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Private Nonindustrial Ownership of Forest Land: An Economic Theory of Owner Motivation and Management Intensity

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PRIVATE NONINDUSTRIAL OWNERSHIP OF FOREST LAND

An Economic Theory of Owner Motivation and Management Intensity

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PREFACE

THIS study reformulates the so-called small woodland owner problem in terms of its fundamental economic realities. The prime objective is to identify determinants of forest management intensity on nonindustrial holdings from the viewpoint of economic theory and in agreement with such facts as are now available in a multiplicity of published empirical studies. Essentially the approach is deductive. Beginning with a critical analysis of the nonindustrial situation, factual evidence relating to woodland owner behavior and action is then reinterpreted in the light of established economic theory, from which conclusions and recommendations with respect to problem solutions are drawn.

The first three sections analyze what is now known about the nonindustrial owner situation. The first is introductory; the second ,describes two groups of research studies, one relating ownership characteristics to management practices, the other investigating economic influences on timber production; and the third critically reviews these studies to reveal strengths and weaknesses and to appropriate nature of further research directed toward understanding how owners decide on degree of management intensity to be practiced.

The nonindustrial owner situation thus pondered, the fourth section elaborates a theory of determination of nonindustrial forest management intensity based on relevant theories of capital and investment. The purpose of developing this theory is to provide a framework for evaluating empirical evidence and to thereby·increase understanding of the fundamental motivating forces governing decisions to intensify management.

The last section illustrates the relevance of theory to current policy issues for promoting and encouraging more intensive management by nonindustrial owners.

The deductive form of analysis was adopted because the nonindustrial owner situation had developed to the point where further empirical investigation of ownership characteristics and management practices seemed futile. A cogent interpretation of available evidence, rather than accumulation of additional data, appeared most urgent in seeking a correct solution to the nonindustrial problem situation.

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ABSTRACT

THIS study separates the public *goal* of increased timber production from the *problem* of getting higher production and largely divorces the latter from the so-called small owner situation.

The study begins with a critical analysis of nonindustrial forest ownership research. This analysis shows that problem formulations generally have been incomplete, a theoretically sound explanation as to why most nonindustrial owners practice a low level of management intensity has not been elaborated, and economic evidence pointing toward such an explanation has largely been overlooked.

An economic theory of owner motivation in relation to intensity of management practiced is developed. Economic alternatives facing forest-land owners include consumption, investment in forestry, or investment in nonforest alternatives. Owners, pursuing positive returns, allocate capital among those alternatives where rates of return are greatest in order to meet goals efficiently. According to this theory owners intensify forest practices when expected rates of return equal or exceed the maximum rate of return from the same capital if invested in a nonforestry alternative, allowing for estimated differences in risk, additional tax on new income, other transfer costs, and adjustment for subjective values realizable.

The primary econon1ic determinant of management intensity is the alternative rate of return, an index that epitomizes owner decisions to accept or reject new investment opportunities, which reflects owner economic situations, objectives in using capital resources, and knowledge of alternative investment opportunities.

Public programs to stimulate aggregate forest investtnent toward a higher level of output need to be reoriented in accord with the fundamental investment character of forestry. Priorities among owner classes also need to be recognized so that the goal of an optimum timber supply can be achieved econon1.ically. Priorities should be based not alone on physical productivity but also on relative owner ability within classes to hold and accumulate growing-stock capital to higher levels and to allocate savings or investn1ent funds voluntarily into forestry enterprises.

Public programs should be channeled first toward public holdings, second toward industrial holdings, and last toward nonindustrial lands. Appropriate program measures, in accord with priorities, include full development on public lands of all forest investment opportunities where expected earning rates equal or exceed the public's minimum acceptable earning rate. Measures for industrial holdings include those designed to raise expected earning rates of currently unattractive opportunities above industrial guiding rates of return. Measures for nonindustrial holdings should be directed only toward those owners who can afford to practice forestry and should be designed to inform them of profitable possibilities, improve current earning rates, or favor reduced alternative rates of return. Measures to accomplish these objectives \'lith respect to nonindustrial owners are outlined and discussed.

A PROBLEM SITUATION AMONG NON-INDUSTRIAL OWNERS OF FOREST LAND

TO what extent can the nonindustrial[1] owner of forest land afford to practice forestry? This is the real question at the heart of the so-called small or non-industrial owner situation in American forestry today.

The question is seldom formulated in economic terms, and it is doubtful whether many of those directly concerned have considered the situation from a rigorous economic standpoint. Many opinions of the situation are incomplete, being based primarily on physical evidence and analyses of physical data. This is not surprising, for research has largely neglected the economic aspect and focused instead on physical, sociological, and even psychological factors.

THE NONINDUSTRIAL OWNER SITUATION

To appreciate fully the contribution of forest economics research toward an understanding of management intensities practiced by nonindustrial owners, a critical examination of the nonindustrial owner situation is necessary. This examination includes a brief review of development of awareness of the present situation and a look at what has happened.

Using the 20/20 vision of hindsight, one can trace the beginnings of national awareness back to the period immediately following the first World War. At this time, national attention was focused on the condition of privately owned forest land and the alleged unwillingness or inability of private owners to apply forest practices on their lands *(G,2* Dana 1956).

Attention was centered primarily on industrial owners of forest land. Outgrowths of this attention were separate but similar drives by the Forest Service and the Society of American Foresters to establish public regulation of cutting on privately owned forest lands. Although both drives proved abortive, the significant point is that since then, private forest-land owners have continuously had the spotlight of national opinion focused on them.

In light of progress 111ade by industrial owners during the last two decades

1. The term "nonindustrial," as used herein, refers to private owners who do not own timber processing facilities. This group, therefore, includes all so-called small owners-those having less than 5,000 acres of commercial forest land-as well as those having more, so long as no processing plant is involved.

2. The capital letter in italics refers to the corresponding category in the bibliography, where references are grouped according to kind of contribution to knowledge of the nonindustrial owner situation.

in voluntarily improving forest practices on their holdings, most observers concede that economic conditions had prevented these owners from earlier adoption of utopian, though unprofitable (at the time) practices advocated by well-meaning idealists.

That history repeats itself is a truism, but the course of human events could be much smoother if lessons taught by history were scrutinized more carefully with hindsight's clearer vision. The nonindustrial ownership situation today illustrates the point. While the owner class on whom attention is centered today is less inclusive than 40 years ago, many similarities are apparent in what is claimed to be the nature of the difficulty and in the remedies advocated to solve a problem inadequately diagnosed.

The Forest Service during the last two decades has repeatedly defined the problem situation in terms of the small private owner segment (those owning less than 5,000 acres of commercial forest land). In hearings before the Joint Congressional Committee on Forestry established in 1938, the Forest Service stated, ". . . the crux of the Nation's forest problem lies in commercial forest lands in private ownership, and the uncontrolled exploitation of these lands" (*G,* Dana 1956). This substantially expressed the official position held since the early 1920's. The committee reiterated this viewpoint in its report to Congress in 1941 by concluding that the Nation's major forest problem was centered in privately held commercial forest lands.

Following major reappraisal of the country's forest situation in 1945, the Forest Service summarized and highlighted its findings (*B,* 1948) with respect to ownership by noting that the country's forest problem centered mainly on private land. After declaring that private forests needed much better protection and acknowledging that some encouraging progress had been made in timber-cutting practices on some of the large private holdings, the report indicated that the small private holding was the critical factor and that bringing this segment under good management was ". . . one of the knottiest problems in American forestry." Emphasizing that this would be difficult of achievement, the report noted that major obstacles to better management were to be found in the great number and small size of holdings, the diversity of aims and lack of skill on the part of owners, instability of tenure, and lack of capital and pressure for current income.

This thinking was more sharply focused in findings of the Timber Resource Review begun by the Forest Service in 1952. In the final report (*B,* 1958b) of this comprehensive analysis, forest productivity was said to be poorest on the many small farm and "other" (primarily nonindustrial) holdings throughout

the country. Furthermore, the report noted that the key to adequate timber supplies in the future lay with the 4.5 million farm and "other" private holdings. This class of holdings was said to control well over half the Nation's commercial timber land, and, therefore, must continue to supply a substantial portion of the raw materials for forest industry.

This view was further expressed in later Forest Service releases, most of which were based on findings of the Timber Resource Review. A few such comments follow:

> Farm forests rank well below other ownership groups in productivity . . . (*G*, U.S. Forest Service 1958).
>
> Productivity of recently cut lands held by "other" private owners . . . is appreciably better than the average farm holding but much below that on forest industry and public holdings (*G*, U.S. Forest Service 1958).
>
> Because farm and other private ownerships are large in acreage and potential growth, and are in poorest cutover condition, they unquestionably hold the key to adequate future timber supplies (*G*, U.S. Forest Service 1958).
>
> The condition of recently cut land is relatively poor on small ownerships (*G*, U.S. Forest Service 1958).
>
> The poor condition of most small forests reflects past overcutting and lack of care, and a need for better management in the future. . . . these holdings in general are more accessible and of relatively higher site quality than larger ownerships. Consequently, they have large potential importance. Potential demands for timber are so high that small forests must be used to help supply the Nation's future timber needs. Because of their large number, wide distribution, and depleted condition, small ownerships present a major challenge for American Forestry (*G*, U.S. Forest Service 1958).
>
> Foresters have been talking for years about the small-woodlot problem, but not too much seems to get done about them—at least in relation to what is needed. . . . The facts are well known. . . . One-half of our future timber will have to come from small forest properties. . . . Basically the physical forestry measures essential to put these lands in shape can only be bought, ordered, persuaded, or obtained by some combination of these three. One thing appears to be clear. Persuasion alone is not getting the job done fast enough. . . . The fateful decision here is whether men of policy and power will have the foresight and, if I may say so, the "guts" to partially compromise deepset philosophical convictions in order that these lands may contribute their essential share to our raw-material base (*G*, McArdle 1960).
>
> The real key to our future timber supply lies in the hands of those one-out-of-every-ten American families who own small forests (*G*, U.S. Forest Service 1960).

These quotations emphasize the distinct trend in Forest Service thinking, beginning with all private holdings, gradually narrowing this to the small pri-

vate segment, refining this to farm and other, and finally singling out the *average* farm holding as exhibiting the *relatively* poorest forest conditions on *recently cut* portions.

So much for the Forest Service position. What about that taken by private owners?

Because of widely apparent effects of their operating policies, the larger industrial timberland owners were first to find themselves in the spotlight of public opinion early in the 20th century. With their attention centered on product markets, where dollar votes sho\ved they were serving the Nation's demand satisfactorily, industrial owners were startled by a spotlight suddenly focused on the result of their activities-thousands of acres of denuded, tax-delinquent lands. Immediately they were forced into a defensive position. Industry spokesmen and organizations, recovering from initial surprise at the attack, argued they were economically unable to do otherwise. Vast remaining reserves of untapped timber made growing of new forests and paying of taxes and fire protection costs on denuded land a burden that could only be assumed by public owners, to whom the level of expected rates of return on current capital outlays was less critical. During the 1920'S and into the 1930's, industrial owners went through a period of soul searching, attempting to determine if tuodified cutting practices might be adopted since this was the biggestfactor in criticism of their actions and the most effective change that could be made to \vard off the threat of public regulation (G, Compton 1960).

By World War II and thereafter, dwindling timber supplies, greatly increased stumpage values, and expectation of favorable rates of return on timber-growing investments combined to make forestry an attractive investment alternative for larger owners, particularly those whose holdings were integrated with processing facilities. Now that these owners have established a fairly high standard of fire protection on their lands and now command. sufficient capital to carry out intensive forest management programs to economic advantage, their holdings have ceased to be a cause for public concern. While industry in general can point with pride to its accomplishments in forestry, it is among larger owners that the most outstanding examples of intensive forest Inanagement are to be found today.

Smaller private owners, and especially nonindustrial owners, have not made such progressive strides, and it will be shown later that this is understandable from an economic viewpoint. But these owners now bear the brunt of public opinion. Some important improvements are becoming evident, however, due to both public and private efforts.

Public effort in behalf of nonindustrial private owners has been most notable as carried out by the Division of State and Private Forestry of the Forest Service in cooperation with state forestry organizations under the Cooperative Forest Management Act of 1950. Soil Conservation Service and Extension Service activities and a number of individual county forestry programs are also producing tangible results. Generally, public efforts include provision of free technical advice and some service, production of planting stock to be sold at cost to landowners, sharing of cost of certain management activities, and demonstration of results that can be obtained through intensification of management. Accumulating evidence (presented in later sections) indicates these efforts have interested only a small nucleus of nonindustrial owners in timber growing, often for reasons other than making a profit from sale of stumpage.

Efforts by private industry to assist nonindustrial owners, though begun much later than public efforts, have shown similar results. Such industry-sponsored programs as Tree Farms and Tree Farm Families, More Trees for America, and the Southern Pulpwood Conservation Association, have as their objective promoting more intensive forestry among nonindustrial owners. A growing awareness among individual companies and associations representing various segments of the industry that a substantial part of future wood supplies may have to come from nonindustrial owners has led to such developments as tree farm families and supplying interested owners with the services of a technically trained forester. Some nonindustrial owners have also begun to avail themselves of services of consulting foresters. Others have found it advantageous to lease their holdings for productive management by wood-using firms.

All such efforts, both public and private, are exerting a moderating influence on the nonindustrial owner situation, although the great number of these holdings and their generally poor condition from which to begin making improvements combine to obscure whatever progress has been made.

The American Forestry Association did not participate in the private owner controversy. Pursuing somewhat of a middle-of-the-road policy, the Association avoided viewing with alarm the status of management on private lands. But neither, on the other hand, did it belittle the existence of a problem. The Association did not join with either the Forest Service or the Society of American Foresters in advocating public control of private cutting. The Association apparently recognized that prevailing economic conditions prevented private owners from managing their timberlands more conservatively. Furthermore, the Association seemed to foresee the abatement of these conditions and the

alleged need for public regulation (B, \Voods 1946). And this is what actually occurred.

The Forest Service, meanwhile, began to experience the effect of changing economic circumstances. Dependent upon Congress for operating funds and facing increasing demand for public timber, the Forest Service finds itself today hard pressed to keep up with its timber sale business and, in many cases, unable to carry out the type and degree of intensive management now being applied by the most progressive industrial owners. In terms of capital outlay per acre for practices such as seeding, planting, thinning, advance road layout, salvage of old-growth mortality, extra fire protection beyond minimum legal requirements, and insect and disease protection, some industrial owners undoubtedly equal, if not surpass, public efforts in forest management.

These industrial owners now find themselves in a position of strength from which to ask that the Forest Service exert more effort toward putting its own house in order and be less concerned about private owners. They contend that economic conditions and a sense of enlightened self-interest will bring about further improvements ()n nonindustrial lands. Continued educational assistance from Government is welcomed; direct intervention is not.

THE NEED FOR RESEARCH-BASED ANSWERS

A statement of the Forest Service position on the nonindustrial owner situation appeared in a paper delivered during the 1960 Fifth World Forestry Congress (D, Barrett 1960). In addition to restating thinking expressed in the Timber Resource Review and conclusions drawn therein, Barrett discussed general features of a small owner program designed to produce 52 billion board feet of sawtimber annually from small holdings by the year 2000. The Timber Resource Review forecasted a deficiency of softwood sawtimber in 2000 unless small holdings were made to yield more than they were producing in 1952. Barrett outlined several means for obtaining increased yields trom these holdings and concluded the most feasible method consisted of a greatly intensified program of persuasion and direct financial assistance.

Such a program. seems implicitly to assume that. (I) small owners are able to invest in forestry, at least to the extent that costs are not completely covered by Federal financial assistance, and (2) acceptable ways can be found to assure that public-private investment on nonindustrial holdings will be maintained and renewed, so as to result in an increased timber supply in 2000. Use of persuasion and financial assistance appears founded on the following explicit presumption:

> . . . a surprisingly large proportion of the area in small ownership is held because of timber values, but the proportion of area on which one or more forest practices have been applied is about one-half the area held for timber values. This comparison implies that an immediate and substantial opportunity exists for building up timber supplies by intensifying the relatively passive interest in timber values to a willingness to undertake forestry programs (D, Barrett 1960).

The stated implication does not follow necessarily. The comparison suggests a *possibility* for increasing timber supplies but not the *opportunity* to do so. Willingness to invest depends not alone on the presence of an investment opportunity, but much more decidedly on ability of owners to accumulate and hold capital and their inclination to choose one particular type of investment over another. Ability to accumulate and hold capital is the basic economic assumption on which a program of persuasion and financial assistance must rest, but this assumption has never been thoroughly examined. Experience through much of the Nation questions the validity of this assumption. An overwhelming majority of small owners do not practice forestry. Even during the last 10 years under the Cooperative Forest Management Act, number of owners persuaded and progress achieved are very small in relation to the magnitude of untouched ownerships and conditions thereon. A greatly stepped-up program of persuasion and financial assistance, therefore, might not be capable of attaining the goals outlined by Mr. Barrett in the time available to do the job, the rate at which progress has been achieved so far.

The program outlined by Barrett was developed from suggestions drawn from a series of meetings where small owner attendance appeared to consist chiefly of those reached by service foresters. Thus, the proposed program apparently was founded on views of those already interested in and practicing forestry of some sort on their holdings. A program designed with wants of this group in mind, however, would not appear suited to the needs of those to whom it would be directed-the vast majority of small owners not yet interested in nor practicing forestry of any sort.

Lack of complete evidence with respect to the nonindustrial owner situation has resulted in inadequate problem formulation. The real problem to be examined is not how to persuade nonindustrial owners to practice more forestry, for the purpose of supplying the Nation's future needs for timber, but whether these owners can, in fact, afford to practice more intensive forestry. If their capacity to do so is severely restricted because of economic limitations, for which there is a growing body of evidence (discussed in subsequent sections), then

half the Nation's timber needs may have to be met from sources other than nonindustrial holdings. Or else some approach other than persuasion and assistance as applied in the past will be required to stimulate owners to increase the intensity of management to a level beyond what ordinarily is economically attained.

The extent of nonindustrial holdings in the country, the status of timber production today in relation to projected needs, and the current public issue relating small holdings to future timber needs pose an important problem situation for forest economics research. Analysis of the nonindustrial owner situation is next developed on the basis of published literature, followed by consideration of the capital-intensive nature of forestry and of certain characteristics of nonindustrial owners. This analysis leads to elaboration of a theory to explain differences in the intensity with which nonindustrial woodlands are managed. With the insight provided by theory, some ideas are developed on the nature and suitability of program measures for stin1ulating the level of forestry investment on nonindustrial holdings.

RESEARCH CONCERNED WITH NONINDUSTRIAL OWNERS

OVER a decade ago, Duerr (*E,* 1948) observed that "farm woodlands have been the object of extensive educational and assistance efforts and the subject of a vast and ever-accumulating literature in forestry." In 1961 that statement still holds. It is even more cogent if applied to all nonindustrial holdings in this country. The rapid accumulation of literature betokens a flood. A thorough literature review was too unwieldy for the purpose of this project. Instead, a modified approach was adopted with the objective of distilling some degree of order from a "vast" amount of literature.

Three steps were involved in arranging the extensive accumulation of thought and empirical data pertaining to nonindustrial forest-land ownership. The first simplifying step was to group publications pertaining to nonindustrial owners into classes according to some criterion relevant to the objectives of this study. The second step was to review the more significant contributions to thought and knowledge of those groups most pertinent to this project. The third step, carried out in the next section, was to analyze critically studies reviewed in this section.

CLASSIFICATION OF LITERATURE

Anyone of several criteria could be used as a basis for classifying literature concerned with nonindustrial ownership of forest land. Consideration from the standpoint of purpose to be served in this project leads to selection of the following criterion: major contribution to knowledge made by each publication. Using this criterion, the following classification is specified and used in preparation of the bibliography:

A. Statistical analyses of ownership situation
   - Concerned primarily with ownership characteristics (Bibliography, section *A)*
   - Concerned both with ownership characteristics and related management practices (Bibliography, section *B)*
   - Concerned with methodology of conducting ownership studies (Bibliography, section C)

B. Pron10tion or encouragement of forest management
   - Generalized discussion of problems of promoting n1anagement (Bibliography, section D)

Specialized analysis of management problems
Economic problems
Production (Bibliography, section *E)*
Marketing (Bibliography, section F)
Technical problems; how-to-do-it manuals (not included in the bibliography)

The several categories are designed to be mutually exclusive; however, since application of this classification system rests on individual judgment, some disagreement might arise over assignment of a particular item to one group or another. Generally, selection of items for inclusion in the bibliography was governed by an endeavor to indicate the scope and tendency of studies in the two major categories. Final selection of items was based on informed judgment and some degree of fan1iliarity with literature in this field.

Under group A of the outline, only those studies concerned with owner characteristics and related management practices will be reviewed. Similarly in group B,only those studies concerned with economic aspects of production will be discussed. These reviews are specialized and do not purport to discuss each study from start to finish. The intent in each review is to reveal the general character of a study-what problem was investigated, the direction the investigation took, and the main conclusions reached. Discussions of methodology and specific findings are generally omitted. Critical commentary forms the substance of the third section, while some findings appear in the fourth section. This unconventional treatment results from the purpose served by the reviews, which is to show that the present unsatisfactory state of knowledge relating to nonindustrial owners and their· management practices is based partly on the nature of research on this subject and partly on analytical oversight that inadvertently failed to interpret and utilize empirical evidence to maximum advantage.

OWNERSHIP CHARACTERISTICS AND RELATED MANAGEMENT PRACTICES

Notwithstanding disparity in scope and type among studies under this heading, they can be grouped together because of similarity of the problem with which each was concerned. They described what owners had done and sought to find correlations between performance and various ownership characteristics.

Some of the earliest studies in this group were national in scope, but were primarily concerned with industrial private holdings. White *(G,* 1950) cited and discussed these.

Chamberlin et al. (B, 1945)

Beginning in the early 1940's, as discussed in the preceding section, national concern turned toward nonindustrial holdings. One of the first to examine both industrial and nonindustrial holdings was a southern region study, sections of which appeared in several published reports *(B,* Folweiler 1944, *B,* Folweiler and Vaux 1944). Chamberlin *et ale* authored a final report on the entire study, which was concerned with management practices of private owners in a particular timber type. The hypothesis used to guide the investigation can be paraphrased in these terms: Type and size of forestland ownership may have an effect on cutting practice and management policies.

After discussing type of ownership, certain aspects of management, and attitudes of owners, the authors defined a concept called pine stocking index (PSI). This was a combined measure of composition and density used to indicate the extent to which pine growing stock utilized a given sample point. This index was then used synonymously for such terms as pine productivity, forest practices, and forest management. Then in order to show for nonindustrial owners "the relationship between ownership class and the type of management, the data on forest productivity [PSI measurements] were classified under different categories and analyzed to determine the significant differences." The different categories were residence of owner, legal identity of owner, length of ownership, size of holding, ownership objective, and occupation of owner.

Residence "had no appreciable effect on pine productivity," although PSl was 3.6 for resident farm owners and 2.6 for nonfarm residents. Concerning legal identity, "a marked contrast in productivity" was found between individual male owners (PSI of 3.4) and nonindustrial corporate owners (PSI of 4.1). There was a slight increase in PSI (3.4 to 3.7) as length of ownership increased from 10 to 30 years, but it was "not great enough to assume that the management of forest lands under stable ownership [was] greatly superior to those under short time ownership." Size of holding "does not appear to have significant relationship to forest practice." Ownership objective "appears to have some relation to the PSI ... but this factor is less important than others" which are unspecified. Occupation shows "little correlation" with PSI, although "the professional group had the highest PSI [3.7], while ... the inactive group [retired] had the lowest [3.4]."

In two-thirds of the cases where owners expressed a negative attitude toward improved practices, they cited incompetency to carryon forest practices and inability to spare time necessary to do the work.

The authors refrained from "detailed discussion of these facts, or [making]

recommendations from them. The important things are self-evident, and where conditions should be changed anyone really interested can see what changes would help the situation." They then concluded that

> ... the facts heretofore presented *seem* to indicate that in the shortleaf-Ioblolly pine type of the South, past management practices were producing less than half of the pine which the land was capable of growing. .. Heavy cutting and fire have heen responsible for the low productivity at present indicated throughout the region.
>
> . . . one of the outstanding opportunities for improving forest practices [is] by increased education and well-placed and well-advertised demonstrations of proper forest cutting.

U.S. Forest Service (B, 1946): *Reappraisal Report NO.3*

A field survey throughout the United States in 1945 formed the basis for this report. The question asked was: What is the quality of management being applied to commercial forest lands of the country? The hypothesis tested appears to have been that quality of management is related to type and size class of ownership.

One of five defined cutting-practice ratings was assigned to each small holding, chosen by sampling methods, on which a recent cutting had been made, generally during the previous 5 years. Holdings on which no recent cutting had been done were classed as nonoperating and not rated. Character of timber cutting was then reported by three size classes of private holdings (small, medium, and large) and by four types of owners (farm, lumber company, pulp company, and other).

One of four recognized ratings of fire protection was given to each holding. Finally, four grades of management were defined based on combinations of cutting practice and fire protection ratings: intensive, extensive good and extensive fair, without management, and nonoperating. In presenting results of privately owned commercial forest land under management and under various combinations of poor practices, nonoperating areas were classed with those holdings receiving less than extensive management. No cutting for timber products was thus included in a category that was taken to imply poor management.

The report concluded that "throughout the country, it is the small ownerships, both farm and nonfarm, that get the worst treatment. The principal factor that puts these properties on the submanagement level is poor and destructive cutting practices."

In order for the Nation's forest lands to "yield wood products in a volume

and quality commensurate with needs determined on a reasonably generous basis," the report declared that

> . . . it will be necessary to bring most of the commercial forest lands of the United States under management. This does not imply that every acre of forest land must produce to its utmost. There is plenty of margin for the recognition of economic and physical limitations which make the highest order of management impracticable in many areas.

Recognizing that "obviously there is no simple, quick, and easy way to bring such a vast acreage of forest land under good management," the report recommended at least five major tasks that must be undertaken if the "reasonably generous" production goal (spelled out in another report) is to be met: more protection, more planting, stand improvement, waste reduction, and improved cutting practices. Better cutting practices were declared to be "the focal point of the management job ahead." Although recognizing the importance of the first four tasks, the study's final conclusion was that "our objective of forest products adequate for future needs will not be attained unless satisfactory cutting practices are applied by the 4¼ million private forest-land owners."

James et al. (B, *1951*); *Yoho* et al. (B, *1957*)

These two studies are discussed together because of their nearly identical nature. Both referred to Forest Service findings on status of management practices on small holdings in the United States as justification for conducting the studies. Yoho *et al.* found added support in the Forest Service preliminary report of the Timber Resource Review and the Stanford Research Institute study of 1954 for asserting that future timber needs will put increasing pressure on the Nation's forest lands, requiring greatly improved management practices to meet these needs.

The problem analyzed in both studies was: What role does forest-land ownership play in improving management practices? The implied working hypothesis was that management practices of owners are affected by

> . . . who the forest landowners are, how they group into different classes, how much forest land each group owns, how management differs between groups, and . . . some of the important pressures, needs, abilities, beliefs, and degrees of knowledge which mold the decisions of these owners (*B,* James 1951).

A nearly identical statement is found in Yoho *et al.*

James *et al.* rated management on the basis of cutting practice and fire protection, in a manner similar to the procedure used in the Forest Service Re-

appraisal Report. Yoho *et ale* omitted :fire protection. Both studies included under cutting practice such qualifications as frequency of harvest; agent in charge of management; grazing by livestock; and timber sale administration including supervision of cutting, marking trees for cutting, specifying diameter limit, and leaving merchantable trees.

Both studies used occupation as a primary basis for grouping owners for analysis of ownership characteristics and management practices. Both discussed attitudes of owners and objectives in holding forest land and then examined the relation between cutting practice and such owner characteristics as length of tenure, distance of owner's residence from forest property, management objective, and owner's concept of timber n1anagen1ent. Yoho *et ale* further examined age of o\vner, method of acquisition, and past and prospective family tenure.

James *et ale* concluded that the poor-to-destructive cutting practices followed by most owners were due to failure to supervise cutting, distance of residence frotn forest, and exploitive objectives and attitudes. To in1prove managelnent, they concluded that control by forest industries over their contractors' operating methods would be beneficial. Beyond this, they saw a need for vigorous public action in the form of education, assistance, and regulation. Based. on indications from the study, they also concluded that education and assistance would not accomplish immediate and rapid improvements, and that additional regulation was needed through strengthening of a Mississippi State harvesting act then providing mild regulation.

Yoho *et ale* concluded that distance from forest, length of family tenure, age of owner, and owner attitudes and objectives were related to cutting practices. No specific recommendations for achieving improved practices were offered, but the authors did offer several suggestions about possible causes underlying observed relations. They inferred that age of owner ties in with financial position, level of income, time preference of owner, and debt position. They also suggested that failure to better control cutting practices was due to demands of more profitable activities.

Mignery (B, 1956)

This was an intensive, localized, case study of eight owners who did and eight average owners who did not practice forestry in Nacogdoches County, Texas. The study was undertaken to answer the question: "Why do some small landowners practice forestry while the great majority fail to do so?" The implicit hypothesis was that ownership characteristics and forestry practices

are related. To "practice forestry" or, in other words, meet "standards of good management," an owner must have done substantial planting or improvement cutting, or taken fire protection measures of his own for at least 2 years. Various ownership characteristics were then compared between those who did and those who did not manage their holdings.

Having discussed the various types of forestry assistance available to small owners over a period of years and the efforts to promote forestry by a number of agencies, the author observed that

> After at least 25 years of forestry promotion, small landowners of Nacogdoches County, Texas, are still in the beginning stages of forest management. The county does not lack for woodland owners who have dabbled in forestry at one time or another, but sustained programs are still rare.

The study found that forest managers

> . . . derived substantial income from sources other than their woodlands and . . . in general were forward-looking, progressive men, successful in farming or business and respected in their community. Their total landholdings (forest and nonforest) were six times the average ownership in the county.

And their forest holdings were reasonably well stocked to begin with.

> Even with these advantages, they did not undertake management until professional foresters encouraged them to do so. Nearly all of them have received continuing assistance from public or private foresters.

The author ended with the observation, "It also seems that forestry programs can most fruitfully be directed toward owners with better than average assets, acreage, and timber growing stock."

Tennessee Valley Authority (B, 1956); *Seigworth* (B, 1958)

These two reports are discussed jointly since Seigworth's article was an analysis of the findings reported in the TVA bulletin resulting from case studies of 505 separate holdings. These cases were set up as forest management demonstration units beginning in 1941; cost records were then maintained on each unit from the time of its establishment. After several forest management surveys in the South had indicated an apparent need for better management on small holdings, the TVA study was initiated in 1955 to investigate why some properties were better managed than others. The apparent hypothesis was that certain characteristics of owners and properties influenced management practices.

Properties were classed as either satisfactorily or unsatisfactorily managed

if they passed two tests: (I) their management practices were clearly either satisfactory or unsatisfactory, according to a set of performance standards that evaluated several components of management including cutting budget, cutting system, logging methods, and fire control and (2) the total volume of desirable growing stock had clearly increased or decreased over the period for which records had been kept. Properties not clearly satisfactory or unsatisfactory in terms of these two tests were dropped from further scrutiny. Altogether, some 289 cases were included for further study. Comparisons between satisfactory and unsatisfactory management were developed for a number of characteristics.

Results can be sumlned up as follows:

> Chances for success seem best where there is pride of ownership and interest in long-term productive land management, where the forest resource hasn't been exploited or otherwise devastated too recently, and where the owner has a measure of economic stability.
>
> There.are also many indications that low income and financial difficulties were the main reason for unsatisfactory management. As a woodland manager, the otherwise efficient businessman was more successful than the inefficient businessman. Owners who improved their general economic status during the past ten years were more often successful woodland managers than those who did not. Those with unmortgaged property were more successful than those with mortgages. The best managers had the most tilnber and retained their property longer.
>
> These facts seenl to indicate that information, interest, and good intentions cannot insure good cutting practices by the lo\v-income, small woodland owner who lives from one financial crisis to the next.

Seigworth concluded that the biggest improvement in management could be obtained most rapidly if efforts of both public and private agencies were directed toward working with the most likely chances first. Ramke *(B, 1958)* illustrated how this thinking was actually carried out. Furthermore Seigworth suggested that development of a conservation ethic would also be necessary to obtain much improvement in management, instilling the idea that productive forest management is socially acceptable and a recognized thing to do. He recommended two lines of· action to develop this ethic: (I) instilling a broader scope of attitudes toward resources in general through the schools at all levels and (2) greatly increased forms of recognition for doing a good conservation job-more awards, prizes, and local and national acclaim.

U.S. Forest Service (B, *1958b): Tilnber Resource Review*

The second national survey of conditions on cutover lands conducted by the

Forest Service was carried out as part of a comprehensive analysis of forestry in the United States. This second survey differed in several notable respects from the first one, presented as Reappraisal Report NO.3 *(B,* U.S. Forest Service 1946). Whereas the latter appraised recently cut areas in terms of degree to which cutting methods and fire protection conformed to specific standards; the second survey discarded this procedure completely, based on the following reasoning:

> Appraisal of recently cut areas by classification of forest nlanagement practices was discarded because the Inethod requires adoption of questionable assumptions on the relation between future growth and various cutting practices, sustained yield, stand improvement, and other management measures.

By omitting such elements of management, the report recognized that "the study does not appraise the status of management." And it was "status of nlanagement" that the first survey specifically sought to evaluate.

Noting that "The current and future growth in volume of forests is greatly influenced by certain conditions of forest stands after cutting" and that "the productive condition of cutover lands has an important bearing upon future supplies and the capacity of ... areas to supply wood requirements in the years ahead," the study posed the problem of investigating the productive condition of recently cut forest land in the United States. A specific hypothesis was stated in these terms:

> Four n1ajor elen1ents ... exercise the greatest combined influence on current and prospective growth of timber in both quantity and quality. They are (a) existing stocking, (b) prospective stocking, (c) species composition, and (d) effect of felling age or premature cutting.

The report went on to state that "Quantitative standards were developed for each element based upon technical forestry information, but tempered by judgment as to practical attainability under current operating conditions and status of knowledge." A thorough analysis followed for each of the four concepts, and the procedure for combining the four elements into a productivity index was discussed in detail.

Results were presented in tern1S of a productivity index, grouped into three classes-upper, medium, and lower-in a number of cross classifications by size and type of ownership, geographical locations, and forest type group.

Conclusions with respect to nonindustrial holdings, particularly for those less than 5,000 acres in size, were that they exhibited the poorest conditions of

productivity. Deficiencies in stocking, poor composition, and premature cutting generally prevailed on this class of holdings.

Emphasis in the report was on presentation and analysis of findings. Recommendations based on these findings and specifically directed toward nonindustrial holdings were contained in the paper delivered by Barrett at the Fifth World Forestry Congress and discussed earlier.

McDermid et al. (B, *1959*)

A random sample of 51 owners were interviewed in a Louisiana parish in order to learn why most small tract owners have been slow to seize opportunities pointed out to them by conservationists concerning benefits to be had from timber growing. The apparent hypothesis is that characteristics of owners and their properties can explain the "gap between precept and performance. . . ." Data on a number of ownership characteristics were obtained and statistically analyzed in terms of distribution among owners practicing forestry. An owner "was considered an active forest manager if he had, singly or in combination, marked timber prior to sale, installed fire lanes, girdled or poisoned undesirable hardwoods, planted trees, or fenced to control grazing." Influences persuading an owner to practice forestry, sources of management assistance, and an owner's reasons for not practicing forestry were also examined.

Results are well summed up in the statement that

> This study reinforces others in indicating that landowners who undertake management programs do so on tracts of above-average size and stocking. It also appeared to the interviewers that owners who were making a start in forestry had generally more financial resources than the non-managers.
>
> These findings offer some suggestions for public and private agencies interested in further increasing the number of small-tract managers in the parish. First, appraisals of alternative land uses should be made to help landowners compare forestry with other enterprises. Those who have not even considered forestry should be given an understanding of what their woodlands might yield for them. Finally, depleted tracts require a substantial investment in remedial measures before they can become productive. Some private or public assistance, in addition to what is already available, may be needed before owners with very limited resources will begin managing.

Sutherland and Tubbs (B, *1959*)

Interviews with 180 small forest owners were obtained in central Wisconsin in order to show how forest productivity, shown by the Timber Resource Review to be lowest on such holdings, could be improved. The implied working hypothesis was that owner characteristics and attitudes toward forest land ex-

plain why owners adopt specific forest practices and respond to specific forestry programs. Data on ownership characteristics were obtained and these were discussed in conjunction with attitudes and actions of owners.

Very tentative conclusions were obtained in this study, as noted in this excerpt from the summary:

> Owner characteristics such as age, tenure, and method of acquisition were in some cases related to owner attitudes and practices, but in the majority of instances, relationships could not be demonstrated. It is difficult to point out the most important characteristics since some are significant in some aspects and not in others. However, occupation has an influence on many owner attitudes and may well be the most important characteristic. Age has some influence, as does size of forest tract. Other characteristics have limited significance in the total picture.

The uncertainty of these conclusions was partly caused by the fact that the study was conducted in an agricultural fringe area characterized by low incomes, a low average value for most holdings, and a net population migration out of the area.

Anderson (B, *1960)*

Another study concerned with identification of small landowners who practice forestry obtained data from 200 interviews regarding owner characteristics. The main hypothesis was that owners who practice forestry have certain common characteristics that correlate with their interest in forestry. Data obtained on owner characteristics included the identity of the landowner, description of his woodland, its use, whether forestry was considered profitable, and what practices were carried out. Those favorably disposed toward forestry were found to have four common characteristics: younger age, higher proportion of property forested, larger woodland, and had sold timber within the past 10 years. The study recommended use of anyone of the four characteristics to identify those owners likely to respond favorably to educational and assistance programs. "Sold timber recently" was further advocated as being the best single indicator because it was most closely associated with those likely to be practicing forestry.

McClay (B, 1961)

The two studies by Sutherland and Tubbs and Anderson were among nine studies, the combined results of which McClay summarized. The study by Webster and Stoltenberg *(E)* 1959) was also one of the nine and is reviewed

later (see p. 31). The common question in these studies was: What factors limit the productivity of small ownerships? The common hypothesis among these studies was that certain characteristics of owners and their attitudes toward public and private programs for improving management practices are correlated with adoption of specific practices. Conditions in the nine study areas varied widely, and the findings reflected this in that factors important in one area appeared less important in others. One objective of these studies was to identify important local factors for further intensive research. McClay discussed in general terms the findings on 17 different factors for which data were obtained and pointed out owner similarities and differences evidenced by the data. Strong implications of the importance of economic factors as motivating influences were revealed by findings on length of tenure, ratio of forest land to total size of holding, application of forest practices, and belief in profitability of forestry.

Having introduced his article with the statement that "Much of the literature [on small private ownerships] has been descriptive in nature, dealing to only a limited degree with owner characteristics and attitudes," McClay said in conclusion that knowledge gained from the nine studies

> . . . confirms much of what is already known of their characteristics and attitudes.
>
> These exploratory studies made some progress toward learning why owners of small forest properties feel as they do regarding the adoption of forestry practices or participation in assistance programs. Thus, when owners were asked why they had not adopted practices or utilized assistance the answer most frequently given was that they were not interested in forestry. Such response points out that future studies should place greater emphasis on the motivational aspects which underlie forest landowners' action or inaction.

Zivnuska (B, *1959*)

This study of small woodland management and policy in Norway differed completely from those preceding. After recognizing that "Improving the management of small woodland properties represents a major challenge for American forestry in the years ahead," the author enumerated some of the difficulties that have beset programs for such improvement:

> . . . in practically all nations in which conscious programs of improving forest management have been adopted. . . . They include such factors as: (1) the incidental or accidental nature of many such ownerships, (2) an assumed level of potential returns which does not appear to justify the invest-

ment in knowledge and time required for effective management, (3) an income level of many such owners which does not enable any form of capital investment program, (4) a lack of markets for the small and low grade materials which often form the main part of such forests, and (5) a lack of adequate marketing institutions for reaching the markets which do exist.

Having further recognized that "The development of appropriate management techniques for small woodlands and of economic institutions conducive to such management n1ust be developed in terms of the specific conditions of particular areas and regions," the author stated his hypothesis in these terms:

> ... analysis of the experience of other nations in meeting this general problem can be useful in evaluating the possible consequences of various procedures in the domestic situation. .. The study ... was undertaken as one such case study in small woodland management and policy.

Zivnuska's analysis of the Norwegian experience concluded with this comment which bears on the hypothesis:

> If it be granted that an improvement of forest management is desirable, then any course of action followed must involve a balancing of advantages and disadvantages. The Norwegian methods appear to have the great advantages of maintaining established social institutions and of continuing the benefits which come from operation by the owner. The principal disadvantages are the need for an elaborate system of controls and the maintenance of a highly complex structure without the econonlies of large-scale management.

Specific details of the Norwegian experience will not be discussed. The important point to be brought out here is that interviewing owners, either in local areas or throughout the United States, is not the only way to develop a sound woodland management policy or a program for its execution. The successes and failures of other nations, viewed within the context of specific national conditions and opportunities, provide potentially useful insights toward solutions to problems in the United States. Many of these nations have a far longer record of experience in dealing with small woodland management than does this country. Zivnuska's study is a pertinent case in point.

ECONOMIC INFLUENCES ON TIMBER PRODUCTION

The preceding section has reviewed several studies directly concerned with describing what owners do and correlating ownership characteristics with management practices. The present section turns to a different category of studies which can be described as specialized analyses of particular economic In-

fluences having an apparent impact on owner decisions to produce timber. These studies are concerned with explaining why owners follow particular courses of action.

Duerr (E, *1948*)

Beginning with the observation that "Small forest properties in private ownership are the crux of the problem of forest management in the United States," as evidenced by the Forest Service's Reappraisal Report of 1946, the author described the problem in these terms:

> Anyone who works very long in the field of small-owner forestry becomes acutely conscious of the refractory nature of the problem. There seems to be a hard core of resistance into which it is extremely difficult for the forester to penetrate in his efforts to improve forest management. This hard core has been variously identified as the owner's "insufficient knowledge," "lack of interest," "poor bargaining position in the market," and so on.

The author set for himself the task of analyzing why small forest owners seem unable to improve the management of their properties. His hypothesis was that low income is a "particular hard core of resistance. . ." to management improvement.

Several case studies were cited to typify the problem of low income. The author pointed out that

> Low income, from the forest-management standpoint, is the problem of exhausted growing stock incapable of producing much timber return. From the community standpoint it is the general problem of depleted local resources and meager employment opportunities. Where resources are insufficient to give people an adequate living, the resulting pressure inevitably leads to exploitation. . . . low income, underemployment, and overpopulation frequently are all symptoms of a single ailment, . . . low *cash* income, . . . the crux of the problem of the small, needy operator.

Additional factors related to low income and that intensify poor management were then discussed: unstable ownership and consequent lack of long-run interest, a high personal rate of discount that prevents investing money in the forest enterprise and waiting for future returns, difficulty of accumulating and retaining capital, and effects of the business cycle.

After characterizing the problem of low income, the author concluded with some recommendations about research needed before remedial action for the problem is undertaken.

> Basic to a consideration of needed research is the fact that the small low-income property is not solely, or even largely, a forest problem. In most cases it is a problem also in sociology, farming, or industry, or indeed, a problem of the whole regional economy. In some cases the forest values are an almost negligible part of all the public and private values involved.
>
> Generally speaking, the problem is that of the rural slum, and emphasis is upon *slum,* and not upon rural or upon forest. The rural slum differs from the urban chiefly in the greater susceptibility to exploitation of the rural environment. . . . The presence of timber among the list is, in any particular case, largely fortuitous. Only as a secondary effect do small, low-income operators—whose problem is the result of maladjustment to the economic environment in general—create a problem of forest management and of the national timber supply.
>
> So broad a problem calls for research on a broad front—primarily research along the lines of economics and sociology, and including forestry only as one of several fields for consideration. The approach to such research depends on the type of area in which the small, low-income properties are situated—or, rather, the type of fundamental maladjustment responsible for the problem.

The author distinguished two general types of maladjustment and after analyzing both, discussed research needed for overcoming them. The two pages devoted to this analysis should be read in full to obtain an adequate appreciation of the author's ideas about what is needed. Research on both types of maladjustment should be directed toward raising general income, thus removing excessive pressure on resources caused by low income and developing "an environment in which resource conservation, including good forest management, will be possible."

Stoddard (E, *1949*)

This study analyzed a specific solution for improved management on small holdings. The problem faced was that small forest holdings "contribute far below their potential to the rural economy of which they are a part" because of their low state of productivity. The hypothesis was that forest farming is a means of both raising the level of productivity and management on small holdings and alleviating rural underemployment and low income in forestry-agricultural fringe areas.

Defining a forest farm to be a unit with sufficient resources to provide a family with at least two men of working age year-around employment with forestry as the major enterprise, the author looked for case studies in two different areas from which to obtain actual data. His analysis led him to the conclusion that

> In both areas studied, it appears theoretically possible for forest farming to yield attractive income and a good standard of living, especially in comparison with other types of farming in such areas of poor soil. However, the returns when the land is owned might be little if any greater than could be obtained by the purchase of stumpage, which would require less capital and involve less risk.

Necessary labor and managerial talents were generally available, but sufficient growing stock to assure continuous year-around employment and capital with which to acquire a balanced distribution of growing stock were both limiting factors. "Farmers in 'fringe' areas and those who depend on woods work for a living seldom have so much capital; and credit on a longterm, low-interest basis adapted to their needs is not available."

With respect to his hypothesis, he concluded that

> Because of the limitations inherent in forest farming under individual family enterprise, especially when ownership is involved, attention was given to other means of achieving the twin objectives of increased rural employment and improved forest management.

These other means included public assistance programs, aid, and education. He concluded that such programs are desirable and should be continued in order to advance forestry among small owners.

Wrigley (E, *1951*)

The problem situation: ". . . few Pennsylvania farmers work regularly in their woods even though many own sizable tracts. The general neglect of the woodland enterprise suggests that most farmers have not found it a particularly profitable farm operation." The hypothesis: ". . . farmers may be overlooking an opportunity to add materially to their incomes by better woodland management."

The procedure followed was to obtain detailed data from 74 cooperators covering either a 1- or 2-year period between July 1, 1946, and June 30, 1948. The cooperators' farms were above average for the State in terms of size, proportion in woodland, and average amount of growing stock. Moreover, the woodlands were productive parts of the farms, cooperators were working in their woods and getting either some cash return or products for use on the farm, and livestock grazing had damaged comparatively little of the woodlands.

> Cooperators got average labor returns of $1.63 per hour for work in their own woods in addition to the cash value of the stumpage and any profit that

would have been secured if a commercial lumberman had purchased the trees removed. Those with large woodland operations, on the average, earned more per hour than those with small operations. Lumber producers earned higher returns than those harvesting other products.

The woodlands of cooperators, on the average, furnished 2.5 hours of productive work per acre per year. . . . The better woodlands . . . furnished about three times this much employment. Work in the woods helped farmers, who had uneven labor requirements, to adjust the supply of labor to the demand without laying off men. . . . an acreage of woods, larger than average, was necessary to accomplish much in this direction.

Barraclough and Gould (E, 1955)

The importance of this study is found in certain generalizations about forest management opportunities, reached by the authors after intensive case studies of nine agricultural fringe-area farms in New England. The point was made that little is known

. . . about the economic sacrifices that might be forced on private owners if they were compelled to follow specified forest practices. And we have only a hazy notion of the practices owners would follow if they clearly understood the full consequences of their management decisions.

This posed the problem of learning "more about what landowners can do with their woodlands profitably and what forest practices they can use in their own interests." The hypothesis was that such information can be developed through case studies that evaluate alternative management programs for individual farm-forest holdings.

The current condition and potential of each farm and farmer was analyzed with the farmer's assistance for the purpose of developing alternative management plans suitable to the owner's particular situation. The analyses were based on three simple but often ignored facts: that woodlands usually are but one part of a larger operating unit, and proposed plans must recognize this;

. . . that practically all forest production problems have several possible solutions.

. . . that usually the owner is the person best equipped to work out, evaluate and choose among alternative farm and forest operating plans, provided he has the right kind of technical assistance.

A high intensity of woodland management generally could be expected to lead to sales some 2½ times greater than those realizable under a low intensity, but only after an intervening period of about 40 years during which growing

stock was built up. Thus, "despite greater yields it would not under all circumstances pay these owners to adopt high intensity forest management."

Net farm income could double with adoption of proposed plans for farm-forest units. Relative contribution from the forest enterprise would vary from 25 to 40 percent of total income. High forest management intensity is only attractive if there is an interest in forest production, a high value is placed on both future and immediate profits, and there is an interest in building up the value of the farm. Technical assistance together with agricultural and long-term forest credit would be needed in carrying out planned farm-forest adjustments to gain improved returns. Reorganization and expansion of the farm business and the maintenance of a fair standard of living while growing stock increased generally demanded more capital than owners could supply unaided.

Redman (E, *1956*)

The problem considered was to discover why farmers in a specific area had heavily disinvested in their woodlands. The implicit hypothesis appears to have been that low physical productivity of woodlands made them a less attractive investment alternative than other enterprises on the farm. Based on considerable empirical evidence, the author stated that

> Uncertainties of yield and price predictions encourage practices that result in preferences for a more certain present income although long-run income may be larger. This rate of discount is the farmer's own estimate of what constitutes a reasonable return on woodland investment. His idea of reasonable return is affected by non-monetary values, relative capital position and needs for capital, or additional cropland and degree of uncertainty envisioned. The need for capital or awareness of a high rate of return from alternative uses tends to increase the farmer's discount rate. . . . When the farmer's discount rate is higher than the market rate of interest, clear cutting and selling timber is encouraged, and conversely, if his discount rate is lower than the market rate, he is encouraged to invest in woodland. In the area under study, the past cutting practices indicate that the prevalent discount rates have been higher than the market interest rates.
>
> Tree growth data from adequately stocked stands indicate that the equilibrium of not more than a 4 percent rate of return on investment and the rate increase in value of lumber will occur at 60 years on sites of good quality. For sites of medium and poor quality the maximum of 3 percent and 2¼ percent can be earned at 75 years and 90 years respectively.
>
> These productivity estimates, coupled with fluctuations in lumber prices and the need for capital in other farm uses, explain the economic basis for disinvestment in the forest enterprise. Clear cutting of woodland has been an important source of capital for more certain production and family living

> and permits the release of land for other enterprises.... For most farmers, there appears to be no economic incentive to invest in production of hardwood lumber. Therefore, such investments, if made, lTIUst be from the social and national standpoint.

Certain of the author's assumptions, data, and conclusions were strongly questioned *(E,* Barraclough 1957), but the net result seems to have been that for the particular area studied and the level of prices and costs assumed, Redman's conclusions were logically consistent. Using data from other areas and assuming different levels for prices and costs would merely yield different estimates of productivity.

Worrell (E, 1956)

The concept of optimum intensity of land use need not necessarily involve small ownerships, but Worrell's choice for illustrative purposes of a region from which to obtain empirical data oriented his analysis toward such holdings, which were predominant in the area. He analyzed relations among timber production, ownership, and management intensity, discussing the influence of each upon the others in northeastern Georgia.

The problem was that of estimating how much of the productive resources of a region should be devoted to forestry and in what combinations. The hypothesis was that in any given region there is an optimum intensity of forest land use that will make the best contribution to a region's total satisfaction. Through the concept of an optimum intensity, resource use can be publicly planned for the benefit of society as a whole.

> Fundamentally, this study consists of the application of the theoretical economic tools of efficient resources use to an analysis of the use of an actual resource-forest land. The analysis starts with a highly simplified situation in which most of the problems of land use are assumed away. Reality will be approached by steps, in each of which a new set of variables is introduced. Although the analysis is primarily economic, we will recognize non-economic variables in the final stages.

Variables involved in the estimation of a regional optimum intensity of use were:

1. Characteristics of the forest land resource, including
   a. the productive capacity of the land,
   b. present forest stand conditions, and
   c. ownership status and size of individual properties.
2. Demand for those products that the land is capable of producing.

3. Technology of silviculture and forest management, as influenced by the cost and supply of labor and capital.
4. Political and social adjustments of the competitive economic system to bring about the optimum intensity of use.

Worrell discussed the concept of efficiency in use of capital as influenced by size of ownership, and showed how costs of timber production, from the public standpoint, vary with size. Important among these costs are those of education and assistance. After a rigorous analysis of the determinants of a regional forest management program, he concluded that

> ... any Regional program of forest management should concentrate on the larger ownership classes, the most productive land classes, and the best present condition classes. If intensive management is achieved on these lands the resulting Regional output will be all that apparently can be marketed profitably. A minimum intensity of management will suffice on the least productive lands and most difficult ownerships. They should be permitted to operate at this minimum level.

Worrell condensed his findings into the following definition:

> Optimum intensity of forest land use on a regional basis is that pattern of quantities of labor and capital, applied through efficient silviculture to the production of forest products on the different classes of forest land in the region, which will make a greater contribution to total economic welfare over time than could any other use of the quantities of all the productive factors involved. The use of more or less of the other factors, or their combination with the land in any other pattern, would result in a smaller contribution to total economic welfare.

The study concluded in this vein:

> Determining the intensity of forest land use is primarily an economic problem, but political and social variables will influence the economic variables.
>
> The number of variables which affect forest land use makes it almost impossible for efficiency to be attained automatically. Yet we need efficient forest land use if we hope to maximize general welfare. Guidance and control of forest land use is essential in the public interest, and the conservation programs now active in this country show that we have long recognized this. The decisions about this guidance and control must be in the hands of policy-making groups which can see forest land use in its proper setting as one of the many factors affecting public welfare. If such groups are to make wise decisions, they need a clear understanding of the potentialities and implications of forest land use adjustments. The concept of an optimum intensity of forest land use can help them get such understanding. This sets up an ideal which probably cannot be attained in practice but which does provide a goal toward which actions can be directed.

Worrell (E, 1957; 1958)

In both these references, Worrell presented a point of view favoring short rotations among small owners. Both references essentially were conclusions reached through a process of detailed deductive reasoning. Beginning with the premise that since "timber from the lands of these small owners is not absolutely essential to the forest economy of the South ... it will not make any difference in the foreseeable future what the small owners do with their forests," so long as other forest lands in the South receive reasonably good management. From this he inferred

> ... that there is no public welfare justification for pushing these small owners into managing their forests in any particular way ... [and that] the only present reason for managing these woodlands is that the owners themselves might benefit from it.

Therefore, "What kind of management would benefit them most?" To this question he replied, "Who can really answer this question but the owner himself? If he is fully informed of the various alternatives which are open to him, he should be able to choose the one which will satisfy him most."

He reasoned that the short planning horizons characteristic of this type of owner influence decidedly the satisfactions to be obtained from woodlands.

> A project with quick capital turnover will yield results in the near and more certain future. Rather than tie up the large amount of capital required for sawtimber production, a small owner may best put most of his capital to other immediate uses and keep invested only the smaller amount required for pulpwood.

Anonymous (E, 1958): *Pilot Woodland Management Program*

The Pilot Woodland Management Program in New Hampshire is devoted to the problem of improving management on small holdings by assisting owners to analyze particular alternatives available to each individually, but leaving final choice of which alternative to follow up to the owner.

> Each forest owner can follow anyone of a wide variety of forest management programs. Intensive management promises greater returns and offers more chance for speculative gain from timber price increases than does extensive management. But these greater returns call for more labor, capital, and management skill, and some types of land do not respond readily to management. Hence, different owners will choose different management plans depending upon their particular situation.

Three specific cases were reviewed, and expected rates of return to be earned by each cooperator \vere given.

> Almost all of the 50 owners cooperating in this study plan to use management programs that are more intensive than those generally in use....
>
> It must also be emphasized that the same type of management should not be used in every case. Intensive and extensive management plans are both desirable depending upon the landowner's interests and resources and other investment opportunities open to him.
>
> A warning is also in order. Forest land is not an equally good investment for all persons, and in the case of the widow, for example, another type of investment might be preferable. A depressed log market for several consecutive years would work great hardship on her, but she gets satisfaction from managing her forest. Other widows, in similar circumstances, might be well advised to sell their property and invest the proceeds in safe securities.

This particular widow was found to have a prospective net return of 4 percent from her investment in growing stock.

Coutu (E, 1958)

The latter half of this paper is significant for its discussion of reasons why small landowners are apathetic toward a forestry enterprise, and for suggested alternative courses of action that might be taken to offset this apathy.

Reasons for apathy included: (1) The forest is a source of emergency capital; (2) owners lack knowledge of incoll1eopportunities; (3) owners are faced with high alternative rates of return; (4) earning rates are relatively low in forestry and there is a lack of complementarity between forestry and farming with respect to both labor and capital; and (5) short-term tenure arrangements are not conducive to management.

Alternative courses recommended to offset apathy included: (1) leaving the situation strictly alone to let economic forces bring about needed adjustments; (2) increased farm management planning, recognizing forestry alternatives and using linear programming techniques to define alternative plans; (3) expanded use of leasing arrangements; and (4) continued public programs providing assistance and education.

An illustration of the type of management planning advocated in (2) was presented by Martin *et al.* (E, 1960). This type of analysis directly investigated the effect on income of variations in levels of capital and management intensity.

Webster and Stoltenberg (E, 1959)

The problem in this study was to find a means for predicting response to forestry programs that had been designed to encourage more intensive management on small holdings. The hypothesis was that certain easily recognizable

and measurable ownership characteristics could be identified to permit grouping owners into categories of responsiveness. Characteristics generally thought to be correlated with owner responsiveness included owner occupation, age, method by which forest property was acquired, length of tenure, distance of owner's residence from forest property, acreage owned, and value per acre of standing timber. These characteristics were tested to see if evidence of relation to owner response could be demonstrated.

The only characteristic which did give statistical evidence of relation to management practices adopted was that of forest acreage owned. Additional testing suggested that this factor was an indirect measure of an even more significant characteristic, level of assets, as indicated by assessed value of owner's property. The conclusion was drawn that additional research was needed to further verify, under different conditions, that many commonly used ownership characteristics may be unrelated to adoption of managelnent practices.

METHODOLOGY OF CONDUCTING OWNERSHIP STUDIES

One study from this category is mentioned here because of the light which it shed on relation between owner characteristics and management practices. The study is that of Christensen *(C,* 1957). He was concerned with the problem of developing and testing "a methodology for research on forest owners' management objectives and on the factors which determine the existence of these objectives." His hypothesis was that management objectives. can be understood if a suitable methodology is devised for (I) analyzing what individuals do, as expressed by actions they have taken (objective variables) and (2) why they act as they do, expressed in terms of motivations, or reasons underlying the existence of management objectives (subjective variables). The methodology tested was that of mail questionnaires and personal interviews in depth.

Some suggestive results from the study were (I) that management of woodlands to produce income from sale of timber products is less common than management for wildlife, recreation, and home use of timber products; (2) selling timber as a management objective increases in frequency as forest land area increases; (3) objectives other than sale of timber products were more closely related to class of owner than to other variables; (4) owners are "motivated" by·a tremendously varied "complex.of sociological, economic, and psychological influences . . .," requiring, therefore, "that educational programs in forest conservation, to be effective, should be based on a wide perspective."

CRITICAL ANALYSIS OF RESEARCH CONCERNED WITH NONINDUSTRIAL OWNER SITUATION

THE preceding section contained reviews of 23 studies concerned with nonindustrial owners. The· reviews were grouped into two· categories: (I) those describing ownership characteristics and management practices and (2) those analyzing particular economic aspects of management. These studies described the scope and tendency of research in the two categories. Critical comn1ent was omitted from the reviews so that in this chapter similarities an10ng studies within the two categories could be emphasized and the categories contrasted.

The somewhat abstruse nature of the foregoing reviews is due in no small measure to the subject itself-nonindustrial owners in the United States. Lack of evidence and contradictory aspects mentioned in the first section were docun1ented in the reviews in the one following. The objective of this section is to clarify an abstruse situation by weaving together a number of inferences drawn from the reviews. This analysis in turn reveals the nature and direction of research needed to resolve an unsatisfactory·situation. The following outline shows how the analysis is developed:

I. Analysis of studies reviewed in preceding section
   A. Comparison of studies concerned with owner characteristics and related management practices
      1. Problems investigated
      2. Hypotheses used
      3. Conclusions reached
      4. Recommendations offered
   B. Comparison of studies concerned with economic influences on timber production
      1. The public point of view
      2. The individual owner's point of view
II. Small o\vnership research in perspective
   A. Viewpoints and implied assumptions
   B. Problem formulation
   C. Future research

The intent of the ensuing analysis is to take a constructive look at \vhat has been done and what has been learned about nonindustrial owners so as to reveal any gaps in present knowledge. A broad background of knowledge against

which to appraise new ideas is one of the surest guides to determinative research-that which points the way to practicable, effective solutions.

OWNER CHARACTERISTICS AND RELATED MANAGEMENT PRACTICES

Analysis of this category·of studies centers around four topics: (1) nature of problem investigated, (2) direction given to the investigation.by the hypothesis used, (3) nature of conclusions reached, and (4) recommendations made, if any. There is no question but that the studies in this category when taken together have contributed much to a better understanding of the small owner situation. A vast amount of interesting and useful data has been collected and different aspects of a provocative situation have been described. While some contradictions in findings among studies have appeared, these may be due more to differences in conditions among study areas and among owner circumstances than to fundamental disagreement.

Problem Investigated

In general, these studies sought to describe the small owner situation in some particular local area and emphasized characteristics of those owners who practiced forestry. The three studies by Chamberlin *et al.)* James *et al.)* and Yoho *et ale* included both industrial and nonindustrial owners and did not specify an upper limit to size of nonindustrial holding. The other localized studies all focused on small owners (less than 5,000 acres of commercial forest land). With the single exception of Mignery's study, each gave prominent recognition in the problelTI formulation to a then-current Forest Service judgment of the status of private forest-land management. After each of the Forest Service's two nationwide studies (Reappraisal Report of 1946 and Timber Resource Review of 1958 -preliminary findings of the latter being generally available in 1955), problem formulations in this category placed increased emphasis on the reported seriousness of the small owner situation and the need to know who these owners were and what they were doing with their woodlands. Justification of the studies was based primarily on the Forest Service's concept that small holdings must be made more productive in order to supply a greater share of the Nation'sfuture softwood requirements.

Precise problem statements were generally lacking, the reader frequently being left to deduce the real question studied. Problems appeared to be formulated in one of two ways: (1) primary emphasis placed on quality of management and condition of property (Chamberlin *et al.)* Reappraisal Report, James *et al.)* Yoho *et al.)* Timber Resource Revie\v); and (2) primary emphasis

placed on relation between owner characteristics and management practices (Mignery, TVA, Seigworth, McDermid *et al.*, Sutherland and Tubbs, Anderson, and McClay). These two subgroups, distinguished by their problem formulations, are referred to frequently in the remainder of this discussion analyzing studies concerned with owner characteristics and management practices (see outline, p. 33).

A distinct time trend is apparent between these two problem formulations. The studies co.mprising the former approach generally were completed earlier in point of time; those comprising the latter appeared later. These studies thus indicate a certain logical progression of ideas in attacking the small owner situation by first investigating what management practices were being followed and what condition these holdings were in and then turning to ownership characteristics to see if correlations could be found with management practices.

A striking feature of these studies was the attention devoted first of all to small owners and secondly to those among small owners then practicing forestry. After describing the situation in terms of number of owners not practicing forestry according to some standard or conception, these studies then placed major emphasis on describing owner and property characteristics of those who had begun management practices of some sort. The limited effort made. to explain observed patterns was always in terms of those who practiced forestry. The other side of the coin-\vhy don't more owners adopt management practices-was not examined directly. Perhaps this was partly explainable in that all studies were strongly influenced by Forest Service views that small owners were the crux of the problem of producing adequate supplies of softwood timber in the United States, that only a small fraction were practicing what foresters considered good management, and that many, many more must be persuaded to do so. Hence the central question expressed or implied in this group of studies: Which landowners practice forestry? Had the Forest Service views not been so prevalent, problem formulations in these studies might have· been less repetitive and more trenchant, thus uncovering a problem of much greater import and magnitude: What factors prevent more owners from intensifying n1anagement?

Some of the most recent studies in this whole category (McClay) do not contribute new knowledge to an understanding of the small owner situation. They further confirm what is already known, although admittedly under differing conditions and circumstances. They round out the picture, but they do not enlarge it. This suggests that the current line of inquiry, as to which landowners practice forestry, may have been pursued far enough.

Hypotllesis Used

With but 2 exceptions (Timber Resource Review and Zivnuska), the hypotheses used to guide investigations in the remaining 11 studies were not well stated. The reader must infer what the working hypothesis really was, only to come up in one case with such an ambiguous deduction as: Type and size of forest ownership mayor may not affect cutting practice and management policies (Chamberlin *et at.).* Contrasted with this is the precise deduction: Foreign experience can suggest alternatives in developing appropriate management techniques and economic institutions to facilitate adoption of management prac-

(Zivnuska).

The importance of a carefully worded hypothesis in social science research is discussed by Duerr and Vaux *(G, 1953).*

> By analyzing the research problem in terms of theoretical concepts and relationships, the student can develop extensions, refinements, qualifications, and applications of the principles which are pertinent to the problem in hand. Statements of this sort, derived from theory, but related to a specific problem, are customarily called hypotheses. • .. The hypothesis states-or infers-the variables to be used ... and identifies the form of the relationship between the several variables. It thus provides the framework around which the research will be built.

Salter *(G,* 1948) had also stressed that to be useful a hypothesis must be practical; it must direct the work of inquiry. He goes on to say, "The hypothesis postulates, in respect to the problem situation, that if (and only if) thus and so is done (with whatever elaborations may be necessary) then thus and so results." The hypothesis in social science research ideally poses tentative means of solution for a problem formulated for investigation, and further specifies expected consequences of following particular courses of action.

Analysis of the hypotheses stated in the reviews shows that they do not ordinarily reach these standards. Individual variables to be tested are not specified, although a class-ownership characteristics, for example-is sometimes stated. Expected relationships among variables are not defined, nor are consequences of particular courses of action specified.

There is an apparent lack of theoretical reasoning about relations observed in experience and a failure to synthesize such observations into cause-effect, or-to use Salter's term-means-consequence statements for testing by the experimental method. Analysis of the studies as to whether they represent adequate research leaves the impression that a primary objective, if not accomplishment,

was gathering of data in hopes that significant clues about cause-effect relations would materialize.

The earlier subgroup of studies which formulated the problem in terms of quality of management and condition of property (see p. 34) defined a standard of management and then showed the relation of various ownership characteristics to several classes of this designated standard. Cutting practice was the primary element in standards of management.

The Timber Resource Review is somewhat of an exception to this generalization. As indicated in the review, it attempted to avoid difficulties inherent in judging status of managen1ent and posed instead the problem of determining the productive condition of recently cutover lands. In the hypothesis, four elements were specified as determinants of condition, which was defined as the current and prospective growth of timber in both quality and quantity. But because of the way in which findings were reported by types of ownership and the great stress laid on poor conditions found in certain types-particularly small holdings-results have been generally interpreted as reHecting status of management, despite Forest Service disclaimers to the contrary.

While the Timber Resource Review has a carefully reasoned hypothesis, it is of a type appropriate for directing research in the physical sciences. It states the variables to be used in the investigation and identifies the nature of the relations among the variables. But this form of hypothesis does not coincide with Salter's definition of the type needed to guide social science research which -as he explains-imposes special conditions on use of the experimental method. The form of hypothesis used in the Timber Resource Review would not occasion comment, at least in this report, had findings and conclusions been restricted only to physical aspects of forest land condition; but they have been extended by implication to conclusions about adequacy of owner actions, thus entering the social science realm. Hence, the particular hypothesis is unsatisfactory in terms of ultimate conclusions in the study. Zivnuska *(G,* I956) has thoroughly reviewed the technical forestry aspects of the Timber Resource·Review investigation of productivity in terms of problem formulation, hypothesis, conclusions, and recommendations.

The latter subgroup of studies which emphasized inHuence of ownership on management (see p. 35) considered management to be a carrying out of any one or a combination of certain practices, clearly specified in some studies but only hinted at in others. The characteristics of owners who did attempt management were then compared variously with those who did not.

After two decades of gathering information about those few owners prac-

ticing forestry, presumably in order to uncover reasons why the great majority of private owners do not do likewise, Dr. McArdle, recently retired Chief of the U.S. Forest Service, made the comment that if motivations of small owners could be determined, the whole problem of bringing 4½ million small holdings under intensive management would be well along toward solution (*D,* Streyffert 1961). McClay (*B,* 1961) also recommended the need for some sort of motivation research, so evidently an answer has not yet been found to explain why small owners do not voluntarily intensify their management practices. This leads inescapably to the conclusion that processes of problem formulation and hypothesizing have either been badly neglected or poorly executed. Evidence from the second subgroup of studies suggests both failings.

Zivnuska's analysis of the Norwegian small owner situation differed widely from the other studies in this first major category. His problem was concerned with developing appropriate management techniques and economic institutions to facilitate adoption of new techniques. His study is the single example in this whole category of a thorough inquiry in social science research. Froin problem formulation to conclusions, it is trenchant and logical.

Conclus£ons Reached

The findings of the entire 12 studies can perhaps be summed up in these terms: Small owners do not generally treat their forest properties in a way that professional foresters prefer to see woodlands handled. As with all generalizations, this is an oversimplification; it epitomizes a viewpoint that seems to underlie many of the recommendations made to resolve the nonindustrial owner situation and that pervades education and assistance programs now in effect.

The earlier subgroup of studies (see p. 34) (Chamberlin *et al.,* James *et al.,* Yoho *et al.,* and the Forest Service Reappraisal Report) found that small owners have what were judged to be poor cutting practices. These poor practices, furthermore, appeared to be variously correlated with a number of factors such as age, occupation, distance of owner's residence from property, tenure, and owner objectives and attitudes; but there was no complete agreement among studies on the importance of. these factors. A factor significant in one study often did not appear significant in another under differing conditions.

The latter subgroup of studies concerned with finding which landowners practice forestry (see p. 35) seems to be in more general agreement that such owners have larger forest acreages and a greater volume of desirable growing

stock (or which at least is less heavily exploited), possess higher asset and income levels, have stability in prospective tenure, and are successful and progressivein nonforestry endeavors.

Both subgroups mainly describe phenon1ena. They show correlations an10ng certain o\vner actions and various ownership characteristics but seldom attempt clear-cut explanations of causes of observed relations. Empirical evidence in a few studies (notably Yoho *et al.,* Mignery, and Seig,vorth) suggests that certain ownership characteristics with strong economic connotations (acreage and volume of growing stock, asset and income level, and stability of tenure) are related to o\vner actions. A basic understanding of the small owner situation might there£ore be gained by thorough analysis of the cause of these relations. Some theoretical reasoning, ""specifying and testing fundamental cause-effect relations, \vould have been desirable, but this was not specifically done in these studies. Strong implications of the importance of economic factors as motivating influences on owner actions were also apparent in conclusions reached by "Anderson and McClay, but again there was no elaboration.

It is noteworthy that conclusions were cautiously drawn and often stated in vague terms (Chamberlin *et al.,* Sutherland and Tubbs, and McClay especially). In the study by Chamberlin *et ale* determinants of management decisions and differences in intensity of management among o\vners were very difficult to assess, since they were lumped together and obscured in the PSI (pine stocking index) which together with cutting practices was used to rate management effort. Differences in PSI were aln10st impossible to interpret. The authors spoke of "significant" differences in PSI but did not explain what was meant nor how significance was determined. The authors attributed "marked contrast" to a difference in PSI of 0.7 in one instance, yet described another difference in PSI of 0.8 as indicative of "no appreciable effect." Another difference of 1.0 in PSI was not even mentioned. The reader is frequently at a loss in attempting to verify or interpret the authors' findings and is forced to conclude that apparently the findings were based on observations and impressions not included in the report.

In the Reappraisal and the Timber Resource Review, conclusions were reached that cannot be logically justified by the analysis. In the former study, improved cutting practices among small owners were claimed to be the main activity by which future timber needs could best be attained, but no evidence was presented to prove that cutting practice actually is the most important limitingfactor accounting for low productivity on small holdings. Since lands not recently cut over were automatically considered to be under poor manage-

ment in the Reappraisal, it does not follow that improved cutting alone would necessarily raise productivity. In the Pacific Northwest, for example, 32 percent of small holdings were nonoperative in 1945, but a fair proportion of these lands supported young-growth stands not yet ready for harvest. These lands, however, could be expected to respond to other management practices-planting, thinning, cleaning-that might greatly improve their productivity.

The use of cutting method as a criterion of management deserves further comment. The Timber Resource Review discussed seven studies (four of which were reviewed in the preceding section) that have used this concept and briefly analyzed variations in application of the concept. Despite differences in concept, the Forest Service noted that "a feature common to all such studies is concern as to the contribution that cutover areas will make to future timber supplies." It follows then that the concept is inapplicable to uncut areas and should not be used to rate their management. Use was made of the concept in the Timber Resource Review and implies an assumption that timber cutting was synonymous with management. However, that report did recognize that recent cutting was an incomplete criterion, by itself, for evaluating management intensity, especially in young-growth stands and in areas where well-developed, small-product markets are lacking.

Use of this concept by Chamberlin *et al.*, The Reappraisal Report, James *et al.*, and Yoho *et ale* showed cutting practices to be poorest for the nonindustrial owner and best for the industrial holdings. That their results coincided does not necessarily argue in favor of the adequacy of the criterion, at least when applied to nonindustrial owners. The concept implies a management objective common to· larger industrial and public owners-essentially the objective of sustained-yield production with continuous or regular harvest. It is this implication that raises serious questions because this objective has been seldom found among small owners. Any criterion of management based on stocking following cutting (which includes the Timber Resource Review) is of limited usefulness for fairly judging small holdings, because it does not distinguish degrees of intensity where management is guided by an objective other than that of continuous commercial cropping. A productivity index reveals differences in physical productivity, but such differences are not a complete measure of the actual quality or success of management applied by nonindustrial owners.

The extent to which small owners could or would respond to whatever methods might be used to promote better cutting was not tested in the Reappraisal Report. Inasmuch as owner objectives and intentions, as well as economic circumstances, were not considered, the soundness of the conclusion that "forest

products adequate for future needs will not be attained unless satisfactory cutting practices are applied by the 4½ million private forest-land owners" is highly questionable.

The Timber Resource Review similarly gave minor attention to owner aims and circumstances, but it went much farther in examining factors that influence productivity on cutover lands. Neither this study nor the Reappraisal, however, gave any indication that it had examined the physical or economic feasibility of alternative methods for achieving a particular output goal. Therefore, that satisfaction of the Nation's future timber requirements rests so heavily on response from small owners was an unjustified conclusion. Such a conclusion could only be justified by evidence which neither study was designed to obtain or evaluate.

A general agreement in conclusions among all studies concerning inadequacy of small owner actions was noted. That this was a valid finding substantiated by evidence obtained in the investigations might well be questioned in view of weaknesses in problem formulation, hypothesizing, and use of an unsatisfactory management criterion such as cutting·method. Explicitly justifying a problem statement by reference to the Forest Service point of view, as all except Mignery did, indicates that owner actions were to be judged from a single viewpoint-that of the public in the context of the forest economy at large, sometimes on a local, sometimes on a national basis. This is not to say that such a viewpoint is necessarily wrong, but that it should only be used, as Zivnuska does, when appropriate to the problem investigated. The viewpoint becomes misleading when it implies or includes an arbitrary evaluation of management on small holdings. The standard of value implicit to such judgment is the notion that good management is that which coincides with a typical public objective of sustained production into an indefinite future, usually characterized by long rotations and a heavy per-acre investment in growing stock. An owner with a different objective must automatically be practicing bad management according to this point of view. The inference, then, is that the same conclusion about inadequacy of small owner actions could just as well have been reached without conducting these studies, given the arbitrary assumptions built into the evaluation applied. Thus, although much interesting and useful data concerning small owners has been amassed, such data typically have been analyzed from a viewpoint that does not disclose useful knowledge about the ability of small owners to practice forestry and which gives no clear understanding of those cause-effect relations that govern management decisions of small owners.

Recommendations Offered

There is nearly complete unanimity among studies that, since small owners with but few exceptions are not practicing forestry for a variety of reasons, they must be persuaded to do so in order for the country to have a plentiful wood supply sometime in the future. This persuasion includes all those measures to be found in use today, either singly or in various cOlnbinations. Such measures run from regulatory legislation designed to be educational rather than punitive, through various forms of public and private demonstrations to all forms of technical and financial assistance-public and private.

Until the study by Webster and Stoltenberg, however, which did not appear until 1959, little or no research effort had been directed toward finding which owners responded to given types of programs and why they did so. It is difficult to understand, therefore, why in the category of descriptive studies under discussion here, untested remedies were continuously recommended, even in the face of warnings that these remedies were not producing desired results *(D,* Stoddard 1950; *B,* Mignery 1956). Furthermore, no evidence had ever been presented to show that all small owners were identical with respect to their aims and circumstances; the import of descriptive owner studies, in fact, suggested the opposite. Thus, there was no sound reason for believing that the same remedies should be applied in blanket fashion to every small owner. Common sense would suggest that some owners might respond to one type of program for a variety of reasons, while other owners might best be reached through different programs. It further would have appeared reasonable to conclude that some owners would be better able than others to respond to any type of program, and that more immediate and fruitful results could be achieved hy identifying and working first with these owners. A few of these studies (notably by Mignery, Seigworth, and Anderson) recognized the wisdom of confining promotional effort to those most likely to respond and made recommendations to this effect.

Specific recommendations were not offered by Zivnuska. Implicit throughout his study, however, was the counsel that all aspects of the small owner situation be carefully examined and alternatives considered in the context of a nation's economy, before initiating policy and programs to modify a situation.

Learning about those owners presently practicing forestry is one understandable approach to possibly discovering what small owner attributes are essential for the practice of forestry. A common failing among the studies adopting this approach, however, was that they did not seek causal explanations for the rela-

tions observed between owner characteristics and practices. Questions were not raised about the why of results; and until very recently (Yoho, McClay), no recommendations were made about needs for additional research to uncover cause-effect relations. Ideally, precise problem fortTIulation and careful prosecution of scientific research to solve a problem should reveal need for additional research and the type of problem solving that promises to uncover useful answers. Scientific problem solving is seldom terminative but usually opens doors to further progress.

Absence of knowledge about cause-effect relations, empirically tested, explains in part why substantially identical recon1mendations for small-owner policies and programs have been made in these descriptive studies. In formulating the problem, emphasis on management status and characteristics of owners practicing forestry inevitably leads to prescribing more of· the same medicine presently in use-persuasive education and direct aid of various kinds -to get more owners to practice forestry. The only alternative courses for getting more owners to practice forestry are those of force (public regulation) and purchase, both seemingly simple and direct but specifically discarded by Barrett (D, 1960) as no longer appropriate under conditions in this country. The very slow improvement of the patient under such medication was noted more than a decade ago (D, Stoddard 1950). Nevertheless, more and stronger dosages of the same medicine are still recommended today, prompted by an inapt view of what small owners *should* do, essentially overlooking what they can or might do economically when motivated by considerations generally not discussed in these studies. These considerations are the subject matter of the next section.

Education can create awareness of need and of sources of help. It may even create a properly receptive disposition and instill some motivation, leading to acceptance of economic aid. But it does not provide the principal and necessary economic conditions and ability to meet that need individually and voluntarily. Specifically, education does not n1eet the main requirement of a large accumulation of capital held for long periods in order to practice forestry intensively.

Doctors Beal and Bohlen, recognized as leading authorities on the subject of how new ideas are received and accepted, have said (D, Anonymous 1961) that an educational project designed to interest owners in ideas to improve timber production cannot be a one-shot program. Many other factors are involved -group attitudes and orientation, values, and rationality-and the economics factor is one of the foremost. Because of long-term operational requiren1ents in

forestry, the question, "When do I get my money back?" was said by Beal and Bohlen to be especially important.

Mignery indicated, as quoted in the review (see p. 16), that 25 years of continuous and varied promotion of forestry in Nacogdoches County, Texas, did not accomplish much toward improved or sustained programs of management. Dana *(G,* 1960) said, "State and Federal cooperation with private owners has so far not been conspicuously successful in bringing about any widespread improvement in forest management. Education, service, and subsidies alike have failed to achieve the hoped-for result, particularly on the part of the small owner. Yoho *(D,* 1961), in connection with the multiplicity of public and private programs directed toward small owners, saw a "need for objective and impartial research into our entire forest policy structure. Such studies should begin with the basic underlying assumptions for I am sure that in the past we have been guilty of predicating entire programs on faulty or unrealistic assumptions."

The continued advocacy of a program of persuasion,. chiefly distinguished by its chronic inability to produce immediate and lasting improvements in management and the reported urgency of the problem it is supposed to solve (52 billion board feet of timber from small holdings by 2,000), further attests to futility of formulating the problem of increased production on small holdings in terms of management status and characteristics of owners now practicing forestry. It is time the other side of the coin was examined: Why don't small landowners practice forestry?

ECONOMIC INFLUENCES ON TIMBER PRODUCTION

The studies grouped under the second major category, while not giving direct answers to why a majority of landowners do not practice forestry, nevertheless afford some illuminating insights on this question. In general, they were concerned with specific analyses of reasons why a minority of landowners do attempt management of their woodlands. Through this approach to explaining observed actions, of attempting to uncover cause-effect relations, they suggest the kind of problem formulation that could lead to an understanding of why the vast majority of small owners in the Nation follow either of two courses with respect to their woodlands: (I) exploitive practices, progressively impairing the productive potential of a holding or (2) neglect of a woodland, neither exploiting nor deliberately improving it.

The significance of studies in this category is not so much in what each tried to do and how it was conducted, but rather in ideas reached through a process

of deductive reasoning. Consequently, the basis for discussion of this category is the viewpoint·behind the reasoning process-the point of departure, so to speak.

Two viewpoints are elaborated by these studies, each discussed·in turn below,.

The Public Point of View

The 1956 study by Worrell and those by Stoddard and by Webster and Stoltenberg adopted a public point of view similar to the former category (p. 33) of. studies that concentrated on owner characteristics and management practices. The three studies had two main traits: (I) each tacitly assumed, in keeping with Forest Service findings, that the Nation would face an eventual deficit in its softwood timber requirements unless small owners produced a larger share than previously and (2) small owners could take actions that would avert a deficit-they could practice forestry. Each study then proceeded to another level of abstraction and analyzed various implications of the particular \vorking hypothesis used. Significantly, conclusions eventually reached in each study questioned the validity of assuming that small owners generally can afford to practice intensive forestry. Worrell, Stoddard, and Webster and Stoltenberg recognized their dilemma and then modified their recommendations to take account of what appeared to be an invalid assumption.

Worrell's 1956 study was unusual in several respects, not the least of which was' an explicit statement of his point of departure:

> In this particular study we are concerned with planning resource use for the benefit of society as a whole. We thus will be considering a social optimum and can restrict the concept under·study to an "optimum intensity of forest land use on a regional basis."

His study cast considerable doubt on the wisdom of assuming (I) that small owners economically can intensify management to any great extent and (2) that public programs can yet devise effective means for overcoming economic determinants of an individual's actions, preliminary to carrying out planned social adjustments.

Worrell's study might well be described as a theoretical problem analysis of the kind that should have been undertaken prior to developing public programs for improving management on nonindustrial holdings. It is noteworthy that Worrell's discussions of short rotation forestry (*E,* 1957, 1958) that followed this study suggested that production from small. holdings in the South may not be essential to the regional economy if other forest lands are well managed and that small owners should be permitted to handle their properties

in a manner dictated by individual objectives rather than by public welfare planners.

Stoddard (*E,* 1949) also clearly illustrated economic limitations that render intensive management by most small owners difficult, if not impossible. Lack of capital was the chief obstacle preventing the establishment of a forestry enterprise. Despite Stoddard's belief that greater production from slnall holdings was needed, he reluctantly concluded that the prospect of obtaining it was unfavorable, even with public progran1s of education and assistance.

Webster and Stoltenberg (*E,* 1959), after examining response to public programs for improving management among small owners, cast doubt on the use of such programs as income-raising devices, showing that chief response generally was from more well-to-do owners. Here, too, a public viewpoint toward small holdings ran aground on a reef of economic determinants apparently circumscribing owner actions.

Because Christensen (C, 1957) was interested in factors determining owners' management objectives, comments on his findings are included here. Inclusion of just one economic variable (income) in the analysis and discovery that only a small proportion of owners (in the counties studied) had a purely economic objective (income from sale of timber) guiding their management activities seemed to imply that analysis of economic factors would contribute relatively little to an understanding of why only a few small owners practiced forestry. Sociological and psychological influences were implied as being much the stronger determinants of action among the few. This point maybe quite near the truth. But the study apparently did not recognize that economic factors may be paramount in explaining why the great n1ajority of small owners do not practice forestry and that those who do, do so only when motivated by nonmonetary considerations.

Because the objective of producing income from timber sales seelned correlated with ownership of larger properties (suggesting higher levels of assets and income), a logical inference would have been that economic determinants prevent most owners with lower incomes from the saving and investing out of income that is a prerequisite to forestry.

An opening statement notes that there have been "numerous public and private programs aimed at making people aware of the need for conservative forest resource use, [but that] ... response has been variable and, in the case of small woodland owners, disappointing. . . ." To have concluded, therefore, "that educational programs in forest conservation, to he effective, should be based on a wide perspective" of sociological, economic, and psychological influ-

ences, seems contradictory. A conclusion more ,varranted by evidence, judging from programs presently in existence, would have been that broad programs have less chance of success than Inore narrowly focused programs specifically designed for classes of owners with similar motivations. In need of testing, then, is the relative success of various types of educational programs aim.ed at different groups of owners, as well as how to group owners responding to similar motivations and thus susceptible to a given type of program. Webster and Stoltenberg's work attacked this question.

A very questionable conclusion in Christensen's study is that "the dearth of research on forest owners' management objectives and motivations means that any study at all in this·field would result in a contribution of one form or another." While this statement is true, its implication is unfortunate. Surely research effort should be confined to those studies that formulate a problem carefully, develop a well-thought-out hypothesis to guide the work, and reach conclusions warranted by the evidence assembled. Contributions are not wanted for their own sake, but for the validity of what they reveal.

The Individual Owner's Point of View

The studies ren1aining in this category concerned with econolnic influences on timber production (Duerr, Wrigley, Barraclough and Gould, Worrell's two studies, Pilot Woodland Managelnent Program, and Coutu) rejected any assumption about the ability of small owners to practice intensive management and recognized that latitude for choice among management alternatives was narrowly restricted by economic characteristics of ownership.

The case studies discussed by Wrigley, Barraclough and Gould, and the Pilot Woodland Management Program specifically took up the question of profitability of woodland management from an *owner's* point of view and described actual results experienced by owners in particular circumstances. Barraclough and Gould explicitly discussed the economic nature of difficulties faced by woodland owners in the managen1ent of their holdings and took exception to the generalrecomlnendation of the publicly oriented group of studies that small owners should be compelled to follow specified practices that are good from a *public* point of view.

All of these studies assumed net returns to the landowner as the primary determinant of an owner's decision to manage his woodlands and recognized that raising total net income through management is not a practicable alternative for many owners who lack capital and labor to commit to such an enterprise. Lesser, but more immediate, returns from the farm enterprise and

inability to accumulate or hold capital were seen to be limiting factors that ordinarily prevent owners from practicing management that would satisfy most foresters.

Careful consideration of these studies leads toward explanation of a peculiar paradox in the realm of small owner forestry, a state of affairs that might be termed the paradox of profitability. Particularly during the last decade, foresters have preached emphatically that forestry is a profitable venture for small owners. Owners are supposed to be able to reap income periodically by putting unproductive lands to work through investments of capital and idle or slack time; that is, now, if they are fortunate enough to possess merchantable products. Otherwise, they will have to invest now and await deferred returns in the future. Demonstration forests in many places throughout the country seem to offer tangible evidence that profits are realizable; public and private assistance is available for owners who wish to follow the example set. But only a small number do so. Why don't more owners take advantage of declared opportunities for gaining increased income when many are desperately in need of additional dollars just to provide necessities of living? This is the paradox of profitability, and the recent studies carried out by research workers with a background of training in forest economics begin to shed some real light on what Duerr has so aptly termed "the refractory nature of the problem." Formulating the problem from the viewpoint of the owner himself, a readiness to hypothesize relations, and emphasis upon economic influences point the way toward a clearer explanation of the small owner situation presented in the section, "The Economic Determinant of Forest Management Intensity on Nonindustrial Forest Lands."

Small Owner Research in Perspective

Completion of the review and critical analysis of representative studies of the small owner situation calls for certain observations by way of summary.

Viewpoints and Implied Assumptions

The viewpoint from which a study is undertaken has important consequences for its outcome. Those studies that viewed small holdings as a crucial element in the Nation's timber supply implicitly assumed that small owners could practice intensive management. Such studies inevitably were forced to conclude that some sort of public planning and assistance were required to catalyze this ability, and a few recognized that economic factors apparently limited an own-

er's ability to practice forestry. This public view appears to have overlooked the possibility that sustained production and frequent harvests coincided with the aims of but very few small owners. This view further overlooked the fact that no effective means had yet been devised for artificially reconciling a public welfare aim and widely divergent private objectives.

The relatively few studies, on the other hand, that recognized an individual owner's objectives and capacity as paramount assumed nothing about the small owner's management ability. Furthermore, these studies cast considerable doubt on the probable effectiveness of public education intended to persuade more owners to practice forestry. It is implied that strong economic influences prevented the great majority of owners from responding to these programs and even hinted that those who did respond to offers of assistance might be favorably disposed toward voluntary investment in management anyway, if forestry knowledge was implanted. Subsidies in their case would be unnecessary. These studies imply that to be realistic efforts to encourage better management on small holdings should help owners to better appraise alternative courses of action economically within their means and let them adopt the management program that most nearly coincides with their immediate objectives and circumstances.

The public view stresses what an owner *should* do. The individual view stresses what an owner *could* do, given his particular circumstances and objectives.

Problem Formulation

Three distinct problem formulations are evident from the results of small ownership research during the last two decades. The first chronologically, and still current, is that conception prompted by a public welfare view, formulating the problem in terms that focus attention on a minority segment of small owners—those presently practicing forestry—and leading to recommendations for ways to encourage more owners to follow suit. The second, which seems to have attracted little notice, is best typified by Duerr's low-income analysis (*E,* 1948). And the third is a promising formulation by Zivnuska (*B,* 1959) from analysis of experience in other countries. These three formulations start from the same thesis that small forest holdings constitute a major problem; but notice the widely separated courses of action to which each viewpoint and formulation leads.

The first formulation mentioned, the viewpoint it embodies, and the recommended course of action to which it leads vividly recalls a conclusion reached

by Salter *(G,* 1948) after an intensive study of land economics research in the United States:

> This critique also indicates that in many instances problem fonnulations have become stereotyped, particularly after public programs have been inaugurated with such problems in mind. Under these conditions research fails to explore contrary clues and may actually overlook, as exceptional, evidence that suggests that an entirely different problem exists.

This formulation, in danger of becoming habitual, is how to make more small o,vners follow improved management practices so as to satisfy a public welfare objective. Neglected evidence is that which points toward economic factors as critical determinants of owner action.

Salter's analysis of published research led him to make the following critical comments, repeated in full because of their appropriateness with respect to small ownership research.

> . . . critical sifting of evidence . . . does, however, reveal pieces of research which succeed in clarifying issues and thus pose problems well formulated for further inquiry. It reveals some which establish highly suggestive quantitative relationships that stand in need of further testing by reference to the actual patterns of experience. Others neatly lead through a conceptual clarification ofa problem with evidence that is drawn from sequential experience but is so poorly arrayed that others cannot even indirectly participate in the observations made; or again they attack clear-cut problems \vith specific and relevant evidence but fall short either of posing problellls for further analysis or of advancing recommendations for action.
>
> To the extent that various research undertakings have accomplished these steps, specific, definable progress has been Iuade. Yet this review of land economics research also leads to the observation that in the absence of an outline of the requisites of full inquiry, succeeding studies fail to build one upon the other. If it is granted that practical considerations made it difficult frequently to engage in full inquiries, it becomes all the more important that segmental studies be so arranged that their specific place can be seen in order that other studies may add further steps in a progressive line of inquiry. Unfortunately, however, it is more common for pieces of research to be repetitive rather than progressional. And even where highly suggestive clues have been uncovered or where problems have been carefully defined in partial studies, these useful starting points have often lain idle for want of further connected study.
>
> This analysis makes clear that one of the greatest obstacles to effective research is the persistent failure to pose a problem or a hypothesis as defined above. The objective of much research is no more clearly defined than 'to present materials that may be of interest to others.' With such a compass the outcome of the work is merely the presentation of a mass of data, the rele-

vance of which to the problematic situation may be great or small but is not indicated in either case. Such work consistently fails to result in warranted recommendations for action or even in suggestive ideas for further inquiry. As previously explained, this type of work may not be without justification; but it cannot be regarded as an effective contribution to progressive social inquiry. In some cases, however, these reports carry recommendations for action; but it is clear that such recommendations came from some source other than the reported research.

Zivnuska's approach in his study of Norwegian experience is one line of research that should be further explored. Other Scandinavian countries and Germany have wrestled with their respective small owner situations for some time. A careful analysis of their conditions and experiences can yield helpful ideas for possible application in the United States. The two articles by Streyffert (*D*, 1961) and Yoho (*D*, 1961) show how fruitful this approach can be.

Inasmuch as Duerr (*E*, 1948) was the only one to have formulated his problem in terms of why owners do not practice forestry and since his analysis has received but scant attention, it might be argued that his conception leads into a dead end. On the other hand, reluctance to follow his lead seems indicative both of neglect of his ideas and of a general unwillingness to formulate an analysis of the small owner situation in strict economic terms-to see it as a problem involving alternative actions.

Recent work shows a strong trend to seek a solution through studies of motivation, emphasizing sociological and psychological factors. Yoho *et ale* (*B*, 1957) in suggesting ideas for further research had this to say:

> The most need seems to call for a fundamental type of study concerning the motivations of private forest owners. Forest economists in the past have tried to explain owner actions in terms of the theory of the economics of the firm. This may explain the behavior of industrial owners, but with the present means the economist has of measuring the intangible values of the forest, economic theory is limited in explaining the actions of most forest owners. This is particularly true for non-farm owners. Even in the case of farmers whose actions can be explained fairly well in agricultural production by economic theory, forestry appears to be an exceptional enterprise.
>
> The author believes that a psychological study of owners' attitudes and behavior Inight make the contribution needed to fill this void.

Christensen (C, 1957) found owners to be "motivated" by a tremendously varied "complex of sociological, economic, and psychological influences," which he interpreted as requiring programs with broad perspectives. Keniston (*B*, 1958), after reviewing studies of the small owner situation made between 1942 and 1957, recommended that future studies should emphasize the owner as a

person, after the manner of agricultural extension and related studies in rural sociology and social psychology. McArdle and McClay, as noted earlier, both endorsed a need for studies of motivation.

A sociopsychological approach is primarily useful for improving the effectiveness of extepsion workers and service foresters; but the two decades of relatively ineffective effort by such workers in this country leads one to strongly question whether the extension approach can ever reach more than a few owners who are *pecuniarily able to practice forestry for nonmonetary satisfactions.* This approach offers no promise for understanding the problems of the great majority of nonindustrial owners who may be economically unable to practice forestry. While sociopsychological studies can enlarge knowledge about a minor segment of nonindustrial owners, such studies cannot disclose why past remedies produced such meager results. The economic approach advocated by Duerr, however, seeks to explain circumstances of the great majority of .nonindustrial owners.

If, according to the paradox of profitability, a small minority of owners manage their woodlands because this is profitable either in terms of dollars or nonmonetary satisfactions, while the great majority of owners apparently regard such action as economically undesirable, then why shouldn't an economic analysis provide the best avenue for attaining complete understanding of the nonindustrial owner situation-and in the process suggest more effective remedies for resolving it?

Future Research

The three premises stated below sum up the foregoing critical review and are the foundation for the remainder of-this study.

Inadequate problem formulation and preoccupation with promoting forestry on small holdings has resulted in most research being concerned with a minority segment of nonindustrial owners—the relatively few disposed to practice forestry, with or without grants and subsidies, once they are introduced to its technical aspects.

Inadequate problem formulation and general lack of hypothesizing account for the fact that even though correlations between some ownership characteristics and certain management actions have been uncovered, a theoretically sound, unifying explanation of such phenomena, based on causal relations, has not yet been advanced to explain actions of both nonindustrial owner segments -those who do or would practice forest1·y, and the much larger number who apparently cannot afford to.

A reoriented research approach, promising a unified solution for a confused and contradict01·y problem situation, lies in elaboration of a theory based on economic principles that seeks to interpret economic implications found in a wide array of evidence drawn from available ownership studies, evidence which has largely been overlooked to date.

THE ECONOMIC DETERMINANT OF FOREST MANAGEMENT INTENSITY ON NON-INDUSTRIAL FOREST LANDS

THE ideas and work of others discussed in preceding sections imply a basic economic cause in the nonindustrial owner situation. The heart of the problem is the profitability of practicing forestry. Formally stated, the question is: What determines the extent to which nonindustrial forest-land ownerscan afford to practice forestry?

A few comments about this problem statement are in order. First, some deadwood is cleared away-there is no mention of small owners. The restriction, "small," was originally used by the Forest Service to describe forest-land ownership in the *1940's* and has since been used widely by others. While useful for summarizing and discussing ownership data, this restriction has not been shown to contribute to an understanding of the real problem at issue today; it has not contributed to an understanding of the incentives that sway management decisions among nonindustrial o\vners. Limiting the· situation to owners holding less than 5,000 acres of commercial forest land is an arbitrary restriction that tells where the problem of low productivity lies but not why it exists.

The new qualification, nonindustrial, has meaningful economic significance. It implicitly accounts for very real differences in management influences to be found between those who just grow timber on the one hand, as compared to those who both grow and convert stumpage. For an industrial converter of stumpage, profitability of a forest enterprise is influenced by a strategic value of woodlands held in conjunction with a manufacturing plant and by the fact that the owner constitutes his o\vn market. Such operators ordinarily are less subject to open-market problems. In general, they are able to obtain a greater economic advantage from their stumpage than those who sell timber through an outside market.

Limiting the problem statement to nonindustrial rather than to small owners broadens the scope of the problem but at the same time permits viewing it in a more homogeneous context of causal influences. The problem as stated encompasses those owners who practice forestry as well as those who do not. A solution to the problem must therefore be framed· in terms of influences that prompt a wide array of responses from both groups of owners. The objective is not that of focusing attention on a large number of owners who are not behaving as professional foresters think they should behave, but rather it is to under-

stand why a particular class of owners, by and large responsive to the same economic influences, react in such a varied manner to those influences-practicing all the way from very low to very high management intensities.

THE ROLE OF THEORY

Empirical Data and Model Building

As evidenced in the preceding section, knowledge of ownership characteristics acquired through interviews with owners and examinations of their properties has not been harmonized by any theoretical treatment, economic or otherwise. An effort to do so must face the fact that a model, or theory, must abstract from empirical data in order to refine, order, and describe them.

A theoretical explanation of observed phenomena faintly resembles explanations and descriptions offered by owners themselves as to what determines their actions. What they recognize as causal influences is based on their particularistic viewpoint as shaped by specific individual interests. In contrast, a theoretical economic explanation is based on aggregative reasoning that seeks to describe some aspect of the economy-in this case, what determines investment decisions of nonindustrial owners.

Explanations and rationalizations given by individuals constitute one set of empirical facts. An aggregative theoretical description of investment decisions of owners must of necessity rest on a quite different set of economic facts or principles. As a result, disagreement with theory often arises over its vague resemblance to ways in which individuals actually think and make decisions. In order to be useful as an aggregative explanatory device, a theory ignores data irrelevant to its purpose. This idea was treated at greater length by Baumol *(G)* 1961), Modigliani *(G)* 1961), Eisner *(G)* 1956), and Alchian *(G)* 1950). As Eisner indicated, interview and questionnaire -findings "can be very useful in enriching the model and offering links between empirical data and theoretical formulations which will make the latter more fruitful in empirical and substantive prediction." In touching on this same issue, Hayek *(G) 1948)* referred to empirical data as knowledge of the particular circumstances of time and place. Interview findings may complement but not substitute for economic theory.

Empirical facts relating to circumstances of time and place are especially useful for identifying those owners who would accept and use advice on how to operate more effectively in pursuit of specific goals; but such facts might be of little use in explaining why owners do or do not respond to various programs

designed to promote intensive management. Facts and principles on which economic theory is built typically are of limited use in telling individuals what actions should be taken or how action should be modified. The usefulness of theory, nevertheless, lies in ability to explain phenomena, such as why the aggregate of nonindustrial owners exhibit varied responses to. the same economic influences. Facts of theory have value for precise predictive purposes because they are independent of changing individual circumstances. The model or theory to which these facts lead can then be used to deduce verifiable implications concerning which owners will respond in what manner to specific influences and how policy'should be initiated or modified to achieve specific goals. These implications are fundamental to formulation of sound policies and programs to ameliorate an undesirable situation.

Decision Theory

A theory of why owners intensify management practices leads directly into an area of economics that is still young and rapidly changing-decision-making under uncertainty. Numerous theories have been advanced; some have been partially tested, but no general agreement seems to have been reached on any one theory.3 Development of decision theory under uncertainty resulted from realization that the classical theory of the firm was woefully inadequate for describing·how individuals act under actual circumstances and conditions that are the reverse of those assumed in the theory. Thus, the theory developed in this section lies in a new and relatively uncharted area, although some elements of decision theory are found to support the theory of owner response presented here.

THE CAPITALISTIC INVESTMENT CHARACTER OF FORESTRY

Forest management intensity refers to the amount of variable inputs of capital and labor that an owner applies on a given area of woodland. The inherent nature and length of the production process in forestry, however, is such that inputs of both land and labor can also be viewed as capital inputs; they become deferred-return investments. Intensity of forest management, therefore, is closely related to the degree of capital intensiveness with which an owner manages a woodland enterprise, that is, the amount of capital invested per unit of area. From this viewpoint, the practice of forestry is dependent upon the capacity of an owner to accumulate and hold forest capital

3. A detailed survey of the status of decision-making theory was undertaken by Simon *(G, 1959)*·

to begin with, and to make further investments of capital in his forestry enterprise. From this reasoning comes the first of two major propositions[4] underlying the theory developed in this chapter: Forestry is a capitalistic venture; its practice presupposes investment in expectation of a profitable return.[5]

The investment character of forestry is illustrated in Table 1. Columns 1 and 2 are taken from a normal yield table for Douglas-fir.

Assuming an even-aged stand, column 2 represents the yield per acre obtainable from a harvest cut at the end of the different rotations given in column 1. Column 3 converts volume yield per acre in column 2 to value yield at the following rates:

Age	*Rate per Thousand Board Feet*
(*years*)	(*dollars*)
30	10
40	12
50	14
60	16
70	18
80	20
90	22
100	24

The increase in rate reflects the effect of age and size on value.

Columns 4 and 5 show marginal growth percents, based on columns 2 and 3 respectively, in volume and value terms. These marginal rates are obtained by the formula,

$$\frac{\text{Volume at end of period}}{\text{Volume at beginning of period}} = (1+p)^{10}$$

The factor $(1+p)^{10}$ is converted to its corresponding percent by reference to a

4. The second is stated on page 75.

5. This has long been a widely expressed and accepted concept in forest economics. See, for example: Buttrick, P. L., Forest Economics and Finance, John Wiley & Sons, Inc., N.Y., 1943 (chapters 14 and 19 particularly); Chapman, Herman H., Forest Finance, Tuttle, Morehouse & Taylor Co., 1926 (chapters 1–12); Duerr, William A., Fundamentals of Forestry Economics, McGraw-Hill Book Co., Inc., N.Y., 1960 (chapters 8–10); Duerr, William A., and Vaux, Henry J., Research in the Economics of Forestry, Charles Lathrop Pack Forestry Foundation, Washington, D.C., 1953 (pp. 13–18 and chapters 3–5); Fernow, B. E., Economics of Forestry, Thomas Y. Crowell Co., 1902 (pp. 125–139); Hiley, W. E., The Economics of Forestry, Oxford University Press, London, 1930 (Part II); Marquis, R. M., Economics of Private Forestry, McGraw-Hill Book Co., Inc., N.Y., 1939 (chapter 2); and Matthews, Donald M., Management of American Forests, McGraw-Hill Book Co., Inc., N.Y., 1935 (chapter 12).

TABLE I. ANTICIPATED YIELD AND RATES OF RETURN FOR AN EVEN-AGED STAND OF DOUGLAS-FIR ON SITE II

Age Class of Stand (1)	*Yield per Acre*		*Marginal Growth Percent*	
	Volume (2)	*Value*[1] (3)	*Volume* (4)	*Value* (5)
	(*board feet*)	(*dollars*)	(*percent*)	
30	2,600	26		
			16.4	18.6
40	11,900	143		
			8.7	10.6
50	27,400	384		
			4.6	6.0
60	42,800	685		
			2.9	4.2
70	57,200	1,030		
			2.0	3.1
80	70,000	1,400		
			1.5	2.4
90	81,000	1,782		
			1.1	2.0
100	90,400	2,170		

1. Value is based on market value of merchantable stumpage only, implying that selling the land and submerchantable growing stock along with the merchantable timber is not considered. The effect of including an expectation value for land and submerchantable growing stock would be to lower the marginal value growth percent slightly in the upper half of the table. The effect would not be noticeable in the lower half for two reasons: (1) adding a constant amount, such as $20 per acre, to column 3 to represent bare land value causes a perceptible change in ratio between successive age-class values only where these values are relatively small and (2) in the older age classes most of the growing stock is merchantable; hence, there would be no additional expectation value for submerchantable timber.

table of compound interest values. Column 5 shows the expected additional or marginal value realizable as rotations are lengthened by 10-year increments.

Columns 2 and 3 illustrate in physical and dollar terms respectively the investment character of timber growing. The act of just holding growing stock is analogous to saving current income. As growing stock accumulates, the total capital invested also accumulates. Even the very lowest level of forest management, the act of just holding growing stock, irrespective of stocking level, requires capital investment.

To do more than just hold growing stock, to apply management practices—planting or seeding, thinning, cleaning, pruning, fencing, or roadbuilding—requires further application of capital. These practices represent economic costs in terms of an owner's time and labor, if done by him, or in cash outlays if la-

bor is hired. Immediate services of current income are foregone in expectation that future income will increase through these practices. Moreover, several decades may intervene between the time when capital resources-land, growing stock, labor, and cash outlays-are committed to forest practices and the time when returns are realized.

Investment Theory and Forestry

A rapidly growing part of economics is concerned with investment theory, an aspect of the theory of capital. Investment theory is by no means completely developed and accepted. The discussion by Haavelmo in his recent book (*G,* 1960) gives an excellent account of the present state of theories of capital and investment. His analysis of these broad concepts follows a typical macroeconomic approach, which is appropriate to their theoretical treatment but is not designed to explain investment decisions of individuals.

During the last decade, other rapidly expanding facets of economic analysis for decision-making have emerged under the general headings of capital budgeting and managerial economics. Essentially, these are applied developments of capital and investment theories at the microeconomic or firm level. Many of these analyses have been directed toward developing easy-to-understand rules and formulas for businessmen to follow in managing businesses. But a good deal of disagreement has arisen among these applied analyses over the question of what businessmen should or do maximize.

Recently, in an effort to find answers to controversial questions about investment decisions of businessmen, these applied treatments have been subjected to intensive theoretical scrutiny,6 and out of such attempts has come not only a closer reconciliation between applied and theoretical aspects of economics but also the beginnings of a theoretical explanation of factors governing investment decisions of private individuals rather than firms. This theoretical approach incorporates the older restricted body of investment theory that had developed around markets for securities.

The central problems in investment theory-what to maximize-and its cor911ary-when does an optimum occur-are two questions that were resolved in forestry literature over 110 years ago, long before investment theory became organized systematically. The soil-rent analysis in forestry or Faustmann formula so-called, named after its originator, was published in 1849 for the pur-

6. See, for example: Hirshleifer *(G,* 1961); Baumol *(G,* 1961); Hitch and McKean *(G,* 1961); the discussions following the two latter papers; Simon *(G,* 1959); Meyer and Kuh *(G,* 1957); and Alchian *(G, 1950).*

pose of providing foresters with a practical guide for estimating an optimum replacement pattern for forest capital. The theoretical validity of this approach, however, long was disputed by foresters and even today is not accepted by many. Moreover, its relation to theories of capital and investment is virtually unrecognized among economists (G, Gaffney 1960). This situation began to change during the last decade or so, largely due to an impetus provided by financial maturity-a recent approach to understanding the management of forest capital. Forest economists, in developing and analyzing financial maturity, have attracted attention of economists (G, Gaffney 1960) and agricultural economists (G, Faris 1960) alike and aroused their interest in the theoretical validity not only of the soil-rent analysis but of financial maturity as well.

Gaffney performed a valuable service by showing how the soil-rent analysis is related to various concepts of financial maturity-essentially formulas or rules devised both by foresters ·and economists to decide when is the optimum time to replace a capital asset and what to maximize in the process. Gaffney's analysis clearly showed the close correspondence between·investment decisions in forestry and the general body of investment theory in economics. Faris elaborated some of the same ideas and also related them to investment theory. Hirshleifer (G, 1958), from a highly theoretical standpoint, did much the same job as Gaffney, but without direct reference to forestry.

The practice of forestry in its financial requirements corresponds essentially to management of any other form of long-term investment. Hence, factors that govern allocation of capital resources to investment opportunities also govern choice of forestry as an appropriate use for capital resources.

But what are these factors? What governs decisions of individuals to spend current income, to save and invest out of income, to disinvest, or to pursue any combination of these broad alternatives? For purposes of discussion, the·pertinent factors can be divided into characteristics of investment opportunities and characteristics of investors.

Investment Characteristics

Investing increases future wealth or income through postponement of present consumption. Hence, the primary characteristic of an investment opportunity is its earning capacity. On the basis of Gaffney's ·and Hirshleifer's' works, net present worth of expected future returns from an investment is an appropriate guide for estimating the earning capacity of·invested funds or resources. This concept is implicit in the soil-rent and financial maturity concepts.

Flora (*E,* 1961) developed a model in which discounting was replaced by a utility maximization approach.

The second characteristic, nature of an investment opportunity, determines to a large extent the ease with which earning power can be evaluated. For some types, such as a stock or a bond, this process is relatively simple and straightforward, especially in the case of a u.S. Government Savings Bond. The only out-of-pocket cost is that of its acquisition; its revenue, expressed as a rate of return, is virtually guaranteed. Market securities of private corporations and some governmental units are not so easily evaluated, for in addition to acquisition costs there may be liquidation costs as well. Moreover, rates of return are not guaranteed and may be difficult to estimate, involving questions about present and future prospects of the economy, an industry, a firm, earning capacity of a company, management ability, future costs and returns, and similar factors that directly affect investment quality of a security. Beyond the field of securities, there lies' a wide territory containing every conceivable type of enterprise investment situation requiring direct ownership or participation—professional services, manufacturing, farming, and forestry. Special problems may be associated with acquiring, holding, and maintaining an enterprise. Furthermore, returns may be continuous or periodic, immediate or deferred. Estimating profitability of such alternatives presents many of the difficulties, complications, and hazards of evaluating securities plus additional problems of controlling enterprises and understanding specialized technologies.

A third investment characteristic is the possibility of capital loss, a hazard that cannot be insured against. While the possibility of default may be almost insignificant in high-grade corporate and Government bonds, capital erosion by inflation isa serious source of loss in. so-called fixed investments-savings accounts, savings bonds, life insurance, and retirement plans, to name a few common ones. The possibility of loss may be very high when establishing a new enterprise to exploit a newly discovered process or product; or it may arise because of a very long production process, as in forestry, during which any number of events could intervene to cause losses and make receipt of future wealth or income very uncertain. Whatever the cause may be, this uncertainty must be taken into account by an investor; it directly affects the estimated profitability of an investment.

Liquidity is a fourth characteristic affecting the attractiveness of an investment. The convenience and ease with which an investment can be converted into cash may figure prominently in choosing an investment opportunity. Liquidity of capital assets is enhanced by the presence of convenient markets

where assets may be sold or traded; by regular or continuous demand for the services of a given type of capital asset; and by an easily recognized or deterj mined capital value. Money represents the ultimate in liquidity. Securities traded on organized exchanges are also highly liquid. Assets represented by a commodity tend to be less liquid, or may even be totally illiquid at times-real estate being one such example.

Evaluating Investments in Forestry

In estimating the earning capacity of a forestry investment, the marginal value growth percent shown in Table 1, column 5, is the marginal revenue on the capital invested-the additional dollar yield accruing to each additional input of capital. The main influences on the marginal value growth percent are incorporated in the example. These influences include (1) the prospective rate of usable timber growth, which is a function of species, size, age, stocking, site quality, and· stand composition, and (2) differences in unit value of timber growth due to size and quality. Other influences, not illustrated in the example, include (3) differences in unit value of growth due to expectation of price level changes and (4) any timber-growing cost that varies with size, age, or stocking such as taxes varying with stand value, regeneration costs in even-aged management, and any prospective changes in levels of cost rates of timber production.

Examples of rates of return earned by nonindustrial owners on a forest investment are not often found in published literature. Expected rates have been cited varying from 3 to 8 percent on large investments in land and timber in the East *(E,* Anonymous 1956). The New England Business Reyiew *(E,* Anonymous 1958) cites three cases where expected earning rates were 4 percent or less on relatively small holdings where. market values of standing timber ranged from $6,400 to $12,500. Redman *(E,* 1956) used rate of return on investment as the basis for a hypothetical explanation of disinvestment in hardwood timber production and indicated that 4 percent is the maximum rate that can be anticipated. Moise *(G,* Fedkiw *et ale* 1960) discussed the earning capacity of timber investments on a national basis and from the point of view of industrial owners, showing that rates of return have typically been in the neighborhood of 3 percent. Bond *(G,* 1938) showed rates of return that varied from 5 to 9 percent.

When forestry investment is evaluated, uncertainty and" liquidity are two cost elements that must be taken into account. Forestry is sometimes considered a relatively risky investment. Degree of risk, however, is highly subjec-

tive and is dependent upon the attitude and knowledge of an owner and the nature of alternative investment opportunities of which he is aware. Length of time required to produce a merchantable product and number of natural hazards to which timber is subject influence degree of risk. Economic risk arising from uncertain estimates of future managen1ent costs and product prices further contributes to uncertainty.

A forest-land' owner may reduce degree of risk from natural causes. by incurring additional costs. Management practices such as building roads and fire trails, fencing, thinning, pruning, and cleaning, can improve the resistance of a stand to loss7causing agents including fire, wind, ice and snow, insects, and disease. While some management practices-precommercial thinning and pruning, for example-may be regarded as deferred-return investments, the others more nearly resemble an insurance premium, wherein a small monetary loss is·deliberately sustained in order to reduce the possibility of a much heavier loss.

In contrast to his possible control over natural hazards, an owner can do little about the probability of loss from economic uncertainties. But he can act to protect himself from large-scale effects of these uncertainties and natural causes on his economic well-being by diversifying his investments. This well-known fundamental of prudent investing affords protection from natural and economic consequences of uncertainty, thereby reducing the cost impact of this investment characteristic. In a carefully diversified program, the net effect of several poor investments on an investor's economic well-being is minimized. To some extent an owner can diversify by geographically spreading his holdings, by practicing all-aged management, or by producing more than one species and product. Outside of forestry there is a wide range of possible avenues for diversifying investments-savings accounts, securities, real estate, and businesses, for example. Owners of relatively small holdings may be precluded from obtaining much diversification.

Diversification also offers protection from consequences of holding an illiquid asset. When several different types of assets are held, a sudden demand for cash need not result in a capital loss due to the forced sale of an asset at a low price in an unfavorable market. At given times, stumpage may be very illiquid, depending on such factors as species, size, grade, and location.

Capital in the form of merchantable growing stock can ordinarily be converted to cash with relative, ease when markets exist. Unlike dollars in the bank or invested in securities, a timber investment is tangible. It corresponds to real property or livestock in this respect; and to some investors a tangible asset is

a desirable quality, perhaps because it affords a feeling of not having relinquished personal control. The asset remains with the owner rather than in someone else's hands.

A timber asset is relatively flexible and over time tends to promote and enhance its own liquidity. It can be stored on the stump as a reserve against unforeseen contingencies or to await improved markets. It can be held and maintained with a minimum intensity of management if an owner has higher alternative uses for capital, or it can absorb and respond to capital inputs and yield a return on money and labor.

CHARACTERISTICS OF AN INVESTOR

To understand why varying intensities of management are practiced and what intensification of management demands of an owner necessitates investigation of those circumstances or qualities that prompt or permit woodland owners to save and to invest.

The act of investing requires that an owner accumulate and hold capital resources or funds, but whether he does so depends on (1) his economic situation, (2) the ultimate goal toward which he strives, and (3) his knowledge of investment opportunities.

Economic Situation

Two aspects of an investor's economic situation are especially pertinent to an understanding of why individuals save and invest: (a) the income level and asset position of a prospective investor, and (b) the nature of the immediate alternatives he faces for the use of capital.

Income level and asset position.-Although specific data on income level and asset position of nonindustrial owners are lacking, general knowledge about their economic situations indicates the majority typically have very modest or low incomes. When low income prevails, current income must be used just to satisfy current wants. Accumulating savings under such conditions is difficult, if not impossible. When income is insufficient to meet immediate needs, then disinvesting or capital consumption may result, if any capital resources are available for liquidation.

Empirical evidence showed a direct relation between asset level and an interest in and capacity for forest management. Owners who practiced management ordinarily had larger woodland acreages, and often a larger total acreage, than those who managed less intensively (*G,* Gaffney 1960; *B,* Anderson *1960; B,* McDermid *et al.* 1959; *B,* Seigworth 1958; *B,* Mignery 1956). Larger holdings generally had a higher volume of growing stock, often constituted of

more desirable species, which contributed to more valuable total assets. Forest managers appeared to have higher incomes and more secure financial situations than nonmanagers (*B,* Seigworth 1958; *B,* Yoho *et al.* 1957; *B,* Mignery 1956). Lack of capital, low income, and consequent inability to accumulate capital were identified as obstacles to intensification of management (*E,* Stoddard 1949; *E,* Duerr 1948).

A direct correlation between size of ownership and belief in profitability of forest management practices has been noted; furthermore, relative importance of the forest-land portion of a holding in terms of income increased with size of total holding (*B,* McClay 1961). Size of holding being directly related to income and to assessed value, and thus to asset level, suggests that intensification of management can be expected to increase as income levels and asset positions improve. The probable presence of an economy of scale is further suggested as a result of an interaction between an astute owner and a larger holding. As size of holding increases, a forest investment becomes intrinsically more profitable.

Alternative uses for capital.—Under the second aspect of an owner's economic situation—the nature of immediate alternative uses for capital—two broad choices face an individual: Capital can be spent, or it can be saved and invested. If an individual has a low cash income, in all probability he will be a consumer only; he cannot afford to save. And even if he is able to accumulate savings, he still may not choose to be an investor. He may prefer hoarding cash rather than depositing it in a bank. But as income level rises beyond the point where current wants are largely satisfied, people usually begin investing through one or more means—a savings account, Government savings bonds, life insurance, securities, buying a home, direct participation in a business or profession, or by practicing forestry. General evidence relating to income level and asset position of nonindustrial owners suggests that most are forced by their economic situation to be consumers; they are unable to save and invest to any great extent. Based on extensive experience in analyzing problems of nonindustrial owners, Yoho (*D,* 1961) remarked that he was almost convinced "that forest-land ownership must be the heritage of the underprivileged; for many of our small forest properties are in the hands of elderly people, partially physically incapacitated and extremely limited on capital."

Ultimate Goal

The second circumstance on which investment decisions depend relates to an owner's ultimate goal in life. Individuals have various goals toward which

they strive, and these goals have significant economic consequences. The precise nature of such goals is not easily specified. But their nature is not as important as their economic consequences with respect to decision-making. These consequences are reflected in individual investment objectives, in planning horizons, and in time-preference rates.

Investment objective.-Three primary objectives prompted by pecuniary motives are generally recognized: security of capital, current income, and growth of principal and future income. A fourth objective, distinguished by a nonpecuniary motive, involves such aims as recreation, hobby, or esthetics, which may yield very real returns to an investor in the form of subjective satisfactions.

If the practice of forestry is a capitalistic eriterprise of an investment character, how does it measure up in terms of these four investment objectives? Actually, a forest investment could be used to fulfill anyone of the pecuniary objectives—income, growth, or security-and is eminently suited for recreational, hobby, or esthetic purposes. Very little basic information is available, however, to indicate which objectives are sought when individuals invest in forestry; nor is it known to what extent such investment may be made involuntarily when property that includes some woodland is purchased for nonforestry purposes. Until recently, almost no consideration has been given to the part that objectives play in shaping management decisions.

Planning horizon.-Another economic consequence of an individual's ultimate goal is his planning horizon, which describes how far into the future his thinking extends. The less secure an individual's economic situation' is, the more concerned he is with daily wants and the less concerned \vith future needs. Until in1mediate necessities are met, he usually is economically unable to provide for the future. An individual's planning horizon is not fixed but may vary over time as his economic situation and objectives shift. Also, at any one time he may have different planning horizons in connection with different goals such as building an estate, retiring, educating children, buying property, or selling forest products.

Evidence on tenure suggests the strong influence that planning horizon exerts on owner decisions. The longer the time" period during which an owner expects to hold and benefit froln a property, the more forestry alternatives are open for his consideration.

Average length of tenure among nonindustrial owners is relatively short, ranging from 10 to 15 years (*D,* Yoho 1961; *B,* McClay 1961). With such potentially short" planning horizons, coupled with' older ages frequently en-

countered among nonindustrial owners *(B,* McClay 1961; *B,* Anderson 1960), general and widespread disinterest· in forestry-as expressed by low manage… ment intensity-is not surprising. Except for a specialty enterprise such as Christmas trees, most forest crops require a much longer period than 10 to 15 years between establishment and harvest. Therefore, unless market values gen… erally reflect higher values for properties with young growing stock than for under- or nonstocked land, there will be little pecuniary incentive for invest- Inent in stand establishment by nonindustrial owners.

Only where an objective such as estate-building (growth of principal) is paramount and future family tenure is expected will intensification of manage- ment appear attractive as an investment opportunity. With low incomes and short planning horizons, low management intensity, or even disinvestment through liquidation of growing stock can be expected.

Family tenure-the period in which a property has been held by one family and is expected to be retained and passed down within that family-ordinarily exerts more·influence than individual tenure because it implies a more distant planning horizon. Expected future family tenure implies long-range objectives. Of primary importance are estate-building, saving for a family's future, ob- taining increased future income, or providing for retirement purposes.

Somewhat contradictory evidence has been obtained in previous studies on the matter of planning horizon and tenure. Chamberlin *et al. (B,* 1945), James *et al. (B,* 1951), and Yoho *et ale (B,* 1957) were unable to find a correlation between length of individual tenure and management practice, but these find- ings do not appear conclusive, primarily because of heavy reliance placed on cutting practice as the criterion of management. But Yoho *et ale* discovered that expected length·of future family tenure seemed to be favorably related to sound cutting practices.

Seigworth *(B,* 1958) cited interest in estate-building as being correlated with management, which suggests a distant planning horizon. Anderson *(B,* 1960) found that forestry was being practiced by owners who were younger in age than nonmanagers. These observations suggest a longer planning horizon among managers and that younger owners perhaps know more about forestry. Sutherland and Tubbs *(B,* I959), on the other hand, observed that length of past tenure was directly related to disinterest in forestry. But this is under- standable in the low-income area to which their findings apply. Chronic low income and depressed conditions. inevitably lead to liquidation of assets; and the longer such conditions prevail, the less incentive or interest there is for activity that requires capital accumulation and investment.

Worrell *(E,* 1957, 1958) specifically discussed short planning horizons as typical of small owners and leading to short-rotation management. Redman *(E,* 1956) also recognized that present consumption was preferred to waiting. Duerr *(E,* 1948) discussed instability among small owners and related this to the idea of short planning horizons.

Thus, where future family tenure is expected, the planning horizon ordinarily will exceed the tenure of a given individual. Where future family tenure is not contemplated, an owner's planning horizon is unlikely to extend beyond his expected tenure and may actually prove to be shorter than his realized tenure period.

Time-preference rate.-The rate at which a person discounts the future is customarily called his time-preference rate. Owners with high time-preference rates based on consumption alternatives are unable to accumulate capital for investment purposes and, therefore, are unlikely to intensify management and invest for deferred returns. The most they can afford to do is to pay fixed obligations such as taxes and fire protection assessments, otherwise ignoring investment opportunities in their woodlands. The cost to them of undertaking any intensification of management is entirely out of proportion to benefits obtainable at some distant date. To them the present is worth much more than the future.

Figure ı portrays the rapid decrease in present value which occurs as interest rates and period of income deferment increase. To an individual with a I5-percent rate, for instance, the present value of an amount to be received 10 years from now is just 25 percent of the total amount. To him the high cost of waiting, signified by his time-preference rate, means that he would just as soon have one-quarter of the total amount now as to wait 10 years to collect all of it.

An alternative portrayal of time preference is shown in Figure 2, which shows a close relationship between planning horizon and time-preference rate. The curves show, for specific time-preference rates, the proportion of total capitalized value of an infinite annuity received by the end of a given period of years. For example, suppose an individual has just acquired a 5oo-acre woodland which under intensive management is expected to yield an average net return of $10 per acre per year for as long as he manages it. Suppose this man's time-preference rate is 10 percent. The capitalized present value of his $5,000 annual net income is $5,000/0.10, or $5°,000. The appropriate curve in Figure 2 indicates the proportion of the $50,000 he will have received 10, 20, 30, or 40 years from now. At 10 years, 60 percent of net present worth has been received;

FIGURE 1. Effect of interest rate level and period of deferment on present value of a single sum received at a future date

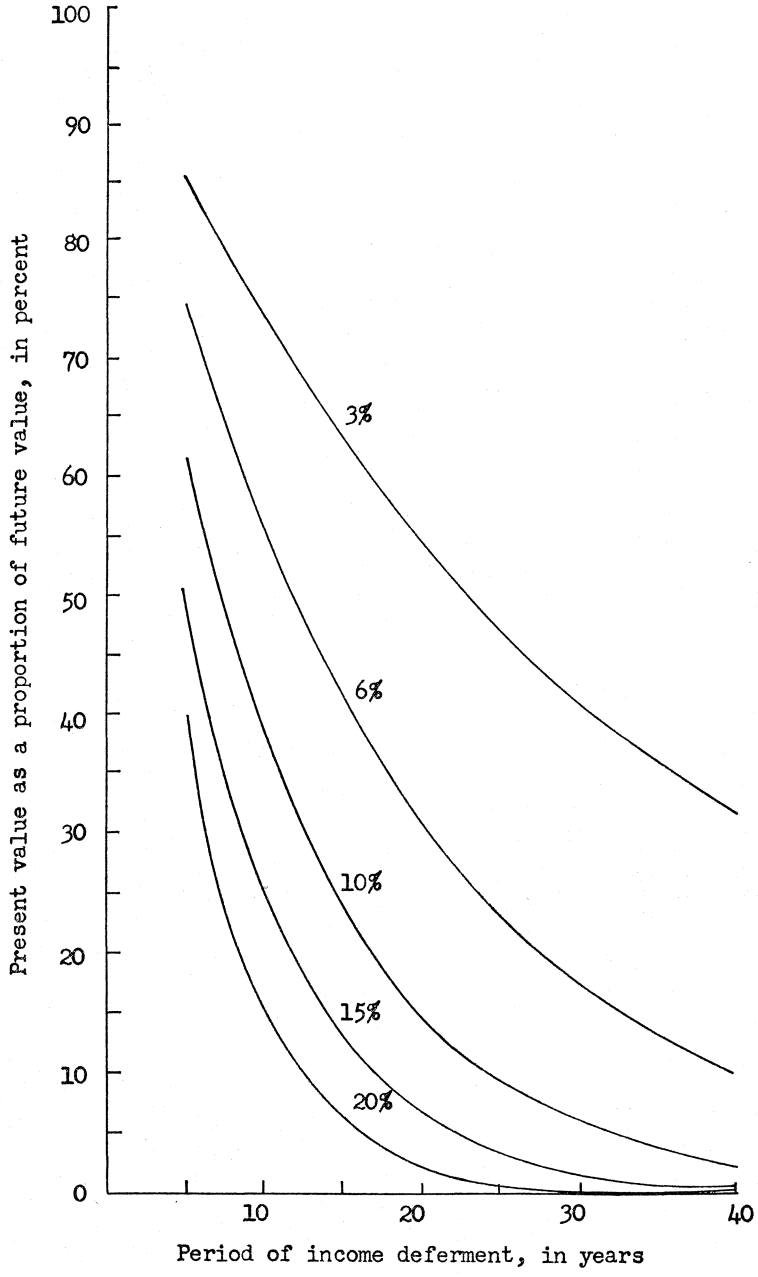
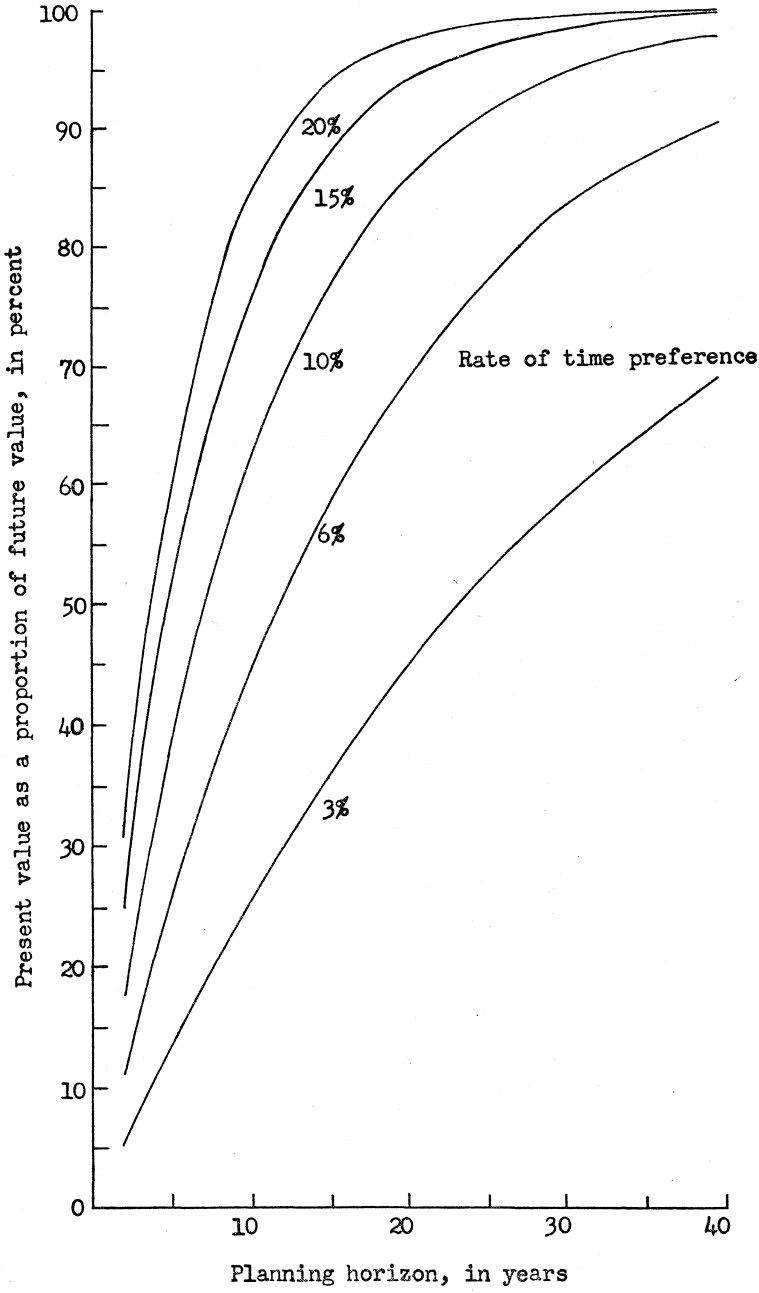


FIGURE 2. Effect of rate of time preference and planning horizon on proportion of an infinite annuity remaining unrealized at the end of a planning period



at 30 years, nearly 95 percent. As long as he holds this property, of course, the stream of earnings always extends into infinity; so he cannot be said to have realized a given proportion of its net present worth until the property is sold.

For any given rate, as the time period in Figure 2 is lengthened or the planning horizon extended, the proportion of net present worth that lies beyond the planning·horizon·decreases. If one arbitrarily assumes that less than some stated fraction of net present worth, say 20 percent, is of little consequence in shaping plans, a method emerges for explicitly relating the concepts of planning horizon and time preference. The planning horizon can be defined in terms of that period of time in which 80 percent of net present worth will have been realized. With a 20-percent rate, the planning horizon lies 9 years in the future; at 15 percent, it is 11 years distant; at 10 percent, it is 17 years away; and at 6 percent, it is 27½ years distant.

The 20 percent of income-more or less if warranted by circumstances and arbitrarily designated as not influencing plans-is justified in terms of an uncertainty allowance for estimating future costs and returns. This is a reasonable and not uncommon procedure for allowing for costs occasioned by uncertainty. Thus, it is possible to tie together time preference, planning horizon, and uncertainty in a logical framework. A brief outline of an alternative framework was presented by Smith *(G,* 1961). The model developed by Flora *(E,* 1961) also related time preference and uncertainty; he showed that time preference exerts an influence on investment decisions and can be distinguished from the value productivity of capital funds.

Guttenberg *(E,* 1950) specifically inferred a relation between individual time-preference rates and owner actions and noted its effect would be most pronounced among small·holders with low cash incomes. Others also have recognized this causal influence. Barraclough and Gould *(E,* 1955) implied a time-preference rate when they discussed high management intensity as being attractive only if future profits were valued highly. Yoho *et ale (B,* 1957) noted that rate of time preference could be expected to increase with age of owner. Streyffert *(E,* 1957) indicated that form of ownership (public, industrial, or nonindustrial) was reflected chiefly in an owner's attitude toward investment in forestry, in evaluation of alternative investment opportunities, in length of rotation followed, and in physical and monetary yields expected.as expressed by financial rates of return on a forest investment.

Redman *(E,* 1956) noted that discount rates applied by owners in decision making with respect to forest management planning were given by the maximum rate of return in alternative enterprises. As early as 1948, Duerr *(E,*

1948) specifically pointed out that small owners could not afford to wait for deferred returns because of their high personal rates of discount (time-preference rates). He realized the interactions involved in the small owner situation and explained the relation of low asset levels, high time-preference rates, short planning horizons, and the inevitable consequence of eXPloitation and depletion of woodlands. He saw this as a vicious circle that could only lead to greater levels of depletion.

Knowledge of Investment Opportunities

Most industrial owners are widely believed to be unaware of potential benefits from intensified woodland management and uninformed about this alternative for improving their cash income position. A lTIOre realistic inference would be that the majority of owners, being reasoning individuals by nature, in one way or another consider various alternatives for use of their capital resources. Through subjective and objective evaluation, hovvever imperfect or uncertain, many evidently conclude that their objectives are best served by pursuing 'alternatives other than intensification of forest management practices. These owners use their limited means in pursuit of what to them are more desirable alternatives and just do not have enough left over to invest in forestry. They do, nonetheless, recognize timber. capital as a means for achieving higher ends, often liquidating it for use in other alternatives.

Important issues are raised by the question)of how well equipped owners are to allocate resources effectively. Under the theory of the firm, which until recently was the only theoretical framework for analyzing actions of individuals, the rational economic man in a perfectly competitive market was assumed to have complete knowledge of market circumstances, or perfect foresight, and to be uniquely motivated by the single objective of maximizing profits. If these two basic assumptions are not met, the theory proves unacceptable as an explanatory device for describing actions of individuals.

Examination of the market situation actually confronting nonindustrial forest-land owners reveals that these two assumptions are unsound. The element of uncertainty, characteristic of any investment opportunity, means that an investor cannot possibly know future costs and returns. And it is axiomatic that no one person, at any moment, possesses all knowledge nor even most of what is known by others. (G, Hayek 1948). The existence of differing time-preference rates and planning horizons among individuals causes them to place different evaluations on the same property, implying the existence of mar-

ket imperfections. There do not appear to be large numbers of willing buyers and sellers at any market location, for all sizes and kinds of forest properties.

Even a single individual's evaluation of a property may not be consistent from orie period to another because of a shifting time-preference rate and planning horizon. Varying time-preference rates and planning horizons also suggest that forest investors may not be uniquely motivated by a profit-maximizing intent. Their desires mayor may not be solely money oriented; or they may display a preference for present certain wealth or income at the·expense of greater future wealth.

In short, nearly all the basic assumptions of the theory of the firm under perfectly competitive conditions are unfulfilled to a greater or lesser extent in markets for forest assets. To adjust various degrees of imperfection, as done in the extended theory of the firm under imperfectly competitive conditions, does not offer a satisfactory route toward development of a theory of owner response under conditions actually facing forest-land investors. The damaging effect of uncertainty on the theory of the firm has been thoroughly explored in the literature of economics.[7] Uncertainty completely invalidates the theory as a de,scriptive microeconomic device.

Alchian (*G,* 1950), however, found one way out of this difficulty by developing an "evolutionary" decision making theory that dispenses with profit maximization, predictable individual behavior, accurate anticipations, and fixed states of knowledge. Instead, he built on an interpretation of the economic systemas an adoptive mechanism and coupled this with a concept of individual behavior that includes adaptation, imitation, and trial-and-error effort as mechanisms through which individuals react to the inescapable presence and effects of uncertainty and incomplete information. His theory sets aside the optimization calculus of individuals motivated by profit maximization, which underlies the theory of the firm, and focuses instead on interrelationships of the market environment and types of economic behavior that appear in response. The pursuit of "positive profits," or what has come to be called "satisficing" *(G,* Simon. 1959) as contrasted to maximizing behavior, is the basic assumption of Alchian's theory. He showed why assumptions about motivations that prompt individual behavior are unnecessary in a theory that specifically takes into account the element of uncertainty.

Many nonindustrial owners may well lack accurate knowledge of. technical

7. See, for example, Simon *(G,* 1959), Alchian *(G,* 1950), and the collection of papers under "Capital Theory and Frontiers in Uncertainty Theory" in the proceedings issue of the American Economic Review, May 1961.

details in forestry. Nevertheless, a general belief prevails both among foresters and the lay public that low earning rates are characteristic of forest investments. This may partly account for the low level of nonindustrial forestry achievement. Owners may reject reforestation of nonstocked areas or new cutovers because the expected earning rate on reforestation investments is generally understood to be low, less than 5 or 6 percent at best except in Christmas trees, and because the waiting period for returns is quite long. Although owner quantification of the earning rate may not be exact, owner understanding of its general level may be quite adequate for decisions to reject reforestation and minimize capital investment in forestry. Lack of detailed knowledge and lack of quantification are not necessarily the same thing.

On the other hand, as pointed out more fully later on, under certain conditions there are some opportunities to earn relatively high rates of return on specific practices; but such opportunities do not occur widely, nor do owners to whom such opportunities are available always fully understand or recognize them. To the extent some owners lack this specific knowledge, technical education in forestry may be effective in promoting more intensive management within this restricted owner group. But a specialized approach will be required to remedy this educational lack. Moreover, the lack appears twofold. Partly it appears as a deficiency in technical knowledge among some owners, and partly in an absence of technical knowledge among foresters.

Earnings in forestry offer the most socially meaningful basis on which to build an educational approach. An earning rate on invested capital is a language intelligible to almost anyone. But to translate the case for intensive practices into this language requires that foresters first of all become thoroughly grounded in an understanding of input-output relationships. They must become proficient not only in working with these data but in compiling them into complete management programs embodying different degrees of management intensity, wherein are stated estimated levels and appropriate timing of all costs of carrying out a program, as well as levels and timing of all returns. Costs and returns then can be summarized in a statement of the potential earning rate on residual or new capital assets and of net cash income from harvested timber generated under each program. This summary statement provides an owner with a meaningful basis for deciding which of several alternative programs best meets his economic circumstances and most nearly fulfills his objectives.

When foresters are ready to approach owners in these terms, then this kind of specialized educational approach may be found capable of persuading some

nonindustrial owners that they might have misjudged the extent to which forestry can fulfill their goals. Before attempting to put someone else's house in order, foresters will want to make sure they are well equipped to do so-that they have the basic professional knowledge to demonstrate why certain nonindustrial owners have not adequately judged the advantages of practicing more intensive forestry.

Persuading owners to practice forestry could have an unfavorable effect. Unless markets expand as output is increased in a given area, forest product prices could fall. And although this would not have an unfavorable impact on decisions to hold growing stock unless prices were expected. to continue to drop, a lower product price would adversely affect decisions to engage in intensive practices involving labor inputs, thus discouraging intensive management.

Quantification of earning·rates could also have an unfavorable consequence. Some owners would disinvest when they learned how little their capital investment in forestry was earning. Nevertheless, a net gain in total number of owners practicing intensive forestry would undoubtedly result from an educational program to overcome lack of knowledge, because of the small number who are presently doing so compared to the larger number who might find it profitable to respond. But there would be some who might decide against continuing a forestry investment program.

THE ALTERNATIVE RATE OF RETURN

Three essential points emerge from the foregoing analysis of owner economic situations, goals, and knowledge: (I) An individual's objectives in using capital resources depend on his economic situation and knowledge of investment alternatives; (2) the types of investment alternatives considered by him are restricted by his economic situation, investment objectives, and degree of knowledge; and (3) every individual has different goals toward which he is working; being aware of some alternatives for achieving these goals and a reasoning individual by nature, he deliberately chooses specific alternatives within his means to achieve such goals. The latter point is the second major proposition, referred to on page 57, underlying the theory developed here.

In this development of a theory of determination of management intensity, accomplishments so far have been twofold: (I) elaborating a set of objective factors characterizing. investn1ent opportunities and (2) elaborating a second set Q£subjective circumstances of individuals governing decisions to spend, to save, or to invest out of income. A third factor will be a description of a means

by which the effects of objective and subjective elements are integrated in. the minds of individuals.

Such a device is found in the alternative rate of return, a concept that explains why an individual manages at a given level of intensity or decides that a different level is desirable. An individual's alternative rate is the maximum rate available to him from the next best alternative use for his capital resources. It is not a rigidly fixed rate, however, but one that fluctuates depending on consumption needs and new investment opportunities, on the availability of capital for new ventures, and on the earning rate and liquidity·of presently committed capital assets. For individuals with limited assets, the alternative rate may fluctuate quite widely; among wealthy individuals it may be more stable.

Essentially, the alternative rate is an aggregative index that incorporates the effect of an o\vner's income and asset levels, time-preference rate, uncertainty allowances, planning period, and desire for liquidity.

Determinants

An individual's alternative rate tends·to be implicit and highly subjective because of the determinants that influence it. The kind of alternatives facing an individual exerts the greatest influence on the level of his alternative rate. Ordinarily the highest alternative rates are to be found among consumers. A consumer's alternative rate is his rate of time preference, and, as indicated earlier, level of income and asset position are prime determinants of the time-preference rate. In instances where both income and assets are low and either or both must be used just to meet current wants, the rate of time preference tends to be high-perhaps 20 percent or more.

When current wants do not require a high proportion of current income or the liquidation of capital, then the rate of interest on capital horrowed for current wants, rather than the time-preference rate, may be a closer approximation of the alternative rate facing an individual. This interest rate can vary from the bank rate on commercial and personal loans to the very high true annual interest rates implicit in some types of installment financing, ranging from 12 to 30 percent or more. The debt position of .an o\vner, therefore, has a bearing on his alternative rate of return.

The individual whose income level permits him to save or to invest usually has a lower alternative rate than the individual who faces consumption or borrowing alternatives only. Generally, the wealthier an individual is, the lower his alternative rate will be. For the very wealthy, the rate may be approximated by yields on high-grade, tax-free, municipal bonds. For the less wealthy, for

whom income tax considerations are less pressing, yields on common stocks or savings accounts may appropriately measure their alternative rates. These are examples of external rates. For an owner of a business or a professional man, an internal rate of return on the use of capital in a business or profession may be an appropriate measure.

Other influences on the level of the alternative rate of return are (I) differences in uninsurable risks against loss inherent among investment opportunities; (2) transfer costs or erosion of capital involved in transferring capital out of one use into another; and (3) any extra income tax payable as a consequence of taking income that otherwise would have been automatically reinvested, such as retained corporate earnings or annual growth in a tree.

Flora (*E,* 1961) developed a concept.termed a discount locus that is akin to the alternative rate of return. He showed how in one time period under given conditions the alternative rate may correspond to an individual's time-preference rate; in another period, under different circumstances, it may correspond to a market rate of interest or to an earning rate on another investment. He showed that "time preference is the sole determinant of the discount path for some persons, a partial determinant for·some, and irrelevant for others."

Briefly, an individual's alternative rate of return embodies the effects of his economic situation, his investment objectives, and his uncertain knowledge of investment alternatives. Because these three influences governing investment decisions are actually variable costs of investing, the alternative rate is an individual's marginal cost of investing. When compared to the earning capacity of a potential investment opportunity, the alternative rate functions as an index or guide for choosing those opportunities that satisfy an individual's desires. As Alchian (*G,* 1950) and Simon (*G,* 1959) have shown, a maximizing motive need not be imputed to individuals. Their undeniable interest in the pursuit of a goal, such as positive returns, is the minimum assumption required to construct a theory of decision making in the face of uncertainty or imperfect knowledge.

The extent to which owners think in such terms is not known, but this does not invalidate the usefulness of an alternative rate concept as an aggregative explanation of decisions and actions of nonindustrial owners. Industrial owners are known to think in terms of alternative rates of return or-as frequently termed-guiding rates of interest. Guiding rates of 3 to 15 percent are known to be used presently by specific industrial forest owners in the Douglas-fir subregion for making business investment decisions.

The empirical test carried out by Flora (*E,* 1961) provides indirect support

for the existence of an alternative rate, at least among the population of generally large, well-to-do, noncorporate industrial and nonindustrial o\vners sampled. The existence of a discount locus for owners evidences what is here termed an alternative rate.

Nonmonetary Objectives

Objections might be raised against use of an alternative rate of return on grounds that the full range of owner goals is inadequately expressed. Extra-market or nonmonetary objectives, it could be argued, are not represented in a numerical index expressing alternatives in monetary terms. An o\vner who holds timber and manag)es it for sentimental, hobby, or recreational purposes does not do so for monetary returns; he may, in fact, spend more money in pursuit of his objective than he could hope to gain in cash returns. He does, however, receive subjective satisfactions that cannot be measured in dollars. Such an objective would inevitably suffer in comparison with money-tnaking alternatives; and, therefore, the alternative-rate-of-return approach breaks down under such circumstances and should not be used for analyzing owner actions prompted by extra-market objectives.

This argument is only partly valid. It does not nullify the usefulness of the alternative-rate-of-return approach for the purpose of this analysis, the objective of which is to understand why a certain class of owners exhibits such varied response to the same economic influences. Owners do receive subjective values, and these may override monetary values in influencing actions; but the alternative-rate-of-return approach is capable of recognizing and accounting for this influence. This is done by accepting the fact that owners' responses are reasoned and deliberate,[8] even to their subjectively adjusting upward the rate of return from forestry to allow for extra-market values when such values are of concern to them.

COMPARING ALTERNATIVES

Insight can now be gained as to why a majority of nonindustrial owners reject intensification of management as being inconsistent with their total circumstances by relating gross returns in forestry to the concept of an implicit alternative rate of return.

8. Alchian (*G*, 1950) has shown, however, that a descriptive economic model can be constructed, embodying conventional analytical tools, without assuming individual rationality, foresight, or motivation.

Returns in Forestry

The practice of forestry is typically believed to yield low returns. In Table 1, the dollar investment in growing stock per acre is shown in column 3, while column 5 shows the additional value yield for each 10-year increment. Column 5, therefore, represents a gross marginal rate of return or value growth percent for each 10-year increase in rotation length. It illustrates in principle that the marginal (as well as average) rate of return in forestry varies inversely with rotation length-an inevitable consequence of diminishing growth per acre as additional units of capital are added to growing stock.[9]

The two methods of expressing yield in volume or value terms (columns 4 and 5) demonstrate an important investment feature of a forest enterprise. Marginal rates of growth or return may be quite high for relatively short periods of time early in the life of a tree or stand. High rates are particularly marked as a stand begins to attain merchantable board-foot volumes. The very high rate at age 40, for example, reflects the yield table assumption that trees under 30 years of age have no board-foot volume. For the next decade or two, many trees suddenly become merchantable at a time when the cumulative volume (and value) of a stand is relatively low. High apparent rates of increase in volume and value result. Although the marginal rate from age 30 to 40 is high, the rate for an entire 40-year rotation would be less, particularly if regeneration costs were substantial.

The typical view that forestry yields low returns is just part of the real story. Certain forest investments such as release of southern pine reproduction from a hardwood overstory or advance roading of Douglas-fir for precommercial thinning can produce rates of return in excess of 10 percent (G, Fedkiw 1960, G, Fedkiw *et ale* 1960).

The high rates occasioned by calculations based on yield table values raise a question of imperfections in the market for young timber. If the market were perfect, such rates would not appear because discounting of future values to the present would smooth out any surge at age 30. There is reason to believe that markets for young timber are steadily improving—that future values are being discounted-but whether or not this kind of imperfection exists and to what extent is irrelevant. This imperfection results from imperfect knowledge or from imperfect markets, but the theory developed here accounts for the presence of uncertainty. This kind of imperfection may be adjusted by an

9. Although Table I assumes thinning is not an alternative, this does not invalidate the point that rate of return decreases as growing stock increases.

individual either through a risk allowance which reduces his planning horizon, by reducing estimated returns, or by increasing estimated costs. Whichever adjustment is used, it is ultimately reflected in an individual's alternative rate of return as a cost element.

If an owner's situation and objectives require a high rate of return from his woodland, and if markets permit, recognition of factors governing average and marginal rates of return suggests the wisdom of harvesting the biggest trees-9rdinarily the least efficient earners-and leaving smaller trees having higher growth rates. Keeping a woodland cut back minimizes the capital investment needed to secure a high rate. That many nonindustrial owners appear to follow this procedure suggests that their implicit alternative rates of return ordinarily are quite high and that intensity of management is governed by subjective circumstances. Empirical evidence obtained by Flora *(E,* 1961) suggested that a monetary objective was of greater importance in influencing management decisions than in decisions to acquire forest land.

More Desirable Alternatives

Unless marginal value growth exceeds an owner's alternative rate of return when he has a pecuniary objective in mind, he cannot afford to hold growing stock, let alone to further intensify management. In effect, in appraising investment possibilities, he has other more profitable alternatives available to him that are consistent with his total circumstances.

If, on the other hand, his objectives in practicing forestry include nonpecuniary aims-esthetics, recreation, or hobby, for instance-the owner might value the subjective satisfactions received highly enough so that the total rate of return in his estimation exceeds the maximum rate available from his next best alternative. Such an owner would then find it profitable to invest in forestry and perhaps even to intensify further his management practices. Empirical evidence, however, suggests such owners constitute a very small minority.

Studies of the nonindustrial owner situation contain numerous findings that nonforestry enterprises were preferred because higher or more immediate returns could be realized therefrom *(B,* McDermid *et ale* 1959; *B,* Yoho *et ale 1957; B,* Chamberlin *et ale* 1945). Redman *(E,* 1956) indicated that woodlands were used as a source of working capital for operating farm enterprises, which apparently constituted a superior investment alternative. Agricultural investment needs governed the time and rate of cutting without much regard to forestry principles. Owner statements about land being more valuable for farm crops, time too valuable to spend in woodland management,. or time fully oc-

cupied by more valuable actIvItIes, indicate that owners do evaluate alternatives. Imperfect knowledge of potential benefits from forestry is one thing; deliberate neglect because of more productive alternatives is a quite different matter.Far from indicating ignorance, it suggests reasoned pursuit of higher goals.

Forest land, moreover, is often obtained not for its own sake but merely as an adjunct to a deal involving other lands valued for crop or pasture purposes (B, McClay 1961). Institutional arrangements, past history of land use, and matters of size and access often impart a joint-product relationship to cropland and woodland. A higher retail price is often obtained for individual parts of a business or estate than when sold in one lump for a wholesale price. While a woodland cannot always be separated from the remainder of a farm and sold separately, merchantable timber can be. Furthermore, individuals may obtain depleted woodlands unintentionally when buying land for other, possibly better paying, objectives. Such purchases, coupled with high alternative rates and consequent short planning horizons, result in woodland management of a very low intensity, perhaps constituting only the paying of taxes. High alternative rates have a disastrous effect on management, because the need for cash for immediate \vants is so strong as to preclude any investing in forest management.

Nonindustrial owners who cut young merchantable timber are often criticized as un\vise from a forester's standpoint because they lose out on the substantial increase in volurne and value in that stage of growth. However, absolute volume and value are not proper criteria for judging owner actions. The rate of increase in percent contrasted with an owner's alternative rate of return, and not the absolute increase in either dollars or volume, is the valid criterion for judging \vhetheran o\vner's action was advantageous or not.

Cutting young timber may be likened to withdrawing money from a savings account just before interest is credited. To an observer, such action may seen1 ill-considered because it appears to result in a loss to the owner. But from an owner's point of view, perhaps a larger loss would have resulted from not having cash available to meet a commitment such as a mortgage payment or ,an emergency need such as a medical bill. The appropriateness of an action cannot be determined just from looking at the forest. The real question is not \vhether timber was too young to be cut, but whether an owner used his various sources of credit efficiently.

An owner's· action cannot be labeled right or \vrong without taking··into consideration the reason that prompted him to'cut timber, the adequacy of his knowledge about his timber and its earning rate, the nature of credit alterna-

tives available to him, his econon1ic situation and goals, and the level of his alternative rate of return. For nonindustrial owners with chronic low cash incomes and whose alternative sources of credit already are fully tapped or who have inadequate collateral, cutting whatever merchantable timber is available may be the most efficient means of borrowing money under their particular circumstances. As an example, if the marginal value growth percent from a poorly stocked, low-value woodland was 4 percent, while cost of a personal loan from a finance company (the only credit alternative available to a particular owner) was even a conservative 12 percent, this owner's most efficient alternative for raising cash would be to harvest whatever merchantable growing stock his woodland contained. Guttenberg (*E*, 1950) outlined a similar situation.

While a great deal has been written and said about need for credit in forestry, so far little interest has developed among nonindustrial owners; and in instances where credit has been made available, little demand for it has arisen (*B*, McClay 1961; *G*, Resources for the Future, Inc. 1958). An explanation rests partly on level of returns in forestry compared to owners' alternative rates of return and partly on credit rationing. Money and labor will not be invested in an enterprise that does not yield a rate of return commensurate with an owner's alternative rate. Nor will credit be advanced if the amount sought exceeds the collateral.

Frequently, nonindustrial holdings are examined by foresters in tern1S of \vhat a woodland "needs" as a basis for developing a management program for an owner to follow. Equally important, however, is analysis of an *owner's* needs-his intentions and wants—before specifying a program he might not be able to afford. Capital outlays for deferred-return investments should be commensurate not only with potential returns but also with the economic situation of an owner as expressed by his alternative rate of return--or, in other words, by his other investment and consumption alternatives.

For an owner deliberately not practicing forestry, it follows that the potential marginal return from a forest enterprise appears less than his implicit alternative rate of return. He believes that he cannot afford to intensify management of his woodland beyond what he currently may be doing, which to an observer may appear to be nothing, but actually may involve holding the property and whatever growing stock is present, paying taxes and fire protection assessments, and selling products whenever they become merchantable or a market becomes available. Such action is management within the scope of the definition of the term as used here. Admittedly, however, this is manage-
l11ent at a low level of capital intensity.

SUMMARY

The economic thesis elaborated in this chapter can be summed up as follows:

The practice of forestry is a capitalistic enterprise of an investment character. Economic alternatives facing a forest-land owner include consumption, investment in forestry, or investment in nonforest enterprises. Owners, pursuing positive returns, allocate capital among those enterprises where rates of return are greatest to meet goals efficiently. An owner, therefore, is induced to intensify forest management practices when his expected rate of return equals or exceeds the maximum rate of return from the same capital invested in a nonforestry alternative, allowing for estimated differences in risk (however imperfect and subjective), additional tax on new income, other transfer costs, and adjustment for subjective values realizable.

Personal inclinations toward this alternative-rate-of-return approach are beside the point. This approach is dictated by the objective reality of the capitalistic investment character of forestry, by the moderate or low income circumstances of the majority of nonindustrial owners, and by the resulting pressure of their economic situations which ordinarily forces them to pursue a pecuniary objective in managing their woodlands.

PROMOTING INTENSIVE MANAGEMENT ON NONINDUSTRIAL HOLDINGS

THE Forest Service has set a goal of 52 billion board feet of sawtilnber to be produced annually on nonindustrial holdings by the year 2000, this being one-half the total projected national requirement of 104.3 billion. feet from all ownerships (D, Barrett 1960). An inference of the theory presented in the previous chapter is that most nonindustrial owners inherently are incapable of producing much more than what they presently contribute. That this owner group could produce 52 billion board feet annually, or 4 billion feet in excess of the total growth on all ownerships in the United States today, is seriously questioned. A conflict in goals is apparent; there is a wide discrepency in what the Forest Service envisions for nonindustrial owners and what these owners envision for themselves.

Since the matter of sufficient commercial forest land in the United States is not at issue, the question centers squarely on levels of management intensity or investment. The Forest Service, in effect, contends that the level of investment on nonindustrial holdings is too low to meet its goal. Nonindustrial owners, on the other hand, seem to find the practice of forestry less attractive than investment in nonforestry alternatives, given their present subjective circumstances. The real problem at issue, therefore, is a low earning rate in forestry contrasted with a high alternative rate of return among owners. These two rates are entirely different things; and because the latter ordinarily exceeds the former for most nonindustrial owners, public interest as defined by the Forest Service and nonindustrial private interest fail to coincide.

SEARCHING FOR A SOLUTION

Raising Nonindust1"ial Goals

If the level of investment on nonindustrial holdings at present is too low to achieve the Forest Service's goal set for this owner class, what are the prospects of raising investment levels sufficiently to attain this goal? To answer this question, forestry input-output relationships for all forest types in every region of the country are needed. Although these are among the most essential kinds of data required for intelligent management planning, they are generally unavailable. Lacking such data, there is no objective basis for deciding whether a given production goal is reasonable or probable of attainment.

Informed judgment, however, based on the theory of owner response elaborated in the previous section, provides a substitute basis for evaluating the possibility of raising nonindustrial output to a 52-billion-foot level per year. To the extent that lack of forestry knowledge or misinformation cause owners to underestimate earning rates in forestry or to choose courses of action' that do not attain owner goals as effectively as a forestry alternative would, then correcdy educating owners about forestry possibilities may lead to a higher level of forestry investment and eventually to greater levels of output from nonindustrial holdings.

Also, the actual amount of a national goal that might be obtained from nonindustrial holdings cannot be realistically estimated until such holdings have been classified according to levels of alternative rates of owners. It would then be possible to compare owners' alternative rates with earning rates of different forest management practices and eventually to compile an estimate of the' amount of wood nonindustrial owners could be expected to produce voluntarily if they changed to intensive forest management.

Appraising the Public Goal

Duerr (*G,* 196o) inferred that the ideal job of tin1ber goal planning has not been done as yet and may never be done. Although long-term goals are essential for policy guides, inherent uncertainties attaching to such goals assure considerable error in final results. Moreover, in addition to this implicit weakness, the total requirements goal of 104.3 billion feet is open to explicit criticism on grounds of validity of the assumptions on which it is based and of methodology used in deriving it (*G,* Duerr 1960; *G,* Zivnuska 1956). Neither the end result, therefore, nor its component parts can be regarded as exact or right.

The accuracy of the end result, however, is of less concern than are implications of the findings for program planning. It does not take an elaborate and detailed study to suggest that increasing vplumes of wood will be demanded ina dynamic and growing economy such as that of the United States.

The price at which wood is made available to the economy is critical. If timber supplies' become restricted, wood can be·priced out of present and potential markets,. as has occurred in some degree since World War II. Therefore, a fundamental principle. of national policy with respect to timber growing should be to promote wood production at prices that not only will compete with substitute materials but will undersell them in uses better served by wood. This promotes conservation-shifting of use into the future-of more critical

nonrenewable resources. The more cheaply wood can be produced, the greater can be its contribution in the economy, which raises the question of efficiency in production.

Efficient wood production implies that timber be grown where it is most profitable to do so-where its value yield, net of all costs of producing it, is greatest. Low cost wood should be favored over more expensive counterparts. But any analysis of the opportunity cost of producing wood implies a comparison of alternative programs for achieving a stated objective. The Forest Service, if it did analyze alternatives, apparently concluded that the acreage of nonindustrial owners can provide half the Nation's wood requirement goal by the year 2000. The Forest Service view sees the problem and the goal as one and the same thing; whereas the real problem is that of stimulating among nonindustrial owners a level of investment sufficient to achieve whatever goal is specified for them.

In view of what is presently known about nonindustrial owners and the economic factors governing their·management intensity (as presented in the previous three sections), it would be inefficient to spend effort and funds in a program that seeks to obtain half the Nation's annual sawtimber growth goal from nonindustrial holdings. Such a proposal is likely to be the most inefficient and costly method of reaching the goal. It would concentrate effort on lands of lowest economic (though not necessarily lowest physical) productivity-owing to economic limitations of the owner.

On the national level, an alternative to stimulating increased investment on nonindustrial lands is additional investment on public lands. Obtaining increased productivity on public lands is a real possibility, especially on National Forest lands in the Pacific Northwest where an excessive volume of decadent old-growth timber results in very low or even negative net growth and, hence, low growing stock efficiency. How nearly increased productivity on public lands would meet the projected goal of 104 billion feet is conjectural. This goal is based on the regional distribution of nonindustrial holdings which is not comparable to the distribution of public holdings.

Aside from questions of whether the Forest Service goal is the most economic, how much additional production is actually needed, or what should be its regional distribution, there are certain features of public lands that make investment on them a more attractive alternative than on nonindustrial holdings. Productivity of funds invested on public lands is enhanced. because complete control over an investment is retained by the public, complete control of Inanagement programs is assured, a low alternative rate of return permits more

intensive management and long-range planning, and high-value product objectives generally prevail.

Fedkiw *(G,* 196o) presented estimates of increased total yields realizable under intensive programs of management in both old- and young-growth forests in the Douglas-fir subregion where 75 percent of commercial forest area is in public and industrial ownership. Annual yields during the next 40 years in the subregion could be increased by about 50 percent, or 4 billion board feet, over the present level of cut if *all* opportunities in mortality salvage, thinning, and prelogging could be captured beginning immediately. Lack of advance roads, however, prevents immediate realization of the full annual potential for increased utilization.

About 30,000 miles of main-line road remain to be constructed on National Forests in the subregion to achieve a density of 4 miles of road per section. A similar estimate of remaining roads to be built on private and other public lands is unavailable, but probably does not exceed twice the National Forest mileage. Assuming an average construction cost of $15,000 per mile, 90,000 miles of road would require an investment of $1,35° million, a considerable sum. Yet this equals just 3 years' outlay under one 4o-year program proposed to attain the·52-billion-board-foot annual goal from nonindustrial holdings in 2000. This program was estimated to cost $428 million a year for just the first 10 years, no cost estimate having been given for the remaining 30 years of the program (*D,* Barrett 1961). At this annual outlay, the subregion could be advance roaded in just 3 years, although practical limitations would probably forestall such a rapid rate of advance roading. Nevertheless, advanceroading presents perhaps the most practicable and productive means for quickly raising yields on industrial and public holdings. As Fedkiw pointed out, advance roads provide the means to achieve increased yields per acre and to

> ... release timber capital of lowest productivity. for more profitable public or private investment elsewhere. Moreover; [advance roads] not only provide the means·to achieve these ends for. the·present.or near future; they will do so indefinitely so long··as the future forests are managed for.maximum economic gro\vth and capital efficiency.

Additional yield would probably replace some wood cut from·private lands, permitting grovving stock on these lands to be built up and thereby increasing. their productivity in later years to some extent.

Efficient use of public funds for obtaining increased future timber yields suggests another alternative-investing funds on industrial and other large private

holdings, rather than just on nonindustrial holdings, few of which are large. The manner of public investment on industrial and other large holdings could take various forms: outright grants; low-interest loans; or tax concessions such as rapid amortization of investments, expensing of planting outlays and other capital investments, and modification of property tax systems so as to encourage intensive management. Such preferential treatment today might be politically unpopular; but if maximum stimulation of wood production is a public goal, efficiency demands that the most economically productive lands be brought to optimuln levels of production first. When the policy goal is clearly understood, public assistance to private firms may become acceptable.

A Pattern for Resolution

Critical appraisal of the public goal for private nonindustrial owners reveals its amount is subject to a large error of estimate, the assumptions on which it is based are questionable, the method of calculating it is open to criticisn1, and the efficiency of achieving it by alternative programs has been apparently overlooked or inadequately evaluated. In other words, the public goal for nonindustrial holdings is not absolutely definitive; it represents a well-informed agency's best judgment. But certainly, an indisputable conclusion is that a substantially increased wood output, at some relative price, is desirable in the public interest.

Although levels of production on some nonindustrial properties could possibly be raised, the volume of increased forest investments in all probability would result in a total output from this owner class considerably short of the announced public goal-52 billion board feet per year. In view of realities of nonindustrial owner situations and objectives, it is economically unreasonable to expect that these holdings, although accounting for 55 percent of this country's commercial forest land, can possibly supply half the projected national requirements goal of 104.3 billion feet annually by the year 2000.

Adjustment between public goals for private owners and goals established by private owners themselves is the answer. Less rigid emphasis on a precise amount for the public goal is in order until research provides data for estimating realistic goals for various owner classes and recognizes inherent limiting economic factors within each class. On the other hand, promising possibilities for raising levels of investment on some industrial holdings should be explored and pursued.

PROMOTING INTENSIVE MANAGEMENT

An appearance of confusion at the grass roots level was noted a decade ago (G, Gulick 1951), but this is only symptomatic of general confusion in policy objectives at higher levels. Similarity of current and proposed forestry assistance programs (D, Barrett 1961) to agricultural assistance programs of the past 25 years implies that a dominant objective of forest policy is to help ov/ners improve welfare of themselves and their families as well as to obtain increased forest production. Yet the Forest Service has stated but a single policy objective -increased timber production fronl small ownerships (D, Barrett 1960). The stated policy goal and resultant program implications are at variance. Dean Shirley (D, 1958) has said:

> Let us face one issue frankly. The so-called "farln programs" beginning with the Agricultural Adjustment Administration and leading on to the Soil Bank are efforts to help farmers and farm families, not to get increased production. Saving soil, improving conditions for vvildlife, and growing trees are only incidental features. The frequent shift from one program to another is evidence that none have been ideal for agriculture. The long-term improvement that has occurred in agriculture is due to improved crop plants, fertilizers, machinery, and to increased size of farm operation which has made possible increased efficiency. Programs to subsidize the man on poor lands or uneconomic-sized farms may have provided temporary relief but they tend to impede the natural adjustment in size of holding and general efficiency that makes for high individual productivity and, consequently, adds to the general standard of living. In approaching the task of improving productivity on small forest holdings, let us keep in lnind the difference bet\veen measures directed towards improving conditions on the land and those directed towards subsidizing the lando\vner.

Confusion can be eliminated and some increased productivity can ultinlately be achieved if public forest policy for nonindustrial holdings is limited to the single goal of raising levels of output and programs are designed to treat fundamental causes of low productivity instead of symptoms of this problem-neglected and depleted woodlands.

The fundamental cause of low management intensity is the high alternative rate of return of most nonindustrial owners and resultant short planning periods. Programs to improve productivity, therefore, must seek either to raise earning rates in forestry or to modify owners' alternative rates. Programs to achieve the first objective may be either educational or risk reducing in nature, while alternative rates of return may be modified through shifts in ownership.

ACHIEVING HIGHER EARNING RATES

Educational and Technical Assistance Programs

Technical advice and service is perhaps the oldest and most extensively used educational measure for encouraging intensive forestry. After nearly two decades of prominent use of educational devices, however, sharp questions have been raised concerning their effectiveness. No less an authority on forest ownership problems than S. T. Dana (*G,* 1960) .said:

> State and federal co-operation with private owners has so far not been conspicuously successful in bringing about any vvidespread improvement in forest management. Education, service, and subsidies alike have failed to achieve the hoped-for result, particularly on the part of the small owner. Ho\v to make the co-operative approach more effective is a problem that deserves, and is receiving, careful study.

President Kennedy in his February 23, 1961, message to Congress on natural resources said in reference to small holdings, "These lands, currently far below their productive potential, must be managed to produce a larger share of our future timber needs. Current forest owner assistance programs have proven inadequate." If current programs are inadequate, can public assistance, then, be made more·adequate in light of the capital limitations of nonindustrial owners and thier investment and spending alternatives?

Inherent inadequacy.-Inadequacy of assistance programs stems largely from the simple fact that in the past the basic cause of the situation to which they were addressed has not been correctly analyzed, and programs which do not recognize this fact have little chance of persuading owners to invest more heavily in their woodlands.

The likelihood of persuading an owner to manage intensively by educating him in technical aspects of forestry or informing him of unit values of timber products depends on how tnisinfortned he is on actual earning, rates in forestry. Some owners regard young timber as brush, hence worthless. Correctly analyzed, such "brush" may show a very favorable earning rate. While unit price expectations are pertinent to decisions to undertake site preparation, planting, cleaning, or other intensive practices where labor inputs are involved, they are not pertinent to the question of whether or not to hold growing stock. Changes in price expectations, however, do influence the latter decision.

The long-term nature of educational effort also contributes to inadequacy of assistance programs. Rapid results cannot be expected because of inevitable slowness of an extension approach for reaching and persuading individual own-

ers and because of inherent slow response of trees. While condition of a woodlot might be improved in a year or two by intensive effort, several decades usually must elapse before results materialize in increased wood yields-again, the problem of deferred returns. Some advocated practices such as planting, cleaning, pruning, and fencing call for immediate cash outlays while pron1ising uncertain future returns unlikely to payout during an average tenure period of 10-15 years.

Unless forest-land markets recognize future values by a discounting process, deferred-return investments will be unattractive to those with short planning periods and high alternative rates of return, which raises an important issue. Why do forest-land markets, generally, fail to reflect future values, and why does this apparent market imperfection continue to persist? This matter is further considered toward the end of this section.

The blanket approach used in educational programs further contributes to inadequacy. Rarely are potential participants selected by comparison of their wants with a program's objectives. Inasmuch as actual administration of educational programs generally depends on local foresters and committees, how well prepared are they to choose participants who can benefit most from a program and thereby contribute to the program's success? Are standards or guides ever provided local administrators for estimating probable levels of owner response in terms of degree of management intensification achieved through program participation?

A typical outgrowth of the blanket approach is a seetning tendency to confuse program participation with program success. Nine hundred people in attendance at a field day and tree farm dedication, 12,000 school children visiting farm forests in one State in one year, total number of acres treated annually under a program, dollars expended per year in various programs, or number of owners assisted per year by service foresters do not show increases in intensification nor do they disclose permanency of results. Nun1bers who came and saw may help in estimating how many parking·spaces to provide and how much food to have on hand for next year's field day, but a real measure of success would be the number who returned home after a demonstration and began applying more intensive practices.

Of those convinced by demonstrations or personal contacts with foresters, how many remained convinced for how long and for what reasons? What happened to properties of converts before and after sale of their properties a few years later? Of the 314,000 acres in the United States given ACP (Agricultural Conservation Program) timber stand improvement treatment in 1959,

how many acres were maintained under management long enough to realize returns on the public investment? Contrasted with the $4 million spent by Federal and State governments in fiscal year 1960 on cooperative forest management, how much additional wood will be produced from this expenditure?

Answers to questions such as these would be more revealing of real success- or failure-among the multiplicity of educational and assistance programs aimed at nonindustrial owners for the purpose of encouraging more intensive forestry.

An educational approach can only influence those owners whose alternative rates of return and planning horizons permit intensification of management. Research effort, therefore, could well be spent in finding ways to identify potential participants. Some effective starts have been made in this direction, such as the Tennessee Valley Authority approach developed in recent years (B, Ramke 1958).

As research develops appropriate criteria, the educational approach, if it is to justify its existence, must concentrate on teaching improved .management techniques *that inc1·ease rates of return* either by raising yields or by reducing costs. These techniques include high-return improvement practices, selection and timing of product markets, do..it-yourself forestry, and carrying a minimum level of merchantable growing stock. An educational approach built around these measures can be made effective.

Suitable program 1neasures.-Owners with young timber, as pointed out in the previous chapter, may have potentially very profitable investment opportunities. Practices, such as release of southern pine reproduction from hardwood overstory and precommercial and commercial thinnings in Douglas-fir, are capable of yielding rates of return in excess of 10 percent when correctly analyzed. When continuing family tenure is expected or imperfections are eliminated in markets for timberland supporting premerchantable growing stock, planning horizon ceases to be a limiting factor in intensified management. An owner who plans to hold on to his property long enough to reap benefits from intensive management and who has funds available could readily be persuaded to invest in forestry if properly approached.

Informed owners may increase rates of return from their properties by concentrating on production of high-value products or those having short rotations. Christmas trees, although somewhat of a risky investment, represent just about the ultimate in a short rotation, with the added attractiveness of a fairly high rate of return. Estimates for plantations of Douglas-fir in the Pacific Northwest indicate the possibility of earning rates in excess of 15 percent when an owner

does his own work and Christmas trees are sold at roadside instead of as stumpage.9ffsetting this attractive picture is the need for intensive seasonal labor inputs for culturing and harvesting, which may not fit in among an owner's other commitments, the need for an increasing amount of specialized and technical knowledge to produce good quality cultured trees, and the lack of well-defined marketing channels in many areas, making it necessary for a producer to seek his own marketing arrangement.

By differentiating forest products and selling each log in the market offering the highest conversion surplus, earning rates on a forest investment and earningsper acre tend toward maximum attainable levels for a particular forest property. When selling stumpage rather than logs, earning rates generally are improved by selling on a grade scale instead of a lump sum basis. Also by "timing" a market and selling at peak prices, an owner may improve his expected earning rate if the realized price exceeds his original expectation.

Certain factors may prevent or nullify owners' attempts to improve earnings with short-rotation forestry or high-value products. An owner may not have a choice among product markets at a given time and place; he may lack forestry knowledge or be unaware of the benefits of choosing or timing a market; and he may not, because of the press of personal circumstances, be able to delay a sale in the hope of getting a better price at a later date. Technical advice and assistance could help reduce such deficiencies and thus contribute to increased productivity.

Studies listed in the bibliography under section F have shown nonindustrial owners frequently to be at a disadvantage because of a considerable range of pressures and conditions urlder which they typically market timber. These studies discuss a number of actions owners can take to improve their position as sellers and point out pitfalls to be avoided.

Much has been written and said about various types of marketing arrangements as solutions to the problem of obtaining increased production on nonindustrial holdings. Suggestions cover arrangements such as tree farm families, cooperatives, and concentration yards. These are concerned only withmarketing difficulties, however, and do not attack directly the basic production problem resulting from high alternative rates of return and short planning horizons.

According to the theory of determination of management intensity in the previous chapter, marketing problems do not account for the general low level of intensity among nonindustrial owners. Solution of marketing problems, though, may result in lower marketing costs and thus permit higher returns to

timber owners. Average earning rates on labor for practices such as reforestation and timber stand improvement measures are influenced by better markets, thereby benefiting intensive forestry. Assistance with management practices, often included in marketing arrangements, may be very effective in persuading owners to intensify management by demonstrating how to obtain lower costs, higher yields, and increased earning rates.

The traditional educational approach encourages owners to do their own woods work to increase cash incomes. Returns thus obtainable have been estimated in specific situations (*E,* Barraclough and Gould 1955; E, Gertel *et ale* 1959; *E,* Mitchell and Webster 196I). Farm woodland owners particularly are said to be able to profit by doing their own work because they generally live close to their woodlands, have slack seasons when woods work can be done, and usually have some farm equipment adaptable to small-scale logging and improvement practices.

In many sections of the country and for certain types of farms, however, slack periods are nonexistent. Woods work, rather than being a complementary activity, is a competitive one with other farm activities. Moreover, many farmers have both farm and off-farm income-producing alternatives that not only compete for time and attention but offer higher rates of return than forestry. Nor are farmers so unique as individuals that they have no desire for leisure or are unwilling to forego some additional earnings to enjoy leisure. To compete effectively for an owner's time, woods work must not only be profitable but it should be more so than alternatives competing with it.

The deferred-income aspect of some forest practices detracts from their competitive potential. Owner interviews continually turn up statements that "My time is too valuable to spend on woods work" or "I don't have enough time to do it." Besides showing that owners value nonforestry alternatives more highly, such statements appear to reflect owner needs for immediate, rather than deferred, cash income.

Also affecting the investment attractiveness of forestry from an owner's viewpoint is the technical or specialized knowledge necessary to carry out intermittent practices. Lacking such knowledge and unaware that assistance is available, an owner may decide that he cannot spare the time required to gain such knowledge only to use it intermittently, perhaps forgetting it during the intervals. One study of low-intensity managers (*B,* Martin and McDermid 1960) indicated the *least* important deterrents were that 'forestry was too complicated and would not payoff. The *most* important deterrents were that capital funds were needed for other farm work, the pay-out period on forest

practices was too long, and other farm work was too heavy. This tends to substantiate that nonforestry activities either have a higher rate of return or that a short pay-out period makes a somewhat less productive alternative even more attractive than forestry.

Do-it-yourself forestry generally is more costly than if the same operation were done by an experienced, technically trained man. Increasing demand among nonindustrial owners for services of consulting foresters recognizes cost savings that accrue from getting a job done more efficiently while freeing an owner's time for pursuit of higher return alternatives.

Coutu, on the other hand, pointed out (*E,* 1961) the potential attractiveness of forestry to certain classes of owners, based on extensive use of labor in forestry as compared to more intensive use in some agricultural pursuits. Income possibilities from forestry may effectively complement a desire for increased leisure time. And the contracting of woods work offers further release of time for leisure pursuits. These possibilities suggest that rural residents not agriculturally oriented might be very receptive to investment opportunities in forestry if informed of its technical aspects and the availability of technical, financial, and marketing assistance.

Do-it-yourself forestry, therefore, has some potential as a means of attaining higher earning rates, primarily through use of high-return improvement practices and selection and timing of product markets. The applicability of do-it-yourself forestry, however, is restricted to particular owners having the inclination, economic sit4ation, and time to do their own work. A goal of the educational approach should be to identify such owners and learn how best to inform them· of the supplemental income possibilities of doing their own work. Full- and part-time farmers and nonfarm rural residents of modest means are most likely to respond favorably to this idea of management. Coutu (*E,* 1961) analyzed the possibilities in more detail.

In addition to orienting educational measures around profitable practices, high-value products, market selection, and do-it-yourself forestry, there is another avenue through which returns nlay be increased. This is reduction of merchantable growing stock to a minimum level-the ultimate being none. A convincing example of this management concept was discussed and illustrated by Gould (*E,* 1960).

In terms of acreage, Harvard University qualifies as a small owner, and at times during its 50-year tenure it was a nonindustrial owner. At other times it hired or owned a small mill. The import of Gould's analysis is to show through the aid of hindsight that the best possible job of meeting Harvard Forest's

management objectives of maximum volume production, income flow, and capital appreciation was not accomplished under a policy of sustained yield based on biological growth rates. Gould stated that "Value changes and the probability of physical and market losses or gains should have been considered in addition to the likely efficiency of capital in alternative uses."

The sustained-yield program actually followed, although competently administered, failed to attain management objectives because it could not incorporate two ingredients essential to the specified objectives: diversification and flexibility of capital.

Diversification-a prime requisite in any prudent investment program-minimizes the sudden possibility of a heavy capital loss. Under the sustained-yield program followed, the forest's assets were heavily concentrated in white pine sawtimber which proved extremely vulnerable to catastrophic loss in a hurricane. Gould showed how two alternative management programs, one involving partial diversification of capital and the other a complete reinvestment of the entire mechantable growing stock capital, would have done a better job of attaining the forest's management objectives. Income flow and accumulation of capital value could have been greatly increased and smoothed out, resulting in a net financial gain of 130 to 320 percent *more* than under sustained yield, *even if the catastrophic blowdown had not occurred.* The blowdown simply worsened an already unsatisfactory investment program that was not achieving the objectives sought.

Gould concluded on the basis of 50 years' evidence that "sustained yield management could not have automatically maximized wood production, income and capital accumulation over time." Attainment of these objectives required fulfillment of four assumptions which, he pointed out, did not occur. These assumptions included (I) efficient production control by silvicultural techniques, (2) reduction or elimination of catastrophic losses, (3) stable demand and prices for forest products, and (4) low opportunity costs, or, in other words, a low alternative rate of return. He made clear that the element of uncertainty rendered everyone of these assumptions unrealistic and explained why none were fulfilled. Summarized, the reasons were that "The demand and price of forest products has varied greatly, silvicultural control has been less effective than anticipated, and natural catastrophies have upset the best laid plans."

Close study of this unusual and very revealing analysis of a specific management program, the context of events and circumstances in which it had to operate, the objectives of the program, and the impact of uncertainty on the

program's outcome, suggest-as Gould points out-that the program's forest management aspects were too rigidly conceived and failed to take account of the realities with which it had to contend. Separately and abstracted from events, the objectives and the formulated program appeared sound; but tied together and let loose in the turbulent stream of economic events of the past 50 years, the two were mismatched.

Once objectives have been defined, a program for their achievement must be consistent with the assumptions on which it is founded. And when these assumptions all relate to various aspects of uncertainty, arising either from economic or natural hazards, prudence demands that management be flexibly designed to withstand the unforeseen hard knocks likely to be served up in the future. Flexibility as an element in management planning is doubly important when, for any reason, diversification of an investment has been achieved only to a limited extent. Lack of flexibility and the consequences of its omission-a cost item of nearly half a million dollars for Harvard Forest-are well documented and discussed by Gould. Inasmuch as knowledge of future events is bound to remain imperfect, there can be no gainsaying his inference, "that flexibility to meet uncertainty and risk should be a central consideration of any theory devised to guide the prudent management of forest resources." How flexibility is best achieved under different circumstances of ownership and·what variables determine degree of flexibility is another problem in the economics of management planning that should be investigated.

The appropriateness of carrying a minimum level of merchantable growing stock as a guiding concept for nonindustrial owners is manifest in the theory elaborated in the previous section; owner goals and economic situations oppose heavy investments in growing stock. This concept, when combined with high-return improvement practices, market selection and timing, and the do-it-yourself approach when applicable, offers a management package that should be singularly attractive to nonindustrial owners. An educational approach built around this package of ideas should prove successful in stimulating timber production to a degree not obtainable under any other approach which fails to recognize the peculiar economic characteristics of nonindustrial owners.

Expanding forestry investments.-Although owner interest and initiative is required.·in carrying out any educational program, outside assistance is required to inform owners of inherent advantages of intensive management. The real focus of the educational approach should be to acquaint a select group of owners with the package of ideas just presented for increasing the rate of earnings from a woodland. Research will be required to identify this select group,

but in general it will comprise those owners whose objectives and resources-physical and economic-potentially enable them to realize monetary benefits from intensified management. This focus is much more narrowly conceived than the current effort to serve woodland owners, irrespective of individual abilities and inclinations to save, to invest, and to continue with a long-term investment program after it is begun.

The most effective technique for gaining acceptance of improved practices is to show expected earning rates. But this requires facility among service foresters in estimating levels and timing of costs, yields, and returns under different conditions of management intensity and ownership. Barraclough and Gould (*E,* 1955) have shown how this can be done; essentially it includes thorough analysis of all relevant ownership conditions-physical, social, and economic-and development of a range of suitable management alternatives encompassing high-return practices, high-value products, and market selection and timing under the constraint of carrying a minimum amount of merchantable timber. This sort of educational approach is more demanding of sophistication and professional competence on the part of foresters than is required for just looking over a woodland to see what it "needs."

Risk-Reducing Measures

Reducing the physical and economic risks of practicing forestry is another means to achieving higher earning rates. Improved techniques for producing young-growth timber, new and expanded uses for it, and cost-sharing programs attract attention as possible approaches.

Product and production 1"esearch.-Markets for easily produced products on relatively short rotations are a powerful incentive for intensive management. Popularity of Christmas tree production, for instance, is due largely to the short production period and the possibility of earning high rates of return. The rapidly expanding Southern pulpwood economy evidences a successful combination of market opportunities and producer objectives among nonindustrial owners who supply a large share of pulpwood demand.

Developing new wood uses and products is a relatively neglected research approach to encouraging nonindustrial forestry. The accomplishments of agricultural product and production technique research are well known. If a comparable level of effort were devoted to such research in forestry, the resulting stimulus toward increased production on nonindustrial holdings would be difficult to foretell.

Cost-sharing programs.—Incentive payments for having carried out specified

practices and provision of planting stock either free or at cost are measures that reduce immediate cash outlays an owner would otherwise have to bear to undertake more intensive management. Reduced expenditures result in higher expected rates of return, making an investment more attractive.

If pushed vigorously, cost-reducing incentive payments are likely to be well received, particularly by those in a position to carry out the same practices without such aid; cost-sharing for them is a real windfall. But for others not in a position to make deferred-return investments, cost-sharing programs are not apt to be attractive unless the grant approaches 100 percent of a total cash outlay. Cost-sharing programs raise serious questions of how to distinguish among potential participants so that programs will actually result in a level of intensified management above that which would occur in their absence. If individuals merely substitute a public grant for all or part of their private expenditure, no net gain in timber production ensues.

Another difficulty raised by cost-reducing payments relates to permanency and continuity of stimulated management. If individuals not otherwise able to afford forest investments because of high alternative rates or very short planning horizons participate in cost-sharing programs, what is the likelihood of such programs being completed? Take an ACP planting program, for instance. An owner who would not otherwise have done so is persuaded to establish a plantation because of the increased expected rate of return it offers him, based on a saw-log objective, for instance. If this owner is typical of many nonindustrial owners and has a very modest or low income and a short planning horizon, the probability of his seeing this investment through to maturity is slight. Perhaps he sells the property in a few years (his average tenure is only 10-15 years). He very likely takes a loss in selling because the future value of a plantation is seldom discounted and reflected in the selling price.

When a property is sold, merchantable timber is likely to be liquidated prior to selling to obtain a retail price for it. And even if a property is not sold, an owner in a low-income situation is under continuous pressure to liquidate capital assets for use elsewhere. To what extent, then, does the use of public funds actually contribute to an increased stumpage supply? Does premature liquidation constitute a waste of resources, or does this timber substitute for that of other owners who allow theirs to grow?

In a perfectly competitive market where everything is certain and complete knowledge prevails, substitution might occur. Under the less perfect conditions of uncertainty and lack of knowledge more nearly characterizing markets for forest products, there could be danger that planting under cost-sharing ar-

rangements would eventually result in a glut in those markets where short-rotation products can be sold—pulpwood and Christmas trees being two examples. In the event of a market glut and attendant low prices, stumpage, being flexible, could be withheld for a later or larger-product market. Unfortunately, however, economic situations of nonindustrial owners seldom are as flexible as their timber capital; owners may be forced to sell regardless of market conditions.

Similar questions about what benefits result and who receives them are raised when timber stand improvement practices are done on a cost-sharing basis. The owner who shares the initial expense may not hold the property long enough to realize any benefits. Moreover, the stand may not be held intact long enough for full realization of benefits from a deferred-return treatment.

Implications about the incidence of costs and benefits under cost-sharing programs could have an important impact on future success of such programs. Incentive to participate will be reduced if and when it appears that the original cost-sharer may stand to gain little or nothing from his investment, either because of his own precarious economic situation that does not permit him to hold a long-term investment to maturity or because of market imperfections which might prevent him from realizing a discounted future value if the investment must be disposed of prematurely.

Points raised concerning effects of incentive-payment programs and the current lack of evidence on which to base answers indicate a research opportunity. If a tendency is found for such cost-sharing programs to result in perverted effects—to induce one group of owners to substitute public for private investment, to reach mainly those owners who could be persuaded to practice intensive forestry without subsidies, or not to result in permanent gains in number of those practicing intensive management—then incentive-payment programs might best be discontinued. Funds diverted from this use to that of product and production technique research might well prove more efficient in achieving more intensive management.

Another type of cost-sharing program, ordinarily not thought of as such, results from the Federal income tax provisions allowing a lower tax rate on capital gains than on current income. The favorable effect of this differential rate in encouraging forest management practices is well recognized and documented (*G,* Briggs 1961; *G,* Ciriacy-Wantrup *et al.* 1959; *G,* Fedkiw *et al.* 1960; *G,* Sizemore 1960). The favorable results of this tax policy, however, are greatly diminished or nonexistent for nonindustrial owners in low income brackets. The difference between the minimum tax bracket of 20 percent and

its corresponding capital gains tax of 10 percent is unlikely to offer sufficient absolute incentive to encourage very many nonindustrial owners to practice Inore intensive forestry. Few apparently have incomes subject to high tax rates. Consequently, the capital-gains approach as a stimulus toward intensive management is ineffective among the majority of nonindustrial owners having modest to lo\v incomes.

Income tax regulations could be modified in either of two ways to create positive incentives toward management intensification. One is to permit expensing of planting and seeding costs, rather than requiring their capitalization as at present. Although this has been a controversial matter for several years, particularly in industrial forestry, the possible merits of this modification as a positive means for encouraging some nonindustrial investment in growing stock capital should not be overlooked. Such investment is basic to raising levels of wood production; but a measure which permits recovery of some portion of planting or seeding costs, while inherently attractive, would have little total effect except among those few owners in higher tax brackets.

A second modification with a wider impact is to grant tax offsets for forest practices. More than just expensing costs, this measure would allow deducting some or even all of the costs of specified practices from the tax bill, rather than just from income. If total costs of carrying out one or several practices on a few acres were to exceed the tax bill of a low-income owner, the difference could be handled as a refund or a carryover to tax bills of succeeding years. A big advantage of a tax offset is that it leaves money in an owner's hands, instead of taking it away as a tax and possibly returning some later as a cost-sharing incentive payn1ent; and its effect is not restricted to high tax brackets. A tax offset could accomplish the same purpose as an incentive payment, but in a more direct manner and, hence, perhaps more efficiently.

Assistance beyond cost sharing.-By relieving an owner of the cost of risk in forestry through a cost-sharing arrangement followed· with income payments for having made a forestry investlnent, earning rates on certain practices may be raised more than enough to meet high alternative rates. The now discontinued soil bank progralll offers an example. Apparently its popularity was due to the fact that it offered a very attractive earning rate on an owner's share of invested capital.

James and Schallau point out *(E,* 1961) that soil bank plantings by 1958 totaled 635,000 acres just 2 years after establishment of this option, while ACP plantings· totaled only 475,000 acres. This difference is attributed to the very different financial incentives involved. While ACP shares up to half the

cost of planting, the soil bank reimbursed in cash or materials up to 80 percent of the cost of establishing a plantation and, very significantly, followed \vith annual rental payments (income supplements) averaging $10 per acre for 10 to IS years thereafter, during which period no products could be cut from the plantation. Despite these two programs being initiated to attack completely different problems and the amount of land eligible for soil bank participation being much less than potential ACP land, it is not surprising that the former gained favor apparently at the expense of the latter.

ACP payments for tree planting, according to Jatnes and Schallau, averaged $ı ı per acre, suggesting, because of the 50-percent cost-sharing feature, that a participant-owner's outlay also averaged $1ı per acre. If a given parcel of land was eligible for either ACP or soil bank payments and total planting cost was $22 per acre, the owner's per-acre cash outlay under ACP would have been $11; under soil bank it could have been as little as $4.40' The subsequent contractual rental payments, to which the lower initial outlay gave rise, constituted a guaranteed income.

Presumably the annual rental payment had to exceed the average annual net earnings from the land, which must have been in production prior to inclusion in the soil bank. Part of the rental payment thus represented income foregone from another crop. For illustrative purposes, assume half the payment covered income foregone, leaving a net earning of $5 per acre per year for .10 years. Then in essence, for $4.40 an owner purchased an annuity of $5 per year for 10 years, implying an interest rate of ı 13.6 percent. The element of income subsidy is apparent; where could a forest-land owner-or anyone else-get such a rate of return on his money?

Owners apparently can be encouraged to invest in forestry if the earning rate is raised to a sufficiently attractive level.

Appraisal of incentive payme12ts.-Incentive payments do not seem to offer an efficient means for raising the level of investment on nonindustrial holdings. Payment programs are difficult to set up and administer because of a need for adequate safeguards to prevent profiteering and inequities. Close supervision and inspection for compliance is required, and administration of such programs is apt to be expensive.

Some wood started under cost-sharing incentive programs never reaches n1aturity; events intervene causing stand destruction and loss of public investInents. A change in property tax procedures in one Washington county in 1961, for example, forced liquidation of young-growth woodlands that had received ACP payments; and a major problem with soil bank plantations established

on grassland in the Douglas-fir subregion has been partial-to-total destruction by" mice, followed by conversion to a nontimber soil bank crop. Circumstances such as these raise the cost of wood produced under incentive programs.

A full economic appraisal of cost-sharing programs in forestry has not yet been undertaken. But this seems a prerequisite to expanded use of such programs, so that intelligent decision with respect to them can be based on knowledge of per-unit costs of wood produced. Additional successful yields achieved through such programs should be weighed against actual total costs of supervision and implementation, including not only cost of successes but also of failures. Cost of net additional yields achieved is increased to the extent that public funds substitute for private funds and no net increase in production is obtained, or ultimate benefits are lost through early partial or total liquidation.

A further dra\vback, in addition to costs of incentive-payment programs, relates to rigidities they engender. The net effect of raising earning rates artificially to meet high alternative rates of owners is simply to subsidize conditions contributing to inefficiency. Though temporarily stimulating investment through lo\vered costs and increased earning rates, incentive programs tend to preserve the existence of uneconomically sized and managed units.

Incentive-payment programs may wander-perhaps inadvertently-into areas where they are totally unnecessary. These areas are typified by Christmas tree production and certain management practices yielding high rates of return. If products and practices are inherently profitable, there is no need for incentive payments. Unless incentive programs exclude those owners able to do without subsidies, public funds inevitably will be substituted for private investment·"and program costs unjustifiably increased.

Incentive-payment programs in agriculture have failed to inspire confidence in their ability either to raise incomes or productivity. In view of distorted conditions induced in the farm economy by such programs, net benefits are difficult to identify and even more so to measure. There is no reason to believe that a similar system for the nonindustrial forest economy could accomplish desirable adjustments. The undistorted working of a relatively open market economy is capable" of bringing about permanent adjustments in productivity and size of holdings without the aid of costly programs that tend mainly to rigidify present unsatisfactory conditions.

MODIFYING HIGH ALTERNATIVE RATES OF RETURN

Lower alternative rates may result from voluntary transfer of ownership and

from deliberately influencing ownership patterns in favor of lower rates by property tax measures.

Buying and Selling Woodlands

Cash needs for consumption purposes and inability to save and invest militate against improving productive capacity of woodlands. Public interest in higher timber production could be served if owners having these limitations would sell out to economically stronger owners who could afford intensive management.

For a complex of reasons stemming from sociological, economic, and psychological factors, large numbers of nonindustrial owners are unlikely to uproot and seek more remunerative opportunities, even when such opportunities are available. That people do not simply sell out when adverse circumstances develop is evident from the attention given to problems of low-income farmers during the last few years. The current concern with depressed urban and rural areas suggests some form of stimulation apparently is needed to convince individuals of inability on their part to adjust to changed conditions and maintain given standards of living.

One form of stimulation is purchase of less intensively managed lands by buyers with lower alternative rates than current owners. Potential buyers include public owners, industrial owners, and other nonindustrial owners with relatively large holdings.

If 80 percent of nonindustrial holdings are assumed to be receiving low-intensity management, some 236 million acres of commercial forest land are involved. Federal acquisition of even a minute fraction of this acreage is not apt to find public support today (*D,* Barrett 196o). State and local acquisition, except for nonforestry uses and by tax delinquency proceedings, would not make much of a dent. Use of State and local revenue to acquire and manage additional forest land, although a possibility, has not materialized to any extent. Although extensive public acquisition of nonindustrial holdings does not appear likely, the real merit of this means for improving productivity of forest land cannot be overlooked. As suggested earlier, when a public goal is clearly seen and appreciated, measures politically unpopular today can become acceptable tomorrow.

Many industrial owners are in the market for additional land. But demand depends on many factors relating to location, size, price, and land needs of each firm. Ordinarily firms are uninterested in small scattered parcels except where these block up present holdings. Larger parcels of good site quality

usually are of prime interest. A survey in Louisiana revealed 83 percent of forest lands owned by pulp and paper companies were obtained from other corporations-mainly lumber companies long out of operation. Only 5 percent of holdings came from farmers and other small owners (G, Heyward 1960).

When forest properties change hands, prospects for improvement in management intensity depend entirely on subjective circumstances of new owners. The free play of market forces tends to direct properties into hands of progressively stronger owners, and the relatively short average tenure among nonindustrial owners favors migration of these holdings at a steady pace. Active markets for forest holdings can be expected to have an indirect beneficial effect on management intensity.

That the public would benefit from more intensive management of nonindustrial holdings is implicit in the public goal to greatly increase the level of nonindustrial timber production. Some shift in the ownership pattern of nonindustrial holdings seems desirable as a move toward this goal. Public policy should favor trends that enlarge some units and reduce the total number of holdings because economies of scale and lower alternative rates of return may thereby be achieved.

Some public aid programs, however, have side effects that prevent or delay consolidation of holdings and shifts in ownership. Examples are: (1) social security payments that enable elderly people to spend their retirement years on the home place without managing it intensively and (2) cost-sharing programs that enable some owners to earn a satisfactory rate of return on their share of invested capital in an otherwise uneconomically sized enterprise. Under the multiplicity of social welfare programs sponsored at various levels of government some conflict in policy goals is perhaps inevitable. Ultimate interest in achieving public goals efficiently suggests that probability of policy-program conflicts be recognized and ways sought to reconcile or Ininimize them.

Woodland Taxation

Property taxation can be used to promote shifts in ownership. An optional law for owners of less than 1,000 acres of woodland, passed by the Oregon legislature in 1961, serves as an example. It is a site tax based on productive capacity of forest land and does not tax growing stock. Although the tax imposed is level over time, its burden in the first several decades is greater than ordinary ad valorem taxes on land and timber. If such a site tax were mandatory instead of optional, it would encourage a shift of holdings to those better able to bear the increased tax burden during the early life of a stand. Moreover, since

this kind of tax does not increase as merchantable timber volume increases, it also encourages longer rotations and, therefore, higher levels of growing stock.

A site tax stimulates intensive practices because there is no tax penalty for increasing volume and value of growing stock and because returns from thinning help offset higher tax costs in the early part of a rotation. The net effect of such a tax is to reduce total taxes over the rotation, thereby increasing an owner's rate of return. Woodland investments are thus made attractive to owners with low alternative rates of return; longer planning horizons are also encouraged. As ownership is stabilized and strengthened, size of holding can also be expected to increase, resulting in more efficient management units.

The Finnish forest-land tax system is also based on productive capacity of a site. In addition, however, it is designed to place a lighter tax burden on owners who manage their property so that it approaches potential productivity and a heavier burden on those doing a less intensive job of management. Such a system also favors those with lower alternative rates who can afford intensive management.

SIGNIFICANCE OF MARKET IMPERFECTIONS

Market imperfections have been implied in connection with differing time-preference rates and planning horizons among individuals, in an apparent failure of forest-land markets to recognize future values fully by a discounting process, and in the element of uncertainty which characterizes expectations about future markets and prices in forestry.

Theoretically, the more nearly a market approaches the standard of perfect competition, the more effectively are wants of both buyers and sellers served without discrimination. The sort of imperfections mentioned tend to prevent this standard from being fully attained. The theory of perfect competition indicates that alternative rates among owners eventually would become equal as forest land is bought and sold by individuals seeking their maximum investment advantage in forestry. While the theory of management intensity presented in the previous section is not invalidated by imperfect competition (as discussed on pages 72-73), consideration of why imperfections arise and persist implicates earning rates and levels of investment by nonindustrial owners.

Basically, imperfections arise as a result of varying tastes and preferences among individuals and from varying capital and savings positions. That individuals do not value alike some commodities such as homes or paintings is manifest in everyday experience. People also apparently impute different values to services provided by forest land. Forest properties, because they cannot

easily be compared, tend to be unique units; hence, market value is not easily established or recognized. Imputing different values gives rise to different earning rates; consequently, one individual is willing to pay more than another for a home, painting, or forest land, because its expectation value to him exceeds that which others ascribe to it.

Perhaps part of the reason why individuals see differing values arises from unlike capital and savings positions. An individual with a restricted income finds it difficult, if not impossible, to satisfy all his continuing consumption needs and to accumulate a surplus of capital as savings. Without this surplus, he is in no position to bid for the services of some commodity which, though it more than meets some minimum level of his needs, possesses a higher value for satisfying someone else's tastes and preferences. Not only can it be said that money (capital) is required to make money, but also that saving precedes enjoyment of the fruits of capital.

Differences among individuals give rise to an imperfection in capital markets, forcing some to pay Inore than others for the privilege of borrowing, due to differing classes of risk. Capital may be rationed not only because of inadequate collateral but because of personal attributes or individual circumstances that make an owner·a poor risk in the eyes of lenders. Despite his sterling character, an individual may find credit very difficult to obtain if he has never used credit or demonstrated his ability to meet contractual obligations.

Another imperfection particularly noteworthy in forestry arises from the capital gains tax, the impact of which is more pronounced within high tax brackets than within low. An investment alternative not subject to capital gains treatment and yielding a high return before taxes may prove less attractive than a lower yielding forestry alternative that, because of capital gains, has a higher after-tax yield than the nonforestry investment. For a person in a 7o-percent income tax bracket, a nonforestry investment with a before-tax yield of 15 percent has an after-tax return of only 4.5 percent, while a forestry alternative yielding 8 percent before taxes yields 6 percent after allowing for the 2s-percent capital gains tax.

Consideration of market imperfections leads to a conclusion that some will always persist so long as individuals differ from one another. Other imperfections, such as that arising from capital gains, could be modified either to widen the impact or to remove it altogether. Analyzing the nature and causes of imperfections may disclose ways to extend favorable effects or to modify or overcome unfavorable effects when either arises from institutional factors rather

than from personal differences. Minimizing institutional imperfections should lead to more efficient forest-land markets, thereby improving earnings in forestry and making forest investments more attractive to a wider circle of nonindustrial owners.

IMPACT OF EOONOMIES OF SCALE

Economies of scale have been implicit in discussion of diversification and flexibility of management, specialized knowledge needed by owners to carry out forestry practices intermittently, and in an observed trend toward consolidation into larger units. Points such as these suggest that economies of operating costs accrue as scale of operation is increased.

The theory of determination of management intensity presented in the preceding section stresses importance of owner characteristics, independent of physical characteristics of a holding, in shaping owner decisions about management intensity. Economies of scale raise a separate but closely related issue of whether an owner with less than some optimum size of holding actually could afford to practice forestry, even though his economic situation, goals, and knowledge of technical forestry were not inhibiting factors.

Size of holding does not affect an owner's alternative rate directly; however, through correlation of size of holding with asset level of owner and thus possibly with income, larger owners ordinarily may be inferred to have lower alternative rates than smaller owners. Size, on the other hand, appears to be directly correlated with earning rates on forest investments. By spreading fixed costs of managing and marketing timber more widely in a large enterprise, investment cost per unit of output may be reduced and earning rates thereby improved. Moreover, the impact of tax advantages also operates in favor of those, in higher income tax brackets. Thus, it may well be that size of operation has an important effect on degree of management intensity practiced, not because of any direct effect on alternative rates of owners but because of an impact on earning rates in forest investments.

This impact leads toward eventual consolidation of holdings in the hands of econonlically stronger o\vners having greater management stability. From the viewpoint of encouraging higher levels of investment in forestry, such consolidation would appear desirable.

TIME-RELATED INFLUENCES

The physical dimensions of a problem as widespread and seemingly serious as that of low productivity on nonindustrial holdings tend to command undue

attention and may largely obscure a time dimension that presents a completely different conception of the situation.

Small woodlands are an inherited problem from the dominantly rural economy of the past; they are anachronisms left over from a way of life that has become outmoded. Lane (G, 1959) developed this idea in relation to woodlots in the Northeast, showing their historical background and development through time. The view as he presented it, over nearly three centuries of time, is a powerful antidote for unwarranted urgency and concern. Woodlands have only become acute as a problem situation during the last two or three decades -and this at a time when our entire rural economy has been convulsed by fundamental social, economic, and technological changes. Little wonder that woodlands appeared either ill used or neglected! Their essential function during this era of rapid and substantial change has·been the release of capital needed by owners for more urgent purposes.

Lane identified three types of change that have occurred. First, the function and importance of woodlots has changed. From an integral and necessary part of a farm, they have declined to an anomalous position of not supplying any really critical need, yet often situated so they cannot be separately disposed of.

A second change is that of size: Woodlots are now found to be increasing in size along with farms. Shifting agricultural patterns and more intensive practices contribute land no longer needed for crops or pasture; farm abandonment results in idle land that often reverts to brush and trees; and new technology in agriculture makes larger units more economic, so suitable lands are blocked up into larger holdings.

Data on extent and direction of shifts are sparse, but there can be little doubt of their occurrence. Coutu (E, 1961) reported a 2o-year trend in the Southeast characterized by decrease in total number of farms over 220 acres in size, increase in number of those under 30 acres, and decrease in number for the intervening size class. I<aufman (G, 1961) stated that in the South the

> Average size of woodland holdings appears to be increasing along with the increase in the size of farms, but the largest commercial holdings, despite fears to the contrary, do not appear to be increasing appreciably in size or number.

Another study in California (F, Casamajor *et ale* 196o) showed pronounced shifts in one county during the period 1948-57. Privately held rural land changed hands extensively, moved from smaller toward larger holdings and from other types of ownership into hands of timber-operating companies and individuals.

While reasons behind shifts in ownership undoubtedly vary from one locality to another and from period to period, impact of such shifts on ownership patterns rather than cause is of prime interest in this study. An inference in the absence of conclusive data is that an ultimate effect will be to shift holdings into hands of stronger owners able to hold woodlands and growing stock for one purpose or another. Land, as a scarce resource, is too valuable a productive agent to remain neglected or misused in the hands of those who cannot put it to its most productive use. Relatively frequent turnover in nonindustrial holdings can be interpreted as indicating a state of flux in which uses, technologies, markets' values, and objectives are undergoing change; and a dominant trend is in the direction of less neglect and higher use of a valuable commodity.

A third change is shifting owner classes: Woodlands increasingly are being held by nonfarm or part-time farm owners. The California study, for example, found recreational use to be an important new reason for acquiring woodlands. Coutu (*E,* 1961) has proposed five categories for classifying landowners when studying woodland management potentials: (I) rural nonfarm residents, (2) rural retired nonfarm residents, (3) rural residents regularly employed in nonfarm work and conducting regular agricultural activities, (4) commercial agricultural firms, and (5) a subsistence and "other" category of tenant families, migratory workers, and others of an uncertain tenure status. His classification emphasizes decreasing importance of farm ownership and emergence of growing groups of landowners having new and different objectives for acquiring woodland.

Along with different reasons for acquiring woodland goes an increased interest in and appreciation of investment opportunities in intensified woodland managenient. Or else as Coutu points out, economic situations and goals of these owners imply that some (mainly nonfarm residents and to a lesser extent part-time and commercial farm operators) might be very receptive to advice and instruction on intensified management, because they generally have low alternative rates of return and relatively long planning·horizons. Another important factor, especially among nonfarm residents, is that while rural residence affords a choice of part-time income-producing activities, the initial capital investment required in many agricultural pursuits is relatively high. Intensified woodland management, especially where some growing stock is already present, offers less of a capital investment obstacle. When improved forest product markets have developed, such as in the South and the Douglas-fir· subregion, those who prefer country living may well discover that forestry offers attractive part- or even full-time income-producing opportunities without heavy equip-

ment investment as in agriculture and the constant attention and work required in most types of specialized farming. Perhaps if Stoddard's forest farming idea (*E,* 1949) were reinvestigated under changed economic circumstances now present in either the South or the Douglas-fir subregion, favorable results might be obtained.

Quinney's comments (G. 1961) further confirm significant and sweeping changes in nonindustrial ownership of woodlands. Function and size of holdings, kind of owners, and owner objectives are undergoing modifications induced largely by economic factors.

Implicit in discussion of time-related influences is an inference that some of them at least are more powerful, more persistent, and more certain in result than artificial efforts to stimulate and encourage forestry. Recognition of these natural forces and realization that the changing nonindustrial-owner situation is likely to be less serious and prolonged than many seem to believe would lead to rational effort to work with rather than against natural change.

WORKING WITH TIME

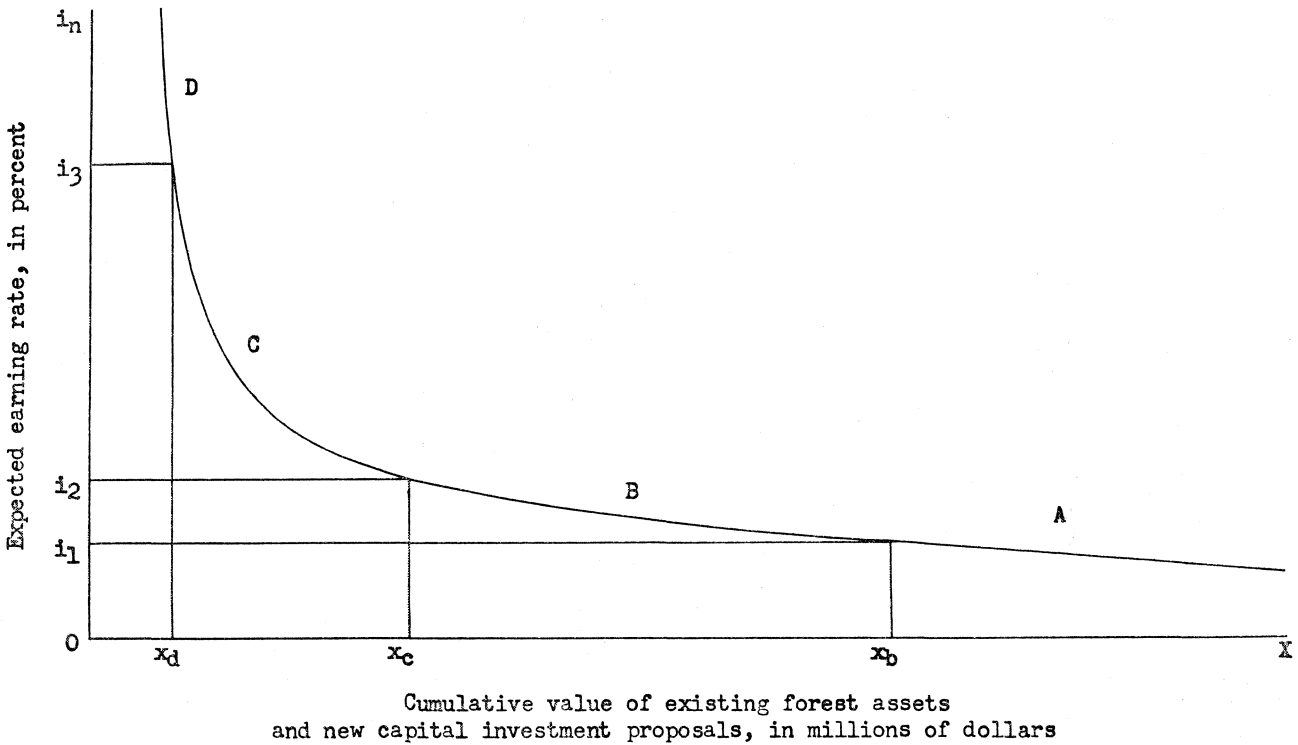
Two conspicuous conclusions emerge from this study of the problem of increasing output from nonindustrial holdings. One is that time may be a potent ally in resolving the so-called small ownership problem, due to radical changes now occurring in function, size, ownership, and importance of nonindustrial woodlands. A second conclusion is that public policy and programs for nonindustrial owners need to be reoriented more closely toward the investment aspect of forestry and investment characteristics of owners.

The key to more growth is simply more investment in timber growing, either through retained and reinvested earnings or through more cash outlays. Increased production, when reformulated in these economic terms, is not a problem of stimulating management but of stimulating forest investment to the extent that assets are capable of producing 1°4 billion board feet of timber annually, or any other absolute level. When the ultimate goal is clearly recognized and the economic realities of attaining any given level are fully understood, an efficient program for achieving the goal can then be designed.

Figure 3 presents an idealized model for allocating public funds to achieve a higher level of timber production in the United States. The curve represents a hypothetical demand schedule for capital on all forest-land holdings throughout the United States.

Segment A of the curve includes all those investment opportunities, existing and potential, that are inefficient for any owner to undertake, assuming none

FIGURE 3. Idealized model of aggregate capital demand schedule for commercial forest holdings of public, industrial, and nonindustrial owners



has an alternative rate of return less than i_1. Segment B includes those forestry opportunities that ordinarily would be undertaken only by public owners. Segment C includes opportunities attractive both to public and private owners, the latter largely comprising industrial owners. And segment D includes opportunities open to all owner classes.

Boundaries shown for each segment of the curve are typical minimum acceptable earning rates for forestry investments among the three major classes of owners. For illustrative purposes, i_1 is approximately equal to 3 percent, a not unreasonable minimum rate for public investments; i_2 approximates 5 or 6 percent but may range as high as IS percent, depending on a given firm and specific forestry investment; while i_a might be approximated by IS percent a guiding rate for nonindustrial owners. Although the actual shape of the is conjectural, there are certainly many more moderate and low-yielding investment opportunities in forestry than those returning in excess of IS percent; hence the curve is steep on the left but rapidly flattens out to the right.

The actual process of efficiently allocating public funds to promote a plentiful supply of wood is facilitated by visualizing three curves identical to that in Figure 3, one for each major owner class. Specific assets and prospective new investments in each owner class are analogous to those shown in Fedkiw's Figure 3 for a single managed forest property (*G,* Fedkiw *et ale* 1960). Since many such assets and proposals are common to each owner class, the problem of allocating public funds to increase the Nation's wood supply becomes one of directing additional public investment into those opportunities not within reach of private investors. In general, such opportunities lie along segment B of the industrial-owner curve, segments Band C on the nonindustrial-owner curve, and segments B, C, D of the curve for public holdings.

Prudent public investment directed toward securing an optimum supply of wood at lowest total cost is dependent upon correctly recognizing priorities in allocating effort among the three owner classes. The proportion of an optimum timber growth goal supplied by each owner group depends not only on acres of timberland owned, site quality, and regional distribution-as seems to have been the basis for the present Forest Service goal for nonindustrial owners-but also on ability of owners to hold and accumulate growing stock capital to higher levels and to allocate savings or investment funds directly into forestry enterprises on their own lands.

Theory indicates that first priority lies on public lands in those new opportunities along higher reaches of the curve of earning rates, beginning with the most productive investments first and proceeding downward along the curve

until the minimum acceptable public earning rate is reached, i_1 in the illustration. Public lands receive first priority for reasons stated on pages 86-87; in essence, ability to hold forestry investments to maturity is assured and complete control over use of funds is retained.

When all first-priority investments are fully developed, attention may then shift to the second priority-assisting industrial owners to make new investments among those opportunities along segment B of the industrial owner curve. These owners are fully capable of turning to advantage opportunities along segments D and C, but they will not continue to invest where expected earning rates fall below alternative or guiding rates of return (segment B).

A major aim of public effort should be to find ways to make opportunities along this segment attractive to industrial owners. Outright grants, low interest loans, or several types of tax concessions might be tried. One of the most effective measures for expanding the flow of private capital into forestry investments has been the Federal income tax provision on capital gains, which makes earning rates on management practices more attractive than they otherwise would be and, therefore, more competitive with nonforestry alternatives. Industrial. lands should be accorded second priority, for, owing to generally stable and responsible ownership, investments made with public assistance on these lands have reasonable assurance of being held to maturity.

The third and lowest priority in a public program to increase wood production lies with nonindustrial holdings, because this group ordinarily manifests the greatest discrepancy between a long-term public goal and short-term private interest occasioned by owners' high alternative rates of return and short planning periods. There are some nonindustrial owners, nevertheless, whose potential goals may be so nearly in accord with a public goal of increased production that a positive program designed to raise their levels of management intensity can be justified as a third priority.

Measures included in such a nonindustrial program should aim either toward raising earning rates in forestry or else reducing alternative rates of return among owners to get at the fundamental cause of low economic productivity. Measures adapted to the first aim are of two sorts. One is a revised educational approach that presents a package of management ideas to a prospective manager and seeks to convince him of the profitability of several alternative management programs embodying different degrees of management intensity. These alternatives are custom tailored to fit his particular circumstances, but the choice as to which program best suits his needs is left to him. This educational approach, in effect, aims toward informing nonindustrial owners of opportu-

nities at the upper end of their curve of expected earning rates. Goals and economic situations permitting, some owners can then be persuaded voluntarily to invest in those practices. that promise to earn more than their alternative rates of return from nonforestry pursuits.

The second approach. to raising earning rates lies in reducing physical and economic risks of practicing intensive forestry and includes developing more efficient techniques for growing and harvesting young-growth timber and finding new uses and products for this timber. A publicly supported program of research could be set up to attack this aspect of the problem. Certain income tax modifications (page 101) also are possible avenues for raising earning rates. Investing public funds through incentive-payment schemes in order to persuade owners to undertake practices that otherwise would return less than their alternative rates appears unwise for reasons cited on pages 98-101 and 102-103.

The second major aim of a public progran1 in support of nonindustrial forestry should be· to favor lower alternative rates of return, which may come about indirectly through shifts in ownership but can also be stilTIulated by specific property taxation procedures.

The public goal of obtaining increased timber production is in harmony with long-range industrial interest in timber management as the basis of continued industrial existence and forestry firms·can playa vital contributing role. Their objectives would also be served by adopting the same educational approach as well as by purchasing nonindustrial woodlands whenever such action is beneficial to a firm.

Because of the industrial stake in an abundant wood supply and the objective of profitable production which industry shares with nonindustrial owners, it is conceivable that industry eventually would shoulder the major burden·of promoting intensified management among nonindustrial owners who can afford it. The public interest in greater productivity from nonindustrial holdings could then be refocused (1) on devising appropriate income and property tax policies that either are neutral toward or else stimulate intensive management, rather than impede it; (2) on conducting research (a) to define realistic output goals for various owner classes, (b) to identify owners able to respond to·the reoriented educational approach, and (c) to develop new ideas in growing, harvesting, and using young-growth timber; and (3) on quantifying the nature, extent,. and direction of time-related influences ameliorating the nonindustrial owner situation.

To describe small owners as holding the key to the Nation's timber supply

(G, U.S. Forest Service 1960) is to charge them unrealistically with a responsibility they cannot afford to accept. Irrespective of how idealistic and conservation-minded these owners might wish to be, only a few percent are apt to be so situated economically that they can afford to intensify management for a nonpecuniary public welfare objective. However cold, hard, or even disquieting these facts may appear, the Sooner they are recognized and accepted, the sooner it will be understood what causes private nonindustrial owners to practice forestry and what determines the extent to which they can afford to do so.

Separating the public *goal* of increased timber production from the *problern* of getting increased production largely divorces the latter from the nonindustrial owner situation; other realistic alternatives are available for meeting the goal. Certain well-chosen measures congruent with the action of time can be counted on to adapt an anachronistic situation to economic and social realities of modern society.

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10. Gaffney's study was first published in 1957, but subsequent unrevised copies bear the later date.

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