BUDGETING FARM-AND-FOREST OPERATING UNITS FOR INCREASED NET INCOME: AMES PLANTATION CASES

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Alfred Pleasonton

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Lee M. James
Major professor

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ABSTRACT

BUDGETING FARM-AND-FOREST OPERATING UNITS

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AMES PLANTATION CASES

by Alfred Pleasonton

Economic problems rooted in agriculture and forestry, and stemming from tradition, seriously affect lives and welfare of people in low-income areas such as in west Tennessee. This project undertook 3 principal objectives.

1. Ascertaining how changes in forestry and farming activities can contribute to higher incomes for low-income farm-and-forest operating units in the area.

2. Ascertaining the regional significance of improved forestry on such units.

3. Indicating use of data permitting more accurate appraisals of opportunities for improved forestry on individual units.

Budget analysis to help owners decide among various alternative allocations of farm resources to increase net income is not a sophisticated procedure. It is commensurate with the accuracy of current practicable methods of forest data collection, timber yield, and income prediction. Furthermore, its very simplicity makes it more suitable for widespread use than more complicated techniques.

The knowledge this project accumulated should constitute a foundation upon which creative agencies can develop action

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The first and second objectives primarily involved study of forestry's relationship to problems of over-all farm management and family income goals. This project was focused on tenant farm units on the Ames Plantation in southwestern Tennessee, but its scope embraces all relevant aspects of timber production and marketing from forests under 3,000 acres. It was designed to encourage inferences for many types of farms, aiming to suggest methods useful in solving some of the current widespread rural economic problems.

Six scheduled data collection phases follow: (1) Woodland ownership data and forty owners' attitudes towards forestry were surveyed by interview. (2) Twenty forest products buyers answered questionnaires probing the markets facing woodland owners and the industries' attitudes toward forestry and future timber supply. (3) The Ames Plantation's 10,400-acre forest was sampled and site-mapped by forest surveying, including intensive sampling on six of the eight case study units. (4) Agricultural input-output data for these eight units were derived by the Ames Plantation Program Director. (5) Specific Tennessee economic data were accumulated from secondary sources. (6) Work-performance data from forestry operations were recorded daily for over two years to develop rates applicable to various work conditions.

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The second product of the study was the illustration, using these data, of the budget method for analyzing alternative plans for integrated farm-and-forest operating-unit resource allocation. In each of eight examples, each of three forestry alternatives--intensive management with harvesting and roadside sales, intensive management with stumpage sales, and extensive forestry with stumpage sales--was combined with a recommended alternative farm management plan. These integrated plans were compared as to net income with the original, traditional system of farm operation which disregarded woodland. Forestry data for each plan were projected over several decades and financial summaries prepared to bring out the returns and advantages, costs and problems, and annual net farm incomes for each alternative.

All three integrated plans show immediate increases in net farm income over the original farm operation. The more labor-intensive alternatives generally yield higher incomes. The most desirable alternative for Units 1-7 is intensive management with roadside sales--because harvesting provides needed wages to each farm family, as agricultural enterprises don't occupy them fully.

Intensive management with stumpage sales is financially more attractive for the Unit 8 family having a large forest acreage but relatively few man-days available for woods-work.

With both intensive forestry programs, returns to timber, land, and labor generally increase decade after decade--until a [illegible] is [illegible]

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fluid equilibrium is reached after 50-70 years. Stumpage value of residual growing stock continually increases, averaging annually for the 8 units from $241 to $6,581 closely proportionate to their forest acreages. Average annual increases per acre range from $2.26 to $2.96, showing a rapid build-up in investment--a further incentive for good management.

The third forestry alternative, stumpage sales when possible, without any improvement efforts--virtually the absence of management--led to downgrading of the forest and yielded relatively negligible returns.

The general regional significance of farm-and-forest budgeting stems from increased capital accumulation, a higher tax base, substantial wage income, expansion of wood-using industries and others, and higher credit ratings for forestry.

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by

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A THESIS

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Department of Forestry

1964

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PREFACE

This project was begun at the suggestion of the late Dr. John D. Black, Henry Lee Professor Emeritus of Economics at the Harvard Graduate School of Public Administration, but supervisory responsibility later was passed to Dr. Ayers Brinser, then Lecturer in Economics, while the project outline was still in an early stage of development. At Dr. Black's recommendation, and with the concurrence of Dr. Brinser, an Ames Foundation Forestry Fellowship administered by the University of Tennessee was applied for and received, making possible most of the field work on the Ames Plantation, in Hardeman County, Memphis, and Jackson, Tennessee, and in Corinth, Mississippi.

Dr. Solon L. Barraclough, then Associate Professor of Forestry at the University, was Resident Forester heading the Ames Plantation Forestry Department and, during my 17 months of field work, gave close and generous supervision to all phases of the research, for which I am deeply grateful. I greatly appreciate the help and kind cooperation of Dr. Thomas J. Whatley, then the University's Program Director on the Plantation and Professor of Agricultural Economics--also that of Dr. Joe A. Martin, Professor of Land Tenure and Policy.

In July 1956 I began work for the Southern Forest Experiment Station of the United States Forest Service as a research forester in the economics of management to complete the forest survey on the Plantation. My sincere thanks for valuable advice on survey procedures go to Philip R. Wheeler, then Chief of the Division of Forest

... Research. I also ...

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... Miss Martha E. ...

... Reid, and Mrs. ...

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To Miss Martha E. Nelson, Mrs. Jacqueline M. Earles, Mrs. Theresa P. Held, and Mrs. Enola Byrd of the Statistical Services Section, much gratitude is due for their care and diligence in preparing IBM cards and tabulations to facilitate analysis and stand projection. For his painstaking help in the monumental and tedious task of projecting the numerous stands, Joe D. Perry has earned a long-lasting measure of my thanks. Mrs. Elaine P. McGowan, Miss Edna M. Villere, Mrs. Janice H. Shelton, and Mrs. Margaret R. Pilié, all deserve great appreciation for the typescripts produced by their nimble fingers.

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And a very special expression of gratitude has been more than earned by my wife, Anna, who has given generously of her talents in painstakingly typing most of the tables, proofreading the entire volume, offering valuable suggestions and criticisms, and especially in tolerating and encouraging me through many difficult days. My final acknowledgment is that any error in fact or judgment remains my own, deserving only of the reader's forebearance and good will.

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[illegible]. Value of yields by ...
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agement and stump...

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of Unit 2 under P...
agement and stump...

[illegible]. Value of yields by ...
of Unit 2 under P...
agement and stump...

[illegible]. Value of yields by ...
of Unit 2 under ...
agement and stump...

[illegible]. Value of yields by ...
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ment and stumpa...

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slope hardw...

[illegible]. Average yields an...
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placing a port...
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[illegible]. Average yields a...
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[illegible]. Average yields a...
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of Unit 3 under ...
agement and ...

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of Unit 3 und...
agement and s...

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and B of Unit ...
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[illegible] Labor requirem
175 acres of
and extensive

[illegible] Labor requirem
harvesting by
in Unit 4 . . .

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[illegible] Value of yield
of Unit 3 u
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[illegible] Value of yield
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[illegible] Value of yield
of Unit 4 u
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Unit - Area B, [illegible]
sapling stand [illegible]
per acre . . .

[illegible]. Average yields [illegible]
Unit - Area C, [illegible]
stand of [illegible]

[illegible]. Average yields [illegible]
Unit - Area [illegible]
stand of [illegible]
acre . . . .

[illegible]. Labor require[illegible]
[illegible] acres of [illegible]
extensive [illegible]

[illegible]. Labor require[illegible]
harvesting [illegible]
in Unit 5 . [illegible]

[illegible]. Value of yiel[illegible]
of Unit 5 [illegible]
agement a[illegible]

[illegible]. Value of yie[illegible]
of Unit 5 [illegible]
agement a[illegible]

[illegible]. Value of [illegible]
of Unit [illegible]
agement [illegible]

[illegible]. Value of [illegible]
of Unit [illegible]
agement [illegible]

[illegible]. Value of [illegible]
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agement [illegible]

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of Unit 5 under [illegible]
agement and st[illegible]

[illegible]. Value of yields [illegible]
Unit 5 under [illegible]
ment and stu[illegible]

[illegible]. Average yields [illegible]
Unit 5 Area A[illegible]
planting a p[illegible]
slope mark[illegible]

[illegible]. Average yield[illegible]
Unit 5 Area [illegible]
stand of upp[illegible]
acre . . . .

[illegible]. Average yiel[illegible]
Unit 5 Area[illegible]
of lower-s[illegible]

[illegible]. Average yiel[illegible]
Unit 5 Are[illegible]
stand of [illegible]
per acre [illegible]

[illegible]. Labor requi[illegible]
[illegible] acre[illegible]
and ente[illegible]

[illegible]. Labor requ[illegible]
harvest[illegible]
on Unit[illegible]

[illegible]. Value of [illegible]
of Uni[illegible]
agemen[illegible]

[illegible]. Value [illegible]
of Un[illegible]
agem[illegible]

[illegible]. Value [illegible]
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stumpage sales . .

[illegible] Average yields and [illegible]
Unit 6 Area A, [illegible]
placing a [illegible]
upper-slope [illegible]
[illegible] acres of [illegible]

[illegible] Average yields and
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stand of upper-[illegible]
acre . . . .

[illegible] Labor requirements
2,[illegible] acres of [illegible]
and extensive [illegible]

[illegible] Labor requirements
harvesting by [illegible]
on Unit 7 . . .

[illegible] Value of yields by
A of Unit 7 under
agement and [illegible]

[illegible] Value of yields [illegible]
of Unit 7 under
agement and [illegible]

[illegible] Value of yields [illegible]
C of Unit 7 [illegible]
agement and [illegible]

[illegible] Value of yields [illegible]
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of Unit 7 [illegible]
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of Unit 7 [illegible]
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of Unit 7 [illegible]
agement and [illegible]

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agement and [illegible]

Table of yields [illegible]
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management a[illegible]

Average yields [illegible]
Unit 7 Area A [illegible]
replacing a [illegible]
slope hardw[illegible]
acres of [illegible]

Average yields [illegible]
Unit 7 Area B [illegible]
placing a [illegible]
bottomland h[illegible]

Average yields [illegible]
Unit 7 Area [illegible]
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Average yiel...
Unit ... Area ...
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Labor requir...
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B of Unit ...
management ...

Value of yiel...
C of Unit ...
management a

Value of yiel...
D of Unit ...
management a

Value of yiel...
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management a

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[illegible] and [illegible]

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Unit [illegible] Area A, a
planting a [illegible]
upper-slope [illegible]
and [illegible] acres [illegible]

[illegible]. Average yields [illegible]
Unit [illegible] Area B, a
and sapling [illegible]
[illegible] MBF per acre

[illegible]. Average yields [illegible]
Unit [illegible] Area C, [illegible]
stand of lower-[illegible]
acre . . . . . .

[illegible]. Average yields [illegible]
Unit [illegible] Area D, [illegible]
of bottom-land [illegible]

[illegible]. Labor requirem[illegible]
operations [illegible]
[illegible] in [illegible]
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CHAPTER I

OBJECTIVES AND SCOPE OF THIS STUDY

Objectives

Economic problems rooted in agriculture and forestry, and stemming from tradition, are seriously affecting the lives and welfare of people living in low-income areas such as are found in west Tennessee. The present study was undertaken as the first link in a chain of action needed to relieve the problems and to improve the conditions described in Chapter III.

The three principal objectives for which this project was intended are as follows:

1. To ascertain how changes in forestry and farming activities can contribute to higher incomes for low-income farm-and-forest operating units in the west Tennessee area.

2. To ascertain the general significance (for this area) of improved forestry on farm-and-forest units.

3. To indicate a use of data that will permit more accurate appraisals of opportunities for improved forestry on individual units in the area.

It is intended that this knowledge constitute a foundation upon which creative agencies (in such fields as education, credit, and planning) can develop action programs to improve the lot of the farm family which presently receives but little cash income and only enough returns in kind to maintain a level of living slightly above subsistence needs. T

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The main element in the first and second objectives involved the study of the relationship of forestry to problems of overall farm management and family income goals. This study was focused on tenant farm units on the Ames Plantation in southwestern Tennessee, but its scope embraces in general all relevant aspects of timber production and marketing from small forest properties (ownerships having less than 1,000 acres in woodland). The assumption is made that it is desirable to take steps to improve the welfare of low-income families in our society if these steps can be made to cause little or no lessening of the welfare of other segments of our society. Furthermore, development steps are assumed to be an overall improvement if by taking them the lot of low-income families can be improved to some small degree <u>even if</u> there is a consequent moderate reduction in the welfare of persons not in the low-income category.

With these points in view, several pertinent aspects of the rural economy of a selected area around the Ames Plantation in west Tennessee were investigated to obtain historical data and to ascertain or develop steps in the appropriate methodology applicable to research and extension education in this field. Analysis of the data collected and of the problems investigated had as a general goal the consolidation and eventual dissemination of improved intelligence on

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the place of forestry in the economy of this low-income area and, insofar as pertinent inferences can be drawn, on the opportunities for forestry in low-income rural economies in general. The breadth of the study was especially designed to provide inferences for many types of farms in west Tennessee and elsewhere. The intention was to suggest methods useful for helping to solve some of the current rural economic problems within the context of the dynamic economy of the United States.

Scope and Method

Appropriate populations were selected for the purpose of data collection so that the objectives of this project could be achieved. Emphasis has been placed on the operating-unit approach involving a number of case study farms in order to proceed from general information on the problems and background setting to specific, individual cases of farm-and-forest resource use, to more general conclusions for a whole area. All the six phases of collection were considered in relation to their roles in piecing together a unified word-picture of the immediate area within the scope of this study, namely southwestern Tennessee. The intention responsible for the design of the data-collection plan was the spreading of limited research resources of people, equipment, time, and money in just adequate intensity and in appropriate areas to accomplish the objectives.

The six phases of data collection were scheduled in the following order. (1) Woodland ownership data and owners' attitudes were sampled by means of a personal interview questionnaire survey.

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(2) Buyers of stumpage and cut forest products were similarly surveyed. (3) Sampling and site-mapping of woodlands were accomplished by a forest survey. (4) Agricultural input-output data were derived from records of several small farm operating units having woodland areas. (5) Specific economic data on Tennessee, especially west Tennessee, were accumulated from various sources. (6) Concurrently with all these five phases, work-performance data were collected from forestry operations on the Ames Plantation over a two-year period.

The first phase of data collection was intended to provide a basis for a description of a range of west Tennessee landowner attitudes toward forestry. The data necessary for a sufficiently reliable description were readily obtainable from a random-block sampling of landowners in Hardeman County. Owner attitudes are to some degree related to forest type. Due to this fact, Hardeman County was selected as typical of west Tennessee because the forested areas of both the county and the region are similar. Most of the area is in the upland hardwood type. A fraction of the total area carries mixed hardwoods characteristic of lower slopes and minor bottoms. Natural shortleaf pine land constitutes a small portion of the area.

The second phase was the collection of data to be used for describing the sort of forest products markets facing west Tennessee forestland owners and the forest products industries' attitudes toward forestry and their future timber supply. The population from which the various strata of wood-using industries were sampled consisted of all buyers of timber and rough products made from wood grown in Hardeman County.

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The third and fourth phases consisted of detailed data collection on the Ames Plantation in Hardeman and Fayette Counties. In the third phase the entire woodland area of 10,400 acres was sampled, with intensified sampling of the woodlands on six of the eight case study areas on the Ames Plantation delineated by the University of Tennessee Agricultural Experiment Station as farm operating units. (The other two of the eight areas are primarily forest farm units.) Agricultural enterprise data were needed for the fourth phase. The University's Ames Plantation Program Director made prospective budgets of operations for these eight units, using agricultural input-output data and acreages of areas best suited to agricultural enterprises. The proposed budget for each farm consisted of an improved farm management alternative based upon University experience with similar small farms having diversified enterprises. He also provided an "historical budget" or reconstructed record of production reported for the most recent combination of "traditional" land uses on each tract. (Such land management was characteristic of farming without University advice on farm planning and enterprise operation.)

The fifth phase involved the gathering of data other than by first-hand observation or sampling survey: numerical and descriptive information of specific economic nature obtained from earlier writings, published statistical reports, and correspondence and interviews with a number of existing agencies.

In the sixth phase input-output data on work of the Ames Plantation Forestry Department crew were recorded daily according to each principal category of job into which man-hours or other resources

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were put during the years 1955-57. (The crew varied in size and organization depending on the type of task and research objective assigned as well as the number of men available and their experience.) Work-performance data were computed following accumulation of the daily input-output records for over two years. The records listed the number of input units of labor, machinery, equipment, and capital supplies or components used in each specific task. They also reported the output (produced at the time the work was done) as a result of the inputs used. The daily records included special remarks if the inputs were applied in a particular combination according to existing conditions or as a result of research-oriented instructions of the supervising forester or the crew foreman.

The methods used in the various phases of data collection are at least partially described in the relevant chapters, with details included in the appendix as needed. For the purposes of this chapter, it is adequate to state that forty woodland owners were interviewed in the first phase and twenty buyers of forest products, stratified by the type of industry, in the second. The forest survey in the third phase was based on point-sampling at the intersections of a rectangular system of grid lines 30 chains apart covering the Ames Plantation. The topographic-forest-site mapping was accomplished by combining published topographic maps and field-recorded site observations to delineate boundaries between the three major topographic sites recognized: upper slopes and ridges, lower slopes, and bottomland areas along streams. No special explanation is necessary for methods used in the fourth and fifth phases. Information assumed on the ...

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was recorded on the input-output cards used in the sixth phase by the supervisor of each crew of forestry department workers, and total hours per man permitted an accuracy check (on labor input per job) at least weekly by the departmental secretary.

The overall reason for the research strategy adopted in this project is that the research resources available were believed to be more efficiently allocated in this kind of case study approach than in any other type or types of research method. While following basically a budgeting case study method, this project has elaborated on the customary method in that it has incorporated some supporting techniques in order to establish the case studies firmly in the context of regional economic and social situations and problems.

This integrated farm-and-forest study used the procedure of analyzing a few reasonable alternatives for overall operating-unit organization, forest products marketing, and forest management over a long enough period of time to bring out the advantages and costs of each alternative. A study of potential alternatives for producing and marketing forest products in conjunction with other farm enterprises requires a knowledge of existing alternatives actually employed by farmers in the area. For this reason the first phase involved intensive analysis of forest production and marketing alternatives being applied by owners of a total of 18,602 acres, 11,884 of which were in woodland uses. The case study method was selected due to the usefulness of information applied to a detailed case study in analyzing the economic consequences of chosen alternatives. Case study data tend to be both (1) precise and reliable, and (2) [illegible] applicable to the [illegible]

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directly applicable to the study area. In this project the eight case study farms selected in the fourth phase comprised a sizable study area, totaling 6,957 acres, with 4,669 in woodland.

One of the advantages of actual case studies over purely theoretical models is that case studies can be completely realistic, as they are not limited by the simplifying assumptions upon which theoretical models are based. Also the realism of case studies can be put to immediate practical use through the choice and subsequent application of a "most preferable" alternative for future operation of the resource. Data collected in case studies, especially subjective data, tend to be more accurate than those obtained from a large number of sources because a single investigator can have a personal knowledge of the operations under study. In addition, economy of travel is achieved and problems of communication, especially misunderstandings, are minimized.

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CHAPTER II

REVIEW OF THE LITERATURE

Many authorities have investigated and discussed various aspects of forestry pertinent to the economies of farms and other small woodland ownerships. In a review of the writings of these previous workers a number of interesting and helpful points are found worthy of mention. To be sure, some conflicts and areas of contention exist, but this is to be expected among persons of differing backgrounds, motives, and points of view. In the references to and quotations from the statements of these various authors the need becomes obvious for a clarification of facts, assumptions, and purposes if future endeavors are to be worthy of the cost and effort invested in them. It is hoped that the present study will make a worthwhile contribution in integrating facts and methods useful for practical application toward improving human welfare.

One of the most prolific authors in the field of farm forestry is John F. Preston, retired chief of the Soil Conservation Service's Forestry Division. The focal elements in Preston's attitude are expressed succinctly in his statement, "The approach to integrated farm forestry is through farm planning rather than forest planning."[1] He defined this as "not how much timber can be cut, but how can the farm woodland best serve the farmer," indeed a proper objective from

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[1]John F. Preston, "Integrated farm forestry," Journal of Forestry, XLIII, 8 (Aug. 1945), p. 577.

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the farmer's point of view. His procedure in achieving this aim Preston briefly described as follows: "One of the first steps in preparing a farm plan involving integrated farm forestry is to find out what farm labor is available, how it can be used in the production of woodland products, and how much additional local labor the farmer might profitably employ in the processing of woodland products. Thus, he will secure for himself the returns for stumpage, labor, and the business of logging." For a farm plan to be made useful, of course, "at first the job is to get a farm plan, involving the woodland, accepted by the farmer, and in operation." Preston urged prompt adoption of a plan and assured that "if the farmer starts cutting on an annual basis, there is plenty of time for refinements as the result of which the annual woods operation may be somewhat changed." For making the farm plan to start with, however, Preston advised that "The farm planner needs some rule-of-thumb guides about woodland productiveness."

In evident contrast to this recommendation Dr. Richard E. McArdle warned small forest owners when, as Chief of the Forest Service, he addressed the 81st annual meeting of the American Forestry Association, "Designing a practical plan of management for growing good timber . . . requires at least as much skill, experience, and technical knowledge as does the production of any crop. You won't get the answers you need . . . by attempting to use some rule-of-thumb guide. So don't underrate or undervalue the technical skill required to do a profitable forestry job. It's easy to make

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[2] U.S. Forest Servi[illegible] ... and Washington (P[illegible] ...), p. 22.

[3] Charles C. Larso[illegible] ... of the administrat[illegible] ... small private wo[illegible] ... College of F[illegible] ..., p. 12.

a mistake that will cut your long-time income to a third or a fourth of what you could have."[2]

Each of these opposing views is abbreviated to a generalization, a result of the compromising of conflicting intents in order to serve what each of the proponents considers the most important aim or need under his assumptions of circumstances. Assumptions should be clearly stated to provide the full context.

A more balanced and complete statement on this point has been made by Larson as follows: ". . . farmers . . . can also learn to apply the basic principles of forest management. However, the minimum amount of knowledge required to develop a satisfactory forestry enterprise is considerably beyond that currently possessed by the average small woodland owner. The services of a professional forester are almost essential, therefore, to aid him . . . until such time as he is able, through continuous learning and experience, to carry on by himself."[3]

Objectives of Farmers, Owners, and Others

Why small woodlands are at all a subject of interest stems from the objectives of the various people who are concerned. A variety of statements on intents of farmers and others have been made by a great number of authors, some of whom are quoted here.

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[2]U.S. Forest Service, Region Six, Small forest landownerships, Oregon and Washington (Portland, Ore.: Division of State and Private Forestry, 1956), p. 22.

[3]Charles C. Larson, Government and the small forest holding; a study of the administration of governmental programs for farm and other small private woodland owners (Unpublished PhD dissertation, Syracuse: College of Forestry of the State University of New York, 1952), p. 82.

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Minckler and Hosner stated simply that "The objective of most farmers is a good, steady income combined with the best current living for the family."[4] Elaboration on this point was made in an optimistic generalization by Murphey and Simonds:

> The farm woodland grows a crop, capable of replacing itself indefinitely. It responds to cultural treatment like any other field crop and the benefits derived from it depend largely on the manner in which it is managed. Until recently woodland was generally considered a source of supply for woodland timber only. Now, however, farmers consider it a crop that may yield them any one of several benefits. For instance, there are those persons who maintain their woods primarily for beauty. Their harvest is in a form of continuous enjoyment. The occasional yields of timber from such a woods are incidental only and not to be compared in value to the year-long satisfaction gained from it by the proprietor.
>
> Others may be managing their woods primarily for the protection it renders their property from storms and wind, for the shelter it affords wildlife, or for the soil and water it conserves for their use. Such benefits are often vital to a happy family life on the farm and may far outweigh in value the possible yields of wood.[5]

There has long been a desire on the part of many researchers and forest managers to quantify woodland values solely in monetary terms so that an observer can objectively evaluate any single woodland opportunity and compare a number of separate situations. The theory of the firm may be roughly applicable in the motives existing in purely commercial forestry, but especially great departures commonly exist in the management of small woodlands.

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[4]Leon S. Minckler and John F. Hosner, How to farm your forest, Central States Forest Experiment Station Miscellaneous Release no. 11 (Columbus, Ohio: 1956), p. 1.

[5]Frank T. Murphey and Walter W. Simonds, Managing the farm woodland, Agricultural Extension Service Circular 207 (State College, Pa.: The Pennsylvania State University College of Agriculture, 1954), p. 1.

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[7] Ibid.

[8] S. V. Ciria ... ... Agricultura... ... pp. 9-1...

For purposes of academic consideration Gregory has started with the common assumption that "Our growth goal will be that planned pattern of stumpage output ... which maximizes the present net worth of the forest, under the set of expected conditions."[6] However, he hastened to qualify this for practical purposes. "An obvious shortcoming to such an intent is that we can consider only monetary costs and revenues. Yet we know that many non-monetary items enter the calculations of most forest enterpreneurs. A second shortcoming to profit maximization as an intent has its basis in uncertainties. The planning agent can calculate only expected costs and expected revenues."[7]

Likewise, Ciriacy-Wantrup suggests that profit maximization for farmers is constrained by their appraisal of intangibles and costs of flexibility to adjust for uncertainly.[8]

A further complication in the area of woodland owner objectives is the fact, recognized by few authors, that many owners have not thought specifically about what their objectives really are. That fact was indicated, however, by K. E. Barraclough in his report on the initiation of the pilot woodland management program involving

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[6]Gustav Robinson Gregory, Developing economic growth goals for forest production (Unpublished PhD Dissertation, Berkeley: University of California, 1953), p. 95.

[7]Ibid.

[8]S. V. Ciriacy-Wantrup, Dollars and sense in conservation, California Agricultural Experiment Station Circular 402 (Berkeley: 1951), pp. 9-10.

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50 small woodlands in New Hampshire. "After giving each owner the vital statistics of his property, the discussion of the alternatives helped to crystallize the objectives of the owner." Adequately alerted and informed" . . . the owner is the person best able to decide which of the various alternatives will develop and utilize his forest resources in a way most likely to maximize all of the monetary and non-monetary returns."[9]

Malsberger raised the question of differing objectives and differing combinations of them for different owners, when he asked, "What interests the landowner in growing trees? Game, water, scenic, recreation, income? One or a combination? These are not the same for all people."[10]

In addition to recognizing the fact that differing objectives exist, Woodworth and Saunders observed that even for a single family ownership they are conflicting with one another and changing over time. ". . . goals and preferences of farm families differ and are likely to change over a period of years."[11] "The task of evaluation

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[9]K. E. Barraclough, "The pilot woodland management program in New Hampshire," Proceedings, Society of American Foresters meeting, Nov. 10-13, 1957, Syracuse, N.Y. (Washington, D. C.: Soc. of Amer. Foresters, 1958), pp. 175, 176.

[10]C. H. Coulter et al., "Panel discussion: the small forest landowner--keystone and enigma in forestry," Proceedings, Society of American Foresters meeting, Oct. 15-17, 1956, Memphis, Tenn. (Washington, D. C.: Soc. of Amer. Foresters, 1957), p. 161.

[11]Roger C. Woodworth and Fred B. Saunders, Evaluating income opportunities on north Georgia farms, Series I, Development of procedures for commercial and part-time farming and application to a case-study farm, Georgia Agricultural Experiment Station Bulletin N. S. 34 (Athens, Ga.: 1956), p. 7.

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[12] Ibid., p. 8.

[13] Larson, p. 112.

and choice among alternatives is a function of management. It cannot effectively be delegated to others since intricate systems of conflicting and changing goals and objectives are involved. A high income may be an immediate objective, but the sacrifice which a family is willing to undergo to obtain this income depends on many complex, intangible, yet more fundamental goals."[12]

An example of conflicting goals where dominance changes due to circumstances changing over time has been described by Larson: ". . . many small owners often are willing to forego the sustained returns to be obtained through woodland management, and to sell their stumpage, inclusive of growing stock, whenever the need for income becomes pressing."[13]

A brief report was made by Hall on the 1958 regional conferences sponsored by the U. S. Forest Service to learn more about the problems of small woodland owners. Although his comments included reflections on many of the conferees' motives and the value of their contributions, Hall noted a commonly voiced difference between the problems of the private owner and the public in regard to forest management on small woodlands. Recognizing the complexity of owner objectives and other factors, he was left with a rather pessimistic view toward the possibility of satisfactory solutions.

> . . . much of the time at the conferences was spent by federal, state, industrial, and consulting foresters, each telling of the successes of their respective programs and proposing that they be expanded.

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[12]*Ibid.*, p. 8.

[13]Larson, p. 112.

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> These jurisdictional conflicts, within government and between government and private interests, contributed little, however, to the definition of the problem, and what, if anything should be done about it. The conferences were called to explore what to do, not who should do it.
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> It was repeatedly brought out that except for the hobbyist, landowners will not invest in forestry unless there are monetary gains in the foreseeable future. While the future timber supply may be a "national problem," the landowner's problem is purely a personal one. It was this emphasis on the future national need for timber that prompted at some of the meetings the suggestion of direct subsidies in the national interest.
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> The U. S. Forest Service . . . has assigned a small staff to analyze the miscellany of information, advice and criticism. . . . It should be obvious, however, that no one solution is possible. Land ownership problems, like the people who have them--and like the land and trees themselves--vary with locality, with owner objectives, with markets, with land values, etc. To attempt a national solution to local problems which are not made of the same weighting of component aspects will be most difficult and probably woefully inefficient.[14]

Management Problems

Problems of management of farm and forest resources on small ownerships have been studied and discussed by many individuals and groups. Key aspects of management problems, being of both private and social importance, are highlighted in quotations from recent references.

Deficiencies in the various resource factors have been stressed in a report by the U. S. Department of Agriculture. "There are nearly a thousand counties in the United States where more than half of the farmers are mainly dependent on the income from small,

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[14] Albert G. Hall, "The small woodland conferences: what they have accomplished," Southern Lumberman, CXCVII, No. 2465 (Dec. 15, 1958), 150-152.

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poorly paying farms. What they are up against, in innumerable cases, is lack of enough good land, lack of equipment, lack of credit facilities, and often lack of the management information and skill which might open wider opportunity to them. . . . With better information, training, sometimes credit . . ., they can achieve a reasonably good living."[15] One recommendation particularly emphasized in this publication is the possibility that ". . . loans, supported by management guidance and technical services, would assist low-income farmers to become soundly established in a successful system of farming."[16]

Likewise, with specific reference to management of forest lands, Barraclough pointed out that ". . . one major impediment to the widespread practice of more productive forestry on small holdings is the problem of getting labor, capital, and managerial capacity properly combined on forest lands over a period of time. All of these factors are necessary for purposeful forest management."[17]

A similar statement, but of general application to farms, was made by Lanham and Butler. "Human and physical resources need to be utilized more profitably on many farms in order to produce

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[15]U.S. Department of Agriculture, Development of agriculture's human resources; a report on problems of low-income farmers, (Washington, D.C.: U.S. Government Printing Office, 1955), p.2.

[16]Ibid., p. 5.

[17]K. E. Barraclough, p. 175.

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higher farm incomes. These needed adjustments require careful planning and programming by individual farmers so that they may avoid financial difficulties in the years ahead."[18]

Taylor and Burch have directed attention to inadequate education as a cause of inefficient management and of underemployment of available labor. "Inadequate education and training often restricts managerial capacity which is reflected in pessimism and conservatism toward technological change in agriculture. It also retards and restrains farmers from developing alternative uses for surplus agricultural resources, particularly labor."[19]

This point was carried further by Johnson and Haver in considering farm management decisions. "With change and imperfect knowledge obviously so important, farmers must continually learn and adjust. As a consequence, they must spend time learning and making decisions on the basis of what they learn. The essence of management is the process of learning and adjusting."[20] Recognizing diminishing returns even in this area, they emphasized that "First among the principles for handling change and acquiring knowledge is not to

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[18]W. J. Lanham and C. P. Butler, Economic analysis of annual adjustments in developing a beef cattle-grain farm in the Piedmont Area of South Carolina, South Carolina Agricultural Experiment Station Bulletin 459 (Clemson, S.C.: 1958), p. 3.

[19]Calvin C. Taylor and Thomas A. Burch, Personal and environmental obstacles to production adjustments on South Carolina Piedmont Area farms, South Carolina Agricultural Experiment Station Bulletin 466 (Clemson, S.C.: 1958), p. 33.

[20]Glenn L. Johnson and Cecil B. Haver, Decision-making principles in farm management, Kentucky Agricultural Experiment Station Bulletin 593 (Lexington, Ky.: 1953), p. 7.

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[21] Ibid., p. 33.

[22] Ibid., p. 33.

[23] Ibid., p. 23.

[24] William B. Back e
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spend more, in time, foregone alternative opportunities, money, and effort, in performing additional amounts of any of the managerial functions than such additional performance is worth."[21] Classified as managerial functions are ". . . those of observing, analyzing, deciding, taking action, and bearing responsibility."[22]

Johnson and Haver stressed the importance of labor integrity and mentioned that a ". . . technique widely used in handling unreliability and dishonesty [of farm workers] involves their elimination through training and development of pride in moral and productivity standards. Religious thought and school and family training are thus valuable from a business standpoint as well as from religious, ethical and moral standpoints. . ."[23]

W. B. Back and his colleagues have considered factors bearing on farm-and-forest management decisions in Kentucky.

> A farmer has the problem of deciding whether the land would better be used for timber or for other farm crops. . . . Level-to-rolling upland in the Eastern Pennyroyal Area can be used for either timber or other crops, and the best use of this land depends upon the future income from woodland, the cost of conversion to cropland, the potential future farm income with and without conversion to cropland.[24]

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[21] Ibid., p. 33.

[22] Ibid., p. 38.

[23] Ibid., p. 28.

[24] William B. Back et al., Economics of the farm woodland in the Eastern Pennyroyal Area of Kentucky, Kentucky Agricultural Experiment Station Bulletin 650 (Lexington, Ky.: 1956), p. 28.

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[25] Ibid., p.30.

[26] Ray T. Britt and ... Woodland, University of T... Bulletin 295 (Knoxville, T...

[27] Larson, p. 493.

> When it is uncertain whether best use of land calls for clearing or leaving the land in timber, a guiding rule is to leave it in timber until a well-based decision can be made, and meanwhile to manage the woodland as if timber were the best alternative use of the land. Woodland resources in the Eastern Pennyroyal Area have been depleted because clear-cutting was anticipated and the woodland was placed in a temporary land-use category, and then the land was not clear-cut as planned.[25]

Some ambiguity exists as to the precise meaning of this last sentence; its general intent, however, is obvious.

Uninformed management was also reported by Britt and Martin from their recent survey of woodland owners in Tennessee. ". . . of all owners interviewed, less than 10 percent had ever received professional aid in marketing their forest products. The landowner's reluctance to ask for professional aid or their lack of knowledge that such aid was available greatly weakens their bargaining power."[26]

Inadequacy of management knowledge is not limited to the woodland owner, however. In discussing the need for forest research, Larson stated that "One of the major obstacles to the promotion of forestry on these small areas is the lack of accurate information upon which foresters can base their recommendations relating to management practices.[27]

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[25] Ibid., p.30.

[26] Ray T. Britt and Joe A. Martin, Marketing sawtimber and pulpwood, University of Tennessee Agricultural Experiment Station Bulletin 295 (Knoxville, Tenn.: 1959) p. 10.

[27] Larson, p. 493.

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Redman has theorized as to how the farmer's forest operations are determined by his response to uncertainty and the market rate of interest on loanable funds.

> Uncertainties of yield and price predictions encourage practices that result in preferences for a more certain present income although long-run income may be larger. This rate of discount is the farmer's own estimate of what constitutes a reasonable return on woodland investment. His idea of reasonable return is affected by nonmonetary values, relative capital position and needs for capital, or additional cropland and degree of uncertainty envisioned. The need for capital or awareness of a high rate of return from alternative uses tends to increase the farmer's discount rate. The degree of uncertainty is enhanced because of the difficulty of using the concept of flexibility to adjust resources to keep the proper relationship with other farm enterprises. When the farmer's discount rate is higher than the market rate of interest, clear-cutting and selling timber is encouraged, and conversely, if his discount rate is lower than the market rate, he is encouragedto invest in woodland. In the area under study, the past cutting practices indicate that the prevalent discount rates have been higher than the market interest rates.[28]

From this reasoning Redman has drawn the conclusion that, "For most farmers, there appears to be no economic incentive to invest in production of hardwood lumber." While many farmers may actually consider what a "reasonable return" may be, it is quite likely that many base decisions for a single cutting simply on liquidation values without consideration of such factors as possible long-run income or market interest rates.

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[28]John C. Redman, "Economic aspects of the farm woodland enterprise," Journal of Farm Economics, XXXVIII, No. 4 (Nov. 1956), 901-910.

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Budgeting

The process of budgeting in developing the farm plan is very important for achieving, on paper, a satisfactory productive organization. The farmer can choose to implement whatever plan appears the most desirable to him.

A concise outline of the over-all procedure has been provided by Woodworth and Saunders as part of a detailed exposition of planning for increased farm family satisfactions. "An evaluation of income opportunities involves planning to allocate resources among alternative uses. . . . Specifically, we are concerned with (1) evaluating the resources available, (2) listing the alternatives which are most appropriate, (3) estimating the resources required for each alternative, (4) developing several alternative farm organizations which would result in increased farm income . . . ."[29]

Attention has been given to the importance of including woodland in the farm plan. "Timber stands are important resources on many Georgia farms. . . . Regardless of how the woodland fits into the farm's organization it is desirable to inventory this resource periodically as a basis for planning."[30]

The woodland resource, being productive capital, needs to be given adequate consideration in planning, due to the interrelationships of the timber volume, growth rate, and harvest outputs, as

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[29]Woodworth and Saunders, p. 8.

[30]*Ibid.*, p. 16-17.

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Gregory has stated. "Outputs cannot be treated as independent through time. We must recognize the interdependence of all outputs throughout the entire planning interval."[31] This is important for planning with the assumption of profit maximization as the sole objective. "Even though the enterpreneurial intent is represented by maximization of present net worth, there remains the possibility of widely differing output patterns through time. In this, two factors are of prime significance: the choice of the interest rate, and the choice of the planning interval."[32]

Furthermore, pursuit of the maximized profit objective is complicated to such a degree, as Ciriacy-Wantrup has mentioned, that "A farmer's uncertainties about future costs and prices are usually so great that he cannot hope to hit exactly the peak of profits. All he can do is to try to move in the right direction; the only course that makes sense is to take one step at a time, try one change after another, improve net returns by trial and error. Most of his trials and errors will be made on paper, by budgeting. In this way a farmer may choose among alternative conservation practices without actually putting them into effect."[33]

Budgeting requires reasonably well estimated input-output data to fulfill its purposes for the farmer, as indicated by Johnson and Haver. "The keeping of financial and other records in farm operation

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[31]Gregory, p. 36.

[32]*Ibid.*, p. 131.

[33]Ciriacy-Wantrup, p. 10.

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and specific enterprises and trials provide him with basic data for planning future operations. Budgeting is a deductive process that formalizes plans, crystalizes [sic] analysis, and thereby reduces the possibility of errors."[34]

Gregory has added the caution that ". . . the process of estimating involves expense, and a balance must be struck between the advantages of obtaining more accurate (and more costly) estimates and those of using less exact estimates but revising plans more frequently."[35]

In the pilot woodland management program for New Hampshire already referred to, several budgets were devised and a corresponding "set of alternative management plans was prepared for each property." As Barraclough briefly described the procedure, "Each alternative plan of management includes an estimate of the amount of labor necessary to carry it out, the amount of income that might be realized from the plan, and the value of the residual trees at the end of a decade. These figures summarized and evaluated the inputs and outputs likely to result from each plan of action. Once these alternatives were presented the owner it was up to him to decide which plan or combination of plans he wished to follow." However, ". . . the owner does not commit himself to a single plan, but . . . the plan is flexible and is a general guide to action."[36]

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[34]Johnson and Haver, p. 27.

[35]Gregory, p. 148.

[36]K. E. Barraclough, pp. 175, 176.

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Flexibility

Considerable attention has been given to the functions and value of flexibility in resource use. Johnson and Haver have pointed out that "Flexibility is often valuable and should be built into a farm organization to the extent that the value of additional flexibility to the organization, in the opinion of the operator, equals or exceeds its costs." "When valuable facts and data become available with the passage of time, it often pays to spend money, time, and effort postponing decisions until more such facts and data become available. The ability to postpone decisions is referred to as flexibility."[37]

While flexibility is advantageous, its great disadvantage, as Ciriacy-Wantrup has stressed, is its deleterious effect upon conservation investment. "A flexible plan allows a farmer to make adjustments from time to time as he sees more clearly what is likely to happen. On the other hand, a flexible plan will bring lower profits than a fixed plan based on the most likely guesses--<u>if such guesses prove right</u>." "An increase in flexibility has important effects upon conservation." "A farmer can make his plans more flexible by . . . postponing investment in improvements--in short, by reducing his sunk costs. As we know (p. 12), a reduction in sunk costs results in depletion."[38]

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[37] Johnson and Haver, pp. 17, 33.

[38] Ciriacy-Wantrup, pp. 10, 17.

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The importance of flexibility in planning stems from its essential potentiality for accommodating future operations to circumstances presently uncertain. With flexibility essential despite its involving some cost, Gregory has explained its practical application, with multi-stage planning. ". . . expectation of events comparatively nearby in time are usually held with greater certainty than those in the more remote future. . . . at the end of the first year he [the planning agent] would probably have additional information on which to base better plans for the coming years. He would therefore strive for flexibility--to make even his short-term goals amenable to re-adjustment in the light of added information." "Multistage planning allows the planning agent to incorporate flexibility into his growth goal at each stage."[39]

With timber being both factory and product, he commented that ". . . the dual nature of standing timber permits an almost extreme flexibility in the harvesting and marketing of the product."[40] Recognizing this highly valued flexibility in timber management, Back and his colleagues have discussed how the farmer can apply it to his advantage. ". . . an individual farmer will realize the greatest income from a woodland in the long run by harvesting and marketing timber in the periods of high prices (at peaks of [business] cycles) and during peak years within the upward part of the cycle. Light cuttings may be necessary in low price periods, when mature trees are damaging the remainder of the stand."[41]

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[39]Gregory, p. 147.

[40]_Ibid._, p. 36.

[41]Back _et al._, p. 20.

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Their recommendation is for continual flexibility. "A major means of minimizing the loss of efficiency resulting from price and technological uncertainty is the maintenance of a [flexible] position which permits 1) more rapid adjustments to be made, or 2) delay in adjustments until adequate information is available on which to base a course of action."[42]

Assistance

Technical forestry assistance has been extended for many years in most areas where small woodlands exist. However, reported experience has commonly been similar to that of Richard C. Smith, who stated in a 1954 report that interviews with Missouri farm operators in 1952 showed that the service functions of the farm forester were only partially understood by the 35 percent who knew that he was available, and over the 10-year period of his employment till then only a very small percentage of them had called on him for assistance in either forest management or marketing.[43]

The farmer's need for assistance was pointed out by Preston in 1943. "Once he has decided that he wants to grow and harvest wood as a farm crop, he will need help in the details of practices. Selecting trees and products in reference to the best markets, as well as with regard to the growing stock to be left, are points on

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[42] Ibid., p. 25.

[43] Richard C. Smith, Marketing farm woodlot products in Franklin, Osage, and Gasconade Counties, Agricultural Experiment Station Bulletin 623 (Columbia, Mo.: University of Missouri, 1954), p. 15.

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which farmers are not usually well informed. Forestry bulletins are available that tell how to put various forestry measures into effect. The Soil Conservation Service can give some field assistance, and the county agent or the State agricultural college will put farmers in touch with other agencies that may assist him."[44]

In 1954, however, Preston prefaced his book on farm forestry with a highly optimistic general statement on the simplicity of farm woodland management. "One purpose of this book is to take the mystery out of farm forestry. Farmers and agricultural leaders have long shied at forestry practices as something beyond and outside the realm of agriculture. . . . Farm management of woodland fields is no more difficult than is pasture management. Even relatively small incomes from the woods will raise the standard of living on a million or more farms. Forestry on the farm is simple and entirely feasible for farmers to learn and to practice."[45]

More realistically, Coulter has made clear that ". . . there is no substitute for personal contacts and on-the-ground service assistance to get better forestry practices by millions of small woodland owners. Flexibility in standards or quality of forestry practices are necessary. This brings up the horrid word 'compromise,' but compromise may be necessary and even desirable due to particular

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[44]John F. Preston, Woodlands in the farm plan, Farmers' Bulletin no. 1940 (Washington,D.C.: U.S. Department of Agriculture, 1943), p. ii.

[45]John F. Preston, Developing farm woodlands, (New York: McGraw-Hill Book Co., Inc.,1954), p. vi.

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[4]Coulter et al., ...

[5]Smith, p. 16.

[6]James G. Yoho a...
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circumstances."[46] In the area of marketing, Smith gave an example of needed compromise, noting that "Frequently, it is necessary to compromise the most desirable forestry practice in favor of selling sufficient volume to attract buyers."[47]

By a field study in a 31-county area in northern Michigan, Yoho and James obtained data for measuring some of the impact on small forest owners of the four major public assistance programs concerned with forestry on small properties: forestry extension, service forestry, Soil Conservation Service cooperation, and the Agricultural Conservation Program. Most striking was the lack of knowledge as to the existence of the assistance programs. "The existence of a forestry extension program was unknown to 82 percent of the forest landowners in the field. Ninety-seven percent of the owners did not know anything about the service forestry program. Ninety percent of the farmers were unaware that payments for forestry practices [were] available under the Agricultural Conservation Program."[48]

The other principal summary observation was that "in view of the limited effort put into them, limited effects from the assistance programs would appear to be inevitable." While forestry extension was concluded to be the most efficient of the programs, advice having been followed and considered sound by 80 percent of

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[46]Coulter _et al._, p. 160.

[47]Smith, p. 16.

[48]James G. Yoho and Lee M. James, "Influence of some public assistance programs on forest landowners in northern Michigan," _Land Economics_, XXXIV, no. 4 (Nov. 1958), pp. 357-359, 361-364.

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those who had applied for it, the volume of such assistance was slight, with forestry extension specialists able to devote only about 90 man-days a year to the 31-county area.

The reaction of the majority of owners assisted by the service forestry program and Soil Conservation Service farm planning indicated the positive attitudes toward woodland management had not been effectively developed by the methods used. This was particularly unfortunate in the case of SCS cooperators, as they held over half the farm forest land in the area.

Only about 3-1/2 percent of all farmers (half of those who had applied for ACP forestry payments) stated that the money incentive had been necessary for them to undertake forestry practices, but practically all of those (90 percent) who had not heard previously of the availability of payments for forestry practices were not interested in changing their practices. Many of these, however, were interested in obtaining payments "but indicated their practices would be unchanged."

While the "need to study these programs in greater depth and over larger geographical areas" was concluded to be "of greater importance that the tentative conclusions" as to weak aspects of the programs, Yoho and James indicated optimism in the possibilities for developing interest in assistance programs among the many owners who had not known that such programs existed. They recognized that "slight interest may, with small stimulus, be converted to strong interest. Moreover, lack of interest is often linked to lack of

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[49] Larson, p. 5...

knowledge. To stimulate interest in forestry assistance it is necessary first to create awareness that a need for such assistance exists."

One over-all view of needed assistance is embodied in Larson's conclusion of his thesis that improved and coordinated administration of government programs is essential. "The great need today is for the development of machinery which will serve to coordinate resource programs at the local level, thereby allowing them to be carried forth to the people as an integrated whole. It is the conclusion of this study that the local soil conservation districts established under state law can and should be developed as the coordinating units for all activities, federal and state, which relate to the conservation and development of land and timber resources held in private ownership."[49]

Marketing and Cooperation

The key problems of timber marketing by the average farmer have been outlined by Westveld and Peck, as follows: ". . . if he produces forest products in excess of his own needs he is frequently at a disadvantage in marketing them because (1) he may not understand timber and timber values, (2) he may sell at the wrong time, (3) he cannot bargain effectively because he has only a small quantity of material suitable for any one product, and (4) he may

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[49]Larson, p. 526.

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find little market for some of the more valuable products such as saw logs, stave bolts, and poles and piling."[50]

These problems are partly due to the fact of the smallness of the woodland enterprise. Minckler and Hosner have touched on this fact and suggested cooperative action as a possible help. "Small tracts do make economical harvesting and marketing more difficult, but it has been demonstrated that operable cuts can be made on woodlands no larger than ten to fifteen acres. Larger holdings, however, would definitely encourage good forestry. The formation of co-operatives or seller groups would help the owners of small woodlands."[51]

An abstract of a similar statement by James W. Craig extended the recommendation to the formation of cooperative forest management units. "Voluntary associations or cooperatives of adjoining landowners offer [the] best method of establishing a workable management unit that can be staffed by a trained forester and that can offer stumpage in quantities large enough to attract better prices."[52]

Woodland owners' current management decisions will have an effect on future markets and, as Colgan has pointed out, their management in turn is affected by their prediction of what future conditions will be. "Every forest landowner, whether large or small, decides for himself what the future market for his products is likely to be. On this basis he handles his property, occasionally

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[50]R. H. Westveld and Ralph H. Peck, Forestry in farm management, 2d ed., (New York: John Wiley & Sons, Inc., 1951), p. 2.

[51]Minckler and Hosner, p. 51.

[52]Coulter et al., p. 162.

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changing his views as new factors enter into his calculations or as he gains added knowledge of current costs and returns. These several millions of owners' opinions are directly correlated with demands of the consumer and the prices consumers will offer."[53]

Organization to aggregate small holdings for forestry and marketing, as suggested by Larson, may have the stabilizing effect of reducing variability among individual owners' actions and producing higher long-term output. "It is likely that the answer to the problems of the small private forest holding will be found in some type of corporate or cooperative organization that will furnish technical forestry services and handle the marketing and processing of timber products for the owners."[54]

The commonly contrasting motivational positions of large and small owners described as follows by Behre have led him to recommend assistance to aggregational arrangements for management of small holdings and loans for joint processing facilities.

> The very factors which have made for progress in forestry by the large owners and for the opening up of public timber not hitherto operable have intensified the small-owner problem. High prices and insistent demand open the way for intensive forest management and better utilization by large owners whose financial interests are strengthened by long-range plans for continuous operation; they tempt small owners to reap profits by premature cutting of growing stock and liquidation of forest values.

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[53] R. A. Colgan, Jr., "Sound economics--the basis of sound forestry," Journal of Forestry, IL, no. 7 (July 1951), 483.

[54] Larson, p. 490.

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> Cooperative or community organization of small owners to provide continuing self-sustaining service to all may be a way to transform the economic pressure to liquidate into an economic incentive for good forest practice. The circumstances of the small owners would be made to coincide more nearly with those of the large owners.[55]

To achieve this end Behre has suggested the following addition to the American Forestry Association's "Proposed Program for American Forestry": "Encouragement and aid to small owners and farm organizations in the establishment and operation of forest cooperatives or other institutional arrangements for group management of small forest properties, including provision for low-cost federal loans for the construction and operation of cooperative processing facilities."

He predicted that "Success means a lessening of the need for public aid and service. The cooperatives or other forms of community organization will take the place of public service that would otherwise be needed."

After describing the success of a cooperative forest products market in North Carolina, Warner was confident in making the optimistic prediction that improved forestry on farm woodlots will result. "As general forestry knowledge increases . . . the owners of farm

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[55] C. Edward Behre, "The problem of smallness," Proceedings of the fourth American Forest Congress, (Washington, D.C.: American Forestry Association, 1953), pp. 253-254.

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woodlots, encouraged by a steady, continuing local marketing outlet, will increase the quality, stocking, and productivity of their woodlands."[56]

Labor Returns

Comparative returns to labor for various enterprises are an important element for consideration in farm planning. Favorable reports have been written on this aspect of farm woodlands in the northern and southern United States and in Finland. "A Wisconsin study of farm income turned up some interesting facts: . . . A dairy farmer, 90 per cent of whose income came from the production and sale of milk and milk products, was shocked to learn that he averaged only $1 per hour for his labour on the dairy farm, while the 10 per cent income he realized from his farm woodland represented a net return of $1.75 per hour of labour."[57] With regard to labor income from pine-hardwood forest land in the South, Mignery reported that ". . . work in well-stocked stands pays as well or better per man hour than most farm activities. The typical return from a good tract may range from $1 to $1.50 per hour, excluding stumpage."[58]

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[56] John R. Warner, History and financial results of a cooperative forest products market operated through Farmers Mutual Inc. of Durham, North Carolina, (Unpublished PhD Dissertation, Durham: Duke University School of Forestry, 1953), p. 96.

[57] J. F. Walker, "A pulp and paper company's approach to extension forestry; with particular reference to tree farms and farm woodlots," Pulp and Paper Magazine of Canada, LV (January 1954), 122.

[58] Arnold L. Mignery, Farm woodland opportunities in the South, Paper delivered before the forestry section, Association of Southern Agricultural Workers, at Dallas, Texas, Feb. 1, 1954 (New Orleans: Southern Forest Experiment Station, 1954), p. 9.

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A similar statement has been made by Fr. Iso-Antilla, a leading Finnish farmer concerned with forest production. He found that ". . . returns from work invested into forest are higher than from that invested into crop production."[59]

In giving the woodland owner some useful considerations in choosing whether to "sell forest products at the mill, at the roadside, or as standing trees . . . ," Minckler and Hosner recommended that "Other things being equal, it seems wiser to concentrate your own labor on the lower-valued products such as mine props, pulpwood, and sawlogs, and to sell the higher-valued cabinet veneer as stumpage." This is because, as they indicated, the labor percentage of the delivered product price is highest for the lowest-value products and lowest for the high-value veneer logs. "Also, veneer-log specifications are more exacting and logs can be more easily damaged by inexperienced crews," as they pointed out.[60] It is hazardous to make sweeping recommendations to landowners for marketing cut products rather than stumpage.

Frequency of Cut

A matter of long-standing controversy is the policy on desirable frequency of cut for small woodlands. The principal division is as to whether the cut should be annual or periodic. Briefly, an

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[59]M. Sipila et al., "How much work is it profitable to invest in farm forests?" (in Finnish), Teho, II (1957), 536-543; English summary 592-593.

[60]Minckler and Hosner, p. 26.

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annual cut is favored primarily for annual income and precisely sustained yield. A periodic cut is larger, permitting, in many cases, more efficient harvesting and better silvicultural practice. Also, if the period is variable, it permits better response to favorable market conditions.

In 1943 Preston recommended cutting trees when they are mature for specific products and when markets are good, thus apparently favoring periodic cuts. "When the trees are ready and the market is right, it is time to cut the big trees into sawlogs, poles, and fuel and some trees into pulpwood." ". . . it will pay to investigate the market before cutting."[61]

In 1945, however, he strongly stressed adherence to an annual cut as the <u>only</u> way of making integrated farm forestry perpetual. "I believe that the only kind of farm forestry that is going to stick is that which enables farmers to get annual incomes from their woodlands, and the only worth-while income on an annual cutting budget is where they cut and sell processed products as they do with other farm crops."[62] In this connection the farmer may be dependent on the forester, as ". . . the forester's primary job . . . is to develop markets so as to make possible the sale of wood products annually in whatever amounts the farmer has the labor to produce.

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[61]Preston, <u>Woodlands</u> . . . , p. 9.

[62]Preston, <u>Journal of Forestry</u>, XLIII, No. 8 (1945), 576.

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Obviously, unless markets can be developed to make possible the annual sale of wood products, the concept of integrated farm forestry cannot be made to work."[63]

H. H. Chapman, on the other hand, has been an outspoken critic of the annual cut and has strongly urged that heavy, infrequent periodic cuts be made.

> Since the advocacy of annual or very frequent 'sustained yield' cutting on these small areas originated from and is based purely on the economic theory that the owner prefers or is even dependent on annual income from timber and cannot afford to practice sound forestry if he has to wait long periods for his results, this assumption constitutes the foundation for the whole superstructure both economic and silvicultural. If defective the building may fall.
>
> The farmer already has and is operating a going concern, the farm, and except for the aforementioned source of fuel and minor products is not dependent on annual net revenue from his woodlands for his livelihood.
>
> Operations in a small woodland for the logging of merchantable products should be concentrated at one time, with the removal of practically all the mature timber in a single sale or logging job. The only difference between past and continuing present practice for these owners, and sound forestry management, consists in the substitution of good silviculture for ruthless exploitation. Neither good silviculture nor sound economics indicate the abandonment of heavy periodic cuts and the adoption of annual whittling out of a few logs or cords.
>
> From the economic standpoint there are two principal sets of reasons for favoring heavy cutting of small tracts at widely separated periods, as against too frequent, or annual cutting. These are:
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> 1. The margin for stumpage values in sales of timber increases _per unit_ of volume sold, directly as the total volume and average stand per acre increases, for the reason that costs of operation are thereby reduced. Unless logging

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[63] _Ibid._, p. 578.

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is done by the owner as a measure for employing labor in slack seasons, this factor is of determining importance provided he obtains fair value in the sale.

2. The owner regards his woodlot in the nature of a reserve or investment rather than a drawing account. In nearly every instance, sales, whether made under forestry practices or not, serve the purpose of securing funds to meet emergencies. . . . When all is said and done, economic factors determine what any class of private or of public owners can and will do with their forest lands. The well meaning efforts so widely and extensively put forth by public agencies to induce owners to abandon heavy and long periodic cutting in favor of 'annual revenue from the woodlands, '. . . are all to the good when justified by sound economics, but not when the practice runs counter to the best interests of the owner, which I am convinced is usually the case for the reasons cited.[64]

In a recent article Aughanbaugh has quoted a statement by Oliver Diller describing management of one of the small farm woodlands in Ohio's "experimental forest" project. "During certain years cutting exceeded growth in order to take advantage of good markets, but in general, the growing-stock has been maintained in a continuously productive condition."[65] This seems to imply some misgivings as to the propriety of letting cuts exceed growth during the years in which they are made, if the aim is to maintain a "continuously productive" growing stock. Such an attitude may indicate too great a concern that sustained yield management achieve an annual cut and that the cut just equal the volume of the year's growth. Taking "advantage of good markets" is good economic strategy, and adherents to the policy of an annual forest crop might well consider the

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[64]H. H. Chapman, "Should small woodlots be managed for sustained annual yield?" Journal of Forestry, IL, No. 5 (May 1951), 343-344.

[65]John Aughanbaugh, "Experimental woodlands as a means of encouraging improved management of small tracts," Journal of Forestry, LVII, No. 6 (June 1959), 410-411.

economic advantages of cuts made at less frequent intervals, when larger volumes-made possible more efficient harvesting operations, and especially in years when timber prices are high.

It is clear that these various authors have started with different assumptions and aimed for specific conclusions. Little attention has been given to what is frequently a very strong reason for annual cutting, namely that the woods work may provide an important outlet for available farm labor. Directly tied in with the question of frequency of cut are other management factors, whether sale is to be of stumpage or of cut products, whether adequate labor and equipment are available, and various other considerations. As with other farm-and-forest management problems, there is no universal solution.

Case Study Farms

The 1955 report on development of agriculture's human resources recommended research to develop more economic use of resources. "Studies should be undertaken, in addition to those already made, to establish the facts concerning the combinations of resources which will increase incomes and improve levels of family living." And particularly, "One aspect of this work might be a number of pilot research farms. On such farms new practices and enterprises or combinations could be tested in the setting of a farm business as a whole."[66]

Numerous case studies of farms have been made ignoring the woodland resource or leaving it out of the budget analysis. However, a specific case study including forestry on the farm has been ana-

[66]U.S. Department of Agriculture, Development . . . , p. 19.

lyzed by Luttrell.[67] The 208-acre Covington farm, located in Tippah County in the Tallahatchie River Watershed Area of northern Mississippi, has a background and general situation much similar to the tenant farms on the Ames Plantation. In this case study farm where "Cotton has been the principal source of cash income," Luttrell has pointed out that "Both general farming and farm woodlot problems in the area are fairly typical of those found in many of the hilly portions of the Eighth Federal Reserve District" (Missouri, Arkansas, northern Mississippi, western Tennessee and Kentucky, and southern Illinois and Indiana). By planning forest management of the 92 acres of woodland as an integral part of the farm operation, Luttrell has estimated that "Net [production] gains, including inventory changes, could be quadrupled during the next three decades." Net cash income from the woodland could almost be doubled and would result in an increase of approximately 15 percent of current net farm income.

Integrating Plans for Farm and Forest

Farm planning for improved allocation of resources requires joint consideration of both agricultural and woodland enterprises, present and prospective. As Larson has clearly stated, the farmer "must learn how to integrate forestry activities with his over-all farm enterprise. For unless woodland management can be developed

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[67] Clifton B. Luttrell, "The Covington farm: a case study in planning and financing farm woodlot production," Monthly Review (Federal Reserve Bank of St. Louis), XXXVI, No. 12 (Dec. 1954), 133-141.

so as to provide the most equitable use of an owner's available land, labor, and equipment, certainly there never can be much justification for a farmer to practice forestry."[68]

In the experience of Richard C. Smith in Missouri, progress toward integrated farm planning has been slow. Typically, "a vestage of the pioneering agricultural tradition remains--farmers do not think of timber as another farm crop. . . . the woodlot is appreciated and used as a source of material for farm construction, fencing, and fuel; but the farmer still does not recognize his woodland fully as an integral, income-producing part of his farm."[69]

Emphasis is given by Preston to the general position that much of the farmer's failure to integrate forestry in his total farm plan is attributable to the educational approach taken by foresters in trying to promote forestry as an independent enterprise on the farm. "Foresters have been trying for 50 years to teach farm forestry as forestry on farmland, seemingly failing to recognize that 'farm' in 'farm forestry' makes the latter an entirely different brand of forestry. Wood as a farm crop is something any farmer can handle all by himself." He has colorfully suggested that ". . . farmers need a few foundation garments of wood crop and farm economy

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[68]Larson, p. 81.

[69]Smith, p. 20.

before we try to clothe them with the silks and satins of silviculture. They need first to accept the fundamental concept of wood as a farm crop."[70]

Westveld and Peck have been less critical of foresters, less forceful, and more persuasive for operational integration through constructive extension of farm forestry education. "Since farm forests can, if properly made a part of the whole farm enterprise, help to increase and stabilize farm incomes and conserve soil and water, farmers should have as thorough an understanding of forest-tree crops as of their other farm crops. Such an understanding on the part of persons engaged in agricultural education should be helpful to them in developing farm programs."[71]

The resources to be considered in planning operating units have been concisely discussed and related by Lanham and Butler.

> In order to have a balanced farm operation consideration must be given toward fitting the various enterprises together into the desired system of farming. First, consideration must be given to the farm operator whose responsibility it will be to initiate and carry forward the proposed plan of organization and operation. . . . The degree of success in reaching the desired goals of the adjustment depends on the operator's experience, training, and attitude toward his farm business.
>
> The family labor that is available to the operator and the ability and interest of the family members in farming are also closely related to the operator's ability.
>
> The number of acres of land and the physical characteristics and fertility of the land must be considered also. These factors

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[70]John F. Preston, "Preston takes issue with talks at La Plata," American Forests, LXIII, No. 1 (Jan. 1957), 6, 71.

[71]Westveld and Peck, p. ix.

influence the decisions relative to intensiveness of the farming system, crops adapted to the particular soil and area, and proper location on the farm for the various crops.

The amount of available capital required for investment in improvements, livestock and equipment, and for operating expenses affects significantly the organization of any farm.[72]

In their bulletin on farm planning Johnson and Parsons have recognized the interrelationships of the various enterprises which must be integrated into the over-all plan. They called attention to the complementary, supplementary, and competitive relationships between enterprises and, as a forestry example for integration, they mentioned that "An undeveloped wood lot on a farm offers the chance for a supplemental enterprise in getting out fence posts and cordwood in the slack winter months."[73] However, no part of the discussion of alternative plans or enterprise selection was devoted to the consideration of woodland contributions and requirements in relation to the over-all farm planning process.

Budget analysis has long been used as a method in farm planning, facilitating integration of whatever enterprises may be appropriate. Numerous studies in the literature of agricultural economics and farm management have been based on this method and it has been highly successful in practical application on innumerable farms. An excellent example already cited was that of Woodworth

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[72]Lanham and Butler, p. 4.

[73]Neil W. Johnson and Merton S. Parsons, Planning the farm for profit and stability, Farmers' Bulletin No. 1965 (1st ed. rev.; Washington, D.C.: U. S. Department of Agriculture, 1956), p. 19.

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and Saunders.[74] Woodland enterprises were absent, however, presumably due to the lack of forest input-output data. Such omission does not warrant criticism, however, as inclusion of a woodland enterprise is not vital to the discussion and illustration of a useful farm planning method. As was pointed out earlier, budgeting requires reasonably well estimated input-output data for each enterprise considered. Almost certainly the absence of analysis of woodland enterprises from the numerous farm planning studies is primarily due to the dearth of forest input-output data.

The 1954 study by Luttrell[75] is unique in that an agricultural economist has predominantly stressed the woodland enterprise on a farm. Rarely have even forest economists given such detailed attention to the various elements of costs and returns for woodland enterprises in conjunction with active farms. Luttrell actually presented a single woodland plan and an over-all farm financial summary for his case-study farm, however, rather than comparable budgets of alternative plans for analysis. His emphasis was on the need for loan capital for woodland development and on the scheduling of woodland income and loan repayment.

In 1955 Barraclough and Gould wrote a bulletin constituting the most comprehensive study of farm-and-forest integration using budget analysis. It has been the most thorough such study to date. First among the objectives outlined in the foreword by Professor

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John D. Black was the purpose of illustrating "a method of analysis that has wide application to the management opportunities and problems of forest and farm operating units." This objective was accomplished by showing in detail ". . . how alternative operating plans can be evaluated by the budget method." Also included were the objectives of deriving ". . . broad generalizations based on the analysis of these farms" and presenting forest planning data.[76] The over-all purpose of the bulletin was stated to be ". . . to increase our understanding of forest production problems by applying available technical information in economic analyses at the forest operating unit level."[77]

In accomplishing their purpose Barraclough and Gould made clear that "The basic concept of budgeting the alternatives in a forest enterprise as a part of a total operating unit is the central theme of this study. The mental attitude suggested by the theme is much more crucial to successful planning than is any set of analytical techniques and data. Once the general idea is grasped, many ways can be devised to implement it."[78]

The development of their analyses was ". . . based on three simple facts. The first is that forest land, especially that in farm woodlots, is . . . usually only part of a larger operating unit," and that interrelationships and external factors must be taken into

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[76]Solon L. Barraclough and Ernest M. Gould, Jr., Economic analysis of farm forest operating units, Harvard Forest Bulletin No. 26 (Petersham, Mass.: 1955), p. 8.

[77]Ibid., p. 12.

[78]Ibid., p. 134.

account. "The second fact is that practically all forest production problems have several possible solutions." "The last and perhaps most important fact is that usually the owner is the person best equipped to work out, evaluate and choose among alternative farm and forest operating plans, provided he has the right kind of technical assistance."[79]

In emphasizing the applicability to farm woodland management of this kind of approach, Barraclough and Gould pointed out that "Foresters will see that this kind of planning is quite different from a management plan that concentrates on detailed ways of using labor and capital efficiently in carrying out a given intensity of management. In this bulletin an array of [three] forest management intensities is analyzed, rather than just one for each farm, without any preconceived ideas about which will turn out best."[80] Thus "Alternative management plans were analyzed on the basis of the physical and managerial resources of each unit, the input-output relationships that could be expected to prevail, and reasonable price and market [conditions]."[81]

An external limiting factor to be considered in evaluating the relative practicability of low, medium, and high intensities of forest management was the forest products market. It was noted that "Before . . . [high intensity] management is feasible there have to be markets for all sorts of forest products, including the

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[79] Ibid., p. 133.

[80] Ibid., p. 23.

[81] Ibid., p. 134.

low-grade timber that often results from thinnings and improvement cuttings." An internal limiting factor may be the owner-operator himself: "The nine farm analyses show that the owner's objectives and capabilities are often deciding factors that determine what kind of forest management is desirable."[82] As is evident from the importance of these two limiting factors alone, feasibility is the overall key to the planning of woodland on farms. And feasibility can be estimated only by considering the woodland in its place in the integrated framework of the entire operating unit.

The importance of farm-and-forest integration was stressed by Mignery in elaborating on the statement that the ". . . chief aim of the Southern Station's farm forestry research program is to seek out farm woodland opportunities, and to interpret them in terms of costs and returns to the farm enterprise." In discussing the studies established to accomplish this aim, he declared that "The various studies have one thing in common: they do _not_ treat the farm woods as an isolated small forest upon which the best silviculture must be practiced and the most money made from timber culture. Rather, the common objective of the studies is to determine what moderate adjustment in overall farm operations will induce a marked increase in total farm income through improved management of the farm woodlands. We feel that if our efforts to improve farm woodland management are to succeed, the management prescription must be simple to

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[82] _Ibid._, p. 135.

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apply, fit into the existing pattern of farm management, be independent of costly and highly specialized machines, and require a minimum of cash outlay."[83]

Warner has commented hopefully on the bright prospects for the widespread development of woodland enterprise integration on the farm. "The era of balanced farm management has begun in the South and shows every indication of spreading. . . . Each year an increasing number of farmers become convinced of the value of a productive farm woodlot and the part it plays in a well-rounded farm management program."[84]

Optimistic indications are indeed encouraging, and hope of course is needed for success; but insight and persistent efforts are the fundamental prerequisites. These are essential for the intelligent development of all available resources and means to achieve integration of woodland and other farm enterprises, and thus to produce more economic operating units with the primary goal of improving the welfare of farm families for whom help is needed.

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[83]Mignery, pp. 1, 3.

[84]Warner, p. 96.

CHAPTER III

HISTORY AND DESCRIPTION OF PROBLEMS AND RESOURCES

Problems in the Economy

The key problem of west Tennessee is low income. It has numerous people whose welfare is severely restricted by limited family resources and by various aspects of the economy. Excluded from this low-income category, however, are the primarily commercial, industrial, and residential city of Memphis and the suburban remainder of Shelby County. The low-income problem is primarily associated with the rural economies, in which a cotton-based agriculture predominates. The three principal problems fundamental to this regional low-income situation are traditional agricultural land use, lack of planning for forest management, and underdeveloped and unstable local economies. While all of these problems are interrelated in the over-all economy of west Tennessee, a brief description of each one separately will contribute to a general picture of the setting of this inquiry.

Traditional agricultural land use

A traditional land use developed from the methods of the pioneer settlers of the 1770's and '80's. These hardy people ". . . poured in from the Carolinas, Virginia, Pennsylvania, and even New England. They came with Revolutionary War land grants either earned

in service or purchased from veterans or speculators."[1] Intensive cultivation of the soil was characteristic of pioneer agriculture, following clearing of small patches in the existing forest.

As the Tennessee farmers came from the East, the first of the State's three natural divisions to be settled was east Tennessee. Rich farm soils were rare in the eastern hilly uplands, however, and much of the soil mantle was so thin that the farm families were barely able to eke out a subsistence. Therefore most settlers proceeded westward to the middle and western divisions of the State where soils were deeper and more fertile. A prosperous agricultural economy developed in the western section soon after the 1818 purchase from the Chickasaw Indians. It stemmed from the fertile alluvial Mississippi River bottomlands where "large plantations produce enormous yearly crops of cotton and corn with no apparent signs of exhaustion."[2] Large plantations are still prevalent today and continue as the most prosperous segment of agriculture.

West Tennessee--the southerly section in particular--had by 1825 ". . . become one of the cotton growing centers of the Midsouth. Cotton showed a decline in middle Tennessee during this period. Here the farmers could not compete with the vast crops produced by the slave-gang system of the newly cleared sections within the State and in Alabama and Mississippi."[3] Southwestern Tennessee's best

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[1]Federal Writers Project of the Works Progress Administration, Tennessee; a guide to the state, American Guide Series (New York: The Viking Press, 1939), p. 48.

[2]Ibid., p. 23.

[3]Ibid., p. 75.

soils and most accessible tillable lands have been devoted to cotton since that time.

The virtual single-crop economy of west Tennessee's bottomlands was also adopted in the hill country. The uplands of the region developed many large and productive farms, as well as numerous small ones. The light, siliceous, and fertile soils of the rolling hills have been subject to pronounced gully erosion. "As early as 1854, the State Agricultural Bureau warned that excessive 'mining' or one-crop cultivation of the soil would finally lead to economic disaster. Farmers following this practice grew one crop year after year without letting the land lie fallow or rotating crops to build up the soil."[4] Gullies result from "shoestring erosion" started by little rain rills which develop on exposed sloping soil. The rills are widened and deepened by successive rains if plant cover is not established, and the cutting process continues to gouge out the earth to such a depth that filling the gullies or leveling the land by bulldozers becomes difficult and often uneconomic. A multitude of gullies and even profound ravines have resulted from a century of such land use.

<u>Lack of planning for forest management</u>

Land use in west Tennessee forests has brought about a relatively low quality timber resource. This base, however, will be called upon to develop the region's future wood production and to yield income to landowners and wood handlers.

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[4]*Ibid.*, pp. 23-24.

The density of the forests was estimated (in the forest survey made in 1948-50 by the U. S. Forest Service) to be about 57 square feet of basal area[5] per acre--greater than any other region of Tennessee[6] and almost a fourth higher than the State average. However, almost three-eighths of this basal area was in cull trees, the remainder being classed as growing stock. Unfortunately, "The percentage of low-value species is increasing, while that of the better grade species is decreasing," as reported by Cowan for the State as a whole in the section on "The Future of Tennessee's Forests" of the State of Tennessee forest resource appraisal of 1945-46.[7]

Forests exist on land where a conflicting use does not take precedence. Compatible multiple uses are, of course, possible. Until recently, however, forest use has usually not been planned. It commonly has evolved as a residual use of land which was left over after agricultural and commercial land development. As has been pointed out by Sternitzke, "The most obvious impact of agriculture on Tennessee's [original] forests has been the clearing of land, which has meant a large reduction in forest area, especially on the better

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[5]For definition of technical terms, see the appended glossary.

[6]Regional statistics are based on Forest Service reports covering the "west Tennessee region," designated to include all of the counties west of the western valley of the Tennessee River except Benton, Decatur, and Hardin. Throughout the text, references to west Tennessee will apply to this region of 18 counties.

[7]W. Foster Cowan, The forest resources of Tennessee, Based on the 1945-46 appraisal by the State Conservation Department Forestry Division and the American Forestry Association ([Nashville, Tenn.]: 1946), p. 33.

soils."[8] Although the better forest soils are generally the better agricultural soils also, farmers have not always been successful in assessing land quality for different uses. A reliable system using natural indicators for grading land productivities in forests has yet to be developed.

Farm areas remaining in forest have been influenced by special uses of farm woods over successive generations. Timberland uses have typically included harvesting of products for fuel, fencing, and farm construction needs; forage and shelter for livestock; and incidental sale of stumpage to local buyers for wood-using industries. These customary uses have had profound effects on the quality of timber remaining in the Tennessee forests, on species composition, and occasionally on the forest type.

Likewise, part of the present forest land pattern has developed from continual farm abandonment over many decades and natural reversion to woods. "New acreage is always being cleared from the forest and old land that becomes worn out, eroded, and in other ways submarginal is being abandoned," according to Sternitzke.[9] Land-use evolution has proceeded slowly, with little marked change from year to year; however, the net effect of farming by successive generations of families in west Tennessee, and land purchase from time to time by newcomers, has been that a substantial proportion of the forest is now on land that once had been cleared for agriculture.

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[8] Herbert S. Sternitzke, Tennessee's timber economy, Forest Resource Report No. 9 (Washington, D.C.: Forest Service, U.S. Department of Agriculture, 1955), p. 8.

[9] Ibid.

Virtually no virgin forest remains in west Tennessee. The existing forest is termed "second growth," having developed from areas where trees had been cut and areas which had formerly been cleared, then abandoned. With good management a second growth forest can be developed up to a level of productivity as high as is economically feasible within the limitations of the soil potential, climate, and existing species. The present state of the majority of west Tennessee's forest areas, however, has developed from the absence of good forest management--in fact, from negligence if not abuse.

Underdeveloped and unstable local economies

The 1950 population in the eighteen counties of west Tennessee ranged from a little over 11,000 in two small, rural counties, Chester and Lake, to over 480,000 in metropolitan Shelby County, which contains the city of Memphis.[10] The city of Jackson had most of the 60,000 population of Madison County, the only urban county other than Shelby. Ten of the sixteen rural counties had populations of between 20,000 and 30,000, and only two had between 30,000 and 50,000.

With regard to distribution of residents between town and country, Shelby and Madison Counties had urban percentages of 85 and 56. Three rural counties each had about one-third of their residents in urban communities, ranging from 32 to 37 percent of total popu-

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[10]U.S. Bureau of the Census, Census of population: 1950, Vol. II, Characteristics of the population: Part 42, Tennessee (Washington, D.C.: U. S. Department of Commerce, 1952).

lation. All other counties had less than 26 percent urban residents, and five had none. Rural non-farm residents ranged from 5 to 41 percent of county population, but only 4 counties had more than one-third of their populations in rural non-farm residences. Rural residents exceeded 50 percent of the total in 12 of the 18 counties and exceeded 60 percent in 9 of them.

These 9 counties also had the lowest median ages of the population, showing an inverse relationship between median age and farm residence. Median age in the 9 counties was less than 27.5 years. In Haywood County, where 77.2 percent of the population resided on farms, the median age was 23.3; and in Fayette County, where the percentage was 83.3, the median age was 20.7 years. In the 8 counties where the farm residents comprised less than 55 percent of the population, no such relationship appeared. Although the median age in these counties varied from 28.0 to 32.1 years, it was quite independent of the percentage of the population residing on farms or in urban centers. The high percentage of young people on farms affects a county's median age only when farm residents constitute a fairly large percentage of the total county population.

The concentration of Negroes was greatest in the 7 southwest counties of west Tennessee. These counties had markedly higher percentages of Negroes in the total population than elsewhere in the region and included 87 percent of the regional total. Seventy-one percent of the Fayette County population was Negro, as was 62 percent of Haywood County's. Ranging from 33 to 37 percent Negro were Hardeman, Lauderdale, Madison, Shelby, and Tipton. Heavily popu-

lated Shelby County had 180,000 or 60 percent of the 302,000 Negroes in all 18 west Tennessee counties. Due to the southwestern concentration the west Tennessee percentage was 33, although 11 counties ranged from 6 to 22 percent Negro.

During the period 1940 to 1950 ten counties decreased in population and 8 increased, largely due to migration. The largest increases occurred in the urban counties, Shelby and Madison, where population rose by 34.1 and 11.1 percent respectively. The greatest decreases were in highly rural Henderson and Fayette Counties, 10.7 and 9.2 percent respectively. Four of the five counties lacking urban communities had decreased in population. The 6 most stable counties, not increasing or decreasing more than 4 percent in the 10-year period, averaged 31.5 percent rural nonfarm residents, higher than any other county in west Tennessee.

Median incomes of families and unrelated individuals ranged from $705 in Fayette County to $2,248 in Shelby County. Between these were one county with less than $1,000, four counties between $1,000 and $1,200, five between $1,200 and $1,400, five between $1,400 and $1,600, and one county over $1,600. Median for this west Tennessee county distribution was therefore in the $1,200 to $1,400 range. The median income for the State was $1,749 and for the United States, $3,619.

In the 16 rural counties of west Tennessee the percentage of families and unrelated individuals having incomes of less than $2,000 ranged from 62.3 to 83.8. The 2 urban counties, Shelby and Madison, had 45.0 and 55.4 percent respectively, Madison's percentage being

very close to the Tennessee percentage of 55.6. For the United States as a whole, however, only 38.6 percent of families and unrelated individuals have incomes of less than $2,000.

The sources of income in west Tennessee are similar to those for the State as a whole. The numbers of individuals employed in each of the most populous industry groups are listed by county, with totals for west Tennessee and for the State (Table 1). Agriculture accounts for 22.7 percent of west Tennessee's total employed civilian labor force, slightly above the 21.9 figure for the State. The regional percentage increases to 49.3 if the two urban counties are omitted, as the 16 rural counties' percentages of agricultural workers range from 34 to 77. The labor force in the two urban counties heavily outweighs the rest of the region, as it comprises 62 percent of west Tennessee's employment.

Segments of the economy in which the percentage of the labor force is greater in west Tennessee than in the State as a whole include transportation and food products manufacture. Principal industry groups having lesser percentages are most manufacturing industries (including furniture, lumber, and wood products manufacturing, and textile and apparel products manufacturing), construction industries, and educational services. While 10 counties have more than 10 percent of their labor force in manufacturing, only 2 closely approach the State percentage of 21--namely, Shelby County with 20 percent and Gibson County with 18. Madison County's labor force is well dispersed among agriculture, manufacturing,

Agri-	Cons-	Mfg.	Mfg.	Mfg.	Mfg.	Trans-	Retail	Repair	Educa-	Total Employed

TABLE 1.--Employed civilian labor force, by county, in most populous industry groups, 1950[1]

County	Agri-culture	Cons-truc-tion	Mfg. Wood prod's	Mfg. Food prod's	Mfg. Textile apparel	Mfg. Total	Trans-por-tation	Retail food stores	Repair ser-vices	Educa-tion	Total Employed civ. labor
Carroll	3,864	524	267	68	946	1,484	375	284	200	334	9,340
Chester	1,866	217	81	9	299	412	62	87	60	155	3,547
Crockett	3,374	236	17	66	91	209	64	177	70	188	5,156
Dyer	3,726	693	248	94	753	1,246	265	358	222	375	10,377
Fayette	6,311	267	47	23	1	130	99	119	53	200	8,246
Gibson	6,631	832	439	110	1,145	3,052	334	364	264	543	17,343
Hardeman	3,948	285	241	15	3	547	143	167	72	248	7,033
Haywood	5,458	238	48	28	131	247	93	173	86	227	8,267
Henderson	2,959	382	121	33	238	436	147	133	90	193	5,402
Henry	2,865	546	177	75	351	925	531	284	179	326	8,480
Lake	2,273	150	84	30	5	229	44	104	48	95	3,879
Lauderdale	4,632	365	150	34	25	270	126	197	94	280	7,794
McNairy	3,342	360	284	9	148	925	172	130	107	208	6,179
Madison	4,811	1,370	747	529	1,397	3,450	1,652	730	344	919	21,960
Obion	3,645	594	178	285	584	1,658	427	309	224	307	10,440
Shelby	8,834	13,772	6,704	5,867	2,405	37,806	14,425	5,632	2,798	5,226	191,193
Tipton	5,000	506	63	56	276	609	128	180	123	280	8,973
Weakley	4,339	550	170	133	622	1,245	295	303	134	415	9,664
West Tenn. total	77,878	21,887	10,066	7,464	9,420	54,880	19,382	9,731	5,168	10,519	343,273
State total	247,372	79,984	38,337	22,393	55,778	239,427	53,159	33,036	18,158	44,489	1,135,646

[1]U.S. Bureau of the Census, Census of population: 1950, Vol. II, Characteristics of the population: Part 42, Tennessee (Washington, D.C.: U.S. Department of Commerce, 1952), Table 43, pp. 98-109.

transportation, construction, and educational services--with no remarkably high percentage of labor force in any one of these industry groups.

Wages and salaries in the manufacturing industries in 1956 are available for Tennessee, the total reported by the U. S. Department of Commerce being $1,079,000,000.[11] West Tennessee figures have been estimated as proportional to the regional employment percentage of the State total. For all manufacturing in west Tennessee, wages and salaries were approximately $247 million, 22.9 percent of the State figure. Key manufacturing industries paid wages and salaries of about $31 million in food products, $29 million in textile and apparel products, and $24 million in furniture, lumber, and wood products, respectively 33.4, 16.9, and 26.3 percent of the State totals for these industries. The first industry listed under leading manufacturing industries by the chambers of commerce of both Memphis and Jackson was wood products.[12] The food products industry came second for Memphis and third for Jackson.

Although industrial activity of west Tennessee has long been mainly in the cities of Memphis and Jackson,[13] as may have been inferred from the urban nature of Shelby and Madison Counties, actually the commerce of Memphis overshadows its manufacturing. Shelby

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[11] U.S. Office of Business Economics, Survey of current business (Washington, D.C.: U.S. Department of Commerce), XXXVII, No. 8 (August 1957), 19.

[12] The blue book of Southern progress, 1955 ed. (Baltimore, Md.: Conway Publications, Inc., Manufacturer's Record, 1955).

[13] Federal Writers Project, p. 72.

County's business volume in 1954 as indicated by sales receipts was $4,782,000,000, over half of which was accounted for by wholesale trade, $2,431,000,000. Retail trade added $653 million, service trade $131 million, and finance $145 million. Shelby's wholesale trade likewise constituted more than half of the State total of $4,325,000,000. Memphis receives raw and partially processed materials from Arkansas and northern Mississippi, in addition to Tennessee, for its wood products industries, cottonseed processors, meat packers, and drug manufacturers. It is the railroad hub of the South and the largest inland cotton-handling port in the nation. Jackson also is a railroad center and, like the smaller towns of Paris, Dyersburg, and Humboldt, is a commercial center for the surrounding rural areas.

Railroad, trucking, and other transportation services occupied 5.6 percent of west Tennessee's total employed civilian labor force in 1950. The transportation industry group ranked fourth, following agriculture, all manufacturing industries, and construction. For the State as a whole, transportation, with 4.7 percent of total civilian employment, was outranked by the textile and apparel manufacturing industry with 4.9 percent. (In west Tennessee only 2.7 percent of all workers were occupied in textile and apparel manufacturing.) Most of the employment in transportation in west Tennessee occurred in Shelby County, 75 percent of the regional transportation industry. In Shelby County it constituted 7.6 percent of all civilian employment, the activity predominantly occurring in the city of Memphis, where it was second only to all manufacturing industry.

Educational services, both public and private, occupied 3.1 percent of west Tennessee's total employed civilian labor force in 1950. This percentage was somewhat lower than the State average of 3.9 percent. Only three west Tennessee counties exceeded the State average, Chester, Madison, and Weakley, and the percentages were scattered fairly evenly in the range from 2.4 in Fayette and Lake Counties to Chester's 4.4. Shelby County, where 55 percent of west Tennessee's labor force was employed, accounted for practically half of the region's employment in educational services, although this was only 2.7 percent of Shelby County's total employed civilian labor force. Most of the teachers in west Tennessee were in the public school system, with only a few in private schools and colleges. The public system included Memphis State Teachers College and the University of Tennessee medical and dental schools located in Memphis, also the University's junior college at Martin in Weakley County.

The west Tennessee educational level, as indicated by the median number of years of schooling completed by the residents at least 25 years old in each county in 1950, was slightly lower than the State median. The median for west Tennessee (taken as the median of the 18 county medians) was 8.1, as compared to 8.4 for the State. These figures combine male and female levels. In west Tennessee counties female schooling levels averaged 0.6 year higher than male, with the higher differences predominating in the counties of lowest schooling level. County medians ranged from 6.3 to 9.5, for Fayette and Shelby Counties respectively. Percentagewise, a similar range existed for the Negro medians: from 3.9 in Lake County to 6.7 in

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Shelby and Carroll Counties, with a regional median of 5.9, somewhat lower than the States 6.5. The regional median for Negroes was lower than the all-population regional median by 2.2 school years, practically identical to the average difference of 2.1 between medians on a county-to-county basis.

Of the 56,124 farm operators reported in the 18 counties of west Tennessee by the 1954 Census of Agriculture 16,239, or 29 percent, were Negro. Percentages of Negro operators in individual counties ran from 2 to 71 percent, with the following frequency distribution:

Negro percentage of all farm operators	Number of counties
0-10	8
11-20	3
21-30	0
31-40	3
41-50	1
51-60	1
61-70	1
71-80	1

The 8 counties having the lowest percentage of Negro farm operators (10 percent or less) included the 5 highest modal-size acreages, 2 in the 70-99-acre class and 3 in the 100-139; these modal-size classes were markedly above all the other counties in west Tennessee, the other 13 counties having their modal-size farms in the 10-29-acre class. The 3 remaining counties in the group of 8 having Negro farm operator percentages of less than 10 percent

had county average-size farm acreages of over 100 acres, however; and one of these three had a modal-size of farm of 30-49 acres as recently as the 1950 Census.

At the other end of the scale, the 4 counties with the highest percentages of Negro farm operators (41 to 71 percent), in addition to having modal-size farms in the 10-29-acre class, had average-size farms of less than 100 acres, and 3 of these averages were in the 60-70-acre class.

A large "average size of farms" is noted to be less significant as a descriptive characteristic of a county than a small average. This is because large average size often results from a few very large farms in a county and may be far above the typical or modal size, whereas a small average size can arise only from a preponderance of small farms.

In 5 of the 7 counties where more than 35 percent of the farm operators were Negro, more than half of all farms were in the Census of Agriculture Economic Classes V and VI (having the value of annual product sales between $250 and $2,500), and in the 2 other counties these classes constituted 43 and 47 percent of all farms. No other counties in west Tennessee reached 50 percent in Classes V and VI; nor did their Negro percentages of all farm operators exceed, or even equal, 20 percent.

Comparing average west Tennessee farm acreages according to operator's race, the average size of farm operated by whites was 104 acres, while that of farms operated by Negroes was 39. Similarly, the average acreages of cropland harvested were 42 and

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20 acres, respectively. Put on a percentage basis, Negro farm acreages averaged 37 percent of white, and average cropland harvested by Negroes was 48 percent of the white average. Dividing average cropland harvested by average size of farm, it appears that whites cropped on the average about 40 percent of their total land in farms, Negroes about 51 percent.

In the 16 "rural" counties, where the rural population was more that 50 percent of the total, the level-of-living index in 1954 was inversely related to the Negro percentage of all farm operators. In the 5 counties where the percentage of Negro operators exceeded 35 percent, the level-of-living index did not exceed 70, the United States average being 100.[14] The only other county with a level-of-living index below 70 was McNairy County, whose index was 68, with a Negro percentage of farm operators of 5 percent. The two west Tennessee urban counties, Madison and Shelby, including the cities of Jackson and Memphis, had level-of-living indexes of 75 and 70, respectively.

Facilities for Economic Development

Establishment of facilities for economic development of Tennessee was long and difficult but generally persistent and successful in the State's history.[15, 16]

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[14] Data were taken from Farm-operator family level-of-living indexes, Statistical Bulletin No. 204, Agricultural Marketing Service, U.S.D.A., March 1957, and adapted to a U.S. average of 100 from the given 140.

[15] Federal Writers Project.

[16] George I. Whitlatch, Industrial resources of Tennessee, (Nashville, Tenn.: State Planning Commission, 1945), 209 pp.

Transportation

River transport.--The lower Tennessee River, northward-flowing below Muscle Shoals in Alabama, has always been directly accessible to the west Tennessee cotton-growing region, furnishing an important freight route for the plantation system. River transport declined rapidly after 1900, for although long freight hauls in some cases were still cheaper by water, the railroads became the chief carriers. In the last forty years, however, waterway traffic has somewhat revived due to recent improvements in mass freight-hauling by tug and barge fleets, spurred by federal operation of the Mississippi-Warrior Service, beginning in 1918. This line rejuvenated common carrier operation, pioneering in the use of steel-covered barges propelled by tunnel-type towboats.

Freight totals on the Tennessee River increased markedly during the 1930's, the primary reason being the saving in freight costs on goods moved entirely by water or by combined river-rail and river-motor truck facilities. River shipments move at rates generally about 80 percent of rail rates; and in Tennessee, barge lines have worked out joint rates with rail and motor carriers that give coverage to practically the entire State and permit shipments to and from almost all points in the Midwest and South. Development of barge-rail rates was inaugurated in 1918 in the operation of the federal Mississippi-Warrior Service.

The Tennessee River flows into the Ohio at Paducah, Kentucky, which provides a link with the Mississippi River at Cairo, Illinois. The Tennessee is maintained to 9-foot navigation depth by a series

of locks and dams, forming an important part of the most extensive interconnected inland waterway system in the United States. This system, which includes the Warrior River in Alabama, the Mississippi River and its tributaries, and the Gulf Intracoastal Waterway, has a total of about 10,000 miles of navigable channel. The river shipping facilities not only provide an economical form of transportation connecting the various inland ports, but also link these ports directly with the industrial and ocean shipping centers of the Gulf Coast. At the coastal ports, river freight can be transferred to ocean-going vessels destined for other coastal or foreign ports. Likewise, import and coastwise freight can be shifted either directly from ship to barge or over the docks.

Common carriers handle about 75 percent of the freight hauled on the Mississippi River, as measured in ton-miles. Memphis is a port of call for 5 major common carrier barge lines and more than 15 private and contract carriers. Five major common carrier barge lines also operate on the Tennessee River.

Railroads.--The wave of railroad building which surged over the country in the 1830's met with little response in west Tennessee, as the region was well served by riverboats and barges. The first line in the State oddly was built from Memphis ten miles eastward by the short-lived LaGrange and Memphis Railroad. The company failed soon after its exhibition run in 1842.

In 1856 the Nashville and Chattanooga Railroad completed a line between Knoxville and Dalton, Georgia. This road later became the Nashville, Chattanooga and St. Louis. The East Coast and the

Mississippi River were linked by the Memphis and Charleston Railroad in 1857. Ten years later the Louisville and Nashville Railroad connected the State directly with the North.

In east and middle Tennessee, railroad branch lines reached into mining, forest, and farming areas. Most of the State's enormous soft coal production has come over rail lines from the coal fields of the Cumberland Mountains. Main lines of the Nashville, Chattanooga and St. Louis Railroad eventually connected Chattanooga, Nashville, Memphis, and Paducah, Kentucky--each on a different large river and separated by hundreds of miles. These connections have required overcoming a great number of natural obstacles--poorly drained swampland in west Tennessee and rivers and high plateaus in other sections.

Railroads connect Tennessee's principal cities with St. Louis, Chicago, Cincinnati, Washington, Pittsburg, Philadelphia, and New York, as well as with all principal points in the South and Southwest. Transcontinental service passes westward from Memphis. Nine important railway systems serve Memphis: The Chicago, Rock Island and Pacific Railroad, and Gulf, Mobile and Ohio Railroad, the Illinois Central Railroad, the Louisville and Nashville Railroad, the Missouri Pacific Railroad, the Nashville, Chattanooga and St. Louis Railroad, the St. Louis and San Francisco Railway, the Southern Railway, and the St. Louis and Southwestern Railroad. Three of these also operate through Jackson: the Gulf, Mobile and Ohio Railroad, the Illinois Central Railroad, and the Nashville, Chattanooga and St. Louis Railroad.

Motor transport.--Although the railroad system is excellent, many communities are more than 25 miles from a railroad and 14 counties are entirely without service. For this reason the development of motor transport service has been encouraged, with the result that virtually every point in the State is now reached by motor carrier. Since the mid-1930's Tennessee has progressed markedly in improvement of both State and county road systems. Expansion of trucking, concurrent with construction of better roads, has made definite contributions to the economic development of the State's agricultural, forest, and mineral resources.

Likewise benefited have been the smaller manufacturing and processing industries, many of which are located in areas where railroad facilities are not available. Usually these industries are dispersed for accessibility to raw material sources and to markets for finished or semi-finished products. The bulk of Tennessee timber, for example, is moved from forest to mill by truck. In addition to milk, livestock, and poultry products, berries and other small fruit and vegetable crops are shipped speedily by truck and with a minimum of handling. Shipments are commonly loaded in the field for truck transportation to market with no intermediate rehandling.

Major arterial routes in Tennessee form a State network of 8,300 miles of paved roads, linked to a county and local system of 16,400 miles paved, 40,000 miles of gravel and stone roads, 2,100 miles of graded and drained dirt roads, and 2,600 miles of unimproved dirt roads, a total of 69,400 miles. At the State boundspr

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aries the principal highways connect Tennessee's road system with the road network of the eight adjoining states. In 1957, 905 truck-line companies were authorized to operate in Tennessee, 201 of which carried on their operations entirely within the State. These lines, operating the majority of the 41,800 trucks registered in the State during 1957, carry practically all classes of freight. All commercial truck lines operating in Tennessee are certified by the Motor Carrier Division of the Tennessee Public Service Commission.

Water Supplies

A total of about 275 Tennessee cities and towns have municipal water distribution systems. Almost two-thirds of these are municipally owned, with ownership of the remainder about equally divided between utility districts and private firms. Wells and springs are the sources of supply for about three-fourths of these municipal systems, and the remaining fourth depend on surface sources, such as rivers, creeks, lakes, or impounding reservoirs. Practically all of west Tennessee's larger municipal water systems use wells as their sources of supply.

A number of sizable towns are incapable of furnishing large volumes of water to new industries without construction of additional pumping facilities. All of the major cities, however, are located on rivers and appear to be able to accommodate considerably increased water consumption, either for direct industrial demands or for indirect ones, such as increased population needs created by industrial expansion.

Industries consuming large quantities of water usually have found necessary the development of their own water supplies. This is often the most practical way of assuring adequate water for their needs. In many cases the water requirements of industry exceed the capacity of municipal systems. In other cases the selected industrial location provides ready access to a surface source that guarantees virtually unlimited supplies of water and facilitates waste disposal.

Although there is considerable pollution of the Tennessee River in east Tennessee and in Alabama, most of it is dissipated by the time the water reenters Tennessee, and in the western valley of the Tennessee River no pollution of any importance occurs.

West Tennessee is drained by a number of major streams, including the Obion, Forked Deer, Hatchie, and Wolf Rivers and numerous small tributary creeks. As the region has relatively minor topographic relief, the streams have very low gradients. However, due to the relatively large amounts of silt and sand received from the adjacent loess formations, the streams are usually turbid and continually clog their channels.

To relieve the problems caused by clogging, and to assist in drainage of lower areas, artificial drainage canals have been cut throughout much of the region. Poor drainage is not conducive to the development of private industrial water supplies from surface sources, nor are sluggish streams well suited to disposal of industrial wastes. Fortunately, several widespread aquifers in

the region exist at moderate depths and are capable of yielding large volumes of water at almost any location.

Memphis, in the extreme southwest corner of west Tennessee, serves as a good example of the geologic conditions in the region and of the results to be obtained in the development of ground water supplies. The city water supply and the private water systems of industrial plants in Memphis constitute one of the largest ground water developments in the United States, according to Whitlatch.[17] The principal water-bearing strata in the area are at maximum depths of 500 and 1,400 feet. To the eastward in the region, horizons similar to those in Memphis are tapped at even shallower depths.

Electricity

There are 25 electric power systems in west Tennessee. Of these systems 14 municipalities and 5 cooperatives buy Tennessee Valley Authority power for distribution. The 6 others generate their own power. Three of them are municipal systems, and 3 are private companies. One of the latter also buys TVA power for distribution at TVA resale rates. The vast network of generating systems and transmission lines operated by the TVA provide unlimited power at exceptionally low rates.

Residential use of electricity, as well as industrial use, is widespread in west Tennessee. Even on farms, electrification is common. Thirteen of the 18 counties in the region had electricity on over 90 percent of their farms in 1954, and the

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[17] *Ibid.*, p. 123.

remaining 5 ranged from 72 to 88 percent. All 5 counties were among the 6 having Negro farm operators constituting at least 39 percent of all farm operators. The sixth county, in which 41 percent of the farm operators were Negro, had electricity on 91 percent of the farms. All 6 counties had progressed markedly since 1950, having the highest county increases in number of farms with electricity; numerical increases ranging from 540 to 1,068 farms and percentage increases varying from 17 to 53 percent. Altogether 12 counties had increases over the 4-year period, one had no change, and 5 had decreases. The 5 having decreased numbers of farms with electricity nevertheless had electricity on at least 96 percent of the farms remaining after the general reduction in total numbers of farms. While the total number of farms in the west Tennessee region fell to 56,124 in 1954, 8,635 less than in 1950, the number with electricity rose to 50,171 in 1954, 5,143 more than in 1950. The regional number of farms with electricity thus increased from 70 to 89 percent of the total number of farms.

Public services

The University of Tennessee Agricultural Experiment Station has branch stations in west Tennessee located at Martin and near Jackson. The Ames Plantation has recently begun to serve some functions similar to those of the older branches, as well as to pioneer in new directions.

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In cooperation with the Agricultural Extension Service of the United States Department of Agriculture, the University of Tennessee Agricultural Extension Service provides numerous services in west Tennessee. Federal agencies active in this area include the Soil Conservation Service, the Farmers Home Administration, the Farm Credit Administration, and the Agricultural Conservation and Stabilization Service.

The Tennessee state government has many agencies concerned with the economy of west Tennessee. However, the principal agencies connected with agriculture are the Department of Agriculture and the Division of Forestry and the Game and Fish Commission of the Department of Conservation.

These numerous agencies for public service, and other related ones, are concerned in their various ways with the development and the stabilization of local economies or the alleviation of widespread problems. Federal, state, and local officials, as well as actively interested local residents, have given much thought to the problems of economic development and have proposed a number of possible measures and contributory partial solutions. Three of the most commonly offered proposals are listed as follows, affording a brief indication of principal current opinions:

1. Encouraging migration of industries is the most commonly proposed solution to the rural counties' economic problems. This proposal is easy to suggest due to publicized successes in other parts of the nation, and it receives popular support, as it implies increased local family income through employment of women

and underemployed farmers. Further attraction comes with the expectation of expansion in other sectors of the economy, wholesale and retail trade, construction, and services. Many towns and counties have organized local committees to survey community resources, to prepare attractive brochures, and to write and sometimes to visit officials of distant manufacturing companies considered to be potential users of community resources. The resource surveys have included industrial sites, water and power sources, numbers and skills of available workers, transportation facilities, and related industries and services available. In some cases community bond issues have been planned to finance construction of industrial buildings for rent to prospective companies; in other cases tax concessions have been offered to encourage establishment of new industries. Many difficulties commonly are involved in implementing this proposal; however, hope exists that potential mutual benefits will bring about successful outcomes in community economic development.

2. In view of the chronic problems of cotton farmers, diversification of enterprises on farms is often proposed by agricultural advisors. A wider variety of specialized farm types within the area might also be an alternative possibility of importance. These recommendations have the advantage of spreading risk of loss or reduction in income due to biological and climatic factors or unfavorable markets for specific products or groups of products. Rotation of land use may also be facilitated by diversification of enterprises, thus tending to conserve the productivity

of the soil. However, diversification increases demands on the managerial skill and capacity of the farm manager and usually requires increased investment.

3. A popular recommendation for relieving the agricultural economy is the increase of cotton acreage allotments, or complete abandonment of the allotment system. This would involve elimination of federal price supports and would put cotton production back on a free-enterprise basis. This might be beneficial in improving resource allocation in the long run by encouraging establishment of substitute enterprises to replace cotton on many farms. In the short run, however, disruption of the economy would be pronounced, and the immediate impairment of farm income might be disastrous on small family farms where cotton is the principal cash crop.

The present study is oriented primarily toward investigation into opportunities in the second category of approach to the problems of farm organization but also is concerned with related areas pertaining to rural economies.

CHAPTER IV

FOREST RESOURCES: TIMBER INVENTORY AND FOREST LAND OWNERSHIP

Timber Inventory

A survey of Tennessee's forest resources was made in 1948-50 by the Southern Forest Experiment Station. Important data obtained by the forest survey crews and by other research were reported by Sternitzke in Forest Resource Report Number 9, Tennessee's Timber Economy.[1]

Tennessee had 12,607,600 acres of forest land, 47 percent of all land in the State. West Tennessee's forest acreage covered 1,794,200 acres, or 30 percent of the total land area. Some counties were much more sparsely forested than others, however, the forest land percentage ranging from 16 in Crockett County to 43 in Hardeman.

The 1949 relationship of net annual growth of timber to the annual cut of timber was less favorable over Tennessee as a whole than in the west Tennessee region. As appears from Tables 2 and 3, while net annual growth of total growing stock of all timber species was greater than annual cut in all regions, averaging 113 percent for the State, growth of sawtimber was less than the cut in all regions except west Tennessee, and averaged 87 percent for

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[1]Sternitzke.

TABLE 2.—Net annual growth in Tennessee

TABLE 2.--Net annual growth in Tennessee, by Forest Survey region, 1949

Survey region	Growing stock in millions of cubic feet			Sawtimber in millions of board feet		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
West	54.5	4.1	50.4	196.8	16.4	180.4
West-central	40.6	2.9	37.7	114.8	8.5	106.3
Central	48.6	2.2	46.4	135.3	3.5	131.8
Plateau	65.9	14.3	51.6	187.3	47.6	139.7
East	75.9	30.4	45.5	242.8	111.4	131.4
State total	285.5	53.9	231.6	877.0	187.4	689.6

TABLE 3.--Annual volume of timber cut in Tennessee, by Forest Survey region, 1949

Survey region	Growing stock in millions of cubic feet			Sawtimber in millions of board feet		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
West	50.2	3.0	47.2	193.2	13.7	179.5
West-central	30.6	3.0	27.6	124.8	15.2	109.6
Central	45.8	3.5	42.3	169.7	14.6	155.1
Plateau	51.7	17.4	34.3	221.1	85.4	135.7
East	74.0	35.9	38.1	304.3	165.8	138.5
State total	252.3	62.8	189.5	1,013.1	294.7	718.4

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Tennessee as a whole. The ratio was most unfavorable for Tennessee softwoods, net growth being only 64 percent of cut for sawtimber and 86 percent for all growing stock. Hardwood growth for total growing stock was 122 percent of cut, but for sawtimber was just 96 percent, nearly a balance.

West Tennessee's relationships of net annual growth to annual cut in 1949 were much more favorable than the State's. Net growth of total timber of all species was 109 percent of cut and for sawtimber was 102. For softwoods the ratios were remarkably high: 137 percent for total timber and 120 for sawtimber. Hardwood growth was 107 percent of cut of total timber and just balanced with cut at 100 percent in the case of sawtimber.

These percentages, showing that west Tennessee's annual timber growth equals or exceeds the annual cut, are favorable indications only of the fact that in general a build-up of total timber volume is occurring rather than a depletion. Also the only indication as to changing quality in the over-all resource is the reduction in average size of timber, as evidenced by the fact that the ratios of growth to cut are less for sawtimber than they are for total timber, in the case of both hardwoods and softwoods.

More important, however is the rate at which growth is occurring, because the current rate of growth affects the length of time needed to build up the timber volume per acre. Also the future growth rate will determine the rate of cutting which will be possible without depleting the forest resource. According to the 1949 data, west Tennessee's 1,704,300 acres in hardwood types

averaged an annual growth of all timber of about 30 cubic feet per acre, including 100 board feet of sawtimber. Softwood types grew an average of 50 cubic feet per acre annually on 83,400 acres, a volume which included almost 200 board feet of sawtimber. These growth averages are below those offered as rules-of-thumb by foresters. Commonly accepted guide rules suggest that forest management can produce annual growth per acre of 60 cubic feet from upland hardwoods, with 200 board feet of sawtimber included, and 100 cubic feet from loblolly pine, including 400 board feet of sawtimber. The guide standards for these specific types are, coincidentally, just double the present averages for all hardwood types and softwood types, respectively.

Commercial forest land comprises very nearly the total forest land area of Tennessee; only the limited areas reserved from cutting of timber are classed as noncommercial. The acreage of commercial forest is listed by major forest types for the five regions of the State in Table 4. West Tennessee had only a small part, 83,400 acres or less than 3 percent, of the State's total acreage of the softwood type. By contrast, hardwood types were well represented in west Tennessee, with 1,704,300 acres or 18 percent of the State's hardwood acreage located in this region. Tennessee's bottomland hardwoods were concentrated in west Tennessee, where 733,400 acres or 80 percent of the State's total acreage in bottomland hardwoods were recorded.

While west Tennessee had only 14 percent of the State's forested acreage, it had 17 percent of the volume of merchantable and

TABLE 4.--Area of Commercial forest land in Tennessee, by forest type and survey region, 1948-50

Forest type	Area in thousands of acres					
	State	West	West-Central	Central	Plateau	East
Softwood types						
Southern yellow pine	2,033.5	67.6	74.8	. .	787.4	1,103.7
Cedar	893.8	15.8	64.6	646.0	97.7	69.7
Other softwood	108.1	. .	. .	. .	38.7	69.4
Total	3,035.4	83.4	139.4	646.0	923.8	1,242.8
Hardwood types						
Bottom-land hardwood	921.9	733.4	66.8	71.9	37.3	12.5
Upland hardwood	6,334.3	867.0	1,651.8	1,591.0	1,367.5	857.0
Upland hardwood-pine	2,062.2	103.9	249.1	35.9	728.1	945.2
Total	9,318.4	1,704.3	1,967.7	1,698.8	2,132.9	1,814.7
All types	12,353.8	1,787.7	2,107.1	2,344.8	3,056.7	3,057.5

potentially merchantable timber. In millions of cubic feet west Tennessee had 973.1 of the State's 5,728.5 total of all species. In their minor position, softwoods comprised only 78.3 million cubic feet or 8 percent of Tennessee's 926.2 volume. Hardwoods in west Tennessee, however, accounted for 894.8 of the State's 4,802.3 million cubic feet, or almost 19 percent. This hardwood volume was 92 percent of the total timber volume in the region.

The economic importance of west Tennessee's hardwoods is further indicated by the fact that they covered 28 percent of the land area of the region. Upland hardwood types grew on 57 percent of the hardwood area, thus constituting the principal source of income on 16 percent of west Tennessee's total land area, while the remaining 43 percent of the hardwood area is in the bottomland hardwood type. However, due to the heavy average volume per acre--651 cubic feet--of bottomland hardwoods, the total volume in this type in west Tennessee slightly exceeded the region's total volume in the upland hardwood types (where the average volume per acre was 503 cubic feet on 867,000 acres of upland hardwoods and 261 cubic feet on 103,900 acres of upland hardwood-pine type).

Basal area per acre was also heavier in bottomland hardwoods than in the other types. West Tennessee had an average of 42.3 square feet per acre of merchantable (including potentially merchantable) hardwoods in the bottomlands, 31.5 in the uplands, and 29.7 square feet per acre of merchantable softwoods. Unfortunately the basal areas of cull trees in all of these types were considerable, 29.7, 15.3, and 7.6 square feet per acre, respectively. These cull

basal areas occupied percentages of 41, 33, and 20, respectively, of the total basal areas of 72.0 square feet per acre in bottomland hardwoods, 46.8 in upland hardwoods, and 37.3 in softwoods. None of these statistics of basal area by type vary appreciably from the State's averages. However, the weighted basal area average for all types is almost 25 percent higher for west Tennessee than for the State as a whole, primarily due to its heavy proportion of bottomland hardwoods and the high percentage of culls in this type. The State averages for basal area per acre were 32.3 square feet in merchantable trees and 13.3 in culls, totaling 45.6 square feet. West Tennessee averaged 35.8 square feet in merchantable trees and 20.9 in culls, with an average total basal area per acre for the region of 56.7 square feet.

These data reveal a high proportion of cull timber in west Tennessee forests and a poor stocking of merchantable timber. While these regional averages for all timber types are predominantly weighted by upland hardwoods, they are somewhat influenced--increased--by the weighting of bottomland hardwoods. In any case, however, in well managed stands the volume of cull timber should be nil. And for both types of hardwoods and basal area in merchantable timber (defined as sound, well formed trees 5.0 inches d.b.h.[2] and larger[3]) should be at least 55 square feet per acre following

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[2]Diameter breast high; stem diameter at a point 4-1/2 feet above average ground level.

[3]Present merchantability standards for most hardwood sawtimber in west Tennessee would class trees under 12 inches d.b.h. as only potentially merchantable for timber products. Throughout most of this region, markets for these [continued on page 85]

a selection cutting--50 percent more than the current west Tennessee average.

Forest Land Ownership

Whereas considerable information has been made available on the timber resource in west Tennessee, there has been little factual knowledge published about timberland owners. Pertinent information was sought in order to learn (1) how owners sold timber, (2) how and why they held forest land, and (3) the relationships between how the timber market functions and how the forest is treated as a source of timber.

The search for information was pursued by means of a survey of a sample of owners of forest land in Hardeman County, a typical west Tennessee county with respect to its forests. A sample of 40 owners was stratified according to the method described in the appendix, to insure interviews with at least 20 recent sellers. It was desired to have at least half of the sample composed of owners who had sold timber in the 1951-1955 period, since these recently active participants in the timber market were considered the most significant segment of the owners whose forest management and timber marketing practices were under study.

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smaller hardwoods have not yet developed, but insofar as such trees are sound and well formed, virtually all will grow into merchantability. Markets for pulpwood and other small products can also be expected to be created and to expand, thus lowering the minimum diameter of actual merchantability.

In respect to the proportion of total forest area in the major forest types, the area included in the sample was similar to west Tennessee as a whole. West Tennessee had 54 percent of its forest area in upland hardwood types (including pine-hardwoods), 41 percent in bottomland hardwoods, and 5 percent in pine. The forest areas in the 40 ownerships totaled roughly 63 percent in upland hardwoods, 32 percent in bottomland hardwoods, and 5 percent in pine.

Sizes and types of forest land

The most common size of total ownership area in the sample was less than 300 acres (Table 5). However, the mean was 465, since 35 percent of the ownerships were larger than 600 acres and covered 68 percent of the area (12,700 of the 18,600 acres). The smallest acreage in the sample was 50 acres and the largest was 1,350. The most common size of forest on these ownerships was less than 150 acres (Table 6), but the mean forest acreage was 297. The range of forest area was from 15 to 983 acres. Over the 40 ownerships the ratios of size of forest to size of total ownership, when expressed as percentages, ranged from 20 to 100 percent. The largest number of ownerships, 14, were in the 41-60-percent class (Table 5) and almost as many, 13, were in the 61-80-percent class. Thus the modal ownership had forest land occupying about 60 percent of its total area.

The predominant forest type was upland hardwoods, including pine-hardwoods, which occurred on 34 of the 40 properties, or 85 percent. Nine of these had only the pine-hardwoods type (two of

TABLE 5.--Number of owners by size class of total area owned and by percentage of area in forest, Hardeman County sample, 1956

Size class of total area owned in acres	Number of owners					
	Percentage of area in forest					Total number
	1-20	21-40	41-60	61-80	81-100	
1-300	1	2	6	7	2	18
301-600	0	2	3	1	1	7
601-900	0	1	5	3	3	12
901-1200	0	0	0	0	1	1
1201-1500	0	0	0	2	0	2
Total number	1	5	14	13	7	40

TABLE 6.--Number of owners by market information source used and by size of forest area, Hardeman County sample, 1956

Size of forest area (acres)	Number of owners					
	Market information source used					Total
	Government forester	Local individuals	Business connections in wood industries	None	USDA agent	
1-150	0	6	2	7	1	16
151-300	3	1	1	4	0	9
301-450	1	3	1	0	0	5
451-600	1	1	3	1	0	6
601-750	0	0	0	0	0	0
751-900	0	2	1	0	0	3
901-1050	0	0	1	0	0	1
Total number	5	13	9	12	1	40
Percentage	12.5	32.5	22.5	30.0	2.5	100%

which also had pure pine stands), and two had pine-hardwoods in addition to other upland hardwoods. Twenty ownerships contained bottomland hardwoods, and all but six of these also had upland hardwood areas, typically considerably larger than the areas in the bottomland types. Twenty-four ownerships had areas in the pine type, either native shortleaf or planted loblolly pine; however, 18 of these ranged from 1 acre to 30 acres; only 6 ran from 41 to 100 acres.

Ownership types

The characteristic ownership type was the resident farm ownership, comprising 36 of the 40 ownerships, or 90 percent. Owners resided on 24 of these, 2 of which were part-time farms, where the owners' principal occupations were off the farm. The other 12 ownerships had only tenant residents, although several properties were multi-farm units, occupied by at least one family for each operating farm unit. Two of the remaining four ownerships were non-resident farms, one of which was a part-time enterprise. The other two were non-farm commercial forest ownerships, one owned by a lumber company and one held by an individual "for timber-growing as an investment to develop into an educational fund to send my son to college."

General description of Hardeman County farms

The preponderance of farms in the sample is in accord with the heavily agricultural nature of Hardeman County. A few census facts about the county will give a sketchy picture of the background involved. Hardeman's 2,700 farms occupied 76 percent of

the almost 420,000 acres in the County, the average size of farm thus being about 117 acres.[4] The modal size of cropland acreage was in the category of 10-20 acres per farm.

The total farm woodland acreage in 1954 was reported to be almost 140,000 acres, and nonfarm woodland in the county brought the Hardeman forest total to over 178,000 acres. Over 53 percent of all farms reported forest areas, with the average woodland acreage on these 1,444 farms being 97 acres.

Of the total farm Census acreage, over 70 percent was operated by the owner, despite the fact that only 48 percent of the total number of farms were owner-operated. This implies also that the tenant-operated farms were smaller than the 117-acre average, which is to be expected--especially as owners who have subdivided large acreages into a number of tenant farms commonly leave the woodland out of the rented areas and retain this forest area in their own farm or non farm operating units.

Electricity was used by 81 percent of all farms reported and tractors were a source of pulling power on 28 percent, mules or horses the only source on 33 percent, and no tractors, mules or horses were listed for the remaining 39 percent. It is probable that the 19 percent reporting no electricity were farms rented to tenants, and they were very likely among the 39 percent without tractive power. Undoubtedly some of these farms used rented or borrowed trucks, mules, or horses to supplement human labor, but

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[4]U.S. Bureau of the Census, Census of Agriculture: 1954, Vol. I: Counties and state economic areas, Part 20, Tennessee (Washington, D.C.: 1956).

some may well have been so small that even such borrowing was unnecessary or uneconomic. Fortunately, however, over 60 percent of all farms had both electricity and tractive power. In the period 1950–1954 there was a 38-percent increase in the number of farms having electricity and a 51-percent increase in the number possessing a tractor.

Of the 2,700 farms in 1954 about 400 were classed as primarily residential and 230 others as part-time operations. About 1,000 farm operators reported working off the farm, with half of these obtaining off-farm employment for 100 days or more during the year. Over 500 farmers reported more family income from off-farm sources than from the sale of farm products.

Over 5 million dollars' worth of farm products were sold from Hardeman County's farms in 1954, with only about $72,000 or 1.4 percent obtained from forest products. This forest income was a marked decrease from the $100,000 worth sold in 1949, which was nearly 2.5 percent of the total value of farm products harvested in that year.

The 1954 aggregate of farm forest sales of sawtimber for veneer and sawlogs was 1,350 MBF (thousand board feet), taken from 87 farms--a farm average of not quite 16 M. If the total value received from all timber products had been equally divided among these 87 farms, the receipts to each farm would have been $820, and the average price slightly over $50 per MBF. A fuelwood volume of almost 13,000 cords was cut on 1,504 farms, and nearly

173,000 fenceposts came from 622 farms. For the 1,504 farms the fuelwood average was 8.5 cords and the 622 post-producers averaged 278 posts.

Ownership objectives

Major ownership objectives as indicated by the 40 owners in the 1956 survey fell into five categories, designated as farming, residence, timber-growing, rental of farm land, and timber-removal. These categories are listed in order of decreasing over-all frequency of occurrence, which is also the order of frequency of the primary objectives of the 40 owners (Table 7). Secondary objectives are noted for all but two of the owners, those two being the non-farm commercial forest owners, whose only objective was timber-growing. Third place objectives were cited by only eight owners.

Farming or rental of farm land were among the objectives of the 38 farm owners, although in only 25 cases were they primary objectives. Two of these farm owners indicated both farming and rental of farm land as ownership objectives.

Residence was notable as the secondary objective on half of all ownerships surveyed and was the primary objective on seven. One farmer residing on his farm considered farming and timber-growing to be his only objectives, residence being so incidental as to be not worthy of even third place. The 12 other ownerships had neither been used nor planned for owner residence. Currently, however, there were 16 properties on which owners did not reside.

TABLE 7.--Number of owners by ownership objectives in order of importance, Hardeman County sample, 1956

Order of importance	Ownership objectives					Total
	Farming	Residence	Timber-growing	Rental of farm land	Timber-removal	
1	23	7	6	2	2	40
2	2	20	5	9	2	38
3	3	0	4	1	0	8
Total	28	27	15	12	4	86

Timber-growing was cited as a major ownership objective by 15 owners, although only 6 rated it as the primary objective. Nevertheless, timber-growing was the third most important objective, following farming and residence.

Timber-removal, without intention to perpetuate a productive forest, was a major ownership objective of four owners. Two held it as the primary objective and the other two as secondary.

The method of initial land acquisition of 24 ownerships, or 60 percent of the sample, was purchase (Table 8). Thirteen ownerships, or about a third, had been obtained by inheritance; and three had resulted from a transfer within a family, not due to the owner's death. While the initial acquisition of one ownership dated from as early as 8 decades before the survey, no other tract had been held over 5 decades. Most holdings (over 60 percent) had been acquired in the last 2 decades. The median length of ownership was slightly less than 20 years. This distribution of duration of ownership reflects the combined action of two factors: the limitation of the length of adult life of the owner and the normal purchase turnover rate.

On 16 ownerships two or more acquisitions had been made. The 16 second acquisitions had all been purchases, made up to 20 years following the initial acquisition and averaging 7 years, with the median at 4-5 years. Three purchases had followed initial inheritance, at intervals of 8,19, and 20 years. One purchase had come promptly after an initial transfer within the

TABLE 8.--Number of owners by method of acquisition of land and by date of acquisition, Hardeman County sample, 1956

Date of acquisition[1]	Method of acquisition			Total number
	Purchase	Inheritance	Transfer within family	
1876-1885	0	1	0	1
1886-1895	0	0	0	0
1896-1905	0	0	0	0
1906-1915	2	1	0	3
1916-1925	1	2	1	4
1926-1935	3	3	0	6
1936-1945	9	3	0	12
1946-1955	8	3	2	13
Date not reported	1	0	0	1
Total	24	13	3	40

[1]Earliest date if ownership was acquired as more than one tract.

family: a young man had extended his property two years after a gift of land from his father.

Twelve of the second purchases had been made by initial purchasers. Thus half of the 24 who had made an initial purchase had wanted to increase their holdings, and typically after only a short period of years. In contrast to the purchaser repeat rate of 50 percent, the heirs' purchase rate was less than 25 percent, and then after a much longer interval on the average.

Sales and harvests and owner's age

The connection between the present age of woodland owners and whether they have sold timber recently or at all is not proof of a relation between owner's age and the farsightedness of his forest management. However, certainly the refraining from unplanned or ill-considered sales of growing timber implies a conservative attitude. The inference is probably not incorrectly drawn that the owner advisedly is holding off from an early sale so as to obtain much more profitable future returns from his woodland.

Six of the 40 owners, or 15 percent, had never sold timber since they had acquired their properties (Table 9). All six were within the age range of 41 to 60 years and constituted a fifth of the total in that group. Eight others had made no sales since 1950, bringing to 14 the total who had sold no timber during the five years preceding the 1956 survey. These eight had, however, sold timber at least once between their acquisition dates and 1950.

TABLE [illegible]—Number of owners by

TABLE 9.--Number of owners by age of owner and by occurrence of timber sales, Hardeman County, 1956

Age of owner (years)	Number of owners				
	Date of timber sale(s)		Sales in both periods	No sales since acquisition	Total number of owners
	1951-1955	Acquisition-1950			
31-40	0	1	0	0	1
41-50	3	1	2	2	8
51-60	6	4	7	4[a]	21
61-70	2	2	3	0	7
71-80	1	0	2	0	3
Total	12	8	14	6	40

[a]Including an incorporated, family-managed lumber company whose paternal president was the sole owner.

Timber sales had been made between 1951 and 1955 by 12 owners who had sold no timber previously. Sales in both periods, however, had been made by 14 owners.

All 10 owners over 60 had made sales at least once, 8 of them in the period of 1951-55. Recent selling by aged owners was widespread, as might have been anticipated, since a man nearing the end of his life realizes that his last sale could well have been his final opportunity to obtain income from his timber. Also the normal income from labor requiring vigor naturally tends to diminish with age, while total need for income diminishes only slightly, if at all.

Five, or 50 percent, of the 10 owners over 60 had made sales in both periods, 1951-55 and previously. By comparison, only 9, or 30 percent, of the 30 owners up to age 60 had sold timber in both periods. At first thought the older owners' higher rate of repeat sales does not appear unexpected, as 60 years is a long time to live and getting money from timber is attractive. In the upland hardwoods typical of west Tennessee, however, two timber sales in a man's lifetime speak fairly well for his conservative nature. The commonly slow growth of many of these lightly stocked hardwood stands seldom permits the harvesting of more than 1,500 board feet per acre every 40-45 years if the logger takes trees down to the commonplace, 12-inch stump diameter 12 inches above the ground. In an owner's 60's and later, a declining interest in timber might be expected due to the long time needed to grow a crop. Indeed,

such declining interest is markedly pronounced among Michigan forest owners over 50, according to a recent study reported by Yoho, James, and Quinney.[5] In the Hardeman County sample, on the other hand, it was noted that six of the ten owners over 60, despite their vigorous record of timber-selling, were trying to manage their timber to assure future returns.

Of the 40 forest owners, 26 had made a total of 35 sales of timber products in the 1951-55 period (Table 10). Twenty-two sales were of stumpage, 6 of logs, and 7 of delivered lumber or ties. The logs and sawed products were sold by their board-foot volumes, as was the stumpage in 3 sales. Most (14) of the stumpage sales, however, required payment of a lump sum agreed upon before the timber was cut. Five sellers preferred to release ownership of their stumpage with the understanding that they would be paid for it by a share system. The stumpage share was usually 1/4 or 1/3 of the money received by the sawmill operator when he delivered the green lumber to a concentration yard or other dealer. Over half (19) of the sale agreements were verbal; and of the 16 written contracts, 10 were drawn up by the buyer or his lawyer.

The share system was expecially advantageous to the small sawmill operator with scant finances. It relieved him of the problem of getting the loan he needs when stumpage has to be paid for in advance of cutting. The only reason some sellers preferred it

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[5] James G. Yoho, Lee M. James, and Dean N. Quinney, Private landownership and management in the northern half of Michigan's lower peninsula, Michigan State University Agricultural Experiment Station Technical Bulletin 261 (East Lansing, Mich.: 1957), p.29.

TABLE 10.--Number of sales by form of main product sold, 1951-55, and by type of payment, Hardeman County sample, 1956.

Form of main product sold	Number of sales			
	Type of payment			Total number of sales
	Lump sum (by the "book of timber")	By the thousand board feet, by the piece, etc.	Shares (1/3 or 1/4) of lumber wholesale price	
Stumpage	14	3	5	22
Logs	0	6	0	6
Lumber and/or ties	0	7	0	7
Total	14	16	5	35

was that they felt adequately paid according to the actual volume of timber cut, without the necessity for a pre-sale inventory or estimate of the volume of trees to be cut. Hardly any of the sales were of marked timber; thus cutting was selective only in that sawmill operators chose the larger trees (above a 12-inch stump diameter for hardwoods and an 8-inch stump for pine) and left the smaller and otherwise less valuable trees in the woods.

Forest products for home use had been harvested by 31 owners, of whom 27 had cut sawtimber and 19 had cut fenceposts. Fifteen of these owners had cut both sawtimber and fenceposts. All 31 were farm owners. No harvests had been made on the 2 non-resident farms nor on the 2 nonfarm commercial forest ownerships.

Plans for future sales and harvests

Few woodland owners had definite plans for future sales or harvests from their forests. Twenty-three, however, had general intentions of selling or harvesting sometime in the next decade or two. Twenty of these expected to regulate timber cutting on a sustained yield basis; three did not. Nine others intended sustained yield, bringing the total to 29, but due to the need to build up their stands, they had no intentions of cutting for at least 20 years.

All 29 who aimed to achieve sustained yield had some idea of what products would be cut, and all but one of these had at least rough intentions or perhaps indefinite plans as to what woodland work should be done. Seven not wishing for sustained yield

nevertheless had some future timber products in mind, but four others expected no future products from their woodlands.

Of the 36 expecting yields at some future time, 12 planned to sell stumpage only. Two others planned to sell stumpage but also to harvest timber, one intending it for home use, the other for roadside sale. Two more planned harvesting timber for home use and two for roadside sale. The remaining 18 expected to harvest and deliver products to the buyers, 5 planning delivery of sawlogs and other logs, 7 pulpwood, and 6 lumber. Of the 6 planning delivery of lumber, 4 planned to saw it on their own mills and 2 would have it custom-sawed.

Labor and capital available for woods work

Although 21 owners (or alternate family members) had done woods work, 5 no longer considered themselves available--primarily due to age. Twenty owners, however, felt that they could do woods work, despite the fact that 6 had no previous experience of this kind. Eleven owners counted on other males in their families to help with such work, and 2 others (who were not able to work in the woods) expected family members to execute the work for them. Fourteen owners had tenants or sharecroppers to help them in woods work, 4 had neighbors available, and 15 expected to hire others to work on their woods crews. In 9 cases where hiring tenants or others was expected, neither the owner nor a family member would be working with them; in 3 of these cases, though, the owner had had previous woods experience and probably would supervise operations.

Equipment available for harvesting of timber included cross-cut saws and other hand tools on 13 ownerships and power saws on 7 others. Nineteen of these 20 ownerships were equipped for skidding, and in most cases for hauling also, by means of tractors, trucks, or mules, with chains, tongs, or wagons.

As to the question of possible need for credit, all owners' responses were negative. Probably in most cases no thought had been given to the possible desirability of credit for forest improvement, such a matter being outside the realm of normal experience. In many other cases credit need was probably ruled out due to general aversion to debt, expecially since risk was increased as a result of lack of knowledge of timber-growing. In practically all cases the subject of credit was a touchy one, the common reaction indicating that it was a personal matter not to be discussed outside the family. Rather than considering credit as a useful tool of farm management, lack of use of credit appeared to be a source of pride to most of the farmers interviewed.

The common aversion to debt was illustrated by one farmer who appeared industrious, progressive, and prosperous, and who was willing to discuss the subject of credit. He reported that he had consulted a government forester regarding management of his timberland. The forester had pointed out to him that if he were to cut, as he intended, a stand of cherrybark red oak, the trees of which were growing, on the average, one inch in diameter annually, he would be losing the potential for about a 10-percent annual increase in volume and value. The farmer's response was that the

cutting of this timber would enable him to pay off a 6-percent note, and that therefore he would be losing only 4 percent annually and gaining peace of mind through reducing unwanted debt.

In the case of a timberland owner whose occupation was operation of a portable sawmill, debt was common to his existence. He had a personal debt of 35 to 40 thousand dollars, largely invested in equipment. Although his business was active, he seemed to be somewhat uncomfortable with this level of debt and appeared to be close to the limit of his credit. Despite the fact that he had bought several timberland properties in the past few years, he had no intention of using credit for growing timber; forested properties were bought for prompt harvesting of all merchantable timber, then conversion to farms.

General management programs and practices

Only one owner had a formal management program; this was for a large nonfarm commercial forest property of bottomland hardwoods. The current phase of the program called for accumulation of volume of merchantable trees, as the timber stand had recently been improved by the girdling of culls. Thirteen other owners had planted loblolly pine seedlings, but this was the only active practice involved in their informal forest management programs. Two others, however, who were growing pine timber had found that natural regeneration of the native shortleaf pine on their tracts was adequate and transplanting of nursery stock was unnecessary.

Management by the remaining 15 owners among the 29 who intended achieving sustained yield forestry did not yet include many active forestry practices. Some of these 15 owners, however, as well as some of the 13 who had planted pine, had made improvement cuttings to remove low quality but merchantable trees, and many had cut cull trees for firewood and low-grade fenceposts.

Basic to their general management policies were the owners' attitudes toward timber as a resource of some value. Statements they made and behavior they revealed during interviews indicated that 33 owners considered timber to be a substantial resource. Among these were the 29 who believed timber to be of sufficient value to make sustained yield management profitable for them. There were four who recognized that growing timber is of value but felt that investing in a program of sustained yield was not suitable for themselves. And seven owners were quite indifferent to timber, giving the impression that it was hardly worth consideration, and certainly worthy of no effort on thier properties. Four of these unquestionably would have regarded timber more highly had their peculiar ownership situations not precluded management effort toward development. Two others considered that management would be uneconomic due to the low value of the resource on their properties. Only one had a really antagonistic attitude toward both timber and people, especially timber buyers and government officials.

Thus all owners but one recognized forestry as a potentially worthwhile enterprise where applicable, even though ten of them had not adopted it on their own land (for various reasons of finances or incentives). This general acceptance of forestry in principle, is in striking contrast to the attitudes reported several

years earlier in Mississippi by James, Hoffman, and Payne, who learned from their interviews in the central part of the State that the owners of 17 percent of the area surveyed either had "no idea" of what forestry was or thought that it was some kind of "nonsense perpetrated by government."[6] Certainly there has been much progress in recent years, although much more is needed.

Knowledge of alternatives in production and marketing

Information was sought about the degree of owners' knowledge of grades and size specifications for timber products, merchantability of timber stands, and existing or prospective markets for timber. As no objective measures were available, a subjective evaluation was made following each interview, and the owner was rated as having one of 6 degrees of knowledge, from "poor" to "excellent," in each of the 3 categories related to timber production and marketing. Over half of the owners were rated as "poor" or "fair" in each of the categories (Table 11), with an over-all average of about 62 percent of the owners in these ratings. Nevertheless, a sizable proportion, 29 percent, were in the ratings of "good" or better, and 18 percent were felt to have "very good" or "excellent" knowledge in the 3 categories.

In deciding whether to make a timber sale and when, how, and to whom, 12 of the 40 owners had sought no market information

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[6] Lee M. James, William P. Hoffman, and Monty A. Payne, Private forest landownership and management in central Mississippi, Mississippi State College Agricultural Experiment Station Technical Bulletin 33 (State College, Miss.: 1951), p. 23.

TABLE 11.--Number of owners by degree of knowledge of products, stand merchantability, and markets, Hardeman County sample, 1956

Degree of knowledge	Number of owners				
	Class of information			Total	Over-all percentage
	Product grades and size specifications	Timber stand merchantability	Existing or prospective markets		
Poor	13	14	14	41	34
Fair	11	7	15	33	28
Fairly good	4	4	3	11	9
Good	3	6	4	13	11
Very good	3	4	0	7	6
Excellent	6	5	4	15	12
Total	40	40	40	120	100

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(Table 6); 9 had obtained advice from people they knew in the forest products industries; 13 had discussed the matter with other local individuals; one spoke about it to a county agricultural technician; and 5 had consulted with foresters, at no direct expense to themselves in these cases since only government foresters were involved--no private consultants. The only obvious relation between size of forest area and the owner's desire for market information was that no owners of less than 150 acres of forest availed themselves of the help of a forester. The 5 owners advised by government foresters held between 160 and 480 acres of forest land, and averaged 292. Four of these ownerships were farms, 3 full-time and one part-time, and one was nonfarm commercial forest. The nonfarm owner was a lumber company which employed a forester to manage company lands in addition to his principal duty of timber buyer or procurement agent. The company called upon the government forester's services to supplement the management work of its own forester.

Relation of ownership objectives to alternatives for management

The alternatives for economic forest management on farms are numerous when a number of conditions are favorable. The greater the restrictions imposed by these conditions the more limited becomes the range of economic alternatives. Ownership objectives are one of the most determining of the limiting factors but also constitute a condition that is susceptible to both minor modification and drastic change. The objectives of each owner are usually multiple, and ordinarily at least 2 or 3 major objectives are consciously recognized, as was indicated by the Hardeman County survey. Additional objectives, however, are likely to be present in the "bundle" of total reasons for ownership; some of these may be conscious and other unconscious. But regardless of whether they are defined clearly or hardly at all in the mind of the owner, his objectives directly limit his alternatives for forest management by eliminating possible choices which are inconsistent with his objectives. They also tend to rule out any management practice which is difficult to accomplish as an addition to time-consuming primary activities. Also, when the ownership objectives are of a short-term nature, the owner is likely to ignore forest management alternatives requiring a longer outlook.

Inasmuch as five principal categories of objectives were revealed by the woodland owners surveyed in Hardeman County, the alternatives for management by these owners can be expected to be restricted to those choices that are compatible with their objectives. Other possible alternatives on each ownership are not likely to be adopted unless a change occurs in ownership, in the owner's objectives, or in other circumstances which have hitherto limited the owner's aspirations toward conceivably feasible objectives.

Where farming is the major ownership objective, possible alternatives in management of the woodland include the harvesting of trees and the transport of round timber products by the farm operator during periods when his time is not fully demanded by the scheduled requirements of his agricultural enterprises. Planting mana

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of nursery stock, either manually or by tractor-drawn planting machine, is likewise often compatible with normal farming schedules and labor skills. Protection of the woodland against fire, grazing, insects, and disease is possible at a high level of effectiveness due to the farmer's active presence around his property and his periodic selection of trees to be harvested for products for farm use, both of which facilitate observation of the condition of his woodland. With respect to grazing, he is likely to be favorably inclined toward fencing his woodlands, as he does his fields, to keep out wandering livestock; however, he may consider that his own livestock need woodland pasture or access to a woodland stream--in which case he will allow grazing in his woods.

The ownership survey revealed that where intensive forest management had not been adopted, the reason was primarily lack of knowledge and associated inadequate motivation. Some owners suggested that they had no surplus labor available for woods work nor would they hire any. More commonly the owners gave indications that intensive forest management may be compatible with over-all farming objectives and be integrated into an economic farm organization.

Residence as the primary ownership objective is more likely to have fewer intensive forest management alternatives associated with it than is farming--except if timber-growing is the secondary objective. If the resident owner is employed away from the property and in some occupation not related to the land, his background and experience are likely to be further removed from woods

work than are the farmer's. He is likely not to have appreciable home use for rough wood products nor to have other occasion to go into the woods except for recreational use--which may also be slight. Furthermore, ownership of equipment, especially power equipment, for woods work cannot be expected to be economic unless it is put to adequate use over time.

Where rental of farm land is either the primary or the secondary ownership objective in conjunction with farming, residence, or timber-growing, it offers good possibilities for intensive forest management alternatives. Associated with farming, it implies cultivation of a considerable area of open fields by operators other than the owner, with the forested portion of the land remaining under the control of the owner. The woodland thus becomes a larger percentage of the owner's operating unit and can bid for more of his attention than if he were responsible for the management of all of his ownership area.

Furthermore, rental of farm land has the advantage that, whether associated with the objective of timber-growing, farming, or residence, it provides the presence of nearby tenant farmers who are under some degree of obligation to the owner and who usually will be willing and sometimes eager to do part-time work in the woods at the direction of the owner. Thus labor is readily available--and usually at low expense--to carry out the practices involved in various phases of intensive forest management alternatives. In the case of nonfarming resident owners and nonresident timber-growers or farmland-renting owners, the presence of a

moderate supply of resident labor tends to offset the problems of equipment economy. Overmechanization is less likely when an assured labor supply is available to permit some economies of scale through adequate (though seasonal) use of equipment and reasonably efficient organization of a woods crew--despite the disadvantage that most tenant farmers are not well trained in woods work and may require several months or years of experience to develop an operating efficiency nearly approaching that of a typical full-time piecework woods crew.

Oftentimes tenant farmers may have equipment available for rent for woods operations--usually a tractor, horse, or mule for skidding and perhaps a wagon or truck usable for hauling. The woodland owner might find that investment in a power saw for harvesting timber is indicated for economic organization, although sometimes it may be sufficient to let tenant farmers use hand tools (either owned or borrowed) if such are preferred.

It is obvious that the two other classes of ownership objectives appearing in the Hardeman County sample--namely, timber-growing and timber-removal--exert a direct and unequivocal influence on the range of alternatives for woodland management. Timber-removal is inconsistent with all but the most extensive degree of management, as it has been defined as harvesting of all merchantable timber with no intention for the perpetuation or reestablishment of a productive forest. In some cases, however, where no alternative land use is made of the cutover forest, timber-removal may be associated with "involuntary forestry"--the owner being fortunate enough to have a new and moderately productive stand (like many existing second-growth areas) developing naturally from the ruins of a clearcut or destructively high-graded stand.

In contrast to the negative influence of timber-removal, the ownership objective of timber-growing is positively beneficial in widening the range of conceivable alternatives for intensive forest management. The possibilities thus can be considered as an open-ended distribution, with the relevant and practical limitations on choices being imposed by contingent factors. Sometimes alternatives may be constrained by the requirements of other goals among the bundle of objectives for a given ownership, but most of the restrictions will arise from other conditions that affect woodland management on small ownerships.

CHAPTER V

FOREST PRODUCTS INDUSTRIES: PRIMARY MANUFACTURERS AND THEIR PRACTICES

Tennessee's Principal Wood-Processing Industries

Tennessee's total number of establishments in lumber and wood products industries was 1,233 in 1954. These included logging camps, construction materials wholesalers, sawmills and planing mills, and others. They employed 18,016 people to whom they paid $41,001,000 in wages and salaries; and by manufacture $70,988,000 in value was added to their raw materials, according to the U. S. Bureau of the Census.[1]

Sawmills and planing mills numbered 971 and employed 11,791 people. Wages of $25,479,000 and value added by manufacture, $43,438,000, averaged respectively $2,160 and $3,680 per employee. Tennessee's 4 veneer mills employed 323 and paid them $873,000, an average of $2,700. The $1,201,000 value added by manufacture averaged $3,720 per employee.[2]

The wooden container industry in Tennessee had 16 box manufacturers employing 1,196 people in 1954, an average of 75 per firm.

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[1]U. S. Bureau of the Census, 1954 census of manufactures. Tennessee, State Bulletin MC-141 (Washington, D.C.: 1957).

[2]Ibid.

Five cooperage manufacturers employed a total of over 250, and 3 firms making fruit and vegetable baskets had over 100 employees in all.[3]

Although only two in number, Tennessee's hardwood distillation plants employed over half of the employees in the eight such plants in the South and West. Data of the Bureau of the Census indicate that the average wage per employee throughout the eight plants was $3,310 and the average value added by manufacture was $5,630.[4]

The wholesale lumber and millwork industry had 101 Tennessee firms in 1954, with a total annual payroll of $2,970,000, as compiled by the Bureau of the Census.[5] Fifty-two of these firms were unincorporated proprietorships. The total number of employees in all firms averaged over 970 in the course of the year, and sales totaled $43,729,000. The average wage was $3,060.

In west Tennessee, the city of Memphis alone had 33 wholesale lumber and millwork firms, a $1,103,000 annual payroll, and about 325 employees on the average. Proprietorships numbered fifteen. In these respects Memphis had about one-third of Tennessee's wholesale lumber industry; however, Memphis sales of $19,713,000 in

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[3] U.S. Bureau of the Census, 1954 census of manufactures. Wooden containers, Industry Bulletin MC-24C (Washington, D.C.: 1957).

[4] U. S. Bureau of the Census, 1954 census of manufactures. Gums and wood chemicals; fertilizers, Industry Bulletin MC-28F (Washington, D. C.: 1957).

[5] U. S. Bureau of the Census, 1954 census of business. Wholesale trade: Tennessee, Area Bulletin W-1-42 (Washington, D.C.: 1956).

1954 were about 45 percent of total state sales in this business, reflecting the commercial dominance of Memphis as the "Hardwood Capital of the Nation."

Manufacturing in a Rural West Tennessee County: Hardeman

The industry picture of Hardeman County is about what might be expected in a primarily agricultural area such as has been described in Chapters I and III. The 655-square-mile county, with a 1950 population of 23,300, had 29 manufacturing firms in 1954, as recorded by the U. S. Bureau of the Census.[6] One of these manufacturers was a tannery employing over 100 people; one wood-using plant was considerably smaller but employed over 20; and the 27 other each employed fewer than 20. Twenty-two of these latter firms were also wood-users: mostly small sawmills, a few hardwood lumber concentration yards with planing mills, and a few other small wood products processors.

The average annual wage in the 29 plants was $2,440, the year's total of $1,118,000 being divided among 459 employees. The total value added by manufacture was $2,666,000, the average per employee being $5,800. The value added by manufacture is 40 percent above the state average of $4,130 for all industries, but the wage figure is somewhat below the state average at $2,750.

Markets and Uses for Hardeman County Timber

High-grade logs and bolts and much rough lumber are shipped from Hardeman County to the nearby hardwood centers of Memphis and

[6] 1954 Census of manufactures. Tennessee .

Jackson, Tennessee, and Corinth, Mississippi. To get a cross-section of this market pattern a survey was made in 1956, interviewing 20 buyers dealing in Hardeman County Timber. Eleven of these were small firms located in the county (and comprised almost half the county total of 23 reported in the Census of Manufactures). Most of the other 9 were large manufacturers outside the county, who represented a major share of the market outlets for the county's output of specialty products and rough lumber.

The principal item made in the three hardwood centers include solid, glued, semi-finished, and finished dimension; kiln-dried rough dimension; hickory ski billets; interior trim and moulding; wall paneling; flooring, thresholds, treads, and risers; railroad ties; vehicle and wagon stock; construction boards; crating stock; bed rails and slats; cedar closet lining; veneer; and plywood. Of course a multitude of minor products are also manufactured from a variety of hardwood species.

Types of Hardeman County forest products industries

Of the 11 Hardeman County firms surveyed, 7 were small sawmills. Five of these were being used primarily as permanent plants. Occasionally one of them would saw from 1 to 3 million board feet of lumber in a year, but each one mostly cut less than a half million annually. The chief problem was to obtain stumpage.

Three of these 5 mills were operated in connection with retail-service combinations. The firms owning these mills were more interested in finishing rough green lumber purchased from portable mills than in sawing logs. The partners who operate one of these

mills, however, occasionally set it out on a tract when a fairly large volume of stumpage is purchased in one section of the county. Their milling was merely an adjunct to their principal business of earth-moving and sales and service of tractors and chain saws, but they also ran a small white oak stave mill which made cooperage materials for bourbon and oil barrels about 50 miles southward in northern Mississippi.

The other two firms were proprietorships combining lumbering with wholesale-and-retail sales business, one connected with general construction materials sales and the other with a chain saw and outboard motor sales and service business. These two firms together bought about 750 MBF of rough green pine lumber from various portable mills, as well as buying hardwood and pine stumpage for their own lumbering operations.

One elderly farmer started up his stationary mill each fall after the "cotton-picking" season and custom-sawed only 50 MBF, chiefly cypress from the Hatchie River bottom, before closing the mill for another year.

The volume handled by the seven sawmills was 85 percent mixed hardwoods (mostly southern red oak) and the remainder was chiefly shortleaf pine from the eastern side of the county.

Two of the plants visited were concentration yards, each of which bought and sold about five million board feet of hardwood lumber annually. Their chief green lumber suppliers were the county's small portable mills, about a dozen of which were operating in any one year. Lumber from nearby counties, mostly to the

south and east within a radius of 75 to 100 miles, is also concentrated by the Hardeman County yards. The yards air-dry and sort the lumber for grade. They sell it to the various secondary manufacturers within a radius of about 50 miles--primarily in Memphis, Jackson, and Corinth.

The Memphis market strongly influences the prices paid for lumber in Hardeman County, and consequently affects stumpage prices. The green lumber price is usually 25 to 40 percent below the price of rough dry lumber in Memphis. The higher grades of rough green lumber sell for prices proportionately much closer to their corresponding prices rough dry than do the lower grades.

Two specialty plants were operating in the county, a bourbon stave mill and a hickory handle-blank mill. Both of these had a substantial output for small mills employing 5 to 10 workers. Although they bought mostly bolts delivered to the yard, when supplies ran low they sought and cut stumpage for which they were willing to pay higher than normal prices in order to maintain mill output.

The stave mill produced only white oak bourbon staves and heading in the last few years and rejected other species formerly purchased. Production has been limited due both to the diminishing supply of forked-leaf white oak blocks and high quality blocks of other suitable species in the white oak group and also to the fact that orders from the distilleries' barrel-makers have become intermittent and for smaller quantities than formerly. Species other than white oaks were no longer purchased due to extinction of former markets which used sweetgum staves for soft-drink syrup barrels and staves of most common hardwood species except hickory for manufacture of gunpowder barrels.

The hickory plant shipped handle blanks to the parent company in Memphis, where finished tool handles are made. This arrangement served to reduce transport costs for the company; but since the country plant, which ran continuously at capacity, was inadequate to supply all the material needed in Memphis, additional bolts were shipped by semi-trailer directly to the principal plant to supplement the supply of handle blanks.

Operations and practices of all surveyed firms--both those in the county and plants outside

Tabulation of certain characteristics (as recorded in the questionnaire schedules) of all the firms in the sample, made evident the fact that these firms seem to be naturally divided into two major groups. Readily apparent were a number of similarities of firms situated within Hardeman County. Several of their characteristics were distinctly different from those of firms whose plants lay outside the county and who generally fell into a separate group.

The most distinguishing characteristics were the following: annual volume of raw material purchased, daily plant capacity, radius of purchase area, longevity in the forest products industries, length of time at present location, and continuity of operation. Only slight or moderate differences between the two groups appeared

with respect to quality requirements, type of transport vehicles, and media for achieving buyer-seller contact. And no significant differences were distinguishable as to stumpage volume estimation methods, product measurement practices, and purchase price determination.

On the basis of type of major product, the 9 firms outside the county could be grouped appropriately into two categories: 6 dealing primarily in lumber and veneer and 3 making only specialty products. These constituted definite subgroups in respect to volume of raw material purchased annually. The 3 specialty firms bought relatively small volumes of rough forest products: from 800 M to 950 MBF annually; and they had plant capacities of 4 M to 23 MBF for an 8-hour day. The 6 others handled annual volumes ranging from 1.3 MM to 90 MMBF, with a median between 9 and 10 MM, although the one very large plant brought the 6-plant average up to 25 MM. These firms had daily capacities of 8 M to 95 MBF, their average coinciding with the median at about 50 M.

Ten of the 11 firms in Hardeman County annually bought between 50 M and 7.8 MMBF of stumpage, logs, and lumber. (The remaining firm could make no reliable estimate of its annual volume, which probably lay fairly near the low end of this range.) The only firms handling over 2 million feet, however, were concentration yards, buying lumber primarily. Their large volumes brought the average up to 1.5 MMBF, although the median was 500 M for all firms, 400 M if the group were to exclude those firms which are primarily concentration yards. The average plant capacity of the sawmills was 9 MBF daily, with individual plant capacities running from 4 M to 16 M and the mode and median at 8 M.

Except for one concentration yard which had a strong preference for the better grades of lumber, all of the Hardeman County firms specified few or no quality requirements for the timber they would purchase. While 3 of the plants outside the county had no specific quality requirements and 1 specified minimum size only, 2 preferred the better grades of trees, logs, and lumber, and 3 had detailed, specific requirements. Sixteen of the total of 20 firms bought stumpage, and in evaluating the purchase value of stumpage 12 of these used ocular estimates exclusively. One made an ocular estimate to ascertain whether timber was suitable for purchase and based payment on the scaled volume and grade of logs delivered to the mill. Two other firms used timber cruises by foresters in some cases and ocular estimates by experienced buyers in other cases, either of these methods of volume estimating being followed by purchase payments made either according to a lump-sum offer for marked or otherwise designated timber or according to log scale at the time of harvest. And one firm made a cruise estimate before making any offer of purchase.

Most of the mills bought logs in addition to or in place of stumpage. They used primarily the Doyle scale as a measure of volume and accepted "woods run" of logs down to a minimum diameter at the small end (as low as six inches inside bark for some mills, although hardwood logs under an 8- or 10-inch d.i.b. were seldom purchased). Occasional scaling departures from the Doyle rule were found, including the use of the Doyle-Scribner rule and obscure local rules, but more commonly the manner in which an allowance was made (for the conservative Doyle scale volume) consisted of an increasing of the board-foot estimate based on the diameter measure "inside" bark. This "sweetening" of the volume estimate of a truckload of logs could be achieved almost at will when a seller thought his products were of better than average quality. He merely refused to release a delivered load for the going "woods run" price; to avoid losing the load to a competing mill, the scaler simply increased the small end diameter measurement by adding either "one bark" thickness or even "two barks" to the d.i.b. reading on his scale stick when he recorded the log volume on his tally sheet. This practice might be considered an informal recognition of log grade differences or a subtle method of competition through buyers' price discrimination.

Buyers of bolts or blocks for specialty mills scaled by the cord or sometimes by the board foot. Those in Hardeman County specified only minimum grade requirements for acceptable material and paid a single price, while those in the hardwood centers stratified acceptable bolts according to a range of specific grades, with corresponding prices. Lumber buyers, both processors and concentration yards, and regardless of location, would buy lumber according to standard grades and at prices individually set but responsive to the published Memphis market prices for rough dry lumber. However, a common practice (followed usually at the request of the operators of small sawmills) was the purchase of rough green lumber at a previously agreed upon single "mill-run" price for all lumber of a given species or species group--as it was delivered, truckload by truckload.

The maximum radius of purchase area for stumpage and logs for the Hardeman County firms averaged 48 miles, ranging from 10 miles (for the seasonal mill run by a farmer) to 150 miles (for a large concentration yard organization). The mode for these firms was a 30-mile radius, and the median fell between 30 and 35 miles. The nine mills outside the county had a range of maximum radius of 30 to 200 miles, with an average of 105 (excluding a couple of situations involving infrequent purchases of from 500 to 8,000 miles for special quality veneer logs of certain species). The median and mode for these mills coincided at a maximum distance of 100 miles.

Practically all the firms, regardless of location, determined their maximum purchase prices on the basis of some sort of estimate of volume (usually in MBF units) and a residual price (per MBF, mill scale) which they all derived--in supposedly independent computations--from their selling price, by subtracting an amount for the cost of precessing and handling and whatever they thought was a reasonable profit. Sometimes, of course, a firm was willing to consider only a minimal profit in order to make a purchase just to keep the mill operating; and in the other direction, firms made allowances for extra profits if the bargaining position of the seller was sufficiently inferior to their own.

All logs and bolts delivered to the Hardeman County firms were transported by truck; but transport outside the county to the six firms for whom estimates were available ranged from zero to 80 percent by railroad (with the remainder delivered to each firm by truck). The percentages of total volume transported by railroad to these firms are listed as follows: zero, 10, 20, 60, 80, 80.

Seventy percent of the logging for the Hardeman County firms was done by their own crews, with the remainder handled by contract crews. The outside firms were about equally divided between use of company crews and contract crews, with one using both types.

The Hardeman County firm, or enterpreneur, that had been in the forest products industry longest had a longevity of 53 years, while the most recent had been in business only 4 years. The eleven firms averaged 22 years, with a median of 19 and a mode of 20 years. These firms had been in their present locations for periods ranging from zero years for one portable sawmill, six months for another, and one month for a large concentration yard, up to 28 years for the oldest family plant. The average duration of occupation of the present sites had been 9 years, which was also the median. The industry stability outside the county had, on the average, been even greater for the eight firms for which information was available. Their business longevity ranged from 9 to 70 years and averaged 36 (the median and mode also coincided at this age). The greater stability of these mills was likewise indicated by the length of time at their present locations, the average being 23--more than double the average of the Hardeman

County firms. These plants' median and modal duration in place coincided at 23-24 years. These average longevities were indeed remarkable, as the eight firms included a portable sawmill only three months at its present location. The seven permanent plants varied in age from 14 to 43 years, with a fairly even distribution within this range.

Throughout the year the plants outside the county operated much more continuously, on the whole, than did the Hardeman firms. Eight of the 9 outside plants worked steadily year 'round, with intermittent operations characterizing only the one remaining plant. The Hardeman County firms, however, in addition to showing less stability in terms of longevity and permanence of location than the plants outside the county, also were less steady in continuity of operation. While 6 of the 11 Hardeman firms operated year 'round, 3 worked intermittently and 2 worked seasonally (one during the winter and the other during the month of August).

Contact between the twenty firms buying timber products and the numerous possible sellers was achieved, as the buyers reported, through a number of media. While some information was obtained through the extension forester, the State service forester, private consulting foresters, buyers' and sellers' newspaper advertisements (either in Memphis dailies or in county weeklies), and buyers' posters, most of the firms learned of prospective sellers through conversation with individuals, service companies, concentration

yards, and so forth. Many of the larger firms in the cities also employed a buyer (or someone whose principal duties at least included raw material procurement).

Procurement policy related to timber management

For many years the only forestry action programs were governmental. Later, wood-using industries recognized their long-range supply problems. Companies had originally hired foresters solely to buy high quality sawtimber and veneer logs. In the last few years, though, some of the firms drawing wood from Hardeman County have become concerned that the obviously diminishing supply of quality timber would hamper future production. Prospective markets for their products appeared promising and they planned to remain in business indefinitely.

The attention to forestry has virtually "snowballed," largely in the decade following World War II and to a great extent as a result of the blackening resource situation produced by heavy wartime drain and the postwar construction boom. Recently many companies have been buying timberland not only to protect their product market and investment in equipment but also to make profits from growing timber. Fourteen firms in the 20-firm sample were forest owners. Of the 11 Hardeman County firms, 8 held timberland ranging in area from 100 to 2,000 acres per firm. These ownerships averaged 1,018 acres, with a median of 800. Outside the county, forest land was owned by 6 of the 9 firms, roughly the same ratio as in the county. Most of these firms, having larger plants, also owned larger acreages than the Hardeman County firms. Their holdings were in the range from 500 to 30,000 acres, the one large ownership bringing the average area up to 7,350 acres although the modal size was between 4,000 and 5,000 acres and the median, about 4,500.

As a result of these investments, foresters have been employed by several of the larger companies to plan future wood procurement: they have been made responsible for managing all land owned by their companies; and even more significant, they have been supplementing the forestry advice and help offered by government agencies with their own action programs to assist the private landowner, both groups appealing to the motives of profit and public welfare. They have made their services freely available to other landowners--especially to ones who may sooner or later have mature timber to sell them.

When an industry forester is buying stumpage, he usually first tries to convince the landowner to have the timber marked for cutting according to forestry principles. From necessity, however, in timber-buying practice all of the interested companies who planned to remain in business permanently would cut "all merchantable timber" as put up for sale by a landowner who wanted the most cash he could get immediately without concern for future wood harvests. A minority of these companies were not disturbed about the effect of destructive cutting in reducing their future sources of supply; they were confident it was not misguided optimism to assume that enough timber would later be available on some other tracts of land to keep them in business.

The policy of some small companies was, by contrast, one of fatalistic pessimism. They felt that to be realistic one would have to admit the increasing scarcity of quality timber, resulting from high-grading and low-diameter-limit cutting. But the future they saw was simply the prospect of going out of business when they reach a point at which they can no longer afford to outbid competitors. By this process only a few strong firms would remain to share the harvesting of the products of involuntary forestry, which would always provide some supply of timber, although the supply on any single forest property would be available only at infrequent intervals.

The forward-looking companies who prefer the cheerier prospect offered by forest conservation practices nevertheless must bid on and cut any stumpage offered for sale even when the owner says, "Cut anything you can use; just offer me 'the big dollar;' " i.e., more money than anyone else will offer. Progressive companies customarily attempt to dissuade such an owner from destroying his forest and urge him to take the long-term policy which will make him higher returns over the indefinite future. Still, if their forest management suggestions are rejected, they must be and are prepared to offer the highest amount they can afford for all the merchantable timber on his land--in order to compete with the fatalistic companies who believe forest management is unnecessary and uneconomic.

The larger firms, at least, throughout the various forest products industries are in widespread agreement that they must share in the task of assuring future wood supplies. Their efforts have impressed many timber-growers and a variety of people in professions related to our forest resources.

CHAPTER VI

THE MEETING OF SELLER AND BUYER: PRESENT AND ALTERNATIVE

Present Relationships

Market structure

In the discussions of forest resources and forest products industries the structure of the timber market in the region has been indicated to be fairly simple and informal. It is complicated, though, to the extent that there is difficulty in channeling the different kinds and qualities of products to their most productive uses. Most landowners with timber to sell do not know how to ascertain among the various outlets for timber the most profitable ones to which to sell nor how to sell most advantageously. Similarly, most timber buyers do not know where the best supplies of mature timber for their needs are located. Considerable inefficiency therefore results, with extra cost to the buyer and lower returns to the forest owner. And as far as use of the resource is concerned, there is an unfortunate waste of better qualities of timber than would normally be required by a given plant for its particular product.

Price determination

Prices of primary forest products are primarily determined by the relative bargaining strengths of the buyer and seller, each working within the range of prices he considers proper. Normally the buyer has a stronger bargaining position because he is more active in the timber market and is consequently better informed as to current transactions. Also the buyer is usually under less pressure to conclude a deal promptly. Furthermore, the seller seldom knows the value (in terms of either past cost to himself as landowner, or fair market value) of his forest products. The buyer, on the other hand, is frequently aware of an approximate unit purchase value of the raw material to him, based on the price he expects to receive for the units of products he sells. He can usually derive a raw material value as a residual obtained by subtracting processing costs and an amount for profit and risk from his expected sales value. In the case of hardwood lumber, which constitutes the majority of the secondary wood products of west Tennessee, the market sales values, by species and grade, are published monthly in the "Hardwood Lumber Report" by the Southern Hardwood Producers, Memphis. For this reason, price determination for primary forest products in most individual transactions in west Tennessee is most strongly influenced by the buyer's side of the market.

Market information and facilities

The west Tennessee primary forest products market lacks formal facilities and sources of information on fair market prices and on lots of timber available for purchase. Through informal consultation with either the extension forester or the State service forester, however, a considerable amount of information is available to both sellers and buyers. This opportunity is of particular value to those who are not regular, active participants in the timber market. These foresters are close enough to cases of current forest products sales to advise prospective sellers as to buyers' activity, species and grades sought, and a range of market prices. They are also able to provide timber owners with a sales strategy that is capable of yielding fair market value. The success of their approach is achieved primarily by letting the buyer know that the seller is informed about what he has to sell and knows its approximate value. They serve also to inform buyers as to location of prospective timber sellers with whom they have had contact, and approximate quantities of species and qualities available.

Alternatives in Producing and Marketing Forest Products

Alternative production objectives

Why a forest landowner owns his woodland is of basic importance in determining why he handles it as he does. The most common reasons for ownership of forest land have been discussed in Chapter IV. In cases where timber production is desired, there may still be a variety of alternative production objectives, some of the most important of which will be listed.

One of the prime objectives in producing timber may be to obtain maximum sale income per acre. An alternative objective is simply to produce a variety of timber products for satisfying home needs, with an incidental surplus available for sale. Another seeks production of sawtimber stumpage for sale. Still another aims for production of sawtimber to provide an outlet for underemployed farm labor through logging, hauling, or perhaps through conversion on a small sawmill of logs into lumber and dimension for sale.

Many other alternative production objectives exist on numerous ownerships, some are coexistent in the case of an individual ownership, and some are interdependent with other objectives of the owner. Inasmuch as an owner usually has two or more objectives, they must be more or less reconciled with each other if the owner is to avoid the annoyance of perpetual conflict. And if coexistence of concurrent objectives is to be satisfactory, areas of competition must be resolved. The most appropriate solution is likely to be achieved through planning. In many cases, owners are not at all clear as to what their objectives are, not having had occasion to think analytically about their woodland enterprises. In such cases the woodland objective could be classed as unconsidered, nonexistent, or neutral--where there is no consideration given to it: neither intention to change existing conditions, nor resistance against circumstances which might tend to change them.

Intensity of forest management

Depending on the potential productivity of the various forest sites, the existing timber stands, and the owners' production objectives, the intensity of forest management will vary from nil, or extensive management, to a very intensive culture of the forest resource. Intermediate degrees of intensity involve the use of one or more of the following elements: application of silvicultural

techniques suitable for development and maintenance of a particular forest type or species composition, fire prevention and control action to supplement the State forest fire control system, control of grazing and browsing, cull timber removal, planting or seeding of desired species, and use of specialized woods labor and machines.

Integration of forestry with farm and other enterprises

Competitive relationships.--Most forestry activities on a farm are competitive with other farm enterprises. Funds for investment in various tools and equipment are usually to be allocated to one use or another. Land suitable for either forest or pasture use may be competed for until a resolving decision is reached through economic evaluation of these alternatives. Competition between forest needs and those of other enterprises may determine the location and type of farm roads to be constructed and maintained. Limitation of time, labor skill, and managerial skill will also result in competition between forestry and other enterprises during most seasons of the year.

Complementary relationships.--A complementary enterprise is one which contributes its product, or part of it, to another enterprise. As Heady points out, "Technical complementarity may arise because of any 1 of 3 reasons: (1) One enterprise may contribute an element of production, a joint product of the first, required by the second enterprise. (2) One enterprise may divert surplus resources from a second product. (3) The products may intersect with each other as the proportions of non-usable joint products change with varying levels of output from a fixed technical

unit. . . . Perhaps the first is the most important in agriculture. In production economics it is the problems of crop rotations economics or land use."[1] Moderate grazing of fairly mature woods not yet scheduled for natural regeneration is a complementary use inasmuch as both the forest and the livestock provide nutriment to each other. Also the forest is a complementary farm enterprise insofar as it provides materials for construction and repair of buildings, fences, and other structures.

Supplementary relationships.--Supplementary enterprises are ones which permit by coordination a fuller use of a given element of production. To the extent that tractors, teams, and trucks acquired for agricultural enterprises can serve forestry purposes during slack seasons on the farm, farming and forestry are supplementary. Land that cannot be used efficiently for agriculture often can be put to supplementary use in forestry. Farm roads passing through or near woodlands may be used supplementarily for hauling forest products, provided such use does not cause excessive deterioration and reduce their efficiency for use in other farm enterprises. As mentioned in connection with production objectives, forestry activities for underemployed farm labor during slack seasons provides supplementary use of time, provided both labor skills and managerial skills are available or can be developed.

Forest administration and tenure

The size of the working circle will vary from small to large

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[1] Earl O. Heady, Economics of agricultural production and resource use, (New York: Prentice-Hall, Inc., 1952), p. 222.

and the number of producing subunits or farms, from one to many. Each combination will offer different possibilities for organization of administrative resources. A working circle, as Chapman defines it, ". . . is an area for which a separate management plan is required, and from which a sustained yield is sought as the object of management."[2] Generally it is preferable to have a working circle of sufficient size to spread the costs of equipment and administration to an efficient level. Equipment use should be scheduled to avoid unnecessary idleness. Yet all administrative resources should permit normal operations in each part of the working circle at intervals of not over about ten years. For continuity of management, tenure should be fairly stable. The importance of this factor, though, will tend to diminish as farmers increasingly adopt forest management as a normal farm enterprise. It will markedly decrease as the real estate market comes to recognize the values of managed woodland investments when total farm values are to be appraised for purposes of purchase, sale, or loan collateral.

Operations may be carried on under cooperative agreement among several owners. These would ideally be neighboring owners in a cooperative working circle, each cooperator having responsibilities established so that operations are scheduled and executed by the members using cooperatively owned equipment. Or operations scheduled by the working circle members may be contracted to out-

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[2]Herman H. Chapman, Forest management (Bristol, Conn.: Hildreth Press, 1950), p. 306.

side operators or may be performed independently by individual owners using jointly owned equipment but hiring labor as needed.

The organization of the marketing units of a well coordinated working circle will be as the independent subunits (or farm ownerships) or as a marketing cooperative. The market power of a cooperative is likely to be substantially greater than that of a smaller seller. (This is in contrast to the situation in woods operations, where independent subunits may be able to achieve operational efficiency of the same order as that of a larger organization.) In the case of timber marketing the bargaining position of a cooperative or association of sellers probably will be enough greater in profit potential so that higher sales prices would more than compensate individual woodland owners for their loss of independence of action. Just how important the difference is, will depend of course on current market conditions in an area and the relative powers of buyers and sellers.

Processing of forest products and integration of operations

Several alternatives are available to the forest landowner as to the form in which he sells timber. The principal categories are these:

1. Stumpage. There is no processing before sale, as this product is standing timber. This form is advantageous to the owner lacking the time, labor, equipment, or managerial skill necessary for his own harvesting of timber.

2. Round products at roadside. The simplest degree of processing is merely the felling of merchantable trees, limbing

the boles and bucking them into suitable lengths for highest combined sale value, and skidding these products to a convenient roadside yard where they can be loaded onto a buyer's truck. (Sometimes skidding of limbed tree lengths or other long lengths may precede bucking of logs or bolts.) An active owner can make profitable use of his time and equipment if he can run a small operation well. He should be sure, however, of having at least one good outlet before he begins harvesting, or he may find himself in a disadvantageous bargaining position with cut products on hand subject to deterioration.

3. Round products hauled to buyer's location. The relatively routine step of hauling can be added to harvesting if the owner has facilities and equipment for loading and hauling round products to a buyer's mill, a railhead, or a woodyard. This operation, in addition to increasing total income, may make possible the extension of an owner's market to include buyers who buy neither stumpage nor round products at roadside.

4. Round products treated for preservation. Treatment of posts and poles by applying preservative chemicals will extend the useful life of these products and thus increase their value. This is especially profitable if they are destined for use in the common locations where they are subject to decay-producing factors. Soaking in preservative solutions is usually much more effective on green products than on dry; so this process should be well coordinated with the harvesting, hauling, and storage phases. Prior familiarity with available outlets is also a prerequisite, as well

as knowledge of approximate prices for grades of products, so that profit margins can be estimated from costs of handling and of chemicals consumed by penetration and lost by evaporation.

5. Lumber or other processed or seasoned products. Some timber owners may be able to increase their net returns by processing round products into lumber and construction timbers, chips, charcoal, or other marketable products. Where the process involves a fairly large capital investment, such as a sawmill, the operation will be profitable only if production is substantial. The supply base for such an enterprise would have to cover a large acreage, but it would not necessarily belong to only one owner. Two or more owners of nearby timberland could cooperate in the supply and operation of a sawmill, although it might be most practicable for mill operations to be carried on by one owner and his crew. The supplying of logs from different ownerships in the working circle would have to be scheduled by the cooperators for good forest management and efficient woods operations.

The degree of integration of harvesting and processing operations will depend upon the available yields of various products and grades. This and the demand of existing market outlets for these products will affect the total returns to the forestry enterprise. Efficient integration of manpower and equipment for various products will increase returns above income yielded by a single-product use of resources.

Knowledge of markets and methods of making sales

The range of completeness of woodland owners' knowledge of available markets and of methods of making sales runs from negligible to very complete for each of these two variables. Owners who are seldom concerned with forest products markets may know nothing about outlets to which they could sell timber. A rare few may have made the effort to learn of all prospective buyers within economic transport range. Similarly, some owners may be entirely unaware of the methods of making sales; others may have a partial knowledge; and a few may be thoroughly informed.

Experience in selling timber is a valuable means of learning; however, the individual owner's experience with sales may commonly be one-sided, thus depriving the owner of a rounded knowledge of alternative methods of making sales. Often sales are made simply by private negotiation with firms considered reputable, with arrangements for payment according to merchantable timber (either including all merchantable timber or limited to certain species or minimum diameters) within a certain boundary. Sometimes, however, sales are negotiated for marked timber in an ownership, for scaled volume of logs removed, for a fractional share of the sale value of rough green lumber sawed from stumpage, or from some other measure. However, where several potential buyers are interested, a more profitable alternative is often the sale of marked timber to the highest bidder, by closed bid or by open auction bid.

Examples of Alternative Combinations of Production and Marketing Variables Possibly Desirable for Owners

There are a tremendous number of alternative combinations of production and marketing variables that owners of forest land in west Tennessee might find satisfactory in fulfilling their ownership objectives. For illustrative purposes here, only four possibly practicable modal types involving intensive forest management are briefly outlined, as the intention is simply to indicate something of the substantial range of types that might be considered. The measures constituting intensive management would be only those now economically practicable in the region. An owner would protect woodland from fire and grazing, girdle cull trees, plant pines on open land, and convert to pine plantations all areas occupied by hardwood stands of low productivity. And trees marked for harvesting would be selected with the intention of leaving a profitable growing stock to be maintained.

1. Large forest operating unit with technical knowledge and facilities for intensive management. Consisting solely of forest land (of well over 1,000 acres in most cases), it would be operated as an independent unit. In west Tennessee it might well be interspersed with separately operated farming units on the tracts of better agricultural soils scattered throughout the region. Fully occupying an operating crew year 'round, it would involve any of a number of types and degrees of owner-operator processing of trees into merchantable products. Facilities would consist of equipment for cutting, loading, and hauling logs and might also include a

small sawmill for making lumber and construction timbers, with a stacking yard for air-drying sawed products.

2. Large unit as in 1. except with, a. sale of logs only, or perhaps b. sale of stumpage only.

3. Combination of several fairly small (100- to 400-acre) farm-forest operating units owned separately but acting cooperatively for intensive forest management on a large working circle. The coordinated group would avail itself of technical knowledge and facilities to achieve efficient integration of agricultural and forest enterprises. The group's large acreage and volume of production would enable it to gain economies of scale in operations and increased market power through centralized marketing.

4. Individual small farm-forestry operating units as in 3., but acting independently, thus lacking the use of specialized harvesting equipment and other beneficial opportunities of larger scale operations.

CHAPTER VII

THE AMES PLANTATION: AN IDEAL AREA FOR CASE-STUDY ANALYSIS OF FORESTRY ALTERNATIVES IN THE REGION

Description

In Chapter I the Ames Plantation was referred to as the setting for the study of the relationship of forestry to problems of over-all farm management and family income goals. Its suitability for case-study research into economic farm operating units for the region it serves has in a relatively short time become well established. Its physical resources and the development of stable management policies and operational arrangements are conducive to continuity in land-use research.

History

Development of the Ames Plantation, formed by consolidation of many separate farms into a single ownership for sporting purposes and gentleman farming, evolving subsequently into an institution dedicated to perpetual encouragement of agricultural research and education, has occupied half a century. In 1903 Hobart Ames, a wealthy manufacturer from North Easton, Massachusetts, having discovered the pleasure of quail-hunting in west Tennessee, began to purchase tracts of farmland in Fayette and Hardeman Counties between Somerville and

Grand Junction in order to develop a hunting preserve.[1] These were about fifty miles east of Memphis, in the Brown Loam Area of the state, and a half dozen miles north of Mississippi. Mr. Ames's last acquisition was made in 1937, bringing the owned acreage to 18,540, but he also bought hunting rights on many thousands of acres of neighboring land when the owners were unwilling to sell the land outright, at least at a price Mr. Ames was willing to pay. Although the irregularly shaped block of owned land covers just twenty-nine square miles, its longest dimension is ten miles (east-west) and its greatest width is seven miles (north-south).

Despite the fact that Mr. Ames was not concerned with the farm properties as sources of income, he was willing to let the existing agricultural use of each tract continue more or less unchanged and to accept the existing residents as his tenants. Being primarily concerned with the establishment and maintenance of favorable conditions for the reproduction of quail, he took steps to improve bird cover in addition to maintaining existing borders between fields and woods by keeping the tenant farms in use. Although continued farming would keep the open fields from evolving into brushland and then forest, Mr. Ames had hedgerows or thickets created in many of the fields to increase the border effect. He was very reluctant to have any fences on the Plantation, however, as they would constitute barriers to cross-country hunting on horseback.

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[1]John A. Ewing, Planning the Ames Plantation, (Unpublished D.P.A. Dissertation, Harvard University, 1956), 330 pp. Many of the basic facts in this section on history were obtained from the Ewing thesis. Others were acquired by personal contact on the Plantation.

Mr. Ames was fortunate in finding available for acquisition, about in the middle of his purchase area, a small cotton plantation having a fine ante-bellum mansion large enough to accommodate his numerous hunting companions and other guests. As his personal use of the Plantation was almost entirely limited to only a few weeks in late winter and early spring, Mr. Ames insured continuous management of the Plantation under the system typical of the area by employing a manager to deal with the tenants and to handle all matters concerning the rest of the Plantation.

As the acquisition of the central plantation tract included livestock as well as fields of cotton and corn, a highly recommended Scot was hired as herdsman. His experience with Black Angus cattle--and especially his enthusiasm for them--eventually persuaded Mr. Ames that a Purebred Aberdeen Angus show herd would be a satisfying addition to his plantation. Therefore, by purchasing animals from some of the best blood lines of the breed, Mr. Ames proceeded to acquire such a herd as a hobby incidental to his ownership of a hunting preserve. He pursued it vigorously, however, and took pleasure in exhibiting his best specimens in the important Angus shows, oftentimes winning. His crowning glory came from once winning the International Grand Championship. Although a generous proportion of the cattle feed was grain purchased for the purpose of developing specimens of superior size and form, all the open land needed for pasture and for the raising of corn and sorghum for feed and silage was allocated in support of the Angus herd, this use of the land taking precedence over cotton production since the income to be obtained from the cotton crop was of little moment to Mr. Ames in comparison to his Angus hobby.

While the Ames Plantation achieved nationwide fame from its successful showing of Aberdeen Angus cattle, this recognition came primarily from the limited number of Angus owners and others particularly concerned with the breed. The Plantation became far better known, however, though not from coast to coast but predominantly throughout the South and Midwest, to the numerous bird-dog owners who followed the annual local, state, and national field trials for bird dogs. For many years the National Field Trials have been held annually on the Ames Plantation, using the two highly reputed hunting courses each of several miles in length. This event became an institution on the Plantation as a result of an invitation by Mr. Ames and the enthusiastic response of the National Field Trial Association in accepting the opportunity. Of course, Mr. Ames's offer stemmed originally from his passion for quail-hunting and then from the consequent actions he took to embellish this sport to the fullest extent possible on his property. Needing pedigreed bird dogs for hunting, he took an avid interest in them and spared no expense in the construction of kennels near the mansion, purchase of dogs, and employment of a "keeper of the hounds" to raise and train them. Likewise, the need for well trained mounts led to a large investment in fine horses, construction of a large brick stable and coach house (the finest building on the Plantation), and the employment of a horse master and assisting grooms.

The central plantation tract, together with some of the adjacent farm and woodland tracts, came to be referred to as the Central Unit. Agricultural work on this Central Unit was done by crews of hired field hands supervised by strawbosses or foremen under the direction of the Plantation manager. On this 8,000-acre unit were located, as has been mentioned, the mansion, kennels, stable, and extensive acreages of pasture and field crops, with slightly over half of the area in woodland. Also centrally situated were the cattle barn, cotton gin, equipment sheds, and repair shops, as well as residences for the manager, foremen, keepers of the hounds and horses, and some of the wage hands.

Surrounding the Central Unit some fifty farm units of various types and sizes have been operated by tenants and sharecroppers under a variety of initial tenure agreements. For ease of administration, with little or no need for attention to each tenant's productivity, sharecropping gave way, wherever feasible, to a standing rent of two bales of cotton annually.

Despite the large income from the annual sale of baled lint cotton and from occasional sales of cattle, Mr. Ames virtually had to "pour" great sums of money into the Plantation to make up the deficit caused by the large recreational expenses incurred (for maintenance of the mansion and other buildings and grounds and for replacement and care of horses and dogs) and the tremendous costs involved in producing and showing the prime Angus specimens. This he did willingly, simply because it was the price to be paid for his personal enjoyment and the satisfaction of pleasing his family and friends.

As a result of their interest in raising superior Angus cattle, the Ames family sought and obtained much information and advice from officials of the College of Agriculture of the University of Tennessee. In a cordially helpful manner both the late Dr. M. Jacobs, formerly Head of the Animal Husbandry Department and later Dean of the College of Agriculture, and Dr. C. E. Brehm, recent University President and former Dean of Agriculture, cooperated very closely with Mr. and Mrs. Ames in developing the purebred herd on the Plantation. The friendly and interested assistance of these officials and others was undoubtedly of great effect in bringing about in the Ameses a sincere concern for the cause of research and education in agriculture in general.

In 1945 Mr. Ames died, leaving the Plantation to Mrs. Ames. She wanted its activities carried on by the manager according to the customs Mr. Ames had established. With hardly any changes (except for the cutting of vast quantities of prime timber to pay the enormous inheritance taxes), this traditional use of the Plantation continued until her death in 1950. Then, through her will, Mrs. Ames made the "facilities of said Plantation available to the College of Agriculture of the University of Tennessee for such scientific and educational purposes as said College of Agriculture is or may be lawfully authorized to pursue, including the carrying on of experiments and investigations in or relating to any such purposes."[2]

Mrs. Ames's will put the complete control of the Plantation

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[2]Will of Mrs. Julia C. Ames, Section 7, appendix II, Boston, 1949, as quoted by Ewing.

into the hands of two trustees, William A. Parker of Easton, Massachusetts, and the Old Colony Trust Company of Boston, whom she considered able and willing to see that the Plantation would be maintained as a memorial to her husband and operated in a manner satisfying what he might have wished his estate to do for posterity.

For this memorial she left the Plantation land, buildings, livestock, and equipment listed as worth $600,000 by conservative valuation, also an endowment fund of negotiable securities valued at $1,008,713 on December 10, 1952. She specified that "the income from said fund may be mingled with the income from said Plantation and the Trustees at any time from time to time may use any funds in their hands for the purposes of . . . carrying on the business and activities of said Plantation, and said trusts. . . ." She stipulated that "The trust herein created . . . shall be a permanent foundation . . . held and operated exclusively for scientific and educational purposes in the manner herein set out and shall be known as the Hobart Ames Foundation." It was her desire that "The use of such facilities [as may exist on the Plantation] shall be extended to students . . . and . . . other young men . . . as a practical training ground in the educational training of boys in farming and in furnishing them with practical experience in the cultivation and conservation of the soil, the raising of crops, the management of large estates, the handling of pure herd cattle and other livestock and in any other branches of Agriculture and farming which may be approved from time to time by the Trustees and said College . . . ."

Mrs. Ames also provided that the National Field Trial Association be welcomed to continue to use the Plantation hunting courses for the annual National Field Trials for as many years as they may wish to do so. This provision has given rise to unforeseen conflicts between maintenance of the lengthy and circuitous original field trial courses and Plantation agricultural operations "exclusively for scientific and educational purposes." For portions of the established field trial courses where these purposes have been mutually exclusive, the trustees have necessarily had to use their discretion and judgment in determining which of the two conflicting uses should be given priority--a serious problem inasmuch as several farm "economic operating unit" research projects of a long-range nature have been involved.

In 1953 the University of Tennessee undertook to design and to begin to implement, with the approval of the Ames Trustees, a research and education program on the Ames Plantation. A planning committee was organized to initiate this program and to cooperate in facilitating the satisfactory execution of the various projects involved in it, as well as to help in solving technical problems arising in the production enterprises on the Plantation. The committee consisted of the Ames Plantation manager and assistant manager and several staff members of the University of Tennessee agricultural divisions: the College of Agriculture, the Agricultural Experiment Station, and the Agricultural Extension Service. The committee chairman was the program director of the University's program on the Plantation, a member of the Department of Agricul-

tural Economics. Other committee members were the associate director of the Agricultural Experiment Station, the head of the Department of Animal Husbandry, the University's forester on the Plantation, and the superintendent of the West Tennessee Experiment Station, and, as project leader for the Ames Plantation project, the director of the Agricultural Experiment Station. Other agencies cooperating with the planning committee, especially in the establishment phase of the program were the Soil Conservation Service, the Tennessee Forestry Division, the Tennessee Valley Authority, the Agricultural Stabilization and Conservation Service, and the Federal Land Bank. The committee members continually review current activities and annually make work plans to be approved by the University and the Ames Trustees for each successive year's operations. Actually supervising the daily operations are the University's forester, animal husbandman, and agricultural economist, all of whom live on the Plantation, the first having been assigned a functional project in 1954, the second in 1955, and the third in 1956.

Resources

Land.--The total area of the Ames ownership is recorded as 18,540 acres, a little more than half being wooded. The wooded tracts, ranging in size from a few acres to several hundred, are intermingled with farm lands.

About 2,500 acres of the woodlands are on bottomland areas which are subject to occasional stream overflow. The bottomland soils are mostly Ina and Beechy. They are medium-textured, im-

perfectly- to poorly-drained soils that were formed of Coastal Plains alluvium and loessial material. The available moisture capacity is high, but soil air is limited at times in these bottomland soils.

The remaining 7,500 acres of woodlands are rolling uplands. They have Red-Yellow Podzolic soils formed of silty loess from a few feet to a few inches deep overlying Coastal Plains material of sandy texture. This overlying loess was deposited in a strip up to about 80 miles wide running along the east bank of the Mississippi River from Louisiana to southern Illinois. Predominant among these soils are Lexington silt loam, Loring silt loam, and Ruston fine sandy loam, with smaller inclusions of Grenada silt loam. Being well-drained soils, these are limited in moisture-supplying capacity.

Frequently these soils have become deeply gullied where they have been cultivated. Erosion of the loess is rapid, quickly exposing the sandy material. Without plant cover the silt and sand are soon washed down into the beds of the intermittent streams (which commonly begin in the lower portions of all gullies). The resultant deposition produces clogging at multiple places of low gradient throughout the drainage system. This not only reduces the potential productivity of the uplands by subtracting from its soil base, but also seriously damages many bottomland acres by covering the topsoil and by inhibiting the draining and aeration necessary for plant growth. Only one permanent stream, the north fork of the Wolf River, flows through the Plantation.

Labor.--The Ames Plantation's principal source of labor for farm work and, since 1954, for forestry work has been the scattered population living within its boundaries. The labor force included a high proportion of men of late middle age and boys in their teens. Farming on the small and usually outlying farm units was done by the resident tenant farmers. The employees of the Central Unit were primarily a core of wage hands living in the Plantation's various log cabins located on the many originally independent farms and tenant farm units of several decades ago, also in wooden shacks typically of similar decrepitude though usually of lesser age. Some of the wage hands were members of the tenant farmers' families, and several of the tenant farmers themselves seasonally joined the ranks of the Central Unit workers. A few of the wage hands, especially ones having special skills needed for an increasingly mechanized agricultural operation, were hired from nearby towns or rural communities.

The Ames Plantation Forestry Department also employed resident wage hands and a minority of skilled workers from outside. Most of the resident workers were experienced in farming but had done relatively little woods work prior to employment by the Department. What little they had done was logging of small timber or cutting of fenceposts and firewood but did not include any forest management activities other than harvesting. Workers in the Forestry Department were paid according to length of time worked. Some forestry work was done by tenant farmers working on their own, mostly harvesting products. These tenants, lacking immediate supervision, were paid at piece rates.

Forestry operations expanded during the slack farming seasons. Only about half of the 12-man forestry crew were steady employees. There was a high rate of turnover even among these six. Due to differences in equipment, age, and skill from tenant to tenant and between the tenants and the forestry crew, labor productivity varied greatly on the different operations.

Capital.--Most of the Ames Plantation capital resources were owned by the Ames Foundation. The trustees managed the principal financial fund as investment capital, the annual income from which they could invest either in more securities or in capital resources for the Ames Plantation. The Plantation manager held a smaller fund of operating capital and controlled the use of Ames buildings, livestock, and equipment on the Plantation. Jurisdiction over the forestry buildings and equipment was delegated to the forester, who was responsible to the trustees for the management of the Forestry Department.

A small quantity of capital goods was owned by the tenants. Their capital resources consisted primarily of a few head of livestock (cows, pigs, chickens, and mules or horses) and a little basic farm machinery and wagons. A few tenants owned pick-up trucks or rarely a flat-bed truck.

Management.--All activities on the Ames Plantation were under the jurisdiction of the manager, who frequently inspected many of the principal operations. Over-all supervision of the farming operations (construction and maintenance of buildings, fences, and roads; and repair and maintenance of equipment) was delegated to the assistant manager. Foremen exercised direct supervision over most of these operations and the various enterprises on the Central Unit.

Management of the Ames Plantation forest and forestry operations was the responsibility of the forester. The Tennessee Agricultural Extension Service forester for the western division of the state assisted in planning management, in marking timber for harvesting, and occasionally in over-all supervision of operations. The crew was directly supervised by the forestry foreman and when it was divided into two crews for separate operations, one of the two was supervised by a woods crew leader.

People and land tenure

The principal inhabitants of the Ames Plantation were the tenants of small farm operating units and their families. A second major group consisted of wage hands and their families. The Ames management staff and the research staff from the University of Tennessee were the remaining residents but constituted a rather heterogeneous group. The research people were provided Ames housing during their periods of service on the Plantation. Periods varied in length from a year to several years, but since the researchers had previous ties in Knoxville or elsewhere, they did not become an integral part of the Plantation's population.

The Ames management staff were expected to reside on the Plantation indefinitely. Most of them had already been established there for at least several years. The manager, assistant manager, and two foremen all lived within half a mile of the headquarters.

The other foremen lived in the central houses of large outlying farm tracts. This distribution made them available at strategic locations in case of emergency during non-work hours and placed them conveniently near their crew-organizing points at the beginning of the work day.

The wage hands who had been assigned Plantation housing (other than the tenant farmhouses) were farm workers who had been selected from outside the Plantation and had been offered jobs by the management due to their reputations for skill or capability. Several of them had worked on the Central Unit operations for many years. The majority ranged in length of employment from several to a couple of years, and a few had been there only a season or two. All these workers and their families could look forward to remaining for an indefinite period provided they kept up the standard of their work and did nothing to offend the assistant manager or manager.

Most of the wage hands were moderately content to remain on the Plantation as long as their wages and paternalistic fringe benefits (such as the management's provision of two fattened pigs a year for each family) were not reduced and as long as the conditions of their houses did not deteriorate excessively. Occupants usually improvised for minor house repairs to suit their personal convenience, but major repairs were seldom authorized by the management due to reluctance to invest in restoration of buildings already several decades old. Where living conditions became a problem for workers whom the management was particularly desirous to retain, approval was given either for repairs or for assignment to more satisfactory quarters. Persistent inaction following repeated complaints by a wage hand, made apparent the fact that the management was indifferent to his retention, and eventually resulted in his departure when he could find work elsewhere. The abandoned house was then usually repaired sufficiently to become acceptable to a new candidate whom the management might locate.

The tenants of small farm units have enjoyed a great security of tenure under the policy of fixed rent and minimum supervision established by Mr. Ames. Tenants could live an entire lifetime on one farm and "inherit" tenancy of the unit from parents who farmed it as either tenants or owners when Mr. Ames bought it.

Most of the heads of tenant families in 1956 were youths or young adults when Mr. Ames began to aggregate the numerous independent farm properties to form the Plantation. The majority of the children of these now elderly tenants have left the Plantation and sought work elsewhere, many in the North and some in Memphis. Many of the emigrants settled in the cities where they found work, married, and bore children. These young couples, unable to take care of children while both parents worked, commonly gave their offspring into the custody of the "old folks" on the Ames Plantation, who would readily accommodate one more baby. The typical tenant farmhouse of two to four rooms was occupied by grandparents and a dozen or so children of ages ranging up to 20 or 25. Another child could always be squeezed in, as an extra mouth to feed made only a slight percentage increase in the family. One family had accumulated twenty-seven members; so one child more or less was almost negligible.

Since establishment in 1953 of the University's program for research and improved farm management, the perpetual fixed rent agreements acceptable to Mr. Ames have been giving way to contracts providing incentives for increased production using conservation methods and specifying arrangements for sharing investments and income. These contracts can be carried out only by fairly industrious and ambitious farmers capable of applying modern systems of farming to planned operating units. The spreading of such contracts throughout the Plantation will eventually require removal of unqualified farmers. Of course, complete coverage will take some years due to the immensity of the task of management planning. Also the University staff members have humanitarian aims and are reluctant to force displacement of aged tenants unless an alternate unimproved farm unit is vacant. Natural attrition of the tenant population helps to relieve the pressure, but this is roughly offset by the frequent enlargement of operating units in the process of converting farming systems for more efficient production. Enlargement of units is achieved by combination of adjacent farms or parts of farms and thus eliminates some former tenant units.

Economic and social conditions

Ames Plantation farm tenants, living under conditions fairly similar to the average inhabitants of Fayette County, probably had a median annual family income close to the Fayette County median of $705 in 1950. This included income from seasonal off-farm employment. Full-time wage hands earned about $900 annually. The typical family had a car or pick-up truck, electricity, radio, and television, but no running water or good sanitary facilities. Few had telephones.

Tenant family capital resources for farming averaged less than $1,000 including livestock, vehicles, machinery, and other equipment. Food for consumption by both tenant and wage-hand families came largely from home-raised garden vegetables and livestock such as cows, pigs, rabbits, and poultry. Beverages made from corn included wine, beer, and whiskey. Purchases of staple foods, tobacco, hardware, and clothing were made at either of two villages within a radius of 5-10 miles or occasionally at one of the two county seats 15-20 miles distant. Fuel for cooking and heating was available, by exertion of a modicum of effort, from the ubiquitous low-grade hardwoods and from slabs produced by the Ames sawmill. During Mr. Ames' lifetime, however, permission was given to fell only dead trees, although in fact some valuable live trees were cut between inspections--commonly at or below ground level. Since establishment of the University's program, the forester has been marking trees which may be cut for fuelwood by each inhabitant.

Both tenants and wage hands were strongly dependent on the landlord and, for certain services, on the county. House repair, as already mentioned, depended on the wishes of the landlord. Likewise for road maintenance; although upkeep of the principal roads, gravel and dirt, through the Plantation was a county road department responsibility, a long mileage of additional dirt roads had to be

maintained by the landlord. Schooling and bus transportation to school were provided by the county school departments. All white children went to the Grand Junction School. Negro children attended elementary school on the Plantation, junior high school in Grand Junction, and high school in Somerville.

Further dependence on the landlord applied primarily in the case of tenants, most of whom were unable to accumulate sufficient capital to operate from year to year. Operating capital or "furnish," in the form of seed and fertilizer, usually had to be borrowed from the landlord before the planting season. This was to be repaid, plus ten percent, at harvest time. Similar advances, but smaller, were made in cash to wage hands who had unusually large bills for items such as medical expenses. No charge was made for this credit, paternally extended.

Most Ames Plantation tenants and wage hands are Negro, some are white. Racial discrimination is less observed on the Plantation than off. Houses once occupied by Negroes are now used by whites, and vice versa. Occasionally protests have been raised, however. Negro families refused to accept promotion to a house in good condition on a good farm unit because the house had been the recent scene of a white "family matter" murder; one family reluctantly agreed to move in. One white tenant on a farm unit adjacent to a vacant house formerly long occupied by whites so strongly protested the manager's announced intention to move a Negro family into the house--in fact he threatened to kill any Negro tenant moving in--that the manager agreed to leave the house vacant. Jobs have been assigned to wage hands mainly on the basis of ability, race being a secondary consideration. Most of the better jobs are held by whites, but usually due to more schooling, skill, training, and experience. Members of both races work fairly harmoniously together and often either cover up for or defend the shortcomings of each other.

Off the Plantation racial discrimination is much more pronounced, except of course on the highway--where one car is as deadly as any other. Facilities available for Negroes are far inferior in hotels, restaurants, transportation terminals, and other public buildings. The situation is especially deplorable in the school system, where buildings are crowded, poorly lighted and heated, and few teaching aids are provided. Despite the higher average educational level of teachers in the schools for Negroes, student morale and level of ambition are low under such circumstances. Slovenliness tolerated or abetted under educational conditions certainly tends to be perpetuated outside of school hours and to become a lifetime habit.

Educational opportunities for inhabitants of the Ames Plantation and vicinity are somewhat limited. The county school systems begin the academic year early in August in order to be able to schedule a cotton harvest recess of several weeks in the fall. Due to the economic importance of speed in harvesting the cotton crop, and to keep low the piece rate for picking, child labor is needed regionally to supplement adult field workers. The superintendent of schools is kept informed on the average ripening conditions in his county, and as soon as a considerable fraction of the county crop reaches ripeness, the schools are closed for the "cotton-picking" season. During the oppressive heat of August and September, classroom instruction is much less effective than usual; so the split school schedule is actually equivalent to a shortening of the academic year. The scholastic levels of the schools and of the majority of pupils suffer as a consequence. High school graduates are not well prepared, on the average, for competitive work in trades or industry other than farming. Few college aspirants from these schools are able to fulfill entrance requirements.

Statutory requirements on school attendance are not seriously enforced, partly due to the expense of enforcement and partly due to informal acceptance of expedients to relieve family poverty. The median number of years of schooling completed by all residents at least 25 years old in 1950 was 6.3 for Fayette County and 7.5 for Hardeman.[3] Comparable figures for Negroes in these two counties were 5.0 and 4.8 years, respectively. Unfortunately the pupils withdrawn from school before graduation due to their recognized competence to do required jobs are frequently those whose growth potential for increased capability through further schooling is above average. It is not clear, however, whether the long-run family welfare is better served by adoption of one alternative course of action or the other.

Membership in local churches is high, for both religious and

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[3]U.S. Bureau of the Census, Census of population: 1950, Vol. II, Part 42, . . . Table 12, pp. 32-33.

social reasons. By religious belief and conviction, people can obtain positive relief throughout trials and difficult circumstances which continually beset them. The healing value of faith is especially evident to those in miserable conditions, but it is also invaluable in imparting special strength to all who exercise it vigorously.

Social and civic organizations stem primarily from affiliation with church and school. Church groups predominate, with Sunday School groups, Bible study groups, rehearsing choirs, and various young people's groups occupying much leisure time. Boy Scout troops and 4-H clubs also operate on a local basis. All of these are beneficial in providing interesting activities for social intercourse and release from the tedium of daily routine. They give the individual member a feeling of approval deriving from identification with an accepted group having social goals and policies. Specific projects of these groups are organized for cooperative execution, giving each participating individual a responsibility and a desire for success. Pride in accomplishment may carry over into personal affairs and foster ambition and industry in family enterprises. The sense of belonging encourages security in other aspects of life and thus also promotes individual and family welfare.

Social habits geared more plainly to pure enjoyment and fellowship include the weekly trip to town on Saturday afternoon or evening for shopping and chatting. Little knots of people gather along the sidewalk to gossip between errands and afterwards. The barber shop and drug store hum, as do restaurants, cafes, and other places of refreshment. People manage to bring themselves up to date on the affairs of others and to unburden their own problems as well as to report events in which they take pride.

Other occasions which are sources of pleasure and invigoration are school athletic events and hunting or fishing expeditions with the conviviality of local clubs or small groups. Leisure is highly valued by most of the people, who rate it above income-earning and investment activity, once a modest annual income can be counted on. While various levels of living are considered satisfactory by different members of local society, no one appears so ambitious for improvement of financial status that he does not allocate a fairly substantial share of his time for recreational pursuits--subjectively appearing to be a larger share than the average urban resident allots.

Similarities to and difference from typical conditions in west Tennessee.

A few principal differences between the Ames Plantation and west Tennessee in general can be noted, although similarities are preponderant in an over-all comparison. While 59 percent of west Tennessee's forest is of upland types and 41 percent bottomland, the Ames forests are 75 percent upland and 25 percent bottomland. Forests cover only 30 percent of the total area of west Tennessee, but 43 percent of Hardeman County and 54 percent of the Ames Plantation.

On the Plantation, the manager acts for the landlord (the Hobart Ames Foundation) in matters concerning the tenants, whereas the most common relationship in west Tennessee is a direct contact between owner and tenant. Ames tenants have enjoyed considerably longer tenure than most others in west Tennessee. Both tenants and wage hands have had somewhat poorer housing, however, less schooling, and substantially lower income than the average in west Tennessee. The heavy concentration of Negroes on the Plantation resembled the situation in the rest of Fayette County, where the percentage of Negroes in the population was more than double the west Tennessee average and several times the percentage in counties outside the southwest corner of the region.

Similarity is apparent, however, with respect to social conditions and accumulation of capital. Likewise the evident condition of land and the general land use patterns on the Ames Plantation have been comparable to the rest of west Tennessee. Close resemblance of external appearances of the rural way of life has also been notable.

CHAPTER VIII

FACTORS IN ANALYSIS OF PRINCIPAL ALTERNATIVES

To provide actual examples of farm-and-forest operating unit planning, using the budget method, eight planned farms on the Ames Plantation are illustrated verbally and statistically in Chapter IX. Analysis of the principal feasible alternatives for each of these units will be abbreviated insofar as possible so that an over-all view of a range of common types of resource situations will be readily grasped. For that reason, several of the most important factors needed for evaluation of an owner-operator's resource allocation are discussed in advance, in general terms. The relevant facts and assumptions for each operating unit can consequently be stated briefly in the illustrative chapter following this explanatory one. The major factors to be discussed and their principal subcategories are outlined as follows:

1. Physical management intensity
    - a. Extensive management
    - b. Intensive management
2. Farm timber products
    - Cut or processed products
3. Management and marketing institutions
    - a. Organization of units
        - (1) Independent farm unit

(2) Forestry service company

(a) Integration with agriculture

(b) Non-integration with agriculture

(3) Farmer cooperative

b. **Methods of making sales**

(1) Noncompetitive sales

(2) Competitive sales

4. Method of analysis

Budgetary comparison of alternatives

5. Data for budgeting alternatives

a. Agricultural budget data

b. Forestry input-output data

(1) Work-performance data

(2) Management-yield data

(3) Timber price data

c. Considerations relating to management-yield data

(1) Development of management program

(2) Rate of return on investment

(3) Rate of wood yield

(4) The development period

(5) Collection of management-yield data

d. Use of management yield data

(1) Scheduling of management needs and wood yields

(2) Scheduling of management work and timber harvests

(3) Examples of schedules

Physical Management Intensity

Extensive management

A farmer who has adopted extensive management of his woodland as appropriate to satisfactory over-all management of his farm-and-forest operating unit either has no wood production objective or intends primarily to hold his timber as an asset for emergency use. He has no intentional silviculture and does not invest in any stand treatment or planting of understocked areas.

The extensive manager occasionally extracts posts, fuelwood, and possibly sawlogs for farm construction. Such harvesting of wood products is not considered in the farm plan, however, nor is it related to farm operations except that woods operations do not compete for time with agricultural enterprises. Likewise, occasional stumpage sales are unplanned, but whenever his woods contain enough to attract a stumpage buyer--usually about 1,500 board feet per acre--the farmer as a reasonably prudent man will try to sell his timber advantageously.

Although the farmer managing his woodland extensively will take no measures to improve yields, and will build neither fences nor fire lanes, he will let his neighbors know that he objects to fire and trespass. In case of wildfire on his property or near enough to threaten it, he will aid suppression crews sent by the state fire organization.

Intensive management

Intensive management includes only measures now economically practicable in the region. The farmer will protect his woodland from fire and grazing, girdle cull trees, plant pines on open land and on areas occupied by hardwood stands of low productivity, and harvest timber selectively to maintain a profitable growing stock. Intermediate cuts will include thinnings or improvement cuts. If natural regeneration appears insufficient following appropriate harvest cutting, planting will be used to supplement it or to substitute for it. More intensive practices than these are not considered to be reasonable alternatives for present management planning.

The intensive manager's production objective is to obtain as much income from his woodland as is consistent with his overall objective of maximum net income for the entire farm. This includes satisfying needs for products for farm and home use. All round products needed for farm use, fenceposts, structural members for sheds, loading or storage areas, and so forth, will be cut and put in place by the farmer, using farm equipment, or may be custom-cut along with needed farm lumber made by a stumpage buyer whenever such coordination is feasible.

Farm Timber Products

Merchantable timber in operable quantities in excess of farm consumption needs is sold as stumpage, or standing timber, under extensive management and also, in cases of inadequate labor supply

or equipment availability, where management is intensive. The extensive manager will sell all merchantable timber, while the intensive manager, will sell only mature trees and undesirable merchantable trees.

Cut or processed products

A number of products will be sold on intensive management units where the manager has sufficient labor and equipment available to cut, haul, and in some cases to process even further the stumpage ready for harvesting. Cut and processed products will include Christmas trees and charcoal as well as bolts, logs, posts, poles, piling, lumber, crossties, crossarms, and various timbers sold green, air-dried, or treated, and available at roadside, processing yard, or delivered to the buyer's place of business or some designated intermediate point suitable for change of mode of transport.

Management and Marketing Institutions

Certain institutions involved in forest owners' management and marketing affect the economic factors influencing incentives for management. These institutions include the internal organization of the management and marketing units and the established methods by which timber is bought and sold in the local market area.

Organization of units

The units controlling and selling timber may be organized in any of three ways, functioning differently but being related directly to the size of forest ownership and the characteristics

of the selected working circle. The organization may be an independent farm, a forestry service company organized for a year 'round working circle which includes several farm forests, or a farmer cooperative developed into a working circle.

Independent farm units.--Products sold by the independent farm unit will usually be limited to logs, bolts, and posts. Exceptions will exist when farmers have special interests, skills, and markets--also in the case of farms having exceptionally large forest acreages which can profitably occupy labor for most of the year and yield enough timber to permit efficient operation of equipment for processing rough products. Regardless of size, the independent farm will have to integrate forest and agricultural enterprises into the annual operating schedule if intensive forestry is to include harvesting of products. Probably most independent farmers, having their primary concerns and skills in enterprises other than forestry, will tend toward the sale of stumpage. They will adopt intensive forestry cultural measures and harvesting only if time spent in farming does not appear to be more immediately remunerative. Harvesting products for sale will be even more demanding of time than cultural measures and hours will have to be available in larger blocks, although long-term investment of labor value will not be so great.

Forestry service company.--For a working circle to be operated year 'round by a forestry service company working for the owners of several farm forests, a large enough acreage must be encompassed

to make economic the acquisition of sufficient equipment and suitable workers for the organization of an efficient crew. Although this crew will continually do work related to forestry, it will have to be well trained in several skills in order to accomplish a rounded forestry program. It will be under the supervision of a crew leader and the general administration and guidance of a forester, whose planning, timber marking, and marketing functions will occupy most of his time. A substantial degree of coordination between operations in the woods and in sheltered processing facilities will be necessary to insure consistently productive crew functioning during inclement weather and periods of too soft ground conditions.

A forestry service company will be economic only if it can achieve economies of scale and maintain harmony among landowners through equitable forest management agreements and satisfactory performance in forest improvement and marketing. Inasmuch as financial results from forest improvement are not so quickly obtained, nor even so quickly indicated, as are the results of most agricultural and industrial investments, the development period possibly necessary to assure the owner of the profitability of the service company's program may be reasonably set at ten years. A shorter period for evaluation of forest management might not allow enough time for primary changes in the forest's growth rate and in establishment or rehabilitation of potentially merchantable trees. There must be a fair opportunity for probation of the newly estab-

lished forestry program tentatively accepted by the landowners who have not previously been convinced of the wisdom of forestry practices.

Financing of the probationary period may be arranged by a sharing system, whereby the service company is paid for its expenditures of time, equipment, and materials by income received from sale of products from improvement cuts and type conversions, with the balance of the out-of-pocket costs being paid for by the landowners. The service company's temporary share of total costs of development may consist of deferred receipt of the balance of management fees, secured by interest in cutting rights for an equal value of timber.

(a) Integration with agriculture.--For farms employing the services of a forestry service company, an ancillary element of organization within the farm may make possible the integration of certain forestry activities with the agricultural operations of the farm units involved. Integration of these separate enterprises requires the application of farm labor and equipment, where suitable, to the execution of forestry functions at certain times throughout the year. The appropriate times will be those periods during which forestry work can be scheduled for the farm hands while other farm activities cannot efficiently use available labor and equipment.

The basic forestry crew of the service company will be scheduled to function all year long. Logging operations can be carried on in all seasons except during inclement weather or, for skidding and hauling, over ground too soft for effective movement. Likewise, barring weather interference, planting can be done by hand throughout the dormant season, and by machine, over firm, fairly even, and unobstructed ground. Tree deadening operations are limited only by weather. Sheltered processing has no scheduling restrictions and lumber stacking is prevented only by inclement weather and soft ground.

Most agricultural enterprises are more severely restricted in period of operation than these common forestry activities. In addition to immediate working weather conditions and soil conditions, farm operations are restricted also by the growth pattern and cultural needs of various crops, the life cycles of all livestock, and climatic variation from normal during the current growth cycle. This means that during all seasons of the year there are certain periods, ranging in length from one day to a few weeks, during which farm labor can be more productively employed in the forest enterprise than in farm work if the individual farm workers are willing and adequately equipped. Wage savings should be possible due to the handy and perpetual availability of part-time employment.

Such intermittent forestry employment, however, requires expert advance planning by the service company, with enough flexibility to provide short-notice scheduling of alternative actions. Various choices may be desirable, depending on season, weather, crew size and individual skills, total current forestry needs (in order of priority), and the existing schedule of operations planned for the basic forestry crew. The key demand on the forester will

be the ability to plan and execute efficient forest management with a crew of variable size and differing combinations of individual skills. Successful administration, however, will enable him to produce a large output of forestry work at a moderate cost.

The advantages to the farmer-landowner of this integration are two, in addition to the possibly increased efficiency of the service company's work output, for part of which he pays. The principal advantage is the more rapid improvement of his forest land, which can therefore benefit sooner and achieve better wood production from the passage of time (hence growth) after improvement, instead of an extended period before improvement. Another advantage is the reduction of out-of-pocket investment costs due to his own participation--or this may be regarded, as it will actually be in later years--as additional farm-family income from part-time employment and possible equipment rental.

(b) Non-integration with agriculture.--The forestry service company may be operated completely independently of the agricultural enterprises of the farms. This non-integrated organization keeps both farmer and forester sovereign in their own specialties and lets each one schedule his own activities for most efficient use of labor and equipment. While this is of no particular advantage to the farmer, as he plans his agricultural work independently anyhow, it relieves him of having to decide just when he reaches the margin at which his labor becomes less efficient in pursuing an agricultural enterprise than it would be in forestry work. At

the same time, however, it also denies him the possibility of forestry labor income or equipment rental.

As for the advantage of independence to the forester, the planning load is much lighter than is the case under integration, which severely taxes his managerial capacity for scheduling and rescheduling efficient operations, allowing for various combinations of labor skills and quantities and types of equipment. Also he can be relieved of worry about execution of operations during any time he must be unexpectedly absent, for his crew leader can follow the simplified yet flexible schedule, including alternative plans in case of sudden occurrence of unfavorable weather or ground conditions or equipment breakdown. The crew size is stable and crew capabilities are well known to the forester and the crew leader, due to their familiarity with the skills of each individual.

While the crew is likely to be highly mechanized for most operations, and consequently efficient in executing them, the fact that a variety of operations are necessary at different times during the year means that there will always be some idleness of equipment. In the case of integration with agriculture, idleness is reduced due to the greater application of labor to the forest management program. Wear and tear as a result of less careful handling may be somewhat greater, but this will be offset by the advantage of more complete equipment use. The non-integration of forestry and agriculture results in greater annual idleness and therefore, despite skilled use of equipment, total work output during equipment life will be less.

Farmer cooperative.--The organization of farmer cooperatives can be varied, within limits of effectiveness, to suit the members. To get satisfactory value from a forest farmer cooperative, the organization will be based largely on collaboration of nearby farmers to integrate forestry with agriculture. Through a moderate amount of study to supplement and reinforce the advice and guidance of a consulting forester, public or private, interested farmers can become as proficient in management of their forestry enterprises as they have already become in the management of their more traditional agricultural enterprises.

The benefits of the cooperative will be primarily its functions in harvesting, processing, and marketing of products. The cooperative members who organize and execute the harvesting and processing operations will have an important effect on the success of the cooperative; but even greater responsibility will lie with those planning and carrying out the marketing. Economies of scale must be obtained in both phases.

Cooperative marketing by shrewd members appointed to this task will benefit from increased bargaining power relative to wood products buyers, as larger volumes can be sold in one transaction than is the case on individual ownerships. Also timber can be withheld from the market if buyers' prices are not acceptable. This is a distinct advantage if a member is suddenly financially pressed and would otherwise sell timber on the open market; the cooperative can make him an advance payment on a future sale and receive cutting rights on a volume of timber to cover the payment.

Also, by handling larger volumes of timber of various categories, the cooperative can operate a concentration yard and can sort each type of product, accumulating small volumes from different ownerships until a satisfactorily merchantable quantity can be sold at an advantageous price. Thus integrated marketing will be coordinated with harvesting and processing schedules designed to obtain the most profitable combination of timber products by efficient use of timber, crews, and equipment.

Harvesting and processing are not quite so well assured of economies of scale as is marketing. Problems of integration of labor and equipment normally used in agricultural enterprises require skillful planning and coordination, as indicated in the discussion of a service company's integration and non-integration with agriculture. These problems demand the true cooperation of all members of the cooperative. The background of a versatile and experienced operating manager is invaluable to the efficient harvesting and primary processing of all merchantable products. Usually the cooperative will have to settle for lesser qualifications. In some circumstances it may be preferable to limit operations to production of only one or two products--or perhaps even to sell stumpage only.

One of the forest products most valuable for general farm use is lumber. If a cooperative can efficiently operate a small sawmill for a large enough portion of the year to avoid excessive overhead costs (especially interest on the investment and costs of depreciation) in relation to its annual output, great economy can be achieved in lumber procurement for each member farm. However, if a sawmill operation is not expected to be economic, as will likely be the case for most small cooperatives, the organization will serve its members best by not making lumber. If farm plans call for considerable consumption of lumber, the cooperative can be effective in coordinating the scheduling of consumption plans so that it can total all needs for a planning period, purchase lumber wholesale, and then pass the savings on to its members.

Financing arrangements can be made with the assistance of an agent of the Farmer Cooperative Service of the U. S. Department of Agriculture. Shares will be the principal financing instrument, not yielding income until profits have been obtained following payment of timber owners for stumpage cut and payment of wages to crew workers.

A farmer joining the cooperative may decide either to collaborate in the physical work of forestry operations on the various tracts owned by cooperative members, on his land only, or not at all. Farmers are likely to reject the alternative of personal work in forestry only if their time is fully occupied by other farm work or if they are physically unable to do it. The fact that there are such farmers as members of a cooperative simply means that there must be enough other farmers and their helpers available to carry on the operations necessary for forest development at a reasonable rate and for keeping up with the management schedule thereafter. The farmers who do not contribute labor equivalent to the amount invested in their own lands will have to

contribute a payment to compensate a substitute worker. This will no doubt mean that practically all cooperative members will be eager to insure efficient work by the working crew, readily providing various elements of assistance to facilitate operations.

Methods of making sales

Noncompetitive sales.--Selling timber at a fair price is difficult if only one buyer is in the market. Required conditions for equitable noncompetitive sales are (1) that the seller know the quantities of the various specific qualities of product that he offers for sale, (2) that he be familiar with the current range of fair market values for his quantities and qualities of product and be willing to sell for prices in that range, (3) that he be under no coercion to sell and be able to withhold the timber from sale if fair conditions are not agreed in contract, and (4) that he be familiar with and able to arrange reasonable terms for payment and for, in the case of stumpage sales, maximum duration of operation, proper woods conditions, and appropriate penalties for contract violations.

Competitive sales.--Timber-selling is much more certain of success if bids are obtained from potential buyers each of whom is aware that his securing of the transaction depends on competitive effort against the others. The obtaining of competitive bids requires considerable effort by the seller, who must (1) locate a number of possible buyers and invite them to bid, (2) arouse in them sufficient interest in his timber to induce them to acquaint

themselves thoroughly with it and to determine its worth to them, (3) convince them of the profitability of bidding as high a price as they can with the expectation of reasonable profit following payment for timber and costs of their particular operations, and (4) collect bids either sealed or unsealed depending on an estimate of the buyers' psychology. Item 4 of the noncompetitive sales procedure is also necessary.

The total effort involved in the competitive sales is not negligible but is likely to require less capacity and responsibility of the seller than is the case with noncompetitive sales because with competition the first three items under noncompetitive sales, though helpful, can be fairly safely dispensed with due to the safeguards inherent in the competitive process. To win the transaction, competing buyers will <u>have</u> to make bids well within the range of current market values and concur with fair conditions of the seller's stipulated contract.

Method of Analysis

Budgetary comparison of alternatives

The principal method of analysis used in this study is budgetary comparison of alternatives over time for the entire farm-and-forest operating units selected. For each unit, given are (1) a certain operator with an existing combination of skills, proclivities, and material resources, (2) a fixed total area composed of a certain mix of land qualities in open land and forest, (3) a landlord of definite characteristics (if the operator is not also the owner), and (4) capital resources of limited extent.

The number of alternatives discussed is greatly reduced from the total number which have been considered, because many are obviously incompatible with one or more of the characteristics listed above. Long-run changes are of course possible with respect to all of these, but for the short run, changes may be restricted to the first and fourth items, the ones most likely to be responsive to development.

Farm operators may be able to develop skills and acquire knowledge required for enterprises different from those presently engaged in. For example, farmers habituated to cotton and corn production may become skilled in any of several livestock enterprises, feed or truck crops, and may also learn how to handle a forested acreage of considerable extent.

To bring about this personal development will require motivation as well as education. The person most likely to be effective in these processes is the county agent of the cooperative agricultural extension service or the local work unit conservationist of the Soil Conservation Service.

The agent working with the farmer will first have to attract the interest of the farmer if he is to be able to accomplish the process of motivation. The technique of budgeting will be introduced as soon as interest is aroused. Motivation and education will occur concurrently. All the reasonably appropriate budgets will be worked out by the agent in collaboration with the farmer, who will presumably be motivated by the more attractive possibilities for improving his farm business. The agent will learn the farmer's characteristics that will restrict the range of possible alternatives. The farmer will learn something of the reorganization techniques for more profitable operation with his total resources. Where necessary, he will also be helped to understand unfamiliar aspects of new enterprises compatible with those to be retained, and perhaps modified, from the existing farm organization.

Decision on a new farm plan may be provisional, depending on an increase in capital for development of an adequate total supply of resources to implement the plan. The farmer may become able to relieve the limitation of capital resources by convincing a local bank or other source of credit that a loan to finance farm reorganization for specific purposes would be well placed. The loan may even permit rental of additional land if area is a limiting factor.

The conclusion of the initial process of budgeting comes with the decision as to which alternative farm plan to put into operation. Still, after the choice has been made and implemented, continual re-evaluation will be advisable so that if operations do not work out as planned, due to either endogenous or exogenous factors, prompt adjustment can be made if necessary.

Data for Budgeting Alternatives

The sources of data used in preparing the alternative budgets are indicated together with the methods of data collection used on the Ames Plantation for each of the principal categories of data. Details are relegated to the appendix.

Agricultural budget data

Data for budgets involving modal combinations of agricultural enterprises have been computed from basic data for individual operating units prepared by experienced farm management specialists of the Department of Agricultural Economics and Rural Sociology of the University of Tennessee Agricultural Experiment Station. The specialists used land capability classifications and soil tests as aids in planning efficient use of the farm resources of land and labor on each of the operating units. Principal categories of modal-type farm units are included among the cases cited.

Forestry input-output data

Work-performance data.--Each type of forestry operation included in the functioning of the Ames Plantation Forestry Department has been observed and pertinent data have been recorded. Work-performance data involve the time required by men and equipment to accomplish an amount of work actually done. A summary of forestry work-performance data for each type of operation is listed in the appendix.

Effective use of work-performance rates requires estimating how nearly conditions of each planned operation will resemble those under which the data were obtained. Average rates vary considerably from operation to operation due to the combined influences of many factors which range up and down at different times and places. Factors responsible for the ranges in rates are of considerable importance in making estimates for farm planning under different

circumstances. Both the method of data collection and aspects important to data interpretation and use are therefore described in the appendix.

Development of new labor-saving methods and machinery for performing forestry jobs can be expected to continue in the future. For this reason long-term projections based on current inputs will be likely to overestimate labor requirements and to underestimate machine use. The projections for the short run, though, will be fairly accurate even though they may have to be adjusted to accommodate technological changes.

Management-yield data.--All major varieties of Ames Plantation forest conditions have been sampled in a survey of the existing woodland. From data recorded in the survey, management-yield data have been computed: levels of growing stock (forest capital) and their associated wood yields (returns) related to forest management policies. The choice of a growing-stock level and its value cannot in practice be separated from the election of a specific management program. Ordinarily a development period of a number of years will be needed to change the characteristics of the existing forest to those desired. Once the desired stocking is attained, it can be relied upon to produce a fairly stable periodic yield of merchantable timber.

When a landowner is induced to appraise his forest resource, he usually finds it desirable to invest more capital and labor in his woodlands. In many cases the investment will be made in the

existing forest acreage, but it could also lead to expansion of the acreage allocated to timber production.

The change in investment per acre will be toward more growing stock of higher unit value. Thus the development period is primarily one of accumulation of forest capital. Nevertheless, there will be timber harvesting during this period. The forest products harvested over the first few decades, however, will typically be of lower qualities and smaller volumes per acre than those available when the effects of the management program are fully realized. For this reason the average annual yield per acre during the period of capital accumulation will be less, and usually considerably less, than the average annual yield from the desired level of stocking, In many cases, it will be even less than the current one. The expectation of a higher future rate of income than the present rate will have to be great enough to induce this foregoing of consumption. The pattern of returns over time depends on the length of the development period, which in turn is influenced by the landowner's demand for income.

A farmer will be more interested in yields and inputs for alternative forestry programs during the next ten years than for the more distant future. While the long-run returns might persuade him of the desirability of forestry, the yields and inputs during the first five or ten years will very likely determine whether he begins intensive management at once or postpones or rejects it. Both short-term (first decade) and long-term management-yield data are scheduled in appendix tables to illustrate typical patterns of timber yield and labor inputs for a variety of initial stand conditions, forest types, and sites.

Timber price data.--The price estimates used in budgeting farm forest management on the Ames Plantation are based on 1955-56 experience in the timber market on the Plantation and in its vicinity. Average prices which are expected to approximate, conservatively, the actual situation over the next fifty years are tabulated in the appendix, along with the assumptions on which they are based. Categories include pine and mixed hardwoods, pulpwood and sawtimber, stumpage and roadside products, extensive and intensive management. The difference between sawtimber stumpage and roadside prices is assumed to be (as it typically has been) $15 a thousand board feet (Doyle log scale), but would vary for sales of timber of different qualities and different per-acre volumes and total volumes. As intensive management improves stand quality, the average price is expected to increase concurrently.

Considerations relating to management-yield data

Development of management program.--A forest management program is comprised of a set of practices. These practices are the operations applied either to the forest stand as a whole or to individual classes of trees. The practices may include such cultural treatments as site preparation, seeding, planting, weeding, thinning, culling, and harvesting. General practices are not likely to change appreciably inasmuch as they are silvicultural

applications of general biological and economic principles relating individual trees to communities of trees and to other aspects of forest environments. Operating methods, however, will change with technological improvements. At any given time techniques will vary among operating units due to differences in acreage, equipment and labor available, land characteristics, and the forest. Forests will differ in species composition, tree size, and spatial distribution of the stems. The forestry alternatives must be integrated with other enterprise alternatives available to the landowner in determining the practices to be applied to his woodland.

In the decision-making process the landowner will strive to achieve the most advantageous combination of uses of land and family resources. Land use alternatives might include forestry, row crops, grazing, water, and recreation. In general the financial merits of an over-all farm plan can be evaluated by anyone through comparison of expected costs and returns. The decisive element in a plan, however, is its acceptability in the minds of the users. This crucial element can be determined only by the owner and his family on a subjective basis:

(1) how attractive the prospective plan is with respect to the kind of work to be done;

(2) the daily, weekly, and seasonal distribution of the work load;

(3) the total capital investment requirements (regardless of rate of return and degree of risk, although these will usually be considered) and possible necessity

for use of credit (to which at least some degree of aversion exists in everyone);

(4) the extent to which managerial activities are required continuously throughout the year, thus "tying down" the owner and prohibiting appreciable travel away from home;

(5) the availability of leisure time, its scheduling, and the opportunity for recreational use of operating-unit resources;

(6) the future pattern of ownership and managerial capacity as it may affect continuity of objectives; and

(7) the ease with which proposed capital investments can be shifted with revisions of the plan.

Through provision for revision of the farm plan as circumstances warrant, there will be a considerable flexibility of policy practicable in response to exogenous factors such as market demand, climatic shifts, relative prices of land, labor, and capital, and in response to endogenous factors such as owner-operator objectives and capacity of management.

In determining a forest management program, another consideration is the amount of capital and labor to apply to a given woodland. The degree of forest management intensity will vary with the potentialities of a tract and the owner's ability to realize them. Programs which require only minor investments in a given acreage may be characterized as "extensive management" programs, as a unit of investment is spread extensively (over many acres). Where

investments of considerable value are used on the same size of area, "intensive management" is involved, because a unit of investment in these cases is applied intensively to the land.

Programs involving intensive management require waiting for income during the commonly necessary development period discussed earlier. Then, when the stable period has been reached, periodic yields flow regularly. Extensive management programs, on the contrary, do not initially involve a long waiting period (if any at all) before income is obtained, but then in the stable period much less income is yielded than under intensive management and the intervals between yields are much longer. In cases of extensive management in which owners exert no forest management effort whatever--merely allowing timber to grow, as it may, until a minimum merchantable volume develops, whereupon it is sold--this is the result of extremely high time-preference for income. In such cases it is convenient to assume as acceptable only a very high rate of interest.

Rate of return on investment.--Alternative annual farm crops can be evaluated without comparing their rates of return. By contrast, when forest crops are to be included in budgetary comparisons, the concept of an alternative rate of return becomes essential. The need arises due to the length of time required to realize a return from an investment in woodland. Moreover, during the development period both the returns from timber sales and investments in management practices will likely vary over the years.

Under these conditions, computations using the owner's required rate of return can be made to carry the alternatives to a common point in time, at which a valid comparison can be made.

Rates of return will naturally vary from owner to owner depending on their financial situations. Even an individual owner may assign higher rates to some alternatives, thus recognizing the degree of risk he associates with the various enterprises. Every venture involves risks, and farm-forest management is no exception. Yet farmers may assign a higher risk rating to forestry than is warranted. Of course, forests are subject to losses from wildfire, trespass, wind, insects, mammals, and disease, but the effect of a forest management program is to moderate these influences. Resident owners can act to control wildfire and trespass. Also losses to wind, insects, and disease can be held to a minimum by timely salvage of dead and dying timber.

The landowner's investment in forestry is in growing stock. The more timber he carries on the land the greater will be his total returns up to a point. It is the specific rate of wood yield in relation to a given level of timber volumes per acre that largely determines his rate of return.

Rate of wood yield.--The rate at which a forest yields wood can be varied over a wide range. Based on the usual volume of timber to be found on farm woodlands, annual growth per acre will be low. The development process operates according to the law of diminishing returns. This can be illustrated by the assumption of increasing the timber stocking on a typical tract by additions of 1,000 board feet per acre at a time. The first few additions increase per-acre yields tremendously--proportionately even greater than the increase in stocking. Each further addition to the growing stock continues to increase total yields but only by a smaller increase than the one preceding it. Finally a point is reached where any additional increase in stocking reduces the total yield. The relevant range of choices for a level of growing stock lies somewhere between this point and the timber currently available in the woodlands. By a level of growing stock is meant a quantity of desirable timber--a quantity that can be maintained while its growth over a period is harvested.

For convenience both wood yield and growing stock are expressed in terms of board feet of sawtimber and cords of pulpwood per acre. These two categories account for most of the total forest products marketed. Additional products, such as veneer logs, poles, and the like, can be adapted to this classification. Summarizing growing stock and growth in these units makes possible a ready conversion to dollars of investment and yield.

Though it is casually implied that the yield is an annual one, the quantity referred to will actually be an average. Practical considerations require a forest to be operated on a cutting-cycle basis, that is, timber may be harvested each year or at some interval of years depending upon the management program. Also weather variations from year to year will affect the yield. Consequently the stated yield should be an average annual growth figure.

A yield factor applies to a particular quality of land, recognizing the variation in woodland productivity. In general the most productive soils occur in the bottomlands along streams and on the lower slopes, with the growth potential declining toward the ridge top. The effects are twofold: first, the more valuable species tend in nature to limit themselves to the best soils. This is particularly true in the hardwood country in which the Ames Plantation is located. Second, the grade of any species is usually higher on the better soil. The combined effect is thus that not only will the growth rate of a certain level of growing stock of a given species or a mix of species be higher on the better soils but the sale value per unit of volume will be greater also. One of the reasons for emphasizing rate of wood yield is that planning must consider alternatives other than forest production. These yield factors provide a basis for deciding whether to grow timber or grass, or to use a particular parcel of land for some other purpose.

The development period.--For a particular level of growing stock the length of the development period is primarily determined by the nature of the existing timber and how much of its growth will be reinvested and how much will be used for income. The most important of the alternative period lengths which should be considered is the shortest practicable one. (Practicability depends to a considerable degree on the scale of cultural operations--some treatments may be so thinly dispersed over the tract as to be prohibitively costly.) The shortest period will usually require a heavy investment program and a willingness to accept only modest cash returns. Any other program will spread investing over a longer period of years, being designed either to yield more income from the intermediate cuts of timber or to hold down by some other means the costs of accumulating a large growing stock volume. The owner can attain the high future yield only at the expense of development period income.

The flexibility inherent in the development period stems from the various alternatives available to the forest manager. He can adopt any of a series of practices that will not only improve stocking and growth but will generate income at the same time. For instance, he can alter the mixture of species by simply marketing the undesirable but merchantable species. Thinning which contributes to stand growth and development also creates income. Because trees differ in individual vigor, taking out the slow growers in the form of forest products also stimulates stand growth and provides income. Trees may be below par in terms of merchantable length, grade of their logs, and freedom from damage by insects, mammals, disease, and fire and still permit ready sale. As long as the volume of this improvement type of cutting is less, over any period, than the current growth of the tract, stocking increases as does growth.

Other practices that speed up the development period ordinarily involve waiting for income. One profitable operation is deadening unmerchantable stems that interfere with the growth or establishment of better trees. Income attributable to this operation may take ten years or more to develop. Similarly, openings in the forest may be seeded or planted. Also, in the general area being considered, ridgetop hardwoods of low productivity may be deadened in the process of converting this type to pine.

Collection of management-yield data.--Most of the yield data for the analyses were obtained directly from the Ames Plantation woodlands. Pine plantation yield data alone were derived from secondary sources. Methods of data collection on the Ames Plantation were much more detailed than usual types of farm planning will demand. This was because the University's forest research program required data in far greater detail than what will be needed on most farm woodlands. For completeness, however, the particular procedures are described in the appendix.

Commonly the data collection method can be fairly simple. It should be commensurate with the types of management programs being considered. Bearing on the justifiable cost of data collection are the value and heterogeneity of the forest resource, the people and facilities available, the urgency of the management planning time schedule and, over all, the degree of difficulty of the decision-making problem.

In many cases the first step toward planned forest management can be made from a relatively small number of practicable alternatives on the basis of very rough information as to resources, procedures, and potential markets. After the initial

step has been taken, a more refined appraisal is likely to be needed for making decisions on the more intensive management practices.

With the help of a forester the decision-maker can choose an appropriate means of data collection. Two inexpensive methods briefly outlined in the appendix are an extensive forest sampling procedure and application of published U. S. Forest Service Survey data.

Use of management-yield data

Scheduling of management needs and wood yields.--Ordinarily the development period is characterized by variability in volumes of timber to be harvested and in the time between harvests. A schedule of cuts and the years in which they may be made can be calculated for any set of forest conditions. These schedules are essential to valid cost-and-returns comparisons. The yield of the desired stable growing stock presents no special problem because it will consequently be fairly stable, too.

The schedule of necessary management operations which involve an investment in cultural practices can also be prepared.

These two schedules, listing the sequences of work to be done and wood to be harvested, can be calculated on a yearly basis, but for practical purposes decadal summaries are sufficient.

Scheduling of management work and timber harvests.--The operational schedule of work to satisfy management needs and of harvests to obtain wood yields should match the need for labor with the labor available.

The first step in making an operational schedule is to consider the sources of labor available to the farm. The primary source is the farm family. The secondary source is the local supply of labor available for hire.

The seasonal pattern of agriculture fairly well fixes routine farm labor needs. Forest operations are seasonal, too, but more flexible than other farm work. For the most part, they can be done when other farm needs are slack.

The second step, filling scheduled needs with labor to be actually used, starts with underemployed labor on the farm and may be finished by assignment of additional labor to be hired (from off the farm) for woods work managed by the farmer. Such work will be done, however, only if thought more profitable than some other use of an equal amount of money and family time. If discrepancies between labor needs and available supply are too great, a major adjustment may be called for. If certain practices are not feasible as farm operations, it may be possible to satisfy the need by contracting an outside operator. Over widespread areas commercial management firms provide contract services for most management practices. Also many wood-buying industrial corporations mark stumpage for cutting according to forestry principles and then bid for the marked timber.

Examples of schedules.--Eight examples of farm-and-forest operating units on the Ames Plantation are briefly described in Chapter IX.

For each of the units a summary of management work and timber harvests for an intensive forest management program is given, also one for an extensive program. The forestry portions of each operating unit budget are based on schedules of management needs and anticipated wood yields summarized in the appendix.

These examples are based on actual conditions observed during the forest survey of 1956. Most of the forested areas are suited to growing hardwoods either intensively or extensively. Each of the various stand types occurs on one of the three topographic slope positions: upper slope, lower slope, and bottom. Another category of forest area includes hardwood stands of such low productivity that intensive management of them would be unprofitable. Extensively managed, however, they might continue indefinitely. To be converted to profitable areas for intensive management, they would have to be clear-cut and planted to pine.

The comparison of intensive versus extensive management is made by evaluating the costs and returns for each program. The long-term schedules project the stand forward in time far enough to reach stability of production and of length of cutting cycle. In addition to the comparisons of costs and returns for each intensity of management during the development period, similar comparisons are made for the cutting cycles under the stability of the final goal of intensive management and under the semi-stable final conditions under the extensive program.

CHAPTER IX

PLANS FOR FARM OPERATING UNITS

General Information

The eight farm operating units referred to in Chapter I are located at the eastern, southern, and western extremities of the Ames Plantation. All of these units have streams running through them or along a border. The acreages of these units range from 230 to 2,601 acres, and their woodland areas from 92 to 2,022.

With family size varying considerably, the different units have "man-equivalents" (corresponding to man-years of labor available annually) as low as 1.8 and as high as 3.5, totaling 540 to 1,050 man-days of labor available annually (a West Tennessee farmer's normal work year consisting of about 300 work days). With the labor requirements for agriculture ranging from 46 percent to 88 percent of the total available annual labor time on each farm, the number of man-days remaining for forestry work by the farm family was from 290 to 75.

By subtracting stumpage value from the sale value of cut products at roadside, the return to labor and equipment used in the harvesting process is determined. Similarly, the quantity of labor for harvesting is obtained by subtracting the man-days needed for management alone from the total labor required for the production of cut products. Then the total value added by harvesting can be divided by the labor quantity and the quotient will be the return for a man-day of harvesting. The harvesting service will include the equipment needed to cut the products and transport them to the roadside. For this reason the labor time might be referred to briefly as an "equipped" man-day. The value of these range from $12.83 to $16.90, with an average of $15.71. The average value of annual wood growth on all eight units is $8.58 per acre but on the individual units runs from a low of $6.08 to $10.89. Unit 6 has this lowest average value because 75 percent of its acreage is a fairly poor site for hardwoods, growing each decade only 2.1 MBF of sawlogs and 3.0 cords of pulpwood (with no market value assumed) per acre after the stand has been built up to the stocking level from which the decadal cut will leave a basal area of 60 square feet.

All the farm operating units are described verbally in considerable detail as separate entities in the remainder of this chapter. Major emphasis is given in each case to the proposed plan assumed to have been selected by the individual farm operator and his family as being the most desirable and workable alternative to the present farm operation. For the benefit of readers who are interested only in a certain type of unit, each unit's discussion stands independently and any reference to another unit is made only for specific clarification; an understanding of the discussion of each unit does not require the reading of the discussion of any other unit. Similar portions of separate units are discussed similarly, and parts of the rationale that are common to all units appear in all the discussions. The reader of more than one unit will find the skimming of such portions desirable once he has assimilated the important similar elements of the verbal discussion technique. Detailed data used in the budgeting of the alternatives discussed are provided in the appendix and furnish a good numerical description of the units.

Unit 1--A Cotton-Hog-Beef-Forestry Farm

This 310-acre farm currently has 51 acres in agricultural uses (32 in cotton, and 19 in corn), 173 acres in woodland and brush, and 86 acres idle or in miscellaneous uses such as roads, buildings, and farmyards. Only 51 acres are in row crops despite the fact that the soils on over half of the total acreage are good for agriculture, a fourth being suitable for permanent pasture and 30 percent for crops. Thus current agricultural operations use less than a third of the acreage suitable for farming and a sixth of the total property. Alternative plans for fuller use of the land best suited to farming will redistribute the acreage with a 30-percent decrease in woodland area and more than a tripling of land in cultivation. The largest shift in acreage will be the establishment of 83 acres in permanent pasture in place of the current grazing on land in the miscellaneous and idle category and on the cropland after harvest. Ten acres are to be allocated for silage production and 14 to grow hay. Corn production will be allocated 45 acres, an increase of 26, and the cotton acreage will be reduced from 32 to 25.

Livestock production will be increased as permitted by the larger pasture acreage, to over nine times the present total, 5 times as many head of beef cattle being planned and 15 times as many swine as at present. The numbers of each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Beef cows	14[1]	36	22
Dairy cows	0	2	2
Calves raised	0	34	34
Sows	1	10	9
Hogs raised	8	140	132
Total	23	222	199

This proposed budgeting of agricultural resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net income is supposedly valued highly enough by him to be worth the added responsibility and work required for carrying out the new plan.

Improved land use on this farm calls for the woodland to occupy about forty percent (133 acres) of the total area. At present over half the acreage is in woodland, and idle land comprises another quarter, inasmuch as a bare sixth is used for agriculture. Five-sixths of this woodland is upland hardwoods and one-sixth is lower-slope hardwoods. In the upland hardwoods about one-fifth of the area produces such slow-growing trees that conversion of the stand to a loblolly pine plantation is indicated.

The present stumpage value of the entire 173-acre woodland

[1]A mixed group of cows, heifers, steers, and calves.

is about $3,100 for a stand of 330 MBF of mostly large sawtimber. Expansion of the agricultural land to 94 acres for crops and 83 acres for permanent pasture will use all the land suitable for these purposes and will leave only 133 acres for timber, with a residual stand of 246 MBF. The total value of the present 173 acres of forest (bare land real estate value plus stumpage value) is approximately $5,900 and the 137 acres of agricultural land are worth about $6,800. The combined value of buildings, livestock, feed, machinery, and other equipment is $4,000. Thus the total investment in the farm is $16,700.

The present farm operation has required an average annual outlay of labor of 260 man-days from the farm family. The work load on a cotton farm is heaviest in the spring and early summer and again in the fall. Between these periods there is time for other work, if it is available.

The opportunities for improved living on this farm lie in fuller use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. After the farmer has talked with agricultural specialists and foresters and considered his own capabilities and resources, he narrows the alternatives down to a few, in this case, four.

Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares these plans with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most desirable in relation to his own personal scale of combined criteria.

If the owner continues with his present farm operation, Plan I, he proposes to sell the farm as soon as he can get $26,000. By investing this amount elsewhere at four percent he can equal his present income of $1,045 from the farm and save property taxes besides.

By adopting and implementing the plan (Plan II) indicated here to be his selection, however, within ten years the farmer will be able to increase his net farm income nearly six times and to achieve a much fuller use of his various resources. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as depreciation) over a broader base. Over the development period this plan results in a considerably increased total investment: from $16,700 to $65,400.

Of this greater amount, however, $20,300 is the stumpage value of the residual timber after six decades of management. The stumpage value increase of almost $17,200 is not directly an out-of-pocket cost--nor is it primarily an expense at all, but a result of refraining from consumption. Similarly, $13,275 is the value of the farm's 177 acres of agricultural land after improved land management has raised the real estate value from $50 to $75 an acre (See Table 12). (These 177 acres include 40 acres of original forest land valued at $16 an acre initially and $75 after clearing and improvement.) This increased investment will take place over several years.

Table 12.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 1

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	137	$6,850	177	$13,275	177	$13,275
Forest land[f]	173	2,768	133	2,128	133	2,128
Buildings, live-stock, and other[g]	. .	4,000	. .	29,740	. .	29,740
Stumpage	. .	3,100	. .	20,300	. .	1,100
Total	310	$16,718	310	$65,443	310	$46,243

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.

Thus almost half ($23,000) of the increase in total farm value is due to the fuller timber stand and the appreciation of the agricultural land. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $4,000 to almost $30,000 will have to be covered in the first couple of years of the new program. Some of this can be paid for by cash on hand but most of it will require a number of years for repayment, by such devices as short-term credit, real estate mortgages (for second mortgages), and preferably intermediate-term credit for construction of buildings. Assuming that the net farm income under the chosen plan will be at least $5,000 for the first two years and at least $6,000 thereafter, the farmer will be able to pay interest and principal on his debt at the rate of $4,000 at first and then $5,000 and still have a disposable income equal to his present one. Therefore even if the entire $25,740 for direct expenditures is borrowed immediately, it can be paid off (with 6-percent interest compounded annually) within 7 years.

Under the new plan the farm family will have available 2.0 man-equivalents of labor. This would be about 600 man-days if spread fairly evenly throughout the year. Most of this labor will be needed for the agricultural enterprises: 440 man-days. The remaining 160 man-days could be used for forest work if needed. During the first decade of intensive forest management, however, only 187 man-days of labor will be needed--about 19 a year--to include harvesting of timber products for sale at roadside. The expected sale value of these products totals $2,456, of which $921 would be stumpage value if the trees were sold on the stump (See Appendix, Table 1-1). Although the remaining $1,535 could be attributed to labor used in harvesting (at $13.70 a man-day for the necessary 112 days), 40 percent of the total labor would have been in forest management and improvement work: 75 man-days. If the returns of this labor were paid at the same rate as the harvesting labor, the stumpage value would be swallowed up. The farmer might consider it quite fair to allocate a zero return to stumpage removed during the first decade inasmuch as the improvement work probably will increase the potential value of the residual stand more than the removal of the harvested products decreases it. The $2,456 income from timber products harvested during the decade would allow a $13.13 daily wage for the 187 man-days of labor if no returns to other factors were considered.

In the long run if prices and volumes do not depart seriously from the estimates for the stable period, the average decadal income from roadside sales will be about $24,490 and labor requirements for all forest work will average 603 man-days.

The average decadal value of stumpage to be cut will be $15,800. If a minimum 4-percent rate of return is required on the average investment of $20,300 in stumpage and $2,128 in forest land, $897 would have to be subtracted from the annual stumpage value of $1,580 of the harvested products, leaving $683 as an additional return to land, timber, and labor. As an average of only 16 man-days of labor is needed each decade for management purposes, less than

2 days a year, practically all of the stumpage returns should be attributed to the timber and land--equal to almost exactly 7 percent of the investment.

The difference of $8,687 between roadside and stumpage sale value would require 587 man-days of labor. These man-days would therefore be worth $14.80 each to the owner who would supply the necessary equipment as well as labor for felling and skidding. This would provide a 15-percent increase over the comparable average harvesting man-day return of $12.84 during the development period. The rise of the stumpage return to 7 percent from the 4.4 of the development period is a far more pronounced increase: 60 percent.

Subtraction of equipment cost of about $2 a man-day would make an adequate allowance for operation and depreciation of a power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about $10.80 during the development period and $12.80 during the stable period.

In the case of this farm, where more man-days are available than are needed for forest management and harvesting either in the first decade or in succeeding decades, intensive forestry with harvesting to roadside is clearly the best alternative. This is the important feature of Plan II that differentiates it from Plans III and IV. The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 13). In the first decade the annual net farm

TABLE 13.--Condensed annual financial summaries for first and second decades, Unit 1

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
	First decade			
Receipts				
Crops	$4,040	$5,468	$5,468	$5,468
Livestock	0	10,832	10,832	10,832
Livestock products	400	0	0	0
Forest products	0	246	92	313
Total receipts	4,440	16,546	16,392	16,613
Cash operating expenses	2,595	8,424	8,404	8,404
Net cash farm income	1,845	8,122	7,988	8,209
Depreciation	800	1,945	1,927	1,927
Net farm income	1,045	6,177	6,061	6,282
	Second decade			
Receipts				
Crops	4,040	5,468	5,468	5,468
Livestock	0	10,832	10,832	10,832
Livestock products	400	0	0	0
Forest products	0	616	162	0
Total receipts	4,440	16,916	16,462	16,300
Cash operating expenses	2,595	8,450	8,404	8,404
Net cash farm income	1,845	8,466	8,058	7,896
Depreciation	800	1,973	1,927	1,927
Net farm income	1,045	6,493	6,131	5,969

[a]Plan I--present farm operation with no timber sales.

[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.

[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.

[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

income under Plan IV is $105 and $221 higher than for Plans II and III, respectively, because under extensive forestry all merchantable sawtimber (313 MBF) is to be cut, whereas only 81 M are to be cut under intensive forestry. While Plan II benefits from the higher price for a volume of cut products over a similar volume of stumpage and also includes an average annual gross income of almost $44 from 5-1/2 cords of hardwood pulpwood not merchantable as stumpage, the cost of harvesting includes $38 annually for operation, maintenance, and depreciation of the power saw.

By the second decade, however, the sort of comparative relationship develops among the three new plans' annual net farm incomes that is repeated in succeeding decades. The highest net farm income is achieved under Plan II--about $500 more than under Plan IV, and Plan III is $160 above Plan IV. These annual differentials are increased in the stable period to approximately $2,300 and $1,500 respectively (See Table 14).

Alternative Plans with purchase of additional acreage

If the farmer sells stumpage only (Plan III), he will need not more than 8 man-days a year on his planned acreage. Thus to use an extra 152 of the 160 man-days available for forestry, he could expand his acreage 19-fold by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 2,660 and the annual net stumpage income $1,840 for the first ten years. The increased investment of $83,980 in 2,527 acres of woodland would thus add $1,748 annually to net farm income during the first decade, a return of 2.1 percent. During the second decade it would add $3,078 annually, a return of 3.7 percent on the additional investment in woodland. The rate would be 6.2 percent during the third decade and would be over 14 percent in all succeeding decades, leveling off to an average of 36 percent in the stable period.

Table 14.--Condensed annual financial summary for stable decades, Unit 1

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$4,040	$ 5,468	$ 5,468	$ 5,468
Livestock	0	10,832	10,832	10,832
Livestock products	400	0	0	0
Forest products	0	2,449	1,580	54
Total receipts	4,440	18,749	17,880	16,354
Cash operating expenses	2,595	8,464	8,404	8,404
Net cash farm income	1,845	10,285	9,476	7,950
Depreciation	800	1,987	1,927	1,927
Net farm income	1,045	8,298	7,549	6,023

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

If forest products are sold at roadside (Plan II), the annual number of man-days needed for forest management and harvesting will not exceed 63 except in the fourth and seventh decades, which call for 97 and 84, respectively. After that, the average needed will not exceed 60. With 160 man-days available annually,

at least 97 of these would be in excess during all but the fourth and seventh decades.

If the farmer wished to make fuller use of these 97 man-days annually, he could buy an additional 205 acres of wooded and idle land similar to what he owns now. For the fourth and seventh decades this would mean hiring annually 34 and 21 man-days, respectively.

The enlarged total acreage would be 338, from which the contribution to annual net income would be only $529 during the first decade but considerably more in the second and later decades. The second decade would yield over $1,300 annually toward the farm's net annual income, and the stable decades, over $5,900. These increased annual net incomes would be $321 more in the first decade than Plan II without the additional 205 acres, $808 in the second decade, and $3,590 in the stable decades. The rates of marginal annual returns during these decades on the $8,108 investment would therefore be approximately 4 percent, 10 percent, and 44 percent, respectively.

Neither of these last two modifications of the intensive forestry alternatives are likely to be implemented for at least several years, because the owner can be expected to have some difficulty in obtaining additional credit until considerable portions of the loans for agricultural improvement have been repaid. If he is eager to finance forest area expansion under either of these proposals, however, and can do so, his long-run profit position will be greatly enhanced.

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Unit 2.--A Cotton-Hog-Sheep-Forestry Farm

This 331-acre farm currently has 50 acres in agricultural uses (10 in cotton, 15 in corn, and 25 in permanent pasture and hay), 178 acres in woodland and brush, and 103 acres idle or in miscellaneous uses such as roads, buildings, and farmyards. The small acreage in agricultural uses is regrettably low inasmuch as the soils on almost a third of the total acreage are good for agriculture, 10 percent being suitable for permanent pasture, 9 percent for temporary pasture, and 13 percent for crops. Thus current agricultural operations use about half of the acreage suitable for farming and a sixth of the total property. Alternative plans for fuller use of the land will redistribute the acreage with almost a 25-percent increase in woodland area and a doubling of open agricultural land, but 5 acres will continue in miscellaneous uses. The largest shift in acreage will be an increase of 43 acres in pasture--the proposed total being 63, instead of 20 as at present. Thirty acres of this increase will be in pasture only temporarily, however, with a possible shift later to cropland or permanent pasture. Hay acreage is to be increased to 10 from the present 5. Corn production will be allocated 22 acres, an increase of 7, and the cotton acreage will remain unchanged from the present 10, in compliance with the federal program designed to control cotton production by acreage limitation.

Livestock production will be expanded, as permitted by the larger pasture acreage to over 9 times the present total. Most important, a sheep enterprise will be added, but also hog production will b

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will be quadrupled, and draw-bar power will be obtained from a tractor replacing the mule team. The numbers of each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Dairy cows	2	1	-1
Ewes	0	50	50
Lambs raised	0	55	55
Sows	1	4	3
Hogs raised	13	56	43
Mules	2	0	-2
Total	18	166	148

This proposed budgeting of agricultural resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net income is assumed to be valued highly enough by him to be worth the added responsibility and work required for carrying out the future operations.

Improved land use on this farm calls for the woodland to occupy two-thirds (221 acres) of the total area. At present over half the acreage is in woodland (178 acres), and idle land comprises almost another third, with less than a sixth in agriculture. Practically all of the existing woodland is in upland hardwoods, with only eight acres in lower slope hardwoods and five in bottomland hardwoods. The bottomland hardwood area and three-fifths of the upland area are so poorly stocked that they should be converted to loblolly pine plantations.

The present stumpage value of the entire 178-acre woodland is about $1,500 for a stand of 117 MBF primarily of poletimber. Expansion of the agricultural land to 42 acres for crops, 30 for temporary pasture and 33 for permanent pasture will use all the land suitable for these purposes and will still leave 221 acres for timber. The total value of the present 178 acres of forest (market value of bare land plus stumpage value) is approximately $4,400 and the 153 acres of agricultural land are worth about $7,600. The combined value of buildings, livestock, feed, machinery, and other equipment is $3,100. Thus the total investment in the farm is $15,100.

The present farm operation has required an average annual outlay of labor of 180 man-days from the farm family. The work load on a cotton farm is heaviest in the spring and early summer and again in the fall. Between these periods there is time for other work, if it is available.

The opportunities for improved living on this farm lie in fuller use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. After the farmer has talked with agricultural specialists and foresters and considered his own capabilities and resources, he narrows the alternatives down to a few, in this case, four.

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Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares these plans with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most desirable in relation to his own personal scale of combined criteria.

If the owner continues with his present farm operation, Plan I, he proposes to sell the farm as soon as he can get $20,600. By investing this amount elsewhere at four percent he can equal his present income of $823 from the farm and save property taxes besides.

By adopting and implementing the plan (Plan II) indicated here to be his selection, however, within ten years the farmer will be able to increase his net farm income to over three times its present value and to achieve a much fuller use of his various resources. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as de

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as depreciation) over a broader base. Over the development period this plan results in a considerably increased total investment: from almost $15,200 to $62,300. Of this greater amount, however, $38,500 is the stumpage value of the residual timber after six decades of management, a $37,000 increase but not directly an out-of-pocket cost.

Similarly, though to a much smaller degree, $8,250 will be the value of the farm's improved 110 acres of agricultural land when modern methods of land treatment have raised the real estate value from $50 to $75 an acre (See Table 15).

TABLE 15.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 2

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	153	$ 7,650	110	$ 8,250	110	$ 8,250
Forest land[f]	178	2,848	221	3,536	221	3,536
Buildings, live-stock, and other[g]	. .	3,125	. .	11,950	. .	11,950
Stumpage	. .	1,542	. .	38,567[h]	. .	1,800[h]
Total	331	$15,165	331	$62,303	331	$25,536

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.
[h]Average in the long run.

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The original agricultural land total of 153 acres valued at $7,650 will be increased in value by $2,750 for this reason, as the preceding table shows, but 43 acres of it will drop in value $1,462 when it is shifted from miscellaneous agricultural use or idleness into forest use--from a real estate market value of $50 an acre, cleared, to $16 an acre, forested. Thus the net increase in land value of the entire farm will be only $1,288. The productivity value increase will be many times greater, however, even over only the first decade, both on the agricultural land and on the forest land.

Over three-fourths of the increase in total farm value during the 60-year development period is due to the fuller timber stand. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $3,100 to almost $12,000 will have to be provided for in the first couple of years of the new program. Some of this can be paid for by cash on hand, but most of it will require a number of years for repayment, using such devices as short-term credit, real estate mortgages (or second mortgages), and preferably intermediate-term credit for construction of buildings. Assuming that the net farm income under the chosen plan will be at least $1,800 for the first two years and at least $2,500 thereafter, the farmer will be able to pay interest and principal on his debt at the rate of $1,000 at first and then $1,700 and still have a disposable income equal to his present one. Therefore even if the entire

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$8,800 for direct expenditures is borrowed immediately, it can be paid off (with 6-percent interest compounded annually) within 8 years.

Under the new plan the farm family will have available 1.8 man-equivalents of labor. This will be about 540 man-days if spread fairly evenly throughout the year. Less than half of this labor will be needed for the agricultural enterprises: 250 man-days. The remaining 290 man-days could be used for forest work if needed. During the first decade of intensive forest management, however, only 468 man-days of labor will be needed--about 47 a year--to include harvesting of timber products for sale at roadside.

The expected sale of these products for the decade totals $4,338, of which $858 would be stumpage value if the trees were sold on the stump (See Appendix, Table 2-1). Although the remaining $3,430 could be attributed to labor used in harvesting (at $15.20 a man-day for the necessary 229 days), 51 percent of the total labor over the decade would have been in forest management and improvement work: 239 man-days. If the returns to this labor were to be paid at the same rate as the harvesting labor, the stumpage return as a source of funds would be woefully inadequate.

In view of the fact that the management and improvement work can be expected to increase the potential value of the residual stand more than the removal of the harvested products will have decreased it, the farmer might well consider the management labo

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labor as an investment for which he should expect no return until later in the development period.

He may prefer, though, to allocate the roadside products' income by equal division among the total number of man-days for harvesting and management labor required over the decade (including the stumpage value of the harvested trees, on the ground that removal of these merchantable trees is part of the over-all improvement operation prescribed for the woodland area and needs no financial return to the land factor to justify the cutting). This would result in a wage of $9.48 a man-day for the 468 man-days of labor if no returns to other factors were considered.

In the long run if prices and volumes do not depart seriously from the estimates for the stable period, the average decadal income from roadside sales will be about $45,500 and labor requirements for all forest work will average 903 man-days.

The average decadal value of stumpage to be cut will be over $29,000. If a minimum 4-percent rate of return is required on the average investment of almost $38,600 in stumpage and $3,500 in forest land, $1,684 would have to be subtracted from the annual stumpage value of $2,933 of the harvested products, leaving $1,249 as an additional return to land, timber, and labor. As an average of only 37 man-days of labor is needed each decade for management purposes, less than 4 days a year, practically all of the stumpage returns should be attributed to the timber and land--equal to almost exactly 7 percent of the investment.

The difference of almost $16,200 between roadside and stumpage sale value would require 866 man-days of labor. These man-days woul

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would therefore be worth $18.68 each to the owner who would supply the necessary equipment as well as labor for felling and skidding. This would provide a 13-percent increase over the comparable average harvesting man-day return of $16.46 during the development period. The rise of the stumpage return to 6.9 percent from the 5.1 of the development period is an even more pronounced increase: 35 percent.

Subtraction of equipment cost of about $2 a man-day would make an adequate allowance for operation and depreciation of a power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about $14.50 during the development period and $16.70 during the stable period.

In the case of this farm, where more man-days are available than are needed for forest management and harvesting either in the first decade or in succeeding decades, intensive forestry with harvesting to roadside is clearly the best alternative. This is the important feature of Plan II that differentiates it from Plans III and IV. The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 16).

In the first decade the annual net farm income under Plan II is $254 more than under Plan III because the income from roadside sales is increased by the higher price for a volume of cut products

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TABLE 16.--Condensed annual financial summaries for first and second decades, Unit 2

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
	First decade			
Receipts				
Crops	$1,550	$2,150	$2,150	$2,150
Livestock	429	2,728	2,728	2,728
Livestock products	0	150	150	150
Forest products	0	434	86	154
Total receipts	1,979	5,462	5,114	5,182
Cash operating expenses	970	2,206	2,156	2,156
Net cash farm income	1,009	3,256	2,958	2,872
Depreciation	186	659	615	615
Net farm income	823	2,597	2,343	2,411
	Second decade			
Receipts				
Crops	1,550	2,150	2,150	2,150
Livestock	429	2,728	2,728	2,728
Livestock products	0	150	150	150
Forest products	0	1,148	391	17
Total receipts	1,979	6,176	5,419	5,045
Cash operating expenses	970	2,226	2,156	2,156
Net cash farm income	1,009	3,950	3,263	2,889
Depreciation	186	685	615	615
Net farm income	823	3,265	2,648	2,274

[a]Plan I--present farm operation with no timber sales.

[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.

[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.

[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

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over a similar volume of stumpage, and also includes an average annual gross income of $146 from 18 cords of hardwood pulpwood not merchantable as stumpage. The cost of harvesting, however, includes $94 annually for operation, maintenance, and depreciation of the power saw. The annual net farm income under Plan II is only $186 higher than for Plan IV, however, because under extensive forestry all merchantable sawtimber (117 MBF) is to be cut whereas only 68 M are to be cut under intensive forestry.

By the second decade, however, the sort of comparative relationship develops among the three new plans' annual net farm incomes that is repeated in succeeding decades. The highest net farm income is achieved under Plan II--on the order of $1,000 more than under Plan IV, and Plan III is a few hundred dollars above Plan IV. These annual differentials are increased in the stable period to approximately $4,300 and $2,800, respectively (See Table 17).

Alternative plans with purchase of additional acreage

With intensive forest management, if the farmer sells stumpage only (Plan III), he will need not more than 24 man-days a year on his planned acreage. Thus to use an extra 266 of the 290 man-days available for forestry, he could expand his acreage 11-fold by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 2,652 and the annual net stumpage income $1,032 for the first ten years.

The increased investment of $55,858 in 2,431 acres of woodland

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land would thus add $946 annually to net farm income during the first decade, a return of 1.7 percent. During the second decade, however, it would add $4,300 annually, a return of 7.7 percent on the additional investment in woodland. The rate would be 5.3 percent during the third decade, 8 percent during the fourth, and would be over 40 percent in all succeeding decades, leveling off to an average of 60 percent in the stable period.

Table 17.--Condensed annual financial summary for stable decades, Unit 2

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$1,550	$2,150	$2,150	$2,150
Livestock	429	2,728	2,728	2,728
Livestock products	0	150	150	150
Forest products	0	4,550	2,933	89
Total receipts	1,979	9,578	7,961	5,117
Cash operating expenses	970	2,246	2,156	2,156
Net cash farm income	1,009	7,332	5,805	2,961
Depreciation	186	705	615	615
Net farm income	823	6,627	5,190	2,346

[a]Plan I--present farm operation with no timber sales.
[b]Plan II-improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

If forest products are sold at roadside (Plan II), the annual number of man-days needed for forest management and harvesting during the development period will not exceed 90 except in t

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in the seventh decade, which calls for 221. Also in the stable period the average needed will not exceed 90. With 290 man-days available annually, at least 200 of these would be in excess during all but the seventh decade.

If the farmer wished to make fuller use of these 200 man-days annually, he could buy an additional 490 acres of wooded and idle land similar to what he owns now. For the seventh decade this would mean hiring annually 131 man-days. The enlarged total acreage would be 711, from which the contribution to annual net income would be $1,094 during the first decade and considerably more in the second and later decades. The second decade would yield over $3,200 toward the farm's net annual income, and the stable decades, over $13,800. These increased annual net incomes would be $754 more in the first decade than Plan II without the additional 490 acres, $2,235 in the second decade, and $9,496 in the stable decades. The rates of marginal annual returns during these decades on the $11,259 investment would therefore be approximately 6.7 percent, 20 percent, and 84 percent, respectively.

Neither of these last two modifications of the intensive forestry alternatives are likely to be implemented for at least several years, because the owner can be expected to have some difficulty in obtaining additional credit until considerable portions of the loans for agricultural improvement have been repaid. If he is eager to finance forest area expansion under either of these proposals, however, and can do so, his long-run profit position will be greatly enhanced.

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Unit 3--A Cotton-Hog-Beef-Forestry Farm

This 398-acre farm currently has 63 acres in agricultural uses (16 in cotton, 22 in corn, and 25 in permanent pasture and hay), 218 acres in woodland and brush, and 117 acres idle or in miscellaneous uses (such as roads, buildings, and farmyards). The small acreage in agricultural uses is regrettably low inasmuch as the soils on almost half the total acreage are good for agriculture, a fourth being suitable for permanent pasture and almost a fifth for crops. Thus current agricultural operations use about a third of the acreage suitable for farming and a sixth of the total property. Alternative plans for fuller use of the land best suited to farming will redistribute the acreage with no change in woodland (except for conversion of brush to pine plantation), but all 175 acres usable for agriculture will be prepared for field uses, and 5 acres will continue in miscellaneous uses. The largest shift in acreage will be an increase of 80 acres in pasture--the proposed total being 100, instead of 20 as at present. Ten acres are to grow silage, and the hay acreage is to be increased to 24 from the present five. Corn production will be allocated 25 acres, an increase of 3, and the cotton acreage of 16 will remain unchanged, in compliance with the federal program designed to control cotton production by acreage limitation.

Livestock production will be expanded as permitted by the larger pasture acreage, to over three times the present total, the largest percentages of increase being in calves and beef cows, but the greatest absolute increase will be in hogs. The numbers of eac

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each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Beef cows	8	30	22
Calves raised	5	27	22
Sows	3	4	1
Hogs raised	20	56	36
Total	36	117	81

This proposed budgeting of farm resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net income is supposedly valued highly enough by him to be worth the added responsibility and work required for carrying out the new plan.

Improved land use on this farm calls for the woodland to occupy over half (218 acres) of the total area. At present this acreage includes both woodland and brush, idle open land comprises almost another third of the farm total, and less than a sixth is in agriculture. Brush occupies 83 acres and woodland 135, all of which acreage is upland except for 10 acres on a lower slope hardwood site. All the existing woodland is either mixed hardwoods or hardwoods in combination with pine or cedar or with pine and cedar. In view of the poor stocking of 50 acres of pine hardwoods and cedar hardwoods, intensive forest management of these areas as well as of the land in brush (all totaling 133 acres) will require conversion to loblolly pine plantations. Well-stocked upland areas of 25 acres in young pine-cedar hardwoods and 50 acres in hardwood poletimber, also a 10-acre tract of moderately well stocked lower slope hardwoods, will need only thinning in the first or s

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The present stumpage value of the entire 135-acre woodland is about $1,000 for a 60-acre stand of 103 MBF primarily of pole-timber. The total bare land value of the 218 acres of woodland and brush is approximately $3,500 and the 180 acres of agricultural land are worth about $9,000. The combined value of buildings, livestock, feed, machinery, and other equipment is $3,000. Thus the total investment in the farm is $16,500.

The present farm operation has required an average annual outlay of labor of 269 man-days from the farm family. The work load on a cotton farm is heaviest in the spring and early summer and again in the fall. Between these periods there is time for other work, if it is available.

The opportunities for improved living on this farm lie in fuller use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. After the farmer has talked with agricultural specialists and foresters and considered his own capabilities and resources, he narrows the alternatives down to a few, in this case, four.

Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management wit

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with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares these plans with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most desirable in relation to his own personal scale of combined criteria.

If the owner continues with his present farm operation, Plan I, he proposes to sell the farm as soon as he can get $25,200. By investing this amount elsewhere at four percent he can equal his present net farm income of $1,009 from the farm and save property taxes besides.

By adopting and implementing the plan indicated here to be his selection, however, within ten years the farmer will be able to increase his net farm income to three times its present value and to achieve a much fuller use of his various resources. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as depreciation) over a broader base. Over the development period this plan results in a considerably increased total investment: from $16,500 to $70,300. Of this greater amount, however, $38,400 is the stumpage value of the residual timber after six decades of management, a $37,400 increase but not a direct out-of-pocket cost.

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Similarly, though to a much smaller degree, $13,500 will be the value of the farm's 180 acres of agricultural land when modern methods of land treatment have raised the real estate value from $50 to $75 an acre (See Table 18).

Table 18.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 3

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	180	$9,000	180	$13,500	180	$13,500
Forest land[f]	218	3,488	218	3,488	218	3,488
Buildings, live-stock, and other[g]	. .	3,000	. .	14,900	. .	14,900
Stumpage	. .	1,030	. .	38,425[h]	. .	1,750
Total	398	$16,518	398	$70,313	398	$33,638

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.
[h]Average in the long run.

Most of the $4,500 value increase will be required during the first decade of improved farming practices--the major investment being in developing 112 acres of miscellaneous and idle land into cropland and permanent pasture.

Almost three-fourths of the increase in total farm value during the 60-year development period is due to the fuller timber

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stand. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $3,000 to almost $15,000 will have to be provided for in the first couple of years of the new program. Some of this can be paid for by cash on hand, but most of it will require a number of years for repayment, using such devices as short-term credit, real estate mortgages (or second mortgages), and preferably intermediate-term credit for construction of buildings.

Assuming that the net farm income under the chosen plan will be at least $2,100 for the first two years and at least $3,000 thereafter, the farmer will be able to pay interest and principal on his debt at the rate of $1,000 at first and then $2,000 and still have a disposable income equal to his present one. Therefore even if the entire $11,900 for direct expenditures is borrowed immediately, it can be paid off (with 6-percent interest compounded annually) within 9 years.

Under the new plan the farm family will have available 2.0 man-equivalents of labor. This will be about 600 man-days if spread fairly evenly throughout the year. About two-thirds of the labor will be needed for the agricultural enterprises: 388 man-days. The remaining 212 man-days can be used for forest work if needed. During the first decade of intensive forest management, however, only 353 man-days of labor will be needed--about 35 a year--to include harvesting of timber products for sale at roadside.

The expected sale of these products for the decade totals $968, of which $75 will be stumpage value if the trees are sold on

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the stump (See Appendix, Table 3-1). No pulpwood stumpage value is included, as only sawtimber is merchantable. Inasmuch as the market value of pulpwood stumpage is expected to remain zero for an indefinite period in the future, the remaining $893 can be attributed to harvesting (at $8.70 a man-day for the necessary 103 days). Of the total labor required for the decade, however, 250 days will be in forest management and improvement work. If the returns to this labor were to be paid at the same rate as the harvesting labor, the stumpage return as a source of funds would be woefully inadequate.

In view of the fact that the management and improvement work can be expected to increase the potential value of the residual stand more than the removal of the harvested products will have decreased it, the farmer might well consider the management labor as an investment for which he should expect no return until later in the development period.

He may prefer to allocate the roadside products' income by equal division among the total number of man-days for harvesting and management labor required over the decade (including the stumpage value of the harvested trees, on the ground that removal of these merchantable trees is part of the over-all improvement operation prescribed for the woodland area and needs no financial return to the land factor to justify the cutting). This would result in a wage of $2.74 a man-day for the 353 man-days of labor if no returns to other factors were considered. Any additional wage for labor performed in the first decade would have to be either foregone, postponed until the next decade, or financed out of agricultural income.

In the long run if prices and volumes do not depart seriously from the estimates for the stable period, the average decadal income from roadside sales will be about $45,900 and labor requirements for all forest work will average 1,083 man-days.

The average decadal value of stumpage to be cut will be about $28,600. If a minimum 4-percent rate of return is required on the average investment of $38,400 in stumpage and $3,500 in forest land, $1,676 would have to be subtracted from the annual stumpage value of $2,860 of the harvested products, leaving $1,184 as an additional return to land, timber, and labor. As an average of only 35 man-days of labor is needed each decade for management purposes, less than 4 days a year, practically all of the stumpage returns should be attributed to the timber and land--equal to almost 7 percent of the investment.

The difference of over $17,300 between roadside and stumpage sale value would require 1,048 man-days of labor. These man-days would therefore be worth $16.53 each to the owner who would supply the necessary equipment as well as labor for felling and skidding. This would provide a 2-percent increase over the comparable average harvesting man-day return of $16.14 during the development period. The rise of the stumpage return to 6.8 percent from the 5.1 of the development period is a far more pronounced increase: 33 percent.

Subtraction of equipment cost of about $2 a man-day would make an adequate allowance for operation and depreciation of a

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power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about \$14.00 during the development period and \$14.50 during the stable period.

In the case of this farm, where more man-days are available than are needed for forest management and harvesting either in the first decade or in succeeding decades, intensive forestry with harvesting to roadside is clearly the best alternative. This is the important feature of Plan II that differentiates it from Plans III and IV. The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 19).

In the first decade the annual net farm income under Plan IV is \$76 and \$95 higher than for Plans II and III, respectively, because under extensive forestry all merchantable sawtimber (103 MBF) is to be cut, whereas only 7.5 M are to be cut under intensive forestry. While Plan II benefits from the higher price for a volume of cut products over a similar volume of stumpage, and also includes an average annual gross income of \$78 from almost 10 cords of hardwood pulpwood not merchantable as stumpage, the cost of harvesting includes \$70 annually for operation, maintenance, and depreciation of the power saw.

By the second decade, however, the sort of comparative relationship develops among the three new plans' annual net farm

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TABLE 19.--Condensed annual financial summaries for first and second decades, Unit 3

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
	First decade			
Receipts				
Crops	$2,340	$3,020	$3,020	$3,020
Livestock	900	5,223	5,223	5,223
Livestock products	0	0	0	0
Forest products	0	97	8	103
Total receipts	3,240	8,340	8,251	8,346
Cash operating expenses	1,457	4,197	4,162	4,162
Net cash farm income	1,783	4,143	4,089	4,184
Depreciation	674	1,055	1,020	1,020
Net farm income	1,009	3,088	3,069	3,164
	Second decade			
Receipts				
Crops	2,340	3,020	3,020	3,020
Livestock	900	5,223	5,223	5,223
Livestock products	0	0	0	0
Forest products	0	1,272	384	50
Total receipts	3,240	9,515	8,627	8,293
Cash operating expenses	1,457	4,245	4,162	4,162
Net cash farm income	1,783	5,270	4,465	4,131
Depreciation	674	1,103	1,020	1,020
Net farm income	1,009	4,167	3,445	3,111

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

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incomes that is repeated in succeeding decades. The highest net farm income is achieved under Plan II--on the order of $1,000 more than under Plan IV, and Plan III is a few hundred dollars above Plan IV. These annual differentials are increased in the stable period to approximately $4,300 and $2,800, respectively (See Table 20).

TABLE 20.--Condensed annual financial summary for stable decades, Unit 3

Income and expense items	Alternative plans: Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$2,340	$3,020	$3,020	$3,020
Livestock	900	5,223	5,223	5,223
Livestock products	0	0	0	0
Forest products	0	4,592	2,860	88
Total receipts	3,240	12,835	11,103	8,331
Cash operating expenses	1,457	4,270	4,162	4,162
Net cash farm income	1,783	8,565	6,941	4,169
Depreciation	674	1,128	1,020	1,020
Net farm income	1,009	7,437	5,921	3,149

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

Alternative plans with purchase of additional acreage

With intensive forest management, if the farmer sells stumpage only (Plan III), he will need not more than 25 man-days a year on his present acreage. Thus to use an extra 187 of the

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212 man-days available for forestry, he could expand his acreage 7-fold by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 1,744 and the annual net stumpage income $64 for the first ten years.

The increased investment of $24,416 in 1,526 acres of woodland would thus add only $56 annually to net farm income during the first decade, a return of a bare 1/6 of one percent. During the second decade, however, it would add $2,691 annually, a return of 8.5 percent on the additional investment in woodland. The rate would be 7.7 percent during the third decade and would be over 16 percent in all succeeding decades, leveling off to an average of 63 percent in the stable period.

If forest products are sold at roadside (Plan II), the annual number of man-days needed for forest management and harvesting will not exceed 83 except in the sixth and seventh decades, which call for 95 and 217, respectively. After that, the average needed will not exceed 108. With 212 man-days available annually, at least 129 of these would be in excess during all but the sixth and seventh decades.

If the farmer wished to make fuller use of these 129 man-days annually, he could buy an additional 339 acres of wooded and idle land similar to what he owns now. For the sixth and seventh decades this would mean hiring annually 12 and 134 man-days, respectively.

The enlarged new total acreage would be 557, from which the contribution to annual net income would be only $69 during the first decade but considerably more in the second and later decades. The second decade would yield annually over $2,800 toward the farm's net annual income, and the stable decades, over $11,000. These increased annual net incomes would be $42 more in the first decade than Plan II without the additional 339 acres, $1,720 in the second decade, and $6,805 in the stable decades. The rates of marginal annual returns during these decades on the $7,026 investment would therefore be approximately 0.6 percent, 24 percent, and 97 percent, respectively.

Neither of these last two modifications of the intensive forestry alternatives are likely to be implemented for at least several years, because the owner can be expected to have some difficulty in obtaining additional credit until considerable portions of the loans for agricultural improvement have been repaid. If he is eager to finance forest area expansion under either of these proposals, however, and can do so, his long-run profit position will be greatly enhanced.

Unit 4--A Cotton-Dairy-Forestry Farm

This 362-acre farm currently has 44 acres in agricultural uses (14 in cotton, 10 each in corn, lespedeza and permanent pasture), 174 acres in woodland and brush, and 144 acres idle or in miscellaneous uses such as roads, buildings, and farmyards. Only 44 acres are in cultivation despite the fact that the soils on nearly half of the total acreage are good for agriculture, over a fifth being suitable for permanent pasture and a fourth for c

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crops. Thus current agricultural operations use less than a fourth of the acreage suitable for farming and an eighth of the total property. Alternative plans for fuller use of the land best suited to farming will almost quadruple the acreage in cultivation and will establish a 10-acre woodland pasture. The largest shift in acreage will be the expansion of the 10-acre permanent pasture to a total of 77 acres, instead of the current grazing on land in the miscellaneous and idle category and on the cropland after harvest. Twenty acres are to be allocated for silage production, 25 for oats and lespedeza, and 9 to grow alfalfa. Corn production will be reduced from 10 to 8 acres, and the cotton acreage will be increased from 14 to 30.

Livestock production will be increased as permitted by the larger pasture acreage, to eight times the present total. The major category, the dairy enterprise will actually become almost 20 times its present size, but all the mules will be eliminated when a tractor is obtained. The numbers of each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Mules	4	0	-4
Dairy cows	2	40	38
Heifers	1	16	15
Total	7	56	49

This proposed budgeting of agricultural resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net i

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income is supposedly valued highly enough by him to be worth the added responsibility and work required for carrying out the new plan.

Improved land use on this farm calls for hardly any change in the woodland acreage, slightly less than half (175 acres) of the total area. At present brush occupies some of this area, and idle land comprises another 40 percent of the total, inasmuch as a bare eighth is used for agriculture. Somewhat over half (93 acres) of the woodland is in upland hardwoods, almost a fifth is in lower slope hardwoods, and nearly 30 percent is well stocked with natural stands of shortleaf pine of various diameter classes up to 30 inches. All of the upland hardwood area produces such slow-growing trees that conversion of the stand to a loblolly pine plantation is indicated.

The present stumpage value of the entire 175-acre woodland is about $5,400 for 300 MBF of small and large sawtimber, $4,800 for 240 M of shortleaf pine and $600 for 60 M of hardwood. Expansion of the agricultural land to 92 acres for crops, 77 acres for permanent pasture and 10 acres for woodland pasture will use all the land suitable for these purposes but will still leave 175 acres for timber. The total value of the present 175 acres of forest (market value of bare land plus stumpage value) is approximately $8,200 and the 187 acres of agricultural land are worth about $9,350. The combined value of buildings, livestock, feed, machinery, and other equipment is $2,300. Thus the total investment in the farm is $19,850.

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The present farm operation has required an average annual outlay of labor of 170 man-days from the farm family. The work load on a cotton farm is heaviest in the spring and early summer and again in the fall. Between these periods there is time for other work, if it is available.

The opportunities for improved living on this farm lie in fuller use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. After the farmer has talked with agricultural specialists and foresters and considered his own capabilities and resources, he narrows the alternatives down to a few, in this case, four.

Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares these plans with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most desirable in relation to his own personal scale of combined criteria.

If the owner continues with his present farm operation, Plan I, he proposes to sell the farm as soon as he can get nearly the value of his investment of almost $19,900. By investing this amount elsewhere at four percent he can receive $796 interest, almost $300 more than his present net farm income of $498 from the farm and save property taxes besides.

By adopting and implementing the plan (Plan II) indicated here to be his selection, however, within ten years the farmer will be able to increase his net farm income to over fifteen times its present value and to achieve a much fuller use of his various resources. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as depreciation) over a broader base. Over the development period this plan results in a considerable increase in total investment: from almost $19,900 to almost $70,400. Of this greater amount, however, $33,900 is the stumpage value of the residual timber after six decades of management, a $28,400 increase but not directly an out-of-pocket cost.

Similarly, though to a much smaller degree, $14,025 will be the value of the farm's improved 187 acres of agricultural land when modern methods of land treatment have raised the real estate value from $50 to $75 an acre (See Table 21). Most of the almost

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$4,700 value increase will be required during the first decade of improved farming practices--the major investment being in developing 135 acres of miscellaneous and idle land into cropland and permanent pasture.

TABLE 21.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 4

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	187	$ 9,350	187	$14,025	187	$14,025
Forest land[f]	175	2,800	175	2,800	175	2,800
Buildings, livestock, and other[g]	. .	2,300	. .	19,675	. .	19,675
Stumpage	. .	5,428	. .	33,874[h]	. .	2,550[h]
Total	362	$19,878	362	$70,374	362	$39,050

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.
[h]Average in the long run.

Over half ($28,400) of the increase in total farm value during the 60-year development period is due to the fuller timber stand. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $2,300 to almost $19,700 will have to be

provided for in the first couple of years of the new program. Some of this can be paid for by cash on hand, but most of it will require a number of years for repayment, using such devices as short-term credit, real estate mortgages (or second mortgages), and preferably intermediate-term credit for construction of buildings.

Assuming that the net farm income under the chosen plan will be at least $5,000 for the first two years and at least $7,000 thereafter, the farmer will be able to pay interest and principal on his debt at the rate of $4,000 at first and then $6,000 and still have a disposable income over twice his present one. Therefore even if the entire $17,400 for direct expenditures is borrowed immediately, it can be paid off (with 6-percent interest compounded annually) within 5 years.

Under the new plan the farm family will have available 3.5 man-equivalents of labor. This will be about 1,050 man-days if spread fairly evenly throughout the year. Most of this labor will be needed for the agricultural enterprises: 880 man-days. The remaining 170 man-days could be used for forest work if needed. During the first decade of intensive forest management, however, only 489 man-days of labor will be needed--about 49 a year--to include harvesting of timber products for sale at roadside. The expected sale of these products for the decade totals $6,992 of which $2,633 would be stumpage value if the trees were sold on the stump (See Appendix, Table 4-1).

Although the remaining $4,359 could be attributed to labor used in harvesting (at $12.13 a man-day for the necessary 359

days), one-fourth of the total labor over the decade would have been in forest management and improvement work: 130 man-days. If the returns to this labor were to be paid at the same rate as the harvesting labor, the total management wage of $1,574 might be subtracted from the stumpage value, leaving only $1,059 as a stumpage return for the decade. If the farmer wishes to keep the stumpage return intact, however, and charge both management and harvesting labor to the $4,359 harvesting return, the daily wage for the 489 man-days would average $8.91.

In the long run if prices and volumes do not depart seriously from the estimates for the stable period, the average decadal income from roadside sales will be about $37,900 and labor requirements for all forest work will average 830 man-days.

The average decadal value of stumpage to be cut will be over $24,400. If a minimum 4-percent rate of return is required on the average investment of almost $33,900 in stumpage and $2,800 in forest land, $1,467 would have to be subtracted from the annual stumpage value of $2,445 of the harvested products, leaving $978 as an additional return to land, timber, and labor. As an average of only 32 man-days of labor is needed each decade for management purposes, about 3 days a year, practically all of the stumpage returns should be attributed to the timber and land--equal to 6.7 percent of the investment.

The difference of almost $13,500 between roadside and stumpage sale value would require 798 man-days of labor. These man-days would therefore be worth $16.91 each to the owner who would supply the necessary equipment as well as labor for felling and skidding. This value is almost the same as the comparable average harvesting man-day return of $16.89 during the development period. The rise of the stumpage return to 6.7 percent from the 5.4 of the development period is a substantial increase, however: 24 percent.

Subtraction of equipment cost of about $2 a man-day would make an adequate allowance for operation and depreciation of a power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about $14.90 during both the development period and the stable period.

In the case of this farm, where more man-days are available than are needed for forest management and harvesting either in the first decade or in succeeding decades, intensive forestry with harvesting to roadside is clearly the best alternative. This is the important feature of Plan II that differentiates it from Plans III and IV. The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 22).

In the first decade the annual net farm income under Plan II is $338 more than under Plan III because the income from road-sales is increased by the higher price for a volume of cut products over a similar volume of stumpage, and also includes an average annual gross income of $224 from pulpwood not merchantable as stumpage, 25 cords of hardwood and 2.6 cords of pine. The cost of

TABLE 22.--Condensed annual financial summaries for first and second decades, Unit 4

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
	First decade			
Receipts				
Crops	$1,480	$6,503	$6,503	$6,503
Livestock	0	1,168	1,168	1,168
Livestock products	0	6,930	6,930	6,930
Forest products	0	699	263	543
Total receipts	1,480	15,300	14,864	15,144
Cash operating expenses	857	5,930	5,882	5,882
Net cash farm income	623	9,370	8,982	9,262
Depreciation	125	1,760	1,710	1,710
Net farm income	498	7,610	7,272	7,552
	Second decade			
Receipts				
Crops	1,480	6,503	6,503	6,503
Livestock	0	1,168	1,168	1,168
Livestock products	0	6,930	6,930	6,930
Forest products	0	867	377	158
Total receipts	1,480	15,468	14,978	14,759
Cash operating expenses	857	5,927	5,882	5,882
Net cash farm income	623	9,541	9,096	8,877
Depreciation	125	1,755	1,710	1,710
Net farm income	498	7,786	7,386	7,167

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

harvesting, however, includes $98 annually for operation, maintenance, and depreciation of the power saw. The annual net farm income under Plan II is only $58 higher than for Plan IV, however, because under extensive forestry all merchantable sawtimber (382 MBF) is to be cut whereas only 146 M are to be cut under intensive forestry.

By the second decade, however, the sort of comparative relationship develops among the three new plans' annual net farm incomes that is repeated in succeeding decades. The highest net farm income is achieved under Plan II--over $600 more than under Plan IV, and Plan III is $200 above Plan IV. These annual differentials are increased in the stable period to approximately $3,500 and $2,300, respectively (See Table 23).

Alternative plans with purchase of additional acreage

In the long run with intensive forest management, if the farmer sells stumpage only (Plan III), he will need on the average not more than 3.2 man-days a year on his planned acreage. During the first decade he will need a total of 130 days, an average of 13 days a year, primarily for timber stand improvement, but thereafter not over 3.2 a year except in the seventh decade which will require 10 days annually. Thus after the first decade, to use an extra 167 of the 170 man-days available for forestry, he could expand his acreage 52-fold by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 9,275.

If this land is bought and improvement work and planting done in the first decade, he will need to hire an extra 520 man-days during that decade. If he pays a wage of $10 to $15 a man-day, or an average annual labor cost ranging between $520 and $780; and if he charges it against the average annual stumpage income of $13,939, the average annual net stumpage income will be between $13,159 and $13,419 for the first ten years.

TABLE 23.--Condensed annual financial summary for stable decades, Unit 4

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$1,480	$ 6,503	$ 6,503	$ 6,503
Livestock	0	1,168	1,168	1,168
Livestock products	0	6,930	6,930	6,930
Forest products	0	3,794	2,445	108
Total receipts	1,480	18,395	17,046	14,709
Cash operating expenses	857	5,965	5,882	5,882
Net cash farm income	623	12,430	11,164	8,827
Depreciation	125	1,793	1,710	1,710
Net farm income	498	10,637	9,454	7,117

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

The increased investment of $427,856 in 9,100 acres of woodland would thus add about $13,000 annually to net farm income during the first decade, a return of 3 percent. During the second decade it would add almost $19,600 annually, a return of 4.6

percent on the additional investment in woodland. The rate would be 6 percent during the third decade, 8.4 percent during the fourth, and would be 22 percent or more in all succeeding decades, leveling off to an average of almost 30 percent in the stable period.

If forest products are sold at roadside (Plan II), the annual number of man-days needed for forest management and harvesting during the development period will not exceed 75 except in the seventh decade, which calls for 189. Also in the stable period the average needed will not exceed 83. With 170 man-days available annually, at least 87 of these would be in excess during all but the seventh decade.

If the farmer wished to make fuller use of these 87 man-days annually, he could buy an additional 183 acres of wooded and idle land similar to what he owns now. For the seventh decade this would mean hiring annually 217 man-days. The enlarged total acreage would be 358, from which the contribution to annual net income would be $1,229 during the first decade and considerably more in the second and later decades. The second decade would yield annually almost $1,600 toward the farm's net annual income, and the stable decades, over $7,800. These increased annual net incomes would be $628 more in the first decade than Plan II without the additional 183 acres, $813 in the second decade, and $4,203 in the stable decades. The rates of marginal annual returns during these decades on the $8,604 investment would therefore be approximately 7 percent, 9 percent, and 49 percent, respectively.

Neither of these last two modifications of the intensive forestry alternatives are likely to be implemented for at least several years, because the owner can be expected to have some difficulty in obtaining additional credit until considerable portions of the loans for agricultural improvement have been repaid. If he is eager to finance forest area expansion under either of these proposals, however, and can do so, his long-run profit position will be greatly enhanced.

Unit 5--A Cotton-Grade A Dairy-Forestry Farm

This 230-acre farm currently has 64 acres in agricultural uses (9 in cotton, 20 in corn, 15 in lespedeza, and 20 in pasture), 92 acres in woodland and brush, and 74 acres idle or in miscellaneous uses such as roads, buildings, and farmyards. The small acreage in agricultural uses is regrettably low inasmuch as the soils on nearly 60 percent of the total acreage are good for agriculture, over 28 percent being suitable for pasture and 80 percent for crops. Thus current agricultural operations use less than half the acreage suitable for farming and less than three-tenths of the total property. Alternative plans for fuller use of the land best suited to farming will increase the acreage in cultivation by over 50 percent and will more than triple the acreage in pasture. The largest shift in acreage will be the expansion of the 20-acre pasture to a total of 65 acres, instead of the current grazing on land in the miscellaneous and idle category, and will be supplemented by grazing on the cropland after harvest. Sixteen acres are to be allocated for silage production, 25 for oats and lespedeza, and 8 to grow millet. Corn production will be reduced from 20 to 13 acres, and the cotton acreage will be increased from 9 to 12.

Dairy livestock production will be increased to almost three times its present size, as permitted by the larger pasture acreage and the elimination of the hog enterprise. Both mules will be eliminated when a tractor is obtained. The numbers of each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Dairy cows	8	30	22
Calves raised	6	10	4
Sows	3	0	-3
Hogs raised	30	0	-30
Mules	2	0	-2
Total	49	40	-9

This proposed budgeting of agricultural resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net income is assumed to be valued highly enough by him to be worth the added responsibility and work required for carrying out the future operations.

Improved land use on this farm calls for the woodland to occupy two-fifths (92 acres) of the total area. At present idle land comprises almost one-third of the total, inasmuch as just over a fourth is used for agriculture. Over four-fifths (75 acres) of the woodland is in upland hardwoods, an eighth (12 acres) is in lower slope hardwoods, and one-twentieth (five acres) is in bottomland hardwoods. Three-fifths of the upland hardwood area (45 acres) produces such slow-growing trees that conversion of the stand to a loblolly pine plantation is indicated.

The present stumpage value of the entire 92-acre woodland is about $720 for 72 MBF of small and large hardwood sawtimber. Expansion of the agricultural land to 69 acres for crops, and 65 acres for pasture will use all the land suitable for these purposes but will still leave 92 acres for timber. The total value of the present 92 acres of forest (market value of bare land plus stumpage value) is almost $2,200 and the 138 acres of agricultural land are worth about $6,900. The combined value of buildings, livestock, feed, machinery, and other equipment is $1,800. Thus the total investment in the farm is almost $10,900.

The opportunities for improved living on this farm lie in fuller use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. The farmer narrows the alternatives down to a few, in this case, four, after talking with agricultural specialists and foresters and considering his own capabilities and resources.

Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares the most attractive alternatives with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most desirable in relation to his own personal scale of combined criteria.

If the owner continues with his present farm operation, Plan I, he proposes to sell the farm as soon as he can get $22,275. By investing this amount elsewhere at four percent he can equal his present net farm income of $891 from the farm and save property taxes besides.

By adopting and implementing the plan (Plan II) indicated here to be his selection, however, within ten years the farmer will be able to increase his net farm income to seven times its present value and to achieve a much fuller use of his various resources. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as depreciation) over a broader base. Over the development period this plan results in a considerable increase in total investment:

from $10,900 to over $47,100. Of this greater amount, however, over $14,800 is the stumpage value of the residual timber after six decades of management, a $14,100 increase but not directly an out-of-pocket cost.

Similarly, though to a much smaller degree, $10,350 will be the value of the farm's improved 138 acres of agricultural land when modern methods of land treatment have raised the real estate value from $50 to $75 an acre (See Table 24).

TABLE 24.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 5

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	138	$ 6,900	138	$10,350	138	$10,350
Forest land[f]	92	1,472	92	1,472	92	1,472
Buildings, live-stock, and other[g]	. .	1,800	. .	20,490	. .	20,490
Stumpage	. .	721	. .	14,814[h]	. .	750[h]
Total	230	$10,893	230	$47,126	230	$33,062

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.
[h]Average in the long run.

Most of the almost $3,450 value increase will be required during the first decade of improved farming practices--the major investment being in developing 70 acres of miscellaneous and idle land into cropland and pasture.

Almost half ($17,500) of the increase in total farm value during the 60-year development period is due to the fuller timber stand and appreciation of the agricultural land. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $1,800 to almost $20,500 will have to be provided for in the first couple of years of the new program. Some of this can be paid for by cash on hand, but most of it will require a number of years for repayment, using such devices as short-term credit, real estate mortgages (or second mortgages), and preferably intermediate-term credit for construction of buildings.

Assuming that the net farm income under the chosen plan will be at least $4,300 for the first two years and at least $6,300 thereafter, the farmer will be able to pay interest and principal on his debt at the rate of $2,500 at first and then $4,500 and still have a disposable income over twice his present one. Therefore even if the entire $18,700 for direct expenditures is borrowed immediately, it can be paid off (with 6-percent interest compounded annually) in less than 7 years.

Under the new plan the farm family will have available 2.0 man-equivalents of labor. This will be about 600 man-days if spread fairly evenly throughout the year. Almost all of this labor

will be needed for the agricultural enterprises: 525 man-days. The remaining 75 man-days could be used for forest work if needed. During the first decade of intensive forest management, however, only 220 man-days of labor will be needed--about 22 a year--to include harvesting of timber products for sale at roadside.

The expected sale of these products for the decade totals $1,581, of which $391 would be stumpage value if the trees were sold on the stump (See Appendix, Table 5-1). No pulpwood stumpage value is included, as only sawtimber stumpage is merchantable. Inasmuch as the market value of hardwood pulpwood stumpage is expected to remain zero for an indefinite period in the future, the remaining $1,190 could be attributed to labor used in harvesting (at $11.90 a man-day for the necessary 100 days). Of the total labor over the decade, however, over half would have been in forest management and improvement work: 120 man-days. If the returns to this labor were to be paid at the same rate as the harvesting labor, the stumpage return as a source of funds would be woefully inadequate.

In view of the fact that the management and improvement work can be expected to increase the potential value of the residual stand more than the removal of the harvested products will have decreased it, the farmer might well consider the management labor as an investment for which he should expect no return until later in the development period.

He may prefer to allocate the roadside products' income by equal division among the total number of man-days for harvesting and management labor required over the decade (including the stumpage value of the harvested trees, on the ground that removal of these merchantable trees is part of the over-all improvement operation prescribed for the woodland area and needs no financial return to the land factor to justify the cutting). This would result in a wage of $7.19 a man-day for the 220 man-days of labor if no returns to other factors were considered. Any additional wage for labor performed in the first decade would have to be either foregone, postponed until the next decade, or financed out of agricultural income.

In the long run if prices and volumes do not depart seriously from the estimates for the stable period, the average decadal income from roadside sales will be almost $17,400 and labor requirements for all forest work will average 411 man-days.

The average decadal value of stumpage to be cut will be over $10,900. If a minimum 4-percent rate of return is required on the average investment of $14,800 in stumpage and almost $1,500 in forest land, $651 would have to be subtracted from the annual stumpage value of $1,092 of the harvested products, leaving $441 as an additional return to land, timber, and labor. As an average of only 14 man-days of labor is needed each decade for management purposes, less than 2 days a year, practically all of the stumpage returns should be attributed to the timber and land--equal to 6.7 percent of the investment.

The difference of almost $6,500 between roadside and stumpage sale value would require 397 man-days of labor. These man-days would therefore be worth $16.24 each to the owner who would

supply the necessary equipment as well as labor for felling and skidding. This value is almost the same as the comparable average harvesting man-day return of $16.59 during the development period. The rise of the stumpage return to 6.7 percent from the 5.0 of the development period is a substantial increase, however: 34 percent.

Subtraction of equipment cost of about $2 a man-day would make an adequate allowance for operation and depreciation of a power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about $14.60 during the development period, and $14.25 during the stable period.

In the case of this farm, where more man-days are available than are needed for forest management and harvesting either in the first decade or in succeeding decades, intensive forestry with harvesting to roadside is clearly the best alternative. This is the important feature of Plan II that differentiates it from Plans III and IV. The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 25).

In the first decade the annual net farm income under Plan II is $75 more than under Plan III because the income from roadside sales is increased by the higher price for a volume of cut products over a similar volume of stumpage, and also includes an

TABLE 25.--Condensed annual financial summaries for first and second decades, Unit 5

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
	First decade			
Receipts				
Crops	$1,375	$2,262	$2,262	$2,262
Livestock	1,030	100	100	100
Livestock products	0	12,000	12,000	12,000
Forest products	0	158	39	72
Total receipts	2,405	14,520	14,401	14,434
Cash operating expenses	1,200	7,157	7,135	7,135
Net cash farm income	1,205	7,363	7,266	7,299
Depreciation	314	1,037	1,015	1,015
Net farm income	891	6,326	6,251	6,284
	Second decade			
Receipts				
Crops	1,375	2,262	2,262	2,262
Livestock	1,030	100	100	100
Livestock products	0	12,000	12,000	12,000
Forest products	0	397	142	25
Total receipts	2,405	14,759	14,504	14,387
Cash operating expenses	1,200	7,158	7,135	7,135
Net cash farm income	1,205	7,601	7,369	7,252
Depreciation	314	1,038	1,015	1,015
Net farm income	891	6,563	6,354	6,237

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

average annual gross income of $58 from 7.2 cords of hardwood pulpwood not merchantable as stumpage. The cost of harvesting, however, includes $44 annually for operation, maintenance, and depreciation of the power saw. The annual net farm income under Plan II is only $42 higher than for Plan IV, however, because under extensive forestry all merchantable sawtimber (72 MBF) is to be cut during the decade whereas only 13 M are to be cut under intensive forestry.

By the second decade, however, the sort of comparative relationship develops among the three new plans' annual net farm incomes that is repeated in succeeding decades. The highest net farm income is achieved under Plan II--over $300 more than under Plan IV, and Plan III is over $100 above Plan IV. These annual differentials are increased in the stable period to approximately $1,600 and $1,050 respectively (See Table 26).

Alternative plans with purchase of additional acreage

In the long run with intensive forest management, if the farmer sells stumpage only (Plan III), he will need on the average not more than 1.4 man-days a year on his planned acreage. During the first decade he will need a total of 120 days, an average of 12 days a year, primarily for timber stand improvement, but thereafter not over 0.9 a year except in the seventh decade which will require 3.6 days annually. Thus after the first decade, to use an extra 73 of the 75 man-days available for forestry, he could expand his acreage 52-fold by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 4,876.

TABLE 26.--Condensed annual financial summary for stable decades, Unit 5

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$1,375	$2,262	$2,262	$2,262
Livestock	1,035	100	100	100
Livestock products	0	12,000	12,000	12,000
Forest products	0	1,738	1,093	37
Total receipts	$2,405	$16,100	$15,455	$14,399
Cash operating expenses	1,200	7,176	7,135	7,135
Net cash farm income	1,205	8,924	8,320	7,264
Depreciation	314	1,056	1,015	1,015
Net farm income	891	7,868	7,305	6,249

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

If this land is bought and improvement work and planting done in the first decade, he will need to hire an extra 564 man-days during that decade. If he pays a wage of $10 to $15 a man-day, or an average annual labor cost ranging between $564 and $846; and if he charges it against the average annual stumpage income of $2,072, the average annual net stumpage income will be between $1,226 and $1,508 for the first ten years.

The increased investment of over $76,500 in 4,784 acres of

woodland would thus add somewhat less than $1,500 annually, say $1,400, to net farm income during the first decade, a return of 1.2 percent. During the second decade it would add almost $7,400 annually, a return of 6.5 percent on the additional investment in woodland. The rate would be 5.1 percent during the third decade, 19 percent during the fourth, and would be over 38 percent in all succeeding decades, leveling off to an average of 50 percent in the stable period.

If forest products are sold at roadside (Plan II), the annual number of man-days needed for forest management and harvesting during the development period will not exceed 37 except in the seventh decade, which calls for 78. Also in the stable period the average needed will not exceed 41. With 75 man-days available annually, at least 34 of these would be in excess during all but the seventh decade.

If the farmer wished to make fuller use of these 34 man-days annually, he could buy an additional 76 acres of wooded and idle land similar to what he owns now. For the seventh decade this would mean hiring annually 65 man-days.

The enlarged total acreage would be 168, from which the contribution to annual net income would be $208 during the first decade and considerably more in the second and later decades. The second decade would yield annually $640 toward the farm's net annual income, and the stable decades, over $3,000. These increased annual net incomes would be $94 more in the first decade than Plan II without the additional 76 acres, $289 in the second decade, and

$1,368 in the stable decades. The rates of marginal annual returns during these decades on the $1,812 investment would therefore be approximately 5 percent, 16 percent, and 75 percent, respectively.

The 52-fold woodland acreage increase for intensive forest management with sale of stumpage only (Plan III expanded) is not likely to be implemented for at least several years, because the owner can be expected to have some difficulty in obtaining additional credit until considerable portions of the loans for agricultural improvement have been repaid. Credit for the $1,800 investment needed for the 76-acre expansion under Plan II, however, should not be difficult to secure in view of the particularly favorable profit outlook for this modification.

Unit 6--A Cotton-Beef-Sheep-Forestry Farm

This 318-acre farm currently has 46 acres in agricultural uses (almost 10 in cotton, 10 in corn, 20 in lespedeza pasture, 5 in hay, and 1 in truck crops), 156 acres in woodland and brush, and 116 acres idle or in miscellaneous uses such as roads, buildings, and farmyards. The small acreage in agricultural uses is regrettably low inasmuch as the soils on almost half the total acreage are good for agriculture, 16 percent being suitable for permanent pasture, 13 percent for temporary pasture, and 15 percent for crops. Thus current agricultural operations use about a third of the acreage suitable for farming and a seventh of the total property. Alternative plans for fuller use of the land will redistribute the acreage with a 12-percent increase in woodland area

and a tripling of open agricultural land, but 5 acres will continue in miscellaneous uses. The largest shift in acreage will be an increase of 70 acres in pasture--the proposed total being 90, instead of 20 as at present. Twenty acres of this increase will be in pasture only temporarily, however, with a possible shift later to cropland or permanent pasture. Hay acreage is to be increased to 23 from the present 5. Corn production will be allocated 15 acres, an increase of 5, and the cotton acreage will remain unchanged from the present almost 10, in compliance with the federal program designed to control cotton production by acreage limitation. Loblolly pine will be planted on 18 acres of idle land ill-suited to agriculture.

Livestock production will be expanded, as permitted by the larger pasture acreage, to over 77 times the present total. Most important, a sheep enterprise will be added, but also a herd of beef cattle will be obtained and the small present dairy production will be continued. The numbers of each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Dairy cows	2	2	0
Beef cows	0	15	15
Bull	0	1	1
Yearling calves sold	1	11	10
Ewes	0	100	100
Rams	0	3	3
Lambs	0	100	100
Total	3	232	229

This proposed budgeting of agricultural resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net income is assumed to be valued highly enough by him to be worth the added responsibility and work required for carrying out the future operations.

Improved land use on this farm calls for the woodland to occupy over half (174 acres) of the total area. At present brush occupies some of this area, and idle land comprises another third of the total, inasmuch as a bare seventh is used for agriculture. All of the woodland is in poorly stocked upland hardwoods, and one-sixth of the woodland area produces such slow-growing trees that conversion of the stand to a loblolly pine plantation is indicated, in addition to the 18-acre plantation on idle open land.

The present stumpage value of the entire 156-acre woodland is about $900 for 91 MBF of small and large sawtimber. Expansion of the agricultural land to 49 acres for crops, 50 acres for permanent pasture and 40 acres for temporary pasture will use all the land suitable for these purposes but will still leave 174 acres for timber. The total value of the present 156 acres of forest (market value of bare land plus stumpage value) is approximately $3,400 and the 162 acres of agricultural land are worth about $8,100. The combined value of buildings, livestock, feed, machinery, and other equipment is $1,700. Thus the total investment in the farm is $13,200.

The present farm operation has required an average annual outlay of labor of 172 man-days from the farm family. The work load on a cotton farm is heaviest in the spring and early summer and again in the fall. Between these periods there is time for other work, if it is available.

The opportunities for improved living on this farm lie in fuller use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. The farmer narrows the alternatives down to a few, in this case, four, after talking with agricultural specialists and foresters and considering his own capabilities and resources.

Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares the most attractive alternatives with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most desirable in relation to his own personal scale of combined criteria.

If the owner continues with his present farm operation, Plan I, he proposes to sell the farm as soon as he can get $16,375. By investing this amount elsewhere at four percent he can equal his present net farm income of $655 from the farm and save property taxes besides.

By adopting and implementing the plan (Plan II) indicated here to be his selection, however, within ten years the farmer will be able to increase his net farm income to over three times its present value and to achieve a much fuller use of his various resources. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as depreciation) over a broader base. Over the development period this plan results in a considerable increase in total investment: from $13,200 to almost $47,700. Of this greater amount, however, almost $24,100 is the stumpage value of the residual timber after six decades of management, a $23,200 increase but not directly an out-of-pocket cost.

Similarly, though to a much smaller degree, $10,800 will be the value of the farm's improved 144 acres of agricultural land when modern methods of land treatment have raised the real estate value from $50 to $75 an acre (See Table 27). The original agricultural land total of 162 acres valued at $8,100 will be increased in value by $3,600 for this reason, but 18 acres of it will drop in value $600 when it is shifted from miscellaneous agricultural use or idleness into forest use--from a real estate market value of $50 an acre, cleared, to $16 an acre, forested.

Thus the net increase in land value of the entire farm will be only $3,000. The productivity value increase will be many times greater, however, even over only the first decade, both on the agricultural land and on the forest land.

TABLE 27.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 6

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	162	$ 8,100	144	$10,800	144	$10,800
Forest land[f]	156	2,496	174	2,784	174	2,784
Buildings, live-stock, and other[g]	. .	1,700	. .	10,000	. .	10,000
Stumpage	. .	910	. .	24,085[h]	. .	1,400[h]
Total	318	$13,026	318	$47,669	318	$24,984

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.
[h]Average in the long run.

Approximately three-fourths ($25,875) of the increase in total farm value during the 60-year development period is due to the fuller timber stand and appreciation of 144 acres of agricultural land. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $1,700 to $10,000 will have to be provided for in the first couple of years of the new program. Some of this can be paid for by cash on hand, but most of it will require a number of years for repayment, using such devices as short-term credit, real estate mortgages (or second mortgages), and preferably intermediate-term credit for construction of buildings.

Assuming that the net farm income under the chosen plan will be at least $1,450 for the first two years and at least $2,100 thereafter, the farmer will be able to pay interest and principal on his debt at the rate of $800 at first and then $1,400 and still have a disposable income equal to his present one. Therefore even if the entire $8,300 for direct expenditures is borrowed immediately, it can be paid off (with 6-percent interest compounded annually) within 9 years.

Under the new plan the farm family will have available 2.0 man-equivalents of labor. This will be about 600 man-days if spread fairly evenly throughout the year. Somewhat over half of this labor will be needed for the agricultural enterprises: 334 man-days. The remaining 266 man-days could be used for forest work if needed. During the first decade of intensive forest management, however, only 248 man-days of labor will be needed--about 25 a year--to include harvesting of timber products for sale at roadside.

The expected sale of these products for the decade totals $2,795, of which $910 would be stumpage value if the trees were sold on the stump (See Appendix, Table 6-1). No pulpwood stumpage value is included, as only sawtimber is merchantable. Inasmuch as the market value of hardwood pulpwood stumpage is expected to remain zero for an indefinite period in the future, the remaining $1,885 can be attributed to harvesting (at $14.50 a man-day for the necessary 130 days). Of the total labor required over the decade, however, 118 days will be in forest management and improvement work. If the returns to this labor were to be paid at the same rate as the harvesting labor, the stumpage return as a source of funds would be woefully inadequate.

In view of the fact that the management and improvement work can be expected to increase the potential value of the residual stand more than the removal of the harvested products will have decreased it, the farmer might well consider the management labor as an investment for which he should expect no return until later in the development period.

He may prefer to allocate the roadside products' income by equal division among the total number of man-days for harvesting and management labor required over the decade (including the stumpage value of the harvested trees, on the ground that removal of these merchantable trees is part of the over-all improvement operation prescribed for the woodland area and needs no financial return to the land factor to justify the cutting). This would result in a wage of $11.27 a man-day for the 248 man-days of labor if no returns to other factors were considered. Any additional wage for labor performed in the first decade would have to be

either foregone, postponed until the next decade, or financed out of agricultural income.

In the long run if prices and volumes do not depart seriously from the estimates for the stable period, the average decadal income from roadside sales will be about $28,400 and labor requirements for all forest work will average 814 man-days.

The average decadal value of stumpage to be cut will be about $17,500. If a minimum 4-percent rate of return is required on the average investment of $24,100 in stumpage and $2,800 in forest land, $996 would have to be subtracted from the annual stumpage value of $1,752 of the harvested products, leaving $756 as an additional return to land, timber, and labor. As an average of only 31 man-days of labor is needed each decade for management purposes, less than 4 days a year, practically all of the stumpage returns should be attributed to the timber and land--equal to over 6 percent of the investment.

The difference of over $10,872 between roadside and stumpage sale value would require 783 man-days of labor. These man-days would therefore be worth $13.88 each to the owner who would supply the necessary equipment as well as labor for felling and skidding. This would provide a 2.8 percent increase over the comparable average harvesting man-day return of $13.50 during the development period. The rise of the stumpage return to 6.5 percent from the 4.1 of the development period is a far more pronounced increase; 58 percent.

Subtraction of equipment cost of about $2 a man-day would

make an adequate allowance for operation and depreciation of a power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about $11.50 during the development period and $12.00 during the stable period.

In the case of this farm, where more man-days are available than are needed for forest management and harvesting either in the first decade or in succeeding decades, intensive forestry with harvesting to roadside is clearly the best alternative. This is the important feature of Plan II that differentiates it from Plans III and IV. The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 28). In the first decade the annual net farm income under Plan II is $139 and $230 higher than for Plans III and IV, respectively.

In the second decade the cutting under Plan IV of a large volume of stumpage (which by then becomes heavy enough per acre to be merchantable) results in an average annual net farm income higher than Plans II and III. At that time under extensive forestry all merchantable sawtimber (273 MBF) is to be cut, whereas no sawtimber is to be cut under intensive forestry. Plan II's second decade forest products' income comes solely from pulpwood obtained by the first thinning of the young 26-acre loblolly pine

TABLE 28.--Condensed annual financial summaries for first and second decades, Unit 6

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
	First decade			
Receipts				
Crops	$1,320	$2,051	$2,051	$2,051
Livestock	20	2,860	2,860	2,860
Livestock products	0	312	312	312
Forest products	0	280	91	0
Total receipts	1,340	5,503	5,314	5,223
Cash operating expenses	570	2,638	2,613	2,613
Net cash farm income	770	2,865	2,701	2,610
Depreciation	115	705	680	680
Net farm income	655	2,160	2,021	1,930
	Second decade			
Receipts				
Crops	1,320	2,051	2,051	2,051
Livestock	20	2,860	2,860	2,860
Livestock products	0	312	312	312
Forest products	0	242	73	273
Total receipts	1,340	5,465	5,296	5,496
Cash operating expenses	570	2,631	2,613	2,613
Net cash farm income	770	2,834	2,683	2,883
Depreciation	115	698	680	680
Net farm income	655	2,136	2,003	2,203

[a]Plan I--present farm operation with no timber sales.

[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.

[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.

[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

plantation, and is reduced by the cost of harvesting which includes $36 annually for operation, maintenance, and depreciation of the power saw.

By the third decade, however, the sort of comparative relationship develops among the three new plans' annual net farm incomes that is repeated in succeeding decades. The highest net farm income is achieved under Plan II--over $400 more than under Plan IV, and Plan III is $66 above Plan IV. These annual differentials are increased in the stable period to approximately $2,600 and $1,700, respectively (See Table 29).

TABLE 29.--Condensed annual financial summary for stable decades, Unit 6

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$1,320	$2,051	$2,051	$2,051
Livestock	20	2,860	2,860	2,860
Livestock products	0	312	312	312
Forest products	0	2,839	1,752	80
Total receipts	1,340	8,062	6,975	5,303
Cash operating expenses	570	2,694	2,613	2,613
Net cash farm income	770	5,368	4,362	2,690
Depreciation	115	761	680	680
Net farm income	655	4,607	3,682	2,010

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

Alternative plans with purchase of additional acreage

In the long run with intensive forest management, if the farmer sells stumpage only (Plan III), he will need on the average not more than 3.1 man-days a year on his present acreage. During the first decade he will need a total of 118 days, an average of 12 days a year, primarily for timber stand improvement, but thereafter not over 3.1 a year except in the seventh decade, which will require 5.7 days annually. Thus after the first decade to use an extra 263 of the 266 man-days available for forestry, he could expand his acreage 85-fold by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 14,964.

If this land is bought and improvement work and planting done in the first decade, he will need to hire an extra 749 man-days during that decade. If he pays a wage of $10 to $15 a man-day, or an average annual labor cost ranging between $750 and $1,125; and if he charges it against the average annual stumpage income of $7,826, the average annual net stumpage income will be between $6,700 and $7,075 for the first ten years.

The increased investment of $313,990 in 14,790 acres of woodland would thus add about $6,800 annually to net farm income during the first decade, a return of 2.2 percent. During the second and third decades the return would be somewhat less. The rate of return on the additional investment in woodland would be almost 21 percent during the fourth decade, and would be over 37 percent in all succeeding decades, leveling off to an average of 47 percent in the stable period.

If forest products are sold at roadside (Plan II), the annual number of man-days needed for forest management and harvesting during the development period will not exceed 73 except in the seventh decade, which calls for 117. Also in the stable period the average needed will not exceed 82. With 266 man-days available annually, at least 184 of these would be in excess during all but the seventh decade.

If the farmer wished to make fuller use of these 184 man-days annually, he could buy an additional 390 acres of wooded and idle land similar to what he owns now. For the seventh decade this would mean hiring annually 113 man-days.

The enlarged total acreage would be 564, from which the contribution to annual net income would be $746 during the first decade and considerably more in the third and later decades. The third decade would yield annually nearly $1,400 toward the farm's net annual income, and the stable decades, almost $8,700. These increased annual net incomes would be $516 more in the first decade than Plan II without the additional 390 acres, $966 in the third decade, and $6,000 in the stable decades. The rates of marginal annual returns during these decades on the $8,280 investment would therefore be approximately 6 percent, 12 percent, and 72 percent, respectively.

Neither of these last two modifications of the intensive forestry alternatives are likely to be implemented for at least several years, because the owner can be expected to have some difficulty in obtaining additional credit until considerable portions of the loans for agricultural improvement have been repaid.

If he is eager to finance forest area expansion under either of these proposals, however, and can do so, his long-run profit position will be greatly enhanced.

Unit 7--A Cotton-Hog-Forestry Farm

This 2,601-acre operating unit currently has 191 acres in agricultural uses divided among four small farming units. There are totals of 45 acres in cotton, 40 in corn, 25 in lespedeza hay, 80 in lespedeza pasture, and 1 acre in truck crops. The rest of the area consists of 2,022 acres in woodland and brush, and 388 acres idle or in miscellaneous uses such as roads, buildings and farmyards. The soils on this unit are inadequate to support indefinitely such a degree of agricultural activity as at present; in fact only half (96 acres) of the area in agricultural uses should continue to be farmed, and 96 percent of the total acreage should be forested.

In addition to specifying removal of three of the four families sharing the area, alternative plans for better land use call for a 24-percent increase in forest acreage. This will be the largest shift in land use, achieved by converting 388 acres of idle land and 95 acres of agricultural land into loblolly pine plantations. The only farmed acreages to remain unchanged will be those in corn and truck crops. The allocation for cotton will be reduced to 10 acres, likewise for lespedeza hay and lespedeza pasture. Twenty acres, however, will be devoted to permanent pasture and five acres will be planted to oats.

Livestock production will be expanded, as permitted by the pasture improvement and reduction of the dairy herd, to almost three times the total under the present farm operation, Plan I. The swine enterprise will be more than quadrupled, but only two milk cows will be left from the 16 existing dairy cattle. The numbers of each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Dairy cows	9	2	-7
Bulls	2	0	-2
Calves raised	5	0	-5
Sows	2	12	10
Boars	1	1	0
Hogs raised	18	84	66
Total	37	99	62

This proposed budgeting of agricultural resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net income is assumed to be valued highly enough by him to be worth the added responsibility and work required for carrying out the future operations.

Improved land use on this farm calls for the woodland to occupy over 2,500 acres, 96 percent of the total area instead of the present 78 percent. Currently idle land comprises one-seventh of the total, inasmuch as just over seven percent is used for agriculture. Over two-thirds (1408 acres) of the present woodland is in upland hardwoods, a twelfth (160 acres) is in lower slope hardwoods, and over a fifth (454 acres) is in bottomland hardwoods.

Forty-five percent of the upland hardwood area (640 acres) and six percent (27 acres) of the bottomland area produce such slow-growing trees that conversion of the stands to loblolly pine plantations is indicated, in addition to the 483 acres of plantation on open agricultural land.

The present stumpage value of the entire 2,022-acre woodland is $29,800 for almost 3,000 MBF of small and large hardwood sawtimber. Reduction of the agricultural land to 66 acres for crops, and 30 acres for pasture will increase by 483 acres the area available for forest use. The total value of the present 2,022 acres of forest (market value of bare land plus stumpage value) is almost $62,300 and the current 579 acres of agricultural land are worth almost $29,000. The combined value of buildings, livestock, feed, machinery, and other equipment is over $7,200. Thus the total investment in the farm is almost $98,400.

The present farm operations have required an average annual outlay of labor of 868 man-days from the four farm families, too small an average amount coming from each of the eight man-equivalents to constitute an efficient use of the human resource or to return an adequate income to more than one family. Economic use of the natural resources (land and timber), in conjunction with the adequate amount of capital that could be obtained, calls for removal of three families and more work per man-equivalent from the family remaining to manage and operate the reorganized unit. The work load on a cotton enterprise is heaviest in the spring and early summer and again in the fall. Between these periods there is labor available for other work, if labor-using operations can be effectively scheduled.

The opportunities for improved living on this farm lie in better use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. The farmer narrows the alternatives down to a few, in this case, four, after talking with agricultural specialists and foresters and considering his own capabilities and resources.

Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares the most attractive alternatives with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most

desirable in relation to his own personal scale of combined criteria.

If the owner continues with the present farm operation, Plan I, he proposes to sell the farm as soon as he can get close to $88,000. By investing this amount elsewhere at four percent he can equal the present net farm income total of $3,520 from the farm and save property taxes besides.

By adopting and implementing the alternative plan indicated here to be his selection, however, within ten years the farmer will be able to increase the net farm income for his own family to almost double the present total for the four families and to achieve a much fuller use of the various resources. This result is based on the assumption that he will choose Plan II, which includes intensive forest management, harvesting of sawlogs and pulpwood, and sale of these timber products at roadside. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as depreciation) over a broader base. Over the development period this plan results in a considerable increase in total investment: from almost $98,400 to almost $468,300. Of this greater amount, however, over $410,100 is the stumpage value of the residual timber after six decades of management, a $380,300 increase but not directly an out-of-pocket cost.

Similarly, though to a much smaller degree, $7,200 will be the value of the farm's improved 96 acres of agricultural land when modern methods of land treatment have raised the real estate value from $50 to $75 an acre (See Table 30).

TABLE 30.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 7

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	579	$28,950	96	$7,200	96	$7,200
Forest land[f]	2,022	32,352	2,505	40,080	2,505	40,080
Buildings, live-stock, and other[g]	. .	7,250	. .	10,850	. .	10,850
Stumpage	. .	29,806	. .	410,121[h]	. .	20,050[h]
Total	2,601	$98,358	2,601	$468,251	2,601	$78,180

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.
[h]Average in the long run.

The original agricultural land total of 579 acres valued at $28,950 will be increased in value $2,400 for this reason, but 483 acres of it will drop in value $16,422 when it is shifted from various agricultural uses or idleness into forest use--from a real estate market value of $50 an acre, cleared, to $16 an acre, forested. Thus the net change in land value of the entire farm will be a decrease of $14,000. The productivity value increase will largely offset this, however, even within the first decade, both on the agricultural land and on the forest land.

Practically the entire increase in total farm value during the 60-year development period is due to the fuller timber stand. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $7,250 to $10,850 will have to be provided for in the first couple of years of the new program. Some of this can be paid for by cash on hand, but most of it will require a number of years for repayment, using such devices as short-term credit, real estate mortgages (or second mortgages), and preferably intermediate-term credit for construction of buildings.

Assuming that the net farm income under Plan II will be at least $4,200 for the first two years and at least $5,200 thereafter, the farmer will be able to pay interest and principal on his debt at the rate of $1,300 at first and then $2,300 and still have a disposable income equal to the present total. Therefore even if the entire $3,600 for direct expenditures is borrowed immediately, it can be paid off (with 6-percent interest compounded annually) in less than 3 years.

Under the new agricultural plan the farm family will have available 3.0 man-equivalents of labor. This will be about 900 man-days if spread fairly evenly throughout the year. Less than half of this labor will be needed for the agricultural enterprises: 429 man-days. The remaining 471 man-days could be used for forest work if needed. During the first decade of intensive forest management 4,940 man-days of labor will be needed under Plan II--about 494 a year--to include harvesting to roadside.

The expected sale of these products for the decade totals $45,029, of which $14,550 would be stumpage value if the trees were sold on the stump (See Appendix, Table 7-1). No hardwood pulpwood stumpage value is included, as only sawtimber stumpage and pine pulpwood stumpage are merchantable. Inasmuch as the market value of hardwood pulpwood stumpage is expected to remain zero for an indefinite period in the future, the remaining $30,479 could be attributed to labor used in harvesting (at $12.28 a man-day for the necessary 2,483 days). Of the total labor over the decade, however, nearly half would have been in forest management and improvement work: 2,457 man-days. If the returns to this labor were to be paid at the same rate as the harvesting labor, the stumpage return as a source of funds would be less than half adequate.

In view of the fact that the management and improvement work can be expected to increase the potential value of the residual stand more than the removal of the harvested products will have decreased it, the farmer might well consider the management labor as an investment for which he should expect no return until later in the development period.

He may prefer to allocate the roadside products' income by equal division among the total number of man-days for harvesting and management labor required over the decade (including the stumpage value of the harvested trees, on the ground that removal of these merchantable trees is part of the over-all improvement operation prescribed for the woodland area and needs no financial return to the land factor to justify the cutting). This would result in a wage of $9.12 a man-day for the 4,940 man-days of labor if no returns to other factors were considered. Any additional wage for labor performed in the first decade would have to be either foregone, postponed until the next decade, or financed out of agricultural income.

In the long run if prices and volumes do not depart seriously from the estimates for the stable period, the average decadal income from roadside sales will be over $485,900 and labor requirements for all forest work will average 11,450 man-days.

The average decadal value of stumpage to be cut will be $312,200. If a minimum 4-percent rate of return is required on the average investment of $410,100 in stumpage and almost $40,100 in forest land, $18,008 would have to be subtracted from the annual stumpage value of $31,220 of the trees cut, leaving $13,212 as an additional return to land, timber, and labor. As an average of only 366 man-days of labor is needed each decade for management purposes, less than 37 days a year, practically all of the stumpage returns (except about $400 for management labor) should be attributed to the timber and land--the net return would be equal to 6.8 percent of the investment.

Thus under Plan III, providing for intensive forest management with sale of stumpage only, the labor requirements are far too small to constitute an opportunity to use adequately the farm family man-days available. Consequently, although Plan III increases net farm income considerably by returning over 6 percent on the forest investment, it contributes little wage income. The problem of finding an economic outlet for the equivalent of over one man-year of labor would remain if Plan III were to be adopted.

To obtain the decadal difference of over $173,700 between roadside and stumpage sale value, Plan II requires 11,084 man-days of labor. These man-days would therefore be worth $15.67 each to the owner who would supply the necessary equipment as well as labor for felling and skidding. This value is comparable to the average harvesting man-day return of $16.22 during the development period. The rise of the stumpage return to 6.9 percent from the 5.3 of the development period is a substantial increase, however: 30 percent.

Subtraction of equipment cost of about $2 a man-day would make an adequate allowance for operation and depreciation of a power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about $14.20 during the development period, and $13.65 during the stable period.

In the case of this operating unit, the number of man-days of farm family labor available for forestry are not quite sufficient for intensive management and harvesting to roadside in the first decade, and although assumed constant in succeeding decades these are far less adequate in relation to the increasing harvesting requirements. Nevertheless, Plan II is clearly the most profitable alternative for the operator despite the fact that he will have to hire outside labor for management work or harvesting every decade--from an average of 23 man-days a year during the first decade to 1,617 annually in the seventh decade and averaging 674 in the stable period.

The opportunity for full use of all the family labor available is one of the key features of Plan II that makes it preferable to the farmer over Plans III and IV. Under Plan IV no effort is expended for forest management, but timber is sold as often as it becomes merchantable as stumpage: whenever a portion of the woodland acreage accumulates enough timber to attract a stumpage buyer--usually an average volume per acre of about 1,500 board feet.

The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 31). In the first decade the annual net farm income under Plan II is $1,830 more than under Plan III because the income from roadside sales is increased by the higher price for a volume of cut products over a similar volume of stumpage, and also includes an average annual gross income of $1,393 from 174 cords of hardwood pulpwood not merchantable as stumpage. The cost of harvesting, however, includes $230 for hiring woods labor at $10 a man-day and $988 annually for operation, maintenance, and depreciation of the power saw. The annual net farm income under Plan II is only $304 higher than for Plan IV, however, because under extensive forestry all merchantable sawtimber (2,981 MBF)

TABLE 31.--Condensed annual financial summaries for first and second decades, Unit 7

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
		First decade		
Receipts				
Crops	$6,228	$2,163	$2,163	$2,163
Livestock	200	2,706	2,706	2,706
Livestock products	0	0	0	0
Forest products	0	4,503	1,455	2,981
Total receipts	6,428	9,372	6,324	7,850
Cash operating expenses	3,085	3,109	2,385	2,385
Net cash farm income	3,343	6,263	3,939	5,465
Depreciation	435	1,034	540	540
Net farm income	2,908	5,229	3,399	4,925
		Second decade		
Receipts				
Crops	6,228	2,163	2,163	2,163
Livestock	200	2,706	2,706	2,706
Livestock products	0	0	0	0
Forest products	0	8,085	2,682	336
Total receipts	6,428	12,954	7,551	5,205
Cash operating expenses	3,085	3,703	2,385	2,385
Net cash farm income	3,343	9,251	5,166	2,820
Depreciation	435	1,088	540	540
Net farm income	2,908	8,163	4,626	2,280

[a]Plan I--present farm operation with no timber sales.

[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.

[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.

[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

is to be cut during the decade whereas only 1,103 M are to be cut under intensive forestry.

By the second decade, however, the sort of comparative relationship develops among the three new plans' annual net farm incomes that is repeated in succeeding decades despite the multiplied costs of harvesting included in "cash operating expenses" and "depreciation" for Plan II. Annual harvesting costs of $770 for hired labor and $548 for power saw operation and maintenance are combined in operating expenses, and $548 is budgeted for depreciation of the power saw and the forest enterprise share of farm equipment used partly for woods work. The highest net farm income is achieved under Plan II--almost $5,900 more than under Plan IV, and Plan III is over $2,300 above Plan IV. These annual differentials are increased in the stable period to almost $37,200 and $30,200, respectively, despite Plan II's harvesting costs of $8,088 for hired labor and a total of $2,290 for operation, maintenance, and depreciation of the power saw and other equipment (See Table 32).

Plan III with purchase of additional acreage

In the long run with intensive forest management, if the farmer sells stumpage only (Plan III), he will need on the average not more than 37 man-days a year on his planned acreage. During the first decade he will need a total of 2,457 man-days, an average of 246 a year, in about equal numbers over the decade for planting pine and for timber stand improvement, totaling 1,265 and 1,192, respectively. For the next five decades he will need only

25 a year for management until the seventh decade, which will require 94 days annually. Thus after the first decade, to use an extra 434 of the 471 man-days available for forestry, he could expand his acreage 11.7 times by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 31,814.

TABLE 32.--Condensed annual financial summary for stable decades, Unit 7

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$6,228	$ 2,163	$ 2,163	$2,163
Livestock	200	2,706	2,706	2,706
Livestock products	0	0	0	0
Forest products	0	48,593	31,220	1,047
Total receipts	6,428	53,462	36,089	5,916
Cash operating expenses	3,085	11,618	2,385	2,385
Net cash farm income	3,343	41,844	33,704	3,531
Depreciation	435	1,685	540	540
Net farm income	2,908	40,159	33,164	2,991

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

If this land is bought and improvement work and planting done in the first decade, he will need to hire an extra 26,536 man-days during that decade. If he has to pay a labor wage of

$10 a man-day, the average annual labor cost of $26,536 will exceed the average annual stumpage income of $18,478.

If the farmer were to prefer Plan III with this expanded acreage (perhaps because the harvesting work of Plan II appears unacceptable to him) and could finance the first decade investment in land and hired labor, income thereafter would substantially exceed expenses. The next five decades would require no hiring of outside labor and would produce many times larger stumpage returns. In each of these decades the farmer would be able to make use of 3,181 of the family's available 4,710 man-days, and in the stable decades, 4,700. From these they could impute adequate wages from the increasing stumpage returns of successive decades.

Only in the seventh decade would hired labor be needed--7,234 man-days--costing $72,340 at $10 a man-day. The total stumpage income for that decade, however, would be $10,129,672, thus leaving $10,057,332, or $1,005,733 annually, as the net return to the total land investment of $509,024 and the average $5,208,537 investment in the growing stock accumulated during the development period. The annual net rate of return to land and timber in the last decade of the development period is therefore 17.6 percent, leveling off in the stable period to 6.8 percent, as has been already stated.

The main attraction of the expanded acreage is that it provides an opportunity to use productively the available family labor. The principal detraction, however, is the large cash investment required initially to pay for land purchase, stand improvement, and planting of pine on large acreages. Unless the expansion is spread over several decades or limited to a considerably smaller total acreage, the problems of land acquisition and financing will probably be too large to have a practicable solution.

Unit 8--A Cotton-Beef-Forestry Farm

This 2,408-acre operating unit currently has 120 acres in agricultural uses divided among three small farming units. There are totals of 30 acres in cotton, 25 in corn, 10 in lespedeza hay, 50 in lespedeza pasture, and 5 in truck crops. The rest of the area consists of 1,634 acres in woodland and brush, and 654 acres idle or in miscellaneous uses such as roads, buildings and farmyards. The small acreage in agricultural uses is regrettably low inasmuch as the soils on almost a fifth of the total acreage are good for agriculture, 8 percent being suitable for permanent pasture, 4 percent for lespedeza pasture, and 6 percent for crops. Thus current agricultural operations use about a fourth of the acreage suitable for farming and a twentieth of the total property.

Alternative plans for better land use call for removal of two of the three families sharing the area and redistribution of the acreage with a 20-percent increase in woodland area and almost a tripling of land in agricultural use, but 10 acres will continue in miscellaneous uses.

The largest shift in acreage will be establishment of loblolly pine plantations on 320 acres of idle land ill-suited to agriculture. Use of another 324 acres of idle land will permit permanent pasture to be developed on 200 acres and the lespedeza pasture to be doubled--to 100 acres. Lespedeza hay acreage will be increased to 40, and 40 acres will also be planted to Balbo rye. The allocation for cotton will be reduced to 8 acres, that for corn to 20 acres and the truck crop acreage will be cut to a one-acre garden. Thirty-five acres, however, will be devoted to corn and cane silage.

Livestock production will be expanded, as permitted by the pasture enlargement and improvement, together with reduction of the dairy herd and elimination of the swine enterprise. A large beef cattle enterprise will be established, increasing 13-fold the number of animals kept under the present farm operation, Plan I.

The numbers of each kind of livestock are as follows:

	Present number	Proposed number	Increase in number
Dairy cows	5	2	-3
Beef cows	0	100	100
Bulls	0	4	4
Heifers under one year	0	45	45
Steers sold	0	45	45
Heifers sold	0	35	35
Sows	1	0	-1
Hogs raised	10	0	-10
Total	16	231	215

This proposed budgeting of agricultural resources will produce the most readily practicable reorganization acceptable to the individual farmer managing this farm. The expected increased net income is assumed to be valued highly enough by him to be worth the added responsibility and work required for carrying out the future operations.

Improved land use on this farm calls for the woodland to occupy 1,954 acres, 81 percent of the total area instead of the present 68 percent. Currently idle land comprises slightly over one-fourth of the total, inasmuch as 5 percent is used for agriculture. Almost three-fourths (1,188 acres) of the present woodland is in upland hardwoods, an eighth (204 acres) is in lower slope hardwoods, and a seventh (242 acres) is in bottomland hardwoods. Seventeen percent of the upland hardwood area (198 acres) produce such slow-growing trees that conversion of the stands to loblolly pine plantations is indicated, in addition to the 320 acres of plantation on idle open land.

The present stumpage value of the entire 1,634-acre woodland is almost $22,700 for 2,268 MBF of small and large hardwood sawtimber. Expansion of the agricultural land to 144 acres for crops, and 300 acres for pasture will use all the land suitable for these purposes but will still allow for enlargement of the forest acreage to 1,954. The total value of the present 1,634 acres of forest (market value of bare land plus stumpage value) is over $43,800 and the current 774 acres of agricultural land are worth $38,700. The combined value of buildings, livestock, feed, machinery, and other equipment is over $5,100. Thus the total investment in the farm is over $92,600.

The present farm operations have required an average annual outlay of labor of 528 man-days from the three farm families, too small an average amount coming from each of the five man-equivalents to constitute an efficient use of the human resource or to return an adequate income to more than one family. Economic use of the natural resources (land and timber), in conjunction with the adequate amount of capital that could be obtained, calls for removal of two families and more work per man-equivalent from the family remaining to manage and operate the reorganized unit. The work load on a cotton enterprise is heaviest in the spring and early summer and again in the fall. Between these periods there is labor available for other work, if labor-using operations can be effectively scheduled.

The opportunities for improved living on this farm lie in better use of the resources of land and labor. The prime essential is to obtain the money and advice to get started on a better farming system. Credit is commonly available from local banks or production credit associations. Advice is available from a number of government agencies for any of the various possible plans for operating the farm. The farmer narrows the alternatives down to a few, in this case, four, after talking with agricultural specialists and foresters and considering his own capabilities and resources.

Plan I calls for continuation of all aspects of the present operation. The three other alternatives all include the agricultural changes described at the beginning of the discussion of this unit. In addition, Plan II requires intensive forest management with harvesting and roadside sale of forest products. Plan III also requires intensive forest management but calls for sale of stumpage only, thus involving no labor for harvesting. Plan IV specifies merely extensive forestry and occasional unplanned sales of stumpage, with no labor allocated for any aspect of forest management.

Next, the farm owner compares the most attractive alternatives with regard to expected net income, capital and labor requirements, seasonality and type of enterprise, and other considerations of importance to him, and then selects the one most desirable in relation to his own personal scale of combined criteria.

If the owner continues with the present farm operation, Plan I, he proposes to sell the farm as soon as he can get nearly the value of his investment of $92,600. By investing this amount elsewhere at four percent he can receive $3,704 interest, $2,220 more than the present net farm income total of $1,464 from the farm and save property taxes besides.

By adopting and implementing the alternative plan indicated here to be his selection, however, within ten years the farmer will be able to increase the net farm income for his own family to more than quadruple the present total for the three families and to achieve a much fuller use of the various resources. This result is based on the assumption that he will choose Plan III, which specifies intensive forest management, and sale of stumpage. He will be able especially to use his time and land more completely and to spread overhead and certain special costs (such as depreciation) over a broader base. Over the development period this plan results in a considerable increase in total investment: from over $92,600 to over $391,200. Of this greater amount, however, almost $288,100 is the stumpage value of the residual timber after six decades of management, a $265,400 increase but not directly an out-of-pocket cost.

Similarly, though to a much smaller degree, $34,050 will be the value of the farm's improved 454 acres of agricultural land when modern methods of land treatment have raised the real estate value from $50 to $75 an acre (See Table 33). The original agricultural land total of 774 acres valued at $38,700 will be increased in value $11,350 for this reason, but 320 acres of it will drop in value $10,880 when it is shifted from various agricultural uses or idleness into forest use--from a real estate market value of $50 an acre, cleared, to $16 an acre forested. Thus the net increase in land value of the entire farm will be only $470. The productivity value increase will largely offset this, however, even within the first decade, both on the agricultural land and on the forest land.

Eighty-nine percent of the increase in total farm value during the 60-year development period is due to the fuller timber stand. The only major area of investment requiring direct expenditures is that of buildings, livestock, feed, machinery, and other equipment. Although not all of these must be paid for immediately, most of the increase from $5,125 to $37,881 will have to be provided for in the first couple of years of the new program. Some of this can be paid for by cash on hand, but most of it will require a number of years for repayment, using such devices as short-term credit, real estate mortgages (or second mortgages), and preferably intermediate-term credit for construction of buildings.

TABLE 33.--Acreage of agricultural and forest land and estimated market value of bare land and other investments under various plans of operation for Unit 8

Investment category	Present operation		Alternative plans			
	Plan I[a]		Plans II[b] and III[c]		Plan IV[d]	
	Acreage	Value	Acreage	Value	Acreage	Value
Agricultural land[e]	774	$38,700	454	$ 34,050	454	$ 34,050
Forest land[f]	1,634	26,144	1,954	31,264	1,954	31,264
Buildings, livestock, and other[g]	. .	5,125	. .	37,881	. .	37,881
Stumpage	. .	22,682	. .	288,073[h]	. .	15,600[h]
Total	2,408	$92,651	2,408	$391,268	2,408	$118,795

[a]Plan I--no timber sales.
[b]Plan II--intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--intensive forestry with sale of stumpage only.
[d]Plan IV--extensive forestry with sale of stumpage only.
[e]Including miscellaneous and idle land.
[f]Including brush land. Values are bare land values.
[g]Including feed, machinery, and other equipment.
[h]Average in the long run.

Assuming that the net farm income under Plan III will be at least $5,500 for the first two years and at least $6,800 thereafter, equipment. A

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the farmer will be able to pay interest and principal on his debt at the rate of $2,500 at first and then $3,800 and still have a disposable income equal to double the present total. Therefore even if the entire $32,756 for direct expenditures is borrowed immediately, the debt can be paid (with 6-percent interest compounded annually) within 14 years. And if the farmer were willing to keep his disposable income equal to the present net farm income until the debt is paid in full, he would be able to make payments at the rate of $4,000 for the first two years and then $5,300. In this event a debt of $32,756 would be paid within 9 years.

Under the new agricultural plan the farm family will have available 3.0 man-equivalents of labor. This will be about 900 man-days if spread fairly evenly throughout the year. Eighty-five percent of this labor will be needed for the agricultural enterprises: 767 man-days. The remaining 133 man-days, could be used for forest work if needed. If Plan II is adopted, requiring intensive forest management, harvesting of sawlogs and pulpwood, and sale of these timber products at roadside during the first decade 4,293 man-days of labor will be needed--about 429 a year.

The expected sale of logs and bolts for the decade totals $37,227, of which $10,188 would be stumpage value if the trees were sold on the stump (See Appendix, Table 8-1). No hardwood pulpwood stumpage value is included, as only sawtimber stumpage and pine pulpwood stumpage are merchantable. Inasmuch as the market value of hardwood pulpwood stumpage is expected to remain

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In view of the fact that the management and improvement work can be expected to increase the potential value of the residual stand more than the removal of the harvested products will have decreased it, the farmer might well consider the management labor as an investment for which he should expect no return until later in the development period.

Or he may prefer to allocate the roadside products' income by equal division among the total number of man-days for harvesting and management labor required over the decade (including the stumpage value of the harvested trees, on the ground that removal of these merchantable trees is part of the over-all improvement operation prescribed for the woodland area and needs no financial return to the land factor to justify the cutting). This would result in a wage of $8.67 a man-day for the 4,293 man-days of labor if no returns to other factors were considered. Any additional wage for labor performed in the first decade would have to be either foregone, postponed until the next decade, or financed out of agricultural income.

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do not depart seriously from the estimates, the average decadal income from the roadside sales of Plan II would be over $379,100 and labor requirements for all forest work would average 9,827 man-days.

The average decadal value of stumpage to be cut during stable decades will be $240,840. If a minimum 4-percent rate of return is required on the average investment of almost $288,100 in stumpage and over $31,200 in forest land, $12,773 would have to be subtracted from the annual stumpage value of $24,084 of the trees cut, leaving $11,311 as an additional return to land, timber, and labor. As an average of 247 man-days of labor is needed each decade for management purposes, less than 25 days a year, practically all of the stumpage returns (except about $300 for management labor) should be attributed to the timber and land--the net return would be equal to 7.4 percent of the investment.

Thus under Plan III, providing for intensive forest management with sale of stumpage only, the labor requirements are far too small to constitute an opportunity to use adequately the farm family man-days available. Consequently, although Plan III increases net farm income considerably by returning over 7 percent on the forest investment, it contributes little wage income. The problem of finding an economic outlet for the equivalent of over a third of a man-year of labor will remain if Plan III is adopted.

To obtain the decadal difference of over $138,300 between roadside and stumpage sale value, Plan II requires 9,580 man-days

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of labor. These man-days would therefore be worth $14.44 each to the owner who would supply the necessary equipment as well as labor for felling and skidding. This value is only a 2-percent increase over the average harvesting man-day return of $14.12 during the development period. The rise of the stumpage return to 7.5 percent from the 5.0 of the development period is a far more pronounced increase: 50 percent.

Subtraction of equipment cost of about $2 a man-day would make an adequate allowance for operation and depreciation of a power chain saw and also for a minor fractional share of the cost of the several pieces of equipment that are likely to be present anyhow on most farms. Thus the actual returns for harvesting labor alone (separated conceptually from the equipment needed) would be about $12.10 during the development period, and $12.45 during the stable period.

In the case of this operating unit, the number of man-days of farm family labor available for forestry are less than a third of the number needed for intensive management and harvesting to roadside in the first decade, and as they are assumed constant in succeeding decades, they become comparatively far less adequate in relation to the increasing harvesting requirements in each later decade until the stable period.

The fact that the farmer would have to hire and supervise a substantial amount of indispensable outside labor for management work or harvesting every decade is a serious disadvantage of Plan II. He would need to hire from an average of 296 man-days a year

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during the first decade to 12,745 annually in the seventh decade and averaging 850 in the stable period to supplement the family's 133 man-days. The opportunity for full use of all the family labor available is not a great enough advantage to compensate for the troubles of hiring a crew, managing the extensive woods operations, and becoming dependent on the presence, ability, and willingness of the various crew members.

The following condensed annual financial summaries for the first and second decades show the comparative net farm incomes for these decades (Table 34). In the first decade the annual net farm income under Plan II is $1,112 less than under Plan III despite the fact that the income from roadside sales is increased by the higher price for a volume of cut products over a similar volume of stumpage, and also includes an average annual gross income of $2,155 from 269 cords of hardwood pulpwood not merchantable as stumpage. The cost of harvesting on this unit is high, of course, including $3,060 for hiring woods labor at $10 a man-day and $878 annually for operation, maintenance, and depreciation of the power saw. The only expense under Plan III is $122 for hired labor for stand improvement work.

The annual net farm income under Plan II is $3,275 less then for Plan IV because under extensive forestry all merchantable sawtimber (2,268 MBF) is to be cut during the decade whereas only 366 M are to be cut under intensive forestry. Under Plan IV no effort is expended for forest management, but timber is sold as often as it becomes merchantable as stumpage: whenever a portion

TABLE 34.--Cond

Income and expense items
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TABLE 34.--Condensed annual financial summaries for first and second decades, Unit 8

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
	First decade			
Receipts				
Crops	$4,152	$2,066	$2,066	$2,066
Livestock	0	14,800	14,800	14,800
Livestock products	0	0	0	0
Forest products	0	3,723	1,019	2,268
Total receipts	4,152	20,589	17,885	19,134
Cash operating expenses	2,360	12,557	9,180	9,058
Net cash farm income	1,792	8,032	8,705	10,076
Depreciation	308	2,333	1,894	1,894
Net farm income	1,484	5,699	6,811	8,974
	Second decade			
Receipts				
Crops	4,152	2,066	2,066	2,066
Livestock	0	14,800	14,800	14,800
Livestock products	0	0	0	0
Forest products	0	8,638	2,841	956
Total receipts	4,152	25,504	19,707	17,822
Cash operating expenses	2,360	13,657	9,058	9,058
Net cash farm income	1,792	11,847	10,649	8,764
Depreciation	308	2,433	1,894	1,894
Net farm income	1,484	9,414	8,755	6,870

[a]Plan I--present farm operation with no timber sales.

[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.

[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.

[c]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

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of the woodland acreage accumulates enough timber to attract a stumpage buyer--usually an average volume per acre of about 1,500 board feet.

By the second decade, however, the sort of comparative relationship develops among the three new plans' annual net farm incomes that is repeated in succeeding decades. The increased cost of harvesting increased volumes of timber are evident in "cash operating expenses" and "depreciation" for Plan II. Annual harvesting costs of $4,060 for hired labor and $539 for power saw operation and maintenance are combined in operating expenses, and $539 is budgeted for depreciation of the power saw and the forest enterprise share of farm equipment used partly for woods work.

These harvesting costs continue to operate strongly against the profit advantage of Plan II, offsetting most of the $5,800 margin in forest products receipts that Plan II obtains over Plan III. The highest net farm income is achieved under Plan II, however--over $2,500 more than under Plan IV, although less than $700 above Plan III. These annual differentials are increased in the stable period to approximately $24,900 and $1,700, respectively (See Table 35). This slight net income edge of Plan II over Plan III is all that remains of the $13,800 difference between roadside products receipts and stumpage receipts, due to Plan II's harvesting costs of $10,200 for hired labor and a total of $1,966 for operation, maintenance, and depreciation of the power saw and other equipment. Plan III benefits from having none of these operating expenses.

TABLE 35.--Cond

Income and expense items
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TABLE 35.--Condensed annual financial summary for stable decades, Unit 8

Income and expense items	Alternative plans			
	Plan I[a]	Plan II[b]	Plan III[c]	Plan IV[d]
Receipts				
Crops	$4,152	$ 2,066	$ 2,066	$ 2,066
Livestock	0	14,800	14,800	14,800
Livestock products	0	0	0	0
Forest products	0	37,915	24,084	806
Total receipts	4,152	54,781	40,950	17,672
Cash operating expenses	2,360	20,241	9,058	9,058
Net cash farm income	1,792	34,540	31,892	8,614
Depreciation	308	2,877	1,894	1,894
Net farm income	1,484	31,663	29,998	6,720

[a]Plan I--present farm operation with no timber sales.
[b]Plan II--improved agricultural organization and intensive forestry with harvesting and roadside sale of forest products.
[c]Plan III--improved agricultural organization and intensive forestry with sale of stumpage only.
[d]Plan IV--improved agricultural organization and extensive forestry with sale of stumpage only.

Plan III with purchase of additional acreage

In the long run with intensive forest management, if the farmer sells stumpage only (Plan III), he will need on the average not more than 25 man-days a year on his planned acreage. During the first decade he will need a total of 1,452 man-days, an average of 145 a year, for planting pine and for timber stand improvement, totaling over the decade 570 and 882, respectively. For the next five decades he will need only 20 a year for management until the seventh decade, which will require 51 days annually.

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133 man-days available for forestry, he could expand his acreage 4.3 times by purchase of woodland and idle land similar to what he owns now. If funds could be obtained for this acquisition, the total woodland acreage would be 10,356. If this land is bought and improvement work and planting done in the first decade, he will need to hire an extra 6,367 man-days during that decade. If he has to pay a labor wage of $10 a man-day, the average annual labor cost of $6,367 will exceed the average annual stumpage income of $1,019.

If the farmer were to prefer Plan III with this expanded acreage and could finance the first decade investment in land and hired labor, income thereafter would substantially exceed expenses. The next five decades would require no hiring of outside labor and would produce many times larger stumpage returns. In each of these decades the farmer would be able to make use of 1,036 of the family's available 1,330 man-days, and in the stable decades, 1,310. From these they could impute adequate wages from the increasing stumpage returns of successive decades.

Only in the seventh decade would hired labor be needed--1,353 man-days--costing $13,530 at $10 a man-day. The total stumpage income for that decade, however, would be $2,435,286, thus leaving $2,421,756, or $242,176 annually, as the net return to the total land investment of $165,696 and the average $1,526,787 investment in the growing stock accumulated during the development period. The annual net rate of return to land and timber in the last decade of the development period is therefore 14.3 percent, leveling off

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The main attraction of the expanded acreage is that it provides an opportunity to use productively the available family labor. The principal detraction, however, is the large cash investment required initially to pay for land purchase, stand improvement, and planting of pine on large acreages. To avoid difficult problems of land acquisition and financing, the expansion, if attempted, should be spread over several decades or limited to a considerably smaller total acreage.

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CHAPTER X

CONCLUSIONS

The economic and social problems that led to the development of this study have been thoroughly discussed. A large portion of the literature bearing on these problems and contributing to their solution has been reviewed to delineate the progressing frontiers of knowledge and work in this field up to the present time. The three principal objectives of the project have been stated, and the scope selected and methods used have been described.

Next it is necessary to analyze and evaluate the results of this study, including conclusions that can be made and inferences that can and should be drawn. Then it will be possible, hopefully, to decide whether the objectives of the project have been accomplished and if so, to put the results to work.

The information sought in the six phases of data collection was successfully obtained in all cases. To the extents necessary for the various categories, the data were tabulated, computed, analyzed, and in formal form were incorporated into Chapters IV through IX and the appendix.

One of the most extensively demonstrated results of the project is the combination of numerical tables and narrative

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description to illustrate the application to farm-and-forest operating units of the budgeting method of economic analysis. The relatively simple examples in Chapter IX of eight units briefly described only two agricultural alternatives but emphasized three types of operation of the forest enterprise on each unit--as alternatives to absolute ignoring of the opportunities for woodland income. This method is a very useful technique that can be learned by most farm owners of moderate intelligence. Adoption by an owner of the tool of budgeting farm and forest resources can lead him to understand how to identify and inventory his resources of land, labor and capital and to reallocate them, on paper, to various possible farm enterprise combinations. For each alternative budget he will compute annual net farm income by subtracting expenses of production from expected receipts. Also he will need to consider for each budget the preferences of his family for the various enterprises and his own capacity for management of the entire coordinated operation.

Then the owner will make the decision to select one budget from among the alternatives he has prepared. This choice is expected to conform to his objectives. The assumed (and widely accepted) primary owner objective of higher net income was found to be satisfactory for the purpose of accomplishing as objective an analysis as was feasible with the data available (both numerical and verbal). The assumed unconscious ultimate objective of the owner to be generally satisfied with his own allocation of resources was considered important in owner-operator decision-making. This final goal, as might be expected was not found measurable by a scale of utility (for lack of adequate data suitable for formal analysis). Owner satisfaction, or most commonly some degree of dissatisfaction, with his operation was observed subjectively, however, during many of the interviews on the owner survey, to be very real. It is undoubtedly of considerable importance to the making of future management decisions. How significant it is in the process is complicated by the prevalent human traits of conservatism, or inertia, and unpredictable reasoning. Lacking a method for objectively evaluating general owner satisfaction, non-financial decisions that were assumed to be those of the farmers in Units 1 through 8 of the Ames Plantation were derived from value judgment estimates made by the author, who put himself temporarily--in his imagination--into the very "shoes" and environment of the farmer.

Each of the three alternatives to the present operation (which does not make profitable use of the forest resource) shows, in the condensed annual financial summaries of Chapter IX, an increase in the total net farm income resulting from the forest products' contributions to total farm receipts. In general (with few exceptions) and always in the long run the more labor-requiring alternatives yield the higher receipts and result in the higher net farm incomes. It is important to note, however, in the discussion of each alternative that different uses of labor yield different rates of return for a man-day. And it is interesting that among the various operating units, and even among different areas in a single unit, labor for a single use has different rates of return--also among different decades of time.

The alternative plan selected as the most attractive and feasible for Units 1 through 7 is Plan II, intensive forest management with harvesting and roadside sale of forest products. This choice results from the fact that the process of harvesting to roadside would provide much-needed wage income for the farm family. The annual labor and income outlook for each of these units and for Unit 8 is best depicted in Table 36.

In all cases a portion of the available farm family man-days are needed, ranging in the first decade from 9 to 100 percent and in the stable period, from 30 to 100 percent. By allocating all of the roadside products' net income to labor, Units 1 through 7 can derive wages for each man-day that range from fair to good--except for Unit 3, where considerable motivation and forebearance are necessary (in the first decade only). In Units 7 and 8 additional man-days would have to be hired; in the first decade averaging annually 23 and 306 respectively, and in the stable period, 675 and 850. To pay this hired labor $10 a man-day in the first decade and $12 a man-day in the stable period, there would be no problem for Unit 7 nor, in the stable period, for Unit 8. In the first decade there would not be enough income for Unit 8, however, to pay for all the outside labor, much less to derive any wages for the 133 man-days of family labor needed. It is not likely that a farm family would choose this situation for a duration of ten years, even though

TABLE 36.--Annual man-days available and averages needed for intensive forest management with harvesting and roadside sales, and resultant annual net returns to farm family labor and to stumpage, first decade and stable period

Unit	Man-days available	First decade				Stable period			
		Man-days needed	Labor return from sales[a]	Stumpage return from sales	Net income a man-day[a]	Man-days needed	Labor return from sales[a]	Stumpage return from sales	Net income a man-day[a]
1	160	19	$208	0	$10.94	60	$749	$1,580	$12.48
2	290	47	340	0	7.23	90	1,437	2,933	15.97
3	212	35	27	0	.77	109	1,516	2,860	13.91
4	170	49	601	0	12.26	83	1,183	2,445	14.25
5	75	22	114	0	5.18	41	563	1,093	13.73
6	266	25	230	0	9.20	81	925	1,752	11.42
7	471	494	3,285[b]	0	7.00	1,145	6,995[c]	31,220	14.85
8	133	439	-215[d]	0	. .	983	1,665[e]	24,084	12.52

[a]After subtraction of $2 a man-day for operation and depreciation of equipment.
[b]Not including $230 needed to hire outside labor at a wage of $10 a man-day.
[c]Not including $8,088 needed to hire outside labor at a wage of $12 a man-day.
[d]Result if $3,060 is paid to hire outside labor at a wage of $10 a man-day.
[e]Not including $10,200 needed to hire outside labor at a wage of $12 a man-day.

the financial prospects thereafter would be much brighter. For several successive decades a larger and larger crew would have to be hired and managed.

Plan III, on the other hand, involving sale of stumpage only, would be immediately attractive financially and was therefore selected for the family on Unit 8, which has a large forest acreage but a relatively small number of man-days available for woods work. Under this plan an average of 145 days would be required annually during the first decade, only 12 in excess of the number available from the family. If these were hired for $120 and if none of the stumpage income were considered (for the first decade) as a return to the forest investment, the remaining $899 would provide a daily wage of $6.76 for the 133 man-days of family labor.

After the first decade only a small fraction of the family labor would be needed under Plan III, but there would be an ever-increasing stumpage return, from which a generous labor return could be allocated for management activities. This would level off in the stable period to just over $24,000. If the 25 annual management man-days were compensated by a daily wage of $15, the return on the forest investment would still exceed $23,700. This is financially practically equal to the stable period net return under Plan II, yet avoids the hazards of a timber harvesting operation and the problems of managing hired labor and selling cut products.

With the intensive forest management program under both Plans II and III, there are the generally increasing returns to

timber, land, and labor, decade after decade--until the fluid equilibrium of the stable period is reached. These are tabulated in the appendix tables 1-1, 2-1, . . . and 8-1.

In addition, by way of further contribution to the landowner's financial status over the development period, there is a continual increase in the stumpage value of his accumulating growing stock. The average annual increase for the eight units ranges from $241 to $6,581 in the same order as the forest acreages--from the smallest, 92 acres, to the largest, 2,505 acres. Table 37 shows the difference between the stumpage value of the residual growing stock at the end of the development period and that after the first decade's harvest (the value of which was allocated to labor in Table 36 and the discussion of Unit 8's Plan III).

When the increase is averaged over the approximately 60-year development period, the average annual rate of capital accumulation is seen to be considerable, roughly in proportion to the forest acreage. The average annual increase per acre ranges from $2.26 to $2.96--not a great variation, and not related to the size of the forest area. This order of increase shows that intensive forest management builds up the value of the investment in growing stock at a substantial rate. The increasing investment value thus provides a further incentive for good management--in addition to the sizable income from labor and from harvested timber each decade.

TABLE 37.--Stumpage value increase of residual growing stock over development period,[1] annual average for each unit,[2] and annual average per acre

		Stumpage value of residual growing stock				
Unit	Forest acreage	After first decade's cut	After devel- opment period	Increase over period	Average annual increase	Average annual increase per acre
1	133	$ 2,220	$20,300	$18,080	$ 301	$2.26
2	221	684	38,550	37,866	631	2.86
3	218	955	38,400	37,445	624	2.86
4	175	2,795	33,900	31,105	518	2.96
5	92	320	14,800	14,480	241	2.62
6	174	0	24,100	24,100	402	2.31
7	2,505	15,256	410,100	394,844	6,581	2.63
8	1,954	12,494	288,100	275,606	4,593	2.35

[1]After first decade's improvement cut.

[2]Assuming development takes about 60 years.

The two farming enterprise alternatives differ from unit to unit, depending on the soil capabilities of each field, the existing pattern of agriculture that has been long established, the types of enterprises that the farmer believes he can operate and manage and the yields and prices to be expected for each type of product. In all cases except that of Unit 7 the alternative agricultural budgets proposed for actual use on each of the units schedule higher receipts and higher net farm income than the present operations.

Thus in regard to both farm and forest enterprises, the use of the budgeting method, coordinating the allocation of a unit's available resources of land, labor, capital, and managerial capacity for the achievement of farm family objectives through efficient operation of compatible agricultural and forest enterprises, can contribute substantially to higher income on low-income farm-and-forest operating units in the west Tennessee area.

The general significance for west Tennessee of improved forestry on farm-and-forest units can be readily inferred from the problems and needs for economic progress that have been described in Chapters III through VI and VIII. Evidence has been supplied from the budgets of all eight case units that intensive forest management will increase the volume of growing stock per acre and the productivity of the residual stand following stand improvement operations--also the productivity of an area planted or converted to a pine plantation. This alone benefits the economy by increasing the tax base--manyfold in the course of several decades. But also when the fast accumulating volume growth of timber is cut and marketed, the owners derive an increasing return on their growing investment and many people in addition have an opportunity to obtain wage income from labor devoted to woods work. Much of their increased net income will probably be spent locally, thus contributing to the flow of money in the community. Likewise, handling and usually some processing of the harvested timber by timber buyers within a 50-mile radius will add employment and value to the economy of the west Tennessee area. And of course there will be a multiplier effect, with some fraction of the money changing hands a number of times. Power chain saws and other equipment will be bought to fell and handle the timber. And numerous other transactions will take place.

With reliable farm-and-forest budgets to present management intentions clearly and to help bankers judge how provident a loan for the expenses of planting or stand improvement will be, woodland loans on merchantable timber are likely to become more common, thus providing at reasonable rates funds needed to accelerate the intensive forest management programs--to the profit of both owner and banker.

Another result of this study is the derivation and use of data that will permit more accurate appraisals of opportunities for improved forestry on individual farm-and-forest operating units in the west Tennessee area. Management-yield data, work performance data, and timber price data have been developed and used as mentioned in Chapter VIII. Information on data collection and computation is provided in Appendix B. All three categories of data were needed for the creation of the set of appendix tables pertaining to each unit's forested acreages (See Appendix A). The work-performance data and timber price data will be applicable under roughly similar conditions of work and markets, respectively. Locally applicable management-yield data will have to be developed for timber stands that differ substantially in any of several characteristics from those described in the respective Ames Plantation tables. Important characteristics in the forest survey data that materially affect management-yield data through their effects on the stand projection procedure are: number of trees in the various diameter classes, form class, tree vigor class for diagnostic prescription, and growth rate for the various diameter classes.

Clearly, in the west Tennessee area the application of intensive forestry and modern farm management methods in conjunction with the budget approach to economic allocation of available resources can help to alleviate poverty by making substantial contributions to higher incomes for low-income operating units and in some degree add to the over-all economic health of the area. Probably the application of these principles in other low-income rural areas can have a similar effect.

And certainly the techniques of data collection, development, and use to permit more accurate appraisals of opportunities for improved forest management can be of value for widespread adoption.

APPENDIX A

STATISTICAL APPENDIX: TABLES OF MANAGEMENT-YIELD DATA FOR OPERATING UNITS ANALYZED IN CHAPTER IX

The following tables of forest management-yield data provide the statistical basis for the forestry contributions to the condensed annual financial summaries of Chapter IX and the other forest data used in analyzing the forestry alternatives for each of the units.

The tables are arranged in sets in the same order as the Units 1 through 8 to which they apply. Within each set the tables are organized in a standard order; for Unit 1 the tables are numbered 1-1 through 1-6C, for Unit 2 they are Tables 2-1 through 2-6D. In the remainder of these explanatory notes preceding the tables they are referred to generically as Tables x-1 through x-6.

Tables x-1 are placed first in each set because they summarize the totals from Tables x-2 through x-5. Tables x-6 are placed last because they are the most basic, and will need to be referred to least often. The letter suffixes A through F to Tables x-3, x-4, and x-6, refer to each unit's Areas A, B, and so forth, which in total comprise the entire forest for the unit. Each of these areas in a given unit has a different forest condition and therefore requires separate computation of management-yield data. A brief description of each area's initial forest condition is provided in the pertinent Table x-6.

Tables x-1 consist of the labor requirements and value of yields by decade from the total area of forest land on each unit, for both intensive and extensive forest management. Under Plan II's intensive management and roadside sales, the data include the number of man-days of labor input required for harvesting sawlogs and pulpwood and skidding them to roadside. The value of these products sold at roadside represents the stumpage value of the products cut plus the value added by harvesting. Under Plan III, labor inputs are required for management work only, as no harvesting to roadside is involved. The value of products sold is the stumpage price alone.

Under the extensive management of Plan IV, no cultural work is required and only stumpage sales are made. Therefore no columns contain data except the value of products sold when possible during the period of declining yield and the average decadal value thereafter. Tables x-1 note the initial stumpage value of the timber and the average value of the growing stock after 60 years of intensive management. They also include the average value of the growing stock following 70 years of extensive management.

The columns of labor input under roadside sales and stumpage sales are obtained from Tables x-2. The values of the products sold in the roadside sales of Plan II are the sums of the corresponding decades of all the Tables x-3 for each unit. The values of products sold in the stumpage sales of Plan III are the sums of the corresponding decades of all the Tables x-4. The values of the products sold in the stumpage sales of Plan IV are the sums of the corresponding decades of all the areas listed in Tables x-5.

Tables x-2 consist of the labor requirements in man-days for management work and for harvesting by decades on every area of forest on each unit, and the unit totals. The total requirement for management and harvesting labor for each decade is given only for the entire unit. The labor requirements for both types of work are given on a per-acre basis for each of the areas, however. These figures are multiplied by the number of acres on which they apply and the products are listed in the second column for each area. The man-days required on a per-acre basis on each area were obtained from the pertinent Table x-6.

Tables x-3A, B, and so forth, list for corresponding Areas A, B, and so forth, of each unit, the value of yields by decade from the total acreage of each area under Plan II, with intensive forest management and roadside sales. For each decade are listed the sawlog yield per acre in thousand board feet, the price per thousand, and the product of these two figures, the value per acre of the sawlog yield. Likewise, for each decade are listed the pulpwood yield per acre in cords, the price per cord, and the product of these two figures, the value per acre of the pulpwood yield. The next-to-last column in each of these tables is the total value per acre of the sawlog yield plus the pulpwood yield. When the figures in this column are multiplied by the number of acres in the area, the area total value is obtained to produce the last column.

The prices in these tables and Tables x-4 and x-5 are all obtained from the average prices in Appendix B, Table B-3, which provides estimates of roadside and stumpage prices related to timber quality (dependent on stand conditions following a given length and intensity of forest management).

Tables x-4A, B, and so forth are organized similarly to Tables x-3 but apply to stumpage sales under Plan III. As will be noted in each of these tables, there is no price per cord of pulpwood for most of the areas. This stems from the fact that the potential pulpwood cut for most of the areas is hardwood, which has no stumpage value. Therefore though the potential pulpwood yield per acre is listed, the pulpwood stumpage value per acre in the case of hardwoods is listed as zero. For this reason the total value per acre is the same as the value per acre of the sawlog yield.

Tables x-5 list the value of yields by decade from all the areas of each unit under Plan IV, with extensive forest management and stumpage sales. As only sawtimber stumpage is sold under Plan IV, only the sawlog yields per acre, price per MBF, and their product, the value per acre of the sawlog yield, are given. For each area, the per-acre figure is multiplied by the number of acres to produce the final column, total stumpage sale value for each area.

Tables x-6 provide for each area the average decadal yields and labor inputs per acre for each decade of the development period under Plans II and III and an average for the stable period--also for the period of declining yield under Plan IV. The potential yields of both sawlogs and pulpwood are given, though no hardwood pulpwood is sold by the stumpage sales of Plans III or IV. These yields for all areas (except the loblolly pine plantations) have been computed from cut-and-leave data columns on development period stand projection sheets for each area. The cut-and-leave determination for each decade was made according to the method described in Appendix B. The yield volumes were computed from the number of trees cut in each diameter class and volumes per tree derived for each area from local board-foot and cubic-foot volume tables prepared for Ames Plantation major species groups. Loblolly pine plantation yields were derived by adjusting yield data from similar site-80 plantations in Louisiana according to short-term data from plantations in west Tennessee and northern Mississippi.

Beginning with the initial stand composition of each area as modified by the first cut, the stand projection was accomplished by applying for decade after decade the projected 10-year growth rates in Appendix B, Table B-2, for crop trees and trees of average vigor for each of the three topographic slope positions. In many areas the projected stands reached an equilibrium condition of stand structure, growth, and cut in fewer than seven decades of development or (in the case of extensive management) of declining yield. In such cases the stable period was scheduled to begin as soon as the equilibrium was reached.

The labor inputs are the sums of the products of the amounts of each kind of work scheduled and the labor requirements per unit of work. The latter were taken directly from the work-performance data in Appendix B, Table B-1. The estimates for timber stand improvement were refined, however, according to the basal area of trees to be deadened, as follows: 0.2 man-day for 3.0 to 5.9 square feet per acre, 0.3 for 6.0-9.9, 0.4 for 10.0-13.9, 0.5 for 14.0-18.9, 0.6 for 19.0-24.9, 0.7 for 25.0-28.9, 0.8 for 29.0-32.9, and 0.9 for 33.0-37.9. In practically all decades 0.1 man-day per acre was allocated for fire protection.

TABLE 1-1.--Labor requirements and value of yields by decade from 133 acres of forest land on Unit 1, with intensive and extensive management

Years of management	Roadside sales: Labor input	Roadside sales: Value of products sold	Stumpage sales: Labor input	Stumpage sales: Value of products sold
	Man-days	Dollars	Man-days	Dollars
		Intensive management[a]		
1-10	187	2,456	75	921
11-20	462	6,160	13	1,618
21-30	634	8,982	13	2,715
31-40	966	15,880	13	6,404
41-50	600	21,428	13	13,416
51-60	571	24,838	13	16,256
61-70	838	42,093	31	28,044
Average per decade for stable period	603	24,490	16	15,803
		Extensive management[b]		
1-10	No cultural work is required and only stumpage sales are made.			3,132
11-20				0
21-30				560
31-40				2,594
41-50				1,844
51-60				430
61-70				1,010
Average per decade after 7th decade				545

[a] The initial stumpage value of the timber is about $3,100, while after 60 years of intensive management the average value of growing stock is about $20,300.

[b] The average value of growing stock following 70 years of extensive management is about $1,100.

TABLE 1-2.--Labor requirements in man-days for management and for harvesting by decades on the 3 categories of forest on Unit 1

	Labor requirements in man-days						
	Area A		Area B		Area C		Total
Decades years	per acre	on 29 acres	per acre	on 76 acres	per acre	on 28 acres	on 133 acres
	Management labor						
1-10	1.6	46.4	0.3	22.8	0.2	5.6	74.8
11-20	.1	2.9	.1	7.6	.1	2.8	13.3
21-30	.1	2.9	.1	7.6	.1	2.8	13.3
31-40	.1	2.9	.1	7.6	.1	2.8	13.3
41-50	.1	2.9	.1	7.6	.1	2.8	13.3
51-60	.1	2.9	.1	7.6	.1	2.8	13.3
61-70	.7	20.3	.1	7.6	.1	2.8	30.7
Average for stable decades	0.2	5.8	0.1	7.6	0.1	2.8	16.2
	Harvesting labor						
1-10	3.0	87.0	0	0	0.9	25.2	112.2
11-20	3.8	110.2	0.7	53.2	10.2	285.6	449.0
21-30	3.5	101.5	3.4	258.4	9.3	260.4	620.3
31-40	1.5	43.5	2.9	220.4	24.6	688.8	952.7
41-50	3.4	98.6	3.4	258.4	8.2	229.6	586.6
51-60	3.8	110.2	3.5	266.0	6.5	182.0	558.2
61-70	12.4	359.6	3.5	266.0	6.5	182.0	807.6
Average for stable decades	4.8	139.2	3.5	266.0	6.5	182.0	587.2
	Total management and harvesting labor						
1-10							187.0
11-20							462.3
21-30							633.6
31-40							966.0
41-50							599.9
51-60							571.5
61-70							838.3
Average for stable decades							603.4

TABLE 1-3A.--Value of yields by decade from the 29 acres of Area A of Unit 1 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
years	MBF	dollars	dollars	cords	dollars	dollars	dollars	dollars
1-10	2.4	25.00	60.00	1.3	8.00	10.40	70.40	2,041.60
11-20	0	. .	0	5.5	10.00	55.00	55.00	1,595.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	1,450.00
31-40	.8	35.00	28.00	1.5	10.00	15.00	43.00	1,247.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	4,495.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	7,105.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	24,360.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	6,757.00

TABLE 1-3B.--Value of yields by decade from the 76 acres of Area B of Unit 1 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
years	MBF	dollars	dollars	cords	dollars	dollars	dollars	dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.0	30.00	30.00	0	. .	0	30.00	2,280.00
21-30	1.5	35.00	52.50	2.4	8.00	19.20	71.70	5,449.20
31-40	2.0	50.00	100.00	1.5	8.00	12.00	112.00	8,512.00
41-50	2.7	55.00	148.50	1.5	8.00	12.00	160.50	12,198.00
51-60	2.7	55.00	148.50	1.6	8.00	12.80	161.30	12,258.80
61-70	2.7	55.00	148.50	1.6	8.00	12.80	161.30	12,258.80
Average for stable decades	2.7	55.00	148.50	1.6	8.00	12.80	161.30	12,258.80

TABLE 1-3C.--Value of yields by decade from the 28 acres of Area C of Unit 1 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.4	25.00	10.00	0.6	8.00	4.80	14.80	414.40
11-20	0	. .	0	10.2	8.00	81.60	81.60	2,284.80
21-30	0	. .	0	9.3	8.00	74.40	74.40	2,083.20
31-40	.5	50.00	25.00	24.2	8.00	193.60	218.60	6,120.80
41-50	2.1	55.00	115.50	6.7	8.00	53.60	169.10	4,734.80
51-60	2.9	55.00	159.50	4.5	8.00	36.00	195.50	5,474.00
61-70	2.9	55.00	159.50	4.5	8.00	36.00	195.50	5,474.00
Average for stable decades	2.9	55.00	159.50	4.5	8.00	36.00	195.50	5,474.00

TABLE 1-4A.--Value of yields by decade from the 29 acres of Area A of Unit 1 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	2.4	10.00	24.00	1.3	3.00	3.90	27.90	809.10
11-20	0	. .	0	5.5	3.00	16.50	16.50	478.50
21-30	0	. .	0	5.0	3.00	15.00	15.00	435.00
31-40	.8	20.00	16.00	1.5	3.00	4.50	20.50	594.50
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	2,856.50
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	4,799.50
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	16,588.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	4,347.10

TABLE 1-4B.--Value of yields by decade from the 76 acres of Area B of Unit 1 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.0	15.00	15.00	0	. .	0	15.00	1,140.00
21-30	1.5	20.00	30.00	2.4	. .	0	30.00	2,280.00
31-40	2.0	35.00	70.00	1.5	. .	0	70.00	5,320.00
41-50	2.7	40.00	108.00	1.5	. .	0	108.00	8,208.00
51-60	2.7	40.00	108.00	1.6	. .	0	108.00	8,208.00
61-70	2.7	40.00	108.00	1.6	. .	0	108.00	8,208.00
Average for stable decades	2.7	40.00	108.00	1.6	. .	0	108.00	8,208.00

TABLE 1-4C.--Value of yields by decade from the 28 acres of Area C of Unit 1 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.4	10.00	4.00	0.6	. .	0	4.00	112.00
11-20	0	. .	0	10.2	. .	0	0	0
21-30	0	. .	0	9.3	. .	0	0	0
31-40	.5	35.00	17.50	24.2	. .	0	17.50	490.00
41-50	2.1	40.00	84.00	6.7	. .	0	84.00	2,352.00
51-60	2.9	40.00	116.00	4.5	. .	0	116.00	3,248.00
61-70	2.9	40.00	116.00	4.5	. .	0	116.00	3,248.00
Average for stable decades	2.9	40.00	116.00	4.5	. .	0	116.00	3,248.00

TABLE 1-5.--Value of yields by decade from Areas A, B, and C of Unit 1 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area A - 29 acres		
1-10	2.4	10.00	24.00	696.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	1.8	10.00	18.00	522.00
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	2.0	10.00	20.00	580.00
Average for stable decades	0.4	10.00	4.00	116.00
		Area B - 76 acres		
1-10	2.1	10.00	21.00	2,436.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	2.1	10.00	21.00	1,596.00
41-50	.4	10.00	4.00	304.00
51-60	.4	10.00	4.00	304.00
61-70	.4	10.00	4.00	304.00
Average for stable decades	0.4	10.00	4.00	304.00
		Area C - 28 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	2.0	10.00	20.00	560.00
31-40	1.7	10.00	17.00	476.00
41-50	5.5	10.00	55.00	1,540.00
51-60	.45	10.00	4.50	126.00
61-70	.45	10.00	4.50	126.00
Average for stable decades	0.45	10.00	4.50	126.00

TABLE 1-6A.--Average yields and labor inputs per acre by decade for Unit 1 Area A, a 29-acre loblolly pine plantation replacing a poorly stocked large sawtimber stand of upper-slope hardwoods containing 2.4 MBF per acre[a]

Decade (years of management)	Yields/acre/decade: MBF of sawlogs	Yields/acre/decade: Cords of pulpwood	Labor inputs/acre/decade: Man-days for management	Labor inputs/acre/decade: Man-days for harvesting
Intensive management of pine stand				
Development period				
Years 1-10[b]	2.4	1.3	1.6[c]	3.0
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.4	3.6	.5	5.2
Av. for stable period[e]	4.0	3.3	0.2	4.8
Extensive management of original hardwood stand				
Period of declining yield				
Years 1-10	2.4	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	1.8	...	...	...
41-50	0	...	...	...
51-60	0	...	...	...
61-70	2.0	...	...	...
Average	1.0	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 48 square feet per acre, of which 32 were in growing stock, 2 in undesirable but merchantable trees, and 14 in culls. The stand contains trees up to 28 inches d.b.h.; 52 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in this decade are hardwood, in succeeding decades, pine.

[c]1.1 man-days for planting pine, 0.5 for deadening unmerchantable hardwoods having a basal area of 14 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 1-6B.--Average yields and labor inputs per acre by decade for Unit 1 Area B, a 116-acre poorly stocked large sawtimber stand of upper-slope hardwoods containing 2.1 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	0	0	0.3	0
11-20	1.0	0	.1	0.7
21-30	1.5	2.4	.1	3.4
31-40	2.0	1.5	.1	2.9
41-50	2.7	1.5	.1	3.4
Average	1.8	1.4	.2	2.6
Av. for stable period[b]	2.7	1.6	0.1	3.5
		Extensive management		
Period of declining yield				
Years 1-10	2.1	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	2.1	...	...	...
Average	.7	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 57 square feet per acre, of which 35 were in growing stock, 13 in undesirable but merchantable trees, and 9 in culls. The stand contains trees up to 30 inches d.b.h.; 61 percent of the trees are below the 14-inch d.b.h. class.

[b]Residual growing stock, 3.4 MBF plus 2.5 cords.

[c]Residual growing stock nil.

TABLE 1-6C.--Average yields and labor inputs per acre by decade for Unit 1 Area C, a 28-acre moderately stocked poletimber stand of lower-slope hardwoods containing 0.6 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	0.4	0.6	0.2	0.9
11-20	0	10.2	.1	10.2
21-30	0	9.3	.1	9.3
31-40	.5	24.2	.1	24.6
41-50	2.1	6.7	.1	8.2
Average	.8	12.8	.1	13.3
Av. for stable period[b]	2.9	4.5	0.1	6.5
		Extensive management		
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	2.0	...	...	...
31-40	1.7	...	...	...
41-50	5.5	...	...	...
Average	2.3	...	...	...
Av. for stable period[c]	0.45	...	...	...

[a]The total basal area of this stand was 80 square feet per acre, of which 66 were in growing stock, 9 in undesirable but merchantable trees, and 5 in culls. The stand contains trees up to 28 inches d.b.h.; 89 percent of the trees are below the 14-inch d.b.h. class.

[b]Residual growing stock 3.6 MBF plus 4.6 cords.

[c]Residual growing stock nil.

TABLE 2-1.--Labor requirements and values of yields by decade from 221 acres of forest land on Unit 2, with intensive and extensive management

Years of management	Roadside sales		Stumpage sales	
	Labor input	Value of products sold	Labor input	Value of products sold
	Man-days	Dollars	Man-days	Dollars
		Intensive management[a]		
1-10	468	4,338	239	858
11-20	700	11,477	22	3,910
21-30	561	8,144	22	2,685
31-40	465	9,402	22	4,070
41-50	779	32,584	22	20,752
51-60	902	46,745	22	31,096
61-70	2,215	134,734	110	91,380
Average per decade for stable period	903	45,505	37	29,331
		Extensive management[b]		
1-10	No cultural work is required and only stumpage sales are made.			1,542
11-20				168
21-30				2,556
31-40				176
41-50				1,457
51-60				505
61-70				2,597
Average per decade after 7th decade				893

[a]The initial stumpage value of the timber is about $1,500, while after 60 years of intensive management the average value of growing stock is about $38,500.

[b]The average value of growing stock following 70 years of extensive management is about $1,800.

TABLE 2-2.--Labor requirements in man-days for management and for harvesting by decades on the 4 categories of forest in Unit 2

Decade years	Area A per acre	Area A on 142 acres	Area B per acre	Area B on 5 acres	Area C per acre	Area C on 66 acres	Area D per acre	Area D on 8 acres	Total on 221 acres
					Management labor				
1-10	1.5	213.0	1.9	9.5	0.2	13.2	0.4	3.2	238.9
11-20	.1	14.2	.1	.5	.1	6.6	.1	.8	22.1
21-30	.1	14.2	.1	.5	.1	6.6	.1	.8	22.1
31-40	.1	14.2	.1	.5	.1	6.6	.1	.8	22.1
41-50	.1	14.2	.1	.5	.1	6.6	.1	.8	22.1
51-60	.1	14.2	.1	.5	.1	6.6	.1	.8	22.1
61-70	.7	99.4	.7	3.5	.1	6.6	.1	.8	110.3
Average for stable decades	0.2	28.4	0.2	1.0	0.1	6.6	0.1	0.8	36.8
					Harvesting labor				
1-10	2.0	198.0	0.2	1.0	0	0	3.8	30.4	229.4
11-20	3.8	539.6	3.8	19.0	1.8	118.8	0	0	677.4
21-30	3.5	497.0	3.5	17.5	0	0	3.1	24.8	539.3
31-40	1.5	213.0	1.5	7.5	3.0	198.0	3.0	24.0	442.5
41-50	3.4	482.8	3.4	17.0	3.6	237.6	2.4	19.2	756.6
51-60	3.8	539.6	3.8	19.0	4.3	283.8	4.7	37.6	880.0
61-70	12.4	1,760.8	12.4	62.0	3.7	244.2	4.7	37.6	2,104.6
Average for stable decades	4.0	568.0	3.3	16.5	3.7	244.2	4.7	37.6	866.3
					Total management and harvesting labor				
1-10									468.3
11-20									699.5
21-30									561.4
31-40									464.6
41-50									778.7
51-60									902.1
61-70									2,214.9
Average for stable decades									903.1

TABLE 2-3A.--Value of yields by decade from the 142 acres of Area A of Unit 2 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
years	MBF	dollars	dollars	cords	dollars	dollars	dollars	dollars
1-10	0.6	25.00	15.00	1.6	8.00	12.80	37.80	3,742.20
11-20	0	. .	0	5.5	10.00	55.00	55.00	7,810.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	7,100.00
31-40	.8	35.00	28.00	1.5	10.00	15.00	43.00	6,106.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	22,010.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	34,790.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	119,280.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	33,086.00

TABLE 2-3B.--Value of yields by decade from the 5 acres of Area B of Unit 2 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0.2	8.00	1.60	1.60	8.00
11-20	0	. .	0	5.5	10.00	55.00	55.00	275.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	250.00
31-40	0.8	35.00	28.00	1.5	10.00	15.00	43.00	215.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	775.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	1,225.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	4,200.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	1,165.00

TABLE 2-3C.--Value of yields by decade from the 66 acres of Area C of Unit 3 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.5	30.00	45.00	0.8	8.00	6.40	51.40	3,392.00
21-30	0	. .	0	0	. .	0	0	0
31-40	0	. .	0	3.0	8.00	24.00	24.00	1,584.00
41-50	2.0	55.00	110.00	2.2	8.00	17.60	127.60	8,422.00
51-60	2.2	55.00	121.00	2.8	8.00	22.40	143.40	9,244.00
61-70	2.4	55.00	132.00	2.0	8.00	16.00	148.00	9,768.00
Average for stable decades	2.4	55.00	132.00	2.0	8.00	16.00	148.00	9,768.00

TABLE 2-3D.--Value of yields by decade from the 8 acres of Area D of Unit 2 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.1	45.00	49.50	3.0	8.00	24.00	73.50	588.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	55.00	82.50	2.1	8.00	16.80	99.30	794.00
31-40	3.3	55.00	181.50	.7	8.00	5.60	187.10	1,497.00
41-50	3.1	55.00	170.50	.2	8.00	1.60	172.10	1,377.00
51-60	3.0	55.00	165.00	2.6	8.00	20.80	185.80	1,486.00
61-70	3.0	55.00	165.00	2.6	8.00	20.80	185.80	1,486.00
Average for stable decades	3.0	55.00	165.00	2.6	8.00	20.80	185.80	1,486.00

TABLE 2-4A.--Value of yields by decade from the 142 acres of Area A of Unit 2 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.6	10.00	6.00	1.6	. .	0	6.00	594.00
11-20	0 0	. .	0	5.5	3.00	16.50	16.50	2,343.00
21-30	0	. .	0	5.0	3.00	15.00	15.00	2,130.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	2,911.00
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	13,987.00
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	23,501.00
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	81,224.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	21,285.80

TABLE 2-4B.--Value of yields by decade from the 5 acres of Area B of Unit 2 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0.2	. .	0	0	0
11-20	0	. .	0	5.5	3.00	16.50	16.50	82.50
21-30	0	. .	0	5.0	3.00	15.00	15.00	75.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	102.50
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	492.50
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	827.50
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	2,860.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	749.50

TABLE 2-4C.--Value of yields by decade from the 66 acres of Area C of Unit 2 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.5	15.00	22.50	0.8	. .	0	22.50	1,485.00
21-30	0	. .	0	0	. .	0	0	0
31-40	0	. .	0	3.0	. .	0	0	0
41-50	2.0	40.00	80.00	2.2	. .	0	80.00	5,280.00
51-60	2.2	40.00	88.00	2.8	. .	0	88.00	5,808.00
61-70	2.4	40.00	96.00	2.0	. .	0	96.00	6,336.00
Average for stable decades	2.4	40.00	96.00	2.0	. .	0	96.00	6,336.00

TABLE 2-4D.--Value of yields by decade from the 8 acres of Area D of Unit 2 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.1	30.00	33.00	3.0	. .	0	33.00	264.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	40.00	60.00	2.1	. .	0	60.00	480.00
31-40	3.3	40.00	132.00	.7	. .	0	132.00	1,056.00
41-50	3.1	40.00	124.00	.2	. .	0	124.00	992.00
51-60	3.0	40.00	120.00	2.6	. .	0	120.00	960.00
61-70	3.0	40.00	120.00	2.6	. .	0	120.00	960.00
Average for stable decades	3.0	40.00	120.00	2.6	. .	0	120.00	960.00

TABLE 2-5.--Value of yields by decade from Areas A, B, C, and D of Unit 2 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area A - 142 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	1.8	10.00	18.00	2,556.00
31-40	0	. .	0	0
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	1.6	10.00	16.00	2,272.00
Average for stable decades	0.4	10.00	4.00	568.00
		Area B - 5 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	2.5	10.00	25.00	125.00
51-60	.5	10.00	5.00	25.00
61-70	.5	10.00	5.00	25.00
Average for stable decades	0.5	10.00	5.00	25.00
		Area C - 66 acres		
1-10	1.5	10.00	15.00	990.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	1.8	10.00	18.00	1,188.00
51-60	.4	10.00	4.00	264.00
61-70	.4	10.00	4.00	264.00
Average for stable decades	0.4	10.00	4.00	264.00

TABLE 2-5 -- Continued

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area D - 8 acres		
1-10	2.3	30.00	69.00	552.00
11-20	2.1	10.00	21.00	168.00
21-30	0	. .	0	0
31-40	2.2	10.00	22.00	176.00
41-50	1.8	10.00	18.00	144.00
51-60	2.7	10.00	27.00	216.00
61-70	.45	10.00	4.50	36.00
Average for stable decades	0.45	10.00	4.50	36.00

TABLE 2-6A.--Average yields and labor inputs per acre by decade for Unit 2 Area A, a 99-acre loblolly pine plantation replacing a poorly stocked poletimber stand of upper-slope hardwoods containing 3.5 cords per acre[a]

Decade (years of management)	Yields/acre/decade: MBF of sawlogs	Yields/acre/decade: Cords of pulpwood	Labor inputs/acre/decade: Man-days for management	Labor inputs/acre/decade: Man-days for harvesting
Intensive management of pine stand				
Development period				
Years 1-10[b]	0.6	1.6	1.5[c]	2.0
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	..8	1.5	.1	1.5
41-50	2.6	2.5	..1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.1	3.6	.4	5.1
Av. for stable period[e]	4.0	3.3	0.2	4.7
Extensive management of original hardwood stand				
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	1.8	...	...	...
31-40	0	...	...	...
41-50	0	...	...	...
51-60	0	...	...	...
61-70	1.6	...	...	...
Average	.6	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 36 square feet per acre, of which 11 were in growing stock, 11 in undesirable but merchantable trees, and 14 in culls. The stand contains trees up to 20 inches d.b.h.; 69 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in this decade are hardwood, in succeeding decades, pine.

[c]1.1 man-days for planting pine, 0.4 for deadening unmerchantable hardwoods having a basal area of 14 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 2-6B.--Average yields and labor inputs per acre by decade for Unit 2 Area B, a 5-acre loblolly pine plantation replacing a poorly stocked seedling and sapling stand of bottomland hardwoods containing 0.2 cord per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management of pine stand				
Development period				
Years 1-10[b]	0	0.2	1.9[c]	0.2
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	0.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.0	3.4	.5	4.8
Av. for stable period[e]	4.0	3.3	0.2	4.7
Extensive management of original hardwood stand				
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	2.5	...	...	...
Average	.5	...	...	...
Av. for stable period[f]	0.5	...	...	...

[a]The total basal area of this stand was 34 square feet per acre, of which 11 were in growing stock and 23 in culls. The stand contains trees up to 12 inches d.b.h.; all trees over 8 inches are culls.

[b]Yields in this decade are hardwood, in succeeding decades, pine.

[c]1.1 man-days for planting pine, 0.8 for deadening unmerchantable hardwoods having a basal area of 32 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 2-6C.--Average yields and labor inputs per acre by decade for Unit 2 Area C, a 66-acre moderately stocked poletimber stand of upper-slope hardwoods containing 1.5 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
	Intensive management			
Development period				
Years 1-10	0	0	0.2	0
11-20	1.5	0.8	.1	1.8
21-30	0	0	.1	0
31-40	0	3.0	.1	3.0
41-50	2.0	2.2	.1	3.6
51-60	2.2	2.8	.1	4.3
Average	1.9	2.2	.1	3.2
Av. for stable period[b]	2.4	2.0	0.1	3.7
	Extensive management			
Period of declining yield				
Years 1-10	1.5	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	1.8	...	...	...
Average	.8	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 39 square feet per acre, of which 14 were in growing stock, 22 in undesirable but merchantable trees, and 3 in culls. The stand contains trees up to 20 inches d.b.h.; 47 percent of the trees are below the 14-inch class. This stand could also be classed as poorly stocked large sawtimber.

[b]Residual growing stock 3.2 MBF plus 3.5 cords.

[c]Residual growing stock nil.

TABLE 2-6D.--Average yields and labor inputs per acre by decade for Unit 2 Area D, an 8-acre well stocked poletimber stand of lower-slope hardwoods containing 2.3 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	1.1	3.0	0.4	3.8
11-20	0	0	.1	0
21-30	1.5	2.1	.1	3.1
31-40	3.3	.7	.1	3.0
41-50	3.1	.2	.1	2.4
Average	2.2	1.5	.2	3.0
Av. for stable period[b]	3.0	2.6	.1	4.7
		Extensive management		
Period of declining yield				
Years 1-10	2.3	...	...	...
11-20	2.1	...	...	...
21-30	0	...	...	...
31-40	2.2	...	...	...
41-50	1.8	...	...	...
51-60	2.7	...	...	...
Average	2.2	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 80 square feet per acre, of which 52 were in growing stock, 21 in undesirable but merchantable trees, and 7 in culls. The stand contains trees up to 32 inches d.b.h.; 60 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as moderately stocked large saw-timber.

[b]Residual growing stock, 3.3 MBF plus 2.7 cords.

[c]Residual growing stock nil.

TABLE 3-1.--Labor requirements and value of yields by decade from 218 acres of forest land on Unit 3, with intensive and extensive management

Years of management	Roadside sales: Labor input	Roadside sales: Value of products sold	Stumpage sales: Labor input	Stumpage sales: Value of products sold
	Man-days	Dollars	Man-days	Dollars
Intensive management[a]				
1-10	353	968	250	75
11-20	834	12,725	22	3,844
21-30	677	10,380	22	3,495
31-40	544	14,179	22	7,276
41-50	826	33,181	22	20,300
51-60	949	47,197	22	30,432
61-70	2,174	126,654	102	84,736
Average per decade for stable period	1,083	45,923	35	28,597
Extensive management[b]				
1-10	No cultural work is required and only stumpage sales are made.			1,030
11-20				500
21-30				0
31-40				2,995
41-50				1,012
51-60				532
61-70				532
Average per decade after 7th decade				877

[a]The initial stumpage value of the timber is about $1,000, while after 60 years of intensive management the average value of growing stock is about $38,400.

[b]The average value of growing stock following 50 years of extensive management is about $1,750.

TABLE 3-2.--Labor requirements in man-days for management and for harvesting by decades on the 5 categories of forest on Unit 3

Decade years	Area A per acre	Area A on 25 acres	Area B per acre	Area B on 108 acres	Area C per acre	Area C on 25 acres	Area D per acre	Area D on 50 acres	Area E per acre	Area E on 10 acres	Total on 218 acres	Total Management and harvesting
Management labor												
1-10	1.4	35.0	1.7	183.6	0.3	7.5	0.4	20.0	0.4	4.0	250.1	...
11-20	.1	2.5	.1	10.8	.1	2.5	.1	5.0	.1	1.0	21.8	...
21-30	.1	2.5	.1	10.8	.1	2.5	.1.	5.0	.1	1.0	21.8	...
31-40	.1	2.5	.1	10.8	.1	2.5	.1	5.0	.1	1.0	21.8	...
41-50	.1	2.5	.1	10.8	.1	2.5	.1	5.0	.1	1.0	21.8	...
51-60	.1	2.5	.1	10.8	.1	2.5	.1	5.0	.1	1.0	21.8	...
61-70	.7	17.5	.7	75.6	.1	2.5	.1	5.0	.1	1.0	101.6	...
Average for stable decades	0.2	5.0	0.2	21.6	0.1	2.5	0.1	5.0	0.1	1.0	35.1	...
Harvesting labor												
1-10	0.5	12.5	0.4	10.0	0	0	1.6	80.0	0	0	102.5	352.6
11-20	3.8	95.0	3.8	410.4	3.3	82.5	4.2	210.0	1.4	14.0	811.9	833.7
21-30	3.5	87.5	3.5	378.0	0	0	3.6	180.0	1.0	10.0	655.5	677.3
31-40	1.5	37.5	1.5	162.0	1.5	37.5	4.8	240.0	4.5	45.0	522.0	543.8
41-50	3.4	85.0	3.4	367.2	2.0	50.0	5.0	250.0	5.2	52.0	804.2	826.0
51-60	3.8	95.0	3.8	410.4	4.7	117.5	5.0	250.0	5.4	54.0	926.9	948.7
61-70	12.4	310.0	12.4	1,339.2	4.8	120.0	5.0	250.0	5.3	53.0	2,072.2	2,173.8
Average for stable decades	4.7	117.5	4.7	507.6	4.8	120.0	5.0	250.0	5.3	53.0	1,048.1	1,083.2

TABLE 3-3AB.-- Value of yields by decade from the 133 acres of Areas A and B of Unit 3 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Areas A-B total value
years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.15	25.00	3.75	0.35	8.00	2.80	6.55	328.00
11-20	0	. .	0	5.50	10.00	55.00	55.00	7,315.00
21-30	0	. .	0	5.00	10.00	50.00	50.00	6,650.00
31-40	.80	35.00	28.00	1.50	10.00	15.00	43.00	5,719.00
41-50	2.60	50.00	130.00	2.50	10.00	25.00	155.00	20,615.00
51-60	4.60	50.00	230.00	1.50	10.00	15.00	245.00	32,585.00
61-70	16.00	50.00	800.00	4.00	10.00	40.00	840.00	111,720.00
Average for stable decades	4.00	50.00	200.00	3.30	10.00	33.00	233.00	30,989.00

TABLE 3-3C.--Value of yields by decade from the 25 acres of Area C of Unit 3 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.2	30.00	36.00	2.5	8.00	20.00	56.00	1,400.00
21-30	0	. .	0	0	. .	0	0	0
31-40	0	. .	0	1.5	8.00	12.00	12.00	300.00
41-50	1.5	55.00	82.50	1.0	8.00	8.00	90.50	2,262.00
51-60	2.4	55.00	132.00	3.0	8.00	24.00	156.00	3,900.00
61-70	2.6	55.00	143.00	3.0	8.00	24.00	167.00	4,175.00
Average for stable decades	2.6	55.00	143.00	3.0	8.00	24.00	167.00	4,175.00

TABLE 3-3D.--Value of yields by decade from the 50 acres of Area D of Unit 3 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	1.6	8.00	12.80	12.80	640.00
11-20	1.2	30.00	36.00	3.4	8.00	27.20	63.20	3,160.00
21-30	1.5	35.00	52.50	2.6	8.00	20.80	73.30	3,650.00
31-40	2.6	50.00	130.00	3.0	8.00	24.00	154.00	7,800.00
41-50	2.8	55.00	154.00	3.0	8.00	24.00	178.00	8,900.00
51-60	2.8	55.00	154.00	3.0	8.00	24.00	178.00	8,900.00
61-70	2.8	55.00	154.00	3.0	8.00	24.00	178.00	8,900.00
Average for stable decades	2.8	55.00	154.00	3.0	8.00	24.00	178.00	8,900.00

TABLE 3-3E.--Value of yields by decade from the 10 acres of Area E of Unit 3 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area E total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	2.0	30.00	60.00	0	. .	0	60.00	600.00
21-30	0	. .	0	1.0	8.00	8.00	8.00	80.00
31-40	0	. .	0	4.5	8.00	36.00	36.00	360.00
41-50	2.0	55.00	110.00	3.8	8.00	30.40	140.40	1,404.00
51-60	2.8	55.00	154.00	3.4	8.00	27.20	181.20	1,812.00
61-70	2.9	55.00	159.50	3.3	8.00	26.40	185.90	1,859.00
Average for stable decades	2.9	55.00	159.50	3.3	8.00	26.40	185.90	1,859.00

TABLE 3-4AB.--Value of yields by decade from the 133 acres of Areas A and B of Unit 3 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Areas A-B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.15	10.00	1.50	0.35	. .	0	1.50	175.00
11-20	0	....	0	5.5	3.00	16.50	16.50	2,194.50
21-30	0	. .	0	5.0	3.00	15.00	15.00	1,995.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	2,726.50
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	13,100.50
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	22,011.50
61-70	16.0	35.00	560.00	4.0	3.00	125.00	572.00	76,076.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	19,936.70

TABLE 3-4C.--Value of yields by decade from the 25 acres of Area C of Unit 3 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.2	15.00	18.00	2.5	. .	0	18.00	450.00
21-30	0	. .	0	0	. .	0	0	0
31-40	0	. .	0	1.5	. .	0	0	0
41-50	1.5	40.00	60.00	1.0	. .	0	60.00	1,500.00
51-60	2.4	40.00	96.00	3.0	. .	0	96.00	2,400.00
61-70	2.6	40.00	104.00	3.0	. .	0	104.00	2,600.00
Average for stable decades	2.6	40.00	104.00	3.0	. .	0	104.00	2,600.00

TABLE 3-4D.--Value of yields by decade from the 50 acres of Area D of Unit 3 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	1.6	. .	0	0	0
11-20	1.2	15.00	18.00	3.4	. .	0	18.00	900.00
21-30	1.5	20.00	30.00	2.6	. .	0	30.00	1,500.00
31-40	2.6	35.00	91.00	3.0	. .	0	91.00	4,550.00
41-50	2.8	35.00	98.00	3.0	. .	0	98.00	4,900.00
51-60	2.8	35.00	98.00	3.0	. .	0	98.00	4,900.00
61-70	2.8	35.00	98.00	3.0	. .	0	98.00	4,900.00
Average for stable decades	2.8	35.00	98.00	3.0	. .	0	98.00	4,900.00

TABLE 3-4E.--Value of yields by decade from the 10 acres of Area E of Unit 3 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area' E total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	2.0	15.00	30.00	0	. .	0	30.00	300.00
21-30	0	. .	0	1.0	. .	0	0	0
31-40	0	. .	0	4.5	. .	0	0	0
41-50	2.0	40.00	80.00	3.8	. .	0	80.00	800.00
51-60	2.8	40.00	112.00	3.4	. .	0	112.00	1,120.00
61-70	2.9	40.00	116.00	3.3	. .	0	116.00	1,160.00
Average for stable decades	2.9	40.00	116.00	3.3	. .	0	116.00	1,160.00

TABLE 3-5.-- Value of yields by decade from Areas A and B, C, D and E of Unit 3 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Areas A and B - 133 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	1.5	10.00	15.00	1,995.00
41-50	.4	10.00	4.00	532.00
51-60	.4	10.00	4.00	532.00
61-70	.4	10.00	4.00	532.00
Average for stable decades	0.4	10.00	4.00	532.00
		Area C - 25 acres		
1-10	0	. .	0	0
11-20	2.4	10.00	24.00	500.00
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	2.0	10.00	20.00	400.00
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	100.00

TABLE 3-5.-- continued

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area D - 50 acres		
1-10	1.7	10.00	17.00	850.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	2.0	10.00	20.00	1,000.00
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	200.00
		Area E - 10 acres		
1-10	1.8	10.00	18.00	180.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	1.8	10.00	18.00	180.00
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.45	10.00	4.50	45.00

TABLE 3-6A.--Average yields and labor inputs per acre by decade for Unit 3 Area A, a 25-acre loblolly pine plantation replacing a poorly stocked poletimber stand of pine-hardwoods containing 0.7 cord per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
	Intensive management of pine stand			
Development period				
Years 1-10[b]	0.1	0.4	1.4[c]	0.5
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.0	3.4	.4	4.8
Av. for stable period[e]	4.0	3.3	0.2	4.7
	Extensive management of original pine-hardwoods			
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	1.5	...	...	...
Average	.5	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 11 square feet per acre, of which 7 were in growing stock, 2 in undesirable but merchantable trees, and 2 in culls. The stand contains trees up to 14 inches d.b.h.; 80 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in this decade are shortleaf pine sawlogs and hardwood pulpwood, in succeeding decades, loblolly pine.

[c]1.1 man-days for planting pine, 0.3 for deadening hardwoods having a basal area of 9 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 3-6B.--Average yields and labor inputs per acre by decade for Unit 3 Area B, a 25-acre loblolly pine plantation replacing a poorly stocked poletimber stand of upper-slope cedar-hardwoods containing 0.8 cord per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management of pine-stand				
Development period				
Years 1-10[b]	0.2	0.3	1.7[c]	0.4
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.0	3.4	.5	4.8
Av. for stable period[e]	4.0	3.3	0.2	4.7
Extensive management of original cedar-hardwoods stand				
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	1.5	...	...	...
Average	0.5	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 25 square feet per acre, of which 14 were in growing stock, 9 in undesirable but merchantable trees, and 2 in culls. The stand contains trees up to 16 inches d.b.h.; 91 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in the first decade are hardwood, in succeeding decades, pine.

[c]1.1 man-days for planting pine, 0.6 for deadening unmerchantable cedars having a basal area of 20 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 3-6C.--Average yields and labor inputs per acre by decade for Unit 3 Area C, a 25-acre well stocked seedling and sapling stand of upper-slope pine-cedar-hardwoods containing 1.3 MBF per acre[a]

Decade (years of management)	Yields/acre/decade MBF of sawlogs	Yields/acre/decade Cords of pulpwood	Labor inputs/acre/decade Man-days for management	Labor inputs/acre/decade Man-days for harvesting
	Intensive management			
Development period				
Years 1-10	0	0	0.3	0
11-20	1.2	2.5	.1	3.3
21-30	0	0	.1	0
31-40	0	1.5	.1	1.5
41-50	1.5	1.0	.1	2.0
51-60	2.4	3.0	.1	4.7
Average	1.0	1.6	.2	2.3
Av. for stable period[b]	2.6	3.0	0.1	4.8
	Extensive management			
Period of declining yield				
Years 1-10	0	...	...	...
11-20	2.4	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	2.0	...	...	...
Average	1.1	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 48 square feet per acre, of which 18 were in growing stock, 25 in undesirable but merchantable trees, and 5 in culls. The stand contains trees up to 18 inches d.b.h.; 72 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as moderately stocked poletimber or poorly stocked large sawtimbers.

[b]Residual growing stock 3.4 MBF plus 3.2 cords.

[c]Residual growing stock nil.

TABLE 3-6D.--Average yields and labor inputs per acre by decade for Unit 3 Area D, a 50-acre well stocked poletimber stand of upper-slope hardwoods containing 1.7 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management				
Development period				
Years 1-10	0	1.6	0.4	1.6
11-20	1.2	3.4	.1	4.2
21-30	1.5	2.6	.1	3.6
31-40	2.6	3.0	.1	4.8
Average	1.8	3.5	.2	4.8
Av. for stable period[b]	2.8	3.0	0.1	5.0
Extensive management				
Period of declining yield				
Years 1-10	1.7	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	2.0	...	...	...
Average	1.2	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 79 square feet per acre, of which 57 were in growing stock, 15 in undesirable but merchantable trees, and 7 in culls. The stand contains trees up to 26 inches d.b.h.; 75 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as poorly stocked sawtimber.

[b]Residual growing stock 3.2 MBF plus 3.2 cords.

[c]Residual growing stock nil.

TABLE 3-6E.--Average yields and labor inputs per acre by decade for Unit 3 Area E, a 10-acre moderately stocked seedling and sapling stand of lower-slope hardwoods containing 1.8 MBF per acre[a]

Decade (Years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	0	0	0.4	.0
11-20	2.0	0	.1	1.4
21-30	0	1.0	.1	1.0
31-40	0	4.5	.1	4.5
41-50	2.0	3.8	.1	5.2
51-60	2.8	3.4	.1	5.4
Average	1.4	2.5	.2	3.5
Av. for stable period[b]	2.9	3.3	0.1	5.3
		Extensive management		
Period of declining yield				
Years 1-10	1.8	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	1.8	...	...	...
Average	.9	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 50 square feet per acre, of which 30 were in growing stock, 13 in undesirable but merchantable trees, and 7 in culls. The stand contains trees up to 34 inches d.b.h.; 59 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as poorly stocked large-sawtimber.

[b]Residual growing stock 3.4 MBF plus 3.5 cords.

[c]Residual growing stock nil.

TABLE 4-1.--Labor requirements and value of yields by decade from 175 acres of forest land on Unit 4, with intensive and extensive management

Years of management	Roadside sales: Labor input	Roadside sales: Value of products sold	Stumpage sales: Labor input	Stumpage sales: Value of products sold
	Man-days	Dollars	Man-days	Dollars
		Intensive management[a]		
1-10	489	6,992	130	2,633
11-20	446	8,670	18	3,766
21-30	526	11,216	18	4,985
31-40	364	12,324	18	6,912
41-50	668	28,415	18	18,036
51-60	745	38,637	18	25,474
61-70	1,893	113,872	103	77,048
Average per decade for stable period	830	37,941	32	24,449
		Extensive management[b]		
1-10	No cultural work is required and only stumpage sales are made.			5,428
11-20				1,580
21-30				3,211
31-40				0
41-50				2,356
51-60				0
61-70				2,088
Average per decade after 7th decade				1,080

[a]The initial stumpage value of the timber is about $5,400, while after 60 years of intensive management the average value of growing stock is about $33,900.

[b]The average value of growing stock following 70 years of extensive management is about $2,500.

TABLE 4-2.--Labor requirements in man-days for management and for harvesting by decades on the 4 categories of forest in Unit 4

Decades years	Area A per acre	Area A on 93 acres	Area B per acre	Area B on 30 acres	Area C per acre	Area C on 20 acres	Area D per acre	Area D on 32 acres	Total on 175 acres
				Management labor					
1-10	1.2	111.6	0.3	9.0	0.3	6.0	0.1	3.2	129.8
11-20	.1	9.3	.1	3.0	.1	2.0	.1	3.2	17.5
21-30	.1	9.3	.1	3.0	.1	2.0	.1	3.2	17.5
31-40	.1	9.3	.1	3.0	.1	2.0	.1	3.2	17.5
41-50	.1	9.3	.1	3.0	.1	2.0	.1	3.2	17.5
51-60	.1	9.3	.1	3.0	.1	2.0	.1	3.2	17.5
61-70	.7	65.1	.7	21.0	.7	14.0	.1	3.2	103.3
Average for stable decades	0.2	18.6	0.2	6.0	0.2	4.0	0.1	3.2	31.8
				Harvesting labor					
1-10	2.0	186.0	1.3	39.0	2.4	48.0	2.7	86.4	359.4
11-20	3.8	353.4	1.3	39.0	1.8	36.0	0	0	428.4
21-30	3.5	325.5	2.3	69.0	3.0	60.0	1.7	54.4	508.9
31-40	1.5	139.5	3.4	102.0	3.0	60.0	1.4	44.8	346.3
41-50	3.4	316.2	3.2	96.0	3.6	72.0	5.2	166.4	650.6
51-60	3.8	353.4	3.9	117.0	4.2	84.0	5.4	172.8	727.2
61-70	12.4	1,153.2	8.8	264.0	10.0	200.0	5.4	172.8	1,790.0
Average for stable decades	4.7	437.1	3.6	108.0	4.0	80.0	5.4	172.8	797.9
				Total management and harvesting labor					
1-10									489.2
11-20									445.9
21-30									426.4
31-40									363.8
41-50									668.1
51-60									744.7
61-70									1,893.3
Average for stable decades									829.7

TABLE 4-3A.--Value of yields by decade from the 93 acres of Area A of Unit 4 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.3	25.00	7.50	1.8	8.00	14.40	21.90	2,037.00
11-20	0	. .	0	5.5	10.00	55.00	55.00	5,115.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	4,650.00
31-40	.8	35.00	28.00	1.5	10.00	15.00	43.00	3,999.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	14,415.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	22,785.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	78,120.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	21,669.00

TABLE 4-3B.--Value of yields by decade from the 30 acres of Area B of Unit 3 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.5	35.00	52.50	0.4	10.00	4.00	56.50	1,695.00
11-20	0.3	35.00	10.50	1.6	10.00	16.00	26.50	795.00
21-30	1.5	35.00	52.50	2.0	10.00	20.00	72.50	2,175.00
31-40	1.5	35.00	52.50	3.5	10.00	35.00	87.50	2,625.00
41-50	2.5	50.00	125.00	2.5	10.00	25.00	150.00	4,500.00
51-60	3.0	50.00	150.00	3.0	10.00	30.00	180.00	5,400.00
61-70	10.0	50.00	500.00	4.0	10.00	40.00	540.00	16,200.00
Average for stable decades	3.1	50.00	155.00	2.5	10.00	25.00	180.00	5,400.00

acres of Area C of Unit 4 under Plan II,

TABLE 4-3C.--Value of yields by decade from the 20 acres of Area C of Unit 4 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	3.2	35.00	112.00	0.7	10.00	7.00	119.00	2,380.00
11-20	2.7	50.00	135.00	0.3	10.00	3.00	138.00	2,760.00
21-30	2.0	50.00	100.00	2.5	10.00	25.00	125.00	2,500.00
31-40	2.0	50.00	100.00	2.5	10.00	25.00	125.00	2,500.00
41-50	2.5	50.00	125.00	3.0	10.00	30.00	155.00	3,100.00
51-60	3.0	50.00	150.00	3.5	10.00	35.00	185.00	3,700.00
61-70	12.0	50.00	600.00	4.0	10.00	40.00	640.00	12,800.00
Average for stable decades	3.6	50.00	180.00	2.6	10.00	26.00	206.00	4,120.00

TABLE 4-3D.--Value of yields by decade from the 32 acres of Area D of Unit 4 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.3	25.00	7.50	2.5	8.00	20.00	27.50	880.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	35.00	52.50	0.7	8.00	5.60	59.10	1,891.20
31-40	2.0	50.00	100.00	0	. .	0	100.00	3,200.00
41-50	3.2	55.00	176.00	3.0	8.00	24.00	200.00	6,400.00
51-60	3.4	55.00	187.00	3.0	8.00	24.00	211.00	6,752.00
61-70	3.4	55.00	187.00	3.0	8.00	24.00	211.00	6,752.00
Average for stable decades	3.4	55.00	187.00	3.0	8.00	24.00	211.00	6,752.00

TABLE 4-4A.--Value of yields by decade from the 93 acres of Area A of Unit 4 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.3	10.00	3.00	1.8	. .	0	3.00	279.00
11-20	0	. .	0	5.5	3.00	16.50	16.50	1,534.50
21-30	0	. .	0	5.0	3.00	15.00	15.00	1,395.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	1,906.50
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	9,160.50
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	15,391.50
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	53,196.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	13,940.70

TABLE 4-4B.--Value of yields by decade from the 30 acres of Area B of Unit 4 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.5	20.00	30.00	0.4	3.00	1.20	31.20	936.00
11-20	.3	20.00	6.00	1.6	3.00	4.80	10.80	324.00
21-30	1.5	20.00	30.00	2.0	3.00	6.00	36.00	1,080.00
31-40	1.5	20.00	30.00	3.5	3.00	10.50	40.50	1,215.00
41-50	2.5	35.00	87.50	2.5	3.00	7.50	95.00	2,850.00
51-60	3.0	35.00	105.00	3.0	3.00	9.00	114.00	3,420.00
61-70	10.0	35.00	350.00	4.0	3.00	12.00	362.00	10,860.00
Average for stable decades	3.1	35.00	108.50	2.5	3.00	7.50	116.00	3,480.00

TABLE 4-4C.--Value of yields by decade from the 20 acres of Area C of Unit 4 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value 1 per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	3.2	20.00	64.00	0.7	3.00	2.10	66.10	1,322.00
11-20	2.7	35.00	94.50	0.3	3.00	0.90	95.40	1,908.00
21-30	2.0	35.00	70.00	2.5	3.00	7.50	77.50	1,550.00
31-40	2.0	35.00	70.00	2.5	3.00	7.50	77.50	1,550.00
41-50	2.5	35.00	87.50	3.0	3.00	9.00	96.50	1,930.00
51-60	3.0	35.00	105.00	3.5	3.00	10.50	115.50	2,310.00
61-70	12.0	35.00	420.00	4.0	3.00	12.00	432.00	8,640.00
Average for stable decades	3.6	35.00	126.00	2.6	3.00	7.80	133.80	2,676.00

TABLE 4-4D.--Value of yields by decade from the 32 acres of Area D of Unit 4 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.3	10.00	3.00	2.5	. .	0	3.00	96.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	20.00	30.00	0.7	. .	0	30.00	960.00
31-40	2.0	35.00	70.00	0	. .	0	70.00	2,240.00
41-50	3.2	40.00	128.00	3.0	. .	0	128.00	4,096.00
51-60	3.4	40.00	136.00	1.6	. .	0	136.00	4,352.00
61-70	3.4	40.00	136.00	1.6	. .	0	136.00	4,352.00
Average for stable decades	3.4	40.00	136.00	1.6	. .	0	136.00	4,352.00

TABLE 4-5.--Value of yields by decade from Areas A, B, C and D of Unit 4 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area A - 93 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	1.5	10.00	15.00	1,395.00
31-40	0	. .	0	0
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	1.6	10.00	16.00	1,488.00
Average for stable decades	0.4	10.00	4.00	372.00
		Area B - 30 acres		
1-10	2.7	20.00	54.00	1,620.00
11-20	1.5	20.00	30.00	900.00
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	1.5	20.00	30.00	900.00
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.5	20.00	10.00	300.00

TABLE 4-5.--

Decade
Years
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average for stable decades
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average for stable decades

TABLE 4-5.-- continued

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area C - 20 acres		
1-10	8.0	20.00	160.00	3,200.00
11-20	1.7	20.00	34.00	680.00
21-30	1.5	20.00	30.00	600.00
31-40	0	. .	0	0
41-50	2.2.	20.00	44.00	880.00
51-60	0	. .	0	0
61-70	1.5	20.00	30.00	600.00
Average for stable decades	0.7	20.00	14.00	280.00
		Area D - 32 acres		
1-10	1.9	10.00	19.00	608.00
11-20	0	. .	0	0
21-30	3.8	10.00	38.00	1,216.00
31-40	0	. .	0	0
41-50	1.8	10.00	18.00	576.00
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	128.00

TABLE 4-6A.--A
Unit 4, Area A
stocked poleti

Decade (years of management)
Development pe
Years 1-10[b]
11-20
21-30
31-40
41-50
51-60
61-70
Average
Av. for stable
Period of decli
Years 1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average
Av. for stable

[a]The total ba
of which 17 wer
trees, and 1 in
d.b.h.; 70 perc

[b]Yields in fi

[c]1.1 man-days
hardwoods havin

[d]0.7 man-day s

[e]Even-aged pin

[f]Residual grow

TABLE 4-6A.--Average yields and labor inputs per acre by decade for Unit 4, Area A, a 93-acre loblolly pine plantation replacing a poorly stocked poletimber stand of upper slope hardwoods containing 2.9 cords per acre[a]

Decade (years of management)	Yields/acre/decade: MBF of sawlogs	Yields/acre/decade: Cords of pulpwood	Labor inputs/acre/decade: Man-days for management	Labor inputs/acre/decade: Man-days for harvesting
Intensive management of pine stand				
Development period				
Years 1-10[b]	0.3	1.8	1.2[c]	2.0
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.0	3.6	.4	5.1
Av. for stable period[e]	4.0	3.3	0.2	4.7
Extensive management of original hardwood stand				
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	1.5	...	...	...
31-40	0	...	...	...
41-50	0	...	...	...
51-60	0	...	...	...
61-70	1.6	...	...	...
Average	.5	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 20 square feet per acre, of which 17 were in growing stock, 2 in undesirable but merchantable trees, and 1 in culls. The stand contains trees up to 30 inches d.b.h.; 70 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in first decade are hardwood, in succeeding decades, pine.

[c]1.1 man-days for planting pine, 0.1 for deadening unmerchantable hardwoods having a basal area of 2 square feet.

[d]0.7 man-day schedule to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 4-6B.--Ave
Unit 4 Area B, a
s

Decade (years of management)	
Development peri	
Years 1-10	
11-20	
21-30	
31-40	
41-50	
51-60	
61-70	
Average	
Av. for stable pe	
Period of declini	
Years 1-10	
11-20	
21-30	
31-40	
41-50	
Average	
Av. for stable pe	

[a]The total basa
of which 57 were
trees, and 5 in
55 percent of the
could also be cla
stocked large sa

[b]Yields in the
portion of the s
in the course of

[c]0.7 man-day s

[d]Even-aged pin

[e]Residual grow

TABLE 4-6B.--Average yields and labor inputs per acre by decade for Unit 4 Area B, a 30-acre well stocked seedling and sapling stand of shortleaf pine containing 2.7 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	1.5[b]	0.4	0.3	1.3
11-20	0.3	1.6	.1	1.3
21-30	1.5	2.0	.1	2.3
31-40	1.5	3.5	.1	3.4
41-50	2.5	2.5	.1	3.2
51-60	3.0	3.0	.1	3.9
61-70	10.0	4.0	.7[c]	8.8
Average	3.4	2.8	.2	4.0
Av. for stable period[d]	3.1	2.5	0.2	3.6
		Extensive management		
Period of declining yield				
Years 1-10	2.7	...	...	...
11-20	1.5	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	1.5	...	...	...
Average	1.4	...	...	...
Av. for stable period[e]	0.5	...	...	...

[a]The total basal area of this stand was 66 square feet per acre, of which 57 were in growing stock, 4 in undesirable but merchantable trees, and 5 in culls. The stand contains trees up to 30 inches d.b.h.; 66 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as moderately stocked poletimber or poorly stocked large sawtimbers.

[b]Yields in the first decade are about 1/3 hardwood. The hardwood portion of the stand will be reduced rapidly to a negligible element in the course of 2 more decades.

[c]0.7 man-day scheduled to assure regeneration of a new pine stand.

[d]Even-aged pine on 60-year rotation.

[e]Residual growing stock nil.

TABLE 4-6C.--Ave
Unit 4 Area C, a

Decade (years of management)
Development peri
Years 1-10[b]
11-20
21-30
31-40
41-50
51-60
61-70
Average
Av. for stable p
Period of declin
Years 1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average
Av. for stable p

[a]The total bas
of which 51 were
trees, and 6 in
44 percent of th

[b]Yields in thi
decades of this

[c]0.7 man-day s

[d]Even-aged pin

[e]Residual grow

TABLE 4-6C.--Average yields and labor inputs per acre by decade for Unit 4 Area C, a 20-acre well stocked large sawtimber stand of shortleaf pine containing 8.0 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10[b]	3.2	0.7	0.3	2.4
11-20	2.7	0.3	.1	1.8
21-30	2.0	2.5	.1	3.0
31-40	2.0	2.5	.1	3.0
41-50	2.5	3.0	.1	3.6
51-60	3.0	3.5	.1	4.2
61-70	12.0	4.0	.7[c]	10.0
Average	4.6	2.8	.2	4.7
Av. for stable period[d]	3.6	2.6	0.2	4.0
		Extensive management		
Period of declining yield				
Years 1-10	8.0	...	...	...
11-20	1.7	...	...	...
21-30	1.5	...	...	...
31-40	0	...	...	...
41-50	2.2	...	...	...
51-60	0	...	...	...
61-70	1.5	...	...	...
Average	2.5	...	...	...
Av. for stable period[e]	0.7	...	...	...

[a]The total basal area of this stand was 98 square feet per acre, of which 51 were in growing stock, 41 in undesirable but merchantable trees, and 6 in culls. The stand contains trees up to 26 inches d.b.h.; 44 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in this decade are almost entirely pine, but in the remaining decades of this first rotation will include about 1/8 hardwood.

[c]0.7 man-day scheduled to assure regeneration of a new pine stand.

[d]Even-aged pine on 60-year rotation.

[e]Residual growing stock nil.

TABLE 4-6D.--Av
Unit 4 Area D, a
slop

Decade (years of management)
Development peri
Years 1-10
11-20
21-30
31-40
41-50
Average
Av. for stable p
Period of declin
Years 1-10
11-20
21-30
31-40
41-50
Average
Av. for stable

[a]The total ba
of which 39 wer
trees, and no c
39 percent of t
could also be c

[b]Residual gro

[c]Residual gro

TABLE 4-6D.--Average yields and labor inputs per acre by decade for Unit 4 Area D, a 32-acre moderately stocked poletimber stand of lower-slope hardwoods containing 1.9 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	0.3	2.5	0.1	2.7
11-20	0	0	.1	0
21-30	1.5	0.7	.1	1.7
31-40	2.0	0	.1	1.4
41-50	3.2	3.0	.1	5.2
Average	1.8	1.6	.1	3.8
Av. for stable period[b]	3.4	3.0	0.1	5.4
		Extensive management		
Period of declining yield				
Years 1-10	1.9	...	...	...
11-20	0	...	...	...
21-30	3.8	...	...	...
31-40	0	...	...	...
41-50	1.8	...	...	...
Average	1.9	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 62 square feet per acre, of which 39 were in growing stock, 23 in undesirable but merchantable trees, and no culls. The stand contains trees up to 22 inches d.b.h.; 59 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as poorly stocked large sawtimber.

[b]Residual growing stock 3.6 MBF plus 3.2 cords.

[c]Residual growing stock nil.

TABLE 5-1.--L
92 acres of f

Years of management
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average per decade for stable perio
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average per decade after 7th decade

[a]The init
after 60 ye
stock is ab

[b]The aver
sive manage

TABLE 5-1.--Labor requirements and value of yields by decade from 92 acres of forest land on Unit 5, with intensive and extensive management

Years of management	Roadside sales: Labor input	Roadside sales: Value of products sold	Stumpage sales: Labor input	Stumpage sales: Value of products sold
	Man-days	Dollars	Man-days	Dollars
		Intensive management[a]		
1-10	220	1,581	120	391
11-20	228	3,969	9	1,418
21-30	212	3,262	9	1,115
31-40	173	6,887	9	4,136
41-50	296	13,158	9	8,394
51-60	370	17,922	9	11,628
61-70	780	44,697	36	29,920
Average per decade for stable period	411	17,382	14	10,926
		Extensive management[b]		
1-10	No cultural work is required and only stumpage sales are made.			721
11-20				252
21-30				765
31-40				339
41-50				756
51-60				324
61-70				720
Average per decade after 7th decade				368

[a]The initial stumpage value of the timber is about $720, while after 60 years of intensive management, the average value of growing stock is about $14,800.

[b]The average value of growing stock following 70 years of extensive management is about $750.

TABLE 5
harve

Decade years
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average for stab decades
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average for stab decades
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average

TABLE 5-2.--Labor requirements in man-days for management and for harvesting by decades on the 4 categories of forest in Unit 5

Decade years	Area A per acre	Area A on 45 acres	Area B per acre	Area B on 30 acres	Area C per acre	Area C on 12 acres	Area D per acre	Area D on 5 acres	Total on 92 acres
	Labor requirements in man-days								
	Management labor								
1-10	2.0	90.0	0.7	21.0	0.4	4.8	0.9	4.5	120.3
11-20	.1	4.5	.1	3.0	.1	1.2	.1	.5	9.2
21-30	.1	4.5	.1	3.0	.1	1.2	.1	.5	9.2
31-40	.1	4.5	.1	3.0	.1	1.2	.1	.5	9.2
41-50	.1	4.5	.1	3.0	.1	1.2	.1	.5	9.2
51-60	.1	4.5	.1	3.0	.1	1.2	.1	.5	9.2
61-70	.7	31.5	.1	3.0	.1	1.2	.1	.5	36.2
Average for stable decades	0.2	9.0	0.1	1.2	0.1	1.2	0.1	0.5	13.7
	Harvesting labor								
1-10	1.2	54.0	0	0	3.8	45.6	0	0	99.6
11-20	3.8	171.0	1.6	48.0	0	0	0	0	219.0
21-30	3.5	157.5	0	0	3.1	37.2	1.6	8.0	202.7
31-40	1.5	67.5	2.0	60.0	3.0	36.0	2.0	10.0	163.5
41-50	3.4	153.0	2.8	84.0	2.4	28.8	4.3	21.5	287.3
51-60	3.8	171.0	3.7	111.0	4.7	56.4	4.3	21.5	359.9
61-70	12.4	558.0	3.6	108.0	4.7	56.4	4.3	21.5	743.9
Average for stable decades	4.7	211.5	3.6	108.8	4.7	56.4	4.3	21.5	397.4
	Total management and harvesting labor								
1-10									219.9
11-20									228.2
21-30									211.9
31-40									172.7
41-50									296.5
51-60									369.1
61-70									780.1
Average for stable decades									411.1

TABLE 5-3A.--Value of yields by decade from the 45 acres of Area A of Unit 5 under Plan II with intensive forest management and roadside sales

TABLE 5-3A.--Value of yields by decade from the 45 acres of Area A of Unit 5 under Plan II with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.6	25.00	15.00	0.8	8.00	6.40	21.40	963.00
11-20	0	. .	0	5.5	10.00	55.00	55.00	2,475.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	2,250.00
31-40	.8	35.00	28.00	1.5	10.00	15.00	43.00	1,935.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	6,975.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	11,025.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	37,800.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	10,485.00

TABLE 5-3B.--Value of yields by decade from the 30 acres of Area B of Unit 5 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per	Price per	Sawlog value per	Pulpwood yield per	Price per	Pulpwood value per	Total value per	Area B total

TABLE 5-3B.--Value of yields by decade from the 30 acres of Area B of Unit 5 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.5	30.00	45.00	0.6	8.00	4.80	49.80	1,494.00
21-30	0	. .	0	0	. .	0	0	0
31-40	1.5	50.00	75.00	1.0	8.00	8.00	83.00	2,490.00
41-50	1.8	55.00	99.00	1.5	8.00	12.00	111.00	3,330.00
51-60	2.0	55.00	110.00	2.3	8.00	18.40	128.40	3,852.00
61-70	2.0	55.00	110.00	2.2	8.00	18.40	128.40	3,852.00
Average for stable decades	2.0	55.00	110.00	2.2	8.00	18.40	128.40	3,852.00

TABLE 5-3C.--Value of yields by decade from the 12 acres of Area C of Unit 5 under Plan II, with intensive forest management and roadside sales

TABLE 5-3C.--Value of yields by decade from the 12 acres of Area C of Unit 5 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.1	25.00	27.50	3.0	8.00	24.00	51.50	618.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	35.00	52.50	2.1	8.00	16.80	69.30	831.60
31-40	3.3	50.00	165.00	.7	8.00	5.60	170.60	2,047.20
41-50	3.1	55.00	170.50	.2	8.00	1.60	172.10	2,065.20
51-60	3.0	55.00	165.00	2.6	8.00	20.80	185.80	2,229.60
61-70	3.0	55.00	165.00	2.6	8.00	20.80	185.80	2,229.60
Average for stable decades	3.0	55.00	165.00	2.6	8.00	20.80	185.80	2,229.60

TABLE 5-3D.--Value of yields by decade from the 5 acres of Area D of Unit 5 under Plan II, with intensive forest management and roadside sales

TABLE 5-3D.--Value of yields by decade from the 5 acres of Area D of Unit 5 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	0	. .	0	0	. .	0	0	0
21-30	0.8	35.00	28.00	1.0	8.00	8.00	36.00	180.00
31-40	1.5	50.00	75.00	1.0	8.00	8.00	83.00	415.00
41-50	2.5	55.00	137.50	2.5	8.00	20.00	157.50	787.50
51-60	2.6	55.00	143.00	2.5	8.00	20.00	163.00	815.00
61-70	2.6	55.00	143.00	2.5	8.00	20.00	163.00	815.00
Average for stable decades	2.6	55.00	143.00	2.5	8.00	20.00	163.00	815.00

TABLE 5-4A.--Value of yields by decade from the 45 acres of Area A of Unit 5 under Plan III, with intensive forest management and stumpage sales

TABLE 5-4A.--Value of yields by decade from the 45 acres of Area A of Unit 5 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.6	10.00	6.00	0.8	. .	0	6.00	270.00
11-20	0	. .	0	5.5	3.00	16.50	16.50	742.50
21-30	0	. .	0	5.0	3.00	15.00	15.00	675.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	922.50
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	4,432.50
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	7,447.50
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	25,740.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	6,745.50

TABLE 5-4B.--Value of yields by decade from the 30 acres of Area B of Unit 5 under Plan III, with intensive forest management and stumpage sales

TABLE 5-4B.--Value of yields by decade from the 30 acres of Area B of Unit 5 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.5	15.00	22.50	0.6	. .	0	22.50	675.00
21-30	0	. .	0	0	. .	0	0	0
31-40	1.5	35.00	52.50	1.0	. .	0	52.50	1,575.00
41-50	1.8	40.00	72.00	1.5	. .	0	72.00	2,160.00
51-60	2.0	40.00	80.00	2.3	. .	0	80.00	2,400.00
61-70	2.0	40.00	80.00	2.2	. .	0	80.00	2,400.00
Average for stable decades	2.0	40.00	80.00	2.2	. .	0	80.00	2,400.00

TABLE 5-4C.--*Value of yields by decade from the 12 acres of* **Area C** *of* Unit 5 **under Plan III,** *with intensive forest* **management and stumpage sales**

TABLE 5-4C.--Value of yields by decade from the 12 acres of Area C of Unit 5 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.1	10.00	11.00	3.0	. .	0	11.00	121.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	20.00	30.00	2.1	. .	0	30.00	360.00
31-40	3.3	35.00	115.50	.7	. .	0	115.50	1,386.00
41-50	3.1	40.00	124.00	.2	. .	0	124.00	1,488.00
51-60	3.0	40.00	120.00	2.6	. .	0	120.00	1,260.00
61-70	3.0	40.00	120.00	2.6	. .	0	120.00	1,260.00
Average for stable decades	3.0	40.00	120.00	2.6	. .	0	120.00	1,260.00

TABLE 5-4D.--Value of yields by decade from the 5 acres of **Area D** *of Unit 5 under Plan III, with intensive forest management and stumpage sales*

TABLE 5-4D.--Value of yields by decade from the 5 acres of Area D of Unit 5 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	0	. .	0	0	. .	0	0	0
21-30	0.8	20.00	16.00	1.0	. .	0	16.00	80.00
31-40	1.5	35.00	52.50	1.0	. .	0	52.50	262.50
41-50	2.5	40.00	100.00	2.5	. .	0	100.00	500.00
51-60	2.6	40.00	104.00	2.5	. .	0	104.00	520.00
61-70	2.6	40.00	104.00	2.5	. .	0	104.00	520.00
Average for stable decades	2.6	40.00	104.00	2.5	. .	0	104.00	520.00

TABLE 5-5
of Unit 5

Decade
Years
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average fo stable dec
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average fo stable dec
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average for stable deca

TABLE 5-5.--Value of yields by decade from Areas A, B, C and D of Unit 5 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area A - 45 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	1.7	10.00	17.00	765.00
31-40	0	. .	0	0
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	1.6	10.00	16.00	720.00
Average for stable decades	0.4	10.00	4.00	180.00
		Area B - 30 acres		
1-10	1.1	10.00	11.00	330.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	1.8	10.00	18.00	540.00
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	120.00
		Area C - 12 acres		
1-10	2.3	10.00	23.00	276.00
11-20	2.1	10.00	21.00	252.00
21-30	0	. .	0	0
31-40	2.2	10.00	22.00	264.00
41-50	1.8	10.00	18.00	216.00
51-60	2.7	10.00	27.00	324.00
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	48.00

TABLE 5-5.

Decade
Years
1-10
11-20
21-30
31-40
41-50
51-60
61-70
Average for stable deca

TABLE 5-5.-- continued

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area D - 5 acres		
1-10	2.3	10.00	23.00	115.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	1.5	10.00	15.00	75.00
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	20.00

TABLE 5-6A.--Average yields and labor inppts per acre by decade for Unit 5 Area A, a 45-acre loblolly pine plantation replacing a poorly stocked poletimber stand of upper-slope hardwoods containing 2.6 cords per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
	Intensive management of pine stand			
Development period				
Years 1-10[b]	0.6	0.8	2.0[c]	1.2
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.1	3.5	.6	4.9
Av. for stable period[e]	4.0	3.3	0.2	4.7
	Extensive management of original hardwood stand			
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	1.7	...	...	...
31-40	0	...	...	...
41-50	0	...	...	...
51-60	0	...	...	...
61-70	1.6	...	...	...
Average	.6	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 53 square feet per acre, of which 20 were in growing stock, 4 in undesirable but merchantable trees, and 29 in culls. The stand contains trees up to 40 inches d.b.h.; 56 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in the first decade are hardwood, in succeeding decades, pine.

[c]1.1 man-days for planting pine, 0.9 for deadening unmerchantable hardwoods having a basal area of 37 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 5-6B.--Average yields and labor inputs per acre by decade for Unit 5 Area B, a 30-acre moderately stocked poletimber stand of upper-slope hardwoods containing 1.1 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	0	0	0.7	0
11-20	1.5	0.6	.1	1.6
21-30	0	0	.1	0
31-40	1.5	1.0	.1	2.0
41-50	1.8	1.5	.1	2.8
51-60	2.0	2.3	.1	3.7
Average	1.4	1.1	.2	2.1
Av. for stable period[b]	2.0	2.2	0.1	3.6
		Extensive management		
Period of declining yield				
Years 1-10	1.1	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	1.8	...	...	...
Average	.7	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 72 square feet per acre, of which 39 were in growing stock, 9 in undesirable but merchantable trees, and 24 in culls. The stand contains trees up to 46 inches d. b.h.; 63 percent of the trees are below the 14-inch d.b.h. class.

[b]Residual growing stock 2.8 MBF plus 2.7 cords.

[c]Residual growing stock nil.

TABLE 5-6C.--Average yields and labor inputs per acre by decade for Unit 5 Area C, a 12-acre well stocked poletimber stand of lower-slope hardwoods containing 2.3 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management				
Development period				
Years 1-10	1.1	3.0	0.4	3.8
11-20	0	0	.1	0 0
21-30	1.5	2.1	.1	3.1
31-40	3.3	.7	.1	3.0
41-50	3.1	.2	.1	2.4
Average	2.2	1.5	.2	3.0
Av. for stable period[b]	3.0	2.6	0.1	4.7
Extensive management				
Period of declining yield				
Years 1-10	2.3	...	...	...
11-20	2.1	...	...	...
21-30	0	...	...	...
31-40	2.2	...	...	...
41-50	1.8	...	...	...
51-60	2.7	...	...	...
Average	2.2	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 80 square feet per acre, of which 52 were in growing stock, 21 in undesirable but merchantable trees, and 7 in culls. The stand contains trees up to 32 inches d.b.h.; 60 percent of the trees are below the 14-inch class. This stand could also be classed as moderately stocked large sawtimber.

[b]Residual growing stock 3.3 MBF plus 2.7 cords.

[c]Residual growing stock nil.

TABLE 5-6D.--Average yields and labor inputs per acre by decade for Unit 5 Area D, a 5-acre moderately stocked poletimber stand of bottomland hardwoods containing 2.5 cords per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management				
Development period				
Years 1-10	0	0	0.9	0
11-20	0	0	.1	0
21-30	0.8	1.0	.1	1.6
31-40	1.5	1.0	.1	2.0
41-50	2.5	2.5	.1	4.3
Average	1.2	1.1	.3	2.0
Av. for stable period[b]	2.6[c]	2.5	0.1	4.3
Extensive management				
Period of declining yield				
Years 1-10	2.3	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	1.5	...	...	...
Average	1.3	...	...	...
Av. for stable period[d]	0.5	...	...	...

[a]The total basal area of this stand was 68 square feet per acre, of which 27 were in growing stock, 11 in undesirable but merchantable trees, and 30 in culls. The stand contains trees up to 28 inches d.b.h.; 83 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as poorly stocked small sawtimber with 0.8 MBF per acre.

[b]Residual growing stock, 3.3 MBF plus 3.2 cords.

[c]The relatively low yields in the stable period result from the short-bodied form of existing trees, indicating poor site.

[d]Residual growing stock nil.

TABLE 6-1.--Labor requirements and value of yields by decade from 174 acres of forest land on Unit 6, with intensive and extensive management

Years of management	Roadside sales: Labor input	Roadside sales: Value of products sold	Stumpage sales: Labor input	Stumpage sales: Value of products sold
	Man-days	Dollars	Man-days	Dollars
		Intensive management[a]		
1-10	248	2,795	118	910
11-20	185	2,420	17	726
21-30	665	5,632	17	660
31-40	603	14,762	17	7,727
41-50	570	21,666	17	13,694
51-60	731	27,992	17	17,682
61-70	1,174	55,095	57	36,088
Average per decade for stable period	814	28,387	31	17,516
		Extensive management[b]		
1-10	No cultural work is required and only stumpage sales are made.			0
11-20				2,730
21-30				0
31-40				0
41-50				3,654
51-60				800
61-70				800
Average per decade after 7th decade				800

[a]The initial stumpage value of the timber is about $900, while after 60 years of intensive management the average value of growing stock is about $24,100.

[b]The average value of growing stock following 70 years of extensive management is about $1,400.

TABLE 6-2.--Labor requirements in man-days for management and for harvesting by decades on the 2 categories of forest on Unit 6

Decades year	Area A per acre	Area A on 44 acres	Area B per acre	Area B on 130 acres	Total on 174 acres	Total management and harvesting
	Management labor					
1-10	1.5	66.0	0.4	52.0	118.0	...
11-20	.1	4.4	.1	13.0	17.4	...
21-30	.1	4.4	.1	13.0	17.4	...
31-40	.1	4.4	.1	13.0	17.4	...
41-50	.1	4.4	.1	13.0	17.4	...
51-60	.1	4.4	.1	13.0	17.4	...
61-70	.7	30.8	.2	26.0	56.8	...
Average for stable decades	0.4	17.6	0.1	13.0	30.6	...
	Harvesting labor					
1-10	0.5	13.0	0.9	117.0	130.0	248.0
11-20	3.8	167.2	0	0	167.2	184.6
21-30	3.5	154.0	3.8	494.0	648.0	665.4
31-40	1.5	66.0	4.0	520.0	586.0	603.4
41-50	3.4	149.6	3.1	403.0	552.6	570.0
51-60	3.8	167.2	4.2	546.0	713.2	730.6
61-70	12.4	546.6	4.4	572.0	1,117.6	1,174.4
Average for stable decades	4.8	211.2	4.4	572.0	783.2	813.8

TABLE 6-3A.--Value of yields by decade from the 44 acres of Area of Unit 6 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0.5	8.00	4.00	4.00	104.00
11-20	0	. .	0	5.5	10.00	55.00	55.00	2,420.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	2,200.00
31-40	0.8	35.00	28.00	1.5	10.00	15.00	43 00	1,892.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	6,820.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	10,780.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	36,960.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	10,252.00

TABLE 6-3B.--Value of yields by decade from the 130 acres of Area B of Unit 6 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.7	25.00	17.50	0.4	8.00	3.20	20.70	2,691.00
11-20	0	. .	0	0	. .	0	0	0
21-30	0	. .	0	3.3	8.00	26.40	26.40	3,432.00
31-40	1.5	50.00	75.00	3.0	8.00	24.00	99.00	12,870.00
41-50	1.8	55.00	99.00	1.9	8.00	15.20	114.20	14,846.00
51-60	2.0	55.00	110.00	2.8	8.00	22.40	132.40	17,212.00
61-70	2.1	55.00	115.50	3.0	8.00	24.00	139.50	18,135.00
Average for stable decades	2.1	55.00	115.50	3.0	8.00	24.00	139.50	18,135.00

TABLE 6-4A.--Value of yields by decade from the 44 acres of Area A of Unit 6 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0.5	. .	0	0	0
11-20	0	. .	0	5.5	3.00	16.50	16.50	726.00
21-30	0	. .	0	5.0	3.00	15.00	15.00	660.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	902.00
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	4,334.00
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	7,282.00
61-70	16.0	35.00	560.00	4.00	3.00	12.00	572.00	25,168.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	6,595.60

TABLE 6-4B.--Value of yields by decade from the 130 acres of Area B of Unit 6 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.7	10.00	7.00	0.4	. .	0	7.00	910.00
11-20	0	. .	0	0	. .	0	0	0
21-30	0	. .	0	3.3	. .	0	0	0
31-40	1.5	35.00	52.50	3.0	. .	0	52.50	6,825.00
41-50	1.8	40.00	72.00	1.9	. .	0	72.00	9,360.00
51-60	2.0	40.00	80.00	2.8	. .	0	80.00	10,400.00
61-70	2.1	40.00	84.00	3.0	. .	0	84.00	10,920.00
Average for stable decades	2.1	40.00	84.00	3.0	. .	0	84.00	10,920.00

TABLE 6-5.--Value of yields by decade from Areas A and B of Unit 6 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area A - 44 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	2.1	10.00	21.00	924.00
51-60	.4	10.00	4.00	176.00
61-70	.4	10.00	4.00	176.00
Average for stable decades	0.4	10.00	4.00	176.00
		Area B - 130 acres		
1-10	0	. .	0	0
11-20	2.1	10.00	21.00	2,730.00
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	2.1	10.00	21.00	2,730.00
51-60	.4	10.00	4.00	520.00
61-70	.4	10.00	4.00	520.00
Average for stable decade	0.4	10.00	4.00	520.00

TABLE 6-6A.--Average yields and labor inputs per acre by decade for Unit 6 Area A, a 44-acre loblolly pine plantation replacing a 26-acre poorly stocked poletimber stand of upper-slope hardwoods containing 0.5 cord per acre[a] and 18 acres of brush or idle land

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management of pine stand				
Development period				
Years 1-10[b]	0	0.5	1.5[c]	0.5
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	0.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.0	3.4	.4	4.8
Av. for stable period[e]	4.0	3.3	0.2	4.8
Extensive management of original hardwood stand				
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	2.1	...	...	...
Average	.5	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 25 square feet per acre, of which 14 were in growing stock, 0 in undesirable but merchantable trees, and 11 in culls. The stand contains trees up to 16-inches d.b.h.; 91 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in first decade are hardwood, in succeeding decades, pine. In the first decade, yields and harvesting labor do not apply to the 18 acres of brush or idle land.

[c]1.1 man-days for planting pine, 0.4 for deadening unmerchantable hardwoods having a basal area of 11 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 6-6B.--Average yields and labor inputs per acre by decade for Unit 6 Area B, a 130-acre poorly stocked poletimber stand of upper-slope hardwoods containing 1.2 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management				
Development period				
Years 1-10	0.7	0.4	0.4	0.9
11-20	0	0	.1	0
21-30	0	3.3	.1	3.3
31-40	1.5	3.0	.1	4.0
41-50	1.8	1.9	.1	3.1
51-60	2.0	2.8	.1	4.4
61-70	2.1	3.0	.1	4.4
Average	1.2	2.2	.2	3.1
Av. for stable period[b]	2.1	3.0	0.1	4.4
Extensive management				
Period of declining yield				
Years 1-10	0	...	...	...
11-20	2.1	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	2.1	...	...	...
Average	1.0	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 51 square feet per acre, of which 30 were in growing stock, 10 in undesirable but merchantable trees, and 11 in culls. The stand contains trees up to 26 inches d.b.h.; 67 percent of the trees are below the 14 -inch d.b.h. class.

[b]Residual growing stock, 2.9 MBF plus 4.4 cords.

[c]Residual growing stock nil.

TABLE 7-1.--Labor requirements and value of yields by decade from 2,505 acres of forest land on Unit 7, with intensive and extensive management

Years of management	Roadside sales: Labor input	Roadside sales: Value of products sold	Stumpage sales: Labor input	Stumpage sales: Value of products sold
	Man-days	Dollars	Man-days	Dollars
		Intensive management[a]		
1-10	4,940	45,029	2,457	14,550
11-20	5,478	80,850	250	26,815
21-30	8,791	193,801	250	89,396
31-40	6,392	269,156	250	169,933
41-50	8,631	383,699	250	250,655
51-60	10,300	499,730	250	330,137
61-70	20,880	1,183,980	940	797,612
Average per decade for stable period	11,450	485,930	366	312,197
		Extensive management[b]		
1-10	No cultural work is required and only stumpage sales are made.			29,806
11-20				3,360
21-30				39,235
31-40				37,240
41-50				25,500
51-60				22,339
61-70				10,744
Average per decade after 7th decade				10,474

[a]The initial stumpage value of the timber is about $29,800, while after 60 years of intensive management the average value of growing stock is about $410,000.

[b]The average value of growing stock following 70 years of extensive management is about $ 20,000.

TABLE 7-2.--Labor requirements in man-days for management and for harvesting by decades on the 6 categories of forest on Unit 7

	Labor requirements in man-days							
	Area A		Area B		Area C		Area D	
Decades year	per acre	on 1,123 acres	per acre	on 27 acres	per acre	on 768 acres	per acre	on 160 acres
				Management Labor				
1-10	1.7	1,909.1	1.4	37.8	0.4	307.2	0.3	48.0
11-20	.1	112.3	.1	2.7	.1	76.8	.1	16.0
21-30	.1	112.3	.1	2.7	.1	76.8	.1	16.0
31-40	.1	112.3	.1	2.7	.1	76.8	.1	16.0
41-50	.1	112.3	.1	2.7	.1	76.8	.1	16.0
51-60	.1	112.3	.1	2.7	.1	76.8	.1	16.0
61-70	.7	786.1	.7	18.9	.1	76.8	.1	16.0
Average for stable decades	0.2	224.6	0.2	5.4	0.1	76.8	0.1	16.0
				Harvesting Labor				
1-10	0.9	576.0	3.1	83.7	0.4	307.2	3.8	608.0
11-20	3.8	4,267.4	0	0	0	0	0	0
21-30	3.5	3,930.5	7.4	199.8	2.1	1,612.8	3.1	496.0
31-40	1.5	1,684.5	1.5	40.5	2.0	1,536.0	3.0	480.0
41-50	3.4	3,818.2	3.4	91.8	3.0	2,304.0	2.4	384.0
51-60	3.8	4,267.4	3.8	102.6	3.4	2,611.2	4.7	752.0
61-70	12.4	13,925.2	12.4	334.8	3.4	2,611.2	4.7	752.0
Average for stable decades	4.7	5,278.1	4.7	126.9	3.4	2,611.2	4.7	752.0

TABLE 7-2.-- continued

Decades Year	Area E per acre	Area E on 267 acres	Area F per acre	Area F on 160 acres	Total on 2,505 acres	Total management and harvesting
			Management Labor			
1-10	0.4	106.8	0.3	48.0	2,456.9	...
11-20	.1	26.7	.1	16.0	250.5	...
21-30	.1	26.7	.1	16.0	250.5	...
31-40	.1	26.7	.1	16.0	250.5	...
41-50	.1	26.7	.1	16.0	250.5	...
51-60	.1	26.7	.1	16.0	250.5	...
61-70	.1	26.7	.1	16.0	940.5	...
Average for stable decades	0.1	26.7	0.1	16.0	365.5	...
			Harvesting Labor			
1-10	3.4	907.8	0	0	2,482.7	4,939.6
11-20	0	0	6.0	960.0	5,227.4	5,477.9
21-30	7.0	1,869.0	2.7	432.0	8,540.1	8,790.6
31-40	2.4	640.8	11.0	1,760.0	6,141.8	6,392.3
41-50	2.6	694.2	4.8	1,088.0	8,380.2	8,630.7
51-60	4.6	1,228.2	4.8	1,088.0	10,049.4	10,299.9
61-70	4.6	1,228.2	4.8	1,088.0	19,939.4	20,879.9
Average for stable decades	4.6	1,228.2	4.8	1,088.0	11,084.4	11,449.9

Labor requirements in man-days

TABLE 7-3A.--Value of yields by decade from the 1,123 acres of Area A of Unit 7 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	25.00	0	0.9	8.00	7.20	7.20	4,608.00
11-20	0	. .	0	5.5	10.00	55.00	55.00	61,765.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	56,150.00
31-40	0.8	35.00	28.00	1.5	10.00	15.00	43.00	48,289.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	174,065.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	275,135.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	943,320.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	261,659.00

TABLE 7-3B.--Value of yields by decade from the 27 acres of Area B of Unit 7 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	3.3	25.00	82.50	0.8	8.00	6.40	88.90	2,400.30
11-20	0	. .	0	5.5	10.00	55.00	55.00	1,485.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	1,350.00
31-40	0.8	35.00	28.00	1.5	10.00	15.00	43.00	1,161.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	4,185.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	6,615.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	22,680.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	6,291.00

TABLE 7-3C.--Value of yields by decade from the 768 acres of Area C of Unit 7 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.5	25.00	12.50	0.1	8.00	0.80	13.30	10,214.40
11-20	0	. .	0	0	. .	0	0	0
21-30	2.3	35.00	80.50	.5	8.00	4.00	84.50	64,896.00
31-41	2.9	50.00	145.00	0	. .	0	145.00	111,360.00
41-50	2.2	55.00	121.00	1.5	8.00	12.00	133.00	102,144.00
51-60	2.3	55.00	126.50	1.8	8.00	14.40	140.90	108,211.20
61-70	2.0	55.00	126.50	1.8	8.00	14.40	140.90	108,211.20
Average for stable decades	2.3	55.00	126.50	1.8	8.00	14.40	140.90	108,211.20

TABLE 7-3D.--Value of yields by decade from the 160 acres of Area D of Unit 7 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.1	45.00	49.50	3.0	8.00	24.00	73.50	11,760.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	55.00	82.50	2.1	8.00	16.80	99.30	15,888.00
31-40	3.3	55.00	181.50	.7	8.00	5.60	187.10	29,936.00
41-50	3.1	55.00	170.50	.2	8.00	1.60	172.10	27,536.00
51-60	3.0	55.00	165.00	2.6	8.00	20.80	185.80	29,728.00
61-70	3.0	55.00	165.00	2.6	8.00	20.80	185.80	29,728.00
Average for stable decades	3.0	55.00	165.00	2.6	8.00	20.80	185.80	29,728.00

TABLE 7-3E.--Value of yields by decade from the 267 acres of Area E of Unit 7 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area E total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.7	25.00	42.50	2.2	8.00	17.60	60.10	16,046.70
11-20	0	. .	0	0	. .	0	0	0
21-30	2.7	35.00	94.50	5.1	8.00	40.80	135.30	36,125.10
31-40	2.8	50.00	140.00	.4	8.00	3.20	143.20	38,234.40
41-50	2.7	55.00	148.50	.7	8.00	5.60	154.10	41,144.70
51-60	2.7	55.00	148.50	2.7	8.00	21.60	170.10	45,416.70
61-70	2.7	55.00	148.50	2.7	8.00	21.60	170.10	45,416.70
Average for stable decades	2.7	55.00	148.50	2.7	8.00	21.60	170.10	45,416.70

TABLE 7-3E.--Value of yields by decade from the 267 acres of Area E of Unit 7 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area E total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.7	25.00	42.50	2.2	8.00	17.60	60.10	16,046.70
11-20	0	. .	0	0	. .	0	0	0
21-30	2.7	35.00	94.50	5.1	8.00	40.80	135.30	36,125.10
31-40	2.8	50.00	140.00	.4	8.00	3.20	143.20	38,234.40
41-50	2.7	55.00	148.50	.7	8.00	5.60	154.10	41,144.70
51-60	2.7	55.00	148.50	2.7	8.00	21.60	170.10	45,416.70
61-70	2.7	55.00	148.50	2.7	8.00	21.60	170.10	45,416.70
Average for stable decades	2.7	55.00	148.50	2.7	8.00	21.60	170.10	45,416.70

TABLE 7-3F.--Value of yields by decade from the 160 acres of Area F of Unit 7 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area F total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.4	50.00	70.00	5.0	8.00	40.00	110.00	17,600.00
21-30	2.0	55.00	110.00	1.4	8.00	11.20	121.20	19,392.00
31-40	3.3	55.00	181.50	8.7	8.00	69.60	251.10	40,176.00
41-50	3.6	55.00	198.00	2.3	8.00	18.40	216.40	34,624.00
51-60	3.6	55.00	198.00	2.3	8.00	18.40	216.40	34,624.00
61-70	3.6	55.00	198.00	2.3	8.00	18.40	216.40	34,624.00
Average for stable decades	3.6	55.00	198.00	2.3	8.00	18.40	216.40	34,624.00

TABLE 7-4A.--Value of yields by decade from the 1123 acres of Area A of Unit 7 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0.9	. .	0	0	0
11-20	0	. .	0	5.5	3.00	16.50	16.50	18,529.50
21-30	0	. .	0	5.0	3.00	15.00	15.00	16,845.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	23,021.50
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	110,615.50
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	185,856,50
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	642,356.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	168,337.70

TABLE 7-4B.--Value of yields by decade from the 27 acres of Area B of Unit 7 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	3.3	10.00	33.00	0.8	. .	0	33.00	891.00
11-20	0	. .	0	5.5	3.00	16.50	16.50	445.50
21-30	0	. .	0	5.0	3.00	15.00	15.00	405.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	553.50
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	2,659.50
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	4,468.50
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	15,444.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	4,047.30

TABLE 7-4C.--Value of yields by decade from the 768 acres of Area C of Unit 7 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.5	10.00	5.00	0.1	. .	0	5.00	3,840.00
11-20	0	. .	0	0	. .	0	0	0
21-30	2.3	20.00	46.00	.5	. .	0	46.00	35.328.00
31-40	2.9	35.00	101.50	0	. .	0	101.50	77,952.00
41-50	2.2	40.00	88.00	1.5	. .	0	88.00	67,584.00
51-60	2.3	40.00	92.00	1.8	. .	0	92.00	70,656.00
61-70	2.3	40.00	92.00	1.8	. .	0	92.00	70,656.00
Average for stable decades	2.3	40.00	92.00	1.8	. .	0	92.00	70,656.00

TABLE 7-4D.--Value of yields by decade from the 160 acres of Area D of Unit 7 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.1	30.00	33.00	3.0	. .	0	33.00	5,280.00
11-20	0	. .	0	0	. .	0	0	0
21-30	1.5	40.00	60.00	2.1	. .	0	60.00	9,600.00
31-40	3.3	40.00	132.00	.7	. .	0	132.00	21,120.00
41-50	3.1	40.00	124.00	.2	. .	0	124.00	19,840.00
51-60	3.0	40.00	120.00	2.6	. .	0	120.00	19,200.00
61-70	3.0	40.00	120.00	2.6	. .	0	120.00	19,200.00
Average for stable decades	3.0	40.00	120.00	2.6	. .	0	120.00	19,200.00

TABLE 7-4E.--Value of yields by decade from the 267 acres of Area E of Unit 7 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area E total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.7	10.00	17.00	2.2	. .	0	17.00	4,539.00
11-20	0	. .	0	0	. .	0	0	0
21-30	2.7	20.00	54.00	5.1	. .	0	54.00	14,418.00
31-40	2.8	35.00	98.00	.4	. .	0	98.00	26,166.00
41-50	2.7	40.00	108.00	.7	. .	0	108.00	28,836.00
51-60	2.7	40.00	108.00	2.7	. .	0	108.00	28,836.00
61-70	2.7	40.00	108.00	2.7	. .	0	108.00	28.836.00
Average for stable decades	2.7	40.00	108.00	2.7	. .	0	108.00	28.836.00

TABLE 7-4F.--Value of yields by decade from the 160 acres of Area F of Unit 7 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area F total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	1.4	35.00	49.00	5.0	. .	0	49.00	7,840.00
21-30	2.0	40.00	80.00	1.4	. .	0	80.00	12,800.00
31-40	3.3	40.00	132.00	8.7	. .	0	132.00	21,120.00
41-50	3.3	40.00	132.00	2.3	. .	0	132.00	21,120.00
51-60	3.3	40.00	132.00	2.3	. .	0	132.00	21,120.00
61-70	3.3	40.00	132.00	2.3	. .	0	132.00	21,120.00
Average for stable decades	3.3	40.00	132.00	2.3	. .	0	132.00	21,120.00

[illegible]

TABLE 7-5.--Value of yields by decade from Areas Aa, Ab, B, C, D, E and F of Unit 7 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area Aa - 640 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	2.4	10.00	24.00	15,360.00
41-50	0	. .	0	0
51-60	1.7	10.00	17.00	10,880.00
61-70	.4	10.00	4.00	2,560.00
Average for stable decades	0.4	10.00	4.00	2,560.00
		Area Ab - 483 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	1.5	10.00	15.00	7,245.00
41-50	.4	10.00	4.00	1,932.00
51-60	.4	10.00	4.00	1,932.00
61-70	.4	10.00	4.00	1,932.00
Average for stable decades	0.4	10.00	4.00	1,932.00
		Area B - 27 acres		
1-10	3.3	10.00	33.00	891.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	1.7	10.00	17.00	459.00
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	1.5	10.00	15.00	405.00
Average for stable decades	0.5	10.00	5.00	135.00

TABLE 7-5.-- Continued

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area C - 768 acres		
1-10	2.0	10.00	20.00	15,360.00
11-20	0	. .	0	0
21-30	2.6	10.00	26.00	19,968.00
31-40	0	. .	0	0
41-50	1.7	10.00	17.00	13,056.00
51-60	.4	10.00	4.00	3,072.00
61-70	.4	10.00	4.00	3,072.00
Average for stable decades	0.4	10.00	4.00	3,072.00
		Area D - 160 acres		
1-10	2.4	10.00	24.00	3,840.00
11-20	2.1	10.00	21.00	3,360.00
21-30	0	. .	0	0
31-40	2.2	10.00	22.00	3,502.00
41-50	1.8	10.00	18.00	2,880.00
51-60	2.7	10.00	27.00	4,320.00
61-70	.4	10.00	4.00	640.00
Average for stable decades	0.4	10.00	4.00	640.00
		Area E - 267 acres		
1-10	2.5	10.00	25.00	6,675.00
11-20	0	. .	0	0
21-30	4.1	10.00	41.00	10,947.00
31-40	2.2	10.00	22.00	5,874.00
41-50	1.6	10.00	16.00	4,272.00
51-60	.5	10.00	5.00	1,335.00
61-70	.5	10.00	5.00	1,335.00
Average for stable decades	0.5	10.00	5.00	1,335.00

TABLE 7-5.-- continued

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area F - 160 acres		
1-10	1.9	10.00	19.00	3,040.00
11-20	0	. .	0	0
21-30	5.2	10.00	52.00	8,320.00
31-40	3.0	10.00	30.00	4,800.00
41-50	2.1	10.00	21.00	3,360.00
51-60	.5	10.00	5.00	800.00
61-70	.5	10.00	5.00	800.00
Average for stable decades	0.5	10.00	5.00	800.00

TABLE 7-6A.--Average yields and labor inputs per acre by decade for Unit 7 Area A, a 1,123-acre loblolly pine plantation replacing a poorly stocked poletimber stand of upper-slope hardwoods containing 0.9 cord per acre[a] and 483 acres of brush or idle land

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
	Intensive management of pine stand			
Development period				
Years 1-10[b]	0	0.9	1.7[c]	0.9
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	0.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.0	3.5	.5	4.9
Av. for stable period[e]	4.0	3.3	0.2	4.7
	Extensive management of original hardwood stand			
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	2.4	...	...	...
41-50	0	...	...	...
51-60	1.7	...	...	...
Average	.8	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 36 square feet per acre, of which 12 were in growing stock, 5 in undesirable but merchantable trees, and 19 in culls. The stand contains trees up to 26 inches d.b.h.; 66 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in first decade are hardwood, in succeeding decades, pine. In the first decade, yields and harvesting labor do not apply to the 483 acres of brush or idle land.

[c]1.1 man-days for planting pine, 0.6 for deadening unmerchantable hardwoods having a basal area of 19 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 7-6B.--Average yields and labor inputs per acre by decade for Unit 7 Area B, a 27-acre loblolly pine plantation replacing a poorly stocked large sawtimber stand of bottomland hardwoods containing 3.3 MBF per acre[a]

Decade (years of management)	Yields/acre/decade: MBF of sawlogs	Yields/acre/decade: Cords of pulpwood	Labor inputs/acre/decade: Man-days for management	Labor inputs/acre/decade: Man-days for harvesting
	Intensive management of pine stand			
Development period				
Years 1-10[b]	3.3	0.8	1.4[c]	3.1
11-20	0	5.5	.1	0
21-30	0	5.0	.1	7.4
31-40	.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.5	3.5	.4	5.3
Av. for stable period[e]	4.0	3.3	0.2	4.7
	Extensive management of original hardwood stand			
Period of declining yield				
Years 1-10	3.3	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	1.7	...	...	...
41-50	0	...	...	...
51-60	0	...	...	...
61-70	1.5	...	...	...
Average	1.1	...	...	...
Av. for stable period[f]	0.5	...	...	...

[a]The total basal area of this stand was 41 square feet per acre, of which 7 were in growing stock, 25 in undesirable but merchantable trees, and 9 in culls. The stand contains trees up to 22 inches d.b.h.; 33 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in first decade are hardwood, in succeeding decades, pine.

[c]1.1 man-days for planting pine, 0.3 for deadening unmerchantable hardwoods having a basal area of 9 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 7-6C.--Average yields and labor inputs per acre by decade for Unit 7 Area C, a 768-acre moderately stocked poletimber stand of upper-slope hardwoods containing 2.0 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
			Intensive management	
Development period				
Years 1-10	0.5	0.1	0.4	0.4
11-20	0	0	.1	0
21-30	2.3	.5	.1	2.1
31-40	2.0	0	.1	2.0
41-50	2.2	1.5	.1	3.0
51-60	2.3	1.8	.1	3.4
Average	2.0	.5	.2	1.9
Av. for stable period[b]	2.3	1.8	0.1	3.4
			Extensive management	
Period of declining yield				
Years 1-10	2.0	...	...	...
11-20	0	...	...	...
21-30	2.6	...	...	...
31-40	0	...	...	...
41-50	1.7	...	...	...
Average	1.6	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 59 square feet per acre, of which 30 were in growing stock, 17 in undesirable but merchantable trees, and 12 in culls. The stand contains trees up to 32 inches d.b.h.; 59 percent of the trees are below the 14-inch d.b.h. class.

[b]Residual growing stock 3.0 MBF plus 3.0 cords.

[c]Residual growing stock nil.

TABLE 7-6D.--Average yields and labor inputs per acre by decade for Unit 7 Area D, a 160-acre moderately stocked large sawtimber stand of lower-slope hardwoods containing 2.4 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	1.1	3.0	0.3	3.8
11-20	0	0	.1	0
21-30	1.5	2.1	.1	3.1
31-40	3.3	.7	.1	3.0
41-50	3.1	.2	.1	2.4
Average	2.2	1.5	.2	3.1
Av. for stable period[b]	3.0	2.6	0.1	4.7
		Extensive management		
Period of declining yield				
Years 1-10	2.4	...	...	...
11-20	2.1	...	...	...
21-30	0	...	...	...
31-40	2.2	...	...	...
41-50	1.8	...	...	...
51-60	2.7	...	...	...
Average	2.2	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 80 square feet per acre, of which 52 were in growing stock, 21 in undesirable but merchantable trees, and 7 in culls. The stand contains trees up to 32 inches d.b.h.; 60 percent of the trees are below the 14-inch d.b.h. class.

[b]Residual growing stock 3.3 MBF plus 2.7 cords.

[c]Residual growing stock nil.

TABLE 7-6E.--Average yields and labor inputs per acre by decade for Unit 7 Area E, a 267-acre poorly stocked large sawtimber stand of bottomland hardwoods containing 2.5 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
	Intensive management			
Development period				
Years 1-10	1.7	2.2	0.4	3.4
11-20	0	0	.1	0
21-30	2.7	5.1	.1	7.0
31-40	2.8	.4	.1	2.4
41-50	2.7	.7	.1	2.6
Average	2.5	2.1	.2	3.8
Av. for stable period[b]	2.7	2.7	.1	4.6
	Extensive management			
Period of declining yield				
Years 1-10	2.5	...	...	...
11-20	0	...	...	...
21-30	4.1	...	...	...
31-40	2.2	...	...	...
41-50	1.6	...	...	...
Average	2.6	...	...	...
Av. for stable period[c]	0.5	...	...	...

[a]The total basal area of this stand was 74 square feet per acre, of which 49 were in growing stock, 13 in undesirable but merchantable trees, and 12 in culls. The stand contains trees up to 30 inches d.b.h.; 58 percent of the trees are below the 15-inch d.b.h. class.

[b]Residual growing stock 3.6 MBF plus 3.4 cords.

[c]Residual growing stock nil.

TABLE 7-6F.--Average yields and labor inputs per acre by decade for Unit 7 Area F, a 160-acre well stocked poletimber stand of bottom-land hardwoods containing 1.9 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
		Intensive management		
Development period				
Years 1-10	0	0	0.3	0
11-20	1.4	5.0	..1	6.0
21-30	2.0	1.4	.1	2.7
31-40	3.3	8.7	.1	11.0
Average	2.2	5.0	.2	6.6
Av. for stable period[b]	3.6	2.3	0.1	4.8
		Extensive management		
Period of declining yield				
Years 1-10	1.9	...	...	...
11-20	0	...	...	...
21-30	5.2	...	...	...
31-40	3.0	...	...	...
41-50	2.1	...	...	...
Average	3.0	...	...	...
Av. for stable period[c]	0.5	...	...	...

[a]The total basal area of this stand was 99 square feet per acre, of which 72 were in growing stock, 18 in undesirable but merchantable trees, and 9 in culls. The stand contains trees up to 24 inches d.b.h.; 76 percent of the trees are below the 14-inch d.b.h. class.

[b]Residual growing stock 3.6 MBF plus 3.0 cords.

[c]Residual growing stock nil.

TABLE 8-1.--Labor requirements and value of yields by decade from 1,954 acres of forest land on Unit 8, with intensive and extensive management

Years of management	Roadside sales		Stumpage sales	
	Labor input	Value of products sold	Labor input	Value of products sold
	Man-days	Dollars	Man-days	Dollars
		Intensive management[a]		
1-10	4,390	37,227	1,452	10,188
11-20	5,391	86,380	195	28,413
21-30	4,671	98,781	195	46,770
31-40	6,228	193,555	195	112,546
41-50	8,907	333,658	195	211,071
51-60	9,493	383,431	195	248,105
61-70	14,074	1,693,579	506	459,488
Average per decade for stable period	9,827	379,153	247	240,840
		Extensive management[b]		
1-10	No cultural work is required and only stumpage sales are made.			22,682
11-20				9,556
21-30				16,148
31-40				22,714
41-50				25,590
51-60				1,280
61-70				4,448
Average per decade after 7th decade				8,058

[a]The initial stumpage value of the timber is about $22,700, while after 60 years of intensive management the average value of growing stock is about $288,000.

[b]The average value of growing stock following 70 years of extensive management is about $15,600.

TABLE 8-2.--Labor requirements in man-days for management and for harvesting by decades on the 4 categories of forest in Unit 8

Decade years	Area A per acre	Area A on 518 acres	Area B per acre	Area B on 990 acres	Area C per acre	Area C on 204 acres	Area D per acre	Area D on 242 acres	Total on 1,954 acres
				Management labor					
1-10	1.5	777.0	0.5	445	0.3	133.5	0.4	96.8	1,452.3
11-20	.1	51.8	.1	99	.1	20.4	.1	24.2	195.4
21-30	.1	51.8	.1	99	.1	20.4	.1	24.2	195.4
31-40	.1	51.8	.1	99	.1	20.4	.1	24.2	195.4
41-50	.1	51.8	.1	99	.1	20.4	.1	24.2	195.4
51-60	.1	51.8	.1	99	.1	20.4	.1	24.2	195.4
61-70	.7	362.6	.1	99	.1	20.4	.1	24.2	506.2
Average for stable decades	0.2	103.6	0.1	99	0.1	20.4	0.1	24.2	247.2
				Harvesting labor					
1-10	1.6	316.8	0	0	4.9	999.6	6.7	1,621.4	2,937.8
11-20	3.8	1,968.4	2.1	2,079	1.0	204.0	3.9	943.8	5,195.2
21-30	3.5	1,813.0	1.0	990	3.1	632.4	4.3	1,040.6	4,476.0
31-40	1.5	777.0	3.5	3,465	3.5	714.0	4.7	1,137.4	6,093.4
41-50	3.4	1,761.2	4.8	4,752.	5.2	1,060.8	4.7	1,137.4	8,711.4
51-60	3.8	1,968.4	5.1	5,049	5.6	1,142.4	4.7	1,137.4	9,297.2
61-70	12.4	6,423.2	5.1	5,049	4.7	958.8	4.7	1,137.4	13,568.4
Average for stable decades	4.7	2,434.6	5.1	5,049	4.7	958.8	4.7	1,137.4	9,579.8
			Total management and harvesting labor						
1-10									4,390.1
11-20									5,390.6
21-30									4,671.4
31-40									6,288.8
41-50									8,906.8
51-60									9,492.6
61-70									14,074.6
Average for stable decades									9,827.0

TABLE 8-3A.--Value of yields by decade from the 518 acres of Area A of Unit 8 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.2	25.00	5.00	1.5	8.00	12.00	17.00	3,366.00
11-20	0	. .	0	5.5	10.00	55.00	55.00	28,490.00
21-30	0	. .	0	5.0	10.00	50.00	50.00	25,900.00
31-40	.8	35.00	28.00	1.5	10.00	15.00	43.00	22,274.00
41-50	2.6	50.00	130.00	2.5	10.00	25.00	155.00	80,290.00
51-60	4.6	50.00	230.00	1.5	10.00	15.00	245.00	126,910.00
61-70	16.0	50.00	800.00	4.0	10.00	40.00	840.00	435,120.00
Average for stable decades	4.0	50.00	200.00	3.3	10.00	33.00	233.00	120,694.00

TABLE 8-3B.--Value of yields by decade from the 990 acres of Area B of Unit 8 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	0.8	30.00	24.00	1.5	8.00	12.00	36.00	35,640.00
21-30	0	. .	0	1.0	8.00	8.00	8.00	7,920.00
31-40	1.5	50.00	75.00	2.5	8.00	20.00	95.00	94,050.00
41-50	2.6	55.00	143.00	3.0	8.00	24.00	167.00	165,330.00
51-60	2.7	55.00	148.5	3.2	8.00	25.60	174.10	172,359.00
61-70	2.7	55.00	148.5	3.2	8.00	25.60	174.10	172,359.00
Average for stable decades	2.7	55.00	148.5	3.2	8.00	25.60	174.10	172,359.00

TABLE 8-3C.--Value of yields by decade from the 204 acres of Area C of Unit 8 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.6	45.00	72.00	3.8	8.00	30.40	102.40	20,889.60
11-20	0	. .	0	1.0	8.00	8.00	8.00	1,632.00
21-30	3.0	55.00	165.00	1.0	8.00	8.00	173.00	35,292.00
31-40	2.8	55.00	154.00	1.5	8.00	12.00	166.00	33,864.00
41-50	3.2	55.00	176.00	3.0	8.00	24.00	200.00	40,800.00
51-60	3.0	55.00	165.00	2.0	8.00	16.00	181.00	36,924.00
61-70	3.1	55.00	170.50	2.5	8.00	20.00	190.50	38,862.00
Average for stable decades	3.1	55.00	170.50	2.5	8.00	20.00	190.50	38,862.00

TABLE 8-3D.--Value of yields by decade from the 242 acres of Area D of Unit 8 under Plan II, with intensive forest management and roadside sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	6.7	8.00	53.60	53.60	12,971.20
11-20	2.2	30.00	66.00	2.4	8.00	19.20	85.20	20,618,40
21-30	3.0	35.00	105.00	2.2	8.00	17.60	122.60	29,669.20
31-40	3.2	50.00	160.00	2.4	8.00	19.20	179.20	43,366.40
41-50	3.2	55.00	176.00	2.4	8.00	19.20	195.20	47,238.40
51-60	3.2	55.00	176.00	2.4	8.00	19.20	195.20	47,238.40
61-70	3.2	55.00	176.00	2.4	8.00	19.20	195.20	47,238.40
Average for stable decades	3.2	55.00	176.00	2.4	8.00	19.20	195.20	47,238.40

TABLE 8-4A.--Value of yields by decade from the 518 acres of Area A of Unit 8 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area A total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0.2	10.00	2.00	1.5	. .	0	2.00	396.00
11-20	0	. .	0	5.5	3.00	16.50	16.50	8,547.00
21-30	0	. .	0	5.0	3.00	15.00	15.00	7,770.00
31-40	0.8	20.00	16.00	1.5	3.00	4.50	20.50	10,619.00
41-50	2.6	35.00	91.00	2.5	3.00	7.50	98.50	51,023.00
51-60	4.6	35.00	161.00	1.5	3.00	4.50	165.50	85,729.00
61-70	16.0	35.00	560.00	4.0	3.00	12.00	572.00	296,296.00
Average for stable decades	4.0	35.00	140.00	3.3	3.00	9.90	149.90	77,648.20

TABLE 8-4B.--Value of yields by decade from the 990 acres of Area B of Unit 8 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area B total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	0	. .	0	0	0
11-20	0.8	15.00	12.00	1.5	. .	0	12.00	11,880.00
21-30	0	. .	0	1.0	. .	0	0	0
31-40	1.5	35.00	52.50	2.5	. .	0	52.50	51,975.00
41-50	2.6	40.00	104.00	3.0	. .	0	104.00	102,960.00
51-60	2.7	40.00	108.00	3.2	. .	0	108.00	106,920.00
61-70	2.7	40.00	108.00	3.2	. .	0	108.00	106,920.00
Average for stable decades	2.7	40.00	108.00	3.2	. .	0	108.00	106,920.00

TABLE 8-4C.--Value of yields by decade from the 204 acres of Area C of Unit 8 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area C total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	1.6	30.00	48.00	3.8	. .	0	48.00	9,792.00
11-20	0	. .	0	1.0	. .	0	0	0
21-30	3.0	40.00	120.00	1.0	. .	0	120.00	24,480.00
31-40	2.8	40.00	112.00	1.5	. .	0	112.00	22,848.00
41-50	3.2	40.00	128.00	3.0	. .	0	128.00	26,112.00
51-60	3.0	40.00	120.00	2.0	. .	0	120.00	24,480.00
61-70	3.1	40.00	124.00	2.5	. .	0	124.00	25,296.00
Average for stable decades	3.1	40.00	124.00	2.5	. .	0	124.00	25,296.00

TABLE 8-4D.--Value of yields by decade from the 242 acres of Area D of Unit 8 under Plan III, with intensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Pulpwood yield per acre	Price per cord	Pulpwood value per acre	Total value per acre	Area D total value
Years	MBF	Dollars	Dollars	Cords	Dollars	Dollars	Dollars	Dollars
1-10	0	. .	0	6.7	. .	0	0	0
11-20	2.2	15.00	33.00	2.4	. .	0	33.00	7,986.00
21-30	3.0	20.00	60.00	2.2	. .	0	60.00	14,520.00
31-40	3.2	35.00	112.00	2.4	. .	0	112.00	27,104.00
41-50	3.2	40.00	128.00	2.4	. .	0	128.00	30,976.00
51-60	3.2	40.00	128.00	2.4	. .	0	128.00	30,976.00
61-70	3.2	40.00	128.00	2.4	. .	0	128.00	30,976.00
Average for stable decades	3.2	40.00	128.00	2.4	. .	0	128.00	30,976.00

TABLE 8-5.--Value of yields by decade from Areas Aa, Ab, B, C and D of Unit 8 under Plan IV, with extensive forest management and stumpage sales

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area Aa - 198 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	1.8	10.00	18.00	3,564.00
31-40	0	. .	0	0
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	1.6	10.00	16.00	3,168.00
Average for stable decades	0.4	10.00	4.00	792.00
		Area Ab - 320 acres		
1-10	0	. .	0	0
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	1.6	10.00	16.00	5,120.00
41-50	.4	10.00	4.00	1,280.00
51-60	.4	10.00	4.00	1,280.00
61-70	.4	10.00	4.00	1,280.00
Average for stable decades	0.4	10.00	4.00	1,280.00
		Area B - 990 acres		
1-10	1.0	10.00	10.00	9,900.00
11-20	0	. .	0	0
21-30	0	. .	0	0
31-40	0	. .	0	0
41-50	1.6	10.00	16.00	15,840.00
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	3,960.00

TABLE 8-5.--continued

Decade	Sawlog yield per acre	Price per MBF	Sawlog value per acre	Total value
Years	MBF	Dollars	Dollars	Dollars
		Area C - 204 acres		
1-10	3.3	10.00	33.00	6,732.00
11-20	1.6	10.00	16.00	3,264.00
21-30	0	. .	0	0
31-40	2.1	10.00	21.00	4,284.00
41-50	0	. .	0	0
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.4	10.00	4.00	816.00
		Area D - 242 acres		
1-10	2.5	10.00	25.00	6,050.00
11-20	2.6	10.00	26.00	6,292.00
21-30	5.2	10.00	52.00	12,584.00
31-40	5.5	10.00	55.00	13,310.00
41-50	3.5	10.00	35.00	8,470.00
51-60	0	. .	0	0
61-70	0	. .	0	0
Average for stable decades	0.5	10.00	5.00	1,210.00

TABLE 8-6A.--Average yields and labor inputs per acre by decade for Unit 8 Area A, a 518-acre loblolly pine plantation replacing a 198-acre poorly stocked poletimber stand of upper-slope hardwoods containing 2.3 cords per acre[a] and 320 acres of brush or idle land.

Decade (years of management)	Yields/acre/decade: MBF of sawlogs	Yields/acre/decade: Cords of pulpwood	Labor inputs/acre/decade: Man-days for management	Labor inputs/acre/decade: Man-days for harvesting
	Intensive management of pine stand			
Development period				
Years 1-10[b]	0.2	1.5	1.5[c]	1.6
11-20	0	5.5	.1	3.8
21-30	0	5.0	.1	3.5
31-40	.8	1.5	.1	1.5
41-50	2.6	2.5	.1	3.4
51-60	4.6	1.5	.1	3.8
61-70	16.0	4.0	.7[d]	12.4
Average	4.0	3.6	.4	5.0
Av. for stable period[e]	4.0	3.3	0.2	4.7
	Extensive management of original hardwood stand			
Period of declining yield				
Years 1-10	0	...	...	...
11-20	0	...	...	...
21-30	1.8	...	...	...
31-40	0	...	...	...
41-50	0	...	...	...
51-60	0	...	...	...
61-70	1.6	...	...	...
Average	.6	...	...	...
Av. for stable period[f]	0.4	...	...	...

[a]The total basal area of this stand was 25 square feet per acre, of which 14 were in growing stock, 7 in undesirable but merchantable trees, and 4 in culls. The stand contains trees up to 18 inches d.b.h.; 64 percent of the trees are below the 14-inch d.b.h. class.

[b]Yields in first decade are hardwood, in succeeding decades, pine. In the first decade, yields and harvesting labor do not apply to the 320 acres of brush or idle land.

[c]1.1 man-days for planting pine, 0.4 for deadening unmerchantable hardwoods having a basal area of 11 square feet.

[d]0.7 man-day scheduled to assure regeneration of a new pine stand.

[e]Even-aged pine on 60-year rotation.

[f]Residual growing stock nil.

TABLE 8-6B.--Average yields and labor inputs per acre by decade for Unit 8 Area B, a 990-acre moderately stocked seedling and sapling stand of upper-slope hardwoods containing 1.0 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management				
Development period				
Years 1-10	0	0	0.5	0
11-20	0.8	1.5	.1	2.1
21-30	0	1.0	.1	1.0
31-40	1.5	2.5	.1	3.5
41-50	2.6	3.0	.1	4.8
Average	1.2	2.0	.2	2.8
Av. for stable period[b]	2.7	3.2	0.1	5.1
Extensive management				
Period of declining yield				
Years 1-10	1.0	...	...	...
11-20	0	...	...	...
21-30	0	...	...	...
31-40	0	...	...	...
41-50	1.6	...	...	...
Average	.6	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 56 square feet per acre, of which 34 were in growing stock, 11 in undesirable but merchantable trees, and 11 in culls. The stand contains trees up to 26 inches d.b.h.; 71 percent of the trees are below the 14-inch d.b.h. class. This stand could also be classed as poorly stocked poletimber with 5.9 cords per acre.

[b]Residual growing stock 3.0 MBF plus 3.4 cords.

[c]Residual growing stock nil.

TABLE 8-6C.--Average yields and labor inputs per acre by decade for Unit 8 Area C, a 204-acre well stocked large sawtimber stand of lower-slope hardwoods containing 3.3 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management				
Development period				
Years 1-10	1.6	3.8	0.3	4.9
11-20	0	1.0	.1	1.0
21-30	3.0	1.0	.1	3.1
31-40	2.8	1.5	.1	3.5
41-50	3.2	3.0	.1	5.2
51-60	3.0	2.0	.1	5.6
Average	2.7	2.5	.1	4.4
Av. for stable period[b]	3.1	2.5	0.1	4.7
Extensive management				
Period of declining yield				
Years 1-10	3.3	...	...	...
11-20	1.6	...	...	...
21-30	0	...	...	...
31-40	2.1	...	...	...
Average	2.3	...	...	...
Av. for stable period[c]	0.4	...	...	...

[a]The total basal area of this stand was 87 square feet per acre, of which 61 were in growing stock, 21 in undesirable but merchantable trees, and 5 in culls. The stand contains trees up to 24 inches d.b.h.; 42 percent of the trees are below the 14-inch d.b.h. class.

[b]Residual growing stock 3.6 MBF plus 2.6 cords.

[c]Residual growing stock nil.

TABLE 8-6D.-
Unit 8 Area

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TABLE 8-6D.--Average yields and labor inputs per acre by decade for Unit 8 Area D, a 242-acre well stocked poletimber stand of bottomland hardwoods containing 2.5 MBF per acre[a]

Decade (years of management)	Yields/acre/decade		Labor inputs/acre/decade	
	MBF of sawlogs	Cords of pulpwood	Man-days for management	Man-days for harvesting
Intensive management				
Development period				
Years 1-10	0	6.7	0.4	6.7
11-20	2.2	2.4	.1	3.9
21-30	3.0	2.2	.1	4.3
Average	2.6	5.6	.3	7.4
Av. for stable period[b]	3.2	2.4	0.1	4.7
Extensive management				
Period of declining yield				
Years 1-10	2.5	...	...	...
11-20	2.6	...	...	...
21-30	5.2	...	...	...
31-40	5.5	...	...	...
41-50	3.5	...	...	...
Average	4.8	...	...	...
Av. for stable period[c]	0.5	...	...	...

[a]The total basal area of this stand was 112 square feet per acre, of which 95 were in growing stock, 10 in undesirable but merchantable trees and 7 in culls. The stand contains trees up to 20 inches d.b.h.; 72 percent of the trees are below the 14-inch class. This stand could also be classed as moderately stocked small sawtimber.

[b]Residual growing stock 3.5 MBF puls 2.9 cords.

[c]Residual growing stock nil.

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APPENDIX B

METHODS, PROCEDURES, RELATED INFORMATION, AND GLOSSARY

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SECTION 1

SURVEY OF FOREST LAND OWNERS

The information in Chapter IV on forest land ownership in Hardeman County was obtained by means of a personal interview questionnaire survey of a sample of 40 owners of forest land. In determining which ownerships to survey, a random block selection method was used to avoid undue bias in selection of the sample. For the reason stated in Chapter IV, the objective of interviewing at least 20 owners who had sold timber in the preceding five years was considered important enough to warrant stratification of the sample within each block by the procedure described below.

By reference to a table of random numbers, 10 blocks (each covering about one percent of the county area) were selected from a 100-block grid system with 10 north-south divisions and 10 east-west divisions. The grid had been drawn on the most recent available Hardeman County map showing existing houses and the road network in detail, the "General Highway and Transportation Map" prepared by the Tennessee State Highway Department in 1938.

On the ownership questionnaire form (a copy of which appears in Appendix C), entitled "Marketing of Forest Products: Data from Producers," pertinent data were collected by interview with the owners of the first four properties identified in each block. The identification was made by the interviewer after he entered the block by an

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block by any road crossing the block boundary--providing that each ownership contained at least 15 acres of woodland.

The stratification of the 4 ownerships in each block was effected by the stipulation that not more than 2 ownerships in a block were included if the owners had not sold any timber in the preceding five years. This stipulation was made in order to obtain data on recent sales from at least half of the ownerships. It was accomplished with a continued mechanical selection of ownerships in each block in case a recent sale had not been made by at least 2 of the first 4 woodland owners contacted. Owners of successive properties within the block were approached until 2 "recent sale" interviews were obtained in addition to the first 2 "no recent sale" interviews. (The only exception to this procedure occurred in one block where so few ownerships existed that only one owner could be found who had made a recent sale.)

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SECTION 2

SURVEY OF TIMBER MARKETS

The information in Chapter V on the markets for stumpage and round timber products from Hardeman County forests was obtained by means of a personal interview questionnaire survey of 20 wood-using industries diligently determined to be or to represent a significant portion of the buyers of Hardeman County timber.

As part of the cross-section of the timber markets facing the county's forest land owners the 9 large firms located outside the county (but within a 50-mile transport radius) were selected to include all the most active outside buyers of Hardeman County timber: large sawmills and veneer mills and plants manufacturing hardwood flooring, dimension, handles, and other specialty products.

The other 11 firms were chosen within the county and included all of the specialty products firms and concentration yards, all of the known active small sawmills operating at permanent (or semi-permanent) locations, and a couple of the dozen small portable sawmills that are operating in any one year.

On the marketing questionnaire form (a copy of which appears in Appendix C), entitled "Marketing of Forest Products: Data from First Buyers," pertinent data were collected by interview with an owner or other responsible officer of each firm.

SECTION 3

WORK-PERFORMANCE DATA

As described in Chapters I and VIII, pages 5-7, 185, and 186, Ames Plantation work-performance data were obtained from record card forms completed daily by forestry crew supervisors during the years 1955-57. (A copy of the work-performance data record card appears in Appendix C.) Each crew supervisor carried with him on the job several of the 3- by 5-inch card forms so that he could complete one each time a change occurred in the type of job, the equipment used on a single job, or the conditions of work (such as weather or ground conditions). The card record system facilitated the sorting of the data by type of operation, size of crew, kind of equipment, area in which the work was done, and season and weather.

The total labor inputs in man-hours on each card were divided by the number of hours in the work day (usually about 9 hours, but ranging up to 10 hours in 1957) to derive the number of man-days required to produce the work output listed under "Total production" on the card. Division of the labor input in man-days by the number of units of output yielded for each record card a quotient of labor requirement in man-days per unit. Man-days are used as the unit of input in work-performance data because they are more convenient and practical units than man-hours, hence more

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hence more meaningful though less precise; experience on the Ames Plantation showed that a man's total output for a day's work was about the same whether the work day was 8, 9, or 10 hours long because the weekly wage total did not vary appreciably. The workers apparently had a standard of what constitutes a reasonable day's work for their rate of pay.

The range of labor requirements on the Ames Plantation is listed in the following Table B-1 for each of the types of operation, sizes of crew, and kinds of equipment that might be involved in the intensive forest management work under Plan II for the various operating units. Within each range, careful judgment has been used to make an estimate of future work-performance requirements under the most typical situation. The estimates (of man-days per output unit) listed in Table B-1 were used as mentioned in Appendix A in the computation of the Tables x-6 total labor inputs for management operations and for harvesting. In all cases of harvesting pulpwood and sawlogs the most typical future situations were judged to include well-equipped crews working with power chain saws and, for skidding or yarding sawlogs, with tractors.

In considering the adaptation of these work-performance labor requirements to other and different situations, thorough attention must be given to the effects of each factor that varies appreciably from the following typical Ames Plantation situations[1] expected in the planning of Units 1 through 8. The more common reasons for variation in work-performance rates are briefly discussed.

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[1]Barraclough and Pleasonton, pp. 11-29.

TABLE B-1.--Labor requirements for work performance in forestry operations on the Ames Plantation, range of requirements in 1955-1957, and estimates for future performance

Operation	Labor requirement in man-days		Unit[1]	Crew and equipment
	Range for	Estimate		

TABLE B-1.--Labor requirements for work performance in forestry operations on the Ames Plantation, range of requirements in 1955-1957, and estimates for future performance

Operation	Labor requirement in man-days		Unit[1]	Crew and equipment
	Range for 1955-1957	Estimate for future		
Hand-planting pine seedlings	1.0-3.5	1.1	Acre	Individual workers with bars and planting bags
Pine release (deadening hardwoods)	.3-1.1	.6	Acre	4 men with axes, power girdler, and 5-gallon sprayer
Hardwood stand improvement (deadening culls)	.4- .8	.5	Acre	4 men with axes, power girdler, and 5-gallon sprayer
Harvesting rough hardwood pulpwood[2]	.6-1.2	1.0	Cord	3 men with power saw, axe, and mule
Harvesting rough pine pulpwood[2]	.8-1.6	1.0	Cord	Man with bow saw
Harvesting rough pine pulpwood[2]	.5-1.3	.7	Cord	2 men with axe and power chain saw
Harvesting hardwood sawlogs[2]	.6-1.4	1.0	MBF	2 men with power saw, axe, and tractor
Harvesting hardwood sawlogs[2]	1.4-2.0	1.5	MBF	2 men with cross-cut saw, axe, and mules
Harvesting pine sawlogs[2]	.5-1.2	.6	MBF	2 men with power saw, axe, and tractor
Harvesting pine sawlogs[2]	.8-1.6	1.0	MBF	2 men with cross-cut, axe, and mules
Timber marking	1.1-3.3	2.0	100 MBF	2 men with paint guns
Building 3-strand wire fence (includes post-cutting)	40-60	48.0	Mile	3 men with axes, power saw, post-hole diggers
Fire protection	0.004-.01	0.01	Acre annually	Crew and equipment as needed

[1]All cords are standard; all board feet are by International rule, 1/4-inch kerf.

[2]Harvesting operations include skidding or yarding to roadside.

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Planting of pine seedlings most commonly involved using a planting bar or dibble to open and close a deep, vertical slit. The seedlings were carried in a canvas planting bag hanging at the planter's left hip from a strap over the right shoulder. Thus equipped and working alone, but with a supervisor in the area, an average forest worker with a few days' experience in planting can be expected to achieve the Plantation's typical performance rate of 1.1 man-days per acre of (about 900) trees planted at a spacing of 6 by 8 feet--or about 1.25 man-days to plant 1,000 seedlings. The planting work-performance data are based on records of experience with the planting of a total of one million loblolly and shortleaf pine seedlings at the standard spacing.

On the Ames Plantation the planting performance rate dropped, requiring more man-days per acre or per thousand trees, when there was no crew foreman in the field to supervise the work of wage hands. The rate was maintained, however, when planting was paid for on a piece-work basis, so that the worker had a greater incentive to work fast.

A 30-percent lower rate of output per man-day resulted when planters worked in pairs, with one carrying the trees and placing a seedling in each slit which the other made and then closed. The use of mattocks instead of dibbles reduced the rate by nearly 25 percent except where the ground was extraordinarily hard, such as the baked clay bottoms of eroded gullies. Before the canvas planting bags had been obtained, a much lower rate of performance had resulted from the use of buckets to carry seedlings.

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Ground cover, topography, and soil condition affected performance rates. Gently rolling abandoned fields covered with broomsedge and light brush constituted about 40 percent of the planting sites. Cutover ridges with a scattered overstory of large cull trees and a ground cover of brush, sprouts, and seedlings made up another 40 percent; and about 20 percent were eroded gullies.

About twice as many trees were planted per man-day on the easiest planting sites--areas of sandy soil and light ground cover--as on the hardest--badly gullied areas or those with heavy brush and briars. Moist soil permitted faster planting than dry or extremely muddy ground. Weather during planting did not seem to influence performance much, provided conditions were at all suitable for planting.

Very small and very large seedlings slowed planting. Storage of seedlings from the nursery was most efficient when the seedling bales were put on racks and watered daily. This procedure saved about one man-day per thousand trees over the method of heeling in trees as they arrived from the nursery and later digging up the number for each day's planting.

<u>Timber stand improvement</u> included both hardwood stand improvement (deadening all culls) and pine release (deadening cull hardwoods following harvesting of merchantable trees). The pine release operation involved deadening on the average about 160 unmerchantable hardwoods per acre. These ranged in diameter from 1 inch to over 2 feet but were predominantly small. About 17 percent were hickories and most of the rest were post oaks, red oaks, elms,

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and gums. The sums of the basal areas of the tree stems averaged 34 square feet per acre, and the average sum of their circumferences at breast height was approximately 193 (lineal) feet per acre.

All hardwoods 3 inches or larger in d.b.h. were girdled, and the ones under 3 inches were deadened by a basal spray of poisonous auxins. In addition, trees under 12 inches in diameter were sprayed around the girdle to prevent sprouting. For girdling, the men used a Little Beaver gasoline-powered back-pack mechanical tree-girdler and axes. All hickories were axe-girdled because their hard, gritty bark quickly clogged and dulled the blades of the "Little Beaver's" fast-rotating cutting head. The spray consisted of one part of auxin concentrate (composed of 2 pounds of 2,4-D and 2 pounds of 2,4,5-T acid equivalent per gallon) dissolved in 20 parts of diesel oil. It was applied by a long spray nozzle attached to the rubber hose of a 5-gallon pressure spray can suspended by a shoulder sling. Basal spraying of the small trees and brush involved soaking with solution a band of bark several inches wide above the root collar.

The timber stand improvement (TSI) crew usually was a 4-man team, but at times the numbers varied from 3 to 6. The foreman laid out the work, cleared away brush and vines ahead of the mechanical girdler, and axe-girdled as time permitted. Axemen girdled hickories and as many other trees as they could, while keeping pace with the Little Beaver. One man operated the machine; another carried the sprayer. The weight and vibration of the machine made mechanical girdling much more tiring than the other tasks; so the men traded about every hour.

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Labor requirements averaged about 0.56 man-day per acre. The Little Beaver was operated about 1.1 hours per acre, and 1.25 gallons of spray solution were used per acre. Work was slowed by rough terrain and heavy ground cover, but it was not appreciably affected by tree size.

Hardwood stand improvement involved girdling of culls in 60 acres of bottomland hardwoods and 66 acres of an upland stand. Deadening of the undesirable trees was done to improve the composition of the growing stock and to create openings into which desirable hardwoods could seed. The operations followed a sawlog harvest in the upland stand and a pulpwood cut in the bottoms.

In the uplands, culls were deadened by the same 4-man crew and with the same equipment as for pine release. In the bottomlands a 3-man crew girdled the trees by axe and by machine, but the poisonous spray was not used.

The labor requirements in the upland stand were about the same as for pine release where similar numbers and sizes of trees were deadened. In the bottomland stand, however, despite the elimination of the sprayer and of one man from the crew, labor requirements per acre were over 50 percent higher. This occurred even though the number of girdled trees, their circumferences, and basal areas were a fourth lower at least than the corresponding statistics for the upland stand. The chief reason for this difference in labor requirement is that the dense ground cover of vines and brush made moving about through the stand very difficult for the crew.

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Harvesting pulpwood from 310 acres of hardwood stands produced approximately 550 units (8-foot long ricks of 5-foot bolts piled 4 feet high), equal to about 700 standard cords (4 by 4 by 8 feet). Of this wood, 55 percent was oak from 185 acres being converted to pine. The remainder was sweetgum, river birch, cottonwood, blackgum, boxelder, and elm from improvement cuttings in 125 acres of bottomland stands.

The total labor requirement for cutting, limbing, bucking, and yarding pulpwood averaged approximately 1.0 man-day per cord. It was slightly higher for the oak because the pulpwood in the oak stands was scattered, the terrain rough, and most of the trees were fire-damaged and of poor form. The cut averaged 1.3 units (or about 1.6 standard cords) per acre. The trees ranged from 7 to 14 inches in d.b.h. but seldom contained more than two 5-foot bolts apiece. Bucking of the stems into bolts was done with a Homelite 5-30 chain saw, which consumed about three-fourths of a gallon of gasoline per unit (or 0.6 gallon per cord). Chains wore out more rapidly in the oak than in the mixed bottomland species, which were softer-textured.

The mixed-wood operation was a combined improvement cut and thinning in a good bottomland stand about 40 years old. The cut averaged 2 units (or 2.5 cords) per acre. One third of the volume was in sweetgum, and another third in river birch. As might be expected, small bolts required more labor per unit than did large bolts. Volume of cut per acre, tree size, and amount of ground cover appeared to be the chief factors influencing felling, limbing, and bucking time. Production was most efficient with large

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with large trees and heavy cuts per acre. Bolts were yarded about 200 feet to a roadside; a mule and logging tongs were used in the bottoms and a mule and slide in the upland oak. A man and mule could yard about 3 units or 4 cords a day.

Pine pulpwood bolts were cut in a small thinning operation on a 15-year-old shortleaf pine plantation. The volume harvested per acre averaged 2 cords, requiring 1.0 man-day per cord of 5-foot bolts when cut by one man with a bow saw, and 0.7 man-day when cut by a 2-man crew with an axe and a power chain saw. This labor requirement included 0.2 man-day per cord for yarding with a farm tractor and trailer and for ricking at roadside.

Harvesting sawlogs produced over a million board feet, Doyle log scale, from the Ames Plantation. Separate records were kept for log-making (felling, limbing, and bucking), and for skidding to a roadside yard; but because both major phases of the operation are necessary for roadside sales of timber products, Table B-1 on page 459 summarizes the ranges of labor requirements for the total harvesting operation. A range of requirements for actual operations and an estimate for future operations are listed for each of the two species categories, hardwoods and pine, and for each of the principal combinations of equipment: power chain saw, axe, and tractor; and cross-cut saw, axe, and mules.

For log-making alone, labor requirements varied primarily according to the species category and the kinds of equipment used, but they were also affected by tree size, volume cut per acre, ground cover, terrain, and the organization, skill, and initiative of the workers. The performance of the Ames Plantation forestry crew in up

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crew in upland hardwoods ranged from 0.6 to 1.2 man-days per MBF with travel time, lost time, and equipment maintenance included. The average was 0.85 man-day. Where trees averaged over 100 board feet and the volume cut per acre was over 1,500 board feet, performance rates of nearly 0.6 man-day per MBF were common.

The crew was composed of 3 or 4 men: a chain-saw operator who also was foreman and log scaler, and 2 or 3 axemen. For the heavy cutting a Mercury 2-man chain saw was used, but a Homelite "5-30" one-man saw served well for the smaller timber. These saws each consumed about 0.7 gallon of fuel per MBF.

To establish a uniform labor policy for all Ames Plantation wage hands, the forestry crew's wages were lowered and their work day was lengthened in April 1957 to conform to the working conditions of the Plantation's field hands. The daily hours were lengthened from 9 to 10, as already mentioned, and the work week was extended from $5\frac{1}{2}$ to 6 days. Pay rates were reduced from hourly wages of about 45 cents to monthly salaries of about $85. The same crew continued logging in similar areas after these changes, with the same equipment and supervision. Output per man-day dropped somewhat and production per man-hour declined sharply; formerly the number of man-hours required to make logs ranged from 5.6 to 9.1 per MBF and averaged 6.6, but with the longer hours and lower pay the range was from 6.3 to 11.8 and the average was 9.6, or almost a full man-day to cut a thousand board feet. Although morale and fatigue are difficult to measure, it is clear that they affect performance at least as much as tree size and other variables that can be easily measured.

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As in the pulpwood harvesting, power saws produced a given volume of output faster than did handsaws. After buying a power saw, a 2-man tenant crew almost doubled the log output per man-day they had achieved in the same stand with a cross-cut saw: from 0.74 man-day per MBF to 1.44.

Skidding to a roadside yard was more commonly done by tractors than by a mule team. In similar operations with comparable skidding distances and volumes of modal log (not over about 50 board feet), the man-day requirements for labor were remarkably alike--whether the logs were pulled by a wheeled farm tractor, an International Harvester TD-6 crawler tractor, or a mule team. With modal log volumes ranging from 45 to 50 board feet (Doyle rule), average skidding distances from 75 to 100 yards, and crews from 1 to 3 men, the range of labor requirement varied from 0.24 to 0.45 man-day per MBF for a variety of hardwood operations. Only when hardwood operations involved a larger modal size of log (75 board feet) over a 100-yard distance, did the crawler tractor demonstrate superior efficiency: 0.20 man-day per MBF--and even this rate was surpassed by a wheeled farm tractor in a shortleaf pine sawlog operation with the same modal log volume and the same average skidding distance: 0.14 man-day per MBF.

Labor requirements for skidding were highest where distances were long and logs were small. Using both a crawler tractor and a wheeled tractor, an upland hardwood operation with a 2- to 3-man crew required 0.38 man-day per MBF for skidding logs with a modal volume of 50 board feet over an average distance of 150 yards. A similar operation used 0.85 man-day per M where the

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modal log contained only 35 board feet and the distance skidded averaged 200 yards. Mud and steep, broken ground were additional factors noted to slow performance greatly.

Timber marking of 3 million board feet on the Ames Plantation by a 2-man crew (and sometimes a third man to tally for the 2 markers) has required under most conditions from 1.1 to 3.3 man-days to mark 100 MBF for cutting. This range is the equivalent of from 30 to about 90 M marked per man-day. Using paint guns on hoses attached to pump pressure spray cans, 4 gallons of paint were needed on the average to mark 100 MBF of trees with a spot at about eye level and a spot at the base (the volume needed ranged from as little as 2 gallons up to 6). The labor requirement varied primarily according to the size of the trees and the average volume to be cut per acre. The typical conditions involved an average tree volume of 200 board feet and an average cut per acre of 1 MBF.

Fencing for protection of woodlands in danger of damage from grazing cattle required from 40 to 60 man-days per mile, and averaged 48 (or about 1.5 man-hours a rod). A 3-strand barbed wire fence along 2 miles of forest boundaries with posts erected at 12-foot intervals was built over rough terrain and through some brush along the forest border. A 4-man crew using hand tools and a power saw needed 12 eighty-rod rolls of wire and 440 posts per mile. The work included cutting, trimming, hauling, and setting cedar posts and stapling the wire. The approximate total cost for labor, posts, barbed wire, and staples was $1 a rod or $320 a mile.

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Protection from fire has a value that is not easy to measure. The cost, though, of activities to supplement the State's services in fire prevention, detection, and suppression is comparatively low and is an advisable investment. On the Ames Plantation, preventive protection was increased by using a tractor and disc to clear fire lanes around young pine stands and by developing good relations with neighboring farmers. The latter activity also added to local detection measures, especially on remote areas of the Plantation. Prompt fire suppression was achieved and areas burned were therefore kept small by equipping the forestry crew with pump spray cans, fire rakes, flappers, and other tools such as shovels and axes. Cooperation with the State Forestry Division was good. These various activities have required annually about 0.01 man-day per acre.

SECTION 4

MANAGEMENT-YIELD DATA

Ames Plantation Procedures: Intensive Survey

As is mentioned in Chapter VIII, the forest research program on the Ames Plantation required data in far greater detail than will be needed on most farm woodlands. To obtain the desired data a forest survey was made in which all land that had been determined to be not economically suitable for agriculture was classed as woodland.

Maps of "compartments" of the entire Plantation were made at a scale of eight inches to the mile on letter-size paper for convenient handling and reproduction. These maps were made by tracing from large government aerial photographs available at this scale (1:7,920). Compartment boundaries were determined by selecting features such as drainage lines, roads, and wire fence lines easily recognizable both on photographs and on the ground. To fit on the $8\frac{1}{2}$ by 11-inch map sheets, the ground area of the compartments averaged 272 acres; few compartments were over one-half square mile in area. Within each compartment were mapped the boundaries of the agricultural land, the open land intended for forest use, and the land already covered with trees or brush.

To secure a representative sample of the forest growth a 3- by 3-inch grid of east-west, north-south lines was drawn on an acetate s

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acetate sheet, and over a light table the points of intersection were traced onto each compartment map. These points were transferred by pin-pricking through each compartment map onto the large aerial photographs, and then they were reproduced by inspection onto standard 9- by 9-inch contact prints (with the larger scale of 1:20,000) for convenient handling in the field.

The master grid consisting of a 30- by 30-chain square pattern on the ground, was established to obtain an estimate of conditions prevailing on the Plantation as a whole. To obtain adequate planning data for the individual operating units within the Plantation the number of inventory locations was quadrupled by halving the grid interval. This smaller grid assured the surveying of at least 6 locations on each unit.

A two-man team collected the information needed for preparation of management-yield data. These men made their survey at the locations indicated on the aerial photographs. This required locating a feature visible on the photograph as well as on the ground and then following a measured compass bearing and distance to the point.

The survey system used was that of point-sampling for forest management by diagnosis of condition classes and treatment prescription[1]. At each location the trees on which information was recorded were indicated by a 3-diopter prism. The prism requires sampling of a higher percentage of the larger, hence more valuable trees, than is the case with plot- or strip-sampling

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[1]Lewis R. Grosenbaugh, Better diagnosis and prescription in Southern forest management, Southern Forest Experiment Station Occasional Paper 145 (New Orleans: 1955), 27 pp.

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methods which include trees according to their actual frequency of occurrence in the forest. Also, the number of trees in each point sample, when multiplied by a factor of ten, gives a fairly good estimate of stand density as expressed in square feet of basal area per acre. Four points were surveyed at each location; the central or photograph point and 3 satellite points 80 feet from the center and separated from each other by 120° angles.

At the central point detailed information was entered on a field record sheet listing for each tree in the sample its species, d.b.h. to the nearest tenth of an inch, tree condition class, past 10-year radial growth(of trees 3 inches or more in d.b.h.), merchantable height in 5-foot bolts of pulpwood trees, height in 16-foot sawlogs (up to an 8-inch top diameter inside bark) of trees merchantable for sawlogs, tree cull factors for crook and for rot, butt log grade, and number of pulpwood bolts above the top of the sawlog portion. The three supplementary points were used to increase the accuracy of the volume estimated by species and tree condition class. The only data needed for this purpose were tree species, d.b.h. by 2-inch class, tree condition class, and merchantable height. (A copy of the field tally sheet for the Ames Plantation forest survey is included in Appendix C.)

The total information recorded at the central point included, in addition to the data on individual trees, noteworthy topographic and cultural features within about 50 feet of the center. Other data listed for the location as a whole were the forest type, maximum stocking percentage (stand density) class, stand siz

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stand size class appropriate to the stocking class, evidence of recent fire, slope aspect, class of principal ground cover, topographic slope position, and average slope percentage class.

A gauge with a basal area factor of 50 was used to determine the need for thinning and planting. When this gauge indicated the possible need for planting, confirmation was obtained by a tally of seedlings, by quality class, on a 1/250-acre plot. An estimate of the need for deadening cull trees was also obtained. In addition, an estimate of the presence or absence of an adequate number of seed trees in poorly stocked areas was recorded.

The plots were permanently established. This provided a basis for obtaining managed-growth data by resurveys called for in the research program. The plots were inconspicuously marked, however, so that management practices would not be influenced. Forest managers in the area can look to the Plantation for more and better data with the passing years.

Extensive Forest Survey

A few broad categories of field information may be collected from locations representative of typical forest condition classes the approximate acreages of which can be estimated. Probably minimum tree data to be collected should include assignment of each tree to a broad grouping of species (according to silvicultural or market use characteristics), a 2-inch d.b.h. class (or basal area class), and a vigor-value potential class. In this case the volume computation must be made by use of a general factor rel

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Meaningful forest classes must recognize the major typical conditions. Point-sampling of trees at two or more representative locations in each broad condition class could provide estimates of the information desired.

Application of U.S. Forest Service Survey Data

The Forest Survey data collected and summarized by the U.S. Forest Service for major forest conditions in each state and its major physiographic subdivisions (Survey regions) are available. These reports can be used to get a broad picture of the forest resource in the area around any particular county. Included are data on acreage by forest types, volumes by major species groups, average basal areas of growing stock and of cull trees by forest types, and sawtimber volume by log class and stand quality and by species group. From this information it is reasonable to recommend a simple series of practices widely applicable to the area's average woodlands. Beyond this usage, however, it should be desirable to check the applicability of broad survey averages to particular tracts.

Computation of Decadal Yields Related to Management Intensity

After completion of the forest survey on the Ames Plantation, average tree volumes and past 10-year growth rates were computed from the field data. Local board-foot and cubic-foot volume tables were prepared according to 2-inch d.b.h. class, form class, and merchantable height in 16-foot logs (to the nearest half log) for sawtimber

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sawtimber in the various major species groups: Southern yellow pines, other softwoods, sweet gum, black and tupelo gums, other soft-textured hardwoods, red oaks, white oaks, and other firm-textured hardwoods. The smallest sawlog considered merchantable was 11 inches in diameter (inside bark at the small end) for hardwoods and 8 inches for pine. A single volume table for half-log trees served for all species--likewise a cubic-foot volume table was made for pulpwood in the top stem of sawtimber of all species. For the cubic-foot volume of pulpwood-size trees, however, local volume tables were prepared according to 2-inch d.b.h. class, form class, and merchantable height in 5-foot sticks for pulpwood in the following groupings of major species groups: Southern yellow pines, other softwoods and sweet gum, black and tupelo gums, other soft-textured hardwoods, and red oaks combined with white oaks and other firm-textured hardwoods.

Both tree volumes and past 10-year radial growth rates were computed and tabulated by International Business Machines methods according to major species group, 2-inch d.b.h. class, tree condition class, merchantable product class, and butt log grade, and according to the slope position, slope percentage, and aspect of the survey location where each tree was tallied. These tabulations revealed that observable differences in past growth rates had occurred for softwoods and hardwoods, on each of the 3 topographic slope positions, by 2-inch d.b.h. class, and by grouped tree condition class. This last variable is, of course, determined on the spot in the field for each tallied tree on the basis of its observable vigor, form, merchantability, and desirability as growing stock. On

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TABLE B-2.

D.b.h. class in inches
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stock. On the basis of these tabulations, Table B-2 was computed to summarize 10-year growth in inches projected for two major classes of trees: the average of those merchantable or potentially merchantable, and ones whose form and other characteristics made them especially suitable for crop trees.

TABLE B-2.--Projected 10-year d.b.h. growth for hardwoods on the Ames Plantation

D.b.h. class in inches	10-year d.b.h. growth in inches					
	Upper slope		Lower slope		Bottomland	
	Crop trees	Average trees	Crop trees	Average trees	Crop trees	Average trees
2	1.6	1.6	1.6	1.6	1.8	1.8
4	1.9	1.8	1.9	1.8	2.1	2.1
6	1.9	1.8	2.0	2.0	2.4	2.3
8	2.1	1.9	2.1	2.1	2.6	2.4
10	2.1	1.9	2.2	2.1	2.6	2.5
12	2.2	2.0	2.4	2.2	2.6	2.6
14	2.4	2.3	2.4	2.4	2.6	2.6
16	2.7	2.4	2.8	2.4	2.8	2.6
18	3.1	2.4	3.1	2.5	3.3	2.8
20	3.3	2.2	3.3	2.5	3.4	2.5
22	3.4	2.0	3.4	2.4	3.5	2.4
24	3.6	2.0	3.6	2.4	3.6	2.4
26	3.6	2.0	3.6	2.4	3.7	2.4
28	3.6	2.0	3.6	2.4	3.7	2.4

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This projection of growth rates was made on the assumption that growth of trees selected to remain in the stands in future decades will be at least as rapid as the growth of similar trees over the past 10 years.

In order to project the volumes of yields and residual growing stock of the stands on each of the 8 operating units, each survey location was classed with respect to its existing forest type group, slope position, crop tree density, and the need (or lack of it) for conversion to a pine plantation. Existing forest type groups were simply softwoods or hardwoods; slope position classes were upper slope, lower slope, and bottom; and crop tree density was classed as either adequate--if the basal area in desirable trees was 60 square feet or more per acre--or inadequate.

In each unit the survey locations that were alike in all 4 classifications were grouped as a stand. The stand structure applicable to the total area of each stand (represented by the survey samples for each group of similar locations) was tabulated. These tabulations listed on a per-acre basis the number of trees--and their volumes, if any, in board feet and in cubic feet--in each 2-inch diameter class within each tree condition class. The tree condition classes were listed in descending order of quality, as defined in Grosenbaugh's diagnostic tree classes,[2] so that when these tabulations were transferred to multi-column tabulating sheets for stand projection over the several decades of the development period, the cut-and-leave prescription for intensive

[2]Grosenbaugh, p. 8.

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management would result in the elimination of the lower quality merchantable timber from the lower part of the sheets.

Intensive forest management

The intensive forest management goal that was adopted was to achieve close to a maximum average annual yield per acre of high quality timber. On the basis of current knowledge of the growth characteristics of all-aged stands of west Tennessee hardwoods, the following cut-and-leave prescription was used. The forest land owner will harvest amounts of timber scheduled each decade if possible but will never remove desirable immature trees (unless overly crowded) and seldom will cut the stand back to a residual total of less than 60 square feet of basal area per acre. The distribution of diameters cut will be planned so that the proportion of trees left in each diameter class will approach that of crop trees in an ideally managed stand. Although different ideals would be appropriate to different sites, a single ideal diameter distribution has been assumed for expediency. This ideal postulates a basal area of 60 square feet per acre in residual growing-stock trees between 2 inches and 26 inches in d.b.h.; further, each 2-inch diameter class contains 40 percent more trees than the next larger class.

For each area, or stand, of Units 1 through 8 (including the first rotation of the small old-field stands of shortleaf pine), the stand structure tabulations just described were projected decade after decade--after deleting (as of the beginning of each decade) all trees scheduled to be cut during the decade--

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using standard stand projection by 2-inch diameter classes and the 10-year d.b.h. growth rates of Table B-2. The minimum operable cut is assumed to be normally 1,500 board feet per acre for sawtimber, 80 cubic feet (about 1 cord) per acre for pulpwood.

Under the cut-and-leave prescription for intensive management, if an improvement cut can be scheduled for the first decade, the harvest will remove the trees that are the least desirable as growing stock. Hence the trees cut initially and during the early decades will usually be poor quality trees or mature individuals and those interfering with the growth of better ones. The owner who cuts timber himself may find it worthwhile to harvest as little as 500 board feet per acre at a time. It may also be desirable for him to remove some small, low quality trees for pulpwood. Intensive management further prescribes that all existing culls be deadened during the first decade and that poorly stocked stands be clearcut and converted to pine plantations. As a result of all forms of improvement operations under intensive management, the proportion of good growing stock continually increases throughout the development period until the "equilibrium stand" of the stable period is reached. The overall growth rate of the residual stand after each operation therefore rises concurrently. Differences in initial species composition and tree form among the various original stands are reflected in future yields and in the volume of the stablized growing stock.

Extensive forest management

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sale will be made as soon as a merchantable volume of 1,500 board feet per acre accumulates. For stand projection over the first decade, the average growth rates in Table B-2 were applied to the existing stand (minus the trees large enough to harvest if the total merchantable volume per acre was 1,500 board feet or more). For the rest of the period of declining yield, this process was repeated on the residual stand for each decade, but the additional assumption was made that basal area per acre would not exceed 116 square feet on bottomlands, 107 on lower slopes, and 98 square feet on uplands. These basal areas were the highest averages that had developed on these sites on the Plantation over decades of extensive management with virtually no harvesting of merchantable timber.

Because extensive management removes no culls, such trees might eventually take over the entire stand. It seems more probable, however, that mortality of culls and regeneration of promising seedlings will always provide about the amount of usable volume that grew on the various sites on the Plantation over the past 10 years. This growth was about 40 board feet per acre annually in the uplands, 45 on the lower slopes, and 50 in the bottomlands.

Estimation of Potential Yields Using Resource Bulletins

Estimates of potential yields can be deduced from standard statewide data tables prepared by the U.S. Forest Service. These data have started to become available for state after state in a series of *Research Bulletins* to be published following the completion

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completion of the next scheduled Forest Survey of each state by the Service's forest experiment stations.

Tables of "Area of commercial forest land by site and ownership classes" (in which all forest types in a state are grouped) list 4 ranges of potential annual volume growth per acre as site classes. Using the area data in the "Farmer and miscellaneous private" ownership class, average statewide percentages of land in each class of potential growth can be computed for this private individuals' ownership class. Then the help of a forester familiar with the forest types and sites in the state is almost essential; but with his knowledge and judgment, related data in other tables (on area-condition classes, mortality rates, and so forth) can be used to adjust the statewide percentages to approximate those for a given owner's forest land. The forester's judgment will be needed to select the appropriate point in each range of potential annual volume growth per acre to adopt as a reasonable level to expect from intensive management by the owner. Based on these points, useful estimates can be made of the annual or decadal yields the owner can expect from each of his principal categories of forest.

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SECTION 5

TIMBER PRICES

The estimated average prices used in calculating the value of timber yields and growing stock on the Ames Plantation farm operating units are summarized in Table B-3.

TABLE B-3.--Average prices for pine and hardwood logs and pulpwood in west Tennessee expected during the next 50 years[1]

Product and stand	Stumpage price[2]	Roadside price[2]
Pulpwood (rough)		
Pine	$ 3	$10
Hardwood	. .	8
Sawtimber, pine		
Unmanaged and young stands	20	35
Well managed older stands	35	50
Sawtimber, hardwood		
Extensively managed stands		
Poor stands	10	25
Good old-growth stands (first cut)	30	45
Subsequent cuts	10	25
Intensively managed stands		
Poor stands	10	25
After 10 years	15	30
After 20 years	20	35
After 30 years	35	50
After 40 years	40	55
Good old-growth stands	30	45
After 10 years	35	50
After 20 years	40	55

[1]Solon L. Barraclough and Alfred Pleasonton, Data for planning woodland opportunities on west Tennessee farms, University of Tennessee Agricultural Experiment Station Bulletin 276 (Knoxville, Tenn.: 1957), p. 54. Estimates assume continuation of the 1957 price level.

[2]Pulpwood prices are for cords, sawtimber prices for MBF, International rule.

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The difference between roadside and stumpage prices of sawtimber is assumed to be $15 for all species and qualities of timber; it actually is an estimated average, however, as the price differential between logs at roadside and standing timber varies several dollars according to volumes and qualities of individual stands. The table shows not only that higher prices are paid for better quality timber but also that the average price is expected to increase over time, as intensive management improves the average quality of each stand.

The price estimates for any specified quality of timber are static, however. In the long run, therefore, the prices in the table will be conservative because they are based on the assumption that future timber values will not rise in relation to the general price level and furthermore that the general price level will be the same as at present. Actually the general level is expected to continue its historic trend upward with lumber prices continuing to increase more rapidly than average prices. If this expectation turns into fact in the indefinite future, the prices in Table B-3 based on the conservative assumptions just mentioned will be exceeded by the actual future prices, which will then serve to direct the forest manager toward even more intensive forest management.

If a forest investment (such as purchase of additional land, establishment of tree plantations, or hiring labor to improve existing stands) is so large that an intermediate- to long-term loan to finance it must be borrowed in the first decade--the debt _per se_ will be advantageous to the forest owner. The dollars borrowed will be worth more in exchange than the dollars used for repayment

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repayment after prices have risen. Therefore a debt will be repaid with a smaller portion of the volume--and value--of his timber than would have been the case if prices had not risen.

Even without a loan to finance investment, the fact that lumber prices are expected to rise relative to the general price level--with only temporary drops--is a cause for optimism of the forest manager. Not only will he benefit from the volume growth of his timber over the years but also will receive an additional financial profit from the preferred price position of his products. Most west Tennessee timber is harvested as sawlogs, and the markets (and therefore prices) for sawtimber are of course responsive to current timber prices.

A similar relative price prospect is expected for veneer logs and other high-quality round products for demanding uses. As the national economy expands along with the number of its citizens, demand increases for high quality timber that is becoming more and more difficult to obtain. Pulpwood prices are not likely to rise more rapidly than the general price level. The potential supply of pulpwood is large and is not likely to become the cause of widespread price competition among pulp companies. This is the most probable expectation for at least the next few decades despite the high current predictions of United States population growth.

Intensive forest management holds a preferred financial position over extensive management not only because it yields larger volumes of timber (at least after the first decade) but also because the average quality of each intensively managed stand will increase over a period of development, as mentioned earlier. Under

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extensive management the sawlogs removed as soon as they are large enough to be merchantable will inevitably be small at each successive occasional sale and will mostly be low in quality. Intensive management will remove practically all of the poorer quality yet merchantable trees (as well as all culls) during the first two decades. From the third decade on, most of the trees allowed to reach merchantable size will be well formed and free of serious defects. Most of the volume harvested during the development period will be from large undesirable trees and from those less than 20 inches in diameter. But when stable yields are achieved, 30 percent of the harvest will come from trees larger than 26 inches in diameter, 45 percent from trees 18 to 26 inches in diameter, and only 25 percent from trees less than 18 inches.

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SECTION 6

GLOSSARY

Acid equivalent. The weight that the active ingredient of a chlorophenoxy-acid auxin herbicide would have if it were stripped of the carrier groups of the molecule and converted to the pure acid. The concentrations are conventionally expressed in terms of pounds of acid equivalent per gallon or hundred gallons of the spray mixture.

All-aged. Refers to a stand in which theoretically trees of all ages (or at least, sizes) are found, up to and including mature individuals.

Auxin. Any of a group of plant growth-regulators that have profound effects on the elongation of plant cells and other important growth phenomena.

Basal area. The area, usually expressed in square feet, of the cross section at breast height of a single tree or of all the trees in a stand. Usually the area inside bark, unless stated otherwise.

Batten. A narrow strip of lumber that is used on buildings to cover cracks in siding or roofing.

Board foot. A unit of measurement represented by a board 1 foot long, 1 foot wide, and 1 inch thick. In practice the working unit is 1,000 board feet (1 MBF).

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Bottomland(s). Low-lying land, usually the flood plain area of a stream.

Breast height. The standard height, $4\frac{1}{2}$ feet above average ground level, at which the diameter of a standing tree is measured.

Clearcut. Cut all the merchantable timber in a stand.

Cord. A measure of wood volume. A standard cord is equal to a pile or rick of stacked wood 4 by 4 by 8 feet, containing 128 cubic feet of wood, bark, and air within its outside surfaces. The volume of solid wood is approximately 75 cubic feet but ranging from 67 to 95, depending on bark thickness, average bolt diameter, and amount of irregularity of shape.

Crop tree. A merchantable or potentially merchantable tree of desirable species, vigor, and form, and essentially free of harmful insects and disease.

Cull. A tree or log of merchantable size that is considered unmerchantable because of poor form, limbyness, rot, or other defect.

Cutover. Refers to an area of forest from which all or part of the merchantable timber has been cut.

d.b.h., diameter, breast high. The diameter of a standing tree measured at 4.5 feet above average ground level.

Doyle rule. A simple formula log rule commonly used for measuring board-foot volume of logs in the eastern and southern U.S.; it underestimates the volume in small logs and overestimates large logs. Doyle log scale. A scale marked on a measuring stick in board feet as computed by the Doyle rule.

Doyle-Scribner rule. A combination rule derived by using Doyle rule values for measuring board-foot volume of logs up to 28 inches in diameter and using Scribner rule values for logs larger than 28 inches.

Even-aged. Refers to a stand in which relatively small age differences exist between individual trees.

Growing stock. All live, potentially merchantable trees in a stand regardless of size, but often used to connote collectively all crop trees, or "desirable trees", that forest managers aim to leave to grow to maturity--in contrast to trees that are expected to be removed in future silvicultural cutting before reaching maturity.

Hardwood. Generally, one of the botanical group of dicotyledonous trees, usually broad-leaved and deciduous, in contrast to the conifers; also wood produced by such trees regardless of texture.

Heeling in. A method for storage of young trees prior to planting, by placing them in a trench and covering the roots or rooting portions with soil.

MBF. . Thousand board feet. MMBF. Million board feet.

Mature. Refers to a given tree or stand that has reached the approximate age or size beyond which the growth rate diminishes or decay begins to increase at a rate likely to assume economic importance.

Merchantable timber. As a class, often set arbitrarily as timber 12 inches or larger in d.b.h., but actual merchantable sizes for many purposes include all sizes of poles as well. In the area of the Ames Plantation, the smallest hardwood sawlog considered mercha

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merchantable had to be 11.0 inches in diameter inside bark at the small end (d.i.b.) and pine, 8.0 inches in d.i.b. For this area a merchantable stand normally had to contain at least 1,500 board feet (International 1/4-inch rule) of sawtimber for sale or one cord of pulpwood (in pine stands).

Modal. Refers to the mode or value of the most common class (of size or other characteristic); belonging to the class having the highest frequency in a given statistical distribution.

Poles, poletimber trees. Trees of commercial species, 5.0 to 9.0 inches in d.b.h. for softwoods and 5.0 to 11.0 inches for hardwoods. More generally, a young tree 4 inches in d.b.h. up to some diameter between 8 and 12 inches, depending on local merchantability standards.

Poletimber stand. A stand at least 10 percent stocked with pole- and sawtimber trees, containing less than 1,500 board feet per acre in sawtimber, but at least 5 percent stocked with poletimber trees.

Pulpwood. Wood prepared for use in the manufacture of wood pulp, which in turn is processed into paper, paperboard, and other cellulose products. Pulpwood, in the commonly accepted use of the term, refers to a round product that has been limbed and cut into bolts ranging from 4 to 8 feet long and from 4 to 10 inches in diameter inside bark at the small end (d.i.b.). In the area of the Ames Plantation, pulpwood bolts were nominally 5 feet long and at least 5.0 inches in d.i.b.

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Round product. A product of the simplest degree of timber processing, a log or bolt cut from a tree that has been felled, limbed, and bucked into lengths suitable for sale after skidding to a convenient roadside yard.

Saplings. Trees of commercial species, 0.5 inch to 4.9 inches in d.b.h., commonly of desirable form and vigor.

Sawlog. A round product large enough to produce lumber or other products that can be sawed. Its size and quality requirements vary with utilization practices. For the area of the Ames Plantation, see merchantable timber. As a unit of measure of merchantable height, a "log" is 16 feet 3 inches long, although in actual sales 12-foot logs and 8-foot long "half-logs" are commonly merchantable.

Sawtimber. Timber, or trees, large enough to yield one sawlog or more (or at least a "half-log") from each tree.

Sawtimber stand. A stand in which the sawtimber trees collectively contain enough sawlogs to equal the commonly minimum merchantable volume of 1,500 board feet per acre (estimated for Forest Survey standards according to the International rule for 1/4-inch-kerf sawing). Large sawtimber refers to stands in which 50 percent or more of the board-foot volume is in trees at least 15.0 inches in d.b.h. Small sawtimber refers to stands in which more than 50 percent of the board-foot volume is in trees under 15 inches in d.b.h.

Scribner rule. One of the oldest diagram rules commonly used in much of the U.S.; it assumes sawing of 1-inch boards only, with a

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a 1/4-inch kerf; it disregards taper and makes a liberal allowance for slabs.

Seedling. Basically a tree grown from seed, but generally used for a desirable young tree under minimum sapling d.b.h. of 0.5 inch.

Seedling and sapling stand. Stands not qualifying as sawtimber or poletimber, but at least 10 percent stocked with growing-stock trees, and with saplings and seedlings composing a plurality of the stocking.

Softwood. Generally, one of the botanical group of coniferous trees, usually evergreen, having needles or scale-like leaves--primarily the conifers; also the wood produced by such trees.

Stand. A portion of a forest constituting the smallest convenient natural unit or subdivision of that forest or forest type based on measurable characteristics. A stand is an aggregation of trees occupying a specific area and being sufficiently uniform in species composition, age arrangement, and condition, to be distinguishable from the forest on adjoining areas.

Stand structure. The constitution of a stand with respect to age, crown characteristics, diameter, and tree classes.

Stocking. A comparison or measure of the collective population of various numbers and sizes of growing-stock trees occupying a given stand, related to a desired density of trees for that stand; it is described in comparative words or percentages.

Stumpage. Standing timber, used with the connotation of merchantability.

Sustained yield. The managed production of volumes of merchantable timber on a sustained renewal basis, with the expectation of yields of a

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of approximately equivalent volume or value over successive units of time in the long run.

Unit. A long cord of wood containing 160 cubic feet within its outside surfaces, or 1.25 (standard) cords. Bolts are usually cut 5 feet long, as compared to 4-foot bolts in a standard cord.

Working circle. An area having sustained yield as a prime objective of management and a large enough forest to require an individual management plan; preferably of a size to permit the spreading of the costs of equipment, labor, and forest administration to an efficient level; and commonly connoting capability of indefinitely supplying enough round products for economic operation of definite harvesting and manufacturing facilities.

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APPENDIX C

FORMS USED IN DATA COLLECTION

The following four forms were used in the field collection of data for this project:

Page

1. Marketing of Forest Products: Data from Producers . . 494
(a 3-page questionnaire used in the personal interview survey of 40 Hardeman County forest land owners)

2. Marketing of Forest Products: Data from First Buyers . 497
(a 4-page questionnaire used in the personal interview survey of 20 firms that are buyers of Hardeman County stumpage or timber products)

3. Work-Performance Data Record Card 501
(copy of a 3- by 5-inch card for field recording of Ames Plantation work-performance data)

4. Ames Plantation Forest Survey Field Record Sheet. . . 502
(a field record "tally" sheet used for listing forest data at each survey location)

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Research Project - - - - - Marketing of Forest Products - - - - - - - - - - - 1955-56
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Data from PRODUCERS

1. County ______ Community ______ Date ______ ,195_

Owner ______ Occupation ______ Age ___

Address ______

Operator(s) ______

Type:
Farm resident ( )
Farm Non-resident ( )
Nonfarm, commercial ( )
Nonfarm, Non-comm., resident ( )
Nonfarm, non-comm., non-resident ( )

Total Ownership Area (acres) ______
(including land located elsewhere but operated jointly with headquarters land)

2. Forest Area (acres) ______ (percent of total) ______

Forest Types and Other Land Uses:

Area	Type or Use	Volume and Condition, Tree Height and Diam., Age,etc.(if forest

3. Acquisition: Date ______ Method ______

4. Ownership Objectives ______

5. Past Sales (dates and products) ______

6. Past Harvesting for Own Use:

Date	Product	Quantity	Uses

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Marketing Project -- PRODUCERS -- 1955-56

County ____________________ Owner ____________________

7. Recent Sales (1954-56) If none, record the last sale made, if possible.

a. Date	Product	Location	Quantity, Grade, and Species	Scale	Price + Method of Determ'n
Buyer (Name, Address)					

b. Returns expected based on: (1) Price & volume (with or w/o grade, species) estimate by ______ ( ), (2) Price & volume (w/o estimate) ( ), (3) Lump sum offer ( ).

c. Reasons for sale: ____________________

d. Agreement: Verbal ( ), Seller's written contract ( ), Buyer's writ. cont. ( ).

e. Basis of payment: Seller's/Buyer's log scale at ______ ( ), Mill tally ( ).

f. Marketing services used: ____________________

g. Method of selecting (1) Buyer: ____________________ No. contacted ( )

(2) Trees: ____________________ Marked by: ____________________

h. Distances: ____________________

i. Other details: ____________________

a. Date	Product	Location	Quantity, Grade, and Species	Scale	Price + Method of Determ'n
Buyer (Name, Address)					

b. Returns expected based on: (1) Price & volume (with or w/o grade, species) estimate by ______ ( ), (2) Price & volume (w/o estimate) ( ), (3) Lump sum offer ( ).

c. Reasons for sale: ____________________

d. Agreement: Verbal ( ), Seller's written contract ( ), Buyer's writ. contract ( ).

e. Basis of payment: Seller's/Buyer's log scale at ______ ( ), Mill tally ( ).

f. Marketing services used: ____________________

g. Method of selecting (1) Buyer: ____________________ No. contacted ( ).

(2) Trees: ____________________ Marked by: ____________________

h. Distances: ____________________

i. Other details: ____________________

keting Pro

County___

Planned S
or Harves

Date___

Buyer___

Future Sa

Form___

Forest Pl

weeding (

b.Skills

Own___

Family___

Neighbors

Tenants &

Other Hir

c. Specie

___

d. Sustai

e. Knowle

___

___

f. Knowle

vol./a ar

___

g. Source

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h. Knowle

___

i. Price

County ______________ Owner ______________

8. Planned Sales or Harvesting Date ______________ Products & Quantities ______________

Buyer ______________ ______________

Date ______________ Products & Quantities ______________

Buyer ______________ ______________

9. Future Sale Products: Form ______________ Location ______________

Form ______________ Location ______________

10. Forest Plans a.Woods work (other than harvesting a final crop): Planting ( ),

weeding ( ),thinning ( ),improvement cutting ( ),girdling+poisoning ( ),pruning( )

b.Skills and experience of labor,equipment for harvesting+handling, time available:

Own ______________

Family ______________

Neighbors ______________

Tenants & Sharecroppers ______________

Other Hired ______________

c. Species in prospect (reasons+uses): ______________

____

d. Sustained yield planned ( ) or not ( ): ______________

e. Knowledge of grades (logs, lumber, etc.) and size specifications: ______________

____

____

f. Knowledge of merchantability of stands (type, tree size, age, accessibility,

vol./a and # of trees/acre required for harvesting, etc.): ______________

____

g. Sources of market information: extension forester ( ), state service forester

( ), county agric. agent ( ), SCS agent ( ), other ( ) ______________

h. Knowledge of existing or prospective markets: ______________

____

i. Price expectations, tax and credit problems, income possibilities under various

alternatives:

Research Proj

County

Name of Firm

Name of Offi

Location of

Type of Firm

Estimated Pl

Products Bou

Form Spe

b. Quality

c. Measure

Owner Class	
Under 500 acres	
500 acres and over	

Products S

Product

Volume Cu

University of Tennessee

Research Project - - - Marketing of Forest Products - - - - - - - - - 1955-56
AP

Data from FIRST BUYERS

1. County ______________ Community ________________ Date __________ ,195__

Name of Firm ____

Name of Official ____________________ Position ____________________

Location of Plant(s) or (Yards) ________________________________

Type of Firm ____

Estimated Plant Capacity for 8-hour Day ______________________

2. Products Bought and/or Harvested by Plant in 1954-55: a. Quantities:

Form	Species and Grade	Prices Paid	Volume (in year 1954)	Cu. ft.

b. Quality Requirements ____

c. Measurement Practices

Owner Class	Purchase Point	Ocular Estimate	Cruise (%)	Tree Scale	Log Scale	Piece Tally	Mill Tally	Other
Under	Stump							
500 acres	Other							
500 acres	Stump							
and over	Other							

3. Products Sold in 1954-55:

Product	Species	Where Sold	Volume (in year 1954)	Cu.ft.

4. Volume Custom-sawed in 1954 ______________________

rketing Proj

County___

Purchase A

Product Bo

___

___

___

Procureme

Product B

___

___

___

Transport

Source of

Ownership Class
Firm's Own Land
Private under 500
Private 500A.+ove
Public land
Tota Forest L

Procurem Material

___

___

___

___

___

Marketing Project -- FIRST BUYERS -- 1955-56

County ____________________ Firm ____________________________ Plant ____________

5. Purchase Area:

Product Bought	Max. Hauling Distance	Outlying Points in 1954-55

6. Procurement Methods:

Product Bought	Range of Prices Paid in 1954	Method of Determination

Transportation by ______________________ Woods Operation ______________

7. Source of Raw Materials by Forest Ownership and Type of Purchase Agreement:

Ownership Class	Percentage of Volume	Verbal Agreement		Buyer's Written Contract		Seller's Written Contract	
		Stump	Other	Stump	Other	Stump	Other
Firm's Own Land							
Private under 500A.							
Private 500A.+over							
Public land							
Total	100%						

Forest Land Owned by First Buyer:	Area (acres)	Duration of Ownership

8. Procurement Policies in Relation to Forest Management Practices & Future Raw Material Production: ____________________

Marketing Project -- FIRST BUYERS -- 1955-56

County____________________ Firm____________________ Plant____________________

6A. Procurement Methods (continued):

Range of prices paid for raw material products bought in 1954:

Product	Species	Grade	Point of Procurement: Stump Price/Unit	Roadside Price/Unit	Mill Yard Price/Unit	Other Price/Unit

Marketing

County

Stability

Number of

Number of

Chief reas

a. Last

b. Planne

Yearly du

Season of

Year arou

Winter

Summer

Intermitt

Only when
orders

Number of

Financial

Marketin

or regio

forester

g. own a

Comments

Marketing Project -- FIRST BUYERS -- 1955-56

County ____________ Firm ____________ Plant ____________

9. Stability of First Buyer:

Number of years in present business ____________

Number of years in present location ____________

Chief reason for:

a. Last move ____________

b. Planned move ____________

Yearly duration of operation for product:

Season of Operation	PRODUCTS						
	___	___	___	___	___	___	___
Year around	___	___	___	___	___	___	___
Winter	___	___	___	___	___	___	___
Summer	___	___	___	___	___	___	___
Intermittent	___	___	___	___	___	___	___
Only when filling orders	___	___	___	___	___	___	___
Number of days	___	___	___	___	___	___	___

Financial arrangements -- Uses of capital and credit. ____________

____

____

10. Marketing Services -- How buyer finds producers. a. market bulletins, state or regional ( ), b. other published sources ( ), c. radio ( ), d. extension forester ( ), e. consulting forester ( ), f. other individuals or agencies ( ), g. own advertising (in newspapers, journals, etc., or by posters) ( ).

Comments: ____________

____

____

____

____

WORK-PERFORMANCE DATA RECORD CARD

Job____________________________ Date_____________,195___

( ) No remarks

Location______________________ ( ) Remarks on reverse

Equipment____

Materials:________gas,_________oil, other_______________

Men & Hours	Men & Hours		
		Total crew hours:	
		Total production:	
		Supervisor:	Hours:

AMES PLANTATION FOREST SURVEY
Grand Junction, Tennessee

Date: ____

AMES PLANTATION FOREST SURVEY
Grand Junction, Tennessee

Cruised by: ____________
Date: ____________

	1 & 2				3&4	Pulp		Sawtimber			
									Butt Log		
Point	Tree #	Species	D.B.H.	Tree Class	10-Yr.R. Growth	Height	Cull	Sawlog Height	Cull	Grade	Top Stem Height
	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										
	10										
	11										
	12										
	13										
	14										
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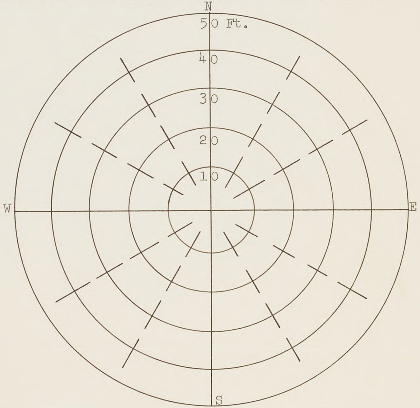
	25										
	26										
	27										
	28										
	29										
	30										
	31										
	32										
	33										

Unit	
Block.	
Compartment. . .	
Location	
Type	
Stand size . . .	
Stocking	
Fire Damage. . .	
Aspect	
Ground Cover . .	
Slope Position .	
Slope Percent. .	

BA 50 Tally	
BA 50 Eval.	
TSI needed	
Seed source	
1/250 Tally	XXX
Cub, Pine	
Cub, Other	
Cur	

Location Notes: ____________



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