimber volume loss was determined by multiplying the percent incidence by the total wood volume in a tree species. This figure, in turn, was multiplied by the percent cull associated with the damaging agent to obtain wood fiber loss. The sawtimber volume was calculated in the same manner but multiplied by 4.5 to convert to thousand board feet.

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

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

6. Economic impact was determined by multiplying the total wood fiber and quality loss for each tree species by the stumpage value per unit. These dollar estimates were taken from an average of all timber sales on National Forest land in South Carolina in 1979. The estimates were received by the State forest pest specialists and modified slightly.

INCIDENCE OF DAMAGING AGENTS

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

Tables 2 and 3 show percentages of trees damaged by the agents recorded by size class and tree species. Overall, hardwoods had more damage than softwood, and saplings had more damage than poletimber or sawtimber. Among softwoods, slash pines were most frequently damaged. Black cherry, black walnut, black locust, and red oak seemed to have the highest occurrence of damage among hardwoods. Significant damage for many of the major species is represented in pie charts (fig. 1). Tables 4 and 5 provide a detailed listing of damage by species and damaging agent.

For susceptible species of softwoods, fusiform rust was the most common damaging agent. Crews tallied insect damage on pines but found relatively little. Since the incidence data are for living trees only and southern pine beetle was at a low level during the survey, low occurrence was not surprising. However, during a southern pine beetle outbreak the occurrence would be markedly higher.

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 rust would have been higher. Annosus root rot, which occurs after thinning, was not abundant. With increased thinning in South Carolina, however, occurrence of this disease can be expected to increase. (In future surveys, root rot on all species will be recorded.) Littleleaf, which occurs on shortleaf pines over 20 years old and on clay soils, was less prevalent than expected. It was identified on less than 3 percent of living shortleaf pines. Incidence of cankers was low on most tree species. Black locust was an exception; over 30 percent of the sawtimber-size trees of this species had cankers.

Damaging branch stubs were rare on softwoods but fairly common on hardwoods with black cherry, beech, and black walnut having the highest occurrence. Most of this damage occurred on large, old trees. Top breakage also occurred infrequently on softwoods but was very common in hardwoods. Among softwoods, basal defects were common only on baldcypress and Atlantic white-cedar; 6 percent of the sawtimber trees of these species were affected. Basal defect was one of the most common damage types for hardwoods.

Fire damage was found in almost all species and age classes, but the percentage of trees affected was low. Fire damage was most often found on young trees. Animal damage was also found on all species, but very few trees were affected. More than 50 percent of the basswood sawtimber trees of this species were damaged by weather. Suppression and stagnation affected about 2 percent of the State's trees. Slash pine saplings, cottonwood saplings, sycamore poles, and chestnut oak saplings were most severely affected. The damage, as expected, was confined primarily to small, young trees. Logging and related damage was highest in spruce pine, beech, and black walnut, with damage concentrated in saplings and poletimber. Form damage was severe on both hardwoods and softwoods, but it was much more common on hardwoods. On both

Logging and related damage

Fire-caused damage

Other basal damage

Hardwood canker

hardwoods and softwoods, frequency of form damage decreased as tree size increased. Ironically, form damage incidence was worst in black walnut and black cherry—two species in which good form is especially important.

In reviewing the incidence, we see separate patterns for softwoods and hardwoods. Softwoods of all sizes are affected most often by form damage and fusiform rust. Weather and logging damage are also significant. Among hardwood saplings, form is clearly the most serious problem, with suppression, stagnation, and logging damage next in frequency. This trend continues into poletimber, with top breakage and basal defects beginning to show increased significance. Hardwood sawtimber is frequently damaged by basal defects, top breakage, branch stubs, and cankers. These damaging agents are typical of mature and overmature trees.

MORTALITY, ASSOCIATED CULL, AND QUALITY LOSS

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

Annual mortality amounts to about 6,334 million board feet of sawtimber and 60 million cubic feet of poletimber. Sixty-three percent of the sawtimber mortality loss and 74 percent of the poletimber mortality occur in softwoods. Sawtimber mortality is about 17 percent of annual removals, and poletimber is 69 percent (table 6).

Although mortality is heavier in softwoods, volume losses to cull are greater in hardwoods. The total cull of softwood sawtimber is equal to about only 4 percent of the softwood sawtimber mortality, while cull in hardwood sawtimber is about equal to the hardwood sawtimber mortality. It must be noted that the mortality figures are annual, whereas the cull is the total volume divided by 10. Distributing the cull losses over a 10-year period[3] shows a total annual loss of 3,475,000 cubic feet for poles and 119,423,000 board feet for sawtimber.

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

The quality loss is reported when a tree associated with a particular damage shifts from the sawtimber to nonsawtimber category. Distributing the loss over a 10-year period yields a 255,000 board-foot annual loss for softwoods and a 3.4 million board-foot loss for hardwoods.

The greatest economic impact occurs in softwood sawtimber, for which the annual loss is $25,557,775 (table 7). This figure is almost double that for hardwood sawtimber—$14,740,812. In poletimber, the difference is even greater, with the $786,562 softwood loss exceeding that of hardwood ($96,756) by more than eight times. In all, 64 percent of all economic impact occurs in softwoods. About 98 percent of the total economic impact is in sawtimber-size trees.

PAST TREATMENT OR DISTURBANCE

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

Diseases head the list of damaging disturbances. Of the 141 sample stands with significant disease, 84 required no remedial treatment, 16 required salvage, 0 needed harvesting, 21 needed thinning, 6 needed cleaning, 6 needed to be converted, and 8 needed to be regenerated artificially (table 8). Wildfire caused the second most damage. The relative ranking of nine treatment or disturbance types is shown in table 8. Under treatment needed, wildfire and diseases required the greatest amount and largest variety of treatments.

DEFINITIONS

Damaging Agents and Their Symptoms

Insects.—All pines. Loose bark, insect galleries in inner bark, exit holes.

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

Annosus root rot.—Pines and redcedar. Diseased trees frequently occur in groups (centers) which usually contain dead or wind-thrown trees; diseased trees with thin, tufted crowns; wind-thrown trees exhibit stringy, white root rot; perennial shelflike or flat conks against base of trees in litter or under roots of wind-thrown trees; conks are rubbery with tan-to-brown upper surface and white pore-bearing undersurface.

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

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

Other diseases.—All species. Damage due to diseases other than those indicated. For example, eastern gall rust, pitch canker, and red heart on pines.

Branch stubs.—All species. Branch holes or stubs greater than 4 inches in diameter on stem.

Top breakage.—All species. Broken stem greater than 4 inches in diameter.

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

Fire.—All species. Fire scar usually at base of stem, widespread in stand, usually on uphill side of slope, charring or reburned stems.

Animal.—All species. Beaver, bear, bird, rodent, rabbit, etc.

Weather.—All species. Wind-thrown, lightning strikes, ice and snow, hail.

Suppression and stagnation.—All species. Overtopped tree with poor form.

Logging and related.—All species. Logging scar on stem, callus ridges within 1 to 2 years after wounding, scattered in stand, no charring, limb breakage, and/or stem scar near crown resulting from tree felling. Look for skid trails, stumps, etc.

Damage from turpentining.—All pines. Scars left during collection of gum. Naval stores.

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

Forest Survey Terms

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

Accumulated volume loss.—Percentage of trees affected times the percent cull times 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 saw-log 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 as square feet of basal area per acre.

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

Commercial species.—Tree species presently or prospectively suitable for industrial wood products.

Desirable trees.—Growing-stock trees of commerical species having no serious defects in quality limiting 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 (4½ feet above the ground). D.b.h. is the common abbreviation for "diameter at breast height." Two-inch-diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h., inclusive.

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

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

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

Saplings.—Live trees 1.0 to 5.0 inches in diameter at breast height.

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

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

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

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

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

Other softwoods. White pine, hemlock, cypress, eastern redcedar, whitecedar, spruce, and fir.

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

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

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

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

REFERENCES

This publication reports incidence and impact of damaging agents on South Carolina'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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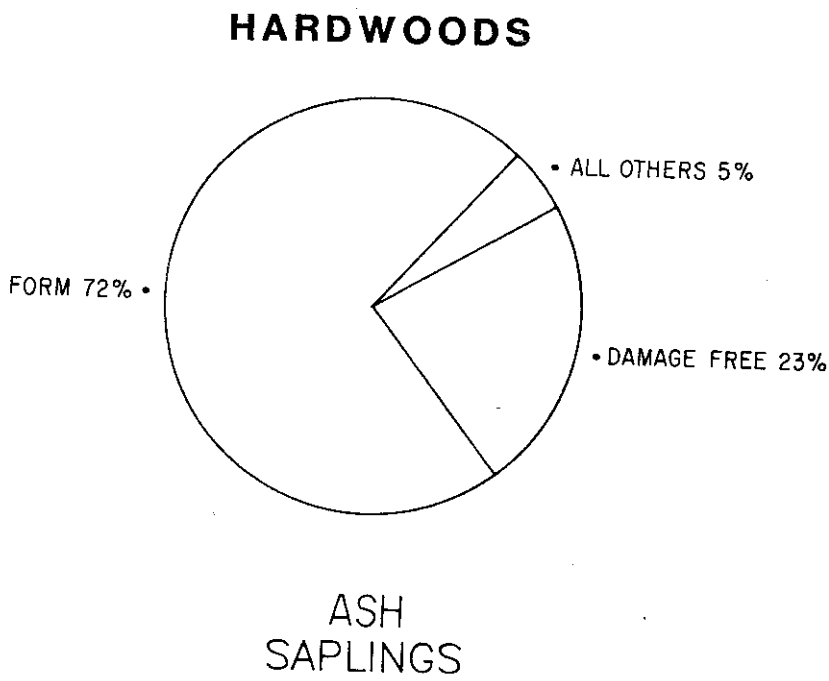
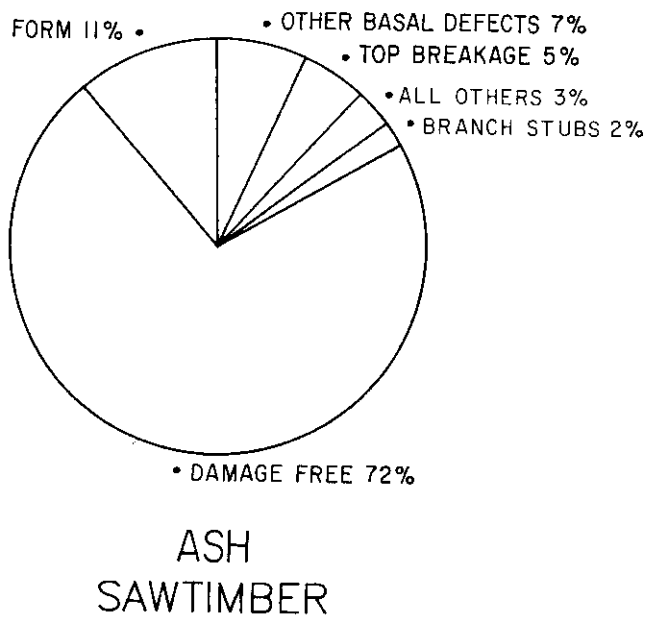
Figure 1.–Significant types of damage on major species of forest trees in South Carolina, 1978.





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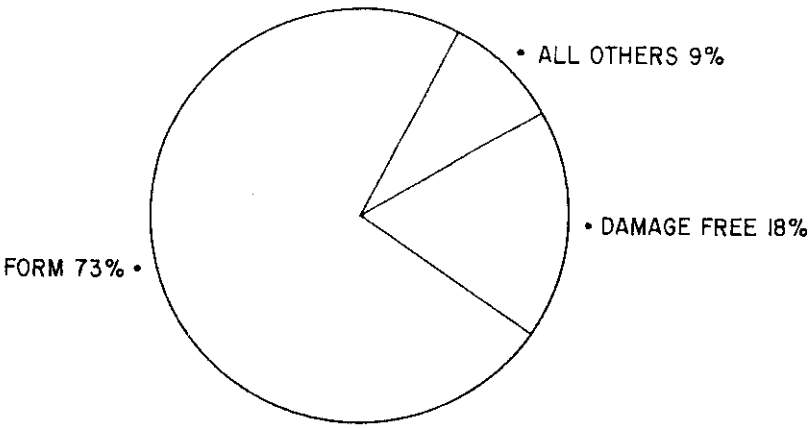

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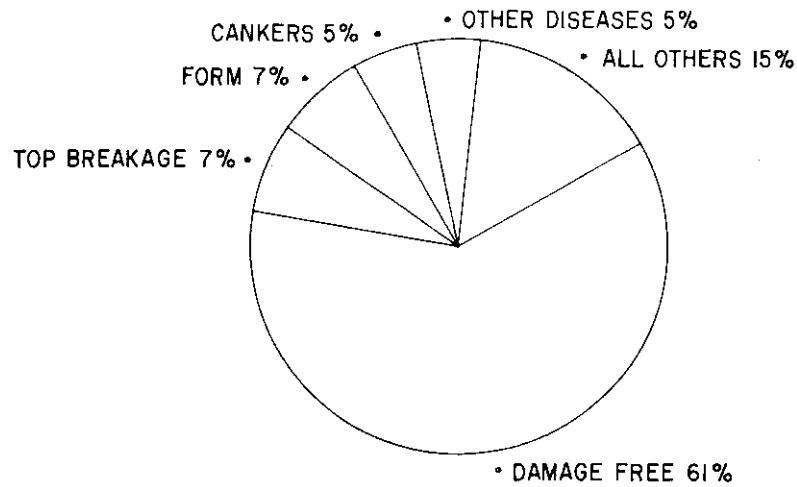

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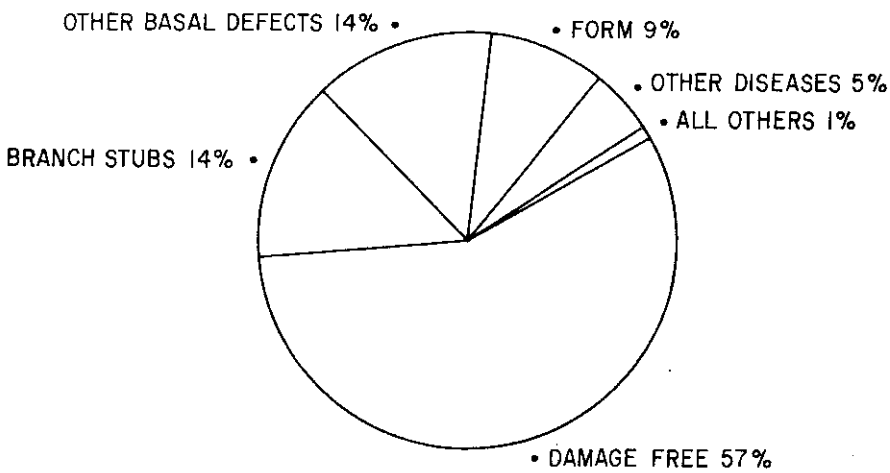

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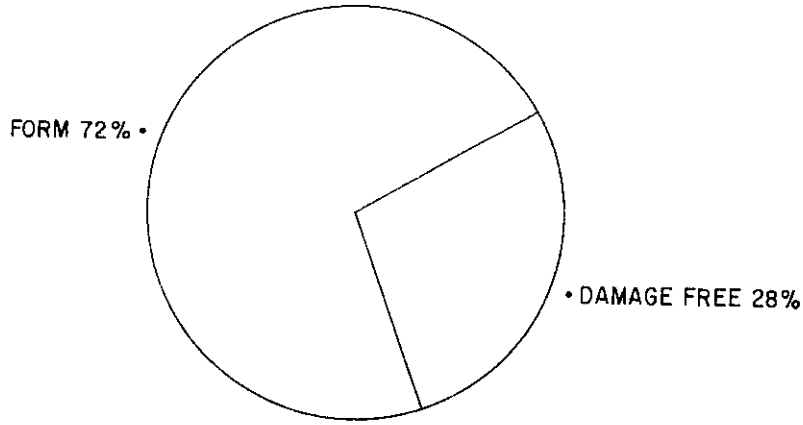

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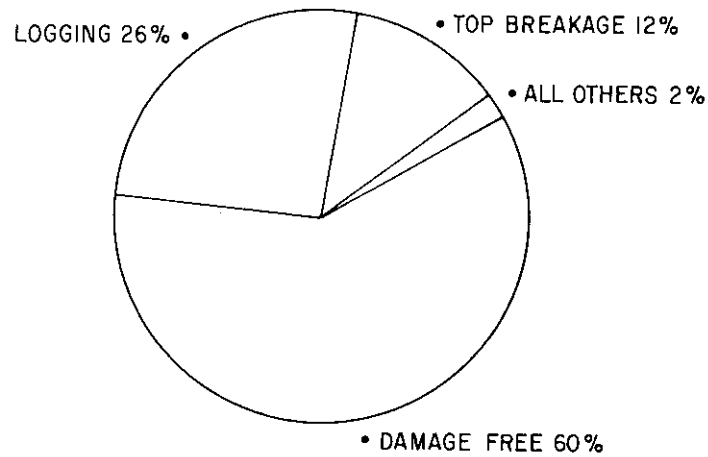

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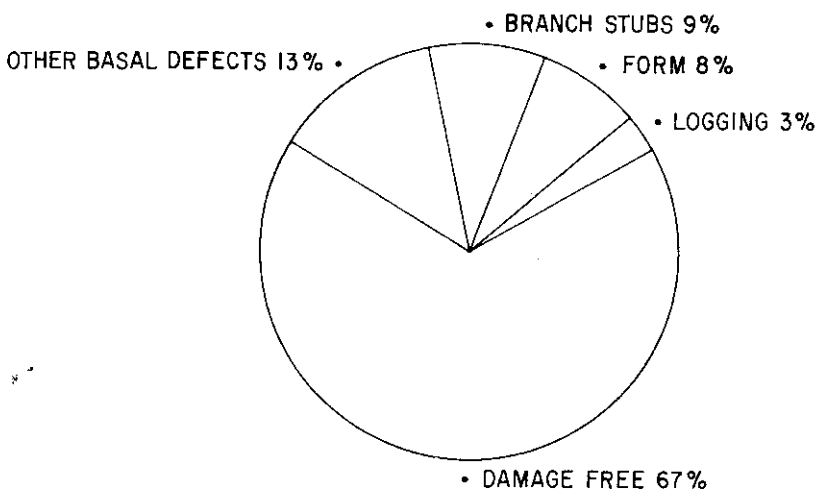

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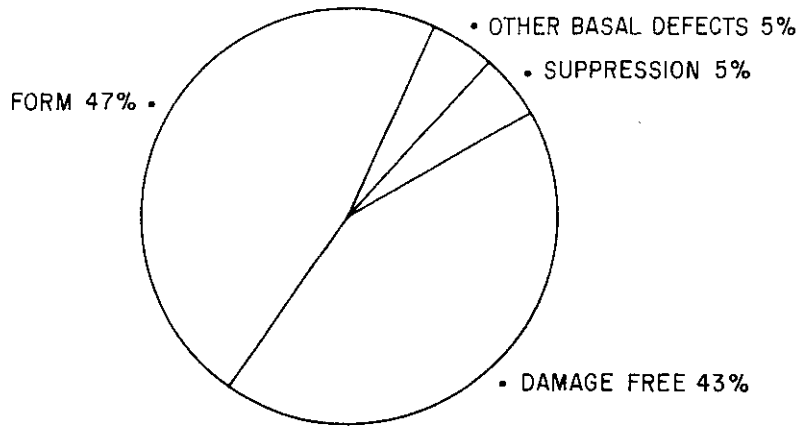

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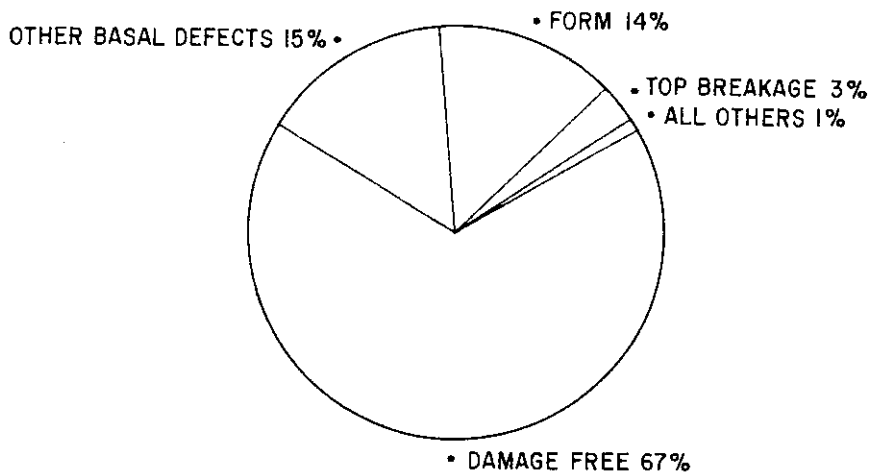

CHESTNUT OAK
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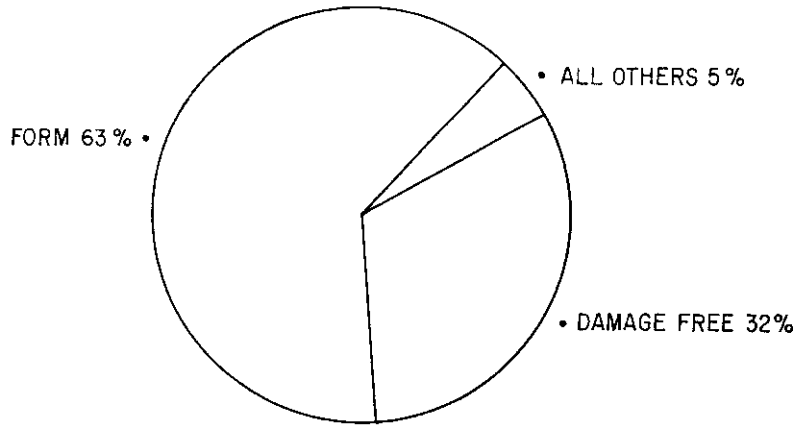

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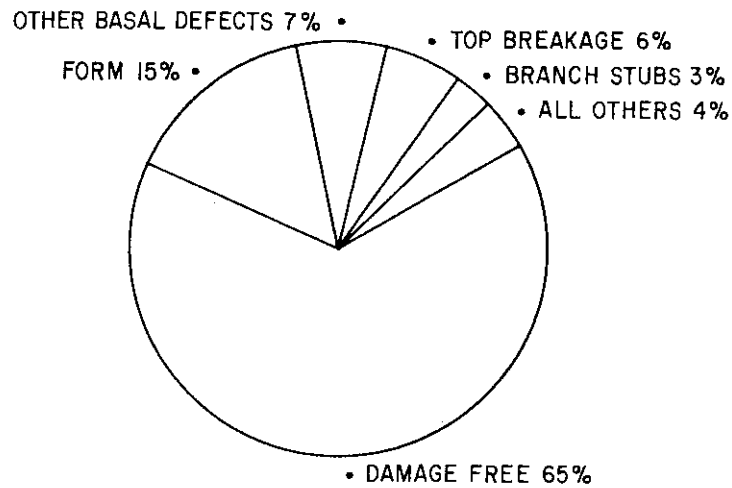

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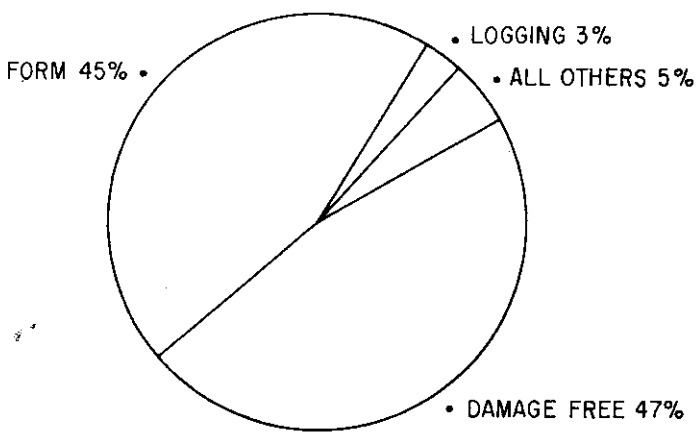

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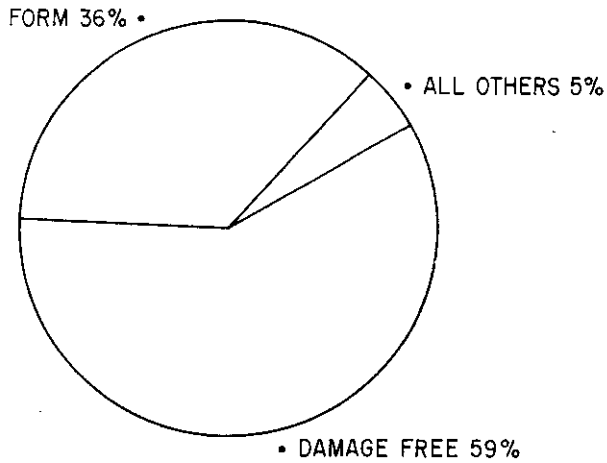

OTHER EASTERN HARDWOODS
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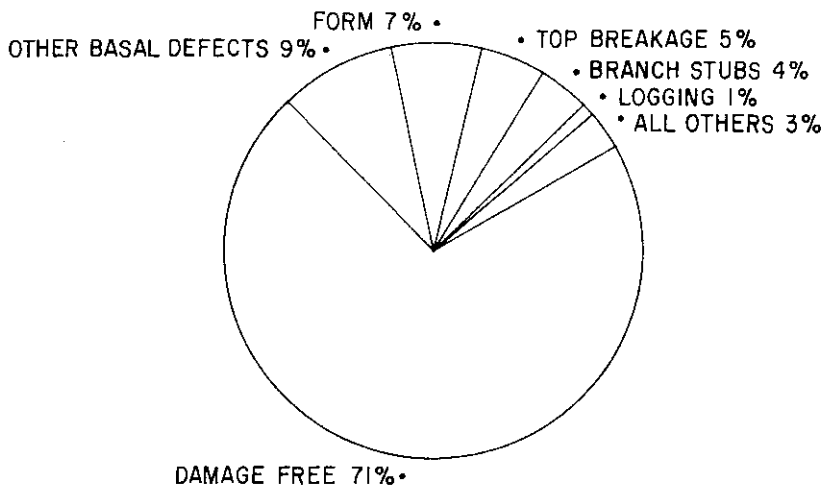

OTHER EASTERN HARDWOODS
SAWTIMBER

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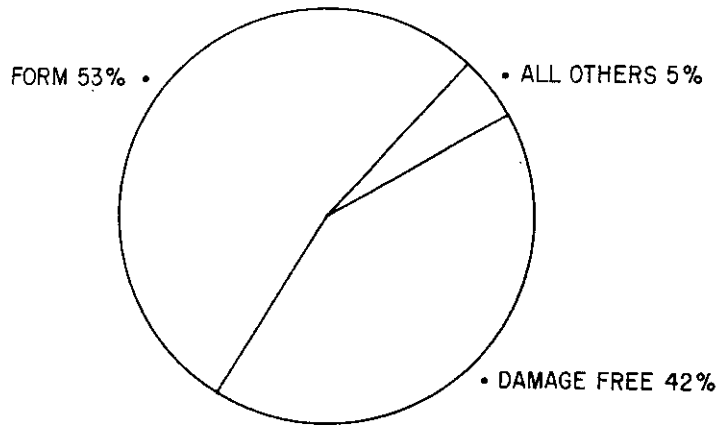
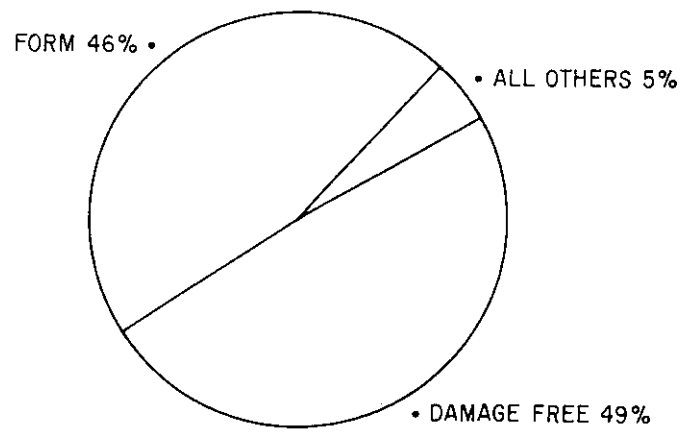
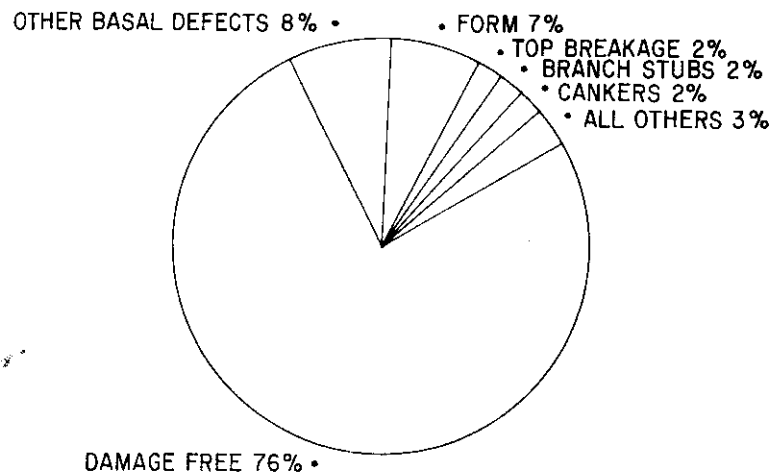


SELECT RED OAK
SAPLINGS



OTHER RED OAKS
SAPLINGS



OTHER RED OAKS
SAWTIMBER

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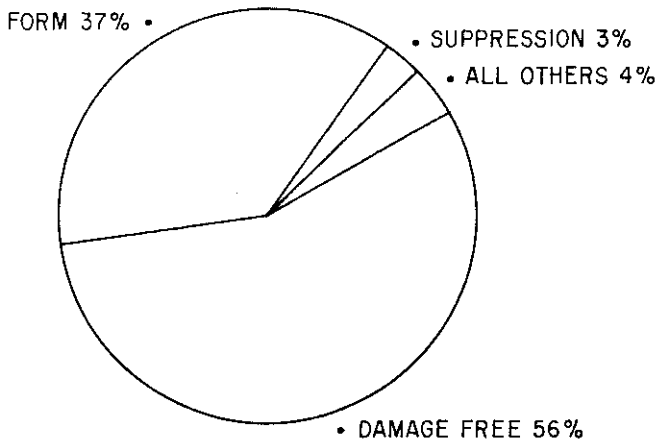
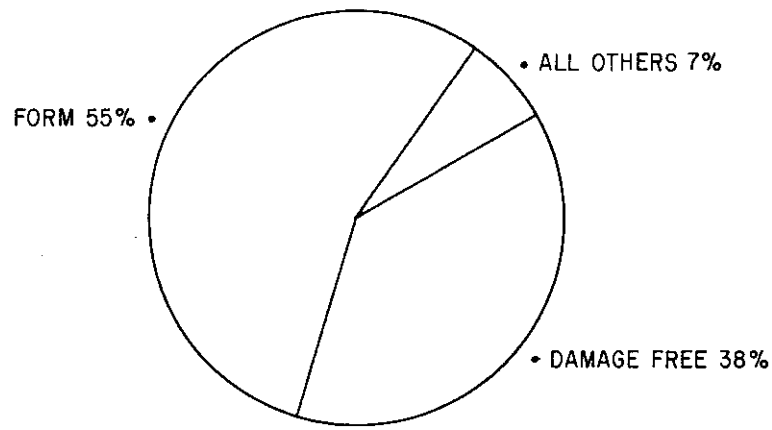
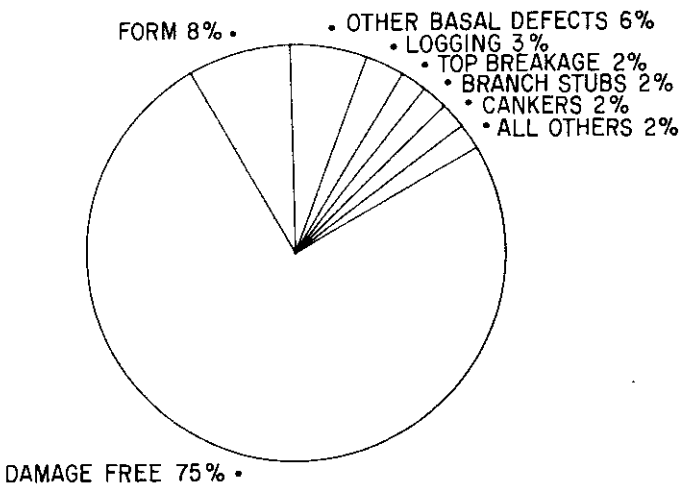


SELECT WHITE OAK
SAPLINGS



OTHER WHITE OAKS
SAPLINGS



OTHER WHITE OAKS
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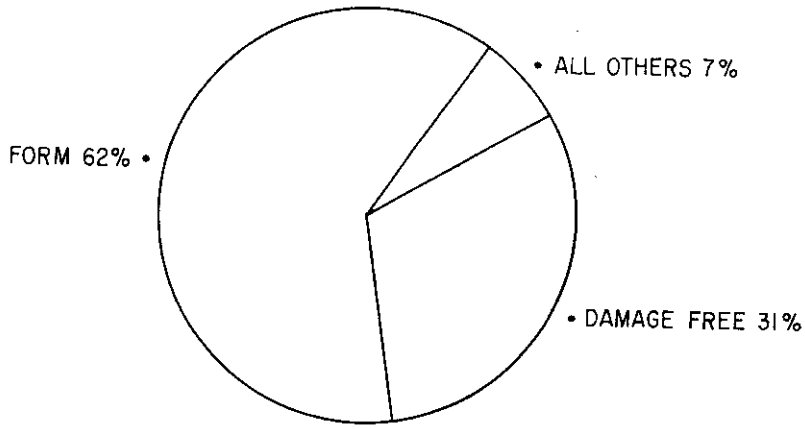
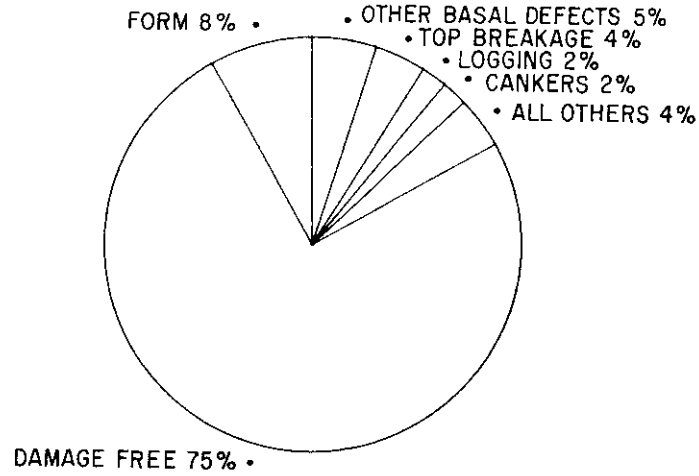
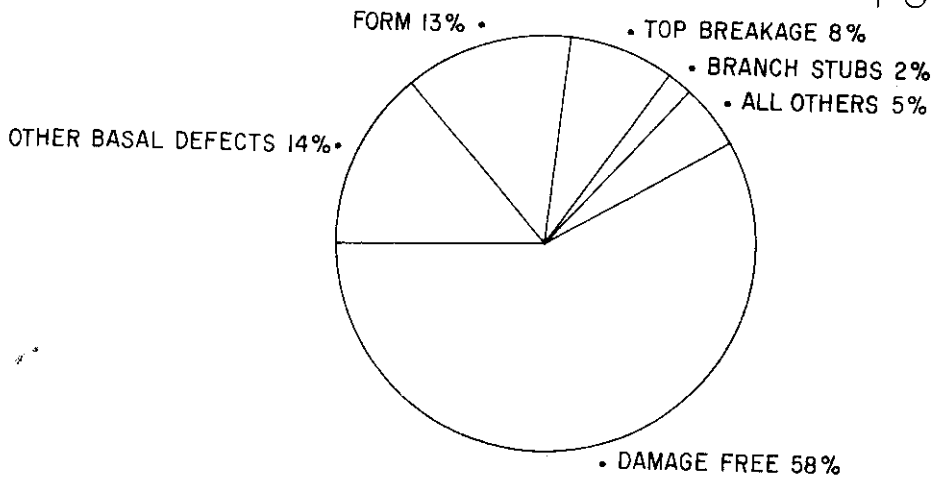


SOFT MAPLE
SAPLINGS

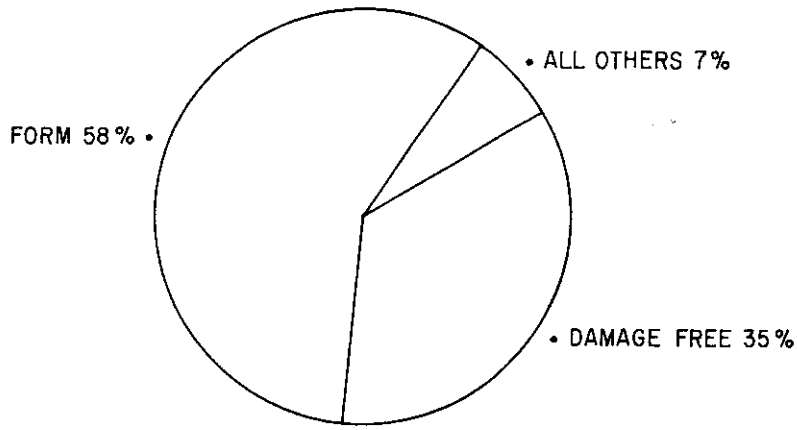


SOFT MAPLE
POLETIMBER

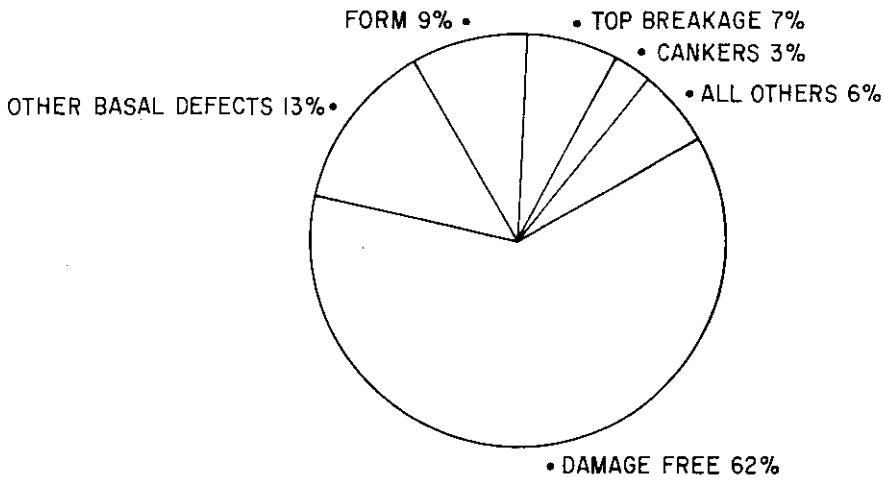


SOFT MAPLE
SAWTIMBER

Continued



TUPELO AND BLACKGUM
SAPLINGS



TUPELO AND BLACKGUM
SAWTIMBER

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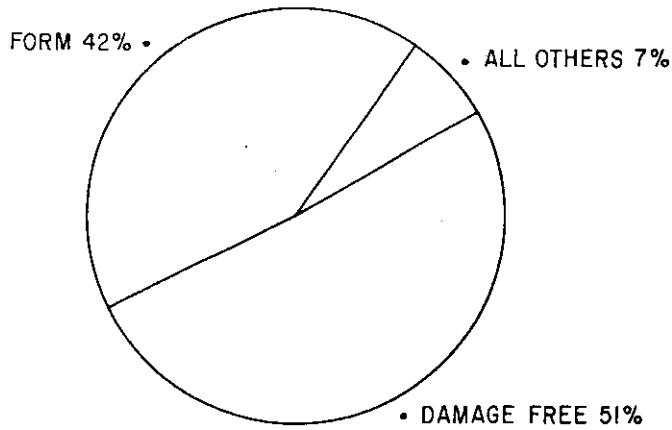
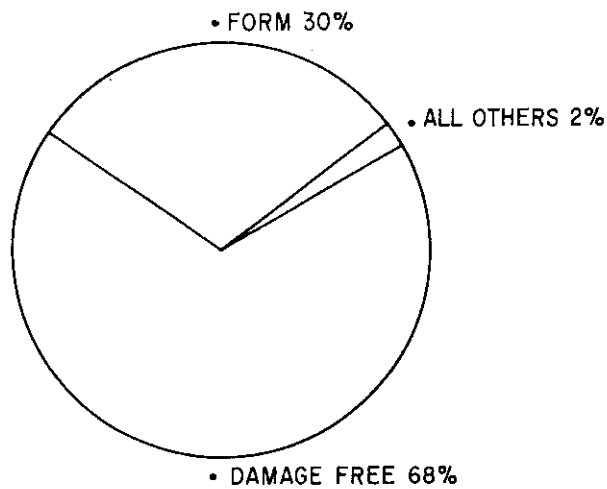
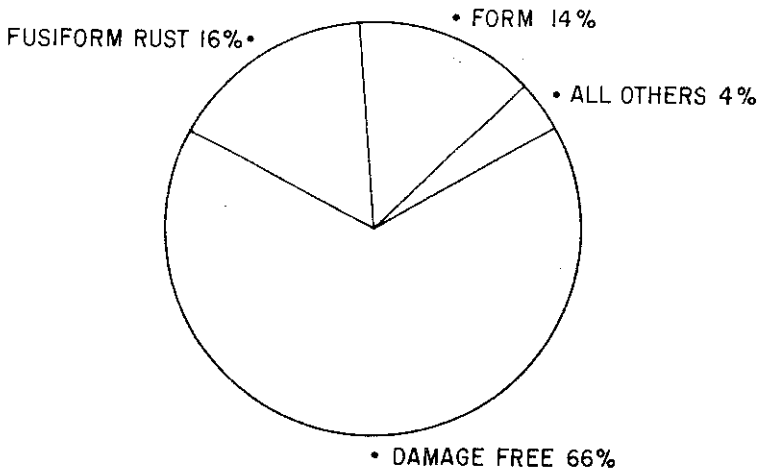


SWEETGUM
SAPLINGS

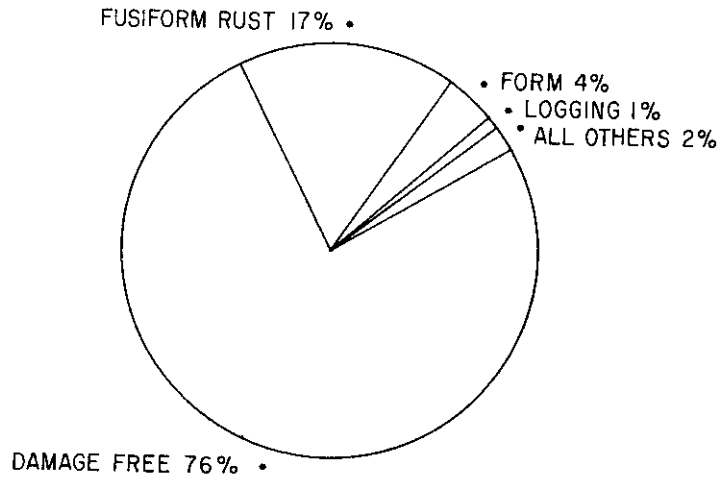


YELLOW-POPLAR
SAPLINGS

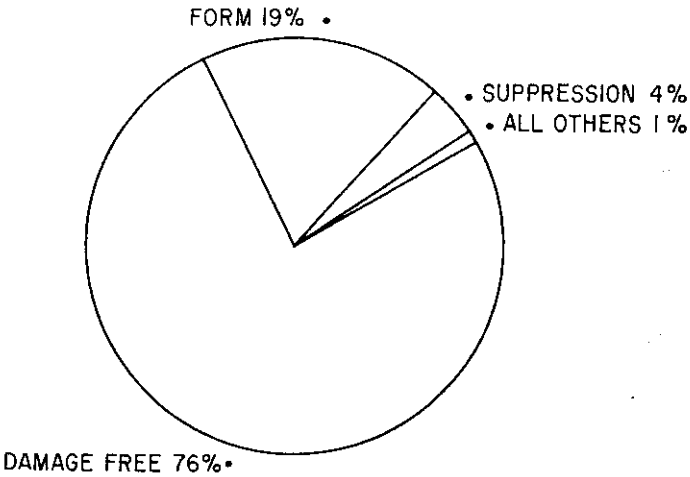
Continued



LOBLOLLY PINE
SAPLINGS

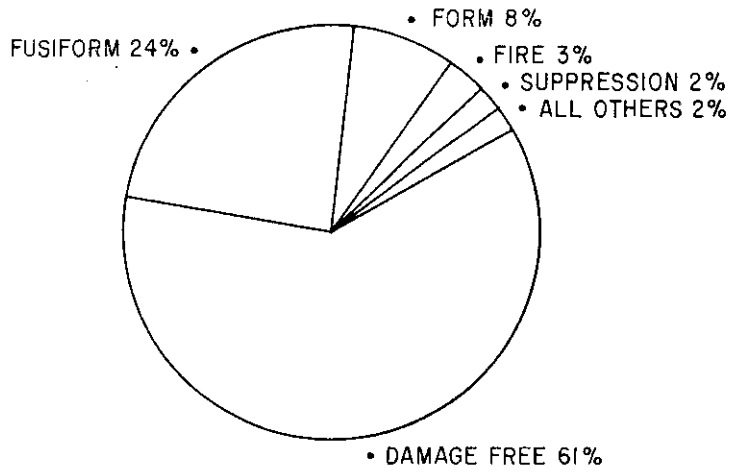


LOBLOLLY PINE
POLETIMBER

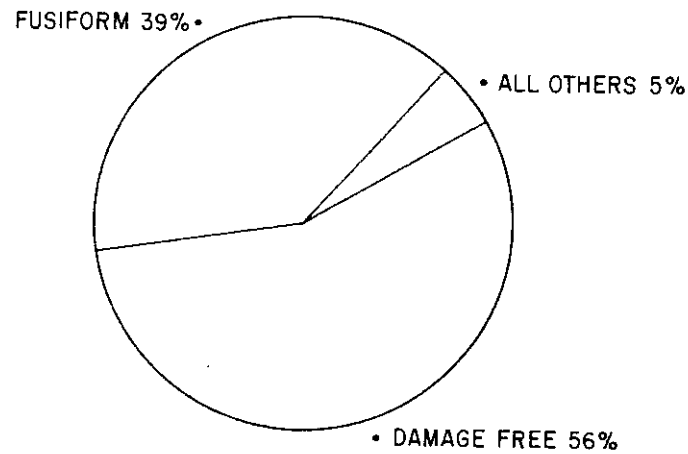


SHORTLEAF PINE
SAPLINGS

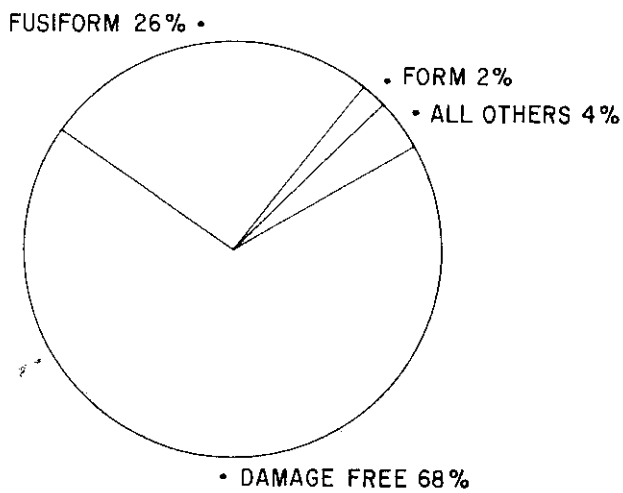
Continued



SLASH PINE
SAPLINGS

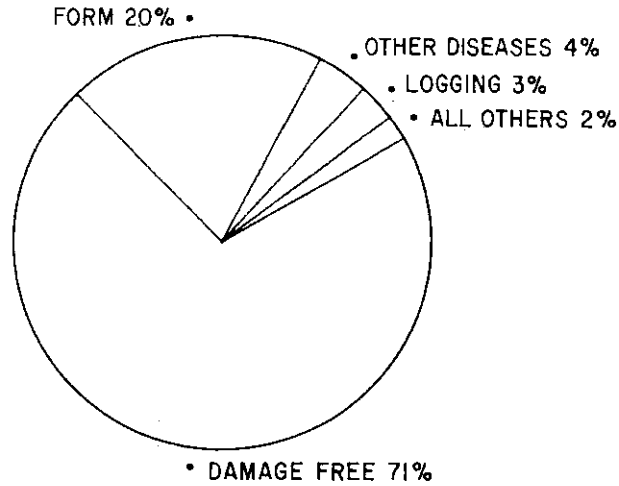


SLASH PINE
POLETIMBER



SLASH PINE
SAWTIMBER

Continued



VIRGINIA PINE
SAPLINGS

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

Forest classification	Acres
Stand-size class:	
Sawtimber	5,454,246
Poletimber	3,552,830
Saplings-seedlings	3,223,313
Nonstocked areas	272,517
All stand sizes	12,502,906
Forest type:	
Loblolly pine	3,403,718
Oak-hickory	2,694,392
Oak-gum-cypress	1,990,754
Oak-pine	1,718,544
Shortleaf pine	655,877
Slash pine	512,137
Longleaf pine	471,112
Pond pine	301,549
Elm-ash-cottonwood	277,434
Southern scrub oak	246,457
Virginia pine	178,021
Eastern redcedar	22,764
White pine-hemlock	13,374
Spruce pine	7,735
Pitch pine	4,633
Chestnut oak	4,405
All types	12,502,906

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

Host	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		Percent		
Loblolly pine	1,419,136	34	24	20
Shortleaf pine	535,107	24	8	8
Redcedar	253,583	22	8	8
Slash pine	193,131	39	44	32
Longleaf pine	128,954	16	16	13
Virginia pine	120,536	29	11	13
Pond pine	103,058	41	31	26
Baldcypress	27,420	27	11	17
White pine	6,344	16	0	7
Spruce pine	4,469	57	16	22
Pitch pine	1,348	100	0	13
Atlantic white-cedar	429	0	0	24

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

Host	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		Percent		
Other eastern hardwoods	2,750,458	41	19	29
Sweetgum	1,226,273	49	18	22
Other red oaks	962,620	51	17	24
Soft maple	815,196	69	25	42
Tupelo & blackgum	730,767	65	29	38
Ash	287,671	77	23	28
Hickory	259,151	53	16	22
Select white oaks	209,061	44	13	17
Elm	189,199	68	15	35
Other white oaks	151,737	62	20	25
Yellow-poplar	122,951	32	16	17
Black cherry	106,928	82	29	43
Select red oaks	55,563	58	15	18
Bay & magnolia	34,116	57	5	38
Hard maple	30,187	75	22	54
Chestnut oak	16,136	57	15	33
Beech	12,053	77	8	52
Cottonwood	8,694	65	23	29
Sycamore	4,661	58	20	21
Black walnut	2,706	72	40	33
Black locust	1,628	100	36	48
Basswood	285	--	12	51

Table 4.—Damage incidence and associated cull in softwoods in South Carolina, 1978

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 ft³*	*M bf*	*M bf*
LOBLOLLY PINE (1,419,136,000 susceptible trees)								
Insect	0	0.10	0.26	0	0.57	0	284	0
Other disease	.05	.37	.58	1.25	.84	61	911	0
Fusiform rust	16.07	17.14	12.07	.08	.28	180	628	1,418
Littleleaf disease	0	.05	.01	0	0	0	0	0
Branch stubs	0	.01	0	5.00	0	7	0	0
Top breakage	.16	.18	.21	9.44	9.17	223	3,584	20
Other basal defects	0	.03	.12	5.00	13.00	20	2,896	0
Fire	.36	.42	.54	.31	1.57	17	1,580	20
Animal	0	0	.12	0	0	0	0	0
Weather	.11	.66	.98	.55	.67	48	1,215	0
Suppression & stagnation	1.99	.50	.11	0	0	0	0	0
Logging & related	.90	1.11	1.61	.32	.30	47	891	0
Form	14.19	3.64	2.90	0	.05	0	263	0
LONGLEAF PINE (128,954,000 susceptible trees)								
Insect	0	.18	.85	0	0	0	0	0
Other disease	.71	.61	.41	0	.45	0	40	0
Fusiform rust	1.71	7.47	2.56	0	.11	0	61	0
Top breakage	.36	.29	.31	7.50	5.83	32	446	0
Other basal defects	0	0	.36	0	9.09	0	810	0
Fire	1.16	1.69	2.01	0	.47	0	243	20
Animal	0	.11	.80	0	0	0	0	0
Weather	.70	1.50	1.20	0	0	0	0	0
Suppression & stagnation	.69	.19	0	0	0	0	0	0
Logging & related	1.60	3.53	3.02	0	0	0	0	0
Turpentining	0	0	.63	0	.45	0	60	0
Form	8.58	.67	1.12	0	0	0	0	0
PITCH PINE (1,348,000 susceptible trees)								
Animal	0	0	2.21	0	0	0	0	0
Weather	0	0	8.58	0	0	0	0	0
Form	100.00	0	2.70	0	0	0	0	0

Continued

Table 4.—Damage incidence and associated cull in softwoods in South Carolina, 1978 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 ft³*	*M bf*	*M bf*
POND PINE (103,058,000 susceptible trees)								
Insect	0	.29	.89	0	0	0	0	0
Other disease	0	.68	.84	0	2.00	0	263	0
Fusiform rust	12.73	19.28	16.78	.17	.30	40	810	284
Top breakage	0	1.38	.51	9.62	9.29	163	770	0
Other basal defects	0	0	.24	0	8.57	0	324	20
Fire	3.46	3.46	1.48	0	2.17	0	506	40
Animal	0	0	.03	0	0	0	0	0
Weather	1.38	1.30	.75	0	6.43	0	770	0
Suppression & stagnation	1.45	.59	.14	0	0	0	0	0
Logging & related	.93	.62	1.67	0	.48	0	122	0
Form	21.51	3.66	2.92	.17	0	8	0	0
SLASH PINE (193,131,000 susceptible trees)								
Insect	.24	.04	.68	0	0	0	0	0
Other disease	.24	.22	.29	0	0	0	0	0
Fusiform rust	24.46	38.52	25.93	.02	.09	23	304	122
Top breakage	.24	.34	.63	19.29	8.33	199	668	0
Fire	2.95	.62	.38	0	0	0	0	0
Animal	.25	0	.04	0	0	0	0	0
Weather	.25	1.97	1.16	0	0	0	0	0
Suppression & stagnation	2.22	.19	.07	0	0	0	0	0
Logging & related	0	.29	.70	0	0	0	0	0
Turpentining	0	0	.07	0	1.67	0	20	0
Form	7.76	1.72	2.14	0	0	0	0	0
SPRUCE PINE (4,469,000 susceptible trees)								
Suppression & stagnation	28.92	0	0	0	0	0	0	0
Logging & related	14.51	9.43	2.99	0	7.50	0	324	0
Form	13.08	6.28	18.89	0	0	0	0	0
SHORTLEAF PINE (535,107,000 susceptible trees)								
Insect	.06	.19	.40	0	0	0	0	0
Other disease	.46	.42	.46	0	0	0	0	0
Fusiform rust	.11	.16	.33	0	.63	0	61	0
Littleleaf disease	.78	2.94	2.29	0	.06	0	20	0
Top breakage	.12	.03	.08	5.00	5.00	7	101	0
Other basal defects	0	.21	.45	8.33	15.63	77	1,904	40
Fire	0	.05	.03	0	0	0	0	0
Animal	0	0	.22	0	0	0	0	0
Weather	.13	.29	.10	0	0	0	0	0
Suppression & stagnation	3.72	.93	0	0	0	0	0	0
Logging & related	.34	.48	1.14	0	0	0	0	0
Form	18.77	2.41	2.90	0	0	0	0	0

Continued

Table 4.—Damage incidence and associated cull in softwoods in South Carolina, 1978—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 ft³*	*M bf*	*M bf*
VIRGINIA PINE (120,536,000 susceptible trees)								
Insect	0	.18	1.54	0	0	0	0	0
Other disease	4.37	5.01	3.98	.05	.53	3	142	0
Top breakage	0	.17	1.01	0	0	0	0	0
Other basal defects	.61	0	0	0	0	0	0	0
Animal	0	0	.19	0	0	0	0	0
Weather	0	1.22	1.45	0	1.00	0	101	0
Suppression & stagnation	.52	.41	0	0	0	0	0	0
Logging & related	2.73	.76	.52	0	0	0	0	0
Form	20.01	3.36	5.55	0	0	0	0	0
BALD CYPRESS (27,420,000 susceptible trees)								
Other disease	0	0	.06	0	27.50	0	243	0
Branch stubs	0	0	.12	0	5.00	0	81	0
Top breakage	2.32	.80	3.69	30.00	28.11	83	15,754	81
Other basal defects	0	1.51	6.52	18.33	24.96	96	24,705	324
Fire	2.31	0	.23	0	50.00	0	1,742	0
Animal	0	1.13	.03	2.50	5.00	10	20	0
Weather	0	.80	1.10	0	2.14	0	40	0
Suppression & stagnation	0	2.49	.15	0	0	0	0	0
Logging & related	0	0	.46	0	1.67	0	122	0
Form	21.94	4.11	4.45	0	0	0	0	0
ATLANTIC WHITE-CEDAR (429,000 susceptible trees)								
Other basal defects	0	0	10.92	0	22.50	0	243	0
Logging & related	0	0	13.45	0	0	0	0	0
HEMLOCK (605,000 susceptible trees)								
Logging & related	0	0	8.00	0	0	0	0	0

Continued

Table 4.—Damage incidence and associated cull in softwoods in South Carolina, 1978—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}	*M bf*	*M bf*
POND CYPRESS (41,036,000 susceptible trees)								
Other disease	0	0	.07	0	5.00	0	20	0
Branch stubs	0	0	.21	0	5.00	0	61	0
Top breakage	0	.99	1.42	45.00	26.67	130	1,883	40
Other basal defects	2.67	2.75	4.09	41.00	29.80	330	6,075	101
Fire	0	.44	1.70	5.00	2.50	24	202	0
Animal	0	0	.24	0	2.50	0	20	0
Weather	0	0	.90	0	0	0	0	0
Suppression & stagnation	1.78	.79	0	0	0	0	0	0
Logging & related	.89	1.09	.90	0	1.25	0	61	0
Form	14.29	7.01	5.81	0	0	0	0	0
REDCEDAR (253,583,000 susceptible trees)								
Other disease	0	.36	.31	0	0	0	0	0
Top breakage	0	.97	0	5.00	0	19	0	0
Other basal defects	0	.50	2.88	5.00	24.00	10	729	0
Fire	0	.21	0	5.00	0	4	0	0
Weather	1.12	1.16	0	0	0	0	0	0
Suppression & stagnation	2.34	1.94	1.89	0	0	0	0	20
Logging & related	.97	2.21	0	0	0	0	0	0
Form	18.02	1.00	3.04	0	0	0	0	0
WHITE PINE (6,344,000 susceptible trees)								
Insect	0	0	1.36	0	0	0	0	0
Top breakage	7.58	0	0	0	0	0	0	0
Other basal defects	0	0	2.91	0	23.33	0	688	0
Weather	8.29	0	1.55	0	0	0	0	0
Logging & related	0	0	1.55	0	0	0	0	0

Table 5.—Damage incidence and associated cull in hardwoods in South Carolina, 1978

Agent	Incidence of damage			Associated cull		Accumulated volume loss		Associated volume loss from sawtimber to poletimber
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent					$M\ ft^3$	*M bf*	*M bf*
BASSWOOD (285,000 susceptible trees)								
Top breakage	0	11.67	0	5.00	0	5	0	0
Weather	0	0	51.11	0	0	0	0	0
BLACK CHERRY (106,928,000 susceptible trees)								
Other disease	2.78	4.52	5.62	0	0	0	0	0
Hardwood cankers	1.94	5.32	0	0	0	0	0	0
Branch stubs	.25	.75	14.46	5.00	7.50	9	506	0
Top breakage	1.55	6.88	0	26.25	0	421	0	0
Other basal defects	.76	1.02	13.65	47.50	12.50	113	790	0
Fire	.29	.93	0	2.50	0	5	0	0
Weather	0	.57	.80	15.00	0	20	0	0
Suppression & stagnation	1.01	1.02	0	0	0	0	0	0
Logging & related	.40	1.24	0	0	0	0	0	0
Form	72.61	6.84	8.84	0	0	0	0	0
COTTONWOOD (8,694,000 susceptible trees)								
Other disease	0	0	1.35	0	13.33	0	547	0
Hardwood cankers	0	2.68	.56	0	0	0	0	0
Branch stubs	0	0	2.54	0	11.43	0	871	40
Top breakage	0	.82	2.85	85.00	14.00	49	1,195	0
Other basal defects	0	0	7.14	0	11.15	0	2,390	40
Weather	0	0	1.11	0	0	0	0	0
Animal	0	3.19	0	0	0	0	0	0
Suppression & stagnation	12.11	0	.32	0	0	0	0	0
Logging & related	5.15	0	.95	0	0	0	0	0
Form	47.82	16.53	11.97	0	.83	0	304	0
ELM (189,199,000 susceptible trees)								
Other disease	0	0	.92	0	3.33	0	223	0
Hardwood cankers	0	0	.67	0	0	0	0	0
Branch stubs	0	.42	2.79	5.00	8.50	14	1,721	142
Top breakage	2.24	1.41	5.58	10.00	15.23	96	6,196	162
Other basal defects	.18	1.28	7.25	6.88	18.29	60	9,659	263
Fire	0	0	.50	0	3.33	0	121	0
Weather	0	.72	.47	0	20.00	0	688	0
Animal	0	0	.65	0	0	0	0	0
Suppression & stagnation	.58	2.22	.72	0	0	0	0	0
Logging & related	2.28	1.88	1.22	0	2.50	0	223	0
Form	63.12	7.07	14.70	0	0	0	0	0

Continued

Table 5.—Damage incidence and associated cull in hardwoods in South Carolina, 1978 -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 ft³*	*M bf*	*M bf*
SWEETGUM (1,226,273 susceptible trees)								
Other disease	0	0	.06	0	16.67	0	608	0
Hardwood cankers	0	.12	.41	5.00	.88	28	223	0
Branch stubs	.08	.05	.97	5.00	14.05	12	8,262	0
Top breakage	1.79	2.59	3.26	21.00	15.22	2,537	30,112	0
Other basal defects	.28	1.94	5.15	16.12	21.29	1,459	66,521	78
Fire	1.32	1.69	.96	1.00	9.04	79	5,265	0
Weather	.25	.75	.48	.34	1.33	12	385	0
Animal	0	.24	.19	0	0	0	0	0
Suppression & stagnation	1.33	.78	.18	0	.71	0	81	0
Logging & related	2.12	2.76	1.44	2.72	2.33	350	2,045	0
Form	42.06	7.30	8.88	.02	.10	7	547	0
SYCAMORE (4,661,000 susceptible trees)								
Other disease	0	0	.91	0	15.00	0	405	0
Hardwood cankers	0	0	.26	0	0	0	0	0
Branch stubs	0	0	.85	0	15.00	0	364	0
Top breakage	0	1.14	1.43	5.00	12.50	3	526	0
Other basal defects	0	0	1.82	0	13.40	0	709	0
Weather	0	5.21	4.04	0	21.60	0	2,552	40
Suppression & stagnation	0	7.17	0	0	0	0	0	0
Logging & related	0	0	1.11	0	2.50	0	81	0
Form	58.04	6.60	10.35	0	0	0	0	0
YELLOW-POPLAR (122,951,000 susceptible trees)								
Other disease	0	0	.05	5.00	0	4	0	0
Hardwood cankers	0	0	1.40	0	1.54	0	526	0
Branch stubs	0	.40	.33	5.00	16.25	17	1,296	0
Top breakage	1.11	3.25	1.78	21.32	30.22	599	12,960	243
Other basal defects	.37	2.11	5.06	10.94	18.31	199	22,316	344
Fire	.28	1.70	.33	4.09	20.71	60	1,640	0
Weather	0	1.27	1.30	0	3.53	0	1,114	0
Animal	0	0	.45	0	0	0	0	0
Suppression & stagnation	.30	.18	0	0	0	0	0	0
Logging & related	.83	.74	.49	2.00	3.13	13	364	0
Form	29.51	6.09	5.40	0	0	0	0	0

Continued

Table 5.—Damage incidence and associated cull in hardwoods in South Carolina, 1978--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 ft³*	*M bf*	*M bf*
ASH (287,671,000 susceptible trees)								
Other disease	0	0	.07	0	40.00	0	344	0
Hardwood cankers	.19	.42	.70	0	4.17	0	364	0
Branch stubs	.32	.52	2.19	10.00	13.96	45	3,868	182
Top breakage	2.31	4.76	5.38	19.50	29.10	809	19,784	425
Other basal defects	.29	4.07	6.76	15.31	17.00	543	547	20
Fire	0	.36	0	7.50	0	0	0	0
Weather	.12	.19	.15	0	0	0	0	0
Animal	0	.74	.76	0	0	0	0	0
Suppression & stagnation	1.36	2.01	.30	0	0	0	0	0
Logging & related	.57	2.30	1.06	1.25	.83	25	101	0
Form	71.96	7.69	10.82	0	.07	0	101	0
BEECH (12,053,000 susceptible trees)								
Branch stubs	0	0	3.18	0	15.00	0	932	506
Top breakage	0	0	2.18	0	36.67	0	1,559	20
Other basal defects	0	1.67	16.48	5.00	29.29	5	13,082	284
Fire	0	0	.70	0	40.00	0	547	0
Weather	0	0	.99	0	35.00	0	668	0
Logging & related	15.00	1.67	1.89	0	17.50	0	648	20
Form	61.72	4.67	26.71	0	.56	0	284	0
BLACK LOCUST (1,628,000 susceptible trees)								
Hardwood cankers	0	13.48	30.43	6.00	20.00	28	547	0
Other basal defects	0	14.78	17.39	40.00	5.00	206	81	0
Weather	0	5.02	0	5.00	0	1	0	0
Form	100.00	2.79	0	0	0	0	0	0
BLACK WALNUT (2,706,000 susceptible trees)								
Branch stubs	0	0	8.68	0	10.00	0	405	0
Top breakage	0	11.89	0	12.50	0	33	0	0
Other basal defects	0	0	13.22	0	35.00	0	2,187	81
Suppression & stagnation	0	1.73	0	0	0	0	0	0
Logging & related	0	25.73	3.31	0	10.00	0	162	0
Form	71.80	0	7.85	0	0	0	0	0

Continued

Table 5.—Damage incidence and associated cull in hardwoods in South Carolina, 1978 -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 ft³*	*M bf*	*M bf*
HICKORY (259,151,000 susceptible trees)								
Hardwood cankers	0	.13	.68	5.00	1.67	7	162	0
Branch stubs	0	.26	.97	16.25	8.00	46	1,174	0
Top breakage	1.30	1.08	1.47	15.00	18.89	176	4,212	0
Other basal defects	.79	1.85	5.91	15.50	22.18	312	19,845	526
Fire	.34	1.61	.20	14.00	10.00	245	3,038	0
Weather	.31	.39	.82	2.50	3.75	11	466	0
Animal	0	.63	.09	0	0	0	0	0
Suppression & stagnation	1.83	.54	.02	0	0	0	0	0
Logging & related	3.45	2.81	1.21	9.35	13.18	286	2,410	0
Form	45.26	6.91	10.86	0	.32	0	526	0
CHESTNUT OAK (16,136,000 susceptible trees)								
Branch stubs	0	0	1.97	0	13.75	0	688	61
Top breakage	0	2.80	2.69	15.00	47.50	59	3,220	0
Other basal defects	5.27	3.06	14.23	9.25	26.84	3,978	9,619	263
Fire	0	1.11	0	0	0	0	0	0
Suppression & stagnation	5.27	0	0	0	0	0	0	0
Form	46.72	7.57	13.99	0	0	0	0	0
SELECT RED OAKS (55,563,000 susceptible trees)								
Hardwood cankers	0	.20	.45	5.00	0	4	0	0
Branch stubs	0	0	.66	0	29.03	0	1,620	40
Top breakage	1.04	.54	1.98	27.27	9.68	52	1,620	40
Other basal defects	0	1.40	6.09	35.21	11.19	174	5,751	162
Fire	1.35	1.15	1.36	0	3.13	0	364	0
Animal	0	.52	.28	0	0	0	0	0
Weather	0	.52	.70	0	3.03	0	182	61
Logging & related	1.36	3.60	.77	4.12	0	52	0	0
Form	52.51	6.89	5.62	0	0	0	0	61
Suppression & stagnation	1.81	.65	.19	0	0	0	0	0

Continued

Table 5.—Damage incidence and associated cull in hardwoods in South Carolina, 1978 –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 ft³*	*M bf*	*M bf*
SELECT WHITE OAKS (209,061,000 susceptible trees)								
Other disease	0	.15	.05	0	0	0	0	0
Hardwood cankers	0	.76	.81	0	2.08	0	364	40
Branch stubs	.62	.25	.36	12.39	9.30	5	709	0
Top breakage	1.47	1.17	.79	13.52	22.58	25	3,807	40
Other basal breakage	.19	.57	3.51	22.52	18.07	20	13,568	324
Fire	0	.29	.23	12.50	18.52	6	911	20
Animal	0	0	.65	0	0	0	0	0
Weather	.16	.67	.57	.97	28.36	1	3,463	20
Logging & related	1.94	2.04	.68	.32	1.25	1	182	61
Form	37.17	6.33	9.72	0	0	0	0	0
Suppression & stagnation	2.60	.54	.06	0	0	0	0	20
OTHER RED OAKS (962,620,000 susceptible trees)								
Other disease	.06	.15	.51	15.22	9.52	117	3,301	162
Hardwood cankers	.14	1.13	1.97	.70	4.36	40	5,852	223
Branch stubs	.10	.28	1.98	33.49	20.30	479	27,398	668
Top breakage	.86	1.85	2.45	20.70	35.01	1,958	58,462	1,114
Other basal defects	.36	1.48	7.91	20.13	21.82	1,523	11,763	3,524
Fire	1.17	1.17	.88	3.19	17.07	191	10,246	162
Animal	0	.06	0	0	0	0	0	0
Weather	.20	.79	.80	3.09	5.33	125	2,916	142
Logging & related	1.25	1.94	.77	2.55	2.09	253	1,094	40
Form	45.67	7.06	6.87	.20	.08	72	364	81
Suppression & stagnation	.86	.64	.07	0	11.54	0	547	20
OTHER WHITE OAKS (151,737,000 susceptible trees)								
Other disease	0	.38	.59	13.86	23.81	40	1,742	81
Hardwood cankers	.41	1.96	1.78	3.04	5.56	45	1,235	142
Branch stubs	0	.37	1.93	8.16	13.97	23	3,341	284
Top breakage	1.06	1.68	2.18	22.44	64.29	285	17,395	243
Other basal defects	.47	2.17	5.98	13.40	22.75	220	16,868	850
Fire	.86	1.47	1.63	5.06	3.48	56	709	101
Weather	.58	1.16	.55	.68	10.26	6	709	40
Logging & related	1.16	4.39	2.76	1.87	4.62	62	1,580	304
Form	55.15	4.74	7.73	0	0	0	0	20
Suppression & stagnation	1.85	1.42	.30	0	0	0	0	40

Continued

Table 5.—Damage incidence and associated cull in hardwoods in South Carolina, 1978.—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}	*M bf*	*M bf*
				HARD MAPLE (30,187,000 susceptible trees)				
Top breakage	1.59	0	15.49	0	59.09	0	3,179	101
Other basal defects	1.63	15.19	10.56	4.90	20.00	30	729	61
Fire	0	0	2.82	0	0	0	0	0
Weather	0	0	9.15	0	0	0	0	0
Logging & related	1.67	0	0	0	0	0	0	0
Form	70.03	4.62	15.49	0	0	0	0	0
Suppression & stagnation	0	2.08	0	0	0	0	0	0
				SOFT MAPLE (815,196,000 susceptible trees)				
Other disease	.07	.11	.31	21.05	2.27	53	162	61
Hardwood cankers	.57	1.75	1.51	1.36	6.16	55	2,126	263
Branch stubs	.22	.42	2.53	10.71	16.38	104	9,436	628
Top breakage	1.54	4.10	7.88	28.51	32.00	2,694	57,429	2,268
Other basal defects	.58	5.07	13.88	21.90	25.75	2,559	81,405	4,030
Fire	.59	1.19	1.17	6.49	25.61	178	6,824	324
Animal	.03	.10	0	0	0	0	0	0
Weather	.42	.83	.99	7.01	8.70	134	1,964	243
Logging & related	1.88	1.77	1.03	.50	9.72	20	2,288	142
Form	62.06	8.42	12.58	0	.11	0	324	122
Suppression & stagnation	.82	.87	.35	0	9.46	0	749	61
				BAY & MAGNOLIA (34,116,000 susceptible trees)				
Top breakage	.75	2.05	14.69	4.35	57.69	14	6,237	122
Other basal defects	0	0	6.78	0	16.67	0	830	40
Fire	1.00	3.16	9.60	0	0	0	0	0
Animal	.75	0	0	0	0	0	0	0
Form	54.27	0	7.34	0	0	0	0	0
Suppression & stagnation	0	0	0	0	0	0	0	0

Continued

Table 5.—Damage incidence and associated cull in hardwoods in South Carolina, 1978 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 ft³*	*M bf*	*M bf*
TUPELO & BLACKGUM (730,767,000 susceptible trees)								
Other disease	.08	.38	.41	0	0	0	0	101
Hardwood cankers	.30	2.28	3.16	1.07	1.05	82	2,329	628
Branch stubs	.09	.33	1.77	7.46	15.35	83	19,116	709
Top breakage	2.44	3.09	6.88	18.62	27.79	1,936	134,480	3,301
Other basal defects	.41	6.44	12.94	3.56	24.70	771	224,816	7,047
Fire	.93	1.55	1.94	12.55	16.59	655	22,640	729
Animal	.04	3.87	0	0	0	0	0	0
Weather	.04	1.02	.60	.19	5.22	7	2,207	162
Logging & related	1.76	1.01	.52	.86	.85	29	304	142
Form	57.59	8.45	9.22	.02	.07	6	446	81
Suppression & stagnation	1.48	.88	.14	.22	1.59	7	162	0
OTHER EASTERN HARDWOODS (2,750,458 susceptible trees)								
Other disease	.04	0	.20	0	30.77	0	648	--
Hardwood cankers	.17	.97	.19	1.75	0	41	0	--
Branch stubs	.10	.93	3.71	1.83	23.85	41	9,234	--
Top breakage	1.52	3.93	4.61	19.15	31.99	1,805	15,390	--
Other basal defects	.39	5.01	9.06	19.25	36.64	2,313	34,628	--
Fire	.59	.67	.25	10.03	6.25	161	162	0
Animal	0	.17	.08	0	0	0	0	0
Weather	.20	.82	.92	7.17	18.64	141	1,782	--
Logging & related	1.05	1.84	1.46	3.23	8.51	143	1,296	--
Form	36.42	4.22	7.40	.05	0	5	0	--
Suppression & stagnation	.77	.60	1.27	3.03	0	44	0	--

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

Species	Annual timber removals		Volume loss due to—				Annual quality loss from sawtimber to nonsawtimber
			Annual mortality		Annual accumulated cull		
	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	
	M ft³	*M bf*	*M ft³*	*M bf*	*M ft³*	*M bf*	*M bf*
			SOFTWOODS				
Yellow pines[a]	58,105	1,330,964	43,298	192,830	115	2,106	198
Eastern white pine	0	2,120	0	0	0	69	0
Cypress[b]	0	23,443	644	761	67	5,103	55
Other eastern softwoods[c]	509	3,967	488	4,724	3	97	2
Total	58,614	1,360,494	44,430	198,315	185	7,375	255
			HARDWOODS				
Select white & red oaks[d]	3,244	73,788	684	4,080	34	3,254	89
Other white & red oaks[e]	9,663	137,887	5,321	36,531	953	28,491	824
Hickory	1,427	20,602	170	2,842	108	3,183	53
Hard maple	0	0	0	0	3	390	16
Sweetgum	7,000	89,001	2,182	20,287	448	1,140	8
Ash, walnut, black cherry	618	11,347	1,701	5,193	202	2,916	71
Yellow-poplar	354	38,091	838	4,231	89	4,021	59
Tupelo & blackgum	2,898	66,868	601	8,665	357	40,650	1,290
Bay & magnolia	0	0	131	0	1	706	16
Other eastern hardwoods[f]	3,144	44,267	4,091	32,653	1,095	27,297	974
Total	28,348	481,851	15,719	114,482	3,290	112,048	3,400
All species	86,962	1,842,345	60,149	312,797	3,475	119,423	3,655

[a]Loblolly, shortleaf, Virginia, pitch, pond, longleaf, slash, spruce pine.
[b]Baldcypress and pondcypress.
[c]Cedar and hemlock.
[d]White, swamp chestnut, cherrybark, northern red.
[e]Chestnut, post, water, southern red, scarlet, black.
[f]Basswood, cottonwood, elm, sycamore, beech, black locust, and soft maple.

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

Species	Annual volume wood fiber loss	Stumpage value per unit	Dollar loss
		---------- *Dollars* ----------	
Softwoods:			
Sawtimber (M bm)[a]	205,945	124.10/M	25,557,775
Poles (M ft^3)[b]	44,615	17.63	786,562
Hardwoods:			
Sawtimber (M bm)	229,930	64.11	14,740,812
Poles (M ft^3)	19,009	5.09	96,756
All species:			
Sawtimber (M bm)	435,875		40,298,587
Poles (M ft^3)	63,624		883,318
Total			41,181,905

[a]1 ft^3 = 4.5 fbm.
[b]1 cord = 75 ft^3.

Table 8.—Past treatment or disturbance as related to treatment needed, by number of samples

Item	Treatment needed							
	None	Salvage	Harvest	Thinning	Cleaning	Stand conversion	Artificial regeneration	Total
Wildfire	37	2	1	2	6	5	26	79
Man-caused flooding	2	1	0	0	1	0	5	9
Grazing	42	0	3	2	2	0	7	56
Construction	26	0	3	3	3	0	10	45
Salvage cut	6	1	1	1	1	2	4	16
Significant disease	84	16	0	21	6	6	8	141
Significant insect	32	4	5	3	2	0	11	57
Significant natural	20	2	1	1	2	4	5	35
All others, including none	2,196	13	243	148	246	159	687	3,692
Total of all samples, including temporary plots[a]	2,445	39	257	181	269	176	763	4,130

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

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1981. Incidence and impact of damage to South Carolina's timber, 1979 . USDA For. Serv., Resour. Bull. SE-56, 34 p. Southeast. For. Exp. Stn., Asheville, N.C.

Recognized damaging agents include: insects, fusiform rust, Annosus root rot, littleleaf disease, hardwood cankers, other diseases, branch stubs, top breakage, other basal defects, fire, animal, weather, suppression and stagnation, logging and related, damage from turpentining, and form (damaging).

KEYWORDS: Insect losses, disease losses, fusiform rust, decay, and weather damage.

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