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Analysis of 15 years of University of Tennessee continuous forest inventory data

Edison Eric Watson

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I am submitting herewith a thesis written by Edison Eric Watson entitled "Analysis of 15 years of University of Tennessee continuous forest inventory data." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Forestry.

Jhn C. Rennie, Major Professor

We have read this thesis and recommend its acceptance:

Garland R. Wells, Edward R. Buckner

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

ANALYSIS OF 15 YEARS OF UNIVERSITY OF TENNESSEE CONTINUOUS FOREST INVENTORY DATA

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ABSTRACT

In 1962 and 1963, permanent inventory plots were established on six University of Tennessee forest tracts to implement a continuous forest inventory (CFI) system. A wide diversity of forest types and physiographic regions within the state was represented by these forests. The permanent plots were measured on five year intervals to meet the following long-term objectives: (1) to relate soil and other site factors, such as aspect, topography, position, and slope to species composition and growth rate; (2) establish a modern timber inventory system for all forest tracts. During 1977 and 1978, these permanent sample plots were measured for the fourth time. The objectives of the present study were as follows: (1) identify errors and inconsistencies in measurements and (2) calculate volume and growth estimates for each forest tract. Sawtimber and pulpwood volumes and various types of growth were calculated with computer programs previously developed. Initial volume, final volume, ingrowth, mortality, loss to cull, outgrowth to sawtimber, gross growth of initial volume, gross growth, net growth of initial volume, net growth and net increase were estimated.

Net growth of sawtimber (331.79 bd.ft./acre/year) in pine plantations at Ames Plantation during the 1973 to 1978 growth period was greater than any other inventory unit.

The Scott County tract and the natural stands at Ames Plantation also had rather high net growth of sawtimber. Growth on the Highland Rim was less than on any other inventory unit; furthermore, it was the only tract in which net growth of sawtimber decreased over the 15-year inventory period. Net growth of pulpwood fluctuated between growth periods for each inventory unit; however, Ames Plantation pine stands recorded the largest pulpwood net growth (64.83 cu.ft./acre/year) during the 1968 to 1973 growth period. Due to the large amount of outgrowth to sawtimber, net growth of pulpwood in Scott County and on Wilson Mountain was negative for the last growth period.

Growth information gained from this study provides a strong data base for making forest management decisions. Even though the University of Tennessee's forests have not been managed intensively, this information provides input for answering such questions as the desirable level, structure, composition of growing stock, and the number and intensity of cuttings. Timber growth, cutting, and the development of the forest is a continuous process. Continuous forest inventory, while providing these growth data, also performs a function of even greater importance--it provides a means of systematically controlling the forest and shows at all times the progress of management.

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CHAPTER I

INTRODUCTION

Forest management for the production of timber and other forest products depends primarily on the quantity and quality of the growing stock available now and in the future. Growth determination is essential for management planning and sustained forest production by volume control. An inadequate knowledge of growth can result in serious overcutting, or in contrast, undercutting of the forest. Management and production costs today are such that few can afford to guess at forest yields and stay in business. Only from the managed forest where growth rates are known can the forest owner expect to obtain maximum returns (Davis, 1964).

In 1962, a research project was initiated in the University of Tennessee Agricultural Experiment Station to study factors influencing forest composition and growth rates. In all, over 500 sample plots were established on four University of Tennessee forest tracts covering 15,000 acres of forest land. A wide diversity in forest types and physiographic regions within the state is represented by these forests. The objectives of this long-term study were: (1) relate soil and other site factors, such as aspect, topography, position, and slope, to species

composition and growth rate and (2) establish a modern timber inventory system for all forest tracts. Continuous forest inventory (CFI) was used to acquire the information to meet these objectives.

Establishment of permanent sample plots began in 1962 and 1963. During the summer of 1977 and 1978, these plots were measured for the fourth time. Sawtimber and pulpwood volume computer programs were developed by MacDonald (1964). The growth program was developed by Martin (1970). This study provides an overall analysis of growth and volume on University of Tennessee forest tracts.

The objectives of this study were: (1) identify errors and inconsistencies in measurements and (2) calculate volume estimates and growth estimates for each forest tract.

CHAPTER II

LITERATURE REVIEW

History

The Continuous Forest Inventory or "CFI" system of forest inventory is a method that has been used throughout the world (Diller, 1960). It is the offspring of the European "methode du controle" system and was worked out in France by S. Gurnaud. He presented this method in the form of a management plan at the International Exhibition of Paris in 1878 (Meyer, 1942; Spurr, 1952). The work of Gurnaud inspired a Swiss forester, Henri Biolly, to a life's work of intensively applying the system to the community forests of the Val de Travers in Neuchatel Canton of Switzerland (Meyer, 1942; Diller, 1960). The forests of Val de Travers have been managed according to this system since 1890. Between 1890 and 1946 they were measured eight times at intervals of six years and twice at intervals of seven years (Meyer, 1942; Spurr, 1952). The "methode du controle" system was still the principal method of measuring volume and growth in Switzerland in 1952 (Spurr, 1952).

The "controle methode" was brought to notice in American forestry by Kirkland in 1934. The differences in the American system and the European are: (1) In Europe, it is customary to make a 100 percent cruise; whereas, in

in this country, systematic sampling is the normal approach. (2) The controle methode was refined with modern computing machines becoming a necessary part of the CFI system. Since 1946, C. B. Stott of the U. S. Forest Service (now retired) has been a leading exponent of the continuous forest inventory system as applied to natural selection silviculture (Barton, 1960; Diller, 1960).

Over the past four decades, an organized plan for permanent plot inventory has gradually evolved in the United States. In 1934, the U. S. Forest Service set up a section for cooperative forest management in the Division of State and Private Forestry in the North Central Region. Calvin Stott was in charge of field work and management planning. Field work was begun in the Winter of 1934; however, permanent inventory plots were not established until 1937. A block of five circular plots was established in selectively cut lands of the Goodman Lumber Company in that year. The Goodman plan was prepared by W. S. Broomley (Stott, 1968; Husch, Miller, and Beers, 1972). A similar inventory of several thousand acres of Ford Motor Company land was also completed in 1937 (Stott, 1965; Avery, 1967).

World War II and a change of work emphasis delayed the re-measurement of these plots for twenty years; then in 1957, 138 of the plots established in 1937 were located and re-measured by Phillip Thorton. The re-measurement was inspired by Eric Bourdo, Director of Michigan Technological University, Ford Forestry Center at L'Anse (Stott, 1965).

Field Methods

Accurate determination of the growth of a forest depends upon the selection of a representative sample and accurate data collection in the successive inventories. Measuring the forest represents an initial as well as a final step in the method. Therefore, the operation should be carried out with the greatest of care (Meyer, 1942).

Advanced planning should be thorough; this step should include such things as preparation for efficient computation or data processing, and construction of skeleton tables needed for the final report. The attention given to this step will determine the difficulties encountered in the steps that follow (Hall, 1965).

The reliability of systematic sampling has been questioned by many statisticians; however, for the actual field measurements a systematic sample has been found most efficient and economical in the United States (Hasel, 1959; Cunia, 1968). Systematic sample sizes are normally based on random sampling formulas without corrections for finite populations. Grosenbaugh (1952) states that the number of sample plots to be taken from an infinite population is:

$$n = \left(\frac{\text{coefficient of variation in percent}}{\text{specified limit of error in percent}}\right)^2$$

The desired number of sample plots can be mechanically distributed by using a transparent dot grid (Husch, 1963).

Permanent plots are then established in the field. Their position is referenced by a direction and distance from a permanent landmark. Fixed-radius plots are usually used but Beers and Miller (1964) described the use of horizontal point sampling in CFI. All trees in the plot are numbered, and the position for diameter measurement marked on the tree with paint, a nail or scribe (Husch, 1963). At re-measurements, trees can be relocated by properly orienting the plot map and sighting with an alidade. Each tree is measured for diameter, height, crown class, vigor, grade, and operability. The plot is also described as to site, topography, forest cover type, density, stand size, and stand condition (Avery, 1967).

In most CFI systems, the height of the trees is measured. This is a very difficult measurement and great care must be taken to obtain accurate data. Total height is recommended because in measuring merchantable height, the element of personal judgment exists, and this factor would probably change with every re-measurement (Meyer, 1942; Cunia, 1968).

Growth Estimation

Forest growth is the heart of sustained yield management. The more common components of forest growth are as follows: survivor growth, mortality, cut, and ingrowth (Gilbert, 1954; Beers, 1962). The structure of a stand

changes from year to year because of growth, death, and cutting of trees. Stand growth is much more complex than individual tree growth. It cannot be considered merely a summation of individual tree growth because of the stand structural changes over a growth period (Spurr, 1952; Evert, 1964).

Any forest inventory made for practical purposes can only contain trees above a certain minimum diameter. A second inventory, in which trees are measured down to the same diameter limit, will contain not only the trees which had already been measured, but also the trees whose dbh have grown past the fixed diameter limit (Meyer, 1942). Ingrowth is defined as the volume of those trees that grew into merchantable classes during the growth period (Gilbert, 1954).

Mortality is the number or volume of trees that died during the growth period due to natural causes, such as old age, competition, insects, disease, wind, and ice. Cut and yield is the number or volume of trees harvested during the growth period (Husch, 1963).

Kozlowski (1962) defined accretion as volume added to trees measured in two successive inventories. Avery (1967), Spurr (1952), and Husch, Miller, and Beers (1972) emphasized that the trees had to be present in the initial inventory to be included in accretion. Marquis and Beers (1969) distinguished two types of gross growth of initial

volume. They used the term accretion for the growth of all trees present at the initial inventory. This definition included growth on trees that were cut or died during the growth period. They used a second term, survivor growth, for the growth of trees living at the time of both inventories.

Gross growth is a measure of the change in total volume for a given stand. In any given diameter class, gross growth is the change in volume, plus mortality during the growth period (Beers, 1962). Net growth of initial volume represents the stand volume increment excluding mortality or deterioration (Pallin, 1965). When ingrowth is added to net growth of initial volume, the result is net growth. When cut is deducted from net growth, the result is net change (Beers, 1962).

The definitions of growth estimates are presented below as formulas (Beers, 1962).

Growth Components

V_2 = stand volume at the end of growth period

V_1 = stand volume at the beginning of growth period

M = mortality

C = cut

I = ingrowth

Types of Growth	Formula
1. Gross Growth of Initial Volume (G_s)	$V_2 + M + C - V_1 - I$

(Types of Growth)	(Formula)
2. Gross Growth	$G_s + I$
3. Net Growth of Initial Volume	$G_s - M$
4. Net Growth	$G_s - M + I$
5. Net Increase	$G_s + I - M - C$

The definitions of growth apply to any measure used to quantify stands, such as height, basal area, volume, or weight.

The actual growth components of a forest stand can be determined in two ways: (1) by measuring the present size of the trees to get V_2 and I; and measuring the width of the annual rings in increment cores to get the past size of the trees for V_1; cut and mortality cannot be estimated without other data; and (2) by measuring and re-measuring the stand at an interval of several years.

The second method of growth determination is used in CFI. The development of forest stands is best studied on permanent sample plots, which are re-measured at regular intervals (Hall, 1959). Each measurement provides information on the volume of the stand, stand structure changes, and stand development.

CHAPTER III

STUDY AREA

The continuous forest inventory (CFI) system is administered on three University Forestry Field Stations, each representing different physiographic regions of Tennessee (Figure 1). Ames Plantation, located in the western part of the state, is characteristic of the coastal plain region. The Highland Rim Forestry Field Station is located in middle Tennessee on the eastern Highland Rim. The Cumberland Forestry Field Station lies at the southern end of the Cumberland Mountain portion of the Appalachian Plateau Province (Fennenan, 1938).

The CFI system was established for the purpose of research and management of the University's forest resource. Table 1 gives information on establishment, number of plots, and area for each of the stations and forests. Table 2 summarizes some of the environmental characteristics of each area. The environmental and site conditions of the three areas are described below.

Cumberland Forestry Field Station

The Cumberland Forestry Field Station was deeded to the University of Tennessee in 1937 by the Bryn Mawr Mining and Land Company (McDonald, 1964). This area contains fairly large deposits of coal which have been mined

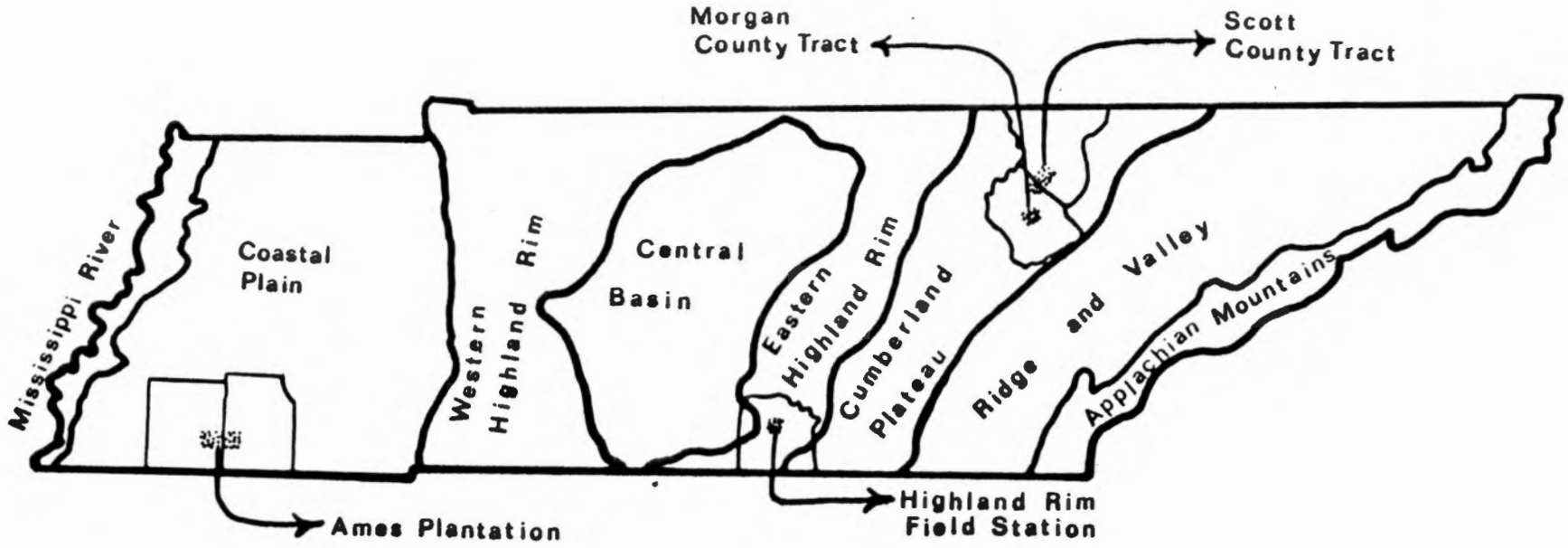

Figure 1. Inventory locations in Tennessee.

Table 1. Summary of continuous forest inventory system.

Forest Tract	Year Established	No. of Plots	Forest Area (Acres)	Total Area (Acres)
Morgan County:				
Brushy Mt.	1963	169	2,663	2,663
Wilson Mt.	1962	69	1,202	1,202
Scott County	1962	99*	4,289	4,289
Highland Rim	1962	25	83	860
Ames Plantation:				
Natural	1963	144	6,777	
Pine Plantations	1968	26	2,764	
TOTAL		532	17,778	27,614

*One plot with one tree was missed in 1962.

Table 2. Major soil series, forest types, and general climatological information on the three study areas (Boyd, 1970).

Study Area	Major Soil Series	Major Forest Type	Annual Rainfall (in)	Avg. Annual Temperature (°F)
Ames Plantation	Memphis Loring Grenada Calloway Henry Lexington Ruston Rustis Vicksburg Collins Falaga Waverly	Oak-Hickory and Oak-Pine	52	62
Highland Rim	Dickson Lawrence Guthrie Mountview Baxter Greendale Ennis Lobelville	Oak-Hickory	54	59
Cumberland Forestry Field Station (Morgan and Scott Counties)	Wellston Hartsells Johnsburg Muskingum Jefferson Nonongahela Tyler Pope Philo	Oak-Hickory and Oak-Pine	54	56

extensively both by drift and strip mines, since 1950. Large areas of open strips pits and spoil banks have resulted from strip mining.

The Cumberland Forestry Field Station is composed of two forest tracts. The Morgan County tract has two forests: Brushy Mountain and Wilson Mountain. The Scott County tract lies astride the Scott and Morgan County line about 15 miles north of the Morgan County tract. Each tract is approximately 4,000 acres.

These two tracts lie within one of the three mixed mesophytic regions in eastern North America (Braun, 1950). The forest is predominantly hardwood with pine and hemlock occurring on some sites. The complexity of the forest is a result of the diverse topography and microenvironment (Shanks and Norris, 1950). Extensive cove and north-slope, mixed-mesophytic forests dominate the area. Oak forests are prevalent on the upper north and south slopes with pine and oak-pine stands occupying shallow sites chiefly with south and southwest aspect (DeSelm, Martin, and Thor, 1978).

Both Scott and Morgan County tracts lie in rough mountainous terrain; elevational changes are often quite abrupt. Differences in elevation of over 700 feet occurring in little over one-quarter of a mile are common. The minimum elevation is 1,400 feet; the maximum is 2,850 feet.

Cool winters and mild summers characterize the climate of Scott and Morgan counties. The mean temperature is approximately 56° F, with monthly temperatures ranging from 32° F in January to 74° F in July. There is little or no water deficiency in any season (DeSelm, Martin, and Thor, 1978). Average rainfall is 54 inches ranging from about 3 inches occurring in October to about 6 inches in January. Average annual snowfall is 10 inches (Dickson, 1960).

Nine Soil Series were mapped by the Soil Conservation Service (Cox, 1963). Great Soil Groups represented were: Red-Yellow Podzolic (Hartsells, Monongahela, Jefferson, and Wellston soil series), Lithosola (Muskingum soil series), Planosols (Tyler and Johnsburg soil series), and Alluvial soils (Pope and Philo soil series). The soils are grouped in relation to major land features such as: uplands, colluvial lands, stream terraces, and bottomlands. Soils of the forested areas are generally deep, acid, and medium textured. Muskinghum silt loam underlies approximately 85 percent of the forested area. Approximately 2 percent of the land has been severely disturbed through strip mining for coal. The soil in the immediate area of coal removal has been altered and in many cases totally destroyed.

Highland Rim Forestry Field Station

The Highland Rim Forestry Field Station is located in Franklin County, 4 miles southeast of Tullahoma, Tennessee. In 1960, 860 acres were transferred to The University of Tennessee, Knoxville from the U. S. Department of Health, Education, and Welfare. Presently, it is an active research unit of The University of Tennessee Agricultural Experiment Station. This station is on the northern section of the eastern Highland Rim in an area known as the barrens. Continuous forest inventory data have been collected on approximately 100 acres of this station.

Forests on the barrens are generally poorly stocked and characterized by the "scrub oak" group, which is characterized by blackjack oak, scarlet oak, post oak, and southern red oak. At present, a large proportion of the forested areas contain trees of low quality, with little or no market value. Many of the oaks have slow growth rates and trees in excess of 14 inches dbh may be 80 years old.

The Highland Rim is characterized by rolling hills and wide valleys, but the barrens are a flat plain with numerous ravines (Fox, et al., 1958). The Highland Rim has an average elevation 970 feet above sea level. At the field station the elevation is approximately 1,050 feet.

Franklin County is characterized by a stable, warm, and humid climate. Summers are hot with the July mean

temperature being 77° F. Summer precipitation averages 12.45 inches. Autumns are cooler and drier. Temperatures average about 50° F and precipitation varies from 3.85 to 2.56 inches. Winter mean monthly temperatures are about 42° F. Precipitation increases from the small amount in autumn to about 6.2 inches in January (Dickson, 1960).

The soils at the Highland Rim Forestry Field Station have developed from residual materials weathered from the underlying cherty limestone or loess. Dickson silt loam occurs over a major portion of this area. Lawrence and Guthrie soils are found in close association with the Dickson soils. All of these soils are strongly to very strongly acid, as well as being low in organic matter and nutrients (Fox, et al., 1958). The upper part of the soil profile is permeable to air, roots and water. However, a siltpan occurs between 18 and 30 inches below the soil surface that is only slightly permeable (Elder and Springer, 1978).

Ames Plantation

Ames Plantation is located in Fayette and Hardeman Counties, about 45 miles east of Memphis and 45 miles south of Jackson. This area consists of 18,600 acres of land. The Plantation is administered for The University of Tennessee as an Agricultural Field Station through a trust from Mrs. Hobart Ames in 1950 for the purpose of education and research.

The native vegetation at Ames Plantation is predominantly hardwoods with a few natural pine stands. The total area forested is 9,541 acres. Table 3 shows the delineation of the Ames forest tract by forest type and acreage. Two hundred and eighty-six acres of cedar-hardwoods and pine-hardwoods were included with upland hardwood forest type (Boyd, 1970). Several loblolly and shortleaf pine plantations have been established for the purpose of controlling erosion (Eubanks and Dimmick, 1974). Plantation pines are separated in the analysis from the natural stands. Eubanks (1972), Yoho (1970), and Hebb (1960) give detailed descriptions of vegetation at Ames Plantation.

The climate at Ames Plantation is characterized by hot, humid summers and cool winters. Annual average rainfall is 52 inches per year with the majority occurring in the spring. Winters have an average temperature of 40° F with approximately 60 days of the year with temperatures below 32° F. The average daily temperature is 65° F with a maximum of 90° F lasting approximately 70 days. Summer droughts with high temperatures are not uncommon (Flowers, et al., 1964).

Soils are derived from loess materials which have covered the coastal plain sediments. In some areas, this wind-blown silt has eroded, exposing the coastal plain material. The following soil series are common to upland

Table 3. Ames Plantation forest type delineation and acreage.

Forest Type	Area in Acres	Percent of Total
Bottomland Hardwoods	2,577	20
Upland Hardwoods	4,200	51
Pine Plantation	2,764	29

hardwood sites: Memphis, Loring, Grenada, Calloway, and Henry. Ruston and Eustis are soils of inferior quality and seldom support hardwoods. The following soil series are bottomland soils: Vicksburg, Collins, Falaga, and Waverly.

CHAPTER IV

METHODS

I. DATA COLLECTION

Collection of data on Highland Rim, Scott County, and Wilson Mountain tracts began in 1962. In 1963, Ames Plantation and Brushy Mountain plots were established. Four inventories have been completed for each area. The Highland Rim inventory was missed in 1967 but was re-measured the following year. The rest of the inventories were made at five-year intervals following the original schedule. Inventories were conducted during the summer to aid species identification. It was recognized that measurements made during this period will result in some error in the growth analysis.

Systematic samples were taken at each of the forest tracts. Sample sizes were determined to give a standard error of 10 percent of the mean or less.

Data were collected utilizing a common plot center for each of the plot sizes--1/5 acre for sawtimber, 1/10 acre for pulpwood, 1/100 acre for ground cover. Individual tree data were recorded on tree tally sheets. Information from the previous inventory recorded in the margin of the tree tally sheet was found most helpful in identifying recording errors while actually in the field. Information

that did not change, such as forest, compartment, plot number, and tree number was recorded on tree tally sheets before the field work was started.

Plot Relocation

Considerable effort was expended to insure ease of plot location at re-inventory. The location procedure began with the plot location cards. These cards gave a distance (chains) and compass bearing from a readily recognizable starting point to the plot center. The location of these starting points was recorded on aerial photographs and topographic maps. The starting point number was also marked or painted on a large tree, or fence post, along a road or field.

Two witness trees were selected and tagged on each plot. Witness trees were picked from the larger trees and as close to the plot center as possible. A compass bearing and distance (feet) was recorded from the plot center to each witness tree. The witness trees were established so that the plot center could be re-established if the plot center stake were lost.

Several types of information were recorded in the field for each tree: dbh, species code, merchantable height, cull deduction percentage, grade, disease incidence, vigor, and mortality or cut codes.

II. VOLUME ANALYSIS

All computer programs have been either revised or written in Fortran IV by the staff of The University of Tennessee Computing Center for the use on the IBM 360/65 system. Figures 2 and 3 are flow charts that show the order of procedures described below.

Upon completion of an inventory, the tree tally sheets and plot sheets were used to generate and verify cards. These cards were used primarily as an input medium for the data checker program described below. After checking, the information was transferred to magnetic tape.

Data Checker Program

The data checker program determined if the data on the individual tree data cards were within the limits specified by the inventory manual. When an error or inconsistency was found, the program gave a listing of the card and probable cause of error. For example, a pulpwood size tree could have only grade codes 4, 5, 6, or 7; if a pulpwood size tree was given a grade code of 2, which is a sawtimber grade, an error message listed that dbh and grade did not correspond. The program also listed the tree card if a duplicate tree number occurred.

Volume Analysis Programs

The sawtimber volume analysis program computed information to express volume of sawtimber size trees

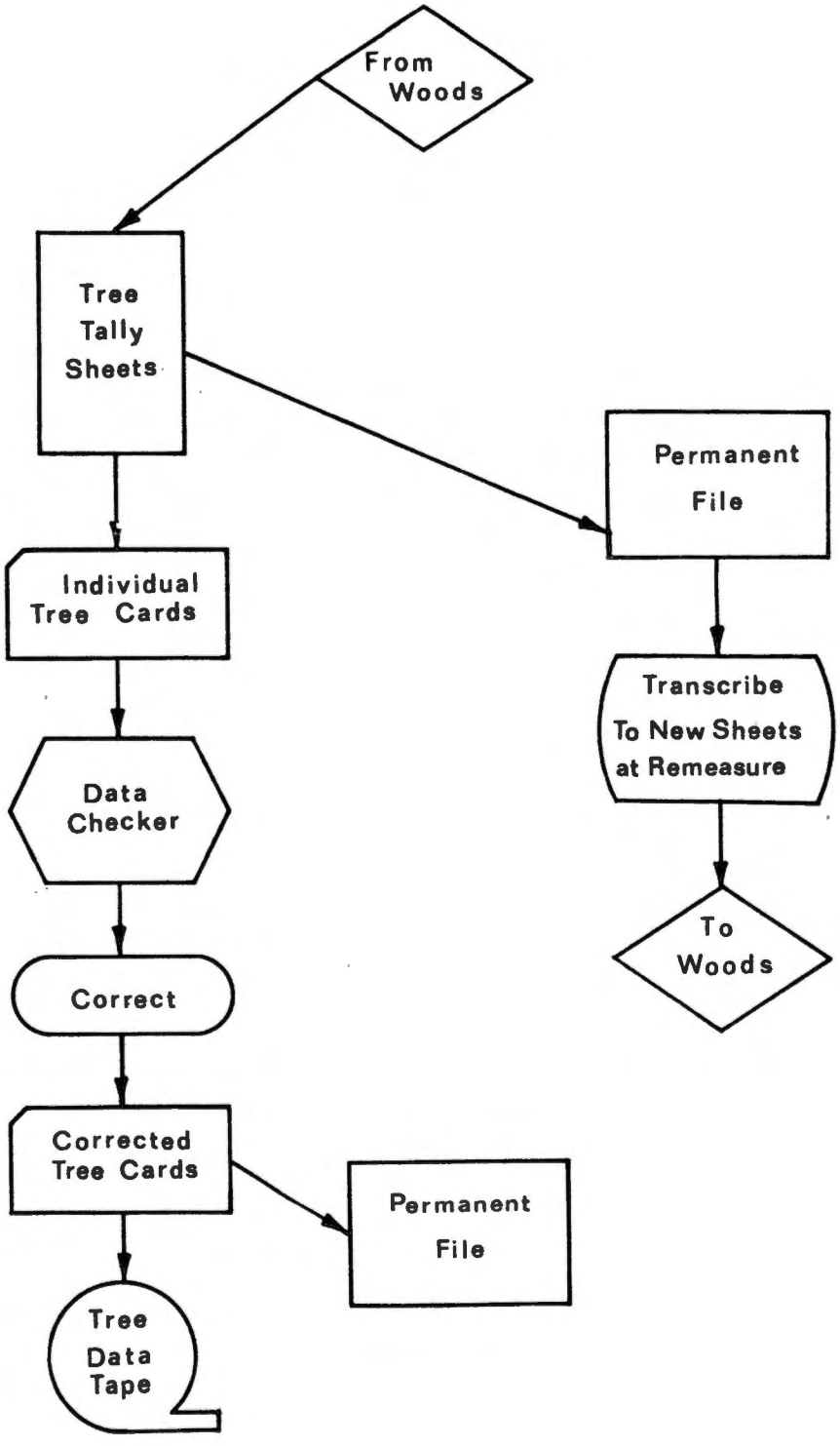

Figure 2. Flow chart of checking and correction procedure.

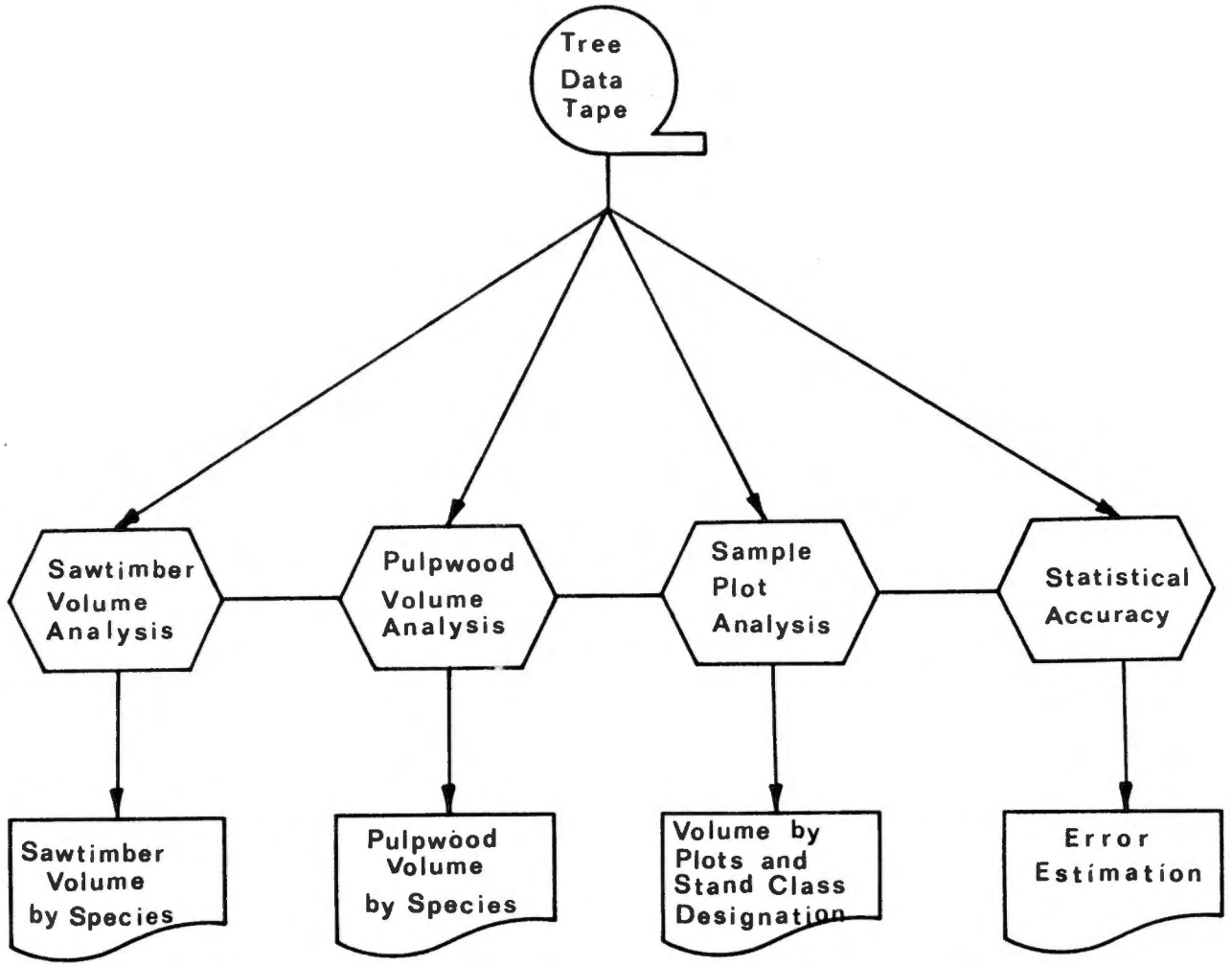

Figure 3. Flow chart of analysis procedures.

(diameter of 11.0+ inches for hardwoods and 9.0+ inches for softwoods) for each species. Volumes were calculated using regression equations developed by the Forest Survey of the United States Forest Service. These volume equations were acquired from the Tennessee Valley Authority. Trees were grouped according to their average stem form (Appendix A, Table 9) and assigned to one of the regression equations (Appendix A, Table 10). Appendix A, Table 11, gives a listing of the code numbers for each species.

The pulpwood volume analysis program yielded similar information to the sawtimber volume program. It determined pulpwood volume in trees 5.0 to 10.9 inches for hardwoods and 5.0 to 8.9 inches for conifers. Volumes were also calculated by one of the regression equations (Appendix A, Table 10).

Statistical Accuracy Program

The statistical accuracy program computed four types of information: (1) total and mean volume per acre of sawtimber and pulpwood for hardwoods and softwoods; (2) mean volume per plot; (3) standard deviation of the volume estimates; (4) standard error of the estimates.

III. GROWTH ANALYSIS

The growth programs (the data merger and the growth program) were designed by Martin (1971) and written by the

staff at The University of Tennessee Computing Center.

Data Merger

Individual tree data from two inventories and the plot information from the most recent inventory were merged onto one card. This assembled a card for the dual purpose of calculating volume growth and as a check against changes in species and decreases in dbh from one inventory to the next.

Inconsistencies in dbh and species were found in each data set for each of the forest tracts. All species inconsistencies that showed up on the data merger were corrected. Changes were made in the species codes of previous inventories to agree with the most recent inventory codes. Most decreases in dbh that were due to mispunching could be corrected; however, decreases that could not be explained were not changed.

Growth Program

The growth program calculated volume and basal area growth for each tree by using cards from the data merger (Figure 4). Volumes and basal area growth were grouped by species and assigned to the proper growth components. Total forest growth was separated into the accounts of ingrowth, accretion, outgrowth, mortality and cut. The formulas for these growth components are listed in Appendix B (Martin, 1971).

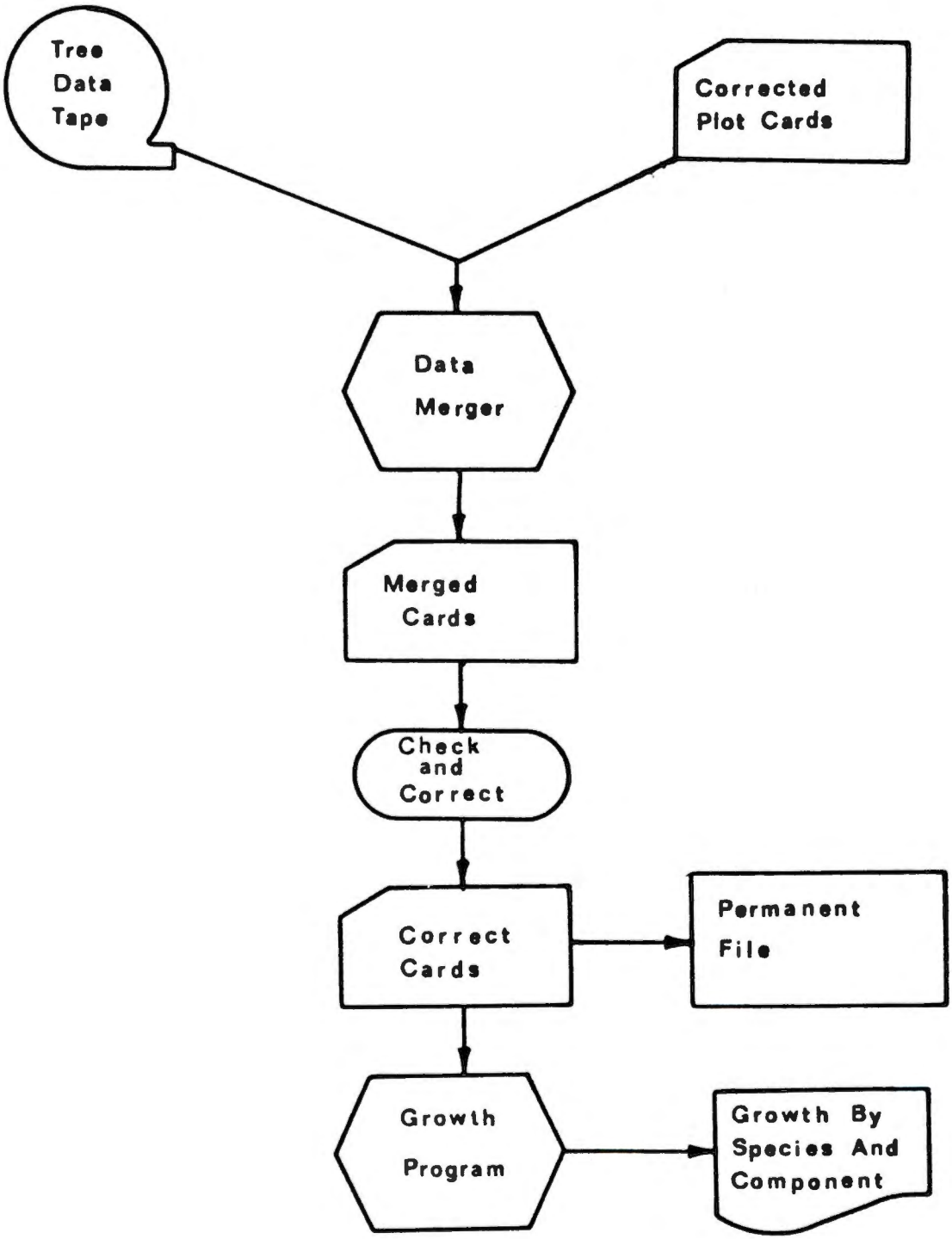

Figure 4. Growth analysis procedures.

CHAPTER V

RESULTS

I. ERRORS AND INCONSISTENCIES

The most common errors found by the data checker program involved discrepancies between tree diameter and grade. This program also found missing tree data, duplicate tree numbers, and tree numbers out of sort. All errors found by the data checker program were corrected before the data merger program was run.

Changes in species were the most common inconsistencies found by the data merger program. By assuming the species code of the most recent inventory was correct, the species codes of the previous inventories were changed to correspond with the most recent code recorded. Decreases in dbh during a growth period were also found. Most of these inconsistencies could be explained and corrected; however, when no logical explanation could be found, decreases in dbh were left unchanged. Magnitudes of these decreases in dbh are presented in Table 4.

II. VOLUME AND GROWTH ANALYSIS

For each area, growth and volume information is presented for each growth period. When discussing the growth results, the last year of the inventory period is used to

Table 4. Magnitude of decreases in dbh that could not be explained.

Location	Growth Period	No. of Trees Last Year of Growth Period	No. of Errors	Percent of Total
Scott County	1962-1967	1432	7	.49
	1967-1972	1581	4	.25
	1972-1977	1655	12	.85
Wilson Mountain	1962-1967	1156	4	.35
	1967-1972	1235	3	.24
	1972-1977	1256	8	.64
Brushy Mountain	1963-1968	2218	2	.09
	1968-1973	2522	11	.44
	1973-1978	2717	12	.44
Highland Rim	1962-1967	217	1	.46
	1967-1973	220	1	.45
	1973-1977	225	0	--
Natural Stands at Ames Plantation	1963-1968	2169	14	.65
	1968-1973	2349	0	--
	1973-1978	2307	6	.26
Pine Plantations at Ames Plantation	1968-1973	752	3	.40
	1973-1978	693	2	.29

represent the interval of interest. For example, net growth of sawtimber in 1967 was 99.37 bd.ft./acre/year on the Wilson Mountain tract. This means the net growth for the inventory period of 1962 to 1967 was 99.37 bd.ft./acre/year.

Only common names for species are used in the text. Scientific names for each species discussed are listed in Appendix A, Table 11. The International 1/4" log rule was used for all board-foot volumes. All volume and growth tables are presented in Appendix C.

Scott County Tract

Volume growth is calculated and presented for each five-year inventory period. Sawtimber and pulpwood volumes per acre by species and inventory year are listed in Appendix C, Tables 12 and 13, respectively. Sawtimber growth components for each of the growth periods are presented in Appendix C, Tables 14, 15, and 16.

Net volume growth of sawtimber increased from 67.06 bd.ft./acre/year in 1967 to 102.22 bd.ft./acre/year in 1972 to 255.52 bd.ft./acre/year in 1977. The large increase in net growth that occurred in 1977 was due to a large increase in initial volume and a large increase in ingrowth.

White pine was the most productive softwood species, showing an increase in sawtimber net growth from 3.55 bd.ft./acre/year in 1967 to 19.56 bd.ft.acre/year in 1977. This

trend was due to a large increase in gross growth of initial volume in 1977. The southern yellow pines of the Scott County tract (shortleaf and Virginia pine) increased in net growth from 6.15 bd.ft./acre/year in 1967 to 12.95 bd.ft./acre/year in 1977. However, in 1972, a low point occurred for the species, with net growth being only 3.92 bd.ft./acre/year. No loss to mortality or cull was recorded for any softwood species in any of the three inventory periods.

Red oaks (black oak, northern red oak, scarlet oak), white oaks (chestnut oak and white oak), and yellow-poplar accounted for about 65 percent of the sawtimber volume growth of the Scott County tract. Yellow-poplar showed the largest increase in net growth--from 9.52 bd.ft./acre/year in 1967 to 23.87 bd.ft./acre/year in 1972 to 79.42 bd.ft./acre/year in 1977. Loss to cull for yellow-poplar averaged about 1.30 bd.ft./acre/year for the three inventory periods. Net growth of red oaks remained fairly constant over the 15-year period and averaged 18.40 bd.ft./acre/year. White oaks, on the other hand, more than tripled their annual growth. Net growth of white oaks for 1967 was 18.86 bd.ft./acre/year while net growth for the 1977 period was 56.66 bd.ft./acre/year.

Pulpwood growth components for each of the five-year growth periods are presented in Appendix C, Tables 17, 18, and 19. Pulpwood loss (mortality, loss to cull, and outgrowth to sawtimber) was more than ingrowth for each inventory period.

Total net growth of pulpwood reached a peak in 1972 at 9.24 cu.ft./acre/year. In 1977, net pulpwood growth fell to 0.63 cu.ft./acre/year. This was due to a small amount of ingrowth (2.87 cu.ft./acre/year) and a large amount of outgrowth to sawtimber (12.01 cu.ft./acre/year) in 1977.

Wilson Mountain

Sawtimber and pulpwood volume by species and inventory year for Wilson Mountain are given in Appendix C, Tables 20 and 21, respectively. Sawtimber volume growth components for each five-year inventory period are presented in Appendix C, Tables 22, 23, and 24. Pulpwood volume growth components are presented in Appendix C, Tables 25, 26, and 27.

White pine, northern red oak, chestnut oak, white oak, and yellow-poplar each had more than 500 bd.ft./acre in each inventory. Softwood species contained 25 percent of the sawtimber volume (Table 20). Pulpwood volume remained fairly constant for the four inventories, with chestnut oak having the most volume (Table 21).

Total net growth of sawtimber increased steadily from 97.83 bd.ft./acre/year for the growth period ending in 1967 to 132.61 bd.ft./acre/year in 1972 to 157.96 bd.ft./acre/year in 1977. This trend was due primarily to increases in gross growth of initial volumes and not to large increases in ingrowth. Mortality was the greatest during the 1972 to 1977 growth period with 33.54 bd.ft./acre/year being lost. Mortality and loss to cull were less

than ingrowth during the 1962 to 1967, and 1967 to 1972 growth periods; however, during the last period, mortality plus loss to cull was 11.85/bd.ft./acre/year more than ingrowth. No cut was recorded during any growth interval. Net growth of yellow-poplar was the largest, increasing from 21.99 bd.ft./acre/year in 1967 to 56.86 bd.ft./acre/year in 1977. This was due to increases in gross growth of initial volume and ingrowth. No mortality or loss to cull was recorded for yellow-poplar during any growth period. Net growth of white pine remained fairly constant for each growth period, averaging 22.22 bd.ft./acre/year. Chestnut oak increased in net growth by 65 percent during the last growth period due to an increase in gross growth of initial volume.

Net growth of pulpwood decreased during the 15-year inventory period. Loss to cull was not very large during any growth period; however, mortality and outgrowth to sawtimber was larger than ingrowth for each of the growth periods. Annual net growth decreased from 3.41 cu.ft./acre in 1967 to -2.72 cu.ft./acre in 1972 to -1.54 cu.ft./acre in 1977. Yellow-poplar and red maple generally had the largest net growth within the pulpwood size class; however, their net growth fluctuated over the 15-year inventory period due to outgrowth of sawtimber.

Brushy Mountain

Sawtimber and pulpwood volume by species and inventory year for Brushy Mountain is given in Appendix C, Tables 28 and 29, respectively. Sawtimber volume growth components for each growth period are presented in Appendix C, Tables 30, 31, and 32. Pulpwood volume growth components are given in Appendix C, Tables 33, 34, and 35.

Total net growth of sawtimber increased from 18.78 bd.ft./acre/year during the 1963 to 1968 growth period to 182.61 bd.ft./acre/year during the 1973 to 1978 period. This increase is attributed to increases in ingrowth and gross growth of initial volume. Ingrowth was greater than loss to cull and mortality was 30.45 bd.ft./acre/year greater than ingrowth during the 1963 to 1968 growth period. Cut of 21.79 bd.ft./acre/year was recorded between 1968 and 1973. Shortleaf pine was the most heavily cut, 11.36 bd.ft./acre/year. No cut was recorded in the other growth periods.

Of the conifer species inventoried, most of the sawtimber net growth was in shortleaf pine. However, due to the large amount of mortality during the 1963 to 1968 growth period, net growth of shortleaf pine was -3.29 bd.ft./acre/year. Net growth of shortleaf pine increased during the 1968 to 1973 growth period to 10.31 bd.ft./acre/year. This increase was due to a large amount of ingrowth and small amounts of mortality and loss to cull during the period. Net growth decreased to 9.35 cu.ft./acre/year in 1978

because of an increase in mortality. Chestnut oak had the largest proportion of total sawtimber volume each year Brushy Mountain was inventoried. Net growth of this species increased steadily from 21.88 bd.ft./acre/year in 1968 to 54.04 bd.ft./acre/year in 1973 to 75.90 bd.ft./acre/year in 1978. Yellow-poplar also showed an increase in net growth--from 6.48 bd.ft./acre/year in 1968 to 22.21 bd.ft./acre/year in 1973 to 28.25 bd.ft./acre/year in 1978.

Total net growth of pulpwood was -2.28 cu.ft./acre/year during the 1963 to 1968 growth period. This negative growth was a result of mortality, loss to cull, and outgrowth to sawtimber being larger than gross growth of initial volume and ingrowth. Net growth increased to 5.29 cu.ft./acre/year during the last growth period due to increases in gross growth of initial volume and ingrowth. Ingrowth was less than mortality, loss to cull, and outgrowth to sawtimber in each period. Only small amounts of cut were recorded during the last two growth periods while no cut was recorded for the first period. Net growth was evenly distributed between the species during the first two growth periods; however, total net growth between 1973 and 1978 was greatest in red maple and yellow-poplar.

Highland Rim Forestry Field Station

Sawtimber and pulpwood volumes by species and inventory year are listed in Appendix C, Tables 36 and 37,

respectively. Volume growth components for sawtimber and pulpwood are presented in Appendix C, Tables 38 and 39. As expected on the barrens at the Highland Rim Forestry Field Station, pulpwood and sawtimber volume and its growth was much lower than the other study areas. Most of the sawtimber volume was in southern red oak while most of the pulpwood volume was in post oak. Only five species contained merchantable sawtimber volume during the entire 15-year inventory period (Appendix C, Table 36) and only seven species contributed to pulpwood (Appendix C, Table 37).

Total net growth of sawtimber was 141.85 bd.ft./acre/year during the 1962 to 1967 growth period; however, due to a decline in gross growth of initial volume, net growth fell by 36 percent to 90.00 bd.ft./acre/year during the 1967 to 1972 growth period. Net growth increased to 96.39 bd.ft./acre/year during the 1972 to 1977 growth period due to increases in ingrowth. During the 15 years that the inventory was conducted, southern red oak accounted for about 43 percent of the net growth of sawtimber.

Total net growth of pulpwood showed a decreasing trend over the 15-year inventory period. Net growth fell from 1.87 cu.ft./acre/year during the 1962 to 1967 growth period to 0.86 cu.ft./acre/year in the 1973 to 1977 period. This decrease was caused by an increase in outgrowth to sawtimber and a sharp decline in ingrowth. Net growth was -4.13 cu.ft./acre/year during the 1967 to 1973 growth

period. The contribution to net growth of individual species was variable over the 15-year period, but post oak and hickory generally made the largest contribution.

Natural Stands at Ames Plantation

Sawtimber and pulpwood volumes by species and inventory year are presented in Appendix C, Tables 40 and 41, respectively. Sawtimber volume growth components for each five-year growth period are presented in Appendix C, Tables 42, 43, and 44. Pulpwood volume growth components are presented in Appendix C, Tables 45, 46, and 47.

Most of the sawtimber volume is in the red oaks (black oak, cherrybark oak, northern red oak, Shumard oak, southern red oak, blackjack oak, pin oak, scarlet oak, water oak, and willow oak) and white oaks (chestnut oak, post oak, swamp chestnut oak, and white oak). Sweetgum also accounted for a large percentage of the total merchantable volume (Table 40).

Net growth of sawtimber increased from 174.00 bd.ft./acre/year in 1968 to 202.34 bd.ft./acre/year in 1973 to 254.64 bd.ft./acre/year in 1978. Ingrowth was more than mortality and loss to cull during the 1963 to 1968 and 1968 to 1973 inventory periods; however, mortality and loss to cull were larger than ingrowth during the 1973 to 1978 growth period. There was a noticeable increase in gross growth of initial volume during the 1973 to 1978 growth period.

Most of the sawtimber growth occurred within the red oak group. Net growth of the red oak group increased from 52.21 bd.ft./acre/year in 1968 to 94.10 bd.ft./acre/year in 1978. Southern red oak contributed more to net growth of the red oaks than any other species. However, during the last two growth periods, cut reduced net growth of southern red oak by 20.26 bd.ft./acre/year in 1973 and 30.08 bd.ft./acre/year in 1978. The white oak group also showed an increase from 16.78 bd.ft./acre/year in 1968 to 59.84 bd.ft./acre/year in 1978. Sweetgum had an annual net growth of 43.74 bd.ft./acre during the 1963 to 1968 growth period; however, growth fell to 20.30 bd.ft./acre/year during the 1973 to 1978 growth period. This decrease in net growth was caused by a loss to mortality of 28.68 bd. ft./acre/year during the last growth period.

Pulpwood net growth reached a high of 15.13 cu.ft./acre/year during the 1968 to 1973 growth period. Net growth declined to 13.99 cu.ft./acre/year during the next five years, even though gross growth of initial volume remained about the same. Large increases in the components of mortality and loss to cull were the underlying reasons for this decline in net growth during this growth period. Only small amounts of cut were recorded during the first two growth periods--0.06 cu.ft./acre/year in 1968 and 0.02 cu.ft./acre/year in 1973. No cut was recorded during the 1973 to 1978 growth period.

Softwood species reduced total net growth of pulpwood by 0.22 cu.ft./acre/year in the first growth period. Softwood growth was only about 2 percent of the total net growth during the last two growth periods. Net growth of hickory and sweetgum was about 27 percent of the total net growth during the 15-year inventory period.

Pine Plantations at Ames Plantation

No information was collected for the pine plantations at Ames Plantation during the 1963 to 1968 growth period because the stands were smaller than the merchantable size limits of the inventory. For subsequent periods, sawtimber and pulpwood volumes by species are listed in Appendix C, Tables 48 and 49, respectively. Sawtimber volume growth components are presented in Appendix C, Tables 50 and 51. Pulpwood volume growth components are presented in Appendix C, Tables 52 and 53.

Due to large increases in ingrowth and growth of initial volume, total net growth increased from 55.33 bd.ft./acre/year in 1973 to 331.79 bd.ft./acre/year in 1978. Ingrowth from pulpwood contributed 38.06 cu.ft./acre/year to this increase in annual growth.

In 1978, loblolly pine accounted for about 67 percent of the sawtimber volume in the plantations. Net growth increased by 219.58 bd.ft./acre/year from the 1968 to 1973 growth period to the 1973 to 1978 growth period. This

increase was due to large increases in ingrowth and gross growth of initial volume. Loblolly pine was the only species with any sawtimber cut recorded. Cut occurred during the 1973-1978 growth period. This decreased net growth by only 5.01 bd.ft./acre/year to yield a net increase of 250.76 bd.ft./acre/year.

Shortleaf pine, the other plantation species, showed an increase in net growth from 17.90 bd.ft./acre/year in 1973 to 49.04 bd.ft./acre/year in 1978. Gross growth of initial volume accounted for 55 percent of this increase in net growth. Hardwood sawtimber volume growth was only about 1 percent of the total net growth in 1973 and 8 percent in 1978.

Net growth of pulpwood showed a decrease from 66.35 cu.ft./acre/year in 1973 to 28.98 cu.ft./acre/year in 1978. This decrease was primarily due to large volumes in mortality and outgrowth to sawtimber. Outgrowth to sawtimber increased to 38.24 cu.ft./acre/year in 1978 from 13.13 cu.ft./acre/year in 1973; also, mortality increased from 2.40 cu.ft./acre/year in 1973 to 20.12 cu.ft./acre/year in 1978. During the growth period of 1973 to 1978, 11.10 cu.ft./acre/year was cut. No cut was recorded between 1968 and 1973.

Loblolly pine and shortleaf pine accounted for most of the pulpwood volume (Appendix C, Table 21). Net growth of loblolly pine decreased from 49.06 cu.ft./acre/year in

1973 to 9.64 cu.ft./acre/year in 1978. This decrease in net growth was due to large increases in mortality and outgrowth to sawtimber, and not to decreasing growth of initial volume. Like loblolly pine, shortleaf pine showed an increase in growth of initial volume, but increases in mortality and outgrowth to sawtimber caused a decrease in net growth for the 1973-1978 growth period.

Statistical Accuracy

Standard errors were less than the target of 10 percent on most of the areas. Pulpwood volume of the pine plantations at Ames Plantation had a standard error of 7.45 percent of the mean for the 1978 inventory; however, the rest of the inventories of the pine plantations at Ames Plantation had standard errors larger than 10 percent of the mean. The Highland Rim Forestry Field Station had standard errors larger than 10 percent for each inventory. The large error at the Highland Rim Forestry Field Station and the pine plantations at Ames Plantation was due to small sample sizes and heterogeneous stand structures.

At some locations, small discrepancies were found between net change calculated as the difference between the volumes of two inventories (V_2-V_1), and net change calculated from information in the growth program. These discrepancies could be due to variations in definitions and methods of calculation used in the two programs.

These differences are presented in Tables 5 and 6. The CFI programs need to be examined and checked to see where these discrepancies lie.

Table 5. Differences between net change of sawtimber as calculated from the growth program and volume program by inventory location and growth period.

Location	Growth Period	$\frac{V_1-V_2}{5}$	Net Change from Growth Program
Scott County	1962-1967	63.84	67.06
	1967-1972	102.43	102.22
	1972-1977	245.69	255.52
Wilson Mountain	1962-1967	97.87	97.83
	1967-1972	132.64	132.61
	1972-1977	157.35	157.96
Brushy Mountain	1963-1968	18.45	18.78
	1968-1973	125.15	126.00
	1973-1978	180.36	182.61
Highland Rim Forestry Field Station	1962-1967	139.43	141.85
	1967-1973	90.00	90.00
	1973-1977	89.99	96.39
Natural Stands at Ames Plantation	1963-1968	170.87	171.88
	1968-1973	169.78	170.18
	1973-1978	191.16	191.74
Pine Plantations at Ames Plantation	1968-1973	55.33	55.33
	1973-1978	329.31	326.78

Table 6. Differences between net change of pulpwood as calculated from the growth program and volume program by inventory location and growth period.

Location	Growth Period	$\frac{V_2-V_1}{5}$	Net Change from Growth Program
Scott County	1962-1967	3.75	4.12
	1967-1972	9.25	9.24
	1972-1977	0.59	0.63
Wilson Mountain	1962-1967	3.41	3.41
	1967-1972	-2.59	-2.72
	1972-1977	-1.81	-1.54
Brushy Mountain	1963-1968	-2.28	-2.28
	1968-1973	3.29	2.96
	1973-1978	5.52	5.26
Highland Rim Forestry Field Station	1962-1967	2.46	1.87
	1967-1972	0.51	0.86
	1972-1977	-4.12	-4.13
Natural Stands at Ames Plantation	1963-1968	8.53	8.40
	1968-1973	14.99	15.11
	1973-1978	13.78	13.99
Pine Plantations at Ames Plantation	1968-1973	66.53	66.35
	1973-1978	17.16	17.88

CHAPTER VI

DISCUSSION

A summary of sawtimber and pulpwood net growth for these areas is presented in Tables 7 and 8, respectively. Net growth of both sawtimber and pulpwood in the pine plantations and natural stands of Ames Plantation was greater than at other inventoried areas. Sawtimber net growth for the natural stands at Ames Plantation was large during each growth period; however, the greatest net growth of sawtimber occurred in the pine plantations of Ames Plantation during the 1973 to 1978 growth period. Loblolly pine, the major species of the pine plantations, can be very productive north of its native range. This proved to be true in the pine plantations at Ames Plantation. Sawtimber net growth of 255.77 bd.ft./acre/year for loblolly pine was 140 percent of its initial volume for the 1973 to 1978 growth period. As expected, ingrowth accounted for most of this net growth. No other inventoried area contained a species that showed a growth rate as large as loblolly pine of this area. Data were collected on the pine plantations at Ames Plantation when the stands were composed of young sawtimber and did not have a wide distribution of ages; whereas, the timber of the other areas was distributed over a wider range of sizes.

Table 7. Sawtimber net growth (bd.ft.,Int.1/4"/acre/year) for each inventoried area and growth period.

Forest	Number of Plots	1962-1967 1963-1968	1967-1972 1968-1973	1972-1977 1973-1978
Ames Plantation:				
Natural Stands	144	174.00	202.34	254.64
Pine Plantations	26	*	55.33	331.79
Scott County	99**	67.06	102.22	255.52
Brushy Mountain	169	18.78	147.79	182.61
Wilson Mountain	69	97.83	132.61	157.96
Highland Rim: Forestry Field Station	25	141.85	90.00	96.39

*Ames pine plantations submerchantable in 1963.

**One plot with one tree was missed in 1962.

Table 8. Pulpwood volume net growth (cu.ft./acre/year) for each inventoried area and growth period.

Forest	Number of Plots	1962-1967 1963-1968	1967-1972 1968-1973	1972-1977 1973-1978
Ames Plantation:				
Natural Stands	144	8.46	15.13	13.99
Pine Plantations	26	*	41.32	28.98
Scott County	99**	4.12	9.24	0.63
Brushy Mountain	169	-2.28	3.73	5.29
Wilson Mountain	69	3.41	-2.72	-1.54
Highland Rim: Forestry Field Station	25	1.87	0.86	-4.13

*Ames pine plantations submerchantable in 1963.

**One plot with one tree was missed in 1962.

The pine plantations also had the largest net growth of pulpwood.

Net growth was 66.35 cu.ft./acre/year during the 1968 to 1973 growth period; however, it declined to 28.98 cu.ft./acre/year in the 1973 to 1978 growth period. This decline was due to increases in increases in outgrowth to sawtimber and not to decreases in gross growth of initial volume. During the 1968 to 1973 growth period, loblolly pine net growth of 49.06 cu.ft./acre/year was 24 percent of the initial volume of this species. Shortleaf pine, the other plantation species, did not contribute as much to the total net growth of the pine plantations at Ames Plantation; however, growth was 22 percent of its initial volume during the 1973 to 1978 growth period. Shortleaf pine occurred naturally on all inventoried areas except the Highland Rim Forestry Field Station; however, growth rates on these areas were not as large because stocking levels were higher in the pine plantations at Ames Plantation.

Net growth of sawtimber in the natural stands at Ames Plantation increased from 174.00 bd.ft./acre/year in 1968 to 202.34 bd.ft./acre/year in 1973 to 254.64 bd.ft./acre/year in 1978. However, when total net growth was expressed as a percentage of the initial volume for the growth period (V_1), net growth remained almost constant at 5 percent. Most of the sawtimber volume per acre was in black oak, cherrybark oak, white oak, sweetgum, hickory, post oak, and

southern red oak. Cherrybark oak was found only at Ames Plantation. Absolute net growth of sawtimber for this species increased from 16.23 bd.ft./acre/year in 1968 to 18.23 bd.ft./acre/year in 1978. Sweetgum was found at Ames Plantation, Wilson Mountain, Brushy Mountain and Scott County. Sawtimber and pulpwood volume for this species was greatest on Ames Plantation. Sawtimber net growth of sweetgum decreased from 43.74 bd.ft./acre/year in 1968 to 20.30 bd.ft./acre/year in 1978 at Ames Plantation. This decrease was caused by mortality of 28.68 bd.ft./acre/year during the last growth period. Net growth of sweetgum pulpwood increased from 5 percent of initial volume in 1968 to 8 percent of initial volume in 1973 and 1978.

Net growth of sawtimber increased for each of the areas during the 15-year inventory period except on the Highland Rim Forest where there was a decreasing trend in both sawtimber and pulpwood total net growth.

One reason for this decreasing trend in growth rates on the Highland Rim could be the site conditions indicative to the barrens of this area. Percent net growth of initial volume decreased for each species inventoried on the Highland Rim. This decrease was probably due in part to loss of merchantable height.

Three areas were inventoried on the Cumberland Plateau--Scott County, Wilson Mountain, and Brushy Mountain. During the last growth period, net growth of sawtimber ranged

from 3 percent of the initial volume at Wilson Mountain to 7 percent at Brushy Mountain to 9 percent at Scott County. The percent growth rates that occurred at Brushy Mountain and Scott County were larger than the 5 percent growth rates in the natural stands at Ames Plantation. This difference was probably due to the low stocking that occurred in the Cumberland Plateau locations. Percent net growth rates at Brushy Mountain and Scott County were larger than those in the natural stands at Ames Plantation because the initial volumes were much greater at Ames Plantation.

White pine occurred at all three of the areas on the Cumberland Plateau. Sawtimber net growth for this species ranged from -1 percent of initial volume at Brushy Mountain to 4 percent at Wilson Mountain to 29 percent in Scott County. Volume estimates for white pine were greatest at Wilson Mountain. Yellow-poplar was a common species on the Cumberland Plateau and at Ames Plantation. Yellow-poplar had an annual sawtimber net growth of about 9 percent of initial volume on the three areas of the Cumberland Plateau. Annual sawtimber net growth of this species was 6 percent of its initial volume at Ames Plantation. Chestnut oak was the most common species at the Cumberland Forestry Field Station. This species also occurred at Ames Plantation but made only a small contribution to volume and growth. Black oak, northern red oak, white oak, and hickory were present at Ames Plantation and the Cumberland Forestry

Field Station. The growth rates of these species were similar at both locations.

Precision of the total volume estimates for the six forest tracts was generally good; however, individual species generally were only a small proportion of the total sample. Therefore, the error may be larger and dependable comparisons cannot be made.

Timber removals or cutting occurred on three of the inventoried areas: pine plantations and natural stands at Ames Plantation and Brushy Mountain. Most of the cutting on the natural stands of Ames Plantation took place during the last two five-year growth periods. Volume cut during these two periods was only about 1 percent of the initial sawtimber volume. Southern red oak was the major species cut in the natural stands at Ames Plantation. Rate of cut (36.08 bd.ft./acre/year) was almost equal to net growth (37.26 bd.ft./acre/year) for this species. Since, until recently, there has been practically no pulpwood market for the Ames Plantation area, annual volume per acre cut was much less than 1 percent of initial pulpwood volume. During the last growth period the volume removed from the pine plantations at Ames Plantation was between 1 and 2 percent of initial volume for both sawtimber and pulpwood.

Sawtimber was cut at Brushy Mountain during the 1968 to 1973 growth period. Since cut was only 1 percent of initial volume, net growth was much greater than rate of

cut at Brushy Mountain. Shortleaf pine was the major species cut at this area. Rate of cut for this species was 11.36 bd.ft./acre/year while net growth was only 10.31 bd.ft./acre/year. No cut occurred at Scott County, Wilson Mountain, or the Highland Rim Forestry Field Station.

County sawtimber growth estimates reported by the USDA Forest Service Forest Survey were generally less than the estimates found in this project. Thi is probably because most of the volume on The University of Tennessee forest tracts was in the lower size classes with faster growth rates; however, this has not been tested. Pulpwood growth estimates, on the other hand, were less than those reported by the Forest Survey. This was probably due to differences in definitions used in the two surveys (Hedlund and Earles, 1971).

CHAPTER VII

CONCLUSIONS

Errors and inconsistencies were found in each data set through the data checker and data merger program. The most common error found by the data checker programs involved discrepancies between tree diameter and grade. Missing tree data, duplicate tree numbers, and trees out of order were also found. All errors found by the data checker program were corrected.

Changes in species were the most common inconsistency found by the data merger program. Species codes were changed to correspond with the most recent code recorded. Decreases in dbh during a growth period were also found. Most of these inconsistencies could be explained and corrected; however, when no logical explanation could be found, no correction was attempted.

The highest growth rates were found in the pine plantations at Ames Plantation. During the 1973 to 1978 growth period net growth of sawtimber on this area was 331.79 bd.ft./acre/year. Net growth of pulpwood was 66.35 cu.ft./acre/year in 1973 but decreased to 28.58 cu.ft./acre/year due to large amounts of outgrowth to sawtimber in 1978. Growth rates of the natural stands at Ames Plantation were greater than for the Highland Rim and Cumberland Plateau

locations (Tables 7 and 8, pages 47 and 48, respectively). Growth rates of both pulpwood and sawtimber at the Highland Rim decreased over the 15-year inventory period. Sawtimber net growth on this area fell from 141.85 bd.ft./acre/year in 1962 to 96.39 bd.ft./acre/year in 1977. Pulpwood net growth at the Highland Rim decreased from 1.87 cu.ft./acre/year in 1962 to -4.13 cu.ft./acre/year in 1977.

CHAPTER VIII

RECOMMENDATIONS

I. FIELD WORK

Contrary to recommendations of MacDonald (1964) to measure only merchantable height, total height should be measured. Problems occurred with taking only merchantable height in this study because it sometimes decreased from one inventory to the next. Although merchantable height can actually be reduced by increasing limb size, decreases can also be due to differences in judgment of the crews conducting the inventory. Total height is a more objective dimension to measure. Measurement of total height would also allow the estimation of total volume (Cunia, 1968).

II. UNITS FOR GROWTH ANALYSIS

This study presents growth in merchantable volume using cubic-feet and board-feet. Growth measures have been most commonly applied to volume; however, they can be applied to any measurable growth characteristic. Basal area growth would be one alternative to volume growth; it would have none of the problems of height measurement discussed earlier.

Sawtimber is generally marketed in board-foot units. This is primarily due to custom and not to accuracy. The board-foot unit is not an exact measure of volume because within logs of exactly the same dimension there can be considerable variation, depending on: (1) amount of defect, (2) thickness of saws used in milling, (3) amount of waste in slabs and edgings, (4) efficiency in milling, and (5) skilled sawyer. Alternately, cubic-foot measurements are simple and exact, eliminating the confusion of different rules.

The original objectives of The University of Tennessee CFI were to identify and evaluate factors affecting stand growth. Cubic foot volume or square feet of basal area would be more accurate and precise units to analyze growth for this objective. For management purposes, board foot growth estimates are often needed. These estimates would best be made by converting cubic growth estimates for the appropriate size classes.

Enough data have been collected to fulfill the objectives of the original project. Furthermore, the work completed in this project would have to be repeated if another inventory is made. Factors affecting stand growth could now be evaluated using the data sets provided in this project.

III. COMPUTER PROCESSING

All CFI programs need to be thoroughly documented. Most of the parameters and variables in the CFI programs were undefined and understanding was difficult. Modifications need to be made to the growth program to calculate gross growth, net growth of initial volume, net growth and net increase.

At some inventoried locations, small discrepancies were found between net growth calculated as the difference between the volumes of two inventories (V_2-V_1) and net growth calculated from information in the growth program. These discrepancies could be due to variations in definitions and methods of calculation used in the two programs. The CFI programs need to be examined and checked to see where these discrepancies lie.

IV. SPECIFIC RECOMMENDATIONS FROM THIS STUDY

During the last growth period, sweetgum at Ames Plantation had 28.68 bd.ft./acre/year lost to mortality. This mortality could have been from beaver damage on one or two plots sampling many sweetgums, but the actual reasons for this mortality need to be examined further. Shortleaf pine at the Cumberland Plateau locations also had high mortality. This was probably due to southern pine beetle damage; however, further examination is needed.

LITERATURE CITED

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Avery, T. Eugene. 1967. Forest Mensuration. New York: McGraw Hill, 290 pp.

Barton, William W. 1960. "A Method of Continuous Forest Inventory for Management." Eastern Region-Forest Service Bulletin. 625. 4 pp.

Beers, Thomas W. 1962. "Components of forest growth." Journal of Forestry 60: 245-248.

Beers, Thomas W., and C. I. Miller. 1964. Point sampling: Research results, theory, and applications. Purdue Univ. Agric. Exp. Stat. Res. Bull. 786.

Boyd, W. M. 1970. Forest stand projections under conditions of uncertainty--a Markov chain approach. Unpublished Master's thesis, The University of Tennessee, Knoxville, 102 pp.

Braun, E. L. 1950. Deciduous Forests of Eastern North America. Philadelphia: The Blakiston Company.

Cox, B. C. 1963. Soilmap, The University of Tennessee, Forestry Experiment Station, Morgan and Scott Counties, Tennessee. Soil Conservation Service.

Cunia, T. 1968. Management inventory (CFI) and some of its basic statistical problems. Journal of Forestry 66: 342-349.

Davis, Kenneth P. 1964. The importance and uses of growth information in timber management. Journal of Forestry 62: 490-492.

DeSelm, H. R., W. H. Martin III, and E. Thor. 1978. The Forest Vegetation of Wilson Mountain, Tennessee. In Proceedings of Central Hardwood Forest Conference II, West Lafayette, Indiana. pp. 24-38.

Dickson, R. R. 1960. Climate of Tennessee, U. S. Department of Commerce, Weather Bureau, Climatography of the United States. 16 pp.

Diller, Oliver D. 1960. "CFI Woodlots--Opportunities for Integrating Research, Education, and Action Programs." Fifth World Forestry Congress Proceedings, Univ. of Wash., Seattle. pp. 1166-1169.

Elder, J. A., and M. E. Springer. 1978. General Soil Map of Tennessee. Soil Conservation Service in Cooperation with Tennessee Agricultural Experiment Station.

Eubanks, T. R. 1972. Food Habits of Bobwhite Quail on Ames Plantation: Implications for Management. The University of Tennessee Agriculture Experiment Station Bulletin. 534. 38 pp.

Evert, F. 1964. Components of stand volume and its increment. Journal of Forestry 62: 810-813.

Fenneman, N. A. 1938. Physiography of the Eastern United States. McGraw-Hill, New York, 714 pp.

Flowers, R. L., et al. 1964. Soil Survey of Fayette County, Tennessee. Soil Conservation Service. 71 pp.

Fox, C. J., et al. 1958. Franklin County Soil Survey. United States Department of Agriculture Series. 1949, No. 8. 91 pp.

Gilbert, Adrian M. 1954. What is this thing called growth? United States Forest Service, Northeast Experiment Station Paper. 71. 5 pp.

Hall, O. F. 1965. "Advance Planning by the Chief Forester." In Proceeding on CFI Conference, Michigan Tech., Houghton, Michigan. pp. 6-19.

Hasel, A. A. 1959. Statistical Validity of CFI Inventory Designs on Large Areas. In Proc. Continuous Inventory Control in Forest Management Short Course. University of Georgia, Athens, Georgia. pp. 45-53.

Hebb, Edwin A. 1960. The relation of soil and other site factors to forest composition and productivity in West Tennessee. Unpublished dissertation, The University of Tennessee, Knoxville, 115 pp.

Husch, Bertram. 1963. Forest Mensuration and Statistics. New York: Ronald Press, 474 pp.

Husch, Bertram, Charles I. Miller, and Thomas W. Beers. 1972. Forest Mensuration. New York: Ronald Press, 410 pp.

Kozlowski, Theodore T. 1962. Tree Growth. New York: The Ronald Press, 442 pp.

MacDonald, R. D. 1964. Establishment of continuous forest inventory on University of Tennessee land in Morgan and Scott Counties. Unpublished Master's Thesis, The University of Tennessee, Knoxville, 117 pp.

Marquis, D. A., and T. W. Beers. 1969. "A further definition of some forest growth components." Journal of Forestry 67: 493.

Martin, M. D. 1970. Growth analysis of University of Tennessee forests in Morgan and Scott Counties. Unpublished Master's Thesis, The University of Tennessee, Knoxville, 88 pp.

Meyer, H. A. 1942. "Methods of Forest Growth Determination." Pennsylvania Agriculture Experiment Station Bulletin. 435. 93 pp.

Phallin, Donald A. 1965. "Growth Components, the Key to Understanding Forest Growth." Proceedings of Conference on CFI. pp. 111-119.

Shanks, R. E., and F. H. Norris. 1950. Microclimatic Variation in a Small Valley in East Tennessee. Ecology 31: 532-539.

Spurr, Stephen H. 1952. Forest Inventory. New York: Ronald Press, 476 pp.

Staebler, George R. 1954. "Standard Computations for Permanent Sample Plots." United States Forest Service, Pacific Northwest Forest and Range Experiment Station. 15 pp.

Stott, Calvin B. 1965. "History of the Lake States' First CFI Plots." In Proceedings of Conference on CFI. Michigan Tech, Houghton, Michigan, pp. 19-28.

Stott, Calvin B. 1968. "A short history of Continuous Forest Inventory east of the Mississippi." Journal of Forestry 66: 832-837.

Yoho, N. S. 1970. Aspects of the winter behavior of bobwhite quail in Tennessee. Unpublished Master's Thesis, The University of Tennessee, Knoxville, 63 pp.

APPENDICES

APPENDIX A

SPECIES CODES AND VOLUME COEFFICIENTS

Table 9. Species groupings by average stem form for volume regressions.

Species	U.T. Species Code	TVA Regression Number	
		Sawtimber	Pulpwood
Shortleaf pine	101	2	42
Other yellow pines	102-105	1	41
Eastern red cedar	201	4	44
White pine, hemlock, misc. conifers	110,202,204	3	43
Cypress	203	5	45
Gums and willow	333-335,340	11	51
Yellow poplar	338	12	52
Other soft hardwoods	330-332,336,337,341-343	10	50
Black oak, scarlet oak, southern red oak	301,305,313	6	46
Other red oaks	302-304,311,312,314-316	7	47
White oak	328	9	49
Other white oaks	321-327	8	48
Beech	348	14	54
Hickory	356	15	55
Other hard hardwoods	All remaining codes	13	53

Table 10. Regression equations for volume calculations.

Volume Regression Number	Constant a	Regression Coefficient b
Sawtimber-size trees		
01	- 3.4	0.02140
02	-12.7	0.02369
03	-20.1	0.02480
04	- 6.1	0.02092
05	-10.9	0.02329
06	- 4.2	0.02539
07	-13.0	0.02618
08	-10.5	0.02669
09	- 5.8	0.02518
10	- 4.0	0.02480
11	- 4.3	0.02328
12	- 4.4	0.02381
13	- 5.8	0.02517
14	-12.1	0.02983
15	0.8	0.02394
Pulpwood-size trees		
41	0.36	0.003114
42	0.35	0.003102
43	0.40	0.003064
44	0.32	0.003015
45	0.40	0.003064
46	0.48	0.002793
47	0.53	0.002724
48	0.50	0.002766
49	0.51	0.002710
50	0.53	0.002791
51	0.50	0.002662
52	0.56	0.002756
53	0.49	0.002761
54	0.46	0.002844
55	0.49	0.002748

Table 11. Scientific names and species codes.

Species Common Name	Scientific Name	Species Code
Shortleaf pine	Pinus echinata Mill.	101
Virginia pine	Pinus virginiana Mill.	102
Pitch pine	Pinus rigida Mill.	103
Loblolly pine	Pinus taeda L.	104
Miscellaneous yellow pines	Pinus spp.	105
White pine	Pinus strobus L.	110
Eastern red cedar	Juniperus virginiana Mill.	201
Hemlock	Tsuga canadensis L.	202
Cypress	Taxodium distichum L.	203
Miscellaneous conifers		204
Black oak	Quercus velutina Lam.	301
Cherrybark oak	Q. falcata var.	302
Northern red oak	Q. rubra L.	303
Shumard oak	Q. shumardii Buckley	304
Southern red oak	Q. falcata Michx.	305
Blackjack oak	Q. marilandica Muenchh.	311
Pin oak	Q. palustris Muenchh.	312
Scarlet oak	Q. coccinea Muenchh.	313
Shingle oak	Q. imbricaria Michx.	314
Water oak	Q. nigra L.	315
Willow oak	Q. phellos L.	316
Bur oak	Q. macrocarpa Michx.	321
Chestnut oak	Q. prinus L.	322
Chinkapin oak	Q. muehlenbergii Engelm.	323
Overcup oak	Q. lyrata Walt.	324
Post oak	Q. stellata Wang.	325
Swamp chestnut oak	Q. michauxii Nutt.	326
Swamp white oak	Q. bicolor Willd.	327
Basswood	Tilia americana L.	330
Buckeye	Aesculus octandra Marsh.	331
Cottonwood	Populus deltoides Marsh.	332
Black gum	Nyssa sylvatica Marsh.	333
Red gum	Liquidambar styraciflua L.	334
Tupelo	Nyssa aquatica L.	335
Magnolia spp.	Magnolia spp.	336
Red maple	Acer rubrum L.	337
Yellow poplar	Liriodendron tulipifera L.	338

Table 11 (Continued)

Species Common Name	Scientific Name	Species Code
Black willow	Salix nigra Marsh.	340
Boxelder	Acer negundo L.	341
Butternut	Juglans cinerea L.	342
Silver maple	Acer saccharinum L.	343
American elm	Ulmus americana L.	345
Winged elm, etc.	Ulmus spp.	346
Ash	Fraxinus spp.	347
Beech	Fagus grandifolia Ehrh.	348
Yellow birch	Betula alleghaniensis Britt.	349
Sweet birch	Betula lenta L.	350
River birch	Betula nigra L.	351
Black cherry	Prunus serotina Ehrh.	352
Black walnut	Juglans nigra L.	353
Dogwood	Cornus florida L.	354
Hackberry	Celtis occidentalis L.	355
Hickory spp.	Carya spp.	356
Persimmon	Diospyros virginiana L.	357
Silverbell	Halesia carolina L.	358
Sourwood	Oxydendrum arboreum L.	359
Sycamore	Platanus occidentalis L.	360
Yellowwood	Cladrastis lutea Michx.	361
Catalpa	Catalpa speciosa Warder	363
Black locust	Robinia pseudoacacia L.	364
Honey locust	Gleditsia triacanthos L.	365
Mulberry	Morus spp.	366
Osage orange	Maclura pomifera Schn.	367
Sassafras	Sassafras albidum Nutt.	368
American hornbeam	Carpinus caroliniana Walt.	401
Chinquapin	Castanea pumila L.	402
Kentucky coffeetree	Gymnocladus dioicus L.	403
Fire cherry, chokecherry, etc.	Prunus spp.	404
Hawthorn spp.	Crataegus spp.	405
Ironwood	Ostrya virginiana Mill.	406
Mountain-ash	Sorbus americana March.	407
Mountain maple	Acer spicatum Lamb.	408
Striped maple	Acer pensylvanicum L.	409
Redbud	Cercis canadensis L.	410
Serviceberry	Amelanchier laevis Wieg.	411
Miscellaneous hardwoods		413

APPENDIX B

CALCULATION OF GROWTH COMPONENTS

The following notation is used in all growth component definitions and formulas:

M1 = first measurement

M2 = second measurement

YV = (d.b.h. of the first measurement - 0.4)^2

XV = (d.b.h. of the second measurement - 0.4)^2

XMH1 = merchantable height of the first measurement

XMH2 = merchantable height of the second measurement

B = beta constant in TVA regression equation

A = alpha constant in TVA regression equation

ZC1 = 1.0 - cull deduction percent of the first measurement

ZC2 = 1.0 - cull deduction percent of the second measurement

VOL = volume

BA = basal area

Y = (d.b.h. of the first measurement)^2

X = (d.b.h. of the second measurement)^2

ICON = 0.005454154

The volume and basal area for each growth component is multiplied by a constant to convert the calculations to a per acre per year basis. The formula for calculating the constant is:

$$\frac{\text{reciprocal of fraction of acre in plot}}{(\text{years between measurements}) \times (\text{number of plots measured})}$$

The threshold diameter limits for sawtimber trees are 9.0 inches d.b.h. for softwoods and 11.0 for hardwoods. Sawtimber volumes are expressed in board feet and basal area is expressed in square feet.

Pulpwood trees are those 5.0-8.9 inches d.b.h. for softwoods and 5.0-10.9 inches for hardwoods. Pulpwood volumes are expressed in cubic feet; basal area in square feet.

Ingrowth

Ingrowth is defined as the volume of trees that grow into measurable size during the interval between measurements.

A. From below 5 inches (pulpwood) and from below 11 inches (sawtimber) - provides a calculation of volume entering the threshold diameter.

Formulas: Pulpwood

$$VOL_1 = [(4.6)^2 \cdot XMH2 \cdot B + A]\ ZC2$$

$$BA_1 = (5.0)^2 \cdot ICON$$

Sawtimber

$$VOL_{21} = [(10.6)^2 \cdot XMH2 \cdot B + A]\ ZC2$$

$$BA_{21} = (11.0)^2 \cdot ICON$$

B. From cull (pulpwood and sawtimber) - calculates the volume contributed by trees that have changed from 100 percent cull in M1 to merchantable in M2.

Formulas: $VOL_2 = (XV \cdot XMH2 \cdot B + A)\ ZC2$

$$BA_2 = X \cdot ICON$$

C. Total ingrowth (pulpwood and sawtimber) - the total amount of incoming wood.

Formulas: Pulpwood

$$VOL_3 = VOL_1 + VOL_2$$

$$BA_3 = BA_1 + BA_2$$

Sawtimber

$$VOL_{22} = VOL_{21} + VOL_2$$

$$BA_{22} = BA_{21} + BA_2$$

Accretion

Accretion is defined as the increment on trees that either were present at both measurements or have contributed some amount of increment after entering a growth component category.

A. Normal survivor growth (pulpwood and sawtimber) - volume and basal area of trees present at both measurements that did not lose merchantable height.

Formulas: $VOL_4 = (XV \cdot XMH2 \cdot B + A)\ ZC2 - (YV \cdot XMH1 \cdot B + A)\ ZC1$

$$BA_4 = (X - Y)\ ICON$$

B. Accretion with height loss (pulpwood and sawtimber) - increment of trees that lost merchantable height between measurements.

Formulas: $VOL_5 = (XV \cdot XMH2 \cdot B + A)\ ZC2 - (YV \cdot XMH1 \cdot B + A)\ ZC1$

$$BA_5 = (X - Y)\ ICON$$

C. Potential survivor growth (pulpwood and sawtimber) - a theoretical value that estimates the amount of volume growth had the tree not lost merchantable height.

Formulas: $VOL_6 = (XV \cdot XMH1 \cdot B + A)\ ZC2 - (YV \cdot XMH1 \cdot B + A)\ ZC1$

$BA_6 - (X - Y)\ ICON$

D. Accretion and ingrowth (pulpwood and sawtimber) - the amount of material a tree contributes after it passes the threshold diameter.

Formulas: Pulpwood

$VOL_7 = [(XV - (4.6)^2)\ XMH2 \cdot B]\ ZC2$

$BA_7 = (X - 25.0)\ ICON$

Sawtimber

$VOL_{23} = [(XV - (10.6)^2)\ XMH2 \cdot B]\ ZC2$

$BA_{23} = [(X - (11.0)^2]\ ICON$

E. Prorated outgrowth (pulpwood) - the amount of growth contributed as a pulpwood tree before reaching the minimum sawtimber diameter.

Formulas: $VOL_8 = [((10.56)^2 - YV)\ XMH1 \cdot B]\ ZC1$

$BA_8 = [(10.96)^2 - Y]\ ICON$

F. Total accretion (pulpwood and sawtimber) - the total volume and basal area of accretion including trees that lost merchantable height.

Formulas: Pulpwood

$$VOL_9 = VOL_4 + VOL_5 + VOL_7 + VOL_8$$

$$BA_9 = BA_4 + BA_5 + BA_7 + BA_8$$

Sawtimber

$$VOL_{24} = VOL_4 + VOL_5 + VOL_{23}$$

$$BA_{24} = BA_4 + BA_5 + BA_{23}$$

G. Potential accretion (pulpwood and sawtimber) - the total increment of accretion assuming that no trees lost merchantable height.

Formulas: Pulpwood

$$VOL_{10} = VOL4 + VOL_6 + VOL_7 + VOL_8$$

$$BA_{10} + BA_4 + BA_6 + BA_7 + BA_8$$

Sawtimber

$$VOL_{25} = VOL_4 + VOL_6 + VOL_{23}$$

$$BA_{25} = BA_4 + BA_6 + BA_{23}$$

Outgrowth

Outgrowth is defined as the amount of growth lost from one account as a tree grows into another account or is culled.

A. Outgrowth to sawtimber (pulpwood) - the total cubic foot volume of a tree at the greatest diameter in the pulpwood class (10.96 inches).

Formulas: $VOL_{11} = [(10.56)^2 \cdot XMH1 \cdot B + A]\ ZC1$

$$BA_{11} = (10.96)^2\ ICON$$

B. Loss to cull (pulpwood and sawtimber) - the total

merchantable volume of the trees that become 100 percent cull between measurements.

Formulas: VOL_{12} = (YV · XMH1 · B + A) ZC1

BA_{12} = (X - Y) ICON

Mortality

Mortality is defined as the volume and basal area of trees that died during the measurement interval.

Formulas: Pulpwood and sawtimber

VOL_{13} = (YV · XMH1 · B + A) ZC1

BA_{13} = Y · ICON

Cut

The amount of wood harvested during the measurement interval is computed in the cut account.

Formulas: Pulpwood and sawtimber

VOL_{14} = (YV · XMH1 · B + A) ZC1

BA_{14} = Y · ICON

APPENDIX C

COMPONENTS OF FOREST GROWTH FOR EACH INVENTORIED LOCATION BY GROWTH PERIOD

Table 12. Sawtimber volume (bd.ft.,Int.1/4"/acre) for Scott County by species and inventory year.

Species	1962 n=98	1967* n=98	1967 n=99	1972 n=99	1977 n=99
Shortleaf pine	102.63	124.63	123.37	134.43	179.83
Virginia pine	--	8.75	8.66	16.32	36.71
White pine	33.66	51.38	50.86	67.99	165.77
Hemlock	0.46	1.78	1.76	1.23	34.38
Totals	136.75	186.54	184.65	220.97	416.69
[S/E./$\bar{X}$] x 100	49.25	42.72	42.51	39.10	33.57
Black oak	164.77	182.87	181.02	221.71	242.33
Northern red oak	96.61	108.37	107.27	152.69	190.06
Scarlet oak	46.64	73.60	72.85	85.62	124.58
Chestnut oak	228.11	278.71	275.89	385.27	558.97
White oak	118.27	161.93	160.29	210.84	313.45
Basswood	13.62	17.80	17.62	17.15	18.36
Buckeye	18.56	19.99	19.79	19.21	22.65
Black gum	40.50	53.33	52.79	52.02	62.25
Sweetgum	9.67	17.28	17.11	27.81	37.99
Magnolia spp.	11.20	11.75	11.63	12.54	4.08
Red maple	8.01	7.41	7.33	9.46	19.90
Yellow-poplar	157.03	196.84	194.85	314.20	710.20
Ash	18.68	27.08	26.81	24.75	44.20
Beech	8.62	11.02	10.91	12.43	14.20
Sweet birch	--	--	--	--	--
Black cherry	1.56	5.44	5.39	14.63	27.75
Black walnut	3.65	4.19	4.15	6.54	12.71
Hickory spp.	425.29	431.97	427.60	464.11	606.15
Sycamore	1.02	2.31	2.29	4.31	15.39
Black locust	3.78	6.61	6.55	7.61	10.81
Misc. hardwoods	88.69	115.57	114.40	149.49	187.43
Totals	1464.68	1734.07	1716.54	2192.39	3225.14
[S.E./$\bar{X}$] x 100	10.95	9.74	9.65	8.54	7.24
Grand Totals	1601.43	1920.61	1901.19	2413.36	3641.83
[S.E./$\bar{X}$] x 100	10.05	8.78	8.74	7.54	5.93

*One plot with one tree was missed in 1962, so volume was also analyzed without this plot in 1967.

Table 13. Pulpwood volume (cu.ft./acre) for Scott County by species and inventory year, based on 99 plots.

Species	1962 n=99	1967* n=98	1967 n=99	1972 n=99	1977 n=99
Shortleaf pine	6.82	7.23	7.16	6.74	6.40
Virginia pine	3.61	4.69	4.64	5.74	8.86
White pine	0.14	0.17	0.17	0.46	0.59
Hemlock	0.15	0.35	0.35	0.20	0.89
Totals	10.72	12.44	12.32	13.14	16.74
[S.E./$\bar{X}$] x 100	30.15	26.97	26.83	27.84	28.95
Black oak	11.13	11.94	11.82	13.29	16.14
Northern red oak	5.60	5.23	5.17	6.70	7.13
Southern red oak	0.46	0.41	0.41	0.86	0.93
Scarlet oak	1.65	2.16	2.14	4.06	7.63
Chestnut oak	26.86	34.43	34.09	45.11	44.30
White oak	13.53	16.92	16.75	22.97	22.14
Basswood	2.63	3.18	3.15	3.79	4.84
Buckeye	0.26	0.29	0.29	0.30	0.36
Cottonwood	0.00	0.00	0.00	0.18	0.36
Black gum	0.89	0.91	0.90	1.86	2.14
Sweetgum	7.30	6.58	6.51	6.78	6.45
Magnolia spp.	0.43	0.47	0.46	0.89	0.82
Red maple	3.86	4.87	4.82	8.79	10.95
Yellow-poplar	47.03	50.92	50.41	59.64	57.70
Black willow	0.28	0.00	0.00	0.00	0.00
Ash	2.80	2.63	2.60	3.72	2.45
Beech	0.00	0.24	0.24	0.52	0.61
Sweet birch	0.28	0.29	0.28	0.45	0.71
Black cherry	2.76	3.02	2.99	3.93	2.52
Black walnut	1.33	0.86	0.85	1.01	0.63
Dogwood	1.09	1.15	1.14	0.77	0.86
Hickory spp.	28.82	27.78	27.50	29.89	25.81
Sourwood	1.00	1.08	1.07	1.06	1.26
Sycamore	5.43	4.55	4.50	4.33	3.54
Black locust	4.52	6.62	6.55	5.41	4.99
Sassafras	0.00	0.00	0.00	0.32	0.68
Misc. hardwoods	3.79	4.22	4.18	7.01	7.66
Totals	173.73	190.75	188.82	234.23	233.61
[S.E./$\bar{X}$] x 100	10.45	8.88	8.84	7.64	6.93
Grand Totals	184.45	203.19	201.14	247.37	250.34
[S.E./$\bar{X}$] x 100	9.45	7.88	7.84	6.73	5.73

*One plot with one tree was missed in 1962, so volume was also analyzed without this plot in 1967.

Table 14. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Scott County 1962 to 1967.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.[a]	G.G.[b]	N.G.I.V.[c]	N.G.[d]	N.I.[e]
Shortleaf pine	0.73	0.00	0.00	0.00	3.67	4.40	3.67	4.40	4.40
Virginia pine	1.66	0.00	0.00	0.00	0.09	1.75	0.09	1.75	1.75
White pine	0.69	0.00	0.00	0.00	2.86	3.55	2.86	3.55	3.55
Hemlock	0.00	0.00	0.00	0.00	0.26	0.26	0.26	0.26	0.26
Black oak	2.49	3.11	0.00	0.56	5.63	8.12	1.96	4.45	4.45
Northern red oak	1.41	0.00	0.00	1.65	2.59	4.00	0.94	2.35	2.35
Scarlet oak	2.46	0.00	0.00	0.00	2.93	5.39	2.93	5.39	5.39
Chestnut oak	5.35	0.00	0.00	2.23	7.01	12.36	4.78	10.13	10.13
White oak	3.64	0.00	0.00	0.22	5.31	8.95	5.09	8.73	8.73
Basswood	0.71	0.00	0.00	0.25	0.37	1.08	0.12	0.83	0.83
Buckeye	0.00	0.00	0.00	0.00	0.29	0.29	0.29	0.29	0.29
Blackgum	0.00	0.00	0.00	0.00	2.57	2.57	2.57	2.57	2.57
Sweet or red gum	0.92	0.00	0.00	0.53	1.14	2.06	0.61	1.53	1.53
Magnolia spp.	0.00	0.00	0.00	0.00	0.11	0.11	0.11	0.11	0.11
Red maple	0.56	0.00	0.00	0.87	0.19	0.75	-0.68	-0.12	-0.12
Yellow-poplar	4.73	0.00	0.00	0.30	5.09	9.82	4.79	9.52	9.52
Ash	0.67	0.00	0.00	0.00	1.01	1.68	1.01	1.68	1.68
Beech	0.00	0.00	0.00	0.00	0.48	0.48	0.48	0.48	0.48
Black cherry	1.05	0.00	0.00	0.31	0.03	1.08	-0.28	0.77	0.77
Black walnut	0.00	0.00	0.00	0.00	0.11	0.11	0.11	0.11	0.11
Hickory spp.	3.11	1.28	0.00	0.64	0.88	3.99	-1.04	2.07	2.07
Sycamore	0.18	0.00	0.00	0.00	0.08	0.26	0.08	0.26	0.26
Black locust	0.31	0.00	0.00	0.00	0.26	0.57	0.26	0.57	0.57
Misc. hardwoods	1.97	0.00	0.00	0.15	3.56	5.53	3.41	5.38	5.38
Totals	32.64	4.39	0.00	7.71	46.52	79.16	34.42	67.06	67.06

Table 14 (Continued)

[a]G.G.I.V. = Gross growth initial volume.

[b]G.G. = Gross growth.

[c]N.G.I.V. = Net growth of initial volume

[d]N.G. = Net growth.

[e]N.I. = Net increase.

Table 15. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Scott County, 1967 to 1972.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.31	0.00	0.00	0.00	2.08	2.39	2.08	2.39	2.39
Virginia pine	0.93	0.00	0.00	0.00	0.60	1.53	0.60	1.53	1.53
White pine	0.00	0.00	0.00	0.00	3.43	3.43	3.43	3.43	3.43
Hemlock	0.00	0.00	0.00	0.00	-0.11	-0.11	-0.11	-0.11	-0.11
Black oak	6.27	2.82	0.00	0.62	5.23	11.50	1.79	8.06	8.06
Northern red oak	3.36	0.00	0.00	0.54	6.27	9.63	5.73	9.09	9.09
Scarlet oak	3.39	0.00	0.00	1.18	0.26	3.65	-0.92	2.47	2.47
Chestnut oak	14.20	0.00	0.00	5.11	12.79	26.99	7.68	21.88	21.88
White oak	1.50	0.00	0.00	1.77	10.38	11.88	8.61	10.11	10.11
Basswood	0.93	0.74	0.00	0.71	0.42	1.35	-1.03	-0.10	-0.10
Buckeye	0.00	0.00	0.00	0.54	0.42	0.42	-0.12	-0.12	-0.12
Black gum	0.00	0.00	0.00	0.85	0.70	2.70	-0.15	-0.15	-0.15
Sweet or red gum	1.13	0.00	0.00	0.00	1.01	2.14	1.01	2.14	2.14
Magnolia spp.	0.00	0.00	0.00	0.00	0.18	0.18	0.18	0.18	0.18
Red maple	0.24	0.00	0.00	0.00	0.18	0.42	0.18	0.42	0.42
Yellow-poplar	13.12	0.00	0.00	3.67	14.42	27.54	10.75	23.87	23.87
Ash	0.52	0.00	0.00	0.00	-0.93	-0.41	-0.93	-0.41	-0.41
Beech	0.00	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30
Black cherry	1.31	0.00	0.00	0.22	0.76	2.07	0.54	1.85	1.85
Black walnut	0.40	0.00	0.00	0.00	0.08	0.48	0.08	0.48	0.48
Hickory spp.	5.56	5.18	0.00	0.52	7.43	12.99	1.73	7.29	7.29
Sycamore	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.40	0.40
Black locust	0.28	0.00	0.00	0.00	-0.07	0.21	-0.07	0.21	0.21
Misc. hardwoods	1.29	0.00	0.00	0.00	5.72	7.01	5.72	7.01	7.01
Totals	54.74	8.74	0.00	15.73	71.95	126.69	47.48	102.22	102.22

Table 16. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Scott County, 1972 to 1977.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	1.46	0.00	0.00	0.00	7.42	8.88	7.42	8.88	8.88
Virginia pine	1.03	0.00	0.00	0.00	3.04	4.07	3.04	4.07	4.07
White pine	0.24	0.00	0.00	0.00	19.32	19.56	13.32	19.56	19.56
Hemlock	4.50	0.00	0.00	0.00	2.13	6.63	2.13	6.63	6.63
Black oak	1.26	0.00	0.00	0.42	5.81	7.07	5.39	6.65	6.65
Northern red oak	1.15	0.00	0.00	0.54	6.87	8.02	6.33	7.48	7.48
Scarlet oak	3.23	0.00	0.00	0.00	5.93	9.16	5.93	9.16	9.16
Chestnut oak	16.75	0.00	0.00	0.00	19.39	36.14	19.39	36.14	36.14
White oak	7.52	0.00	0.00	0.00	13.00	20.52	13.00	20.52	20.52
Basswood	0.00	0.00	0.00	1.27	1.85	1.85	0.58	0.58	0.58
Buckeye	0.00	0.00	0.00	0.00	0.69	0.69	0.69	0.69	0.69
Black gum	0.55	0.00	0.00	0.00	1.50	2.05	1.50	2.05	2.05
Sweet or red gum	1.39	0.00	0.00	0.54	1.19	2.58	0.65	2.04	2.04
Magnolia spp.	0.00	0.00	0.00	1.81	0.12	0.12	-1.69	-1.69	-1.69
Red maple	0.84	0.00	0.00	0.00	1.24	2.08	1.24	2.08	2.08
Yellow-poplar	33.63	0.00	0.00	0.00	45.79	79.42	45.79	79.42	79.42
Ash	0.97	0.00	0.00	0.00	3.05	4.02	3.05	4.02	4.02
Beech	0.00	0.00	0.00	0.00	0.35	0.35	0.35	0.35	0.35
Sweet birch	0.23	0.00	0.00	0.00	0.11	0.34	0.11	0.34	0.34
Black cherry	2.16	0.00	0.00	0.63	1.10	3.26	0.47	2.63	2.63
Black walnut	1.19	0.00	0.00	0.00	0.04	1.23	0.04	1.23	1.23
Hickory spp.	9.39	0.00	0.00	0.45	21.98	31.37	21.53	30.92	30.92
Sycamore	0.97	0.00	0.00	0.00	1.25	2.22	1.25	2.22	2.22
Black locust	0.00	0.00	0.00	0.00	0.64	0.64	0.64	0.64	0.64
Misc. hardwoods	4.25	0.00	0.00	0.00	4.66	8.91	4.66	8.91	8.91
Totals	92.71	0.00	0.00	5.66	168.47	261.18	162.81	255.52	255.52

Table 17. Pulpwood volume growth (cu.ft./acre/year) for Scott County, 1962 to 1967.

Species	Ingrowth	Mortality	Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.11	0.00	0.00	0.00	0.23	0.20	0.31	-0.03	0.08	0.08
Virginia pine	0.10	0.00	0.00	0.00	0.22	0.33	0.43	0.11	0.21	0.21
White pine	0.03	0.00	0.00	0.00	0.04	0.02	0.05	-0.02	0.01	0.01
Hemlock	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04	0.04
Black oak	0.22	0.09	0.00	0.10	0.44	0.58	0.80	-0.05	0.17	0.17
Northern red oak	0.08	0.00	0.00	0.10	0.22	0.19	0.27	-0.13	-0.05	-0.05
Southern red oak	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Scarlet oak	0.07	0.00	0.00	0.06	0.00	0.10	0.17	0.04	0.11	0.11
Chestnut oak	0.67	0.12	0.00	0.08	0.58	1.77	2.44	0.99	1.66	1.66
White oak	0.26	0.05	0.00	0.10	0.30	0.84	1.10	0.39	0.65	0.65
Basswood	0.00	0.00	0.00	0.05	0.00	0.16	0.16	0.11	0.11	0.11
Buckeye	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Black gum	0.02	0.00	0.00	0.04	0.00	0.02	0.04	-0.02	0.00	0.00
Sweet or red gum	0.05	0.12	0.00	0.14	0.23	0.35	0.40	-0.14	-0.09	-0.09
Magnolia spp.	0.03	0.00	0.00	0.00	0.00	-0.02	0.01	-0.02	0.01	0.01
Red maple	0.23	0.00	0.00	0.05	0.10	0.12	0.35	-0.03	0.20	0.20
Yellow-poplar	0.54	0.38	0.00	0.17	0.90	1.81	2.35	0.36	0.90	0.90
Black willow	0.00	0.00	0.00	0.06	0.00	0.00	0.00	-0.06	-0.06	-0.06
Ash	0.00	0.00	0.00	0.00	0.16	0.16	0.16	0.00	0.00	0.00
Beech	0.05	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.05
Black cherry	0.07	0.00	0.00	0.00	0.33	0.31	0.38	-0.02	0.05	0.05
Black walnut	0.00	0.00	0.00	0.14	0.00	0.04	0.04	-0.10	-0.10	-0.10
Dogwood	0.02	0.00	0.00	0.03	0.00	0.03	0.05	0.00	0.02	0.02
Hickory	0.21	0.11	0.00	0.30	0.22	0.22	0.43	-0.41	-0.20	-0.20
Sourwood	0.04	0.00	0.00	0.00	0.00	-0.03	0.01	-0.03	0.01	0.01
Sycamore	0.00	0.00	0.00	0.00	0.18	0.00	0.00	-0.18	-0.18	-0.18
Black locust	0.43	0.00	0.00	0.18	0.02	0.21	0.64	0.01	0.44	0.44
Misc. hardwoods	0.12	0.00	0.00	0.04	0.26	0.26	0.38	-0.04	0.08	0.08
Totals	3.39	0.87	0.00	1.64	4.43	7.67	11.06	0.73	4.12	4.12

Table 18. Pulpwood volume growth (cu.ft./acre/year) for Scott County, 1967 to 1972.

Species	Ingrowth	Mortality	Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.10	0.09	0.00	0.00	0.31	0.22	0.32	-0.18	-0.08	-0.08
Virginia pine	0.25	0.00	0.00	0.00	0.39	0.36	0.61	-0.03	0.22	0.22
White pine	0.04	0.00	0.00	0.00	0.00	0.02	0.06	0.02	0.06	0.06
Hemlock	0.00	0.03	0.00	0.00	0.00	0.00	0.00	-0.03	-0.03	-0.03
Black oak	0.65	0.37	0.00	0.00	0.65	0.66	1.31	-0.36	0.29	0.29
Northern red oak	0.42	0.05	0.00	0.00	0.35	0.29	0.71	-0.11	0.31	0.31
Southern red oak	0.00	0.00	0.00	0.00	0.00	0.09	0.07	0.09	0.09	0.09
Scarlet oak	0.60	0.00	0.00	0.00	0.26	0.17	0.77	-0.09	0.51	0.51
Chestnut oak	1.39	0.11	0.00	0.00	2.05	2.97	4.36	0.81	2.20	2.20
White oak	0.45	0.00	0.00	0.00	0.36	1.15	1.60	0.79	1.24	1.24
Basswood	0.03	0.00	0.00	0.08	0.00	0.18	0.21	0.10	0.13	0.13
Cottonwood	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03
Black gum	0.11	0.00	0.00	0.00	0.00	0.08	0.19	0.08	0.19	0.19
Sweet or red gum	0.10	0.15	0.00	0.00	0.23	0.33	0.43	-0.05	0.05	0.05
Magnolia spp.	0.03	0.00	0.00	0.00	0.00	0.06	0.09	0.06	0.09	0.09
Red maple	0.53	0.00	0.00	0.00	0.14	0.40	0.93	0.26	0.79	0.79
Yellow-poplar	1.06	0.26	0.00	0.05	2.54	3.65	4.71	0.80	1.86	1.86
Ash	0.08	0.00	0.00	0.00	0.12	0.27	0.35	0.15	0.23	0.23
Beech	0.02	0.00	0.00	0.00	0.00	0.03	0.05	0.03	0.05	0.05
Sweet birch	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Black cherry	0.05	0.00	0.00	0.00	0.12	0.25	0.30	0.13	0.18	0.18
Black walnut	0.06	0.00	0.00	0.00	0.08	0.05	0.11	-0.03	0.03	0.03
Dogwood	0.00	0.02	0.00	0.05	0.00	-0.01	-0.01	-0.08	-0 08	-0.08
Hickory spp.	0.75	0.00	0.00	0.06	0.77	0.56	1.31	-0.27	0.48	0.48
Sourwood	0.06	0.00	0.00	0.00	0.00	-0.06	0.00	-0.06	0.00	0.00
Sycamore	0.02	0.08	0.00	0.00	0.00	0.03	0.05	-0.05	-0.03	-0.03
Black locust	0.06	0.03	0.00	0.34	0.00	0.09	0.15	-0.28	-0.22	-0.22
Sassafras	0.06	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.06
Misc. hardwoods	0.25	0.00	0.00	0.00	0.04	0.35	0.60	0.31	0.56	0.56
Totals	7.20	1.19	0.00	0.58	8.41	12.22	19.42	2.04	9.24	9.24

Table 19. Pulpwood volume growth (cu.ft./acre/year) for Scott County, 1972 to 1977.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.00	0.00	0.00	0.05	0.23	0.20	0.20	-0.08	-0.08	-0.08
Virginia pine	0.16	0.00	0.00	0.00	0.06	0.53	0.69	0.47	0.63	0.63
White pine	0.00	0.00	0.00	0.00	0.09	0.12	0.12	0.03	0.03	0.03
Hemlock	0.08	0.00	0.00	0.00	0.00	0.06	0.14	0.06	0.14	0.14
Black oak	0.06	0.08	0.00	0.04	0.00	0.63	0.69	0.51	0.57	0.57
Northern red oak	0.05	0.13	0.00	0.00	0.16	0.33	0.38	0.04	0.09	0.09
Southern red oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Scarlet oak	0.20	0.00	0.00	0.00	0.12	0.52	0.72	0.40	0.60	0.60
Chestnut oak	0.73	0.19	0.00	0.12	2.65	1.98	2.71	-0.98	-0.25	-0.25
White oak	0.10	0.00	0.00	0.02	1.25	1.00	1.10	-0.27	-0.17	-0.17
Basswood	0.00	0.00	0.00	0.00	0.00	0.21	0.21	0.21	0.21	0.21
Buckeye	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Cottonwood	0.02	0.00	0.00	0.00	0.00	0.02	0.04	0.02	0.04	0.04
Black gum	0.00	0.00	0.00	0.04	0.00	0.07	0.07	0.03	0.03	0.03
Sweet or red gum	0.08	0.04	0.00	0.07	0.14	0.31	0.39	0.06	0.14	0.14
Magnolia spp.	0.00	0.00	0.00	0.04	0.00	0.03	0.03	-0.01	-0.01	-0.01
Red maple	0.50	0.00	0.00	0.21	0.17	0.33	0.83	-0.05	0.45	0.45
Yellow-poplar	0.61	0.25	0.00	0.07	4.62	3.98	4.59	-0.96	-0.35	-0.35
Ash	0.00	0.04	0.00	0.00	0.29	0.08	0.08	-0.25	-0.25	-0.25
Beech	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Sweet birch	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05
Black cherry	0.02	0.00	0.00	0.00	0.54	0.24	0.26	-0.30	-0.28	-0.28
Black walnut	0.00	0.02	0.00	0.00	0.00	-0.05	-0.05	-0.07	-0.07	-0.07
Dogwood	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Hickory spp.	0.09	0.17	0.00	0.02	1.35	0.63	0.72	-0.91	-0.82	-0.82
Sourwood	0.06	0.00	0.00	0.02	0.00	0.03	0.09	0.01	0.07	0.07

Table 19 (Continued)

Species	Ingrowth	Mortality	Loss to Cut	Outgrowth to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Sycamore	0.00	0.06	0.00	0.15	0.00	0.05	0.05	-0.16	-0.16	-0.16
Black locust	0.02	0.28	0.00	0.04	0.00	0.21	0.23	-0.11	-0.09	-0.09
Sassafras	0.04	0.00	0.00	0.00	0.00	0.03	0.07	0.03	0.07	0.07
Misc. hardwoods	0.05	0.00	0.00	0.00	0.34	0.30	0.35	-0.04	0.01	0.01
Totals	2.87	1.26	0.00	0.89	12.01	11.92	14.79	-2.24	0.63	0.63

Table 20. Sawtimber volume (bd.ft.,Int.1/4"/acre) for Wilson Mountain by species and inventory year, based on 69 plots.

Species	1962	1967	1972	1977
Shortleaf pine	361.84	377.30	399.00	329.12
Virginia pine	11.06	13.15	18.62	24.81
White pine	458.47	566.18	667.44	791.82
Hemlock	211.23	233.60	257.79	265.63
Totals	1042.60	1190.23	1342.85	1411.38
[S.E./$\bar{X}$] x 100	33.11	34.55	35.15	37.68
Black oak	79.66	76.08	103.88	125.92
Northern red oak	486.55	529.49	604.99	683.98
Southern red oak	12.74	14.02	15.53	16.76
Scarlet oak	36.36	42.04	54.85	54.65
Chestnut oak	1134.82	1293.61	1436.89	1672.73
White oak	400.38	439.53	497.14	567.41
Basswood	--	--	3.00	4.13
Black gum	107.09	104.16	106.62	115.83
Red gum	8.34	9.92	18.35	21.15
Red maple	52.51	62.45	75.91	70.92
Yellow-poplar	363.42	473.39	639.28	923.62
Ash	39.39	42.39	52.20	56.88
Black walnut	53.58	39.23	17.13	17.48
Hickory spp.	245.73	236.89	248.79	267.83
Black locust	11.55	10.44	9.44	2.69
Sassafras	1.54	1.75	1.97	2.20
Totals	3033.66	3375.39	3885.97	4604.18
[S.E./$\bar{X}$] x 100	11.20	11.08	10.59	9.87
Grand Totals	4076.26	4565.62	5228.82	6015.56
[S.E./$\bar{X}$] x 100	9.27	9.63	9.39	9.15

Table 21. Pulpwood volume (cu.ft./acre/year) for Wilson Mountain by species and inventory year, based on 69 plots.

Species	1962	1967	1972	1977
Shortleaf pine	21.46	21.53	18.37	17.53
Virginia pine	2.19	3.52	3.32	2.12
White pine	8.08	4.61	5.28	3.94
Hemlock	1.22	1.47	1.58	1.96
Totals	32.95	31.13	28.55	25.55
[S.E./$\bar{X}$] x 100	26.97	27.21	24.92	25.04
Black oak	7.66	9.31	7.54	5.84
Northern red oak	6.84	7.89	8.81	8.83
Blackjack oak	0.22	0.27	0.29	0.31
Scarlet oak	4.80	6.06	6.97	7.85
Chestnut oak	109.39	107.54	93.41	87.51
Post oak	0.49	0.54	0.60	0.67
White oak	14.21	13.18	11.17	10.04
Basswood	0.74	0.87	--	--
Black gum	9.31	10.60	11.62	11.57
Red or sweet gum	4.48	5.56	5.88	6.22
Red maple	21.45	28.12	28.44	34.95
Yellow-poplar	28.01	35.41	40.80	39.12
Winged elm	1.02	1.05	1.05	0.22
Ash	3.78	4.31	4.12	4.89
Beech	0.36	0.43	0.48	0.55
Sweet birch	0.69	0.76	0.82	0.82
Black cherry	--	0.21	--	--
Black walnut	2.52	1.93	1.25	1.25
Hickory spp.	28.50	26.29	25.25	22.64
Sourwood	6.47	6.67	7.41	6.76
Dogwood	0.29	0.30	0.30	0.44
Black locust	1.95	4.94	5.47	5.40
Persimmon	0.61	0.62	0.64	0.64
Mulberry spp.	0.41	0.00	--	--
Sassafras	0.36	0.56	0.72	0.42
Serviceberry	0.45	0.46	0.48	0.49
Totals	255.01	273.88	263.52	257.43
[S.E./$\bar{X}$] x 100	8.88	8.19	7.70	7.58
Grand Totals	287.96	305.01	292.07	282.98
[S.E./$\bar{X}$] x 100	6.38	5.90	5.42	5.42

Table 22. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Wilson Mountain, 1962 to 1967.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.95	2.54	0.00	0.00	4.68	5.63	2.14	3.09	3.09
Virginia pine	0.00	0.00	0.00	0.00	0.42	0.42	0.42	0.42	0.42
White pine	1.92	0.59	0.00	0.00	20.21	22.13	19.62	21.54	21.54
Hemlock	0.00	0.00	0.00	0.00	4.48	4.48	4.48	4.48	4.48
Black oak	0.27	0.00	0.00	2.90	1.91	2.18	-0.99	-0.72	-0.72
Red oak	1.33	3.49	0.00	0.00	10.70	12.03	7.21	8.54	8.54
Southern red oak	0.00	0.00	0.00	0.00	0.26	0.26	0.26	0.26	0.26
Scarlet oak	0.00	0.00	0.00	0.00	1.14	1.14	1.14	1.14	1.14
Chestnut oak	11.64	0.00	0.00	2.11	22.23	33.87	20.12	31.76	31.76
White oak	1.14	0.94	0.00	0.00	7.62	8.76	6.68	7.82	7.82
Black gum	0.00	0.00	0.00	1.58	1.00	1.00	-0.58	-0.58	-0.58
Sweet or red gum	0.00	0.00	0.00	0.00	0.32	0.32	0.32	0.32	0.32
Red maple	0.32	0.00	0.00	0.26	1.93	2.25	1.67	1.99	1.99
Yellow-poplar	9.97	0.00	0.00	0.00	12.02	21.99	12.02	21.99	21.99
Ash	0.00	0.00	0.00	0.00	0.60	0.60	0.60	0.60	0.60
Black walnut	0.00	0.00	0.00	0.84	-2.03	-2.03	-2.87	-2.87	-2.87
Hickory spp.	1.71	3.97	0.00	1.11	1.60	3.31	-3.48	-1.77	-1.77
Black locust	0.00	0.00	0.00	0.57	0.35	0.35	-0.22	-0.22	-0.22
Sassafras	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04
Totals	29.25	11.53	0.00	9.37	89.48	118.73	68.58	97.83	97.83

Table 23. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Wilson Mountain, 1967 to 1972.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.60	0.50	0.00	0.00	4.24	4.84	3.74	4.34	4.34
Virginia pine	0.50	0.00	0.00	0.00	0.59	1.09	0.59	1.09	1.09
White pine	0.00	0.24	0.00	0.00	20.49	20.49	20.25	20.25	20.25
Hemlock	0.00	0.00	0.00	0.00	4.84	4.84	4.84	4.84	4.84
Black oak	2.24	0.00	0.00	0.00	3.32	5.56	3.32	5.56	5.56
Northern red oak	2.32	0.00	0.00	0.00	12.78	15.10	12.78	15.10	15.10
Southern red oak	0.00	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30
Scarlet oak	1.05	0.00	0.00	0.00	1.51	2.56	1.51	2.56	2.56
Chestnut oak	12.30	3.46	0.00	7.73	27.54	39.84	16.35	28.65	28.65
White oak	1.66	0.00	0.00	0.58	10.45	12.11	9.87	11.53	11.53
Basswood	0.59	0.00	0.00	0.00	0.01	0.60	0.01	0.60	0.60
Black gum	0.24	0.00	0.00	0.79	1.04	1.28	0.25	0.49	0.49
Sweet or red gum	1.14	0.00	0.00	0.00	0.54	1.68	0.54	1.68	1.68
Red maple	0.79	0.34	0.00	0.25	2.48	3.27	1.89	2.68	2.68
Yellow-poplar	11.95	0.00	0.00	0.00	21.23	33.18	21.23	33.18	33.18
Ash	1.05	0.00	0.00	0.00	0.91	1.96	0.91	1.96	1.96
Black walnut	0.00	0.00	0.00	4.63	0.21	0.21	-4.42	-4.42	-4.42
Hickory spp.	2.31	2.74	0.00	0.38	3.19	5.50	0.07	2.38	2.38
Black locust	0.00	0.00	0.00	0.30	0.10	0.10	-0.20	-0.20	-0.20
Sassafras	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04
Totals	38.74	7.28	0.00	14.66	115.81	154.55	93.87	132.61	132.61

Table 24. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Wilson Mountain, 1972 to 1977.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.22	15.22	0.00	0.00	1.62	1.84	-13.60	-13.38	-13.38
Virginia pine	0.50	0.00	0.00	0.00	0.74	1.24	0.74	1.24	1.24
White pine	0.21	0.00	0.00	0.00	24.66	24.87	24.66	24.87	24.87
Hemlock	0.00	3.19	0.00	0.00	4.76	4.76	1.57	1.57	1.57
Black oak	1.20	0.00	0.00	0.36	3.57	4.77	3.21	4.41	4.41
Northern red oak	0.90	6.58	0.00	0.77	22.25	23.15	14.90	15.80	15.80
Southern red oak	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.25	0.25
Scarlet oak	0.60	1.72	0.00	0.39	1.47	2.07	-0.64	-0.04	-0.04
Chestnut oak	10.48	5.46	0.00	2.98	45.14	55.62	36.70	47.18	47.18
White oak	0.90	0.00	0.00	0.39	13.54	14.44	13.15	14.05	14.05
Basswood	0.00	0.00	0.00	0.00	0.23	0.23	0.23	0.23	0.23
Black gum	0.54	0.00	0.00	0.00	1.30	1.84	1.30	1.84	1.84
Sweet or red gum	0.47	0.00	0.00	0.00	0.09	0.56	0.09	0.56	0.56
Red maple	1.26	0.00	0.00	4.50	2.24	3.50	-2.26	-1.00	-1.00
Yellow-poplar	13.80	0.00	0.00	0.00	43.06	56.86	43.06	56.86	56.86
Ash	0.00	0.00	0.00	0.00	0.94	0.94	0.94	0.94	0.94
Black walnut	0.00	0.00	0.00	0.00	0.07	0.07	0.07	0.07	0.07
Hickory spp.	0.00	0.00	0.00	0.00	3.81	3.81	3.81	3.81	3.81
Black locust	0.00	1.37	0.00	0.00	0.02	0.02	-1.35	-1.35	-1.35
Sassafras	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05
Totals	31.08	33.54	0.00	9.39	169.81	200.89	126.88	157.96	157.96

Table 25. Pulpwood volume growth (cu.ft./acre/year) for Wilson Mountain, 1962 to 1967.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.05	0.26	0.00	0.00	0.00	0.22	0.27	-0.04	0.01	0.01
Virginia pine	0.09	0.00	0.00	0.00	0.00	0.18	0.27	0.18	0.27	0.27
White pine	0.06	0.00	0.00	0.00	0.95	0.20	0.26	-0.75	-0.69	-0.69
Hemlock	0.03	0.00	0.00	0.00	0.00	0.02	0.05	0.02	0.05	0.05
Black oak	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.33	0.33
Northern red oak	0.20	0.00	0.00	0.00	0.31	0.33	0.53	0.02	0.22	0.22
Blackjack oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Scarlet oak	0.03	0.00	0.00	0.00	0.00	0.22	0.25	0.22	0.25	0.25
Chestnut oak	0.69	0.34	0.00	0.00	4.19	3.47	4.16	-1.06	-0.37	-0.37
Post oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
White oak	0.13	0.00	0.00	0.00	0.70	0.37	0.50	-0.33	-0.20	-0.20
Basswood	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Black gum	0.03	0.00	0.00	0.00	0.00	0.22	0.25	0.22	0.25	0.25
Sweet or red gum	0.03	0.00	0.00	0.00	0.00	0.19	0.22	0.19	0.22	0.22
Red maple	0.46	0.00	0.00	0.08	0.00	0.95	1.41	0.87	1.33	1.33
Yellow-poplar	0.61	0.08	0.00	0.00	0.83	1.79	2.40	0.88	1.49	1.49
Winged elm	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Ash	0.04	0.11	0.00	0.00	0.00	0.17	0.21	0.06	0.10	0.10
Beech	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Sweet birch	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Black cherry	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04	0.04
Black walnut	0.00	0.09	0.00	0.04	0.00	0.01	0.01	-0.12	-0.12	-0.12
Hickory spp.	0.06	0.14	0.00	0.00	0.77	0.40	0.46	-0.51	-0.45	-0.45
Sourwood	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04
Black locust	0.33	0.00	0.00	0.00	0.00	0.27	0.60	0.27	0.60	0.60
Mulberry	0.00	0.00	0.00	0.08	0.00	0.00	0.00	-0.08	-0.08	-0.08
Sassafras	0.03	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.04	0.04
Totals	2.91	1.02	0.00	0.20	7.75	9.47	12.38	0.50	3.41	3.41

Table 26. Pulpwood volume growth (cu.ft./acre/year) for Wilson Mountain, 1967 to 1972.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.16	0.44	0.00	0.00	0.55	0.21	0.37	-0.78	-0.62	-0.62
Virginia pine	0.00	0.00	0.00	0.00	0.26	0.22	0.22	-0.04	-0.04	-0.04
White pine	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.13	0.13	0.13
Hemlock	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Black oak	0.11	0.00	0.00	0.00	0.61	0.14	0.25	-0.47	-0.36	-0.36
Northern red oak	0.12	0.00	0.00	0.00	0.23	0.29	0.41	0.06	0.18	0.18
Blackjack oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Scarlet oak	0.25	0.00	0.00	0.00	0.34	0.26	0.51	-0.08	0.17	0.17
Chestnut oak	0.67	0.79	0.00	0.00	6.33	3.52	4.19	-3.60	-2.93	-2.93
Post oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
White oak	0.29	0.06	0.00	0.00	0.87	0.24	0.53	-0.69	-0.40	-0.40
Basswood	0.00	0.00	0.00	0.00	0.21	0.04	0.04	-0.17	-0.17	-0.17
Black gum	0.13	0.04	0.00	0.09	0.00	0.20	0.33	0.07	0.20	0.20
Sweet or red gum	0.00	0.05	0.00	0.00	0.00	0.12	0.12	0.07	0.07	0.07
Red maple	0.50	0.00	0.00	0.12	1.21	0.89	1.39	-0.44	0.06	0.06
Yellow-poplar	0.68	0.00	0.00	0.00	2.19	2.59	3.27	0.40	1.08	1.08
Ash	0.06	0.00	0.00	0.05	0.26	0.20	0.26	-0.11	-0.05	-0.05
Beech	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Sweet birch	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Black cherry	0.00	0.04	0.00	0.00	0.00	0.00	0.00	-0.04	-0.04	-0.04
Black walnut	0.00	0.21	0.00	0.00	0.00	0.07	0.07	-0.14	-0.14	-0.14
Hickory spp.	0.12	0.04	0.00	0.06	0.46	0.24	0.36	-0.32	-0.20	-0.20
Sourwood	0.16	0.00	0.00	0.05	0.00	0.03	0.19	-0.02	0.14	0.14
Black locust	0.15	0.22	0.00	0.04	0.00	0.22	0.37	-0.04	0.11	0.11
Sassafras	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03
Totals	3.43	1.89	0.00	0.41	13.52	9.67	13.10	-6.15	-2.72	-2.72

Table 27. Pulpwood volume growth (cu.ft./acre/year) for Wilson Mountain, 1972 to 1977.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.15	0.80	0.00	0.00	0.00	0.27	0.42	-0.53	-0.38	-0.38
Virginia pine	0.04	0.13	0.00	0.00	0.27	0.13	0.17	-0.27	-0.23	-0.23
White pine	0.00	0.23	0.00	0.00	0.12	0.08	0.08	-0.27	-0.27	-0.27
Hemlock	0.06	0.00	0.00	0.00	0.00	0.02	0.08	0.02	0.08	0.08
Black oak	0.03	0.00	0.00	0.00	0.60	0.22	0.25	-0.38	-0.35	-0.35
Northern red oak	0.04	0.07	0.00	0.00	0.20	0.23	0.27	-0.04	0.00	0.00
Scarlet oak	0.14	0.03	0.00	0.00	0.37	0.43	0.57	0.03	0.17	0.17
Chestnut oak	0.27	0.46	0.00	0.00	4.59	3.60	3.87	-1.45	-1.18	-1.18
Post oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
White oak	0.00	0.46	0.00	0.08	0.00	0.41	0.41	-0.13	-0.13	-0.13
Black gum	0.07	0.00	0.00	0.06	0.20	0.17	0.24	-0.09	-0.02	-0.02
Sweet or red gum	0.03	0.00	0.00	0.00	0.00	0.04	0.07	0.04	0.07	0.07
Red maple	0.92	0.34	0.00	0.17	0.35	1.25	2.17	0.39	1.31	1.31
Yellow-poplar	0.79	0.00	0.00	0.00	3.95	3.19	3.98	-0.76	0.03	0.03
Winged elm	0.00	0.16	0.00	0.00	0.00	0.00	0.00	-0.16	-0.16	-0.16
Ash	0.09	0.15	0.00	0.00	0.00	0.22	0.31	0.07	0.16	0.16
Beech	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Dogwood	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03
Hickory spp.	0.00	0.82	0.00	0.00	0.00	0.29	0.29	-0.53	-0.53	-0.53
Sourwood	0.00	0.00	0.00	0.15	0.00	0.02	0.02	-0.13	-0.13	-0.13
Black locust	0.06	0.33	0.00	0.00	0.00	0.30	0.36	-0.03	0.03	0.03
Sassafras	0.00	0.07	0.00	0.00	0.00	0.01	0.01	-0.06	-0.06	-0.06
Totals	2.72	4.05	0.00	0.46	10.65	10.90	13.62	-4.26	-1.54	-1.54

Table 28. Sawtimber volume (bd.ft.,Int.1/4"/acre) for Brushy Mountain by species and inventory year, based on 169 plots.

Species	1963	1968	1973	1978
Shortleaf pine	326.97	310.80	305.57	348.86
Virginia pine	41.86	38.75	54.93	73.03
Loblolly pine	--	9.30	43.07	65.77
White pine	56.30	33.94	40.23	37.24
Hemlock	31.92	36.65	40.76	43.38
Totals	457.05	429.44	484.56	568.28
[S.E./$\bar{X}$] x 100	17.85	18.85	17.08	17.08
Black oak	112.26	113.52	142.74	205.48
Northern red oak	138.15	166.38	218.89	274.30
Southern red oak	3.02	4.04	6.74	7.41
Scarlet oak	118.36	114.92	132.23	183.68
Chestnut oak	532.68	640.10	908.70	1285.88
Post oak	1.78	1.03	2.63	3.51
Swamp chestnut oak	--	--	1.22	2.60
Swamp white oak	4.03	0.00	1.30	6.37
White oak	197.55	184.48	237.58	315.72
Buckeye	6.90	7.63	10.66	12.17
Black gum	29.75	30.68	31.96	35.70
Red gum	24.64	21.68	27.70	41.99
Magnolia spp.	--	--	1.51	1.66
Red maple	12.55	12.58	25.39	45.39
Yellow-poplar	169.47	201.33	300.76	441.15
Winged elm	10.30	11.90	13.39	14.88
Ash	13.69	14.66	20.24	22.68
Beech	9.88	10.63	4.39	6.55
Black cherry	1.71	1.99	2.09	0.00
Black walnut	0.89	1.00	1.19	1.24
Hickory spp.	123.88	89.26	102.48	104.23
Sourwood	--	0.69	0.00	0.00
Black locust	4.29	5.58	8.32	6.19
Misc. hardwoods	14.06	15.63	18.21	19.60
Totals	1529.84	1649.71	2220.32	3038.38
[S.E./$\bar{X}$] x 100	10.08	10.31	9.31	8.23
Grand Totals	1986.89	2079.15	2704.88	3606.66
[S.E./$\bar{X}$] x 100	7.46	7.92	7.08	6.31

Table 29. Pulpwood volume (cu.ft./acre/year) for Brushy Mountain by species and inventory year, based on 169 plots.

Species	1963	1968	1973	1978
Shortleaf pine	52.15	47.67	41.28	32.82
Virginia pine	2.82	1.93	6.36	8.62
Pitch pine	--	--	0.07	0.10
Loblolly pine	4.50	9.53	8.78	2.80
White pine	0.33	0.55	0.37	1.09
Hemlock	0.12	0.23	0.09	0.15
Totals	59.92	59.91	56.95	45.98
[S.E./$\bar{X}$] x 100	17.00	19.92	19.46	20.08
Black oak	9.00	6.73	6.00	5.61
Northern red oak	6.46	4.25	4.93	5.23
Blackjack oak	0.22	0.24	0.15	0.00
Scarlet oak	16.81	9.94	11.32	14.99
Chestnut oak	77.47	69.11	72.62	78.14
Post oak	0.14	0.18	0.19	0.67
Swamp white oak	0.59	0.87	0.70	0.32
White oak	16.60	14.80	12.40	13.38
Basswood	0.48	0.51	0.81	1.06
Buckeye	0.93	1.09	0.68	0.62
Black gum	1.71	2.16	2.78	3.34
Red gum	5.32	7.75	13.37	18.56
Magnolia spp.	0.40	0.46	0.00	0.00
Red maple	6.24	7.81	12.57	23.87
Yellow-poplar	12.42	13.78	17.89	25.77
Winged elm	0.58	0.77	0.62	0.78
Ash	2.06	2.64	3.08	3.60
Sweet birch	0.86	0.78	0.89	1.24
Black cherry	--	0.34	0.93	1.40
Black walnut	1.09	1.52	2.06	2.00
Dogwood	--	0.12	0.00	0.00
Hickory spp.	7.32	7.40	6.95	7.40
Sourwood	1.89	1.76	1.70	2.58
Sycamore	0.78	1.07	1.28	1.76
Black locust	1.90	3.72	5.06	5.30
Mulberry	--	0.08	0.29	0.60
Ironwood	0.06	0.06	0.06	0.00

Table 29 (Continued)

Species	1963	1968	1973	1978
Serviceberry	0.31	0.33	0.37	0.32
Misc. hardwoods	--	--	--	0.12
Totals	171.64	160.27	179.70	218.66
[S.E./$\bar{X}$] x 100	7.92	8.15	7.46	7.23
Grand Totals	231.56	220.18	236.65	264.24
[S.E./$\bar{X}$] x 100	5.62	6.38	5.69	5.54

Table 30. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Brushy Mountain, 1963 to 1968.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	4.56	13.32	0.00	0.00	5.47	10.03	-7.85	-3.29	-3.29
Virginia pine	0.44	2.63	0.00	0.00	1.56	2.00	-1.07	-0.63	-0.63
Loblolly pine	1.58	0.00	0.00	0.00	0.31	1.89	0.31	1.89	1.89
White pine	0.00	5.34	0.00	0.00	0.79	0.79	-4.55	-4.55	-4.55
Hemlock	0.00	0.00	0.00	0.00	0.96	0.96	0.96	0.96	0.96
Black oak	1.58	4.11	0.00	0.00	2.78	4.36	-1.33	0.25	0.25
Northern red oak	1.24	0.46	0.00	0.00	4.97	6.21	4.51	5.75	5.75
Southern red oak	0.00	0.00	0.00	0.00	0.21	0.21	0.21	0.21	0.21
Scarlet oak	2.07	5.48	0.00	0.00	2.70	4.77	-2.78	-0.71	-0.71
Chestnut oak	8.79	2.19	0.00	0.00	15.28	24.07	13.09	21.88	21.88
Post oak	0.21	0.36	0.00	0.00	0.00	0.21	-0.36	-0.15	-0.15
Swamp white oak	0.00	0.82	0.00	0.00	0.00	0.00	-0.82	-0.82	-0.82
White oak	1.34	7.73	0.00	0.00	3.73	5.07	-4.00	-2.66	-2.66
Buckeye	0.00	0.00	0.00	0.00	0.15	0.15	0.15	0.15	0.15
Black gum	0.23	0.38	0.00	0.19	0.54	0.77	-0.03	0.20	0.20
Sweet or red gum	0.29	1.45	0.00	0.00	0.55	0.84	-0.90	-0.61	-0.61
Red maple	0.71	0.98	0.00	0.00	0.27	0.98	-0.71	0.00	0.00
Yellow-poplar	2.52	2.94	0.00	0.00	6.90	9.42	3.96	6.48	6.48
Winged elm	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.33	0.33
Ash	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.20	0.20
Beech	0.00	0.00	0.00	0.00	0.15	0.15	0.15	0.15	0.15
Black cherry	0.00	0.00	0.00	0.00	0.06	0.06	0.06	0.06	0.06
Black walnut	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Hickory spp.	0.00	8.15	0.00	0.00	1.10	1.10	-7.05	-7.05	-7.05
Sourwood	0.14	0.00	0.00	0.00	0.00	0.14	0.00	0.14	0.14
Black locust	0.19	0.00	0.00	0.00	0.07	0.26	0.07	0.26	0.26
Misc. hardwoods	0.00	0.00	0.00	0.00	0.32	0.32	0.32	0.32	0.32
Totals	25.89	56.34	0.00	0.19	49.42	75.31	-7.11	18.78	18.78

Table 31. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Brushy Mountain, 1968 to 1973.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	4.93	1.48	11.36	0.00	6.86	11.79	5.38	10.31	-1.05
Virginia pine	0.82	0.00	0.00	0.00	2.44	3.26	2.44	3.26	3.26
Loblolly pine	3.51	0.00	0.00	0.00	3.44	6.95	3.44	6.95	6.95
White pine	0.19	0.00	0.00	0.00	1.08	1.27	1.08	1.27	1.27
Hemlock	0.01	0.00	0.00	0.00	0.82	0.83	0.82	0.83	0.83
Black oak	3.40	0.16	2.66	0.00	5.30	8.70	5.14	8.54	5.88
Northern red oak	2.54	0.55	0.13	0.00	8.71	11.25	8.16	10.70	10.57
Southern red oak	0.00	0.00	0.00	0.00	0.54	0.54	0.54	0.54	0.54
Scarlet oak	2.80	0.57	2.81	0.70	4.71	7.51	3.44	6.24	3.43
Chestnut oak	29.43	1.13	2.44	1.05	29.23	58.66	27.05	56.48	54.04
Post oak	0.00	0.00	0.00	0.00	0.32	0.32	0.32	0.32	0.32
Swamp chestnut oak	0.22	0.00	0.00	0.00	0.02	0.24	0.02	0.24	0.24
Swamp white oak	0.22	0.00	0.00	0.00	0.04	0.26	0.04	0.26	0.26
White oak	3.37	0.91	0.00	0.39	8.60	11.97	7.30	10.67	10.67
Buckeye	0.52	0.00	0.00	0.00	0.09	0.61	0.09	0.61	0.61
Black gum	0.00	0.00	0.00	0.00	0.26	0.26	0.26	0.26	0.26
Sweet or red gum	0.45	0.37	0.17	0.00	1.31	1.76	0.94	1.39	1.22
Magnolia spp.	0.27	0.00	0.00	0.00	0.03	0.30	0.03	0.30	0.30
Red maple	2.06	0.00	0.00	0.18	0.70	2.76	0.52	2.58	2.58
Yellow-poplar	7.68	0.00	2.22	0.00	14.53	22.21	14.53	22.21	19.99
Winged elm	0.00	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30
Ash	0.00	0.00	0.00	0.00	1.12	1.12	1.12	1.12	1.12
Beech	0.19	0.00	0.00	1.54	0.09	0.28	-1.45	-1.26	-1.26
Black cherry	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Black walnut	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04

Table 31 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Hickory spp.	1.47	0.00	0.00	0.00	1.29	2.66	1.29	2.66	2.66
Sourwood	0.00	0.00	0.00	0.14	0.00	0.00	-0.14	-0.14	-0.14
Black locust	0.02	0.00	0.00	0.00	0.55	0.57	0.55	0.57	0.57
Misc. hardwoods	0.00	0.00	0.00	0.00	0.52	0.52	0.52	0.52	0.52
Totals	64.00	5.17	21.79	4.00	92.96	156.96	83.79	147.79	126.00

Table 32. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for Brushy Mountain, 1973 to 1978.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	4.13	7.46	0.00	0.00	12.68	16.81	5.22	9.35	9.35
Virginia pine	0.58	0.00	0.00	0.00	2.99	3.57	2.99	3.57	3.57
Loblolly pine	1.98	1.91	0.00	0.00	5.31	7.29	3.40	5.38	5.38
White pine	0.28	2.48	0.00	0.00	1.60	1.88	-0.88	-0.60	-0.60
Hemlock	0.00	0.00	0.00	0.00	0.52	0.52	0.52	0.52	0.52
Black oak	3.07	0.00	0.00	0.22	9.77	12.84	9.55	12.62	12.62
Northern red oak	0.20	2.66	0.00	0.00	13.61	13.81	10.95	11.15	11.15
Southern red oak	0.00	0.00	0.00	0.00	0.13	0.13	0.13	0.13	0.13
Scarlet oak	2.57	0.36	0.00	0.00	8.15	10.72	7.79	10.36	10.36
Chestnut oak	17.66	3.65	0.00	1.66	63.55	81.21	58.24	75.90	75.90
Post oak	0.00	0.00	0.00	0.00	0.18	0.18	0.18	0.18	0.18
Swamp chestnut oak	0.00	0.00	0.00	0.00	0.28	0.28	0.28	0.28	0.28
Swamp white oak	0.47	0.00	0.00	0.00	0.55	1.02	0.55	1.02	1.02
White oak	3.50	1.72	0.00	0.00	13.94	17.44	12.22	15.72	15.72
Buckeye	0.00	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30
Black gum	0.47	0.27	0.00	0.33	0.88	1.35	0.28	0.75	0.75
Sweet or red gum	1.37	0.00	0.00	0.00	1.51	2.88	1.51	2.88	2.88
Magnolia spp.	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Red maple	2.17	0.00	0.00	0.16	2.01	4.18	1.85	4.02	4.02
Yellow-poplar	8.39	0.32	0.00	0.00	20.18	28.57	19.86	28.25	28.25
Winged elm	0.00	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30
Ash	0.30	0.42	0.00	0.00	0.41	0.71	-0.01	0.29	0.29
Beech	0.00	0.00	0.00	0.00	0.43	0.43	0.43	0.43	0.43
Black cherry	0.00	0.42	0.00	0.00	0.00	0.00	-0.42	-0.42	-0.42
Black walnut	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01

Table 32 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Hickory spp.	0.48	2.60	0.00	0.38	2.84	3.32	-0.14	0.34	0.34
Black locust	0.00	0.46	0.00	0.00	0.03	0.03	-0.43	-0.43	-0.43
Misc. hardwoods	0.00	0.00	0.00	0.00	0.28	0.28	0.28	0.28	0.28
Totals	47.62	24.73	0.00	2.75	162.47	210.09	134.99	182.61	182.61

Table 33. Pulpwood volume growth (cu.ft./acre/year) for Brushy Mountain, 1963 to 1968.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	1.02	1.28	0.00	0.00	2.04	1.39	2.41	-1.93	-0.91	-0.91
Virginia pine	0.02	0.11	0.00	0.00	0.19	0.10	0.12	-0.20	-0.18	-0.18
Loblolly pine	0.23	0.00	0.00	0.00	0.38	1.18	1.41	0.80	1.03	1.03
White pine	0.01	0.02	0.00	0.00	0.00	0.05	0.06	0.03	0.04	0.04
Hemlock	0.01	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.02	0.02
Black oak	0.12	0.62	0.00	0.00	0.30	0.34	0.46	-0.58	-0.46	-0.46
Northern red oak	0.04	0.33	0.00	0.00	0.40	0.24	0.28	-0.49	-0.45	-0.45
Scarlet oak	0.07	1.35	0.00	0.04	0.49	0.41	0.48	-1.47	-1.40	-1.40
Chestnut oak	0.46	0.29	0.00	0.00	4.22	2.35	2.81	-2.16	-1.70	-1.70
Post oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Swamp white oak	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.06	0.06	0.06
White oak	0.12	0.41	0.00	0.00	0.59	0.51	0.63	-0.49	-0.37	-0.37
Basswood	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Buckeye	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Black gum	0.05	0.00	0.00	0.00	0.00	0.04	0.09	0.04	0.09	0.09
Sweet or red gum	0.32	0.12	0.00	0.02	0.00	0.31	0.63	0.17	0.49	0.49
Magnolia spp.	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Red maple	0.10	0.01	0.00	0.00	0.08	0.37	0.47	0.28	0.38	0.38
Yellow-poplar	0.19	0.24	0.00	0.03	0.43	0.80	0.99	0.10	0.29	0.29
Winged elm	0.03	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.04	0.04
Ash	0.05	0.00	0.00	0.04	0.00	0.10	0.15	0.06	0.11	0.11
Sweet birch	0.01	0.00	0.00	0.00	0.06	0.02	0.03	-0.04	-0.03	-0.03
Black cherry	0.05	0.00	0.00	0.00	0.00	0.02	0.07	0.02	0.07	0.07
Black walnut	0.05	0.00	0.00	0.00	0.00	0.0[illegible]	0.09	0.04	0.09	0.09
Dogwood	0.02	0.00	0.00	0.00	0.00	0.0[illegible]	0.02	0.00	0.02	0.02
Hickory spp.	0.02	0.01	0.00	0.06	0.09	0.15	0.17	-0.01	0.01	0.01
Sourwood	0.04	0.03	0.00	0.00	0.04	0.00	0.04	-0.07	-0.03	-0.03

Table 33 (Continued)

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Sycamore	0.02	0.00	0.00	0.00	0.00	0.04	0.06	0.04	0.06	0.06
Black locust	0.31	0.10	0.00	0.00	0.00	0.16	0.47	0.06	0.37	0.37
Mulberry	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01
Serviceberry	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Totals	3.37	4.92	0.00	0.19	9.31	8.77	12.14	-5.65	-2.28	-2.28

Table 34. Pulpwood volume growth (cu.ft./acre/year) for Brushy Mountain, 1968 to 1973.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.26	0.66	0.28	0.00	1.95	1.42	1.68	-1.19	-0.93	-1.21
Virginia pine	0.10	0.04	0.00	0.00	0.00	0.09	0.19	0.05	0.15	0.15
Pitch pine	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01
Loblolly pine	0.18	0.04	0.00	0.00	0.58	0.60	0.78	-0.02	0.16	0.16
White pine	0.04	0.00	0.00	0.00	0.13	0.06	0.10	-0.07	-0.03	-0.03
Hemlock	0.00	0.00	0.00	0.00	0.04	0.01	0.01	-0.03	-0.03	-0.03
Black oak	0.23	0.00	0.14	0.00	0.58	0.34	0.57	-0.24	-0.01	-0.15
Northern red oak	0.21	0.09	0.03	0.00	0.22	0.27	0.48	-0.04	0.17	0.14
Blackjack oak	0.00	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.02	-0.02	-0.02
Scarlet oak	0.38	0.11	0.00	0.10	0.41	0.52	0.90	-0.10	0.28	0.28
Chestnut oak	1.07	0.11	0.15	0.09	3.02	3.01	4.08	-0.21	0.86	0.71
Swamp white oak	0.00	0.00	0.00	0.00	0.09	0.06	0.06	-0.03	-0.03	-0.03
White oak	0.23	0.12	0.00	0.00	1.16	0.56	0.79	-0.72	-0.49	-0.49
Basswood	0.05	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.06	0.06
Buckeye	0.00	0.00	0.00	0.00	0.12	0.04	0.04	-0.08	-0.08	-0.08
Black gum	0.11	0.03	0.00	0.00	0.06	0.10	0.21	0.01	0.12	0.12
Sweet or red gum	0.72	0.06	0.07	0.00	0.20	0.74	1.46	0.48	1.20	1.13
Magnolia spp.	0.00	0.00	0.00	0.00	0.10	0.00	0.00	-0.10	-0.10	-0.10
Red maple	0.96	0.00	0.03	0.05	0.56	0.64	1.60	0.03	0.99	0.96
Yellow-poplar	0.66	0.05	0.00	0.00	1.22	1.44	2.10	0.17	0.83	0.83
Winged elm	0.01	0.04	0.00	0.01	0.00	0.01	0.02	-0.04	-0.03	-0.03
Ash	0.04	0.01	0.00	0.04	0.00	0.10	0.14	0.05	0.09	0.09
Sweet birch	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Black cherry	0.09	0.00	0.00	0.00	0.00	0.03	0.12	0.03	0.12	0.12
Black walnut	0.02	0.00	0.00	0.02	0.00	0.11	0.13	0.09	0.11	0.11
Dogwood	0.00	0.00	0.00	0.02	0.00	0.00	0.00	-0.02	-0.02	-0.02
Hickory spp.	0.25	0.13	0.07	0.04	0.22	0.12	0.37	-0.27	-0.02	-0.09
Sourwood	0.03	0.03	0.00	0.04	0.00	0.03	0.06	-0.04	-0.01	-0.01

Table 34 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Sycamore	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04
Black locust	0.19	0.13	0.00	0.01	0.00	0.22	0.41	0.08	0.27	0.27
Mulberry	0.01	0.00	0.00	0.00	0.00	0.03	0.04	0.03	0.04	0.04
Serviceberry	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Totals	5.85	1.65	0.77	0.42	10.66	10.61	16.46	-2.12	3.73	2.96

Table 35. Pulpwood volume growth (cu.ft./acre/year) for Brushy Mountain, 1973 to 1978.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.12	1.49	0.00	0.00	1.46	1.20	1.32	-1.75	-1.63	-1.63
Virginia pine	0.06	0.02	0.00	0.02	0.20	0.14	0.20	-0.10	-0.04	-0.04
Pitch pine	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Loblolly pine	0.00	0.84	0.03	0.00	0.30	0.21	0.21	-0.93	-0.93	-0.90
White pine	0.02	0.00	0.00	0.00	0.00	0.12	0.14	0.12	0.14	0.14
Hemlock	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Black oak	0.15	0.02	0.00	0.00	0.53	0.27	0.42	-0.28	-0.13	-0.13
Northern red oak	0.04	0.15	0.00	0.00	0.19	0.36	0.40	0.02	0.06	0.06
Blackjack oak	0.00	0.01	0.00	0.02	0.00	0.00	0.00	-0.03	-0.03	-0.03
Scarlet oak	0.23	0.05	0.00	0.03	0.29	0.92	1.15	0.55	0.78	0.78
Chestnut oak	0.95	0.21	0.00	0.08	3.93	4.40	5.35	0.18	1.13	1.13
Post oak	0.11	0.02	0.00	0.00	0.00	0.00	0.11	-0.02	0.09	0.09
Swamp white oak	0.00	0.00	0.00	0.00	0.09	0.02	0.02	-0.07	-0.07	-0.07
White oak	0.08	0.07	0.00	0.07	0.33	0.58	0.66	0.11	0.19	0.19
Basswood	0.03	0.04	0.00	0.00	0.00	0.06	0.09	0.02	0.05	0.05
Buckeye	0.00	0.00	0.00	0.00	0.06	0.04	0.04	-0.02	-0.02	-0.02
Black gum	0.09	0.00	0.00	0.00	0.15	0.17	0.26	0.02	0.11	0.11
Sweet or red gum	0.23	0.32	0.00	0.00	0.20	1.32	1.55	0.80	1.03	1.03
Red maple	1.58	0.04	0.00	0.03	0.64	1.40	2.98	0.69	2.27	2.27
Yellow-poplar	1.01	0.03	0.00	0.02	1.77	2.34	3.35	0.52	1.53	1.53
Winged elm	0.02	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.03	0.03
Ash	0.06	0.04	0.00	0.00	0.07	0.15	0.21	0.04	0.10	0.10
Sweet birch	0.03	0.00	0.00	0.00	0.03	0.07	0.10	0.04	0.07	0.07
Black cherry	0.03	0.05	0.00	0.00	0.00	0.11	0.14	0.06	0.09	0.09
Black walnut	0.00	0.09	0.00	0.00	0.00	0.08	0.08	-0.01	-0.01	-0.01
Hickory spp.	0.01	0.20	0.00	0.01	0.00	0.28	0.29	0.07	0.08	0.08
Sourwood	0.15	0.03	0.00	0.02	0.00	0.07	0.22	0.02	0.17	0.17

Table 35 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Sycamore	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10
Black locust	0.14	0.23	0.00	0.05	0.00	0.19	0.33	-0.09	0.05	0.05
Mulberry	0.02	0.00	0.00	0.00	0.00	0.05	0.07	0.05	0.07	0.07
Ironwood	0.00	0.01	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01
Serviceberry	0.00	0.00	0.00	0.02	0.00	0.00	0.00	-0.02	-0.02	-0.02
Misc. hardwoods	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.02
Totals	5.18	3.96	0.03	0.37	10.24	14.68	19.86	0.11	5.29	5.26

Table 36. Sawtimber volume (bd.ft.,Int.1/4"/acre) for Highland Rim by species and inventory year, based on 25 plots.

Species	1962	1967	1978	1977
Black oak	39.24	108.20	134.64	140.74
Southern red oak	321.09	605.33	832.02	984.50
Blackjack oak	106.76	163.99	278.85	350.25
Scarlet oak	62.34	148.05	180.49	202.98
Post oak	139.85	340.85	480.43	587.93
Totals	669.29	1366.42	1906.43	2266.40
[S.E./$\bar{X}$] x 100	21.77	18.24	16.67	15.10

Table 37. Pulpwood volume (cu.ft./acre) for Highland Rim by species for each inventory year, based on 25 plots.

Species	1962	1967	1978	1977
Black oak	2.41	0.00	0.00	0.00
Southern red oak	18.72	21.75	20.76	24.46
Blackjack oak	57.10	54.06	46.26	27.10
Scarlet oak	2.21	2.13	1.76	2.39
Post oak	52.75	66.32	77.75	75.66
Black gum	1.23	1.11	2.05	2.36
Hickory spp.	0.00	1.37	1.20	1.33
Totals	134.42	146.74	149.78	133.30
$[S.E./\bar{X}] \times 100$	15.10	13.53	13.73	13.33

Table 38. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) by growth period for Highland Rim Forestry Field Station.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Black oak	6.96	0.00	0.00	0.00	6.83	13.79	6.83	13.79	13.79
Southern red oak	13.21	4.70	0.00	0.00	48.35	61.56	43.65	56.86	56.86
Blackjack oak	11.74	2.09	0.00	0.00	1.80	13.54	-0.29	11.45	11.45
Scarlet oak	11.26	0.00	0.00	0.00	5.88	17.14	5.88	17.14	17.14
Post oak	23.50	0.00	0.00	0.00	19.11	42.61	19.11	42.61	42.61
Totals (1962-1967)	66.67	6.79	0.00	0.00	81.97	148.64	75.18	141.85	141.85
Black oak	0.00	0.00	0.00	0.00	4.41	4.41	4.41	4.41	4.41
Southern red oak	6.58	0.00	0.00	0.00	31.20	37.78	31.20	37.78	37.78
Blackjack oak	9.36	0.00	0.00	0.49	10.27	19.63	9.78	19.14	19.14
Scarlet oak	2.14	0.00	0.00	2.77	6.03	8.17	3.26	5.40	5.40
Post oak	6.74	0.00	0.00	1.34	17.87	24.61	16.53	23.27	23.27
Totals (1967-1973)	24.82	0.00	0.00	4.60	69.78	94.60	65.18	90.00	90.00
Black oak	0.00	0.00	0.00	0.00	1.53	1.53	1.53	1.53	1.53
Southern red oak	19.15	0.00	0.00	0.00	25.35	44.50	25.35	44.50	44.50
Blackjack oak	18.10	0.00	0.00	1.45	1.20	19.30	-0.25	17.85	17.85
Scarlet oak	0.00	0.00	0.00	0.00	5.63	5.63	5.63	5.63	5.63
Post oak	12.60	0.00	0.00	1.80	16.08	28.68	14.28	26.88	26.88
Totals (1973-1977)	49.85	0.00	0.00	3.25	49.79	99.64	46.54	96.39	96.39

Table 39. Pulpwood volume growth (cu.ft./acre/year) by growth period for the Highland Rim Forestry Field Station.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Black oak	0.00	0.00	0.00	0.00	0.49	0.01	0.01	-0.48	-0.48	-0.48
Southern red oak	0.64	0.39	0.00	0.00	0.97	1.37	2.01	0.01	0.65	0.65
Blackjack oak	2.23	1.34	0.00	1.54	1.20	1.24	3.47	-2.84	-0.61	-0.61
Scarlet oak	0.00	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.02	-0.02	-0.02
Post oak	1.34	0.05	0.00	0.17	0.55	1.52	2.86	0.75	2.09	2.09
Black gum	0.00	0.00	0.00	0.00	0.00	-0.03	-0.03	-0.03	-0.03	-0.03
Hickory spp.	0.21	0.00	0.00	0.00	0.00	0.06	0.27	0.06	0.27	0.27
Totals (1962-1967)	4.42	1.78	0.00	1.71	3.21	4.15	8.57	-2.55	1.87	1.87
Southern red oak	0.00	0.23	0.00	0.00	1.42	1.48	1.48	-0.17	-0.17	-0.17
Blackjack oak	0.33	0.37	0.00	0.00	2.40	1.37	1.70	-1.40	-1.07	-1.07
Scarlet oak	0.24	0.00	0.00	0.00	0.37	0.07	0.31	-0.30	-0.06	-0.06
Post oak	1.10	0.46	0.00	0.66	1.38	3.19	4.29	0.80	1.90	1.90
Black gum	0.00	0.00	0.00	0.00	0.00	0.16	0.16	0.16	0.16	0.16
Hickory spp.	0.08	0.00	0.00	0.00	0.00	0.02	0.10	0.02	0.10	0.10
Totals (1967-1973)	1.75	0.95	0.00	0.66	5.57	6.29	8.04	-0.89	0.86	0.86
Southern red oak	0.39	0.00	0.00	0.25	1.91	2.69	3.08	0.53	0.92	0.92
Blackjack oak	0.30	0.35	0.00	0.53	5.29	1.08	1.38	-5.09	-4.79	-4.79
Scarlet oak	0.00	0.00	0.00	0.00	0.00	0.16	0.16	0.16	0.16	0.16
Post oak	0.44	0.19	0.00	0.24	3.48	2.93	3.37	-0.98	-0.54	-0.54
Black gum	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08	0.08
Hickory spp.	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04
Totals (1973-1977)	1.13	0.54	0.00	1.02	10.68	6.98	8.11	-5.26	-4.13	-4.13

Table 40. Sawtimber volume (bd.ft.,Int.1/4"/acre) for natural stands at Ames Plantation by species and inventory year, based on 144 plots.

Species	1963	1968	1973	1978
Shortleaf pine	61.56	75.33	90.52	90.49
Loblolly pine	--	--	--	5.51
Eastern red cedar	52.13	54.68	79.68	100.35
Totals	113.69	130.01	170.20	196.35
[S.E./$\bar{X}$] x 100	50.58	51.75	44.00	39.25
Black oak	176.65	221.58	258.95	303.82
Cherrybark oak	160.88	242.07	303.69	394.66
Northern red oak	1.31	3.42	7.94	13.88
Shumard oak	0.98	0.00	7.48	12.20
Southern red oak	520.88	620.94	685.20	691.08
Blackjack oak	0.00	0.00	0.00	7.33
Pin oak	2.05	8.02	0.00	15.05
Scarlet oak	25.25	39.08	36.08	83.91
Water oak	--	3.94	4.80	11.90
Willow oak	21.82	30.33	32.70	58.01
Chestnut oak	0.00	0.00	1.87	2.69
Post oak	233.70	272.98	356.08	487.48
Swamp chestnut oak	13.72	28.28	43.58	63.73
White oak	216.51	243.08	322.38	411.67
Basswood	--	1.22	1.77	1.92
Cottonwood	11.79	69.57	90.86	116.67
Black gum	56.03	58.97	78.68	101.22
Red gum	712.17	930.69	1131.79	1232.78
Red maple	26.68	33.94	39.89	45.39
Yellow-poplar	75.54	106.45	164.83	227.84
Black willow	9.75	22.08	26.57	33.19
Boxelder	--	2.95	8.67	19.41
American elm	71.92	83.98	81.88	77.28
Winged elm	173.64	214.26	185.12	189.63
Ash	55.67	73.71	108.53	125.58
River birch	118.75	135.00	150.79	166.66
Black cherry	51.65	51.20	62.53	63.37
Black walnut	5.45	9.90	13.30	16.47
Hickory	114.14	158.61	199.29	307.62
Persimmon	5.82	11.81	19.65	21.99
Sycamore	82.41	109.59	167.37	202.26
Black locust	2.19	2.35	5.10	11.99
Honey locust	1.44	2.00	2.16	6.11

Table 40 (Continued)

Species	1963	1968	1973	1978
Mulberry	--	--	--	1.70
Sassafras	3.28	0.89	2.06	4.73
Misc. hardwoods	2.77	--	--	--
Totals	2954.84	3792.89	4601.59	5531.26
[S.E./$\bar{X}$] x 100	8.25	7.92	7.25	6.63
Grand totals	3068.53	3922.90	4771.79	5727.61
[S.E./$\bar{X}$] x 100	7.83	7.50	6.83	6.42

Table 41. Pulpwood volume (cu.ft./acre) for natural stands of Ames Plantation, by species and inventory year, based on 144 plots.

Species	1963	1968	1973	1978
Shortleaf pine	1.40	0.54	--	0.36
Loblolly pine	--	--	0.07	2.65
Misc. yellow pine	--	--	0.63	0.28
Eastern red cedar	8.36	7.98	9.22	8.16
Totals	9.76	8.52	9.92	11.45
[S.E./$\bar{X}$] x 100	25.83	25.00	31.67	23.50
Black oak	4.14	5.61	6.90	9.39
Cherrybark oak	6.35	5.67	9.07	9.65
Northern red oak	0.22	1.55	2.05	2.88
Shumard oak	0.78	1.90	1.64	2.98
Southern red oak	10.90	13.88	20.12	26.43
Blackjack oak	0.00	0.13	1.02	1.06
Pin oak	0.09	0.44	1.07	1.57
Scarlet oak	1.36	0.89	0.70	1.74
Water oak	1.05	1.12	1.71	1.98
Willow oak	0.72	1.15	3.10	2.67
Post oak	12.40	16.72	18.87	24.53
Swamp chestnut oak	1.45	1.45	2.35	1.96
Swamp white oak	0.11	0.17	0.23	0.42
White oak	6.63	11.27	17.58	24.53
Cottonwood	2.70	0.81	1.04	0.23
Black gum	3.04	4.06	3.75	5.60
Red gum	24.14	29.55	41.43	56.61
Red maple	4.21	6.34	9.25	11.87
Yellow-poplar	2.36	4.71	7.17	14.38
Black willow	8.36	6.43	3.15	0.18
Boxelder	2.86	4.74	7.95	10.56
American elm	7.16	9.02	13.55	17.90
Winged elm	9.58	12.46	14.89	13.41
Ash	6.61	11.26	14.62	17.17
River birch	5.58	6.69	7.90	6.16
Black cherry	6.01	7.22	11.94	17.67
Black walnut	1.02	0.64	0.73	1.05
Dogwood	2.01	1.89	4.47	7.17
Hickory	7.05	13.24	22.83	24.84
Persimmon	1.43	0.62	1.70	2.70
Sourwood	0.00	0.00	0.17	0.26
Sycamore	2.77	4.84	6.00	5.10
Black locust	0.22	0.00	0.36	0.28
Mulberry	0.00	0.40	1.30	1.57

Table 41 (Continued)

Species	1963	1968	1973	1978
Osage orange	0.09	0.07	0.07	0.29
Sassafras	1.28	1.36	0.71	0.64
Ironwood	0.05	0.16	0.06	0.98
Red bud	0.00	0.16	0.54	0.61
Misc. hardwoods	0.00	0.00	0.17	0.19
Totals	144.73	188.62	262.16	329.51
[S.E./$\bar{X}$] x 100	8.83	7.33	6.33	5.58
Grand Totals	154.49	197.14	272.08	340.96
[S.E./$\bar{X}$] x 100	8.00	6.75	5.83	5.08

Table 42. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for natural stands at Ames Plantation, 1963 to 1968.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.35	0.00	0.00	0.00	2.40	2.75	2.40	2.75	2.75
Eastern red cedar	1.00	0.00	1.14	0.46	1.12	2.12	0.66	1.66	0.52
Black oak	1.29	0.45	0.32	1.15	9.61	10.90	8.01	9.30	8.98
Cherrybark oak	2.72	0.00	0.00	0.00	13.51	16.23	13.51	16.23	16.23
Northern red oak	0.00	0.00	0.00	0.00	0.42	0.42	0.42	0.42	0.42
Shumard oak	0.00	0.00	0.00	0.20	0.00	0.00	-0.20	-0.20	-0.20
Southern red oak	4.36	6.04	0.00	1.98	23.67	28.03	15.65	20.01	20.01
Pin oak	0.00	0.00	0.00	0.00	1.19	1.19	1.19	1.19	1.19
Scarlet oak	0.91	0.00	0.00	0.24	2.10	3.01	1.86	2.77	2.77
Water oak	0.73	0.00	0.00	0.00	0.06	0.79	0.06	0.79	0.79
Willow oak	0.24	0.00	0.00	0.16	1.62	1.86	1.46	1.70	1.70
Post oak	2.34	0.00	0.32	2.02	8.24	10.58	6.22	8.56	8.24
Swamp chestnut oak	0.70	0.00	0.00	0.00	2.21	2.91	2.21	2.91	2.91
White oak	1.49	4.15	0.00	0.30	8.27	9.76	3.82	5.31	5.31
Basswood	0.24	0.00	0.00	0.00	0.00	0.24	0.00	0.24	0.24
Cottonwood	2.47	0.00	0.00	0.00	9.08	11.55	9.08	11.55	11.55
Black gum	0.71	0.00	0.00	0.86	0.74	1.45	-0.12	0.59	0.59
Sweet or red gum	6.84	2.87	0.00	0.00	39.77	46.61	36.90	43.74	43.74
Red maple	1.10	0.00	0.00	1.63	1.98	3.08	0.35	1.45	1.45
Yellow-poplar	0.57	0.00	0.00	0.00	5.61	6.18	5.61	6.18	6.18
Black willow	1.66	0.00	0.00	0.00	0.81	2.47	0.81	2.47	2.47
Boxelder	0.52	0.00	0.00	0.00	0.07	0.59	0.07	0.59	0.59
American elm	1.36	0.00	0.00	0.25	1.30	2.66	1.05	2.41	2.41
Winged elm	2.82	2.83	0.00	0.74	8.87	11.69	5.30	8.12	8.12
Ash	0.70	0.00	0.00	0.59	3.49	4.19	2.90	3.60	3.60
River birch	1.94	1.06	0.00	0.44	3.44	5.38	1.94	3.88	3.88

Table 42 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Black cherry	0.64	0.00	0.00	0.21	-0.53	0.11	-0.74	-0.10	-0.10
Black walnut	0.41	0.00	0.00	0.00	0.48	0.89	0.48	0.89	0.89
Hickory spp.	5.81	0.41	0.34	0.24	4.08	9.89	3.43	9.24	8.90
Persimmon	0.86	0.00	0.00	0.00	0.34	1.20	0.34	1.20	1.20
Sycamore	3.59	2.40	0.00	0.00	4.24	7.83	1.84	5.43	5.43
Black locust	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Honey locust	0.00	0.00	0.00	0.00	0.11	0.11	0.11	0.11	0.11
Sassafras	0.00	0.00	0.00	0.26	-0.21	-0.21	-0.47	-0.47	-0.47
Misc. hardwoods	0.00	0.00	0.00	0.55	0.00	0.00	-0.55	-0.55	-0.55
Totals	48.37	20.21	2.12	12.28	158.12	206.49	125.63	174.00	171.88

Table 43. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for natural stands at Ames Plantation, 1968 to 1973.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.61	0.00	0.00	0.00	2.43	3.04	2.43	3.04	3.04
Eastern red cedar	2.45	0.78	0.00	0.26	3.59	6.04	2.55	5.00	5.00
Black oak	4.42	4.53	0.95	0.00	8.53	12.95	4.00	8.42	7.47
Cherrybark oak	2.91	1.34	2.26	0.00	13.01	15.92	11.67	14.58	12.32
Northern red oak	0.84	0.00	0.00	0.00	0.06	0.90	0.06	0.90	0.90
Shumard oak	1.25	0.00	0.00	0.00	0.25	1.50	0.25	1.50	1.50
Southern red oak	5.19	1.76	20.26	1.36	31.04	36.23	27.92	33.11	12.85
Pin oak	0.00	0.00	0.00	1.60	0.00	0.00	-1.60	-1.60	-1.60
Scarlet oak	0.45	0.54	0.00	1.98	1.46	1.91	-1.06	-0.61	-0.61
Water oak	0.00	0.00	0.00	0.00	0.17	0.17	0.17	0.17	0.17
Willow oak	0.00	0.00	0.00	0.82	1.29	1.29	0.47	0.47	0.47
Chestnut oak	0.31	0.00	0.00	0.00	0.06	0.37	0.06	0.37	0.37
Post oak	9.33	2.15	2.20	0.32	11.95	21.28	9.48	18.81	16.61
Swamp chestnut oak	0.41	0.00	0.00	0.00	2.65	3.06	2.65	3.06	3.06
White oak	4.38	0.00	1.01	0.00	12.49	16.87	12.49	16.87	15.86
Basswood	0.00	0.00	0.00	0.00	0.11	0.11	0.11	0.11	0.11
Cottonwood	0.00	0.00	0.00	0.00	4.26	4.26	4.26	4.26	4.26
Black gum	1.58	0.00	0.00	0.00	2.37	3.95	2.37	3.95	3.95
Sweet or red gum	12.95	5.87	1.98	0.59	35.71	48.66	29.25	42.20	40.22
Red maple	0.51	0.00	0.00	0.15	0.83	1.34	0.68	1.19	1.19
Yellow-poplar	6.39	3.41	0.00	0.00	8.69	15.08	5.28	11.67	11.67
Black willow	0.00	0.21	0.00	0.00	1.11	1.11	0.90	0.90	0.90
Boxelder	0.96	0.00	0.00	0.00	0.18	1.14	0.18	1.14	1.14
American elm	0.31	1.76	0.82	2.28	4.12	4.43	0.08	0.39	-0.43
Winged elm	3.02	10.64	0.00	2.60	4.40	7.42	-8.84	-5.82	-5.82
Ash	2.09	0.00	0.00	0.23	5.11	7.20	4.88	6.97	6.97

Table 43 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
River birch	1.35	0.00	0.00	2.68	4.48	5.83	1.80	3.15	3.15
Black cherry	0.08	0.00	0.00	0.00	2.62	2.70	2.62	2.70	2.70
Black walnut	0.16	0.31	0.00	0.00	0.83	0.99	0.52	0.68	0.68
Hickory spp.	3.40	2.68	2.68	1.58	11.68	15.08	7.42	10.82	8.14
Persimmon	0.27	0.00	0.00	0.00	1.30	1.57	1.30	1.57	1.57
Sycamore	2.99	0.00	0.00	0.00	8.56	11.55	8.56	11.55	11.55
Black locust	0.00	0.00	0.00	0.00	0.55	0.55	0.55	0.55	0.55
Honey locust	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Sassafras	0.20	0.00	0.00	0.00	0.04	0.24	0.04	0.24	0.24
Totals	68.81	35.98	32.16	16.45	185.96	254.77	133.53	202.34	170.18

Table 44. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for natural stands at Ames Plantation, 1973 to 1978.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.18	0.00	0.00	0.00	-0.19	-0.01	-0.19	-0.01	-0.01
Loblolly pine	0.56	0.00	0.00	0.00	0.54	1.10	0.54	1.10	1.10
Eastern red cedar	2.08	2.40	0.00	0.43	5.14	7.22	2.31	4.39	4.39
Black oak	2.66	0.92	6.61	0.62	14.46	17.12	12.92	15.58	8.97
Cherrybark oak	4.02	3.32	0.00	0.00	17.53	21.55	14.21	18.23	18.23
Northern red oak	0.33	0.46	0.00	0.00	1.33	1.66	0.87	1.20	1.20
Shumard oak	0.00	0.00	0.00	0.00	0.94	0.94	0.94	0.94	0.94
Southern red oak	9.34	9.56	36.08	0.22	37.70	47.04	27.92	37.26	1.18
Blackjack oak	1.46	0.00	0.00	0.00	0.00	1.46	0.00	1.46	1.46
Pin oak	3.01	0.00	0.00	0.00	0.00	3.01	0.00	3.01	3.01
Scarlet oak	3.61	0.00	0.00	0.00	5.93	9.54	5.93	9.54	9.54
Water oak	0.52	0.00	0.00	0.00	0.90	1.42	0.90	1.42	1.42
Willow oak	3.03	0.00	0.39	0.00	2.43	5.46	2.43	5.46	5.07
Chestnut oak	0.00	0.00	0.00	0.00	0.16	0.16	0.16	0.16	0.16
Post oak	5.15	0.00	3.15	0.68	24.91	30.06	24.23	29.38	26.23
Swamp chestnut oak	0.00	0.00	0.00	0.00	4.03	4.03	4.03	4.03	4.03
White oak	5.59	0.70	8.41	0.00	21.38	26.97	20.68	26.27	17.86
Basswood	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Cottonwood	0.26	0.00	0.00	0.00	4.91	5.17	4.91	5.17	5.17
Black gum	1.32	0.00	1.25	0.00	4.53	5.85	4.53	5.85	4.60
Sweet or red gum	6.45	28.68	0.00	0.00	42.53	48.98	13.85	20.30	20.30
Red maple	1.01	0.71	0.15	0.00	0.95	1.96	0.24	1.25	1.10
Yellow-poplar	3.81	0.00	1.33	5.61	16.01	19.82	10.40	14.21	12.88
Black willow	0.74	1.18	0.00	0.00	1.60	2.34	0.42	1.16	1.16
Boxelder	1.35	0.00	0.00	0.00	0.80	2.15	0.80	2.15	2.15

Table 44 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
American elm	0.37	3.71	0.00	0.00	2.42	2.79	-1.29	-0.92	-0.92
Winged elm	5.28	13.21	1.71	0.00	10.54	15.82	-2.67	2.61	0.90
Ash	3.69	3.28	0.00	0.33	3.33	7.02	-0.28	3.41	3.41
River birch	3.32	4.08	0.00	1.49	5.43	8.75	-0.14	3.18	3.18
Black cherry	0.28	0.46	0.84	1.69	2.88	3.16	0.73	1.01	0.17
Black walnut	0.00	0.00	0.00	0.16	0.79	0.79	0.63	0.63	0.63
Hickory spp.	10.45	0.51	1.97	1.01	14.71	25.16	13.19	23.64	21.67
Persimmon	0.00	0.00	0.00	0.00	0.47	0.47	0.47	0.47	0.47
Sycamore	2.17	5.74	1.01	0.00	11.61	13.78	5.87	8.04	7.03
Black locust	0.35	0.00	0.00	0.00	1.02	1.37	1.02	1.37	1.37
Honey locust	0.00	0.00	0.00	0.00	0.79	0.79	0.79	0.79	0.79
Mulberry	0.31	0.00	0.00	0.00	0.03	0.34	0.03	0.34	0.34
Sassafras	0.00	0.00	0.00	0.00	0.53	0.53	0.53	0.53	0.53
Totals	82.70	78.92	62.90	12.24	263.10	345.80	171.94	254.64	191.74

Table 45. Pulpwood volume growth (cu.ft./acre/year) for natural stands at Ames Plantation, 1963 to 1968.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.00	0.09	0.00	0.00	0.11	0.03	0.03	-0.17	-0.17	-0.17
Eastern red cedar	0.13	0.05	0.03	0.07	0.40	0.34	0.47	-0.18	-0.05	-0.08
Black oak	0.13	0.05	0.03	0.00	0.36	0.59	0.72	0.18	0.31	0.28
Cherrybark oak	0.14	0.00	0.00	0.01	0.86	0.59	0.73	-0.28	-0.14	-0.14
Northern red oak	0.16	0.00	0.00	0.00	0.00	0.10	0.26	0.10	0.26	0.26
Shumard oak	0.05	0.00	0.00	0.00	0.00	0.18	0.23	0.18	0.23	0.23
Southern red oak	0.36	0.01	0.00	0.03	0.94	1.22	1.58	0.24	0.60	0.60
Blackjack oak	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03
Pin oak	0.04	0.00	0.00	0.00	0.00	0.03	0.07	0.03	0.07	0.09
Scarlet oak	0.03	0.00	0.00	0.00	0.23	0.11	0.14	-0.12	-0.09	-0.09
Water oak	0.05	0.00	0.00	0.00	0.11	0.07	0.12	-0.04	0.01	0.01
Willow oak	0.02	0.00	0.00	0.00	0.04	0.10	0.12	0.06	0.08	0.08
Post oak	0.30	0.25	0.00	0.00	0.50	1.32	1.62	0.57	0.87	0.87
Swamp chestnut oak	0.01	0.00	0.00	0.00	0.15	0.14	0.15	-0.01	0.00	0.00
Swamp white oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
White oak	0.38	0.00	0.00	0.00	0.31	0.86	1.24	0.55	0.93	0.93
Cottonwood	0.00	0.05	0.00	0.00	0.44	0.11	0.11	-0.38	-0.38	-0.38
Black gum	0.08	0.00	0.00	0.00	0.14	0.26	0.34	0.12	0.20	0.20
Sweet or red gum	0.45	0.00	0.00	0.00	1.19	1.84	2.29	0.65	1.10	1.10
Red maple	0.16	0.00	0.00	0.00	0.11	0.38	0.54	0.27	0.43	0.43
Yellow-poplar	0.19	0.01	0.00	0.00	0.14	0.44	0.63	0.29	0.48	0.48
Black willow	0.08	0.42	0.00	0.07	0.44	0.46	0.54	-0.47	-0.39	-0.39
Boxelder	0.17	0.00	0.00	0.06	0.10	0.37	0.54	0.21	0.38	0.38
American elm	0.16	0.21	0.00	0.00	0.18	0.60	0.76	0.21	0.37	0.37
Winged elm	0.33	0.10	0.00	0.01	0.40	0.76	1.09	0.25	0.58	0.58
Ash	0.14	0.04	0.00	0.00	0.00	0.83	0.97	0.79	0.93	0.93
River birch	0.07	0.09	0.00	0.00	0.32	0.40	0.47	-0.01	0.06	0.06

Table 45 (Continued)

Species	Ingrowth	Mortality	Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Black cherry	0.31	0.07	0.00	0.08	0.22	0.31	0.62	-0.06	0.25	0.25
Black walnut	0.00	0.00	0.00	0.00	0.13	0.05	0.05	-0.08	-0.08	-0.08
Dogwood	0.06	0.09	0.00	0.03	0.00	0.03	0.09	-0.09	-0.03	-0.03
Hickory spp.	1.07	0.04	0.00	0.00	0.52	0.74	1.81	0.18	1.25	1.25
Persimmon	0.03	0.00	0.00	0.00	0.21	0.02	0.05	-0.19	-0.16	-0.16
Sycamore	0.14	0.00	0.00	0.00	0.23	0.50	0.64	0.27	0.41	0.41
Black locust	0.00	0.00	0.00	0.04	0.00	0.00	0.00	-0.04	-0.04	-0.04
Mulberry	0.07	0.00	0.00	0.00	0.00	0.01	0.08	0.01	0.08	0.08
Sassafras	0.01	0.00	0.00	0.02	0.00	0.03	0.04	0.01	0.02	0.02
Ironwood	0.01	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.02	0.02
Redbud	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03
Totals	5.39	1.57	0.06	0.42	8.78	13.84	19.23	3.07	8.46	8.40

Table 46. Pulpwood volume growth (cu.ft./acre/year) for natural stands at Ames Plantation, 1968 to 1973.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.00	0.00	0.00	0.00	0.12	0.01	0.01	-0.11	-0.11	-0.11
Loblolly pine	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01
Misc. yellow pine	0.09	0.00	0.00	0.00	0.00	0.04	0.13	0.04	0.13	0.13
Eastern red cedar	0.13	0.10	0.02	0.00	0.32	0.56	0.69	0.14	0.27	0.25
Black oak	0.24	0.00	0.00	0.00	0.65	0.67	0.91	0.02	0.26	0.26
Cherrybark oak	0.17	0.11	0.00	0.02	0.23	0.86	1.03	0.50	0.67	0.67
Northern red oak	0.14	0.00	0.00	0.02	0.16	0.16	0.30	-0.02	0.12	0.12
Shumard oak	0.01	0.00	0.00	0.00	0.22	0.16	0.17	-0.06	-0.05	-0.05
Southern red oak	0.36	0.19	0.00	0.07	0.66	1.81	2.17	0.89	1.25	1.25
Blackjack oak	0.15	0.00	0.00	0.00	0.00	0.03	0.18	0.03	0.18	0.18
Pin oak	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.13	0.13	0.13
Scarlet oak	0.02	0.00	0.00	0.00	0.13	0.07	0.09	-0.06	-0.04	-0.04
Water oak	0.01	0.00	0.00	0.00	0.00	0.10	0.11	0.10	0.11	0.11
Willow oak	0.15	0.00	0.00	0.00	0.00	0.24	0.39	0.24	0.39	0.39
Post oak	0.33	0.10	0.00	0.02	1.20	1.40	1.73	0.08	0.41	0.41
Swamp chestnut oak	0.02	0.00	0.00	0.00	0.00	0.16	0.18	0.16	0.18	0.18
Swamp white oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
White oak	0.49	0.25	0.00	0.04	0.45	1.50	1.99	0.76	1.25	1.25
Cottonwood	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05
Black gum	0.01	0.00	0.00	0.05	0.28	0.26	0.27	-0.07	-0.06	-0.06
Sweet or red gum	0.77	0.16	0.00	0.01	1.03	2.83	3.60	3.60	2.40	2.40
Red maple	0.25	0.11	0.00	0.05	0.14	0.63	0.88	0.33	0.58	0.58
Yellow-poplar	0.22	0.00	0.00	0.00	0.47	0.74	0.96	0.27	0.49	0.49
Black willow	0.03	0.84	0.00	0.00	0.00	0.24	0.27	-0.60	-0.57	-0.57
Boxelder	0.24	0.02	0.00	0.05	0.23	0.70	0.94	0.40	0.64	0.64
American elm	0.43	0.18	0.00	0.07	0.00	0.73	1.16	0.48	0.91	0.91

Table 46 (Continued)

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Winged elm	0.37	0.27	0.00	0.01	0.43	0.82	1.19	0.11	0.48	0.48
Ash	0.24	0.03	0.00	0.08	0.63	1.13	1.37	0.39	0.63	0.63
River birch	0.06	0.08	0.00	0.00	0.33	0.59	0.65	0.18	0.24	0.24
Black cherry	0.21	0.12	0.00	0.00	0.04	0.90	1.11	0.74	0.95	0.95
Black walnut	0.02	0.00	0.00	0.00	0.06	0.05	0.07	-0.01	0.01	0.01
Dogwood	0.40	0.00	0.00	0.02	0.00	0.13	0.53	0.11	0.51	0.51
Hickory spp.	0.75	0.17	0.00	0.00	0.32	1.74	2.49	1.25	2.00	2.00
Persimmon	0.13	0.00	0.00	0.00	0.00	0.08	0.21	0.08	0.21	0.21
Sourwood	0.03	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.04	0.04
Sycamore	0.04	0.00	0.00	0.00	0.38	0.58	0.62	0.20	0.24	0.24
Black locust	0.07	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.07	0.07
Mulberry	0.13	0.00	0.00	0.00	0.00	0.05	0.18	0.05	0.18	0.18
Sassafras	0.02	0.19	0.00	0.00	0.00	0.04	0.06	-0.15	-0.13	-0.13
Ironwood	0.01	0.00	0.00	0.03	0.00	0.00	0.01	-0.03	-0.02	-0.02
Redbud	0.04	0.00	0.00	0.00	0.00	0.04	0.08	0.04	0.08	0.08
Misc. hardwoods	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03
Totals	6.82	2.92	0.02	0.54	8.48	20.25	27.07	8.31	15.13	15.11

Table 47. Pulpwood volume growth (cu.ft./acre/year) for natural stands at Ames Plantation, 1973 to 1978.

Species	Ingrowth	Mortality	Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	0.06	0.00	0.00	0.00	0.00	0.01	0.07	0.01	0.07	0.07
Loblolly pine	0.30	0.00	0.00	0.00	0.00	0.21	0.51	0.21	0.51	0.51
Misc. yellow pines	0.00	0.05	0.00	0.00	0.08	0.06	0.06	-0.07	-0.07	-0.07
Eastern red cedar	0.01	0.36	0.00	0.03	0.45	0.53	0.54	-0.31	-0.30	-0.30
Black oak	0.13	0.07	0.00	0.00	0.25	0.69	0.82	0.37	0.50	0.50
Cherrybark oak	0.27	0.17	0.00	0.01	0.68	0.71	0.98	-0.15	0.12	0.12
Northern red oak	0.00	0.00	0.00	0.00	0.11	0.28	0.28	0.17	0.17	0.17
Shumard oak	0.00	0.00	0.00	0.00	0.00	0.27	0.27	0.27	0.27	0.27
Southern red oak	0.43	0.35	0.00	0.00	1.02	2.20	2.63	0.83	1.26	1.26
Blackjack oak	0.09	0.00	0.00	0.00	0.15	0.07	0.16	-0.08	0.01	0.01
Pin oak	0.03	0.00	0.00	0.00	0.00	0.07	0.10	0.07	0.10	0.10
Scarlet oak	0.14	0.00	0.00	0.00	0.08	0.16	0.30	0.08	0.22	0.22
Water oak	0.02	0.10	0.00	0.00	0.00	0.13	0.15	0.03	0.05	0.05
Willow oak	0.02	0.00	0.00	0.00	0.33	0.22	0.24	-0.11	-0.09	-0.09
Post oak	0.48	0.02	0.00	0.03	0.78	1.47	1.95	0.64	1.12	1.12
Swamp chestnut oak	0.00	0.07	0.00	0.00	0.00	0.00	0.00	-0.07	-0.07	-0.07
Swamp white oak	0.03	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.04	0.04
White oak	0.65	0.18	0.00	0.00	0.91	1.90	2.55	0.81	1.46	1.46
Cottonwood	0.00	0.00	0.00	0.00	0.20	0.03	0.03	-0.17	-0.17	-0.17
Black gum	0.07	0.00	0.00	0.00	0.00	0.30	0.37	0.30	0.37	0.37
Sweet or red gum	1.19	0.68	0.00	0.00	1.04	3.57	4.76	1.85	3.04	3.04
Red maple	0.22	0.10	0.00	0.00	0.23	0.63	0.85	0.30	0.52	0.52
Yellow-poplar	0.36	0.14	0.00	0.00	0.50	1.65	2.01	1.01	1.37	1.37
Black willow	0.00	0.32	0.00	0.08	0.23	0.04	0.04	-0.59	-0.59	-0.59
Boxelder	0.26	0.15	0.00	0.00	0.20	0.62	0.88	0.27	0.53	0.53
American elm	0.25	0.37	0.00	0.00	0.00	0.99	1.24	0.62	0.87	0.87
Winged elm	0.27	1.11	0.00	0.03	0.29	0.88	1.15	-0.55	-0.28	-0.28

Table 47 (Continued)

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Ash	0.20	0.34	0.00	0.02	0.33	1.00	1.20	0.31	0.51	0.51
River birch	0.04	0.13	0.00	0.16	0.44	0.34	0.38	-0.39	-0.35	-0.35
Black cherry	0.35	0.25	0.00	0.00	0.00	1.05	1.40	0.80	1.15	1.15
Black walnut	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.06	0.06	0.06
Dogwood	0.31	0.07	0.00	0.04	0.00	0.34	0.65	0.23	0.54	0.54
Hickory spp.	0.41	0.27	0.00	0.05	1.27	1.58	1.99	-0.01	0.40	0.40
Persimmon	0.10	0.02	0.00	0.00	0.00	0.12	0.22	0.10	0.20	0.20
Sourwood	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Sycamore	0.00	0.00	0.00	0.00	0.47	0.29	0.29	-0.18	-0.18	-0.18
Black locust	0.00	0.00	0.00	0.04	0.00	0.02	0.02	-0.02	-0.02	-0.02
Mulberry	0.03	0.02	0.00	0.03	0.08	0.15	0.18	0.02	0.05	0.05
Osage orange	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04
Sassafras	0.03	0.08	0.00	0.00	0.00	0.04	0.07	-0.04	-0.01	-0.01
Ironwood	0.18	0.00	0.00	0.00	0.00	0.01	0.19	0.01	0.19	0.19
Redbud	0.02	0.06	0.00	0.00	0.00	0.06	0.08	0.00	0.02	0.02
Misc. hardwoods	0.04	0.03	0.00	0.00	0.00	0.00	0.04	-0.03	0.01	0.01
Totals	6.99	5.51	0.00	0.52	10.12	22.82	29.81	6.67	13.99	13.99

Table 48. Sawtimber volume (bd.ft.,Int.1/4"/acre) for pine plantations at Ames Plantation by species and inventory year, based on 26 plots.

Species	1968	1973	1978
Shortleaf pine	135.69	225.20	470.41
Loblolly pine	0.00	180.95	1447.45
Eastern red cedar	5.63	10.04	15.20
Totals	141.32	416.19	1933.06
[S.E./$\bar{X}$] x 100	84.13	46.87	17.65
Black oak	36.59	34.33	54.74
Cherrybark oak	0.00	0.00	14.53
Southern red oak	19.45	31.32	69.50
Pin oak	14.44	16.53	45.84
Post oak	39.53	29.61	47.97
Red gum	0.00	0.00	8.90
Totals	110.01	111.79	241.48
[S.E./$\bar{X}$] x 100	56.29	53.74	44.71
Grand totals	251.33	527.98	2174.54
[S.E./$\bar{X}$] x 100	51.58	36.87	13.92

Table 49. Pulpwood volume (cu.ft./acre) for pine plantations at Ames Plantation by species and inventory year, based on 26 plots.

Species	1968	1973	1978
Shortleaf pine	50.71	120.58	146.02
Loblolly pine	197.80	444.35	471.18
Eastern red cedar	2.98	3.20	4.80
Totals	251.49	568.13	622.00
[S.E./$\bar{X}$] x 100	17.06	13.73	11.96
Black oak	1.17	2.61	5.15
Southern red oak	13.74	18.66	34.63
Blackjack oak	1.62	1.78	1.81
Pin oak	3.47	6.34	6.85
Willow oak	--	--	0.54
Post oak	0.54	3.08	4.57
White oak	--	0.66	2.56
Sweetgum	2.64	3.88	9.20
Yellow-poplar	--	0.59	1.94
Winged elm	1.47	2.57	0.37
Black cherry	0.37	0.86	4.17
Dogwood	--	0.28	1.55
Hickory spp.	0.37	--	--
Totals	25.39	41.41	73.34
[S.E./$\bar{X}$] x 100	42.16	40.20	32.75
Grand totals	276.88	609.54	695.34
[S.E./$\bar{X}$] x 100	13.73	11.18	7.45

Table 50. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for the pine plantations at Ames Plantation, 1968 to 1973.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	3.81	0.00	0.00	0.00	14.09	17.90	14.09	17.90	17.90
Loblolly pine	27.61	0.00	0.00	0.00	8.58	36.19	8.58	36.19	36.19
Eastern red cedar	0.00	0.00	0.00	0.00	0.88	0.88	0.88	0.88	0.88
Black oak	0.00	0.00	0.00	0.00	-0.45	-0.45	-0.45	-0.45	-0.45
Southern red oak	2.03	0.00	0.00	1.35	1.69	3.72	0.34	2.37	2.37
Pin oak	0.00	0.00	0.00	0.00	0.42	0.42	0.42	0.42	0.42
Post oak	0.00	0.00	0.00	0.00	-1.98	-1.98	-1.98	-1.98	-1.98
Totals	33.45	0.00	0.00	1.35	23.23	56.68	21.88	55.33	55.33

Table 51. Sawtimber volume growth (bd.ft.,Int.1/4"/acre/year) for the pine plantations at Ames Plantation.

Species	Ingrowth	Mortality	Cut	Loss to Cull	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	17.77	0.00	0.00	0.00	31.27	49.04	31.27	49.04	49.04
Loblolly pine	139.22	0.28	5.01	0.00	116.83	256.05	116.55	255.77	250.76
Eastern red cedar	0.00	0.00	0.00	0.00	1.03	1.03	1.03	1.03	1.03
Black oak	0.00	0.00	0.00	0.00	4.08	4.08	4.08	4.08	4.08
Cherrybark oak	0.60	0.00	0.00	0.00	2.31	2.91	2.31	2.91	2.91
Southern red oak	4.81	0.00	0.00	0.00	2.83	7.64	2.83	7.64	7.64
Pin oak	1.88	0.00	0.00	0.00	3.99	5.87	3.99	5.87	5.87
Post oak	0.00	0.00	0.00	0.00	3.67	3.67	3.67	3.67	3.67
Sweet or red gum	1.64	0.00	0.00	0.00	0.14	1.78	0.14	1.78	1.78
Totals	165.92	0.28	5.01	0.00	166.15	332.07	165.87	331.79	326.78

Table 52. Pulpwood volume growth (cu.ft./acre/year) for the pine plantations at Ames Plantation, 1968 to 1973.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	3.53	0.00	0.00	0.07	1.37	11.93	15.46	10.49	14.02	14.02
Loblolly pine	19.50	1.34	0.00	0.30	11.15	42.35	61.85	29.56	49.06	49.06
Eastern red cedar	0.00	0.06	0.00	0.00	0.00	0.10	0.10	0.04	0.04	0.04
Black oak	0.00	0.00	0.00	0.00	0.00	0.29	0.29	0.29	0.29	0.29
Southern red oak	1.05	0.93	0.00	0.00	0.61	1.48	2.53	-0.06	0.99	0.99
Blackjack oak	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Pin oak	0.09	0.00	0.00	0.00	0.00	0.49	0.58	0.49	0.58	0.58
Post oak	0.38	0.00	0.00	0.00	0.00	0.15	0.53	0.15	0.53	0.53
White oak	0.09	0.00	0.00	0.00	0.00	0.04	0.13	0.04	0.13	0.13
Sweet or red gum	0.22	0.00	0.00	0.00	0.00	0.03	0.25	0.03	0.25	0.25
Yellow-poplar	0.11	0.00	0.00	0.00	0.00	0.01	0.12	0.01	0.12	0.12
Winged elm	0.00	0.00	0.00	0.00	0.00	0.22	0.22	0.22	0.22	0.22
Black cherry	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10
Dogwood	0.06	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.06
Hickory spp.	0.00	0.07	0.00	0.00	0.00	0.00	0.00	-0.07	-0.07	-0.07
Totals	25.03	2.40	0.00	0.37	13.13	57.22	82.25	41.32	66.35	66.35

Table 53. Pulpwood volume growth (cu.ft./acre/year) for the pine plantations at Ames Plantation, 1973 to 1978.

Species	Ingrowth	Mortality	Loss to Cut	Loss to Cull	Outgrowth to Sawtimber	G.G.I.V.	G.G.	N.G.I.V.	N.G.	N.I.
Shortleaf pine	1.06	0.09	7.45	0.00	4.55	16.09	17.15	11.45	12.51	5.06
Loblolly pine	10.48	19.48	3.54	0.00	32.49	51.13	61.61	-0.84	9.64	6.10
Eastern red cedar	0.08	0.11	0.00	0.00	0.00	0.35	0.43	0.24	0.32	0.32
Black oak	0.21	0.00	0.00	0.00	0.00	0.29	0.50	0.29	0.50	0.50
Southern red oak	0.31	0.00	0.11	0.00	0.23	3.23	3.54	3.00	3.31	3.20
Blackjack oak	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Pin oak	0.00	0.00	0.00	0.00	0.70	0.80	0.80	0.10	0.10	0.10
Willow oak	0.09	0.00	0.00	0.00	0.00	0.02	0.11	0.02	0.11	0.11
Post oak	0.13	0.00	0.00	0.00	0.00	0.16	0.29	0.16	0.29	0.29
White oak	0.20	0.00	0.00	0.00	0.00	0.18	0.38	0.18	0.38	0.38
Sweet or red gum	0.64	0.00	0.00	0.00	0.27	0.63	1.33	0.42	1.06	1.06
Yellow-poplar	0.00	0.00	0.00	0.00	0.00	0.27	0.27	0.27	0.27	0.27
Winged elm	0.07	0.44	0.00	0.07	0.00	0.00	0.07	-0.51	-0.44	-0.44
Black cherry	0.37	0.00	0.00	0.00	0.00	0.29	0.66	0.29	0.66	0.66
Dogwood	0.16	0.00	0.00	0.00	0.00	0.10	0.26	0.10	0.26	0.26
Totals	13.80	20.12	11.10	0.07	38.24	73.61	87.41	15.18	28.98	17.88

VITA

Edison Eric Watson was born in Valdese, North Carolina, on November 13, 1954. He graduated from Valdese High School in 1973.

He enrolled in The University of Tennessee, Knoxville in the fall of 1973 and received a B.S. degree in Forest Management in 1977.

The author entered The University of Tennessee, Knoxville, Graduate School in July 1977 to begin work toward a Master's degree in Forestry, specializing in Biometry and Mensuration. As a graduate student he worked as a graduate research assistant in Forestry.

The author married Lucinda Vaughn Moose of Valdese, North Carolina in September of 1977.

The author is a member of the Society of American Foresters and Xi Sigma Pi Honorary Society.