United States
Department of
Agriculture

Forest Service

**Southeastern Forest
Experiment Station**

Resource Bulletin
SE-82

Incidence and Impact of Damage to North Carolina's Timber, 1984

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December 1985

Southeastern Forest Experiment Station
200 Weaver Blvd.
Asheville, North Carolina 28804

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Foreword

This Bulletin reports survey data on agents damaging trees in North Carolina's forests. Data were collected in 1982, 1983, and 1984 by the Forest Inventory and Analysis Work Unit of the Southeastern Forest Experiment Station. This effort was part of the fifth inventory of the State's forests. Considerably more information was gathered for this inventory than in the previous data collections, which makes possible the publication of this specialized report on timber damage, as well as reports on forest resources other than timber.

The Southeastern Forest Experiment Station in Asheville, NC, periodically inventories and evaluates forest resources in Florida, Georgia, North Carolina, South Carolina, and Virginia. The Region 8, State and Private Forestry, Forest Pest Management Staff Unit, headquartered in Atlanta, GA, provides training and field support and helps evaluate the data on forest insects, diseases, and other damaging agents.

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

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Introduction

During the fifth inventory of North Carolina's forests in 1982-1984, damage to live trees on sample plots was noted. Where possible, a cause or damaging agent was specified. This Bulletin reports and interprets these observations.

Since plots are visited only once but at any time of the year, it is only possible to keep records on agents that produce symptoms or signs in all seasons. On the basis of these "durable" symptoms and signs, the recognized agents are listed in "Definitions."

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

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

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

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

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

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

Sampling Procedure

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

- Initial estimates of forest and nonforest acreages were developed from the classification of 91,765 sample clusters systematically spaced on the latest aerial photographs available. Field crews checked a subsample of 8,123 of these 16-point clusters on the ground. A linear regression was fitted to the data to develop the relationship between the photo and ground classification of the subsample. This procedure provided a means for adjusting the initial acreage estimates for change in land use since date of photograph and for photo misclassifications.
- For the entire State, estimates of timber volume and forest classifications were based on measurements recorded

at 5,355 ground-sample locations systematically distributed on commercial forest land. The plot design at each location was based on a cluster of 10 points. In most cases, variable plots delineated with a basal area factor of 37.5 square feet per acre were systematically spaced within a single forest condition at 5 of the 10 cluster points. Trees less than 5.0 inches d.b.h. were tallied on fixed-radius plots around the point centers.

- Equations developed from detailed measurements of standing trees in North Carolina and throughout the Southeast were used to compute volumes of individual tally trees. A mirror caliper and sectional aluminum poles were used to measure upper stems of standing trees. In addition, felled trees were measured at 100 active cutting operations to provide utilization factors for the different timber products and species groups and to supplement the standing-tree volume study.
- Growth, removals, and mortality were estimated from the remeasurement of 4,878 permanent sample plots established in the fourth inventory. A 1983 survey of timber products output, conducted by the North Carolina Division of Forest Resources, along with the annual pulpwood production study in the South, provided additional information for a breakdown of removals, by product.

All field data were sent to Asheville for editing and were entered into disk and magnetic-tape storage for processing. Final estimates were based on statistical summaries of the data. As data collection by each of the five Survey Units in North Carolina was completed, special summaries of the information were added to master data files of forest resource statistics maintained in Asheville for the entire Southeast. A Forest Information Retrieval (FIR) program is available for compiling information for any area of interest as a cooperative service.

Computations

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

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

3. The symptoms used to identify the cause of damage to living trees on the sampled plots are listed in "Definitions." The percentage of incidence and volume of cull associated with each damage class were determined for each species. Note that these data do not imply total tree loss. Only a part of the volume lost due to cull would fail to qualify for some commercial use, such as firewood. The volume loss was determined by totaling the volume of cull associated with each damaging agent, by species.

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

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

Incidence of Damaging Agents and Associated Cull

North Carolina has 18,450,269 acres of commercial forest, and most of the acreage is in the oak-hickory, loblolly pine, oak-gum-cypress, and oak-pine

forest types. Table 1 shows the acreage in the various stand-size classes and forest types. The remaining tables in this report show how much of the timber resource is damaged and the agents responsible for the damage. Remember, the term "damage" refers to an injury the tree has suffered. A damaged tree is still alive.

Overall, hardwoods had a higher incidence of damage than softwoods. For most hardwood species, 30 to 60 percent of the saplings were damaged and most of this can be attributed to form damage. Black cherry, hickory, tupelo and blackgum, and ash all had 60 percent or more damaged saplings. The highest incidence of damage to sawtimber-size hardwood trees occurred on bay and magnolia (62 percent), black walnut (44 percent), and soft maple (38 percent). Loblolly pine is by far the most abundant and economically important softwood species in North Carolina and it had relatively little damage compared with the other softwood species. Table 2 shows percentages of trees damaged, by size class and tree species.

Table 3 shows damage incidence and volume loss due to cull for hardwoods, by tree species. Of all the types of damage found on hardwoods, basal defect had the highest associated volume loss due to cull and quality loss. Basal defect affects the usable volume in the tree because there is usually some type of rot associated with it, and this affects the first and largest log of the tree. Basal defect is usually associated with fire or past logging. The major hardwood species, from an economic point of view, are red oak, white oak, yellow-poplar, and tupelo and blackgum. Although the percentage of incidence of basal defect is fairly low for these species, the associated volume loss due to cull is very high. Volume loss in cull is rotten wood and does not provide any economic return. Quality loss, where sawtimber-size trees cannot be used for sawtimber due to defects, is even greater than cull. Trees with quality loss, however, can still be used for some pulpwood product or firewood, and therefore provide the owner with some economic return.

Form damage to saplings is very high for all hardwood species, particularly those growing in bottom lands (bay and magnolia, tupelo and blackgum, soft maple, ash, and elm). Saplings also exhibit damage due to suppression and stagnation, usually between 5 and 10 percent. Hickory had an unusually high incidence of terminal shoot and stem borers; 26 percent of saplings were affected and 13 percent of the poletimber. The highest incidence of hardwood borers (10 percent) was observed on hard maple saplings.

Black cherry had particularly high damage incidence in the sapling- and poletimber-size classes. Black knot, a disease which would come under the "other diseases" category, probably contributed to this. This disease is very easy to identify by the elongated black swellings it causes on the twigs and branches.

Table 4 shows damage incidence and volume loss due to cull for softwoods, by species. The major softwood species in North Carolina is loblolly pine, and fusiform rust is the major damaging agent for this species. Trees in all size classes were affected. Fusiform rust was recorded only if the gall was on or within 12 inches of the main stem. If galls farther out on the limbs had been recorded, occurrence of fusiform would have been higher. Slash pine had a high incidence of fusiform rust but very little associated volume loss.

Suppression and stagnation and form are the most prevalent damage types in softwood saplings. Basal defect on baldcypress and pondcypress had relatively low incidence but high associated volume loss due to cull and quality loss. Sawtimber-size cedar had a high volume quality loss due to dieback.

The incidence of bark beetle damage on live softwood trees is very low, even though bark beetles are the greatest insect pest of pine in the Southeast. The main reason that bark beetles do not show up as a significant damaging agent is that this survey reports damage to living trees, and most often bark beetles are associated with dead trees. Therefore, bark beetle-infested trees would be considered damaged only when

they were newly attacked and not yet dead. Bark beetle outbreaks also occur in cycles, so it is highly probable that a survey may not coincide with a beetle outbreak. In fact, this survey of North Carolina's forests was conducted during a time when bark beetle populations were very low.

Reported incidence and associated volume loss due to insect damage on both hardwoods and softwoods were very low. This is because it is difficult to diagnose the occurrence of many types of insect damage, and significant damage from insects usually occurs in cycles. Insect outbreaks are easily missed in a survey done every 10 years, as is this one.

Mortality, Losses to Cull, and Quality Loss

Annual mortality for all live hardwood timber was about 122 million cubic feet; for softwood timber, 119 million cubic feet. Hardwood mortality was approximately 34 percent of the annual harvest, and softwood mortality was 27 percent of the harvest. Approximately 58 percent of hardwood mortality and 45 percent of softwood mortality occurred in sawtimber-size trees. The mortality figures shown in table 5 are the total for the resource and do not reflect any discounting for trees whose death represented no economic loss. Table 5 also shows the estimated volumes of cull and quality loss for the major species groups in North Carolina. Annual harvest figures are given to place the volume losses in perspective.

The volume loss due to cull is much greater in hardwoods than softwoods. The annual accumulated cull for hardwoods is 26 percent of annual hardwood mortality, whereas cull for softwoods is less than 2 percent of softwood mortality. Quality loss was also greater in hardwoods than softwoods. It should be noted that mortality figures are on an annual basis, whereas annual accumulated cull and quality loss were determined by dividing total accumulated cull and quality loss by 10, so that losses were distributed over a 10-year period.

Definitions

Damaging Agents and Their Symptoms

Diseases

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

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

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

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

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

Other diseases.--All species. All damage caused by diseases not identified in separate categories (e.g., red heart of pine, brown spot, and leaf diseases).

Trees showing degrade caused by diseases and not identified elsewhere are included in this category.

Growth Defects

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

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

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

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

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

Natural Phenomena

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

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

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

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

Animals and Birds

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

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

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

Insects

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

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

Terminal shoot and stem borers.--All species. Fresh attacks show boring dust and frass at the entrance holes, which are most often located at the base

of leaf petioles and buds. Resin globs may be present at points of attack. Dieback results from larval tunneling within terminal shoots and branches. Foliage on the shoots turns yellow, red, and finally brown.

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

Human Activities

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

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

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

Forest Survey and Forest Pest Management Terms

Acceptable tree.--A tree that qualifies as growing stock but does not meet the minimum requirements to qualify as a desirable tree. Included are sawtimber-size trees that do not contain a 12-foot saw log because of excessive, natural taper in the butt log but have the potential to produce a 12-foot saw log as diameter increases.

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 conventionally regarded as being able to develop into trees suitable for the manufacture of industrial timber products. Species that typically exhibit small size, poor form, or inferior quality are excluded.

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

Desirable tree.--A tree that qualifies as growing stock and has no serious defects in quality, limiting present or prospective use; is of relatively high vigor (30 percent or more live crown ratio); is compatible with the site and physiographic class; has a total board-foot loss not to exceed 15 percent in softwoods or 25 percent in hardwoods as a result of severe sweep, crook, or lean; and has a relatively clear bole.

Diameter class.--A classification of trees based on tree d.b.h. (D.b.h. is the common abbreviation for diameter at breast height, 4-1/2 feet above the ground.) Two-inch diameter classes are commonly used by Forest Inventory and Analysis, 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 sawtimber-size trees of commercial species containing at least a 12-foot log, or two noncontiguous saw logs each 8 feet or longer, meeting minimum grade requirements (hardwoods must qualify as a log grade of either 3 or 4; softwoods must qualify as a log grade 3) with at least one-third of the gross board-foot volume (International 1/4-inch rule) between a 1-foot stump and the minimum saw-log top being sound, or a live tree below sawtimber size that will prospectively qualify under the above standards.

Incidence.--Percentage of susceptible trees affected by a damaging agent.

Mortality.--The merchantable volume in trees that have died from natural causes during a specified period.

Noncommercial species.--Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

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

Quality loss.--Volume in the saw-log portion of trees sufficiently large to qualify as sawtimber, but unsatisfactory for sawtimber because of damaging agent.

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

Rough trees.--Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of roughness, poor form, splits, cracks, and with less than one-third of the gross tree volume in sound material; and live trees of noncommercial species.

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

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

Sawtimber-size trees.--Softwoods 9.0 inches d.b.h. and larger; hardwoods 11.0 inches d.b.h. and larger.

Sawtimber volume.--Growing stock volume in the saw-log portion of sawtimber-size trees in board feet (International 1/4-inch rule).

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

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

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

Other white oaks: Overcup, post, and live.

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

Other eastern hardwoods: Chestnut oak, black locust, yellow birch, buckeye, birch, hackberry, dogwood, persimmon, honeylocust, silverbell, holly, butternut, cucumbertree, mulberry, scrub oaks, willow, and noncommercial species.

Other eastern softwoods: Eastern white pine, eastern hemlock, spruce, and fir.

Stand-size class.--A classification of forest land based on the diameter class distribution of growing-stock trees in the stand.

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 total 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 total stocking is saplings and seedlings.

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

Timberland.--Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, not currently developed for non-forest use, capable of producing 20 cubic feet of industrial wood per acre per year, and not withdrawn from timber utilization by legislative action.

References

This publication reports incidence and impact of damaging agents on North Carolina's timber. It does not discuss their identification or control. References listed below are provided to assist those desiring additional information on causal agents.

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Table 1.--Area of timberland, by stand-size class and forest type, North Carolina, 1984

Forest classification	Acres
Stand-size class:	
Sawtimber	8,978,576
Poletimber	5,286,888
Saplings-seedlings	3,856,610
Nonstocked areas	328,195
All stand sizes	18,450,269
Forest type:	
Oak-hickory	6,600,835
Loblolly pine	3,409,207
Oak-gum-cypress	2,302,762
Oak-pine	2,276,670
Virginia pine	780,017
Pond pine	742,850
Shortleaf pine	502,901
Elm-ash-cottonwood	401,107
Longleaf pine	389,013
Chestnut oak	259,241
White pine-hemlock	204,710
Slash pine	195,365
Maple-beech-birch	157,637
Southern scrub oak	107,141
Pitch pine	61,155
Eastern redcedar	30,430
Spruce-fir	18,457
Table Mountain pine	10,771
All types	18,450,269

Table 2.--Percentage of susceptible trees damaged, by species and tree size, North Carolina, 1984

Species	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		Percent		
		HARDWOODS		
Other eastern hardwoods	3,418,331	25	25	35
Soft maple	2,170,082	56	24	38
Sweetgum	1,409,227	37	20	22
Tupelo & blackgum	937,987	61	25	35
Other red oaks	810,517	33	19	25
Yellow-poplar	517,375	26	18	17
Bay & magnolia	446,710	59	25	62
Select white oaks	420,559	34	15	18
Hickory	353,915	62	34	34
Ash	307,210	60	24	31
Black cherry	144,664	65	45	27
Elm	134,886	47	21	35
Other white oaks	126,075	45	24	30
Select red oaks	123,660	31	17	23
Beech	100,560	47	17	31
Hard maple	63,177	54	30	34
Basswood	22,383	54	16	16
Sycamore	13,066	31	30	33
Cottonwood	9,601	23	0	20
Black walnut	8,565	24	38	44
		SOFTWOODS		
Loblolly pine	1,391,126	23	17	15
Virginia pine	450,505	27	23	19
Pond pine	282,576	45	22	19
Shortleaf pine	271,272	25	14	11
Other eastern softwoods	223,575	21	14	11
Cedars	204,283	28	26	19
Longleaf pine	84,952	18	20	19
Slash pine	73,740	22	24	35
Pitch pine	34,058	34	19	15
Baldcypress	22,753	40	14	13
Pondcypress	12,221	9	7	14
Table Mountain pine	5,829	15	0	4

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			M ft^3		
SOFT MAPLE (2,170,082,000 susceptible trees)						
Hardwood cankers	2	1	<1	46	67	383
Other diseases	0	1	3	214	1,629	8,226
Branch stubs	0	1	4	1,191	5,418	17,499
Basal defects	0	3	12	3,950	26,133	62,035
Dieback	0	1	1	433	602	1,472
Suppression & stagnation	5	2	<1	139	23	455
Form	36	3	5	80	113	3,394
Fire	0	0	1	0	330	0
Lightning	0	0	<1	0	64	80
Weather	2	6	7	2,144	3,646	14,109
Beaver	0	0	<1	0	46	230
Other animals	0	0	<1	0	113	252
Sapsucker	0	0	1	0	170	2,100
Hardwood borers	7	2	1	26	0	0
People	0	<1	<1	62	120	586
Logging	3	4	3	1,370	327	5,539
SWEETGUM (1,409,227,000 susceptible trees)						
Hardwood cankers	0	0	<1	0	75	0
Other diseases	0	<1	1	64	533	1,185
Branch stubs	0	<1	1	195	731	1,210
Basal defects	0	2	6	1,653	12,060	21,886
Dieback	1	1	2	145	679	846
Suppression & stagnation	9	3	0	0	0	0
Form	18	2	2	0	0	364
Fire	1	1	<1	34	97	0
Lightning	0	0	<1	0	156	0
Weather	3	4	4	384	554	1,093
Sapsucker	0	0	1	0	42	0
People	0	<1	1	92	231	0
Logging	3	6	3	607	338	620

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
TUPELO & BLACKGUM (937,987,000 susceptible trees)						
Hardwood cankers	1	1	1	140	555	612
Other diseases	0	1	3	136	1,153	2,532
Branch stubs	0	1	3	483	7,567	12,832
Basal defects	0	5	14	4,602	49,814	94,835
Dieback	1	3	2	587	3,967	9,306
Suppression & stagnation	9	2	0	6	0	0
Form	42	4	3	0	23	1,390
Fire	1	<1	<1	47	207	503
Lightning	0	0	<1	0	96	320
Weather	3	4	3	843	4,072	6,832
Beaver	0	0	<1	0	18	0
Other animals	0	0	<1	0	40	0
Sapsucker	0	0	1	0	0	0
Hardwood borers	1	0	0	0	0	0
Other insects	0	<1	0	57	0	0
People	0	<1	<1	75	128	914
Logging	2	3	2	494	593	2,784
OTHER RED OAKS (810,517,000 susceptible trees)						
Hardwood cankers	1	1	2	37	374	672
Other diseases	0	2	3	135	1,676	5,186
Branch stubs	0	1	1	348	3,248	3,885
Basal defects	0	1	5	1,618	15,848	28,366
Dieback	0	2	2	110	1,176	1,187
Suppression & stagnation	5	2	<1	0	26	274
Form	21	2	2	0	0	0
Fire	1	1	<1	0	143	0
Lightning	0	0	<1	0	568	2,791
Weather	1	3	4	368	1,993	4,012
Hardwood borers	1	2	1	0	0	815
People	0	<1	1	69	495	1,058
Logging	2	4	3	821	283	1,933

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M ft^3$		
YELLOW-POPLAR (517,375,000 susceptible trees)						
Hardwood cankers	0	0	<1	0	328	1,075
Other diseases	0	0	1	0	315	342
Branch stubs	0	<1	<1	52	1,532	2,852
Basal defects	1	1	2	524	8,462	11,564
Dieback	0	0	<1	0	122	0
Suppression & stagnation	7	4	0	40	0	408
Form	10	2	2	16	51	0
Lightning	0	0	<1	0	319	1,140
Weather	3	6	5	598	1,451	539
Other animals	1	0	0	0	0	0
Sapsucker	0	0	2	0	0	0
Hardwood borers	1	1	1	0	36	0
People	0	0	<1	0	325	0
Logging	3	3	1	568	447	701
BAY & MAGNOLIA (446,710,000 susceptible trees)						
Hardwood cankers	1	1	0	0	0	0
Other diseases	0	0	1	0	0	0
Branch stubs	0	1	8	76	396	1,253
Basal defects	0	5	33	687	2,004	6,989
Dieback	0	1	3	47	79	379
Suppression & stagnation	5	0	0	0	0	0
Form	47	5	6	0	0	0
Fire	0	2	0	0	0	0
Lightning	0	<1	0	35	0	0
Weather	2	5	4	181	47	0
Sapsucker	0	2	6	0	0	0
Hardwood borers	1	1	0	0	0	0
Logging	1	2	0	11	0	0

Continued

Table 3.---Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
SELECT WHITE OAKS (420,559,000 susceptible trees)						
Hardwood cankers	0	0	<1	0	112	0
Other diseases	1	2	2	0	148	585
Branch stubs	0	0	1	0	2,528	2,736
Basal defects	0	1	4	538	11,935	22,430
Dieback	2	2	1	121	112	674
Suppression & stagnation	8	2	0	0	0	0
Form	16	1	2	50	0	488
Weather	2	2	2	110	978	1,195
Other animals	0	0	<1	0	280	701
Sapsucker	0	1	2	0	0	0
Hardwood borers	1	0	0	0	0	0
People	0	<1	1	26	657	0
Logging	4	4	2	57	142	0
HICKORY (353,915,000 susceptible trees)						
Hardwood cankers	0	<1	1	41	43	0
Other diseases	0	1	1	0	279	0
Branch stubs	0	<1	2	37	942	1,388
Basal defects	0	2	9	388	7,670	15,876
Dieback	1	0	<1	0	149	721
Suppression & stagnation	6	1	1	93	46	0
Form	20	2	2	0	0	0
Fire	1	1	1	23	0	0
Weather	2	3	3	53	274	290
Sapsucker	0	5	7	0	0	0
Hardwood borers	1	<1	1	25	63	0
Terminal shoot & stem borers	26	13	3	0	0	0
People	0	<1	1	24	158	0
Logging	3	4	2	42	32	668

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
ASH (307,210,000 susceptible trees)						
Hardwood cankers	0	0	1	0	0	0
Other diseases	0	<1	2	52	218	744
Branch stubs	0	2	3	379	668	3,264
Basal defects	0	3	10	793	4,975	8,166
Dieback	1	3	2	0	241	1,443
Suppression & stagnation	7	4	0	0	0	528
Form	46	5	4	31	0	0
Lightning	0	0	<1	0	28	0
Weather	3	2	5	439	925	1,394
Sapsucker	0	1	2	0	0	561
Logging	1	4	2	264	0	0
BLACK CHERRY (144,664,000 susceptible trees)						
Hardwood cankers	1	0	0	0	0	0
Other diseases	11	8	0	78	0	0
Branch stubs	0	1	3	21	53	0
Basal defects	0	3	0	160	0	0
Dieback	1	2	2	0	56	0
Suppression & stagnation	8	3	0	0	0	0
Form	40	10	8	0	0	0
Weather	2	6	10	47	405	1,439
Other insects	0	6	0	41	0	0
People	0	1	0	0	0	0
Logging	2	4	3	77	0	0

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M ft^3$		
ELM (134,886,000 susceptible trees)						
Hardwood cankers	0	0	1	0	0	0
Other diseases	0	2	2	0	245	1,451
Branch stubs	0	<1	3	21	415	460
Basal defects	0	<1	4	38	977	2,276
Dieback	0	2	6	0	273	767
Suppression & stagnation	7	2	0	18	0	0
Form	35	8	6	0	0	557
Flooding	0	0	1	0	0	0
Weather	2	3	2	111	134	0
Sapsucker	0	0	8	0	131	523
Logging	2	3	1	45	0	0
OTHER WHITE OAKS (126,075,000 susceptible trees)						
Hardwood cankers	1	1	2	0	0	569
Other diseases	1	3	2	36	24	574
Branch stubs	0	<1	2	85	638	1,730
Basal defects	0	2	7	161	2,490	5,722
Dieback	2	2	1	66	375	697
Suppression & stagnation	8	1	0	0	0	0
Form	25	2	2	0	93	618
Fire	2	2	1	17	0	0
Lightning	0	0	<1	0	88	0
Weather	2	4	4	88	259	141
Sapsucker	0	1	2	0	0	0
Hardwood borers	1	0	0	0	0	0
People	0	<1	2	24	284	314
Logging	4	5	4	150	134	1,033

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
SELECT RED OAKS (123,660,000 susceptible trees)						
Hardwood cankers	1	0	1	0	164	0
Other diseases	0	2	1	0	438	1,175
Branch stubs	0	<1	1	71	1,059	2,061
Basal defects	0	1	5	201	9,126	12,546
Dieback	1	2	2	31	717	2,444
Suppression & stagnation	5	1	0	0	0	0
Form	18	3	3	0	27	0
Fire	1	1	<1	0	150	0
Weather	2	4	7	0	297	548
Hardwood borers	3	3	2	0	0	0
People	0	0	<1	0	288	780
Logging	0	1	1	0	14	0
BEECH (100,560,000 susceptible trees)						
Hardwood cankers	1	1	0	0	0	0
Other diseases	0	1	1	0	0	0
Branch stubs	0	0	4	0	1,144	2,239
Basal defects	0	4	10	121	4,426	11,577
Dieback	6	2	2	0	245	1,273
Suppression & stagnation	6	1	0	0	0	0
Form	26	0	6	18	0	887
Fire	0	<1	0	17	0	0
Weather	2	3	5	424	246	1,669
Hardwood borers	1	0	0	0	0	0
People	0	1	1	0	25	492
Logging	4	3	2	246	0	0

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
HARD MAPLE (63,177,000 susceptible trees)						
Hardwood cankers	5	8	2	101	0	0
Other diseases	0	1	2	0	43	0
Branch stubs	0	0	1	0	62	607
Basal defects	1	4	9	60	1,323	2,554
Dieback	3	1	0	0	0	0
Suppression & stagnation	5	5	0	0	0	0
Form	24	2	4	0	0	0
Weather	4	9	10	94	102	0
Beaver	0	1	0	0	0	0
Sapsucker	0	0	3	0	0	0
Hardwood borers	10	0	3	0	0	0
Other insects	1	0	0	0	0	0
Logging	1	0	0	0	0	0
BASSWOOD (22,383,000 susceptible trees)						
Hardwood cankers	4	0	0	0	0	0
Basal defects	0	0	12	0	1,405	1,658
Suppression & stagnation	4	0	0	0	0	0
Form	38	2	1	0	0	0
Weather	5	12	2	29	0	0
Sapsucker	0	3	1	0	0	0
Logging	4	0	1	0	0	0

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M ft^3$		
SYCAMORE (13,066,000 susceptible trees)						
Branch stubs	0	0	1	0	162	0
Basal defects	0	4	11	65	1,071	3,074
Dieback	0	0	3	0	40	398
Suppression & stagnation	12	4	0	0	0	0
Form	11	9	6	0	0	0
Flooding	0	0	1	0	0	267
Weather	3	13	7	26	54	0
Beaver	0	0	1	0	0	0
Hardwood borers	2	0	1	0	0	0
Other insects	0	0	1	0	0	0
People	0	0	<1	0	25	0
Logging	4	0	1	0	0	0
COTTONWOOD (9,601,000 susceptible trees)						
Branch stubs	0	0	2	0	60	0
Basal defects	0	0	2	0	89	0
Suppression & stagnation	7	0	0	0	0	0
Form	16	0	0	0	0	0
Weather	0	0	12	0	0	0
Sapsucker	0	0	1	0	0	0
Hardwood borers	0	0	3	0	0	0

Continued

Table 3.--Damage incidence and associated cull in hardwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M\ ft^3$		
BLACK WALNUT (8,565,000 susceptible trees)						
Hardwood cankers	0	4	6	0	0	0
Branch stubs	0	0	2	0	168	285
Basal defects	0	0	9	0	652	1,268
Dieback	0	4	9	0	0	0
Suppression & stagnation	18	8	4	0	26	0
Form	6	3	0	0	0	0
Fire	0	7	0	0	0	0
Weather	0	8	5	0	36	0
Sapsucker	0	0	3	0	0	0
Hardwood borers	0	0	4	0	0	579
Logging	0	5	3	0	0	0
OTHER EASTERN HARDWOODS (3,418,331,000 susceptible trees)						
Hardwood cankers	1	1	2	307	861	2,639
Other diseases	1	2	4	1,385	2,967	11,020
Branch stubs	0	1	3	959	4,544	13,339
Basal defects	0	5	10	6,171	26,211	63,769
Dieback	1	3	2	500	871	4,547
Suppression & stagnation	4	1	0	73	0	269
Form	9	1	3	0	71	1,569
Fire	1	1	1	290	555	2,264
Flooding	0	0	<1	0	200	210
Lightning	0	0	<1	0	286	0
Weather	3	5	7	1,357	2,639	13,771
Sapsucker	0	1	1	0	0	1,313
Hardwood borers	1	1	0	14	0	0
People	0	<1	<1	50	128	809
Logging	3	4	1	1,103	415	3,173

Table 4.--Damage incidence and associated cull in softwoods in North Carolina, 1984

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
LOBLOLLY PINE (1,391,126,000 susceptible trees)						
Fusiform rust	9	10	7	79	770	3,882
Other diseases	0	<1	<1	37	412	0
Branch stubs	0	0	<1	0	118	0
Basal defects	0	<1	<1	16	549	0
Dieback	0	0	<1	0	35	0
Suppression & stagnation	7	2	0	0	0	0
Form	3	1	1	0	26	1,047
Fire	0	0	<1	0	29	0
Lightning	0	0	<1	0	161	0
Weather	2	2	1	99	252	774
Sapsucker	0	0	2	0	36	0
Bark beetles	0	0	1	0	31	596
Terminal shoot & stem borers	1	0	0	0	0	0
Other insects	0	0	0	0	0	385
People	0	<1	<1	12	504	0
Logging	1	1	2	0	114	0
VIRGINIA PINE (450,505,000 susceptible trees)						
Fusiform rust	2	2	2	0	0	0
Other diseases	6	7	7	24	0	0
Basal defects	0	0	<1	0	40	0
Suppression & stagnation	9	2	0	0	0	0
Form	5	2	1	0	0	0
Weather	2	3	2	29	0	0
Sapsucker	0	0	1	0	0	0
Bark beetles	1	4	3	0	0	351
Other insects	0	1	0	0	0	0
People	0	<1	<1	14	32	0
Logging	2	1	1	0	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M ft^3$		
POND PINE (282,576,000 susceptible trees)						
Fusiform rust	8	11	9	112	0	511
Other diseases	1	1	1	0	247	586
Basal defects	0	0	1	0	680	516
Dieback	1	<1	<1	6	45	0
Suppression & stagnation	6	1	0	0	0	0
Form	22	2	1	0	0	0
Fire	2	2	2	12	36	1,517
Weather	2	2	1	0	212	333
Bark beetles	1	0	0	0	0	0
Logging	1	2	2	77	84	0
SHORTLEAF PINE (271,272,000 susceptible trees)						
Fusiform rust	1	1	1	0	0	0
Littleleaf	1	1	1	0	0	0
Other diseases	1	1	1	4	81	0
Basal defects	0	0	<1	0	71	0
Dieback	0	1	0	0	0	0
Suppression & stagnation	12	4	0	0	0	0
Form	6	1	1	0	0	0
Weather	2	4	2	18	125	0
Sapsucker	0	0	1	0	0	0
Bark beetles	0	0	1	0	0	0
People	0	0	1	0	167	482
Logging	1	2	1	0	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M\ ft^3$		
OTHER EASTERN SOFTWOODS (223,575,000 susceptible trees)						
Other diseases	1	1	0	0	0	0
Branch stubs	0	<1	<1	24	335	1,393
Basal defects	0	0	1	0	3,562	3,936
Dieback	0	0	<1	0	59	0
Suppression & stagnation	9	5	1	0	0	0
Form	5	1	0	0	0	0
Fire	0	0	1	0	650	1,296
Lightning	0	0	0	0	169	0
Weather	3	2	3	73	79	1,020
Sapsucker	0	1	2	0	0	0
Terminal shoot & stem borers	1	0	0	0	0	0
Other insects	0	1	1	0	44	0
People	0	1	0	0	0	0
Logging	2	2	1	41	42	0
CEDARS (204,283,000 susceptible trees)						
Other diseases	2	1	2	0	0	404
Basal defects	0	4	6	599	464	884
Dieback	0	0	2	0	208	2,544
Suppression & stagnation	7	2	0	0	0	0
Form	7	1	0	0	0	0
Fire	1	2	0	0	0	0
Weather	6	9	7	61	50	393
Other animals	1	0	0	0	0	0
Sapsucker	0	1	0	0	0	0
People	0	<1	2	20	0	0
Logging	3	5	1	0	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M ft^3$		
LONGLEAF PINE (84,952,000 susceptible trees)						
Fusiform rust	0	5	2	0	0	0
Other diseases	0	0	1	0	86	0
Basal defects	0	0	<1	0	169	402
Suppression & stagnation	5	1	0	0	0	0
Form	3	0	0	0	0	0
Fire	3	3	2	0	89	423
Weather	4	3	1	51	0	0
Sapsucker	0	2	5	0	0	0
Bark beetles	0	1	1	43	0	0
Other insects	1	2	1	0	0	0
People	0	0	1	0	0	0
Logging	2	3	3	0	0	0
Turpentining	0	0	1	0	0	0
SLASH PINE (73,740,000 susceptible trees)						
Fusiform rust	18	21	26	46	0	0
Suppression & stagnation	2	0	0	0	0	0
Weather	1	1	0	0	0	0
Sapsucker	0	0	4	0	0	0
Other insects	1	0	0	0	0	0
People	0	0	1	0	42	0
Logging	0	1	4	0	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M\ ft^3$		
PITCH PINE (34,058,000 susceptible trees)						
Other diseases	4	7	5	0	172	0
Basal defects	0	1	0	13	0	0
Suppression & stagnation	14	2	0	0	0	0
Form	12	1	3	0	0	0
Fire	2	3	1	14	27	0
Weather	3	6	3	0	57	0
Sapsucker	0	0	1	0	0	0
People	0	0	1	0	42	0
Logging	0	0	1	0	0	0
BALDCYPRESS (22,753,000 susceptible trees)						
Other diseases	0	0	1	0	523	529
Branch stubs	0	0	1	0	813	1,107
Basal defects	0	3	5	104	5,289	10,051
Dieback	2	0	0	0	0	0
Suppression & stagnation	25	7	0	0	0	0
Form	9	2	1	0	0	0
Lightning	0	0	1	0	70	0
Weather	0	2	2	61	198	229
Sapsucker	0	1	0	0	0	0
Hardwood borers	0	0	1	0	0	0
Logging	4	0	1	0	0	0
PONDCYPRESS (12,221,000 susceptible trees)						
Branch stubs	0	0	<1	0	30	0
Basal defects	0	3	11	32	2,951	5,879
Dieback	0	0	<1	0	84	0
Suppression & stagnation	0	4	0	0	0	0
Form	5	0	0	0	0	0
Fire	0	0	2	0	0	0
Logging	3	0	0	0	0	0

Continued

Table 4.--Damage incidence and associated cull in softwoods in North Carolina, 1984 --Continued

Damaging agent	Incidence of damage			Volume loss due to cull		Quality loss
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	
	Percent			$M\ ft^3$		
TABLE MOUNTAIN PINE (5,829,000 susceptible trees)						
Other diseases	0	0	2	0	172	688
Suppression & stagnation	8	0	0	0	0	0
Weather	0	0	2	0	0	0
Bark beetles	7	0	0	0	0	0

Table 5.--Annual volume of timber removals and wood loss due to mortality, cull, and quality loss, North Carolina, 1983

Species	Timber removals		Mortality		Cull		
	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality Loss
	M ft^3						
HARDWOODS							
Yellow-poplar	11,170	49,400	2,841	2,963	180	1,339	1,862
Other red oaks	19,865	43,514	9,528	17,050	351	2,583	5,108
Select white oaks	9,449	27,545	2,437	2,790	90	1,689	2,881
Sweetgum	19,278	25,657	2,931	4,392	317	1,550	2,720
Tupelo & blackgum	6,827	20,183	2,137	5,128	747	6,823	13,286
Soft maple	16,613	18,203	6,188	7,309	966	3,880	11,636
Other eastern hardwoods	13,376	15,510	14,932	13,004	1,222	3,975	11,869
Select red oaks	3,021	10,957	1,654	3,019	30	1,228	1,955
Hickory	4,258	9,986	1,924	4,213	73	966	1,894
Ash	1,166	5,444	937	1,914	196	706	1,610
Beech	798	4,125	85	1,284	83	609	1,814
Other white oaks	3,101	3,585	712	2,597	63	439	1,140
Elm	2,123	2,716	1,225	1,979	23	218	603
Sycamore	547	1,955	0	327	9	135	374
Black cherry	1,073	684	1,042	366	42	51	144
Black walnut	258	529	0	0	0	88	213
Bay & magnolia	1,856	469	1,621	622	104	253	862
Cottonwood	99	258	536	164	0	15	0
Hard maple	62	181	317	755	26	153	316
Basswood	313	0	178	524	3	141	166
Total	115,253	240,901	51,225	70,400	4,525	26,841	60,363
SOFTWOODS							
Loblolly pine	41,608	197,775	23,692	23,663	24	304	668
Shortleaf pine	18,446	45,153	15,915	10,451	2	44	48
Pond pine	13,241	32,678	5,173	5,781	21	130	346
Virginia pine	10,183	21,673	14,145	5,916	7	7	35
Other eastern softwoods	142	18,903	1,859	3,043	(a)	(a)	(a)
Longleaf pine	4,267	17,321	75	414	9	34	83
Cedars	1,414	4,009	1,357	770	68	72	423
Baldcypress	0	2,534	184	888	17	689	1,192
Pitch pine	133	2,129	2,769	1,711	3	30	0
Slash pine	927	920	471	0	5	4	0
Pondcypress	0	145	115	53	3	307	588
Table Mountain pine	0	0	98	382	0	17	69
Total	90,361	343,240	65,853	53,072	159	1,641	3,452

a/ This information was not calculated for the other eastern softwoods group.

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In North Carolina, annual mortality for all live hardwood timber was about 122 million cubic feet; for softwood timber, 119 million cubic feet. Losses, by major timber species and damaging agent, are shown in tables.

KEYWORDS: Forest insects, forest diseases, damage assessment.

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