PRACTICES AND PROBLEMS IN THE MANAGEMENT OF SMALL, PRIVATELY OWNED TIMBERLANDS IN EAST TEXAS

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

CHAPTER I

THE PROBLEM

Historically and in its present economy and land use, East Texas is timber country. Its virgin timber stands played a major role in initial settlement and development and established it in the annals of lumbering history. Despite the original cut-over of virgin stands, repeated cuttings, land-clearing and destructive fires, more than half of the area remains forested and, according to the 1954 Census of Manufactures, the Texas forest products industry ranks among the five most important in the state in persons employed and payroll. The remarkable regenerative ability of the southern pines has, in general, renewed a timber resource beyond anything most people believed possible 30 years ago.

However, the improvement in timber productivity has not been uniform. Foresters and others interested in resource management have long been concerned over an obvious lack of good timber management practices on much of the East Texas forest area. A recent Forest Survey revealed that the productivity of East Texas timber is far below its potential capacity, and that it is actually deteriorating in areas of predominantly small ownerships, particularly in Northeast Texas (1). In the last 20 years, much acreage formerly in productive stands of pine have degenerated to stands of low quality or cull hardwoods because of poor cutting practices and other poor management practices. The report of the Timber Resource Review on the West Gulf area, which was based partly on East Texas data, clearly shows that there are major

differences in levels of productivity between broad size classes of forest ownerships (2). Small ownerships were found to be particularly low in productivity, reflecting a low degree of management,[1] but the data indicated that desirable management practices were being applied on most of the medium and large ownerships.

Statement of the Problem

It seems clear that an economic problem associated with ownership exists in land use and timber production in East Texas. The importance of this problem in relation to the economy and to the public interest is intensified by certain features of timber management and production. It appears that an increase in timber production in the area, even to the full practical potential on existing acreage, would find a ready market. Characteristically, timber is an extensive crop requiring little management time and labor investment, and in this respect should be well adapted to a large segment of East Texas land owners (3, 4). Even though management requirements are small, the rapid growth rates and resulting high productivity per unit of land plus the forest products industry which can be generated by timber production make it an industry capable of employing many people. Another favorable aspect is that it is a desirable land use well-suited to the physical environment of the area. By its nature it would obviously enhance the values of recreation and soil and water conservation. It is important in the major land use adjustment now taking place in the area, particularly in

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[1] Refers to technical forest management, rather than the decision-making concept of management (see Appendix A, Explanation of Terms).

Northeast Texas where many acres of abandoned cropland present an opportunity for reforestation. From a national standpoint, an improved forest economy would contribute to national strength and national security; wood products are now one of our major imports.

It has been noted that the productivity of the southern pines and the response of medium and large ownerships to the advantages of timber production have improved the timber resource as a whole in recent years. The facts known about timber production in East Texas indicate that it should be the most profitable use on much acreage not now in productive timber stands or under good management. Some owners of small timbered holdings are applying good management practices with resulting profits, and these have seemed sufficient in number and variety to indicate there should be opportunity for good returns to investment in timber stand improvement on many similar but poorly managed ownerships. Yet, not only is there a lack of good management practices on many ownerships, there also is widespread practices of destructive cutting which obviously reduces productivity drastically. The practice of uncontrolled woods burning is also of this nature, and while there has been substantial improvement, it remains a major problem requiring much protective effort.

There are a wide variety of influences important in the management of small forested ownerships in the area. The quality of timber management on small ownerships apparently is due in a significant degree to the effects of institutional, financial, economic, personal and other factors associated with ownership.

As a consequence of the foregoing considerations, a cooperative project was undertaken in 1954 by the Texas Forest Service, Texas Agricultural Experiment Station and Agricultural Research Service, U. S. Department of Agriculture, to study ownership, utilization, and management of land in the East Texas commercial timber area. The author was employed for the study as assistnat silviculturist, Texas Forest Service and Texas Agricultural Experiment Station, with special responsibilities in the investigation of the quality of timber management by owners and the need for and means whereby improvement in management might be achieved. The methods, results and interpretations of this investigation constitute the subject of this thesis.

Solution to the management problem appears to lie in the answers to these questions: What are the major influencing factors and their effects on the management and productivity of small timbered ownerships? What do these relationships indicate as to the most effective approaches to improvement? The problems may be stated more explicitly as follows:

(1) To what degree do owners apply practices necessary to full utilization of the timber growth potential of the land, and which are being applied on the better-managed ownerships?

(2) What is the productive state of the timber resource on small ownerships?

(3) What are the major factors which influence the degree of timber management practices applied, and what are their effects?

(4) In the light of answers to the foregoing questions, what are the indicated ways and means to greater improvement in the management and productivity of small East Texas forest ownerships?

Scope of Study

This investigation was limited to a study of small private forested or partly forested ownerships and their owners in the commerical timber producing area of East Texas. A small ownership as defined in this study is a private ownership of at least 21 acres but not exceeding 5,000 acres in size and having at least three acres of timber.[2] An additional quality of the ownerships studied was that the owners resided on the land or within approximately 25 miles of the headquarters or principal timbered tract. As such, they were considered to be representative of the population of small ownerships of residents described in previous reports on other phases of the comprehensive research project of which this study is a part (3, 4). A summary of numbers and acreage of these ownerships is presented in Table I. This summary was made by combining data from the previous reports and excluding all public, corporate and institutional lands, and non-resident and non-forested ownerships. The ownerships presented in Table I included about 79 percent of all small ownerships, about 82 percent of the land held in such ownerships, and about 50 percent of all land in the study area.

The Texas commercial timber resource consists principally of the East Texas Piney Woods; the pine-hardwood timber belt which lies chiefly within 36 counties along the eastern border. This area is essentially the productive range of the southern pine species in the state. The study area proper is represented by the shaded portions of Plate I. A feature of the area is the concentration of sawtimber

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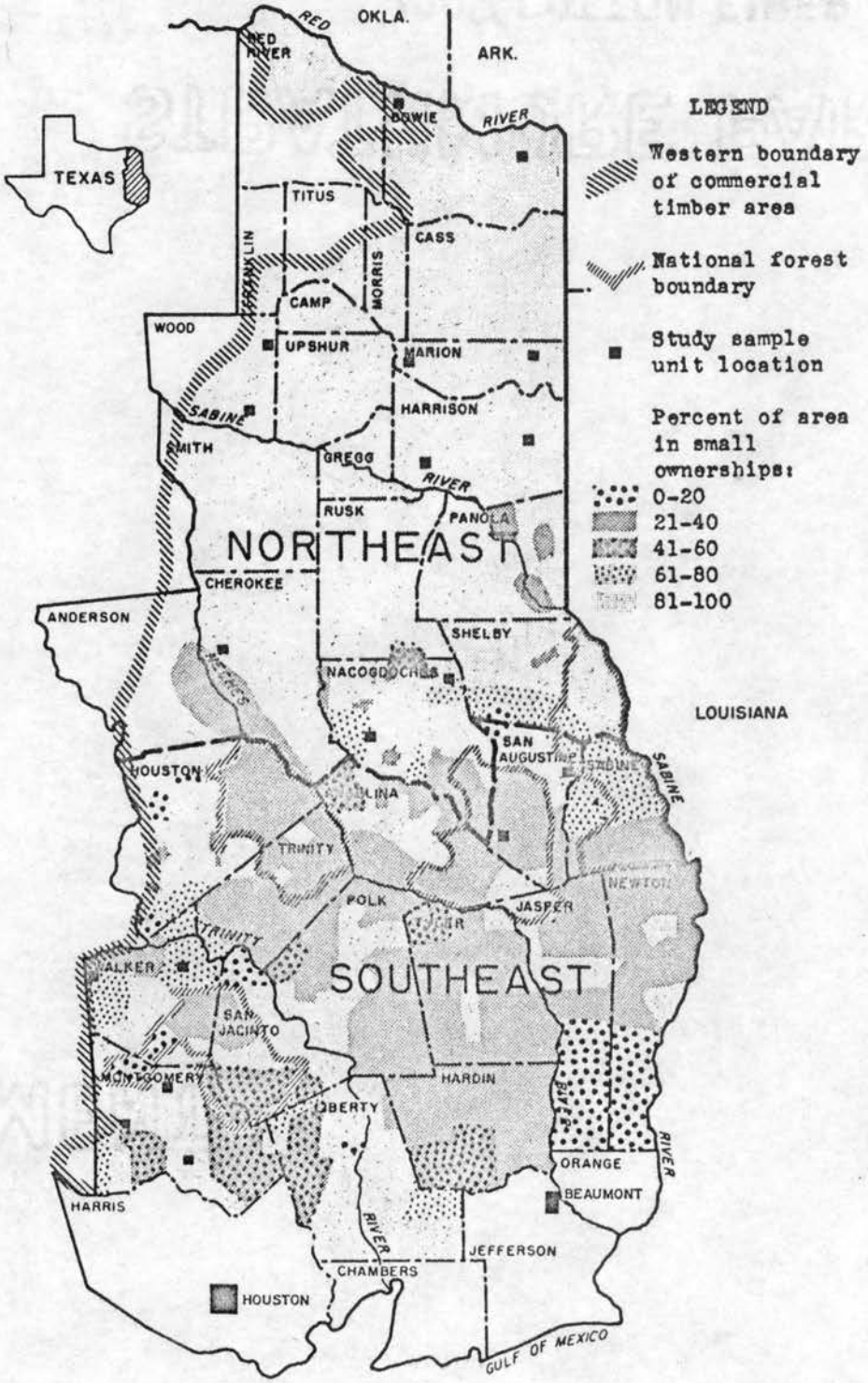
[2]Ownership size classes are further defined in Appendix A.

TABLE I

SMALL PRIVATE FORESTED OR PARTLY FORESTED OWNERSHIPS
OF RESIDENTS IN THE COMMERCIAL TIMBER AREA
OF EAST TEXAS, 1955

Ownership Size Class (Acres)	Number of Ownerships		Total Acreage Owned	
	Number	Percent	Number	Percent
21 - 120	40,193	71.1	2,482,300	31.5
121 - 200	8,329	14.7	1,320,300	16.8
201 - 320	4,007	7.1	1,019,600	12.9
321 - 640	2,547	4.5	1,140,500	14.5
641 - 1,000	744	1.3	603,900	7.7
1,001 - 1,500	367	0.7	446,000	5.7
1,501 - 2,500	250	0.4	473,800	6.0
2,501 - 5,000	114	0.2	387,500	4.9
Totals	56,551	100.0	7,873,900	100.0

Plate I. Distribution of Small Ownerships and Location of Sampling Units in the Commercial Timber Area of East Texas



volume and several large private and federal ownerships in Southeast Texas. This area is 68 percent forested.[3] In contrast, Northeast Texas is characterized by small ownerships, has less sawtimber and more hardwoods, and is only about one-half forested.

The factors hypothesized to have significant effects on the quality of timber management on small forest ownerships are classified and listed as follows:

Ownership Features

Size of ownership

Size of forested acreage

Geographic location

Number and dispersion of tracts

Tenure Factors

Estate status

Time of acquisition

Method of acquisition

Timber resource tenure

Owners' Management Concepts and Intent

Concepts of timber management

Opinion of woods burning

Intent in land use

Obstacles to timber management

Timber Resource Features

Timber type

Productibity

Timber value

Owner Characteristics

Age

Chief source of income

Occupation

Sex

Race

Residence Factors

Rural versus urban residence

Residence versus non-residence

[3]See Appendix A for definition of forest.

The influences of economic factors were studied in conjunction with investigation of the opinions and concepts of owners. Such factors do not necessarily exist as owners see them, but it is vital to consider them in relation to the concepts and knowledge on which management decisions are based.

The study has involved mainly the collection and analysis of primary data in the investigation of these factors. Secondary data has also been obtained and used in illustrating potentials of timber production in the area. An explanation of terms used throughout this thesis is contained in Appendix A.

CHAPTER II

REVIEW OF THE LITERATURE

The principal methods and concepts of studies which related to problems of this investigation are described below. Included in the review is a description of related research in East Texas and of sources of information on the economics of timber production, joint production relationships and credit for timber production. Some secondary data are presented on potential returns to timber production in East Texas.

Studies of Similar Nature

Investigations similar to this study have been carried out on a nation-wide scale (2, 5), in Michigan, (6), the Northeast (7,8), and in other parts of the South (9, 10, 11, 12). A feature common to all such studies was the attempt to determine the relation of ownership-associated factors to the level of management or of timber productivity on the ownerships studied. These studies revealed apparent differences between areas or regions in the degree of influence of factors studied. Thus timber management problems need to be approached on the basis of areas relatively homogeneous in the conditions likely to affect timber management. However, in one important respect, the conclusion was the same in all the studies listed. Management level (or timber productivity as an indicator of management level) was found to vary significantly by broad forest ownership size classes, and the major problem in improvement in timber management was found to lie in the small ownership group.

Management Rating Concepts

The measurement of degree of management practices applied, or quality of management, is a major problem in studies of this nature. In order to determine the relationships of management to the several factors investigated, a method of grouping ownerships by similarity of management quality is needed. This necessitates establishing a standard of management practices to permit assignment of ratings of management to sample ownerships. Rating management is complicated by the apparent necessity to consider several management practices, each of which varies in need and degree of application among ownerships, and in the practical necessity for one standard or comprehensive rating of management to facilitate analysis.

A review of the studies cited revealed two differing basic concepts in rating timber management. One, which is based on the assumption that a measure of timber productivity is a good indicator of management quality of the owner, was applied by Chamberlin, Sample and Hayes (10), by Folweiler and Vaux (11), and in the Timber Resource Review (2). The major advantage of the method based on this concept is that ratings can be determined entirely on the basis of measurements taken on the timber stand on the sample ownerships, and they need not involve obtaining data on specific practices. The method consists basically of the collection of data on growing stock and existing or prospective reproduction on the most recently cut area on the ownership, and rating the revealed conditions against a standard of productivity which is both silviculturally desirable and practicably attainable. However, such ratings are at best only indirect measures of applied timber management by owners, and are likely to be influenced by factors beyond the control of owners.

A second concept for classifying quality of timber management is based on direct measurement of practices needed and quality and degree of practices applied on the ownerships. Methods based on this concept were used in most of the other studies cited. Because it permits a direct measure of management practices applied and minimizes the effects of factors not associated with current ownership, it was found most suitable and was applied in this study.

Other Related Research

Studies of East Texas Small Ownerships

In 1956, Mignery reported on a study of small ownerships in Nacogdoches County. He concluded that the few instances where timber management was being practiced on small ownerships were usually associated with well-stocked stands and with owner financial conditions such that there was no pressure to cut immature growing stock (13). The study and conclusions were based primarily on a survey of the opinions and observations of community leaders.

Reports on East Texas land ownership numbers and classification have been published as a result of completion of the initial phase of the comprehensive research project including this study (3, 4). Reports on other phases of the project are in manuscript or are scheduled on detailed analyses of timber marketing practices, characteristics and land management intent of owners and features of their ownerships (14), their concepts, knowledge and opinions of timber management, and the problems, practices and management intent on non-resident owners. A summary of some of these results has been issued (15).

Timber Production Economics

Sources of Data. There is a lack of indigenous information on the economics of timber production which imposes a serious limitation on economic land use and timber management decisions in East Texas. There has been no systematic collection of data from ownerships. Research on timber production, carried on principally by the Texas Forest Service on experimental forests and by the Forest Service, U. S. Department of Agriculture, at Nacogdoches, has been concerned mainly with the technical aspects of management and growth of timber. The results are applicable to quite limited conditions and are incomplete in cost data. Some useful but incomplete data on costs are available from investigations of practice techniques, including the study of prescribed burning by Silker (16), the work by Silker and Darrow on aerial chemical control of hardwoods (17) and the project analysis of pine regeneration problems in East Texas by Ferguson and Stephenson which provides some information on relative effectiveness and costs of practices, and a large bibliography (18).

Information on the economics of timber production is also available from other parts of the South, including Arkansas (19), Louisiana (20), and from publications for regional use (21, 22). Such sources can furnish guides to production potentials in East Texas, particularly where site index is used and comparisons can be made between areas of corresponding site quality.[1] However, differences in risks, markets, practice needs, techniques and costs make it unlikely that data from

[1]Site index is a measure of the productive capacity of the forest site (see Appendix A).

such sources will be adequate for or directly applicable to specific situations on small East Texas forest ownerships.

East Texas Production Potentials. Although the data from experimental forests in the area are limited in applicability, they can serve to show some potentials in production and returns. A record of production has been maintained by the Texas Forest Service on Slash Pine Plantation 26-C on the E. O. Siecke State Forest, near Kirbyville in Newton County (23, 24). This plantation was set out in 1926, and is the oldest pine plantation in East Texas. The timber products output data from this plantation were used as the basis for the estimates of costs and returns presented in Table II. The prices and costs applied in Table II are representative of those which existed in 1955 and 1956.

On the basis of the actual output record, and the costs and prices estimated to be representative of 1955 and 1956 levels, a net return of about 22 dollars per acre per year is indicated. Since this return is above all costs and interest charges, it represents the amount by which the net income to timber production is greater than that of the assumed best alternative. Plantation 26-C was growing at the rate of 929 board feet (or $27.87 in value) per acre per year as of January, 1957. It is on a better than average site, with an index of about 110. All of the products cut were removed in needed commercial thinning and improvement cuttings. The production of this plantation is believed fairly typical of fully stocked pine stands on sites of comparable quality. On many stands, some costs would be involved in addition to those listed, particularly in hardwood control. However, Plantation 26-C has not been free of problems; at the age of 12 years, 142 trees per acre were lost as the result of a storm.

TABLE II

ESTIMATED TIMBER PRODUCTION COSTS AND RETURNS
BASED ON E. O. SIECKE STATE FOREST DATA
AND 1956 LEVELS OF PRICES AND COSTS

Years of Age at Time of Cutting	Output per Acre of Slash Pine Plantation 26-C[a]			
	Product	Amount Cut	Estimated Stumpage Value	Value Compounded at Five Percent to End of Period
11	Pulpwood	0.7 cords	$ 2.45	$ 6.50
14	Pulpwood	1.0 cords	3.50	8.02
16	Pulpwood	2.3 cords	8.05	16.74
19	Poles	57 pieces	142.50	255.92
21	Pulpwood	7.3 cords	25.55	41.62
26	Pulpwood	8.1 cords	28.35	36.18
31	Pulpwood	2.9 cords	10.15	10.15
Total Stumpage Value			$220.55	
Total Income at 31 Years				$375.13
Value of Standing Timber at 31 Years (January, 1957):				
Sawtimber, 12,440 Bd. Ft. at $30.00 per thousand				373.20
Pulpwood, 3 cords at $3.50				10.50
Total Value (Received and in Standing Timber)				$758.83

Item[a]	Estimated Costs per Acre		
	Cost	Cost Compounded at Five Percent to End of Period	
Initial Planting	$10.00	$45.38	
Fire Protection, ten cents per year	3.10	7.08	
Administration, ten cents per year	3.10	7.08	
Land Tax, fifteen cents per year	4.65	10.61	
Total Costs	$20.85		$70.15
Net Returns for 31-Year Period			688.68
Net Returns per Acre per Year			$22.22

[a] Costs and Returns, Slash Pine Plantation 26-C, E. O. Siecke State Forest, Kirbyville, Texas, Texas Forest Service Mimeograph (College Station, Texas, not dated); and other unpublished Texas Forest Service data on Plantation 26-C.

Supersession Costs. According to Johnston and Barlowe (25), one of the major problems in desirable land use adjustment is the cost of supersession. This is the cost involved in changing to a higher level or kind of use, and is postulated as a basic reason for long delays or failure to convert land to uses which are most profitable in the long term. It is apparent that postponement or avoidance of supersession costs by a landowner would be due to lack of profit or sufficient profit within his planning period or time preference, or else because of financial limitations. The authors cited have suggested the supersession cost obstacle as the primary basis for the need for incentive payments by society to landowners, and that incentive payments should be for investment-type costs of this nature, rather than for the costs of operation to which most incentive payments in the agricultural program are now directed.

The concept of supersession cost was found to be relevant in this study to the interpretations of results in terms of action needs in the last chapter. Definitions of costs of supersession and operation as applied are provided in Appendix A.

Joint Production of Timber and Livestock

Relevant to the small forest ownership management problem are the widespread practice of forest grazing in East Texas, the differences in forest grazing use and conditions that exist, and the possibilities for combination of livestock and timber production for optimum returns along with maintenance of the resources. A study on the forest grazing aspect of timber and livestock management was carried out recently by the Texas Forest Service. In this study, Silker investigated the grazing practices

and systems in an 11-county area in Southeast Texas (26). He found that in 1953 about 97 percent of the forest land was grazed, with the importance of the forest range to the livestock operation varying from minor to complete dependence. It was estimated that about 277,000 cattle used the forest range to some degree in the area in 1950, which presents a ratio of about one animal to 15 acres of forest range. Several grazing management systems were found in use, and the need for development and use of systems more adapted to the timber and range resources was a conclusion of the study.

The work by Silker and other experience and research (27, 28) indicate wide differences in influences of grazing on forest stands, and in returns to forest grazing. Such influences have been observed to vary by season, rate and distribution of grazing, age, composition and stocking of forest stands, understory vegetation characteristics, type and age of animal, productivity of site, and other factors. It has been pointed out by Heady (29) and Gregory (30) that joint production relationships may exist between timber growth and forage production on forest land used for grazing, and that, depending on the indicated variables, these relationships may exist through the range of complementary to timber production, grazing use of the same area must result in an increase in returns from the timber activity, as well as net income from livestock production. A supplementary relationship may exist over a limited range of use rates between forest range use and timber production on an area where the use or increase in use of forest land for grazing will increase the returns from livestock production without appreciably reducing or increasing the returns from timber production. The competitive condition exists when

an increase in the rate of forest range use decreases returns to timber production.

Heady limited the relations to situations where resources are held constant; that is, for two activities being considered, an increase in the output of one is possible only by diverting funds or resources from the other. This restriction is realistic where the relationships are considered as they apply to a given firm or management unit, and assuming decisions have already been made as to the major use of acreages. For example, on a forest ownership being managed as a joint timber-livestock operation, with forest acreage established and with limited operating capital, the operator may consider increasing livestock production by such means as more animal units and forest range improvement. However, such actions would in some degree reduce operating capital available for timber production. It is thus apparent that specific knowledge of all of the indicated relationships is relevant and important to wise economic decisions within the management unit. Knowledge of this nature is lacking in East Texas. Research bearing on this problem is now being conducted by Silker, in an investigation of browse indicators of forest range use rates (31). Joint production relationships were investigated to a limited extent in this study by obtaining information on the opinions and range use practices of owners and by classification and comparison of ownerships with respect to forest range use rates and degrees of effect of forest grazing on timber stands and sites.

Credit for Timber Production

A recent study by Resources for the Future, Inc., concluded that the lack of adequate credit limits the practice of timber management

on small ownerships (32). The report of this study presents useful information on forest credit and guides to application of loans for timber production. The report recommended greater promotional effort by present lending agencies, closer cooperation between credit and forestry groups, encouragement of forest insurance, consolidation or joint management arrangements for small ownerships, and studies where needed on directly related factors such as taxes and forest lending authority of state chartered banks.

This research on credit and the studies discussed above have provided guides to the planning, conduct and data analysis of this thesis problem, and have pointed up the problem areas where additional basic knowledge is needed.

CHAPTER III

METHOD AND PROCEDURE

The procedure of the study consisted of (1) collection of data on ownership features, owner characteristics, and owner concepts and intent in land use and management; (2) developing and applying a method for measuring rates of practices applied and quality of overall timber management on the ownerships; and (3) analyses of the data to provide answers to the stated objectives. The procedure and methods used in each of these phases are described in the following sections.

Owner and Ownership Sample

Data on owners and ownerships were obtained from a sample of small ownerships and interviewing their owners.[1] The ownerships were selected in randomly located area segments in ten East Texas counties. The segments had been previously selected and used by the U. S. Forest Service in the Timber Resource Review. They were selected by first choosing at random a sample of counties in the commercial timber area. Then for each sample county a transparent grid was laid over a general transportation map of the county, and points were marked under two randomly selected grid intersections as the approximate centers of segments. The area segment boundaries were then determined by referring

[1] A detailed questionnaire covering characteristics of owners, acquisition and tenure, intent of owner in land use, management practices, and other data, was used in the survey.

to county land ownership plats and maps and outlining an area as nearly as possible to 2,560 acres (four sections), using established ownership boundaries and having the sample point as the approximate center.

The sample ownerships were those having the characteristics described in the section on limitations of the study in Chapter I, and also having at least part of the ownerhsip within the sample segment. In addition, a limit of approximately 50 miles was imposed on travel from the area to obtain an interview, to avoid excessive costs. The sample thus obtained was limited to ownerships whose owners resided on or near the land. Numbers and acreage of the population of ownerships sampled are presented in Table I. The sample included 282 ownerships, 44,508 forested acres and 85,249 total acres. The coefficients of variation of ownership size classes in the sample were found to be very close to those of the population.

Ownership Inspections

To determine the degree of timber management applied on the ownerships and to facilitate analysis of the hypothesized influences, it was necessary to obtain data on the forest ownerships and timber management practices. As an aid in this problem, the Texas Forest Service defined the management practices which were believed most essential to attaining desired timber improvement and production goals in East Texas. These are silvicultural cutting practice, hardwood control, provision for regeneration, fire protection and grazing control. The nature of these practices and the practice standards applied in this study are described in Chapter IV and Appendices B and C.

Arrangements were made in the study for the four assistant district foresters of the Texas Forest Service and two Soil Conservation Service foresters to participate in obtaining the information needed on these practices. Alternatives in procedure considered for inspecting ownerships and assigning management ratings were (1) development of a procedure for inspection of ownerships and assignment of ratings by the inspecting foresters, or (2) inspection of ownerships by the participating foresters and assignment of management ratings as an office procedure by one worker on the basis of information obtained by inspection. An inspection schedule was prepared and tested during the period that interviews were being made. On the basis of the experience of this pretest, it was decided that the talents and experience of the inspecting foresters could best be used by adopting the latter procedure and confining their efforts to obtaining inspection data as accurately as possible. This prevented variations which may have resulted from having the ratings assigned by several different persons.

The inspection schedule provided for verification of items of information obtained previously by interview, and for observation and recording of data on the management practices and their components. It also provided for estimates by the inspecting forester of the volume and value of standing timber, and a rating of productivity of the entire forest stand, in addition to the stocking classification of the area last cut.[2] To maintain accuracy and keep bias at a minimum in the inspection work, instructions were provided on the ground to the

[2]See Appendix A for definitions of productivity and stocking, and field procedures in measuring stocking.

assisting foresters, complete written field instructions for the schedule were provided and used, and the supervising forester made numerous checks of inspection work. Uniformity of data was further insured in that the supervising forester (the author) did approximately one-half of the inspections, visited all of the sample areas and observed almost all of the ownerships.

In addition to the 282 sample ownerships of residents, inspections were completed on 71 ownerships in or partly in the area segments which were held by non-residents. Management ratings were also assigned to the ownerships of these non-residents, to permit a comparison of management between residents and non-residents.

Timber Management Ratings

The problem of developing an equitable management rating system or index for assigning management ratings to individual ownerships was complicated by the differences between ownerships in degrees and acreages of practices needed or applied. To simplify the problem of developing and using a management index, and yet retain the essentials of the management situation, the index was developed on the basis of the five essential practices. Two minimum requirements or concpets of management were used to facilitate classification and also to define a fair or median level of applied practices. These were that the owner must have made some positive effort[3] in application of desirable practices, and that the combined effoct of all practices by the owner could reasonably be expected to result in maintenance of the forest stand in a fairly

[3]See Appendix A for detailed definition of positive effort.

productive state. With a fair or median level of management defined, reasonably concise definitions of higher and lower levels of management were found to be possible, and they were developed and used as guides in classifying ownerships. Excellent management was easily determined in that it required performance of all needed practices; good management constituted performance of most practices with resulting good productivity; poor management was indicated by limited present productivity and lack of positive effort or sufficient practices to maintain a fairly productive stand; and, very poor management was identified by complete neglect and practices of a very destructive nature (Appendix D).

The two concepts described above formed the basis for a simple measure of quality of management found equally applicable to all small ownerships regardless of variations in practices and practice needs. The resulting index avoided the complication of attempting to compare management quantitatively on the basis of acreage of different practices needed and applied. It was based primarily on qualitative data, with classes in three of the practices (hardwood control, artificial regeneration, and fire protection) consisting of either performance or non-performance of the practice. The effective initiation of a needed practice was considered to be performance. Sample ownerships were grouped into four classes of effect of forest range use on the timber stand, and five classes of cutting practice. For rating management, these were consolidated to three classes in each case. The small number of quality classes for each practice permitted organization of the index so that its function in establishing management ratings was similar to that of a key.

A basic problem in organizing a rating system is in the weighting of practices according to importance in management. In this regard, cutting practice was assumed to have by far the most important direct influence on productivity. On many ownerships, the quality and effect of the cutting practice was such that observation and classification of this practice was sufficient for making an initial and accurate classification of overall timber management. Therefore, cutting practice was given the greatest weight in the index and was used as the basic management classification criterion.

Since most small ownerships have had poor cutting practices applied, and little or no satisfactory performance of other needed practices, much classification was done by a mechanical process of elimination. In almost all cases, no subjective evaluation was involved in assigning a rating. The index was organized so that each management class was characterized by an explicit descriptive statement, followed by examples of typical combinations of management practice conditions representative of that class. In a few instances some judgment was necessary, but any bias which may have resulted could not have been serious because of the small number of ratings involved and the effective means of comparison provided.

As an example in classification, an ownership with only a fair level of cutting practice applied, and performance of some but not all other needed practices, would probably be classed as fair in over-all timber management. There were very few instances of a management rating above the level of cutting practice applied. On ownerships where a cutting practice rating was not determined because of no recent cutting

by the owner, the management rating was based on the other four practices and the condition of the timber stand in regard to merchantability, need for cutting or forbearance from cutting.

Analyses of the Data

With the exception of the section of the questionnaire on forest range management practices, the questionnaire and inspection schedule data were coded and punched on cards for IBM machine tabulation analysis. One-way and two-way tables for the desired information were then set up for machine analysis. The resulting tables provided summaries of practice performance and groupings of owners and ownerships by similar characteristics and by levels of timber management. The tables served as first-hand indicators of probable relationships. However, in addition to the tabular analysis, the relationships were tested statistically by chi-square analysis.

In general, the interpretations made in this study agreed closely with the statistical results. However, in making judgments consideration was given to the known limitations of the data and to any additional relevant information. In the discussion of results in the next chapter, certain limitations of the data are pointed out, and interpretations which differ from the statistical results are explained.

The data on forest range management practices was summarized directly from the questionnaires for narrative and tabular presentation.

CHAPTER IV

RESULTS

The results of analyses of the data are presented in this chapter. There was no need for expansion of the sample results to estimate numbers and acreages of ownerships in the area, since this information was previously obtained. The results are presented and discussed in terms of the sample owners and ownerships, but also as being indicative of true situations with reference to the population of small forested ownerships in East Texas to which the study applied.

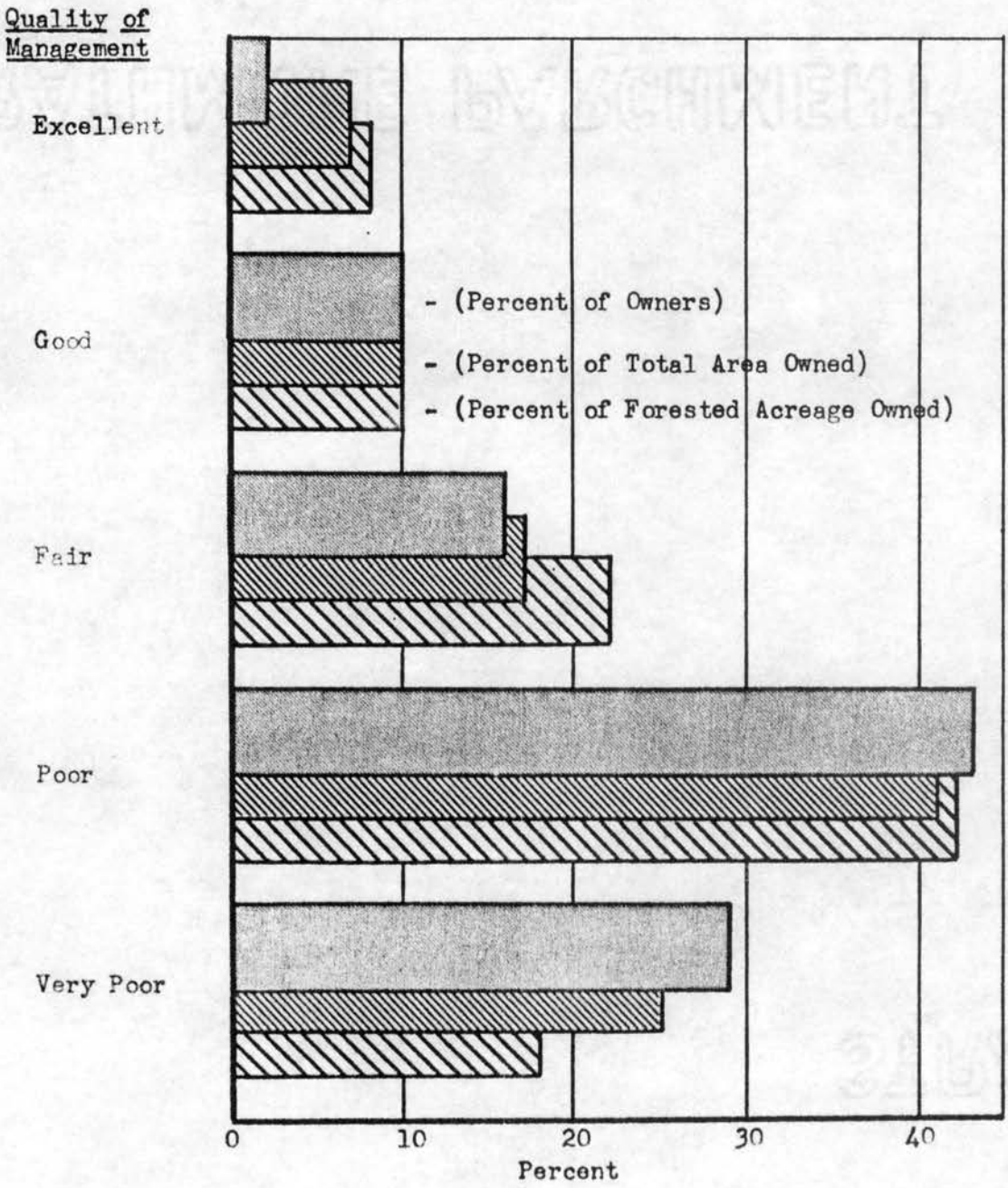
The first part of the chapter is a summary of the timber management situation and state of the timber resource as found by the study. This is followed by detailed presentations of the nature and performance rates of the essential timber management practices and their components, practices in joint production of timber and livestock, and activity of owners in programs of education and cooperation and other practices. The final part of the chapter presents the results of analysis of effects of the factors hypothesized to influence timber management.

Timber Management Situation on Small Ownerships

Performance of Over-all Timber Management

The results of the study indicate that only a little over one-fourth of the owners practiced at least a fair degree of timber management as defined (Plate II). The relatively small proportions of numbers as compared to forested acreage in the fair to excellent management groups

Plate II. Percent of Owners, Total Acreage Owned and Forested Acreage Owned by Quality of Timber Management



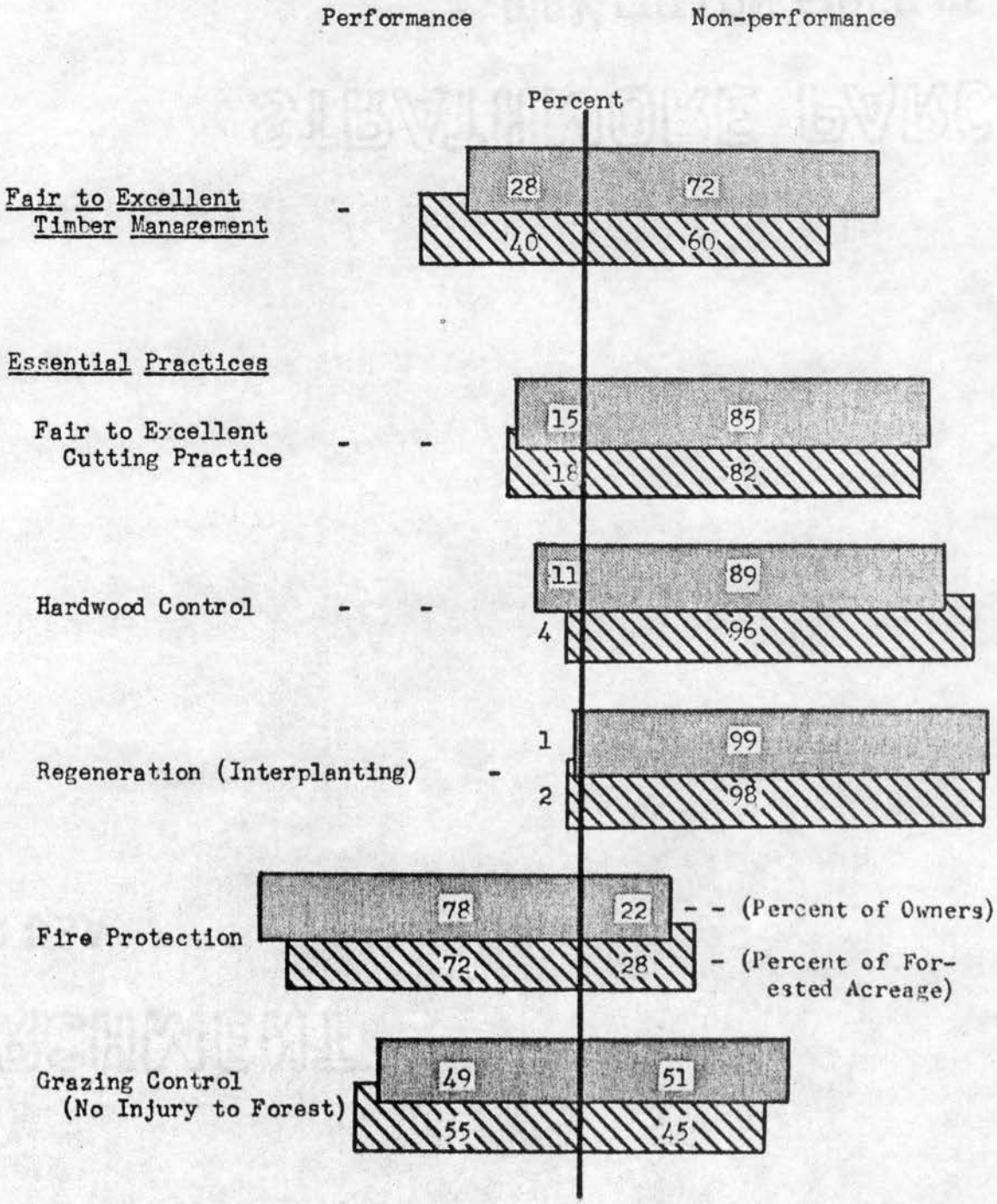
show that the average size of these forested acreages is larger than of those which were poor to very poor in management.

Performance of Essential Practice

The performance of each of the five essential practices is illustrated in Plate III in comparison to over-all management, in terms of percent of owners who have applied the practice within the previous ten years, and percent of acreage in the sample needing the practice on which the practice was applied. The state of over-all timber management appears in general more favorable than in the case of individual practices, because more performance factors were considered in rating management than in applying the standard of performance on individual practices. However, it is obvious that much improvement has been accomplished in fire protection. Fifty-three percent of the owners reported no wild-fire on their land within the previous ten years. Other information obtained by interview revealed that most owners have realized the harmful effects of wild-fire, and consider fire protection to be an important practice. The improvement in understanding by the owners of the economic losses from wild-fire has apparently resulted through experience as well as education, and since it is based on knowledge gained by the owners on true effects of uncontrolled burning, it may be considered permanent.

With respect to lack of performance and silvicultural importance of practices, it is apparent from Plate III that the greatest needs for improvement are in cutting practice, hardwood control and regeneration. Poor cutting practices combined with the ability of the less valuable or cull hardwoods to take over forest stands create serious and difficult silvicultural and economic problems in forest management. Results

Plate III. Summary of Performance of Over-all Timber Management and Essential Practices



described later in the chapter indicate that major reasons for poor cutting practices are financial problems and lack of good cutting control. The improvement of stands which have been destructively cut frequently involves costly practices in interplanting and hardwood control.

Practice Performance in Relation to Quality of Management

The nature of the management problem is further revealed by an analysis of the relation of performance of essential practices to quality of timber management (Table III). These relationships were all found to be highly significant, indicating close relation of practice performance to quality of timber management. It also indicates that the management rating index was an effective measure of over-all performance of practices.

In all practices other than hardwood control, more than 90 percent of the ownerships needing the practice but with no satisfactory performance were poor to very poor in management, indicating little or no performance of other essential practices. Four fifths of the ownerships needing hardwood control but with no performance were poor to very poor in timber management.

All owners with cutting practices at least fair were found to practice at least a fair degree of timber management. On the ownerships shown in Table III on which timber was merchantable but without cutting in the previous ten years, cutting control had obviously been exercised. The ownerships on which there had been no cutting and timber was not merchantable were found to be low in quality of timber management and timber productivity.

TABLE III

PERFORMANCE OF ESSENTIAL PRACTICES IN RELATION TO QUALITY OF OVER-ALL TIMBER MANAGEMENT

Rates of Performance of Essential Practices	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Cutting*					
Good to Excellent	18	5	0	23	8
Fair	6	16	0	22	8
Poor to Destructive	0	17	167	184	65
Non-cut; Merchantable	10	7	3	20	7
Non-cut; Unmerchantable	0	0	33	33	12
Hardwood Control*					
Performed	16	10	3	29	10
Non Needed	5	1	6	12	4
Needed, Not Performed	13	34	194	241	86
Regeneration					
Interplanting or reforestation, or both	8	10	12	30	11
No interplanting Needed	23	24	22	69	24
Interplanting Needed, Not Performed	3	11	16	169	65
Fire Protection*					
Average Annual Burn Percent:					
0-5	33	44	174	251	89
6 or more	1	1	29	31	11
Grazing Control*					
Degree of Injury by Livestock:					
None	28	22	86	136	48
Light	5	20	75	100	36
Medium	1	3	31	35	12
Heavy	0	0	11	11	4
Totals by Management Class (Applicable to Each Sub-table Above)					
Number of Ownerships	34	45	203	282	
Percent of Ownerships	12	16	72	100	100

*Relation of rates of performance to management quality highly significant by Chi-Square test ($\alpha \leq .01$).

In the case of fire protection, it is indicated that fire protection practices and resultant low average annual burn are closely associated with performance of other practices, and that owners practice better management when there is less occurrence of uncontrolled burning and therefore less risk. Of the ownerships rating fair or better in quality of timber management, 86 percent had an average annual burn of not more than two percent of the forested acreage.

State of Timber Productivity

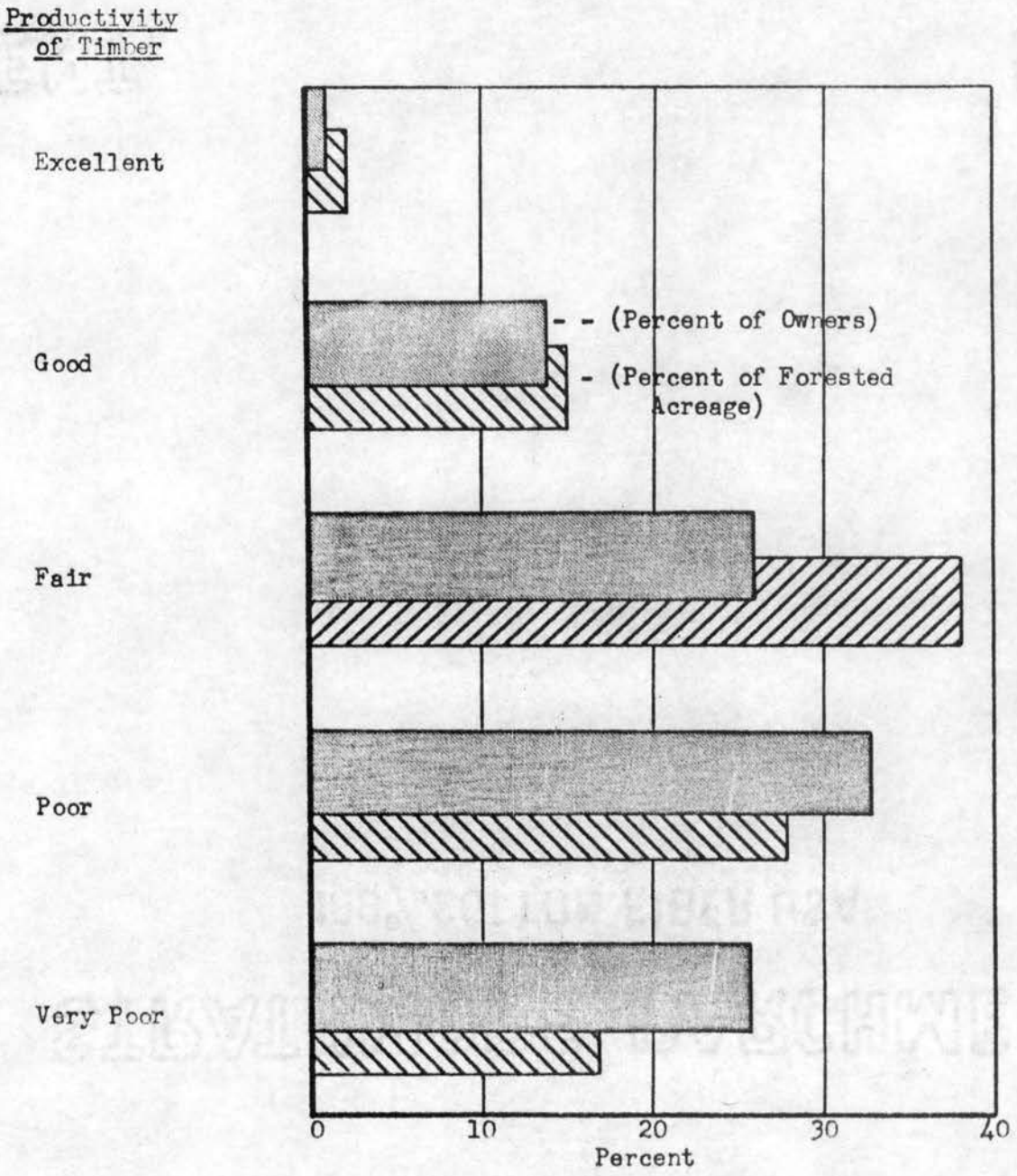
Productivity of the Ownerships

The state of the timber resource on the small ownerships as determined by inspections and presented in Plate IV indicates that productivity of the timber is at a higher level than the management situation alone would indicate. This is believed due to the natural ability of the forest to regenerate and produce in some degree in spite of neglect and poor practices.

The more productive ownerships were found to be relatively large in average size, as was also the case with ownerships relatively high in quality of management applied.

Although the area segments for the Timber Resource Review sample of small ownerships were used in this study, the data obtained are not comparable to the Timber Resource Review results on ownership productivity because of differences in criteria applied in selecting ownerships within the sample segments and in productivity ratings.

Plate IV. Percent of Owners and Forested Acreage Owned by Degree of Timber Productivity



Effect of Management Practices on Timber Productivity

The quality of timber management practiced and the performance of each of the essential practices as measured in this study were found to be closely related to the productive state of the timber resource (Plate V). Some of the data on which Plate V is based are presented and discussed in a subsequent section on timber resource features in relation to timber management.

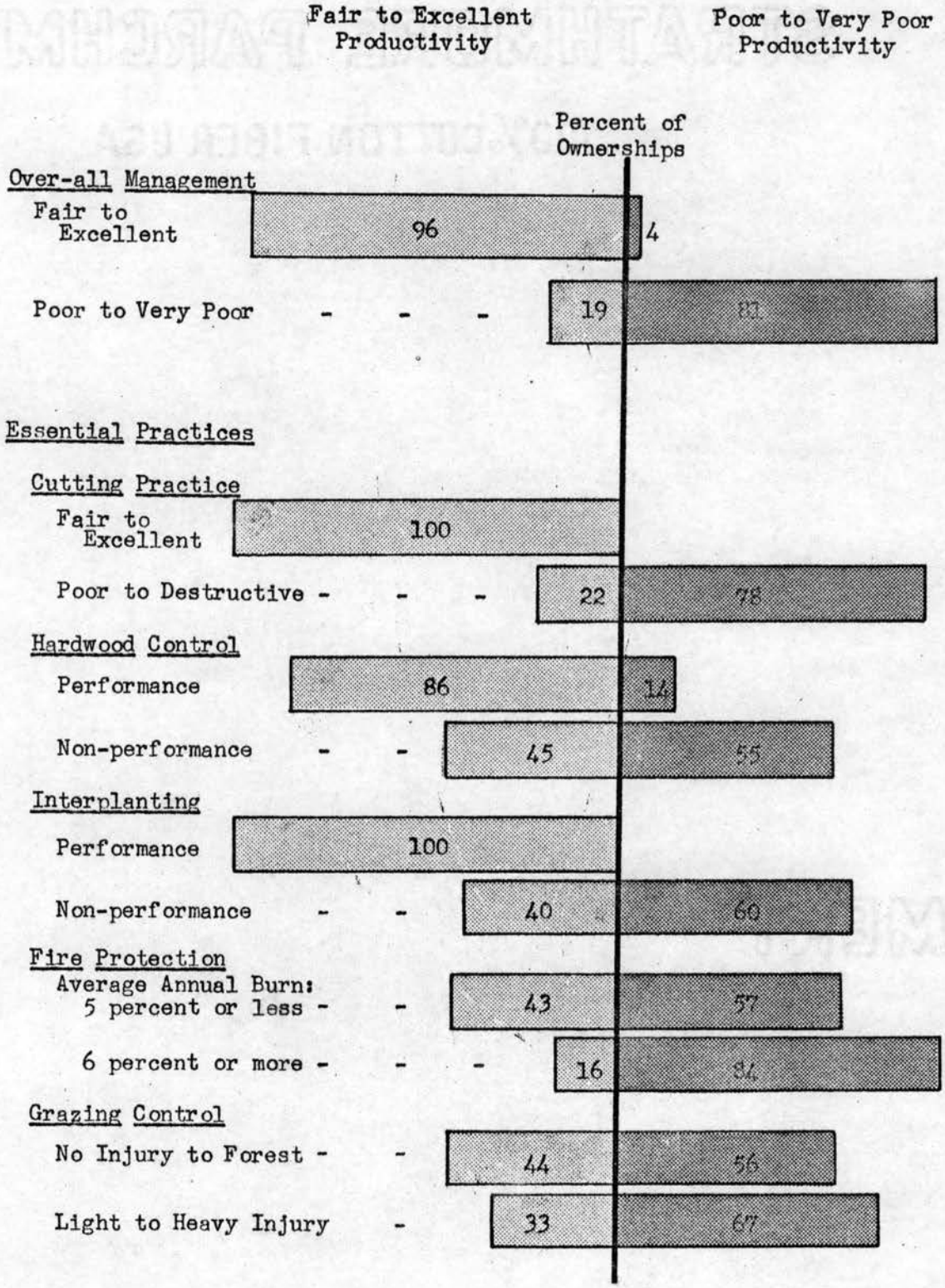
Essential Practices and Components

The foregoing described results indicate the general state of timber management and of the timber resource on small East Texas forest ownerships. However, a more complete grasp of the management situation and management problems requires understanding of the nature of the individual practices and the standards and degrees of performance of the essential practices and their components. In the inspections, data were obtained on all readily measurable features or components of the essential practices. These components were specific practices or factors directly affecting or determining performance of the essential practices, and in some cases were used as measures of performance. Details of the nature, standards and performance of the essential practices and their components are presented below. The performance rates show the proportion of ownerships needing the practice on which it was applied, unless otherwise indicated.

Cutting Practice and Components

The Forest Survey results show a considerable increase in upland hardwood acreage in Northeast Texas as a direct result of stand

Plate V. Effects of Timber Management Practices on Productivity of Timber



deterioration due to destructive cutting of pine timber stands. The prevailing practice on small ownerships in East Texas is to cut all merchantable timber recurrently as young timber stands reach merchantable size and volume. The result is that stands are not only kept in a state of low productivity, but eventually deteriorate to worthless cull trees and brush because of destruction of desirable seed trees and the encroachment of low-quality hardwoods.[1]

The type of cutting practiced by the owner on the area most recently cut in the previous ten years was observed and classified. Twelve cutting type classifications were observed. By means of these type classifications and observations on each ownership on the effect of cutting on species composition and stocking, five cutting practice ratings were developed. A cutting practice rating was assigned to each ownership. The cutting type classifications and the cutting practice rating criteria are presented in Appendix C.

The more favorable performance in maintenance of forest stocking and composition[2] as compared to cutting practice rating (Plate VI) was due to instances where the cutting was an undesirable removal of all merchantable trees from young pine stands, yet left a residual stand of relatively high productivity. Observarions indicated this had occurred because of plentiful forest stocking before cutting or good conditions of site and seed source for potential stocking, rather than through the intention of the owner. In such cases the cutting practice

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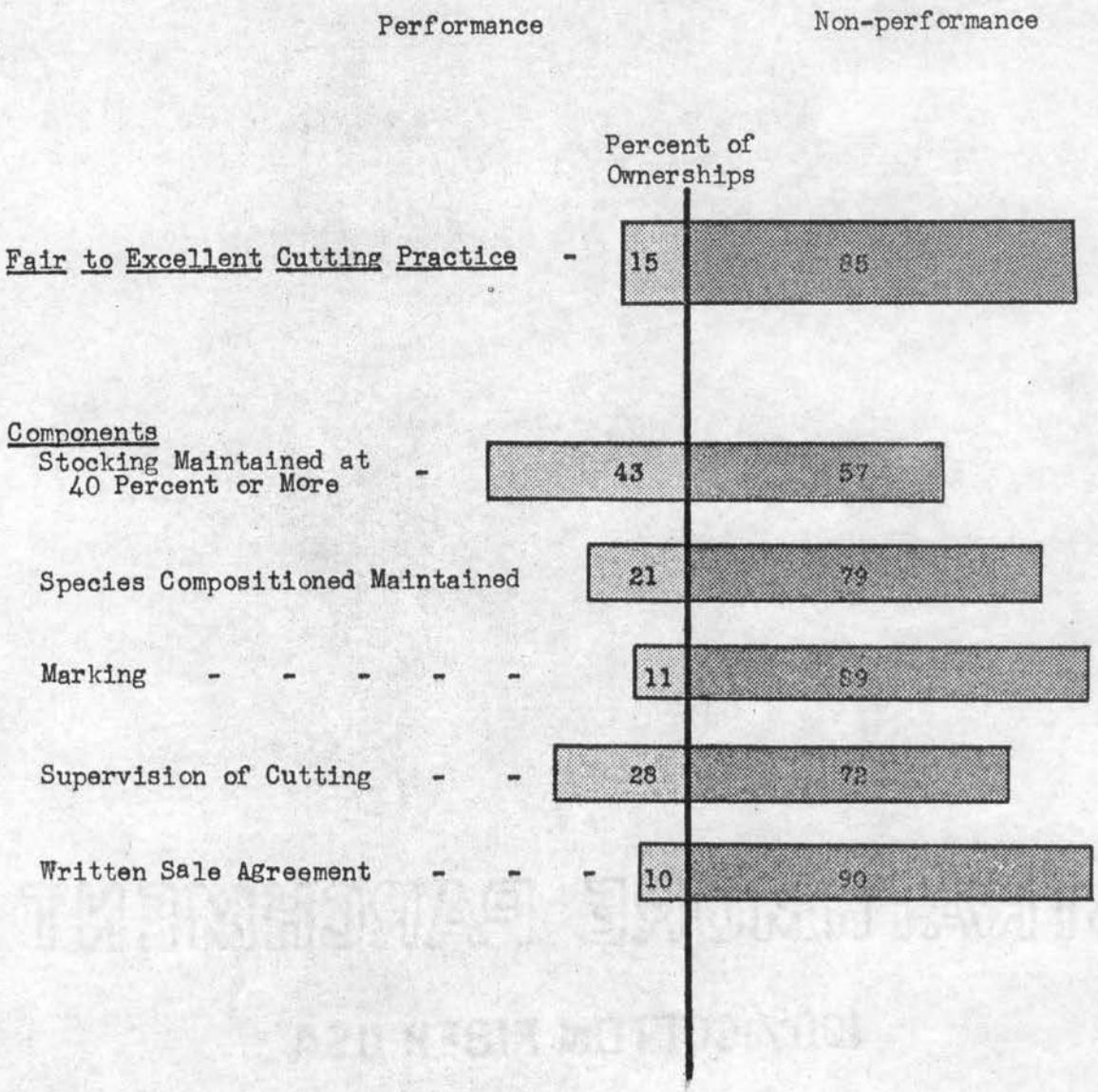
[1] See Appendix A for listing of desirable species.

[2] See Appendix A for definition of species composition.

Plate VI. Rates of Performance in Cutting Practice and Components



was rated lower than the resulting stocking and composition would ordinarily indicate.

The low degree of application of the practices of marking, supervision and written sale agreements (PlateVI), which are necessary to good cutting control, is surely a major reason for the poor quality of cutting practice and low timber productivity on small ownerships. In this regard, it was found through contacts with foresters working with small owners in the area that a major limitation on the effectiveness and morale of the foresters was the frequency of instances where they had done an apparently effective job of advising an owner, even to the extent of marking timber for cutting, only to see the timber stand devastated by the cutting practice or in cuttings subsequent to the sale of marked trees. Such instances were usually attributed by the foresters to lack of sufficient interest by the owner, and also to pressure to sell which was found quite intense in some areas of active competition among buyers for the timber. This was particularly true where there was overlap in procurement areas of two or more mills. Because of lack of knowledge among owners in timber measurement and volume, and frequent failure to obtain more than one bid, competition among buyers usually did not work to the advantage of the seller. As an additional factor, most buyers stipulated or wanted to cut all merchantable timber. No contacts were made with buyers as a part of this study, but the foresters reported that the position usually taken by buyers was that it did little good to make a partial cutting because a competing buyer was likely to attempt and to be successful in obtaining the remainder of the merchantable stand in a subsequent cutting.

Forty-four percent of the owners who cut and sold timber during the ten years previous to the interview stated the immediate need for money was their principal reason for cutting and selling when and as they did. The silvicultural quality of the cutting practice of these owners was particularly low.

It appears that these two factors, the lack of control in stumpage sales and the financial problems of owners, are major limitations to good timber mamagement on small ownerships.

In addition to controlling the silvicultural quality of cuttings, timber managers are concerned with nature and timing of cuttings with respect to alternatives in technical systems of management and obtaining labor income. In this regard there is disagreement among foresters in East Texas, and consequently in the advice given to owners, as to the advisability of frequent selective cuttings (as often as annually) with the development of an all-aged stand suited to and as a result of this type of stand management. The alternative is even-aged management, with less frequent cuttings on a given area. An advantage usually attributed to all-aged management on small ownerships is that it provides opportunity for the owner to make use of his time more completely in obtaining labor income through frequent harvests of his own timber.

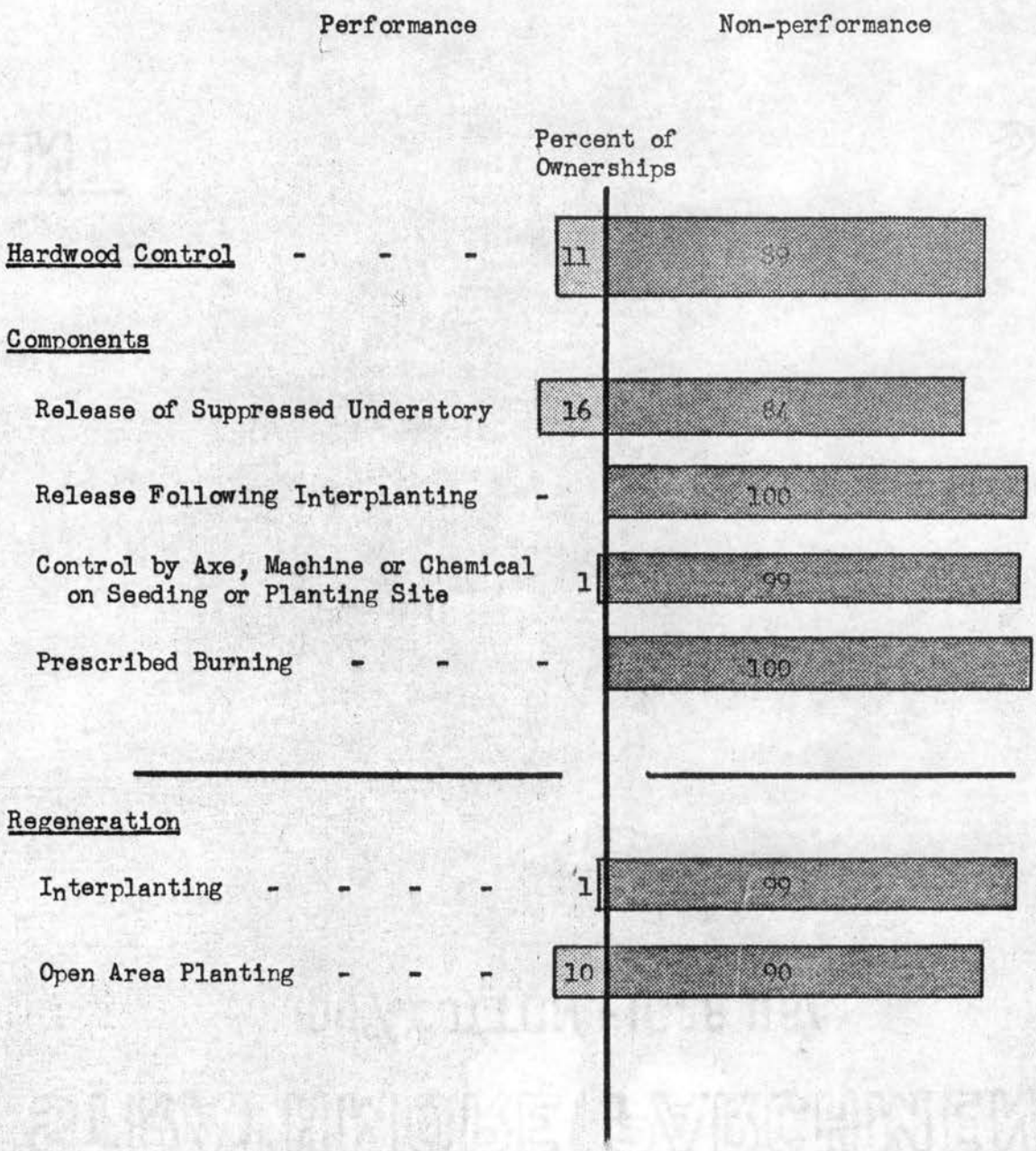
Yet, only about one third of the owners were found to be occupied solely in farming and therefore in a position for complete freedom to allocate time between timber harvesting and other work on the ownership. Also, it was found that none of the owners practiced cutting every year in their stands. Three fifths of them made only one sale during the ten-year period. More than nine out of ten sold on the stump and did

not do their own harvesting. The principal reasons given for selling on the stump rather than doing logging and hauling were, in order of frequency, lack of equipment, a matter of convenience or lack of time, and inability or lack of help. From the standpoint of actual practices of owners, it appears that even-aged management would be more suitable since they are apparently unwilling or unable because of other problems or commitments to harvest frequently, and since they would be at a better advantage in stumpage sales by having larger volumes to be marketed.

Hardwood Control and Components

The major silvicultural problem in the area is in the suppression of the climax timber type, the hardwoods, in order to produce the more valuable pine species. Hardwood trees such as sweet gum and the oaks have greater tolerance, or ability to survive and grow in the shade of other trees, than do the pine species. Because of this greater tolerance, any opening made in the timber stand has the result of favoring the development of hardwoods. This is true even of desirable types of cutting. Heavy pine cuttings which result in decimating sources of pine seed and the release and vigorous growth of hardwood understory, or in leaving pine reporduction under the dominance of low-quality hardwood overstory, are particularly destructive of productivity. The Forest Survey revealed that a hardwood problem exists on about 7.5 million acres of forest in East Texas. The sample data indicated that hardwood problem conditions exist on about 75 percent of the forested acreage in small ownerships. Yet, hardwood control treatments had been completed on only four percent of this acreage, although a greater proportion of owners had initiated the practice (Plate VII). In terms of management problems presented and

Plate VII. Performance Rates in Hardwood Control and Regeneration Practices and Practice Components



specific practices required, East Texas hardwood problem conditions may be considered under two general headings: (1) suppression of desirable reproduction or occupation of site by hardwood overstory, and (2) hardwood understory on areas needing planting or seeding.

Where desirable reproduction is being suppressed by a low-quality hardwood overstory, the control problem is usually least difficult practicably and economically. This problem was found to exist on about 35 percent of the forested acreage in the sample. Almost all of the hardwood control practices accomplished (PlateVII) probably were applied as a result of the cost-share payments by the Agricultural Stabilization and Conservation program. Stands in this condition can qualify for cost-share treatment for hardwood control if at least 300 desirable seedlings per acre are present. Control may be done by girdline, use of chemicals, or both, with the method depending largely on the size and number of cull trees to be removed (17, 33).

A second and particularly difficult hardwood overstory problem exists on upland hardwood stands of low quality or pine-hardwood stands with inadequate pine stocking and seed source.[3] Such stands need interplanting of pine followed by hardwood control after successful establishment of seedlings, and may need elimination of hardwood brush as a planting site measure before planting is attempted. Stand improvement under these conditions is particularly costly and may not be profitable at the present time on many such areas. Seedling survival is a critical problem, and one on which more research is urgently needed. The applicable methods of hardwood control would be the same as described in the

[3]See Appendix A for definition of forest types.

above case. This condition was found to exist on about one-third of the forested acreage, but no instances of performance in control were found.

Because of their tolerance characteristics, young hardwoods will develop under dense overstory where the less tolerant pine seedlings do not survive. This necessitates some type of control in order to prepare the stand for eventual pine reproduction to replace trees harvested. Research by the Texas Forest Service indicates that scientifically applied burning, known as prescribed burning, is an effective and inexpensive means of accomplishing control under proper meteorological conditions on some even-aged stands (16). This is possible because pine species are more resistant to ground fires than are the hardwoods. In order to keep burning under control and to obtain maximum benefit with the least possible injury, it must be done under particular and carefully measured conditions and under the supervision of persons experienced in this practice. It is a new practice just out of the experimental stage, and it has not yet had the opportunity of being accepted and practiced on small ownerships. All-aged stands are less adapted to prescribed burning because of the pine seedlings and saplings present throughout the stand. Prescribed burning is also not feasible on areas of sparse pine stocking, because its success depends greatly on a sufficient quantity of pine needle duff for fuel. Other means of control, including aerial application of chemicals and cutting of individual stems by axe or machine, are more costly. A very small degree of application of control with axe was found (Plate VII).

Another type of hardwood control treatment needed on much East Texas forest land is the case where understocked areas are heavily infested with brush species such as yaupon or hawthorne, or dense sapling stands of oak or sweet gum. An expensive problem of mechanical or chemical control is involved in the preparation of such areas for planting or natural reproduction. There was no performance in practices of this nature.

Data obtained by inspection indicated that at least one fifth of the forested acreage in the sample needed hardwood control treatment in preparation for planting or seeding.

Regeneration and Components

Regeneration practices as defined for this study concern only interplanting on partly stocked areas and open area plantations.[4] Provision for natural establishment of desirable reproduction is also a regeneration problem, but it is considered to be a part of cutting and hardwood control practices. No attempt was made in this study to determine needs for open area planting or reforestation, but acreage data were obtained on reforestation done, and these were taken into account in management ratings. Interplanting needs were determined on the basis of stocking deficiencies indicated by basal area measurements and the standards of the Timber Resource Review Guide for Timber Type Groups (5).

Interplanting practices as considered in this study included planting of pine in sparsely stocked pine stands, and also pine plantings under upland hardwood overstory. The need for planting in upland hardwood

[4]See Appendix A for definitions of interplanting and reforestation.

stands has been greatly intensified by the poor cutting practices which generally result in removal of pine seed sources and result in cull hardwood stands unable to regenerate naturally to pine species. Such areas are extensive, and an expensive problem exists in stand improvement which would involve both hardwood control and interplanting of pine seedlings. There is also an important need for interplanting on extensive areas of thinly stocked cut-over stands and idle cropland which has become partly stocked. The Forest Survey found that about three million acres of forest land in East Texas have inadequate stocking or insufficient seed sources and are in need of interplanting practices (1). Interplanting was found needed on 73 percent of the sample ownerships and on about 35 percent of the forested acreage.

Performance rates of interplanting and reforestation are presented in Plate VII. No composite of total regeneration accomplishment is presented because needs for reforestation or open area planting were not determined. Open area planting performance is presented in terms of all sample ownerships. Interplanting had been initiated on only one percent of the ownerships needing the practice. This points up a very low rate of application on a major practice need in the area. It is a costly practice, particularly when it must be in conjunction with hardwood control. It frequently requires manual labor, since machine planting may also be difficult. The technical problems of planting on partially forested areas and the higher costs involved probably account for the difference in rate of application between interplanting and open area planting. The unreliability of seedling survival is a major deterrent to both practices. Most of the plantations observed

on the sample ownerships had survival rates of less than 50 percent.

Fire Protection and Components

Although there has been great improvement in the prevention and control of woods burning, much loss in timber productivity still results from wild-fire in East Texas. The degree of wild-fire or uncontrolled burning is affected by owners through their activity in participation in fire-fighting, keeping fire-fighting equipment on hand, establishing and maintaining firelanes, cooperating in organized protection with the Texas Forest Service, and by grazing practices. It is also influenced by the purposeful, uncontrolled burning by some owners.

The ability of individual owners to eliminate wild-fire is seriously limited because important factors which influence woods burning are beyond their control. The reduction in burning has tended to increase fire hazard, since greater amounts of fuel accumulate in the absence of annual burning. The proportion of fires caused by persons other than owners, accidentally or intentionally, has increased. Fires often originate from causes other than the owner, or outside the boundaries of the ownership. An additional complication is that the degree of incendiarism varies among communities. The acreage burned is also affected by weather, the degree of protection provided by the community or state, and the availability of special equipment. Experience of the Texas Forest Service indicates that most recent fire losses are the result of extremely hazardous conditions or incendiarism, or combinations of these factors. This complexity of conditions makes fire protection difficult to measure as a management practice.

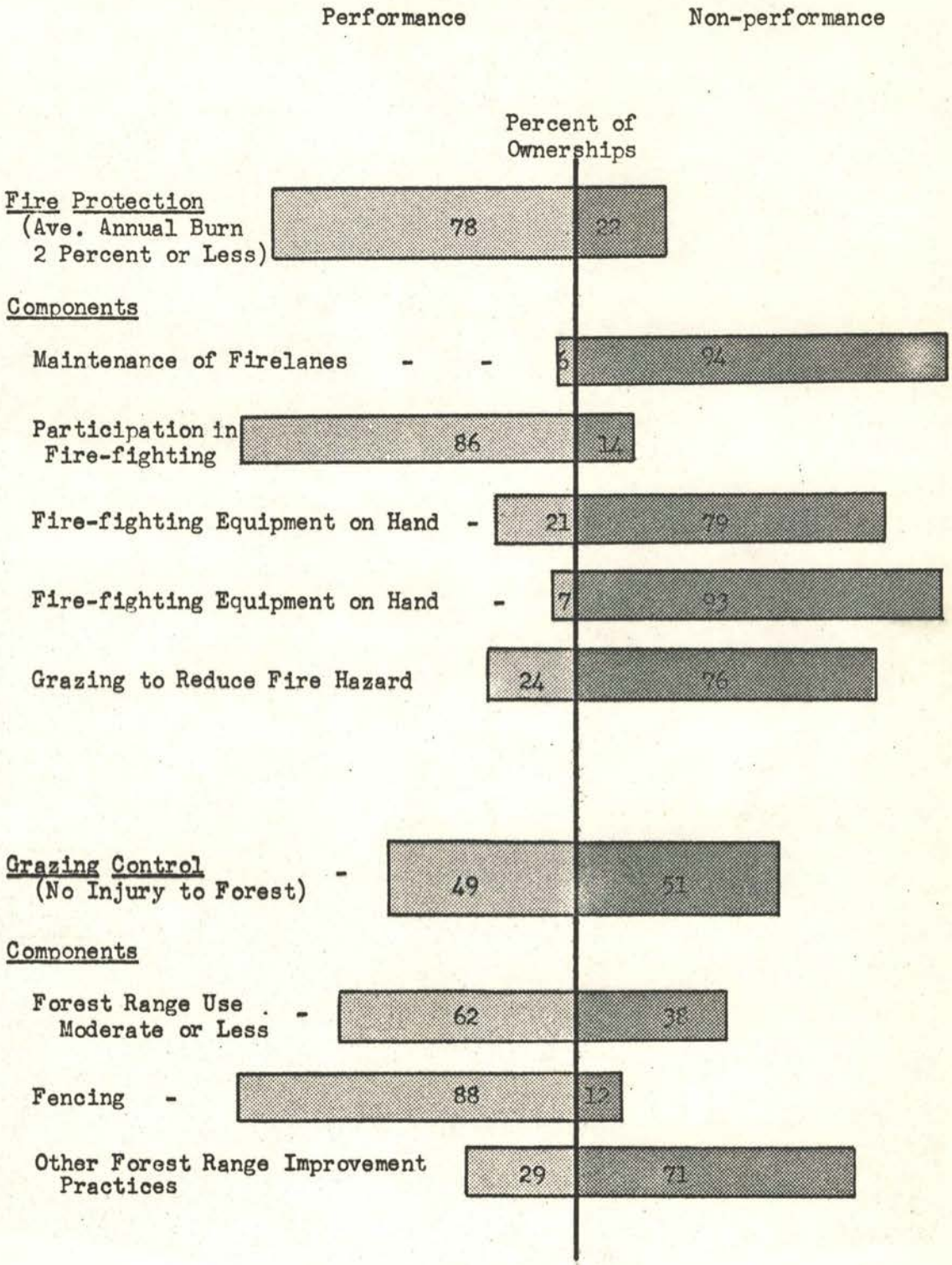
The average acreage burned annually in the last ten years was used as a measure of fire protection on the forest acreage on the ownerships. It is expressed as a percent of the total forested acreage in the ownership. Since owners are likely to have only limited control over acreage burned, an average annual burn of not more than five percent was allowed without affecting the management rating. However, this is not considered to be the minimum goal or desirable practice in fire protection. For the comparison of fire protection with the status of other practices in Plate III a performance level of a maximum of two percent average annual burn was applied as a more comparable measure of fire protection performance.

The rates of performance by owners in five practices which affect woods burning show a relatively low degree of application of practices which involve direct costs and may appear less urgent (Plate VIII). Almost all owners were found willing to participate in fighting fires that do occur.

The rate of participation by owners with the Texas Forest Service in fire protection agreements concerns only the 14 percent of owners found to have the minimum of 300 acres within the fire protection boundary, which is required for eligibility for an agreement. Most of the non-participating eligible owners expressed unawareness or a belief that an agreement was not available, as reasons for not participating.

Observations on grazing indicated that, regardless of other effects, the practice of grazing tends to reduce fire hazard. Grazing results in a reduction in volume and height of combustible understory

Plate VIII. Performance Rates in Fire Protection and Grazing Control Practices and Practice Components



vegetation and dead plant material. It actually had this beneficial effect in varying degrees on all ownerships grazed. However, the degree of applied practice presented in Plate VIII represents only the owners who stated that they practiced grazing with reduction in fire hazard as a purpose. This purpose was in most cases secondary to livestock production.

The rate of application of the practice of maintaining firelanes applies to the 55 percent of owherships on which it was observed that firelanes were needed (Plate VIII). It was found that, even on farmstead improvements where hazards indicated a need for firelanes, only five percent had them established and maintained.

Grazing Control and Components

The use of East Texas forest lands for grazing is widely practiced. Information obtained from the sample owners indicated that many of them consider livestock production to be the major use of their ownerships (14). About one-fifth of the owners believed that timber production and livestock production were both important on their ownerships. Eighty-one percent reported that their forest lands were grazed. However, the results of inspection of the ownerships and other research previously cited (26) have shown that almost all East Texas forest land is grazed in some degree by domestic livestock. Much of the land is not fenced and is grazed under uncontrolled free range conditions.

Grazing on forest land can be controlled by the regulation of the season and length of grazing periods, stocking rates, fencing, distribution of salting and watering places, supplemental feeding or pasturages and deferred or rotation grazing. However, for the purposes of the study,

a single measure of grazing control as a timber management practice was required. In relation to timber productivity, forest range use and the consequent possibility of injury to trees and site productivity by livestock are particularly important where desirable seedlings are present or needed. The degree of injury to the forest stand and site caused by livestock was used as a factor in rating timber management, since it was a direct, single measure of the effect of grazing. However, it was assumed to be usually less important than any of the other essential practices, and observations on the ownerships indicated this to be true.

Estimates of the degree of forage use on each ownership also were made in order to further reveal the nature and degree of forest grazing on small forest ownerships, and to permit some analysis of the relation of rates of forest range use to timber management and production. The grazing control and forest range use classifications, consisting of heavy, medium, light and no injury, and heavy, moderate and light use rates, were made on the basis of percent of forest area affected under each classification. The criteria and procedures used in classification are presented in Appendix B.

In addition to these observations on the ownerships, information was obtained by interview on forest acreage grazed, fencing, intent in use, leasing, measures to improve the forest range and opinions on the relation of livestock production to timber production and the problems involved.

Relatively high rates of performance in grazing control and forest range use were found (Plate VIII). It should be pointed out that the

inspections were made during a season of unusually good forage growth due to a high summer rainfall rate, and that this condition tended to result in ratings on these practices somewhat better than average conditions. In view of this condition, inspectors were instructed to assign ratings they judged to be representative under average trowth conditions. Nevertheless, it is probable that the forest range use situation indicated represents conditions better than average. The performance rate on grazing as it affects the forest is more likely to represent typical conditions since the evidence used may have dated from previous seasons (Appendix B).

Practices in fencing, range improvement and rate of forest range use were included as components of grazing control (Plate VIII) since they are major influences on the effect of grazing on the forest. Ownerships were included as being fenced if the forest area was surrounded by fence, either separately or inclosed with non-forest areas. Many ownerships so included needed additional fencing for effective grazing control. Other forest range improvement practices reported included hardwood brush control by 16 percent of the owners, range improvement by seeding or rotation grazing (or both) by 13 percent, and water development by three percent of the owners.

Another important aspect of forest range use was found to be the practice of leasing forest land for grazing. About eight percent of the owners had leased-in fenced timber land for grazing. About 14 percent had leased-out at least part of their forest range. Leasing arrangements varied, and in some cases were written. They usually included reservations concerning timber use. Cash leases ranged from seventy-five

cents to two dollars per acre on an annual basis. Some ownerships were leased for grazing in exchange for fire protection, overseeing property, or fencing by the lessee.

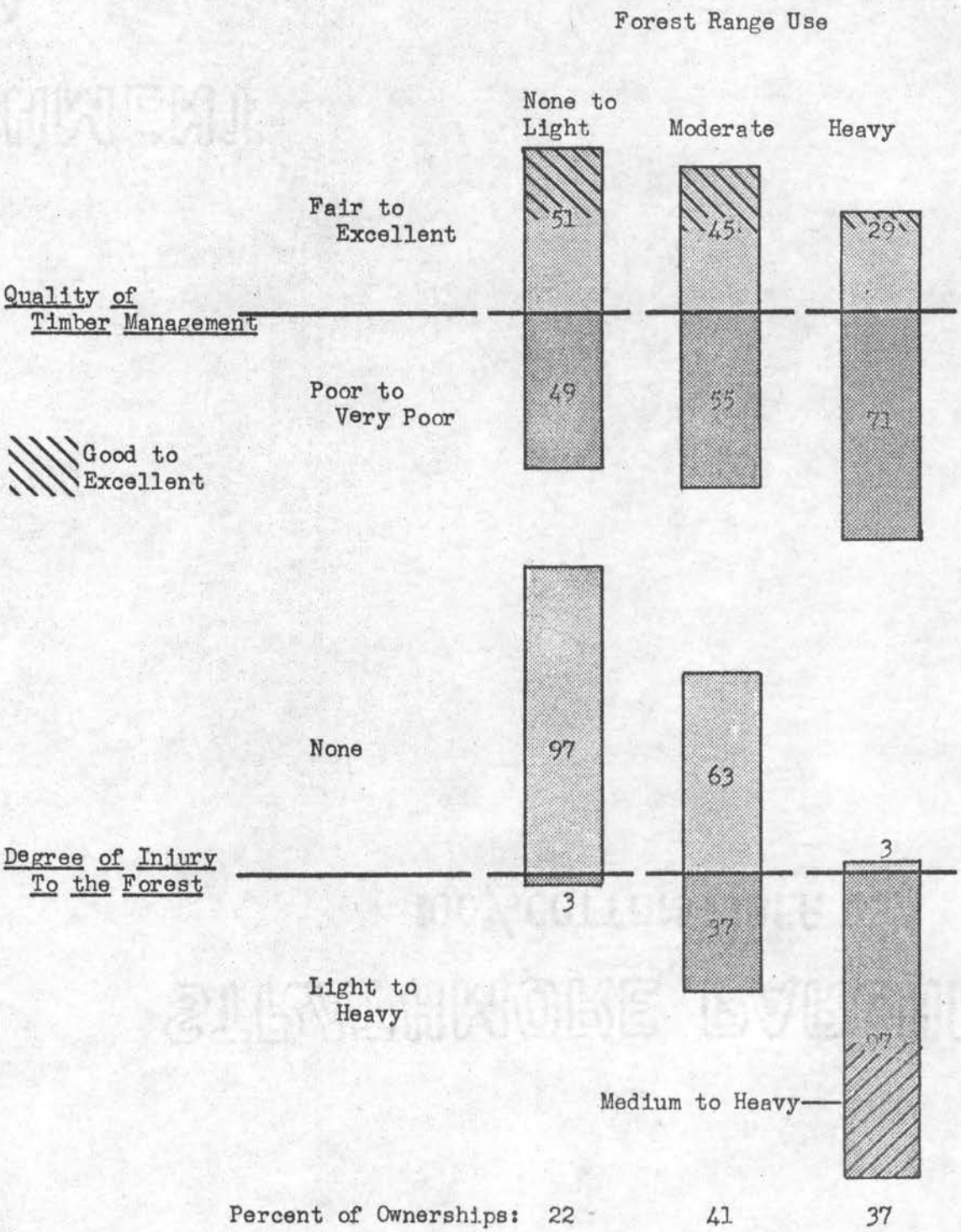
Timber-Livestock Joint Production Practices

The study has not permitted detailed analysis of joint production relationships, since the inspection observations did not include any determination of the silviculturally beneficial effects of grazing, nor any collection of data amenable to economic evaluation of either harmful or beneficial effects. The net economic effects of forest grazing were found too difficult to measure in the present state of knowledge and techniques. Nevertheless, the revealed relationships of forest range rates to their effects on timber stand and site and to quality of management (Plate IX) indicate that the previously described conditions of joint production do frequently exist in East Texas. The relationships presented in Plate IX were found to be highly significant. These results show that degree of forest range use is closely related to quality of timber management, and that the physically harmful effects of grazing are proportional to the degree of range use. Light to moderate rates of grazing resulted in practically no adverse effects. Even in the case of heavy use rates, only a light degree of injury was observed to be the situation on more than one half of the ownerships.

Complementary, Supplementary and Competitive Conditions

Complementarity of grazing to timber production exists, for example, on pine-hardwood forest areas having an accumulation of, or a tendency to accumulate inflammable undesirable undergrowth and duff.

Plate IX. Forest Range Use Rates in Relation to Quality of Timber Management and Degree of Injury to the Forest



Moderate grazing use under such conditions was observed to have the result of reducing fire hazard and thereby aiding in timber production. Also, livestock activity is beneficial in working pine seeds down to mineral soil, and in controlling hardwoods by browsing.

A supplementary relation of forest grazing to timber production is apparently much less frequent than complementary or competitive situations in the area. This appears true even in the absence of a limited operating capital restriction. Such a relationship must necessarily exist where grazing would have no beneficial effect, as may be the case where the existing grazing season and stocking rates accomplish fully the desired benefits, but a longer period or higher rate of stocking of livestock could be instituted without harmful effects to timber productivity. Supplementary conditions appear likely to be very limited in range.

Heavy rates of grazing are likely to be competitive to timber production, primarily because the detrimental effects on the soil, seedlings and small trees tend to decrease timber output. However, the results show that heavy use rates under some conditions may not be competitive. Taking into account the beneficial effects, it is quite possible that the heavy range use rates on some of the pine-hardwood areas studied were within the complementary range with respect to net effects on timber production.

Joint Effects of Individual Practices

It is apparent that individual practices need to be weighed in terms of these relationships. To the extent that they exist and that it is economically feasible to do so, use should be made of complementary relationships. Range improvement practices which are likely to

be complementary to timber production are hardwood brush control, water development and fencing. Hardwood control practices for range improvement can also release pine reporduction. Development of water reservoirs for livestock would be complementary to timber production to the extent that water would be provided for fire-fighting. Fencing can be complementary in the distribution of grazing, control of stocking rates and in protecting the forest from theft or injurious trespass. However, fencing was not always found to lead to better forest range use, and actually resulted in conditions competitive to timber production on some ownerships. This was observed to be frequently true on small woodlots, where there is a tendency to confine too many livestock on small fenced areas, or to use fenced woodlots as holdings or feeding areas for livestock. In such cases, over-grazing was observed to be more severe than ordinarily would be found under unfenced open range conditions. Probably because of this situation, the practice of fencing as determined on the ownerships was found to have no statistically significant relation to quality of timber management.

With regard to the effect of timber production on livestock production on the same acreage, it is always competitive in the general sense that any forest overstory will compete with forage plants for light and moisture. However, on acreages committed to timber production, with the objective of combining livestock and timber production activities, certain timber stand improvement practices can be temporarily complementary to forage production. Thinning operations and hardwood control tend to open the stand and make more light and moisture available to the understory vegetation. Measures to protect

the forest from fire also protect the forest range. Seeded and grazed fire-breaks protect the forest and range and also provide additional forage (28). Prescribed burning improved the timber stand and also is likely to improve the range by lowering the browse, reducing the competition for moisture and nutrients and thereby increasing the growth of palatable grasses.

Existing Appreciation of Joint Relationships

The relationship between enterprises on an operating unit is necessarily the result of the practices and resource use rates applied in each. The influence of forest range use on timber production is a composite of several effects. Some incidental injury to the timber stand is likely to result even under light grazing use, such as when cattle occasionally bite off a seedling in the act of grazing other vegetation. However, the occurrence of some injury does not necessarily mean that grazing must be curtailed or eliminated to maximize income or to maximize timber production. The objective in management may best be attained by sustaining a degree of detrimental effects from forest grazing in order to obtain other desirable effects which may be more influential. For this reason, the frequency and range of complementary relationships of forest grazing to timber production may be greater on East Texas forest lands than is ordinarily supposed by foresters and others whose interests are primarily in forestry and timber production.

The results presented in Plate IX and Table IV indicate that many owners do recognize the existence of these relationships and attempt to make use of them in principle. Not only do most owners practice grazing on their forest lands, but many believe grazing is beneficial to timber

TABLE IV

OPINIONS OF OWNERS ON COMBINING TIMBER PRODUCTION AND FOREST GRAZING

Opinion	Percent of Owners
Benefits of Grazing to Timber Production	
Controls Hardwood Trees and Underbrush	44
Reduces Fire Hazard	16
Improves Soil Fertility	5
No Benefits, or Harmful Effects Outweigh Benefits	20
No Opinion	26
Benefits of Forestry Practices to the Forest Range	
Harvesting and Thinning Timber	25
Controlling Hardwood Trees and Underbrush	35
Burning for Hardwood Control	3
Pruning	1
No Benefits	2
No Opinion	4
Principal Problems in Combining Timber Production and Grazing	
Forest Range Forage Insufficient or Not Nutritious; Short Season of Good Forage	14
Harmful Effects of Grazing on Timber Stand	9
Hardwood Trees and Underbrush Hinder Grass Production	5
Overgrazing; Control of Grazing	4
It Doesn't Pay	1
Lack of Information	1
No Problems	27
No Opinion; Not Aware of Problems	29
Means for Overcoming Problems	
Control Grazing (Including Don't Overgraze; Graze Lightly; Fence to Control Grazing; Deferred Grazing)	5
Don't Graze Seedling Areas	5
Clear Underbrush; Control Hardwoods	5
Thin Timber Stands	4
Don't Overcut; Follow Advice of Forester	1
Clear Timber for More Open Areas; More Improved Pasture	1
Don't Combine Grazing and Timber Production	6

production, and a considerable number have given thought to establishing the optimum use combination on their ownerships.

Other Practices and Activities of Owners

Other Timber Management Practices

In addition to the five essential practices described, other practices applicable in East Texas include forest insect and disease control and crop tree pruning.

Insect control is of major importance in East Texas only in cases involving outbreaks, or measures to prevent eminent outbreaks. Some endemic loss from insects occurs in East Texas forests, for which the practicable measure would be salvage and control measures on individual trees. The only instances observed on the sample ownerships were fire ant infestations on three ownerships.

In the present state of forestry, disease control is less important than the five practices described as essential on small ownerships. An exception is in the case of need for prescribed burning to control brown spot needle blight on longleaf pine seedlings, but no need of this practice was observed on the sample ownerships. As in the case of insect activity, there is endemic loss always occurring from tree diseases, but usually not of a nature to permit treatment except in salvage cutting. The need for insect or disease control usually does not exist to the extent of the practices considered to be essential. It was not considered in rating management, except that any control of this nature needed must have been performed to merit an excellent rating.

Crop tree pruning is the practice of pruning only those trees in a young stand which are likely to be the final crop trees on which quality growth is desired. Although crop tree pruning may be profitable on some ownerships where the owner is certain of receiving a premium for the extra quality produced, this does not appear to be the situation on most small ownerships at the present time. For this reason, and because pruning has only a minor relationship to productivity, it was not considered in rating management. No actual crop tree pruning was observed on the sample ownerships. About 16 percent of the owners had done pruning, but these were usually instances of pruning to improve the appearance of trees, or to benefit grazing. In two instances the pruning was intended to improve the stand but consisted of pruning of all trees, a practice that is costly and less profitable than crop tree pruning.

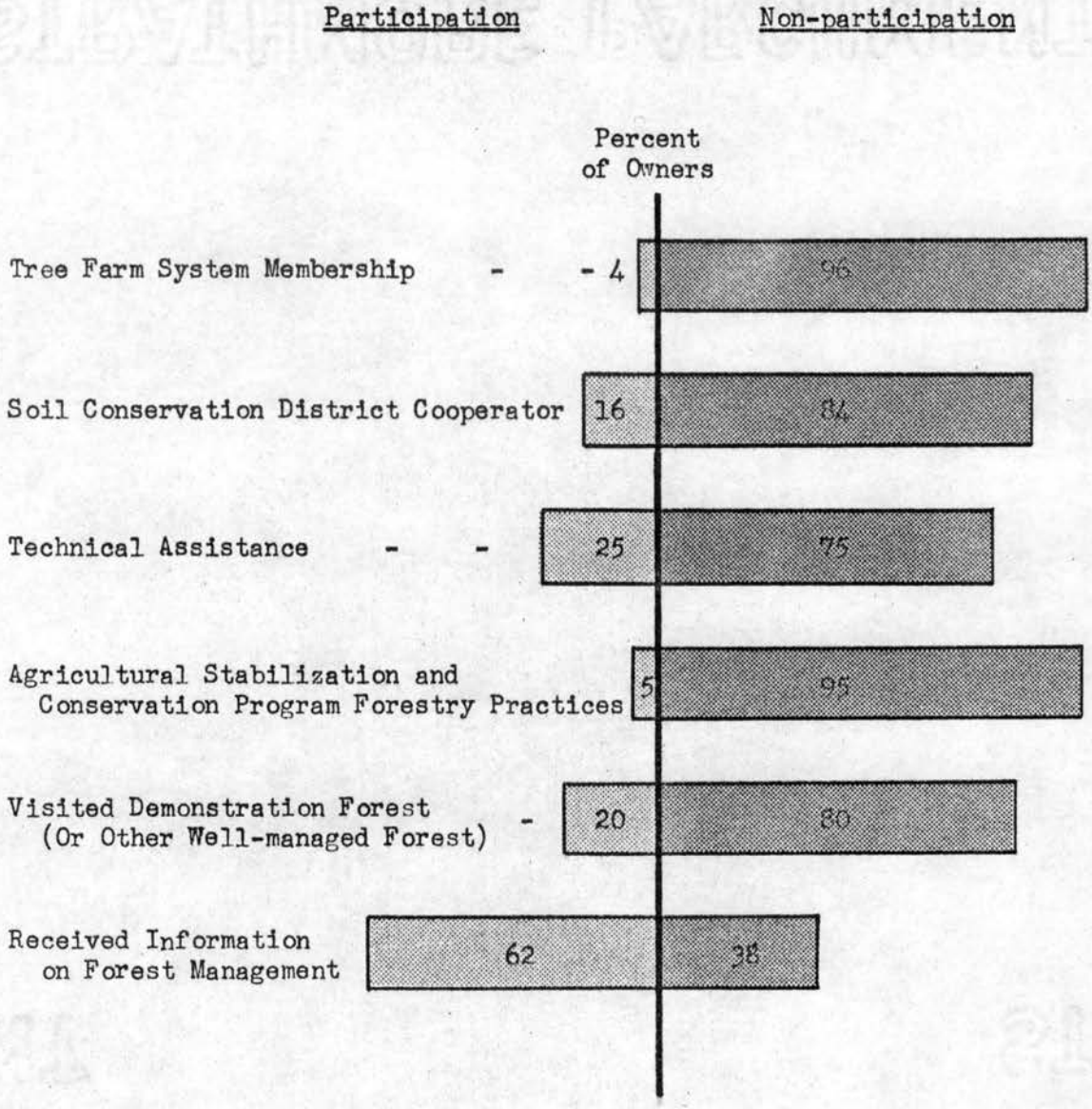
Participation in Programs of Cooperation, Assistance and Education

The extent of participation of owners in programs of cooperation, assistance and education in the previous ten years is presented in Plate X.

The degree to which the Tree Farm movement can be expanded in East Texas is indicated in that more than one fourth of the owners rated fair or better in management, yet only four percent of these were Tree Farmers. It is likely that most of the ownerships rating at least fair in management would be eligible for registration as Tree Farms.

The proportion of small forest ownerships under cooperative agreements with soil conservation districts is likely to be higher

Plate X. Participation of Owners in Programs of Cooperation, Assistance and Education



than the 16 percent revealed by the study. This percentage represents only those owners who reported an agreement and thus were probably currently active in cooperation. One-fourth of the owners received assistance from one or more agencies during the ten-year period.

A particularly low rate of participation was found to exist in cost-share practices in cooperation with the Agricultural Stabilization and Conservation program. An enumeration of the timber stand improvement practices completed and for which payments were received in 1954 revealed that only 140 owners had participated in the ten sample counties. Only three percent of cost-share payments on all practices in these counties were for forestry practices (planting and hardwood control), yet the cost-share ratio was at least as favorable as on other conservation practices. The proportions presented in Plate X are in terms of all sample ownerships. Most forest owners probably would include some planting to advantage in their management, but many ownerships do not have the conditions which would make them eligible for hardwood control practice payments.

Data was obtained by interview on ways in which owners had received information on forest management practices. Radio was the most frequently reported medium, followed by publications and movies. Most of the owners reported receiving information through at least one of the media of exhibit, publication, moving picture, radio and television.

Relation of Institutional and Other Factors to Management

The degrees of influence by institutional, personal, economic, financial and conceptual factors on quality of timber management are

presented in this section. The data are presented in graphic and tabular form accompanied by a brief discussion of the highlights and some of the details of the results which appear to indicate actions toward improvement in management.

Programs of Cooperation, Assistance and Education

The results in Table V show that without exception there was a close relation between the management quality of owners and their participation in programs of cooperation, assistance and education which involved direct contacts.

According to the criteria applied in this study, a particularly high proportion of Tree Farmers and ASC program participants rated at least good in timber management.

Owners received technical assistance and information on timber management by direct contacts with Soil Conservation Service technicians, the Texas Extension Service, foresters of the Texas Forest Service and forest industries and forestry consultants. All of these activities and the demonstrative-type education resulting from observations of well-managed forest properties were revealed as being effective in improving timber management. There was no significant difference between agencies in the results from providing technical assistance.

Owners reported receiving information on forest management practices in other ways and frequencies as shown in Table VI. Chi-square analysis indicated no significant difference among the media in influence on timber management. In separate comparisons, a significant difference was found only in that owners who had received information by exhibit and publication were indicated to be generally better in quality of management than those who had received no information.

TABLE V

PARTICIPATION OF OWNERS IN COOPERATIVE AND EDUCATIONAL PROGRAMS IN RELATION TO QUALITY OF THEIR TIMBER MANAGEMENT

Participation by Owners	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Tree Farm System*					
Member	8	2	3	13	4
Non-member	26	43	200	269	96
Soil Conservation District*					
Cooperator	14	5	25	44	16
Non-cooperator	20	40	178	238	84
Agricultural Stabilization and Conservation Program*					
Participator	8	2	4	14	5
Non-participator	26	43	199	268	95
Number of Sources from which Assistance was Received					
2 or more	10	4	12	26	9
1	9	11	25	45	16
None	15	30	166	211	75
Visit to Well-managed Forest Property*					
Public and Tree Farm	3	3	5	11	4
Tree Farm Only	7	3	16	26	9
Public Only	2	5	12	19	7
None	22	34	170	226	80
Totals by Management Class (Applicable to Each Sub-table Above)					
Number of Owners	34	45	203	282	
Percent of Owners	12	16	72	100	100

*Relation between participation and management quality significant by chi-square test ($\alpha \leq .05$).

TABLE VI

RELATION OF MEDIA OF INFORMATION TO QUALITY OF TIMBER MANAGEMENT

Media by Which Owners Received Forest Management Information	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals Number	Percent
Media					
Exhibit	9	10	27	46	16
Publication	17	17	55	89	32
Movie	14	15	49	78	28
Radio	13	20	69	102	36
Television	8	11	53	72	26
Number of Media					
3 or more	12	14	41	67	24
1 or more	13	15	79	107	38
None	9	16	83	108	38
Totals by Management Class	34	45	203	282	100
Percent by Management Class	12	16	72	100	

The sample distribution of ownership numbers by size class in Table VII shows relatively more larger ownerships than is indicated by the population data (Table I) which was obtained from county tax rolls. This difference, which a chi-square analysis indicated to be significant, probably resulted from a difference in size class distribution between the sample countries and the entire study area, or the possibility of duplication in the enumeration of multiple-tract ownerships from county tax rolls, or from both factors. To the extent that the first case existed, the relationships presented relating to size of ownership are less less likely to be representative of the entire study area. However, in view of all relevant factors including those previously described, it is believed that the results are generally indicative of the East Texas small ownership situation.

TABLE VII

OWNERSHIP FEATURES IN RELATION TO QUALITY OF MANAGEMENT

Ownership Features	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Size of Ownership (Acres)					
21-320	20	31	157	208	74
321 or more	14	14	46	74	26
Size of Forested Acreage*					
3-80	17	22	131	170	60
81-320	9	16	56	81	29
321 or more	8	7	16	31	11
Geographic Location					
Northeast Texas	21	24	140	185	66
Southeast Texas	13	21	63	97	34
Number of Separate Tracts					
1	23	34	164	221	78
2-4	9	8	31	48	17
5-10	2	1	4	7	3
11 or more	0	2	4	6	2
Maximum Distance Between Tracts					
1 Tract only	23	34	164	221	79
1-5 Miles	4	5	23	32	11
6-10 Miles	4	2	5	11	4
11 or More	3	4	11	18	6
Totals by Management Class (Applicable to Each Sub-table Above)					
Number of Ownerships	34	45	203	282	
Percent of Ownerships	12	16	72	100	100

*Significantly related to management quality by chi-square test ($\alpha \leq .05$).

Results of previous research cited in Chapter II indicated that, among broad forest acreage size classes over all forest ownerships, timber management was generally better on the larger forest ownerships. The results of this study show that there is also a close relationship between size of forested acreage and quality of management within the small ownership group (Table VII). Most excellent cases were found among forest ownerships of more than 320 acres. The proportion of ownerships rating very poor in management was progressively greater in smaller size classes and included about one half of forested units of three to 20 acres.

It is likely that larger forested acreages attract more management attention from owners because of the greater potential returns from given managerial effort. Also, it is probable that stronger capital position, ability to make investments for future income, and less need to liquidate for immediate income are factors more frequently associated with ownerships of larger forested acreages. Other information obtained by interview revealed that many larger forested acreages are held by owners occupied at least part time in non-agricultural business or profession. Such owners have sources of regular income other than from the land.

The productivity of timber stands on the ownerships, in terms of stocking or prospective stocking of desirable species, was found to be closely related to the degree of management applied by the owner (Table VIII). Almost all ownerships which were fair or better in productivity had some management practice applied in the previous ten years, while almost all those poor to very poor in productivity had no management

TABLE VIII

RELATION OF TIMBER RESOURCE FEATURES
TO QUALITY OF TIMBER MANAGEMENT

Timber Resource Features	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Productivity*					
Good to Excellent	28	12	1	41	14
Fair	6	31	36	73	26
Poor to Very Poor	0	2	166	168	60
Major Forest Type*					
Pine-hardwood	34	44	126	204	72
Bottomland Hardwood	0	1	5	6	2
Upland Hardwood	0	0	72	72	26
Merchantable Value (Dollars)*					
Less than 10	0	8	126	134	48
10-500	4	13	62	79	28
510-1,000	6	4	9	19	7
1,010-5,000	16	12	4	32	11
5,010 or more	8	8	2	16	6
Totals by Management Class (Applicable to Each Sub-table Above)					
Number of Ownerships	34	45	203	282	
Percent of Ownerships	12	16	72	100	100

*Timber resource features significantly related to management quality by chi-square test ($\alpha \leq .05$).

practices applied. Thus it appears that owners usually do not believe it profitable to apply practices where the timber is not currently productive, and also that more productive stands soon result from good management practices (Plate V).

The quality of timber management practiced by the owners was found to be significantly related to the principal forest type on the ownership as determined by the majority of the forested acreage (Table VIII). Pine-hardwood was the major type on almost all of the ownerships that rated fair or better in management. All ownerships on which the major type was upland hardwood were poor to very poor in management and also low in productivity, with the principal needed practices consisting of expensive interplanting and hardwood control to convert to pine production. The general level of management was also relatively low on the small number of ownerships on which the major type was bottomland hardwood. The management of bottomland hardwood timber may be no more difficult or expensive than on pine-hardwoods of comparable productivity, but a major limiting factor exists in the longer period required to grow the larger trees necessary for the high-value furniture and veneer stock which economics indicate should be the objective in hardwood management. Upland hardwood as the major type was found to be more frequent among the ownerships with smaller forested acreages.

The higher rate of performance of timber management on more valuable timber stands (Table VIII) signifies the degree in which present marketable value is an incentive to management, and that stands under management have or soon acquire marketable value.

Tenure Factors

The results show no real difference between estates and non-estates in quality of management practiced (Table IX). Management practices are carried out on a considerable number of estates, notwithstanding the uncertainty of control and ownership common to them.

Estates appear more numerous than the sample data indicate. The reports on other phases of the project show that about one fifth of all small ownerships are in estate status (3, 4).

Relatively more of the owners who acquired their land recently are practicing timber management (Table IX). It was also found that owners who acquired land recently are concentrated by occupation in business or profession, or part-time non-farm business. Also, the intent to grow timber as the major land use was more frequent among owners who acquired land during the previous decade.

Owners who acquired their land before 1930 can be considered an aged group, yet a considerable proportion of them practiced timber management to a fair degree or better.

Method of acquisition was found not related to quality of timber management.

Characteristics of Owners

No relation was found between age of owner and quality of timber management (Table X). This is contrary to a common assumption that, since the time element is an obstacle to timber production, fewer aged owners can be expected to practice timber management. However, these results are supported in that the intent to grow timber as the major land use was found to be at least as frequent among aged owners as

TABLE IX

DEGREES OF INFLUENCE BY TENURE FACTORS
ON QUALITY OF TIMBER MANAGEMENT

Tenure Factors	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Estate Status					
Estate	5	3	32	40	14
Non-estate	29	42	171	242	86
Period of Acquisition*					
1941-1955	16	26	73	115	41
1931-1940	5	4	48	57	20
1930 and Before	13	15	82	110	39
Method of Acquisition					
Purchase	26	38	151	215	76
Inheritance	7	5	50	62	22
Gift or Foreclosure	1	2	2	5	2
Timber Resource Tenure					
Owner-operated	32	36	167	235	82
Manager-operated	1	6	14	21	8
Not operated	1	3	22	26	9
Totals by Management Class (Applicable to Each Sub-table Above)					
Number of Ownerships	34	45	203	282	
Percent of Ownerships	12	16	72	100	100

*Significantly related to management quality by chi-square test ($\alpha \leq .05$).

TABLE X

QUALITY OF TIMBER MANAGEMENT IN RELATION TO CHARACTERISTICS OF OWNERS

Characteristics of Owners	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Age					
23-40	3	7	20	30	11
21-50	5	9	38	52	18
51-60	13	11	56	80	28
61-70	9	9	41	59	21
71-94	4	9	48	61	22
Chief Source of Income					
Farming	14	16	84	114	41
Wages	5	11	33	49	17
Business or Profession	8	7	35	40	18
Income from Investments	3	4	11	18	6
Pensions or Social Security	3	6	31	40	14
Other	1	1	9	11	4
Occupation					
Farmer	10	15	71	96	34
Farmer-laborer	6	11	28	45	16
Farmer and Other Business	8	6	30	44	16
Business or Profession	3	4	11	18	6
Wage Earner	1	1	8	10	4
Housewife	0	1	11	12	4
Retired Farmer	4	6	33	43	15
Other Retired	2	1	11	14	5
Sex					
Male	30	39	158	227	80
Female	4	6	45	55	20
Race*					
White	33	43	165	241	85
Negro	1	2	38	41	15
Totals by Management Class (Applicable to Each Sub-table Above)					
Number of Owners	34	45	203	282	
Percent of Owners	12	16	72	100	100

*Significantly related to management quality by chi-square test ($\alpha \leq .05$).

among younger owners (14). Although physical disability and the long waiting period for returns undoubtedly seriously limit the practice of timber management by many aged owners, it is evident that there are other compensating factors. It is probable that many older owners find timber growing to be a suitable land use and have had the experience of seeing growth results and dependable recurrent harvests of timber. Some owners in the sample believed their timber to be a desirable estate to leave their children.

About four fifths of the owners were at least partly occupied in agricultural enterprises, or were retired from farming. This agricultural group owned about three fourths of the forested acreage, and it was made up largely of rural residents living on or within a few miles of their land. The results revealed that, in contrast, the less numerous owners in non-farm business or profession or retired from such occupations generally held larger, more productive forested acreages, and they resided in town away from their land (14).

Race was the only owner characteristic found significantly related to quality of timber management. The quality of management of Negro owners was found to be generally lower than that of other owners (Table X). This was probably due to the relatively small size and low productivity of their forested acreages, and to financial problems.

Residence Factors

No significant difference in quality of management practiced was found attributable to rural or urban residence, or to distance of the owner's residence from his main or headquarters tract (Table XI). However, urban residents and owners living considerable distances from but

TABLE XI

QUALITY OF TIMBER MANAGEMENT IN RELATION TO OWNER RESIDENCE FACTORS

Owner Residence Factors	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Rural Versus Urban Residence					
Rural	29	34	155	218	77
Urban	5	11	48	64	23
Totals	34	45	203	282	100
Residence Versus Non-residence					
Resident	34	45	203	282	80
Non-resident	3	9	59	71	20
Totals	37	54	262	353	100
Distance from Land					
On Land	24	32	138	194	69
1-10 Miles	6	7	38	51	18
11-25	4	6	27	37	13
Totals	34	45	203	282	100

within 25 miles of their land were found to have relatively large forested acreages and more frequent major intent in growing timber, as compared to rural residents and owners living on or near their land (14). The more frequent interest among these owners in growing timber was probably due to the limitation of many of them to an extensive type of land management, to less frequent interest in farming as a means of way of living, and to a relatively high proportion of forested acreage on their ownerships. However, it appears likely that many of them would be seriously limited in ability or facility to apply desired or needed practices. For apparent reasons including convenience and greater supervision possible, rural residents (most of whom were found to live on their land) are potentially more able to carry out practices. Many

rural residents were found to have a secondary intent to grow timber; this was particularly true of those who were interested mainly in range or pasture use.

A comparison of quality of timber management was also made between the owners interviewed (defined as residents) and those who lived too far away for interview (non-residents). Some of the non-residents lived hundreds of miles away, and almost all lived outside the counties where their land was located. No statistically significant difference was revealed in quality of timber management between residents and non-residents. Information obtained by mailed questionnaire from a group of non-resident owners revealed that many of them were interested in managing their ownerships for timber production.

It is apparent that, while residence factors result in general differences in management interests and problems, the net effects of these factors tend to result in a state of timber management much the same among the owner groups discussed.

Owners' Management Concepts and Intent in Land Use

The concepts held by owners of what constitutes good management on their ownerships were found to be generally on a much lower level than management standards used in the ratings. More than one half of the owners who believed their management to be good to excellent were found to be poor managers by the standards of the study (Table XII). The wide variation in concepts indicates that many owners do not know what are good management practices, or else that there are no prevalent standards in the viewpoints of owners.

TABLE XII

QUALITY OF TIMBER MANAGEMENT OF OWNERS IN RELATION TO THEIR CONCEPTS OF MANAGEMENT AND INTENT IN LAND USE

Management Concepts and Intent	Number by Management Quality: Good to Excellent	Fair	Poor to Very Poor	Totals: Number	Percent
Owner's Appraisal of His Management*					
Good to Excellent	15	18	39	72	25
Fair	13	18	70	101	36
Poor to Very Poor	4	8	87	99	35
No Estimate	2	1	7	10	4
Opinion of Woods Burning					
Should Burn Annually	2	7	36	45	16
Burn Less Frequently Than Annually	6	10	27	43	15
Should Not Burn	25	27	137	189	67
No Opinion	1	1	3	5	2
Major Intent in Land Use					
Crops and Pasture	6	8	63	77	27
Timber Production	6	12	26	44	16
Range or Pasture	17	18	68	103	37
Residence	2	4	31	37	13
Other	3	3	15	21	7
Major Obstacles to Timber Management					
Economic Problems	15	17	92	124	44
Lack of Interest	4	9	40	53	18
Disability	3	3	24	30	11
Risk of Loss from Fire or Theft, or Both	5	7	13	25	9
Lack of Information	1	0	10	11	4
Other	2	1	14	17	6
None	4	8	10	22	8
Totals by Management Class (Applicable to Each Sub-table Above)					
Number of Owners	34	45	203	282	
Percent of Owners	12	16	72	100	100

*Related significantly to management quality by chi-square test ($\alpha \leq .05$).

It was also found by interviewing the owners that 44 percent were aware of only one of the essential practices as being good management, and only one third considered two or more of the essential practices to represent good management. The concepts of owners as to what actually is involved in silvicultural cuttings, fire control and hardwood control appears in many cases to be considerably different from the silviculturally desirable practice.

Opinions were also obtained from the owners on the condition or productivity of their timber. In most instances, the owner's opinion of his management was closely correlated to his estimate of the productivity of his timber.

Expressions of opinion were obtained from the owners on the practice of uncontrolled woods burning, or wild-fire. Only a small proportion believed the woods should be burned every year. Several of the owners made the qualification that burning conditions resulting from continuous fire protection have made burning a more harmful and unwise practice than formerly.

The differences in opinion were found not related to quality of timber management of the owners.

One third of the owners believed that burning could have beneficial effects, including range improvement, hardwood and brush control, reduction of fire hazard, killing insect pests, and others.

The opinions of owners on the status of fire protection was also requested. Seventy-eight percent of them believed that protection as provided in emergencies by the state and community organizations was satisfactory. Major reasons given by the remaining owners for

dissatisfaction were lack of availability of mobile equipment, not enough rural organization in fire-fighting, and too limited extent of protection, area-wise, provided by the Texas Forest Service.

The objectives of owners in holding and managing land were determined by asking each sample owner to state his major intent in managing his land, at the time of acquisition and also at the present. Some important changes in intent have taken place, particularly from crop farming to other use. The greatest shifts in management intent and in actual use of land have been into range and pasture use, growing timber and residential use (14). Only about five percent had timber production as their original intent, but about 16 percent have the major present intent of growing timber. A chi-square test involving all of the 282 sample owners did not reveal a close relationship between major intent in land use and quality of management (Table XII). However, a significant difference was indicated by an analysis which included only the principal groups by intent, excluding the owners in the "Other" classification. The greatest differences in quality of timber management were found between owners whose major intent was in growing timber, and those whose intent was mainly in crop and pasture or residence use.

Owners who intended to grow timber as their major use and those whose major intent was in range or pasture use were not greatly different in quality of timber management practiced. Many owners with major intent in range or pasture use were found to consider timber growing as a secondary intent. The major intent of about one half of the owners with excellent timber management ratings was found to be in range or pasture use.

About one third of the owners who intended to grow timber and of those whose major intent was in range or pasture use had received assistance in timber management practices, as compared to less than one fifth of owners with other major intent. The participation in timber management assistance programs by owners whose major intent was found to be in range or pasture use was probably due to an appreciation of the benefits of hardwood control to both grazing and timber improvement.

Only about one tenth of the agricultural group of owners previously described intended to grow timber as their major land use. Relatively more of the owners occupied in non-farm business or profession or retired from non-farm occupation intended to grow timber (14).

An expression was obtained from each owner interviewed of what he considered to be the major and secondary obstacles to timber management on his ownership. A chi-square analysis involving all groups by major obstacles did not reveal significant differences in quality of management associated with differences in obstacles. However, the analysis indicated there were significant differences in quality of management between groups by obstacles, as in the case of the generally lower degree of management practiced by owners who considered their principal obstacle to be lack of information, as compared to those who believed they had no obstacles, or considered fire to be the main obstacle.

In view of the general aged characteristic of the owners and that about one fifth of them were found to be women owners, it is notable that only 11 percent considered physical disability to be their major obstacle.

The most frequently expressed obstacles were those of economic nature. These limitations were expressed by 44 percent of the owners as their major obstacles, and as secondary obstacles by numerous others. Such problems are likely to be particularly difficult, and are indicated to be major deterrents to timber management among small ownerships. Yet the owners who expressed these problems as their major obstacles were about median in terms of performance in management. Specific economic and financial obstacles expressed included long-term nature of timber production, infrequent returns, the long period before the first income from improvement practices, more profitable return to the owner's time in other endeavors, lack of funds, immediate need for income and lack of profit in timber production.

Expressed obstacles classed as "Other" included poor marketing conditions and cutting practices of buyers, problems with divided interests in estate management, the hardwood control problem, and scarcity of suitable labor.

Difficulty was experienced in obtaining meaningful statements of obstacles or problems fron nine percent of the owners. Most of these (mainly the owners of this group who were poor to very poor in quality of timber management practiced) stated they did not know. It was apparent in these instances that they had such little interest in timber management or had given such little thought to it previously that they were unable to intelligibly state the problems involved. A few of the owners had difficulty in expressing themselves generally, because of age or other personal limitation, and obstacles were not determined for some of them.

CHAPTER V

INTERPRETATION OF RESULTS

The basis for management of a timber stand is decision by the owner, which he must make in the light of his knowledge of the alternatives in resource management and use, understanding of the limitations and advantages involved, and under the influences of the problems he faces. Therefore, efforts to improve timber management and productivity on small forest ownerships must necessarily be directly concerned with the problems and concepts of owners, and the ways and means for overcoming their problems by research, extension and policy actions. Presented below are the action needs as they are indicated by the revealed obstacles, relationships, influences, practice performance rates and other relevant factors concerning small forest ownerships and their management.

Research Needs

The results show that to meet most problems, research is the principal or else the initial action needed. Such problems are discussed first in relation to research needs. Related extension and policy action needs are pointed out where pertinent in connection with research, and later summarized separately. Research needs are presented as follows in terms of the revealed obstacles or problems and the indicated roles research should play in their solution.

Problems in Timber Production Economics

Economic problems were by far the most frequent obstacles expressed by the owners. Problems in timber production economics, as distinguished from problems arising from lack of capital, may be grouped into two principal types: (1) those where timber production is likely to be profitable, in which case there are questions involving economic analysis of relative advantages and disadvantages in time and income between land use and management practice alternatives; and (2) instances where there is not likely to be an adequate return to the owner for improvement practices in the present state of technology and costs. The principal action need on these problems is research in order to better understand the probability of returns under the various alternatives in use, use rates and practices, to better recognize areas on which timber management practices are likely to be profitable, and to find economic means for production on forest ownerships which are presently marginal or submarginal for timber production. Some of the specific management problems of economic nature are discussed below.

Problems of owners in cutting practice are to a large extent financial in nature because of the need for income and operating funds from other sources when cutting is postponed for increased income in the future. However, economic questions of the first type described above exist in choice of the nature and timing of cuttings as they pertain to rotation age, alternatives in technical systems of timber management and means for regeneration. It was pointed out in the previous chapter that occupational limitations and the actual practices of owners indicate even-aged management to be most suited to the small ownerships. However,

there are variables including prices, products, species, growth and volume characteristics, management facilities of owners and their opportunities and need for labor income from their timber which affect such decisions and which are likely to differ considerably among owners or ownerships. It is apparent that sound decisions in cutting practice are complex and dependent on applying economic analysis to each ownership. Research is needed to provide more complete economic information and to develop analytical procedures better suited to small ownerships.

An additional problem related to the cutting practices of owners and the economics of timber production exists in the prevalent timber marketing procedures in East Texas. The timber measuring, harvesting and selling procedures as generally practiced on small ownerships are much inferior in marketing advantage to those of producers in enterprises which compete with timber production in land use. This problem is discussed later in relation to need for information and assistance in management, and to its effect on the interest of owners in timber production.

The principal problems in hardwood control may be classed into the two economic situations previously described. The first may include pine-hardwood stand conditions which need elimination of a hardwood overstory to release suppressed young pines, or a hardwood understory to permit development of pine reproduction. The limited economic data available and the experience of timber managers indicate that hardwood control practices on such stands are usually profitable; yet, only a few owners have applied hardwood control practices. As in the case of cutting practice, research and extension education in the economics of practices appear to be basic needs, along with research for less costly, more efficient techniques for more profitable production.

The second type of hardwood control problem of an economic nature includes principally the upland hardwood stand conditions where cull hardwood trees or brush need removal in conjunction with planting. On such unproductive areas where stand improvement measures would be costly and of questionable profitability to the owner, education would have little result. The basic problem here is one of overcoming or reducing supersession costs. As pointed out in Chapter II, there may be some basis for allocation of at least some cost-share payments to investment-type costs of this nature. However, in view of the magnitude of the problem, the high cost of the practices and limited cost-share funds, it is likely that the basic economics of costs and benefits of various alternatives may dictate the principal action to be research for better methods of assuring survival of plantings or seedings and less costly means of hardwood control.

Forest grazing is almost universally practiced in East Texas and many in the area depend on income from livestock production. Economic problems in the joint production of timber and livestock are major factors in the management of small East Texas forest ownerships. Timber production is a long-term activity. This also is true of the management of the forest range resource, and of the beef production enterprise to a lesser degree. For these reasons, long-term ecological and economic effects or results must be considered in joint production. Because of the necessity for long-term considerations, the wide variation in conditions existing on East Texas forest lands, and the almost total lack of factual knowledge of the complex range of joint production relationships, there is much that is indeterminate in estimating true relations and for

making management decisions on East Texas forest ownerships for optimum returns commensurate with maintenance of the resources.

There is, therefore, much need for investigation of the ecological directly related economic aspects of joint production of timber and livestock on small East Texas forest ownerships. The long-term aspects make research of this nature difficult to finance and perform, but they also argue for the high priority for planning and initiation of collection of data.

An aspect of joint production or multiple-use not considered in this study is in the use of forest land for wild-life and recreational values. These uses of forest land are increasing. The leasing of private lands for hunting is an appreciable source of income for landowners in some areas of Texas. Research in joint production on forest land should duly consider these uses.

Financial Problems

In addition to the expressed obstacles, the need for relatively long-term financial arrangements is indicated by the low rates of performance in the essential practices of silvicultural cuttings, hardwood control and interplanting. To postpone cutting, or to leave uncut a part of the merchantable volume as growing stock or seed trees, necessarily involves a decision for long-term production and foregoing present income in favor of greater income in the future. This apparently is beyond the financial capability or credit facility of many owners; the immediate need for money was found to be the most frequent reason for decision by owners to sell timber. In the case of hardwood control, actual returns can result only through years of additional growth on young stands. The

same is true of any planting practice. Most small owners thus have a serious and unprovided need for financing to tide them over such waiting periods. The results indicate that this is a major cause, if not the principal one, for the generally lower level of timber management on small ownerships as compared to that of larger corporate ownerships and others of medium and large size which can be expected to be more favorably situated financially.

There has been little or no attempt by credit sources to develop and apply loan arrangements specifically designed for timber production on small ownerships. Loans for agricultural production are available from federal land banks, cooperative credit associations, state banks and other private sources, but they are tailored to relatively short-term needs for production or for long-term acquisition needs. A major problem in credit for timber production is the need for collateral, and this is particularly true of forest ownerships which have no appreciable amount of timber of currently merchantable value. Lenders have alternatives for making production loans on enterprises having actual inventory values or a much shorter term of production, such as on livestock or crops which will mature or be ready for market within a few months of time. To compete in the market for loans, many small forest owners need sources of collateral in addition to currently marketable timber.

A favorable feature of stand improvement by hardwood control or interplanting, or a combination of these practices, is that the resulting increase in growth and productivity will add to the saleable value of the forest land even though the timber itself may not yet be merchantable. A type of loan which takes into account such increment in forest

land value as well as any marketable timber values, and ties the timber stand to the land while at the same time enabling the owner to carry out timber management with provisions for cutting and income, may be suitable to many East Texas forest credit needs. However, the absence of loans on small ownership timber production means that both lenders and producers have no experience on which to arrange equitable loans. The requisites and means for timber production loans which would be widely acceptable to lenders and timber producers are subjects of much importance and need investigation.

Research appears to be the initial action need on the credit problem. In addition to investigation of loan requisites and means, study is needed on the demand for and practicability of loans; the extent to which they can be provided under existing institutions, available capital and competition; the possible need for additional credit facilities; and the need for and feasibility of the insurance on timber stands which is certain to be a requirement for timber production loans. The requirement of annual interest payments where returns are less frequent than annual (the latter being a major expressed management obstacle) is also likely to be a credit problem in need of investigation.

In the management of enterprises which are competitive with timber production in land use, owners are accustomed to knowing with reasonable accuracy the values of current inventory, degree of risks, production potentials and earning rates, and to having the reference of past experience and other information for making fairly reliable predictions of future situations and probable returns. Until information of comparable quality, completeness and applicability is available for timber production

on small ownerships, the desirable shifts into timber production are likely to be slow, even where it may actually be most profitable or most expedient for the management situation of the owners.

As compared to other land use enterprises, the relative disadvantages in the timber marketing procedures of many small owners also have an important bearing on the lack of interest in timber production. There is an obvious need for the descriptive information on the marketing procedures as practiced in East Texas, which is to be reported separately, and for such additional research and action as may be indicated to place small owners in a more equitable position in timber marketing transactions. Improvement in the position of owners in this respect is practically certain to have an appreciable effect in increasing interest in timber production.

Since livestock production is a major land use in the area, more adequate knowledge of the complementary and supplementary relationships in timber-livestock use combinations should be effective in inducing more owners to product timber.

Research to provide more adequate economic and technical knowledge and to improve efficiency in timber production appears to be the principal current action need toward development of interest and changes in intent where timber production is the most profitable use, or is most expedient for the owner. For research to be effective, it must be complemented by extension education and management facilities as subsequently described. There is also need for certain policy-implementing research, described in a later section.

Extension Needs

The problems in extending educational and assistance programs in forest management to owners involve mainly such personal factors as knowledge, management intent, occupation and residence of owners, and the numbers, features and size distribution of ownerships. Some interpretations of the results in terms of needs in extension education and the direction of extension programs are as follows.

Limitations in Knowledge of Owners

Lack of information or knowledge of timber management was found to be relatively minor as a major obstacle expressed by owners. However, there are other indications of the importance of lack of knowledge of timber management among small owners. Although most owners had received information on some aspects of timber production and revealed some knowledge of good management practices, the understanding or standards of management of many of them were not adequate. The comparison of owners' opinions of their own management to actual quality of management as rated by the index revealed that their practices were frequently not as desirable silviculturally as they believed, or else they were not aware of all needed practices.

Most owners were found to have no accurate knowledge of the value and volume of timber products on their land, and practiced marketing on the stump in lump sum, untallied sales without reasonably accurate prior estimates of standing volume. Nonetheless, only a very few owners expressed marketing problems as major obstacles. Most owners apparently visualize their marketing procedures as customs that

necessarily go with selling timber, rather than as involving limitations that can be overcome. There appears to be an unfulfilled need among owners for knowledge of better marketing procedures, economics of the marketing process and relation of point of sale and forest labor income to maximization of returns.

A reasonably good knowledge of the means of production, amounts and value of products, and equitable marketing practices is surely fundamental to good economic decisions in timber management. Yet, this study has demonstrated great gaps in such knowledge among owners. It is therefore indicated that lack of knowledge is a much greater obstacle than owners themselves realize.

Limitations in Basic Knowledge

Not only is there a wide disparity between the knowledge of owners and the available store of technical and economic knowledge in timber management, but the previous discussion in this chapter has pointed out what is probably an even greater limitation in the comparison of our present state of knowledge to the problems owners must face in attempting to make good decisions toward obtaining optimum returns along with maintenance of resource productivity. Actions are therefore clearly required in the research as described and the development of more adequate extension of knowledge to timber producers. As part of both research and extension, there appears to be much need for economic analyses of timber production opportunities and potentials. Such analyses should take into account all of the economic factors and timber conditions with which small owners are faced in management decisions, and should result in guides to economic analysis directly applicable to

the extent of production knowledge available to the conditions on small East Texas forest ownerships. As production data become more adequate and management more advanced, there is likely to be need for refinement of analyses and application of such procedures as management service.

Extension Education Needs

To the extent that lack of good practices and interest in timber production is due to unawareness, misconceptions, or lack of understanding of known techniques and economics of good management practices, education is the means needed for improvement. Great improvement has been made in the ideas of owners concerning uncontrolled burning. These improvements are significant in showing what can be achieved in removing misunderstanding and ignorance of practices through well-organized and sustained effort. They also indicate that in the future the program of education in fire protection may need relatively less emphasis. In comparison, the relatively poor status of practices in silvicultural cuttings, hardwood control and interplanting indicates the need for greater effort in education in these practices.

It is apparent that a major need exists for development of demonstration ownerships for educational purposes. Such demanstrations should be of a long-run nature, showing management practices on typical problem conditions, and especially with provision of information and maintenance of records on costs and returns of practices.

Personal Factors

From the standpoint of reaching major groups of owners with similar interests, occupations, concepts and practical ability and knowledge, the

design and long-range direction of improvement programs should be aimed at the previously described agricultural group of owners.

The problem involved in reaching non-residents, and the different problems which face them as compared to residents are likely to require special effort if improvement is to be accomplished in their management.

Of the other personal factors investigated, none appeared important enough to warrant emphasis in actions or programs. However, even the lack of significant influences as in the case of the relation of age to intent and quality of management, is important in showing that owners with such characteristics should not be considered as unlikely timber managers. It is encouraging that some owners within almost all the various groups investigated have been able to cope with their problems and practice a substantial degree of timber management.

Ownership Features and Size Distribution

The dominant problem in terms of numbers of owners, greatest potential for forest improvement, and low status of management and productivity lies in the smaller size groups of ownerships. Forested or partly forested ownerships of 21 to 320 acres in size, including more than 56,500 held by residents, may be considered as representative of the problem. Ownerships of this size held by residents make up about 93 percent of small forested or partly forested ownerships of residents, and include about 62 percent of total land and more than half of the forest land in them. In addition, the previous reports on ownership show that there are about 10,500 small ownerships held by non-residents. Almost all of these are at least partly forested. These are indications that to obtain widespread application of good management practices, to benefit many owners

and also to obtain the greatest forest improvement in the long run, ownerships of this size group should receive major emphasis in designing or directing actions to improve forest management.

This does not mean that large ownerships should be disregarded as unimportant, but that the problem they present is much smaller. It may be practical to identify and work with many of them on an individual basis. Concentration of effort toward owners with larger, more productive forested acreages and desirable forest types would probably result in the greatest immediate improvement in management and forest productivity.

Policy Needs

Major concerns of policy are in the direction of efforts and allocation to obtain the maximum improvement in timber management and productivity with given amounts of funds. Policy problems indicated by the study may be stated generally as: (1) possible differences between individuals and society in desires or aims in forest resource management, and the consequent question of advisability or economic soundness of public investment in timber stand improvement practices which owners do not ordinarily find profitable; and (2) needs for continuance, re-orientation or institution of indicated action needs which are in line with what may be described as the traditional land-grant policy of obtaining and providing land owners with research, technological improvements, economic and technical information and assistance in management organization and facilities needed for more profitable, more efficient practices in production.

Knowledge of relative costs and benefits of programs and actions is necessary for making optimum approximations in allocation of funds, priority in time, and orientation of activities toward obtaining maximum benefits in improvement. This study has shown differences in effectiveness of some programs, but no definite or specific information is available on relative permanence of effects, or on costs of programs and actions in terms of effects. These deficiencies in knowledge and the problem of coordination among the several organizations involved make the performance and application of such approximations extremely difficult, if not impracticable, in the existing situation. There appears to be a major need for policy-implementing research in this respect.

Premises

Only a general approach to such approximations can be made, and to this end the following considerations appear helpful: (1) programs of education in economics and techniques of practices and technical assistance in practices have been found effective, but they can be so only to the extent of the knowledge available, and to removing management problems associated with lack of information and know-how; (2) present cost-share payments applied to costs operational in nature (hardwood control on potentially productive stands) are likely to be profitable to owners even in the absence of payments, and, as such, they are aimed at counteracting lack of knowledge or else the more fundamental causes for poor management; (3) basic limitations, education and technical assistance can be substituted effectively for the present type of cost-share program; and (4) the more basic problems of most owners and for most of the

forest acreage are the obstacles of financing, lack of management facility or ability to carry out profitable practices, and actual unprofitability of practices within the planning period of the owner. Present programs do not attack these basic problems, other than in limited technical research to discover more efficient and less costly practices.

In situations where the supersession costs make change in use to timber production (or to a productive level of the timber) unprofitable within the planning period of the owner and the present state of the arts, an incentive payment in the form of an investment by society apparently would be the only feasible means for improvement in the short-run. Public investments of this nature would likely be permanent in effect, since they would enable owners to reach a more productive and profitable plane of resource management.

The Forest Service, U. S. Department of Agriculture, has recently concluded that actions of this nature are needed; i.e., if future generations are to enjoy the use of timber products at the same relative abundance and prices as at the present, we must "...achieve within the next few years a degree of forestry on all commercial forest land roughly equivalent to that which is practiced today on the better managed lands" (16). However, this has not been accepted as a basis for these interpretations due to reasons outlined below and to considerations previously stated in support of technical research as the basic need.

Two processes could result in increases in timber production over and above what private owners are willing to produce in the present state of technology and prices: (1) development of relative scarcity in timber products through increased total demand with the expected

increase in population, which will tend to stimulate private investment in timber production; or (2) investment by society in timber stand improvement practices not presently considered profitable by private owners. Any judgment of these alternatives from the standpoint of society or conservation needs should take into account the opportunity costs and treatment and administrative costs of the latter alternative. Opportunity cost would occur in the loss in timber production sustained by not allocating the required funds to other alternatives in actions needed (to research, for example). Actual treatment and administrative costs of what apparently would be a relatively high-cost program would have to be borne by the people, through taxation, which also involves administrative costs. Current national revenue commitments and the present course in government fiscal action make it probable that at least part of such a program would be financed by deficit. In that event, and with the relatively short timber production period in the South, the costs and also the benefits of a program of this nature would be borne to a considerable degree by the same generations. To the extent that this is true, the concept that investment in conservation involves sacrifices for future generations does not apply.

This question is therefore pertinent: which of the alternatives will result in the most economical increases in timber production? In other words, which will yeild the least increase in cost of timber products in future consumption? This appears to be an important question on which the literature does not reveal any investigation or analysis. Until more is known in this respect, there appears no sound basis for recommending high-cost actions involving relatively inefficient,

high-cost practices which are, to a major extent, unpredictable in results (as previously indicated). Such action would not come to grips with the basic problem of reducing costs and increasing efficiency of practices. Fortunately, a limiting feature of the problem is that it involves a renewable resource and therefore no complicating conservation problem of irrecoverable decrease in productivity.

Research and Extension in Economics, Techniques and Marketing

Policy action is needed to orient and implement the research and extension needs for development of interest and to obtain performance of practices indicated to be profitable to owners. These actions, as previously described, include research to provide basic economic and technical information, improve marketing practices and reduce costs of practices, provide extension education in the economics and techniques of practices, and provide technical assistance. Emphasis in policy action on practices should be in hardwood control, good cutting practice and regeneration.

It is probable that the greatest short-run results in application of hardwood control may come through greater emphasis and encouragement by local committees and groups in prrticipation by owners in practices approved under the ASC cost-share program. In addition to directly increasing productivity, participation should develop interest in timber production and serve to demonstrate good management practices. Under the premises set forth earlier, the latter effects appear as the principal justifications for cost-share payments on operational practices of this nature. On that basis, the contribution of cost-share payments

in comparison to program alternatives should be wiighed primarily in terms of permanent educational results.

Credit, Insurance and Protection

Considering the great importance of financial problems as obstacles to timber producers, it is apparent that there is a need to initiate investigations on credit policy, and to follow with actions based upon the research results. The previously described recommendations of the study by Resources for the Future, Inc., also appear applicable to East Texas.

In spite of the improvement that has been accomplished in fire protection, the risk of loss from fire and theft is an important factor affecting the interest of owners in practicing timber management. A factor adding to risks is the high proportion of owners who do not live on their land and therefore are limited in the protection they can provide. Possible means for minimizing this obstacle are the development of arrangements for delegation of supervision and protection, development of forest insurance facilities, and broadening of eligibility and increasing participation in fire control agreements. Such actions should facilitate development of credit. Insurance and fire control agreements are likely to be essential to timber production loans.

Assistance and Facilities in Management

Many owners find that they are limited in ability or facility to apply timber management practices because of disability due to age or other physical handicap, because they live some distance from their land, or are limited by other activity in the time they can give to timber management. Problems also exist in ownership tenure situations.

Women owners are likely to be limited in ability to practice timber management.

The technical assistance provided in the existing programs generally is limited to instructions in practices, inspections of forest acreages and recommendations on management, and providing other information by personal contact. While these activities were found to be effective, they do not provide the degree of assistance or facility for management needed by many. Owners with obstacles indicated above frequently need management arrangements whereby they can delegate responsibilities for carrying out practices, making and supervising sales, general supervision and protection and actual management decisions. These needs are beyond the scope of activity by public programs, and can be provided only by private forestry organizations or services or by the owners.

Effective facilities may include management cooperatives or other associations of ownerships for marketing or management, and management services provided by consulting foresters. Manager-operation of forest ownerships was found to be effective in the study area. Public agencies can assist to the extent of doing research and providing advice on such arrangements, and promotional and educational activities to encourage them. An instance of possible need for investigation is in the case of estate status and management. Estate ownership is frequent in East Texas forest ownerships, and timber management is being practiced on some of them. The predominance of aged owners indicated that the problem of estate management will increase and will need more attention. Research and other activity to promote management continuity in

provisions of wills, estate settlement, and ownership transfers may be effective. Consolidation of ownerships can contribute to greater interest and better management, and it appears to be a trend which should be encouraged and facilitated.

Summary and Priority of Program and Action Needs

As a further means to show needed actions in basic terms, they can be identified as those which can be implemented by established facilities or programs at present levels, and those requiring expansion of programs or initiation of new actions. The recommended actions of the latter nature are those aimed at removing the basic causes for lack of management, while the emphasis in present programs is almost entirely against poor practices (or lack of practices) which are very evident, yet only symptomatic of basic causes. For large degrees of improvement, there appears an imperative need to initiate the actions aimed at basic causes for lack of management.

Program and action needs are summarized as follows in general order of present priority as indicated by the foregoing analysis:

(1) further research in the following problem areas:

(a) economics of land use, timber production and management alternatives;

(b) development of more successful and less costly practice techniques, particularly to reduce supersession costs;

(c) requisites of timber production loans that would be acceptable to both lenders and timber producers, and other research on forest credit as previously described;

(d) the need for and feasibility of insurance on timber stands (corollary to credit research);

(e) economics of joint production of timber, livestock and other values of the forest, and corresponding research in ecology for necessary basic knowledge;

(f) marketing procedures and alternatives;

(g) investigations of practical joint or delegated management and marketing arrangements, and the demand for cooperative management or professional management services;

(h) policy-implementing research, including appraisals of results of alternative actions and programs in terms of relative permanence and costs and optimum allocation of funds; and,

(i) needs and means for greater continuity of timber management in tenure changes;

(2) extension needs:

(a) education in economics of timber production, land use, joint production relationships and marketing practices;

(b) continuation of programs of technical education and assistance;

(c) establishment of demonstration ownerships; and,

(d) development of more effective use of media information;

(3) policy needs:

(a) development of facilities to overcome obstacles of owners which are not associated with profitability of practice, involving credit and insurance, delegated or joint marketing and management arrangements, and more comprehensive coverage

in fire protection; and,

(b) continuation of incentive payments on the basis of their value in education and demonstration;

(4) extension and policy orientation:

To achieve improvement in management and productivity among major groups of owners and ownerships and on most of the forested acreage in small ownerships, long-range actions should be aimed at relatively small ownerships, to a large extent presently held by aged owners who live in rural areas on or near their land, and who are occupied at least partly in agriculture. For immediate results and the benefit of such results in demonstrative effect on other owners, immediate effort in some actions may be best concentrated among owners in higher-income occupations, many of whom are urban residents and do not live on their land, and particularly to such owners having larger, more productive forest acreages. In view of the apparent changes underway in land use, management intent, tenure situations related to the present aged characteristic of owners, and in the economics and techniques of timber production, frequent appraisals of program and action orientation appear in order.

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APPENDIX

APPENDIX A

EXPLANATION OF TERMS

Basal Area

Basal area was used as a measure of forest stocking. It is the sum of the cross-section area at breast height of trees on a given land area, expressed in terms of square feet per acre. Studies have indicated that for the southern pines the basal area remaining immediately following cuttings should be maintained relatively constant throughout the life of the stand, and approximately equal to the site index.

Desirable Species

For the determination of practice needs, the southern pine species adapted to the area (loblolly, longleaf, shortleaf and slash) were considered to be the species desirable on pine sites. This involved the assumption that, while some hardwoods should be grown in stands of pine, there is usually no management problem in maintaining hardwoods in the stand. On bottomland sites, desirable species include pine, red oak, sweet gum, and other species listed as desirable or acceptable for the site in the Timber Resource Review Guide for Timber Type Groups (5).

Forest

The definition of forest as applied in this study is the same as used in the Texas Forest Survey. Essentially, it means that the land must bear at least 10 percent stocking in terms of growing space occupied by trees of any species.

Forest Types

Forest lands were grouped into three types: pine-hardwood, upland hardwood and bottomland hardwood. Pine-hardwood stands are characterized by having 25 percent or more of the stand in pine species. Pine plantations were included in this type. Upland hardwoods are stands on upland areas having less than 25 percent of the stand in pine species, and usually poor to very poor in productivity. Bottomland hardwoods are stands on bottomland with less than 25 percent pine species; hardwood species are usually more adapted to such sites.

Growing Stock

This term refers to existing trees of desirable species for the site. For convenience in field measurements in this study, growing stock was further defined as including only trees of at least four inches diameter at breast height. Trees of smaller diameter were considered in a separate seedling-sapling stand size group.

Interplanting

As used in this study, interplanting includes the practice of planting in open spaces of a partly stocked area, and also underplanting in areas stocked with undesirable hardwoods.

Maintenance of Species Composition

The objective is to maintain the more valuable pines or other desirable species in the stand. However, almost any opening made in the forest canopy tends to result in an increase in the hardwood proportion. Maintenance of composition is therefore a relative concept with reference to effects of cutting. It was assumed in this study to be the same in effect as would ordinarily result from a silviculturally good cutting.

Management

The terms "management" and "timber management" as applied in this study refer in almost all instances to the forestry concept of management, which is the application of silvicultural and other techniques in the treatment, control or manipulation of forest stands to achieve the desired yield of timber products. References to degree or quality of management are all in the forest management concept. In the few instances where the term "management" refers to the economist's decision-making concept, the term is used explicitly in connection with decision-making or use of the operator's time.

Ownership Size Groups

Large, medium and small size groups were defined for the purposes of the over-all ownership research project. Ownerships of more than 50,000 acres were classified as large, those with 5,001 to 50,000 acres as medium, and ownerships with 21 to 5,000 acres were classed as small ownerships.

Positive Effort by Owner

This was considered to be evident when a practice was applied with obvious intent to improve the timber stand. Instances where considerable reproduction or seed source in the form of unmerchantable trees remained following an undesirable liquidation cutting were not construed as positive effort unless other evidence of practices indicated that the owner intended to maintain or improve productivity. Likewise, absence of injury by livestock or from woods burning were not considered to be evidence of positive effort if other needed practices had not been initiated.

Productivity

The concept of productivity refers to the ability of a given timber stand to utilize growing space in the production of wood of desirable species. It was measured and expressed in terms of degree of stocking, which is the extent that growing space is occupied by growing stock trees or has seed source and seed bed conditions favorable for reproduction where needed (see definitions of stocking and growing stock).

Reforestation

This term ordinarily means the re-stocking by planting of land which had previously been forested. However, some of such areas become reforested naturally from adjacent seed trees.

Species Composition

This refers to the proportions of the stand made up by the various species.

Stocking

Stocking is related to productivity, and, as used here, it refers to the proportion of forest land area occupied by trees of desirable species. Basal area as determined by a series of prism observations was used to measure stocking and to rate productivity. To leave a minimum average basal area of 80 square feet per acre in trees of four inches d.b.h. and larger was considered the desirable practice on good sites in thinning operations. Where reporduction was found needed, the degree to which the area was additionally stocked by seedlings and saplings or portentially stocked by provision for seed source and seed bed was estimated to the nearest 10 percent and considered in rating productivity. The Timber Resource Review Guide for Timber Type Groups was used in

making these observations. Stocking classes and corresponding productivity ratings were applied as follows:

Stocking percent	Productivity rating
90 - 100	Excellent
70 - 89	Good
40 - 69	Fair
10 - 39	Poor
0 - 9	Very Poor

Site Index

Site index is a measure of the productive capacity of the forest site. It is determined and expressed in terms of the average height of dominant and co-dominant trees in the stand at a given age. As such, it takes into account the influences on growth from all factors. As an example of the usual expression of site quality in the South, a site index of 90 means that 90 feet of height growth can be expected in 50 years.

Supersession and Operational Costs

The cost of any practice which has the result of improving timber productivity is necessarily long-term in expected returns, and may properly be considered as investment. However, for the purposes of this study, costs of this nature are classed into supersession costs and operational costs. Supersession cost is purely investment in nature, defined as the cost involved in converting from other land use to timber production, or from a poor to a high level of timber production, and limited to situations where profit can be expected only in a planning period extending beyond that of the owner. An operational cost is of that type

which would be intermediate in a managed stand, such as for a hardwood control measure, and would ordinarily be profitable during the planning period (usually the life) of the owner.

APPENDIX B

FOREST RANGE USE CRITERIA

Guides used for observation and classification of forest range use and degree of injury to the timber stand and site are as follows. The occurrence of grazing use in rather definite patterns and types and the relatively easy recognition of light or no use and heavy use contributed to objectivity in classification. Observations were made throughout the forest area, with close examinations on the basis of the criteria at the timber sampling points.

Injury Caused by Livestock

No Injury. There must have been no recent injury in any amount sufficient to prevent normal development of an adequate stand of desirable reproduction, where it is needed. The effects of trampling, soil compaction, or erosion should not be excessive and not worse than that considered to be typical of moderate grazing use. Evidence of unavoidable injury of trampling on very small areas, such as salting or watering places, should not be considered as injury.

Light. Injury is slight, but sufficient to prevent normal development of an adequate stand of reproduction where it is needed. From one to five percent of an adequate stand of desirable seedlings have been destroyed or prevented from developing where needed on the forest area grazed. Excessive trampling, soil erosion, and soil compaction as a result of grazing may exist, but on not more than 10 percent of the forest area grazed.

Medium. From five to ten percent of an adequate stand of desirable species have been destroyed or prevented from developing where needed on the forest area grazed. Excessive compaction, trampling and soil erosion exists on 10 to 20 percent of the area grazed.

Heavy. Eleven percent or more of desirable reproduction has been destroyed or prevented from developing where needed on the forest area grazed. Extensive trampling, compaction and soil erosion has resulted on more than 20 percent of the area grazed. A heavy range use condition exists.

Forage Use

Forest range use in terms of forage use refers to the average utilization of forest range forage, as indicated by conditions on the forest area. It should be based on the probable use in a year of average rainfall and growth. Below are general descriptions of classes of use. "Poor" and "good" plants are as listed on page four of Extension Service Bulletin 236, "Range Plants of Texas".

Light. Light use may include no apparent use. If grazed, only the best or most palatable plants are used. Average height of good grasses such as big and little bluestems, Indiangrass, switchgrass and longleaf uniola is more than five inches at end of grazing season. Less than half of yearly growth of these grasses is utilized. More than 20 percent of seed heads of these grasses remain or are developing. There is little or no evidence of browsing of unpalatable woody species such as pines, oaks, elms, or yaupon. There is very little or no evidence of trampling, compaction or erosion as a result of grazing.

Moderate. This constitutes proper use; that is, what is believed by range specialists to be the maximum use commensurate with maintenance of range conditions. Of the tall grasses, an average height of about five inches and from 10 to 20 percent of the seed heads remain at the end of the grazing season. About half of the year's growth is utilized. There is very little evidence of browsing of unpalatable woody species. Compaction, trampling, or erosion as a result of grazing are not excessive; occurrence of such conditions is spotted, and lacking over most of the area grazed.

Heavy. The range has a clipped, very closely grazed appearance. Less than five inches average height of good tall grasses remain. Poorer plants are carrying most of the grazing load. Less than 10 percent of seed heads of the good grasses remain at end of season. Invasion by the poor grasses and unpalatable forbs such as yankeeweed, bull nettle and bitterweed is evident. Extensive browsing on unpalatable woody species is evident. Excessive trampling, compaction and erosion damage exists. NOTE: In areas where prostrate forage plants such as carpet grass and common lespedeza predominate, range use must be judged on the basis of presence of unpalatable invasion-type for forbs and poor grasses, on extent of browsing of more unpalatable species, and on degree of compaction, trampling and erosion, rather than on the basis of remaining number of seed heads, or height of remaining forage.

APPENDIX C

CUTTING PRACTICE TYPE AND QUALITY CRITERIA

Types of Cutting

On the basis of data obtained by interview and observations on the cutting areas, the type of cutting on each ownership was classified by a forester. They were typed primarily on the basis of cutting, which included considerations of kind of products removed, quality of selection practiced and original condition of the stand with respect to maturity and silvicultural need for cutting. Factors which permitted ease in classification were that good practices were so scarce as to be outstanding and readily classified, and that almost all other cuttings fell into readily identified types that are common to the cutting and marketing customs of the area. Type classes are described below in general order of silvicultural desirability.

1. Silviculturally desirable crop tree harvest or improvement cutting of sawlogs or poles.

2. Silviculturally desirable pulpwood or post thinning.

3. Improvement cutting of low quality hardwoods. Cutting of this type had been done on only two percent of the ownerships. This type of cutting results in improvement in productivity and species composition.

4. Non-cut and merchantable, but with no cutting needed. Conditions of this type were considered to constitute proper cutting control.

5. Non-cut but merchantable, with improvement cutting needed. Owners with stands of this condition were considered to be practicing some cutting control.

6. Minimum diameter limit of not less than 12 inches. Although they are not desirably selective in nature, cuttings of this type represent considerable cutting control and intent of the owner to maintain the stand and grow products of higher value and in greater volume. The quality of cutting practice of this type would depend somewhat on the stocking and size distribution before and after cutting. Most of them resulted in leaving the stand fairly productive with no serious deterioration.

7. Other partial cuttings not silviculturally desirable. Included in this class were mine prop cuttings not silviculturally desirable, high grading for poles or piling in young stands, heavy pulpwood thinnings, unnecessarily heavy salvage cuttings and partial cuttings for pasture openings. In all such cuttings, some merchantable timber remained. They were not liquidation cuttings and in most cases the stand was left fairly productive. A few had serious reduction in productivity and deterioration of composition.

8. Cuttings of all sawtimber, or minimum diameter limit of less than 12 inches. Some of these were partial cuttings, but they were generally less desirable than those listed above. The productivity and change in productivity resulting from cuttings of this type depended to a great extent on the nature of the stand before cutting. In a few cases, comprising about 13 percent of ownerships with cuttings of this type, productivity following the cutting was found to be good, with little

deterioration in composition. Some left the stand in a fairly productive condition, but most cuttings of this type were found to result in serious deterioration of composition and reduction in productivity.

9. All merchantable timber, but some seed source remaining. Liquidation cuttings of this type had some seed source remaining in adjacent non-cut areas or non-merchantable trees. Such seed sources were found to be inadequate and in most cases productivity was poor. About one fifth of cuttings of this type resulted in a fair degree of productivity.

10. All merchantable timber with no seed source remaining. Cuttings of this type were liquidation cuttings which left no seed source and usually very little reproduction. Most cuttings of all merchantable timber resulted in a stocking of less than 40 percent, or below a fair degree of productivity.

11. Non-cut and non-merchantable. Ownerships of this status were not rated on cutting practice. Unless other needed practices had been initiated, management of such ownerships was considered to be typical of the cutting practice previous to the ten-year period. Practically all rated poor to very poor in management.

12. Recently acquired and non-cut. On ownerships of this classification, no cutting practice rating was assigned. There were very few in the sample. Management was based on performance of other practices, including forbearance from cutting where it existed.

Cutting Practice Rating

The type of cutting is generally indicative of the quality of the cutting practice in terms of silvicultural desirability. However, the additional criteria of productivity and species composition (defined in

Chapter I) are needed for more accurate measurement of silvicultural quality. To be silviculturally desirable, cuttings should be based on selection and removal of less desirable trees not needed in the stand for growing stock or seed source, and leaving more desirable trees for additional growth and crop trees. The removal of all merchantable timber is good practice only in final crop tree or seed tree harvests in even-aged management. Cuttings to a minimum diameter limit are not good because there is no selection practiced and superior fast growing trees are often removed rather than the less productive.

The principal requirements concerning species composition in rating cutting practice were that, in cuttings rated as excellent, composition must have been maintained to the extent possible through adequate stocking or seed source and seed bed conditions, and that cuttings of fair quality must have resulted or tended to result in at least a fair degree of productivity, and this could not have had much adverse effect on composition. Actually, some areas with cuttings of fair quality were found to be maintained in composition to the same degree as in cases of good to excellent cuttings.

Taking into account the basis of cutting and effects on productivity and species composition, cuttings were grouped into the five ratings described below.

Excellent. Excellent cuttings included silviculturally desirable harvest, thinning or improvement cuttings. Desirable selection must have been practiced where required and the stand must have been left adequately stocked and maintained or improved in composition.

Good. Good cuttings were silviculturally desirable in nature and of the same type as excellent, but were at fault in the selection practiced or because of reduction below a well-stocked condition.

Fair. Fair cuttings mush have shown evidence of intent to maintain the stand in at least a fairly productive condition. Diameter limit cuttings to not less than 12 inches were typical of this class.

Poor. Poor cuttings were characterized by great reduction in productivity and deterioration of stand composition. From 10 to 39 percent stocking remained after the cutting. They included cuttings of all merchantable, and some cuttings of all sawlogs.

Destructive. These cuttings involved the removal of all merchantable timber, with such a lack of reproduction or provision for reproduction that less than 10 percent of stocking of desirable species could be expected to result.

Quality of Cutting Types

The listed cutting types one through five were rated as good to excellent in cutting practice. Most of types six and seven were rated as fair. Most of types eight and none were rated as poor, and type 10 rated from poor to destructive. An additional conditional rating was used in some of the cutting practices of types eight, nine and 10. In these cases, the stand following cuttings of all or almost all merchantable timber remained fairly productive because fortunate natural circumstances had provided reproduction or a considerable remnant stand, but apparently through no intent of the owner to exercise cutting control. Unless some positive effort in other essential practices had been performed, such a cutting practice was considered to be poor as a factor

in quality of timber management. This was done under the assumption that, with a continuance of the existing level of management and type of cutting on the ownership, a destructive recurrence of this type of cutting would be likely. On almost all of these ownerships, no effort in other practices was in evidence.

APPENDIX D

TIMBER MANAGEMENT RATING INDEX

Excellent Management

This requires initiation of all silviculturally desirable practices necessary to improve species composition and stocking to full practical productivity of the land, or to maintain the stand at that level (the level attainable by application of practices now practical in the area, including the five practices defined as essential).

Typical Conditions

A. Excellent cutting practice; adequate provision for regeneration including initiation of interplanting where needed; all needed practices initiated; no injury by livestock; not more than five percent average annual burn.

B. No cutting practice rating; ordinarily, timber is merchantable but not in need of cutting; other conditions as under A.

Good Management

The composite effect of practices tends to improve the stand toward full practical productivity or to maintain it at a high level of production, but not all practices as required under excellent management have been initiated. Ordinarily, cutting must have been silviculturally desirable, and composition maintained.

Typical Conditions

A. Excellent cutting practice; some effort toward management evidenced by substantial provision for regeneration or initiation of hardwood control, but neglect shown in one of these practices or in fire protection or control of grazing.

B. Good cutting practice; other conditions as under excellent management.

C. No cutting practice rating; subordinate to excellent in that there is need for cutting, or in that other practice conditions are as in A, immediately above. Ordinarily, timber is merchantable.

Fair Management

This level of management requires some positive effort and is the minimum required to maintain the stand in a fairly productive state. It ranks below good quality because of the limitation on productivity caused by such factors as lack of good cutting practice, failure to undertake other essential practice needed, or excessive damage from grazing use or frequent burning. The combined effect of cutting and other practices will not allow further deterioration of the stand, and will result in a fair degree of stocking.

Typical Conditions

A. Good cutting practice; stand remains in serious need of hardwood control and provision for regeneration, but no positive effort in either practice; damage from woods burning or injury by livestock may be excessive.

B. Fair cutting practice; very serious problem existing in regeneration or hardwood competition; failure to apply one or more of the practices of stand improvement, provision for regeneration, fire protection, or grazing control; the limited application of practices is evident to the extent that the stand will be maintained at a fair degree of stocking.

C. No cutting practice; timber may be merchantable and a cutting operation may be needed; other conditions as in B immediately above.

Poor Management

Poor management is essentially a "not managed" classification, ordinarily characterized by liquidation cutting, deterioration of the timber stand, and lack of any positive effort to maintain productivity. It differs from the next lower level mainly in that some means of regeneration remains and a higher degree of stocking (at least 10 percent) exists or can be expected to result.

Typical Conditions

A. Fair cutting practice; no stand improvement; no positive effort to provide for regeneration; excessive damage from heavy grazing use or woods burning, or both.

B. Poor cutting practice; no stand improvement; no effort to provide for regeneration; woods burning and injury by livestock may be excessive.

C. No cutting practice rating; no stand improvement; no effort to provide for regeneration; under present level

of management, stand development on the forest area is limited by effects of lack of seed source, hardwood competition, overgrazing or frequent burning to a stocking of from 10 to 39 percent.

Very Poor Management

This is destructive use of the forest, characterized by the cutting of all merchantable timber and leaving the area without means for regeneration. Under present conditions of use on the ownership, less than 10 percent stocking of desirable species has resulted or can be expected to result, or stand will degenerate to unproductive upland hardwood type.

Typical Conditions

A. Poor or destructive cutting practice; no stand improvement; no provision for regeneration; typically the situation of unproductive upland hardwood timber unable to regenerate naturally to pine species because of lack of seed source, hardwood competition, overgrazing or frequent burning.

B. No cutting practice rating; other conditions as under A.

VITA

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