

The Economic Problems
of Forestry in the
Appalachian Region

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HARVARD UNIVERSITY PRESS
CAMBRIDGE · MASSACHUSETTS

1949

HARVARD ECONOMIC STUDIES
VOLUME LXXXIV

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LONDON : GEOFFREY CUMBERLEGE
OXFORD UNIVERSITY PRESS

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PRINTED AT THE HARVARD UNIVERSITY PRINTING OFFICE
CAMBRIDGE, MASSACHUSETTS, U. S. A.

PREFACE

THIS BOOK is aimed at defining the field of the economics of forestry and outlining the economic problems of forestry as background for research. Its ultimate purpose is to aid in solving the forestry problems of the people by encouraging better understanding and more pointed research in attacking these problems. The book deals specifically with the Appalachian Region — the five southern Appalachian states of Kentucky, North Carolina, Tennessee, Virginia, and West Virginia — in the years adjoining 1940. But the theoretical issues proposed have wider applicability, and the point of view taken may be of general interest to those concerned with forest-resource management. In a sense, therefore, the Appalachian Region and the time context chosen are used merely for convenience in providing concrete illustrations of principles.

The approach, however, is regional. An attempt is made to view the forestry problems of each locality against the background of the economy of the whole region. Likewise an attempt is made to view the problems and the needs for research in each branch of the field of forestry economics in relation to conditions in the entire field as they appear from the regional level. It is assumed that the relative importance of problems and the relative need for different lines of research will be judged to a large extent on the basis of regional considerations — and, it should be added, of regional considerations of the long run rather than the short run.

The field of forestry economics is still largely unformed. It is an advantage that there are no well-established precedents that must either be followed or be overcome with great difficulty, but it is a disadvantage to the single worker that the field is so largely uncharted and that so much of it remains to be discovered and developed. The work of exploration lying ahead is not a job for one person or for one research organization. The writer of this book cannot do more than sketch the merest outlines of much of the material with which it deals.

The definition of a field of research itself requires research in

that field. Research and definition of the field tend to develop together. There are advantages in looking out ahead of current development and in charting the field, if only tentatively. But insufficient knowledge makes it difficult to advance the charting process considerably beyond the stage of current research development.

The task of problem analysis is a case in point. Research and problem analysis go hand in hand: each is improved as the other is improved. The type of research in question here is not the compilation of facts, but research in a fuller sense. For example, a major forestry problem is reputed to be the misuse of land: the use of it for forest production where some other use is more economical, or vice versa. But the existence of this problem may not definitely be confirmed or analyzed until the best use of land is known, and this, in turn, calls for research.

In view of the limited development of research in the economics of forestry and the preponderance of mere fact compilation in such research as has been done, the present analysis is of necessity both tentative and incomplete. This fact is underscored in such branches of the forestry-economics field as marketing and income, where investigation has been especially meager.

This book is limited in another sense, in that it deals with research only from the regional or narrower than regional viewpoint. It does not deal with aspects of the economics of forestry involving interregional, national, or international considerations. It cannot, therefore, treat such matters as interregional competition in an exhaustive manner, and it must disregard altogether such questions as international trade, tariffs, and national and world policy.

W. A. D.

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INTRODUCTION

INTRODUCTION

FIELD OF THE ECONOMICS OF FORESTRY

THIS ENTIRE BOOK serves as a definition of the economics of forestry. It is best to let that definition unfold gradually. However, it may be helpful at the outset to indicate summarily the content of forestry economics¹ and some of the principal characteristics of the field.

CONTENT OF THE FIELD

In society as we know it, mankind has many wants. Man fills these wants by producing goods and services, using for that purpose the productive factors — land, labor, and capital — which he combines and operates in accordance with such technology as he has developed. But man cannot totally fill his wants, because the supply of productive factors is not sufficient. He is therefore obliged to “economize” these factors: to allocate them among their alternative uses.

Economics may be regarded as the science of the allocation of productive factors and the application of productive technology, in the light of consumers' wants, to maximize human satisfaction.² Forestry economics would then be that branch which is especially concerned with the allocation and application of forest resources (productive factors and technology).

In this book the field is regarded as including the economic aspects of the use of forest land and the genetic production of forest products as well as the economic aspects of the further production (extraction, processing, and distribution) and the consumption of forest products insofar as these are closely related to forestland use and forest production. These terms are used broadly. The term *forest land* is intended to be interpreted in such a way

¹The writer is indebted to Mr. Paul E. Malone, formerly of the United States Forest Service, for helpful suggestions concerning the approach to this section. For some brief definitions of forestry economics, see Appendix.

²Some considerations pertinent to evaluating human satisfaction are discussed later in this introduction.

that the question of the utilization of land may be regarded as a part of the economics of forestry where forestry is one of the possible alternative uses. The term *production* is meant to encompass all the productive processes that lead to consumption of forest goods and services, not least among them being the generation, growing, and culture of the forest (forest production). The term *forest products* includes not only such physical goods as trees, logs, wooden articles, resin, forage, domestic stock, and wild life; but also such services as aesthetic and other recreational attractions and the storage and regulation of water.

The economics of forestry as outlined here may seem to cover more than its proper ground. It may be argued that the manufacture of products is not legitimately a part of the economics of a genetic industry, but falls more properly within the sphere of industrial economics; or it may be felt that the question of alternative uses of land is the province of "land economics," which is concerned with all types of land, rather than forestry economics, which is concerned primarily with forest land. But the overlapping of fields upon many subjects is perfectly proper and may help the progress of research. There are few subjects which can be claimed as the exclusive possession of any one field of study. The economics of forestry itself is compounded of a variety of physical, biological, and social sciences. Its nucleus is the economics of forest production; but to understand the elements of production requires a consideration of marketing, prices, processing, and consumption as well. The economics of forestry shares these subjects with other fields of study and considers them only insofar as they bear significantly upon forest production.

The view taken here of forestry economics excludes, however, so far as possible, those aspects of forestry belonging chiefly to branches of social science other than economics. This interpretation is probably narrower than is customary. It is quite usual, in fact, to include within forestry economics both the sociological and the economic aspects of forestry.³ There is a close relation between these two fields which makes it difficult to draw a separating line between them. Nevertheless, in the present study, it is con-

³ Social Science Research Council, Subcommittee on Scope and Status of Research in Forest Economics, *A Survey of Research in Forest Economics* (Soc. Sci. Research Council Bull. 24; vii + 52 pp.; New York, 1936), p. 4.

sidered appropriate to isolate the economic aspects as far as possible.

ECONOMICS A LINK BETWEEN THINGS AND PEOPLE

The science of economics, informally speaking, is concerned with the use of productive factors and technology in satisfying human wants. Economics takes as its subject, on the one hand, resources such as forests, labor, managerial skill and experience, credit facilities, logging and milling methods and equipment, and the means for commodity distribution. On the other hand it considers the wants of the people who stand ready to consume lumber and wooden articles, forest-recreation services, and other products. It takes these two elements of human activity, the producing and the consuming, and studies the principles whereby, in the process of value and price formation, the outputs in the various lines of production are equated to the demands for consumable goods and services, and whereby the consumable product of human activity is distributed among the factors responsible for its production.

To say that economics is concerned with value and price is not to say that it is concerned, necessarily, with dollars and cents. It derives its principles in those human motives out of which arises a standard for evaluating the relative worth of different commodities and lines of action. This standard is the power to satisfy human wants by goods and services with a minimum of pain and labor.

Thus, in a sense, economics is a study of the link between man's physical environment on the one hand, and his labor and enjoyment in it on the other. In the same sense, economics is a link between the naturalistic sciences and psychology. Its relation to the former is of interest here. Let us suppose that a bridge is proposed across a certain body of water. The question of whether it is physically possible to build this bridge is an engineering question, as is the question of how to go about constructing it. But the question of whether to build the bridge is an economic one; it is a question of evaluating alternative means of transportation, among which the bridge is one. Again, suppose that a new variety of vegetable is envisioned, having special qualities. Whether this variety can possibly be developed is a question for the biologist, as is the question

of how to develop it and subsequently how to cultivate it. But the question of whether to develop it for use, and whether it will be used, is an economic one.

Biology and engineering are the principal naturalistic sciences linked with the economics of forestry. They are the sciences concerned with the physical task of producing trees and with harvesting, processing, and transporting them. With respect to these sciences on the one hand and human social psychology on the other, the function of forestry economics is a coördinating function — to evaluate the methods and results of the biologist and the engineer in terms of human satisfaction.

In research, the naturalistic branches of forestry are coördinate with the economics of forestry. As an applied science, and in its pure-science phases as well, the economics of forestry customarily builds upon and interprets the work of the biologist, physicist, or chemist. Sometimes the latter may carry on from principles developed by the economist. But it is the economics of forestry which, in the last analysis, must provide the link with human motivation. It is the task of forestry economics to determine the optimum stand of timber after the biologist has determined the range. It is the function of economics to investigate which of several alternatives defined by the engineer or biologist is the most acceptable — which of them contributes to the greatest human satisfaction. It is a function of economics, also, to aid in evaluating the worth of research results and, by the same logic, to aid in evaluating proposed studies.

Since the ultimate objective of all forestry research is to help solve problems of the people — to help maximize human satisfaction — it follows that all forestry research has in it elements of economic analysis as well as of biological or physical analysis. Only studies of methodology may lack this dual character, and they too, when applied, take on the dual form.

The essentially economic character of forestry research is obvious in many cases. Take for example a study of planting methods. The purpose of this study is to find the best method for given conditions. Obviously the best method is not necessarily the one requiring the least effort or the one resulting in the highest survival of trees. The best method is that producing the greatest excess of survival over effort. To find a common denominator for

survival and effort and measure the amount of the excess is a problem in economics, calling for the use of economic techniques. The engineering and biological phases of the study are concluded when effort and survival are determined. Regardless of the individual who carries the study to termination from that point, the research involved is economic, and not physical or biological.

Some types of forestry research contain applications of economics which are so simple that they are taken for granted or are not recognized as such. Another example in the field of forest regeneration is a proposal to determine the best kind of trees to plant for timber on a given site. Of the kinds available, it is found that only shortleaf pine grows well; the others do very poorly. That shortleaf pine is best appears obvious, and it appears that this conclusion has been reached solely within the field of biology and without reference to economics. Actually, however, behind this conclusion lay an appraisal of the usefulness of the products which would result from the plantation. This economic appraisal was automatic and was taken for granted. If the only kind of tree that would survive well had been scrub oak, a tree whose value for timber is in some doubt, the economic character of the problem would have been more easily recognized; or if there had been a choice among alternatives, the economics would have been more readily recognized. Furthermore, although the question of the best tree to plant has been answered, the question of whether to plant it has not been answered and cannot be answered by either biology or engineering.

In the study cited, it was possible to take for granted what would have been regarded as an economic commonplace, and to let biology alone find the answer. To carry this practice far is risky. It may lead to the conclusion that what is biologically most successful or physically most feasible is therefore best for man — as, for example, that the fully stocked forest or the most rapidly growing trees or the most complete control of forest pests is the best for man. Further, what is best for man may even be lost as an objective: what is best for the forest, or the trees, or the soil may become the objective.

Some types of forestry research, on the other hand, appear not only to have an obvious economic character, but even to be exclusively economic. Such, for example, are certain studies in mar-

keting or in income. Disregarding methodological research, it will be found that these studies are no more exclusively economic than are any studies with the human objective. They may have in them a larger proportion of economic analysis, but they are still based upon biology and engineering. They must either take as given or investigate the technology of forest products, transportation, milling, communication, storage, packaging, and the like.⁴

The point made, then, is that economics — firmly rooted in biology and engineering — plays an essential part in nearly all forestry research. This has nothing to do with the question of the administration of research projects. It is assumed that individual projects should be led by biologists or economists according as the techniques chiefly involved are those of biology or economics. Regardless of administration, there must be close collaboration between the two groups of workers. It is a principal thesis of this book that fuller use of economic techniques can advantageously be made in forestry research. One purpose is to show where those techniques can be used. Another purpose is to demonstrate the usefulness of the "economics approach" and the "economics viewpoint" in forestry research. The approach is a system of research methods; the viewpoint is that of human welfare.

SOCIAL ECONOMICS AND PRIVATE ECONOMICS

It is possible to take one of two viewpoints toward economic analysis. On the one hand such analysis may be aimed at solving the problems of the individual person or firm or industry. The objective here, in general, is to maximize private profit. On the other hand analysis may be aimed at solving the problems of communities of people or of society as a whole. The objective here is to maximize the general economic welfare. These two types may be synonymous; often they are not.⁵

The position to be taken in this book is that the economics of forestry is concerned in large measure with social, not necessarily private, objectives. In part the necessity for this position arises from the character of forest resources and of forestry. In part it

⁴ John D. Black, ed., *Research in Marketing of Farm Products—Scope and Method* (Soc. Sci. Research Council Bull. 7; 221 pp.; New York, 1932), pp. 4-5.

⁵ Bernhard E. Fernow, *Economics of Forestry* (xii + 520 pp.; New York, 1902), pp. 1-4.

arises from the exercise of scientific disinterest⁶ where public and private points of view are incompatible.

To accept social interest as the major concern of the economics of forestry, however, is not to disclaim the study of private enterprise. Nor is it to deny the feasibility of forest production under the private-profit system. Indeed, the economics of forest production by the individual firm — that is to say, private forest management — is a large segment of the economics of forestry.⁷ The objective here is the organization of the factors of production available to the individual manager — the land, forest growing-stock, labor, and equipment and other capital — in such a way as to maximize net income.

In its study of the individual firm the economics of forestry holds, however, to its central function: the evaluation of alternative lines of action as means of satisfying human wants. It is in no sense either bookkeeping or accounting, nor does it, in general, employ the procedures developed in those fields. Much of the formalism of the accountant, where it is more than just an aid to arithmetic, has arisen in response to legalistic and other institutional requirements sometimes foreign to the progress of scientific inquiry.

In its social aspects the economics of forestry is concerned with the values of forestry and the costs of forestry to society, whether it be the community or the world. A principal inquiry of the economics of forestry is how forest resources (productive factors and technology) may be apportioned and used as a part of the apportionment and use of all resources for the maximization of the general economic well-being or human satisfaction. The objective is not necessarily to maximize the net return from forests, but to maximize the general net return. Neither is the objective for the community to receive the greatest possible net income from forests, but for it to receive the greatest total net income compatible with the welfare of other communities, the forest contributing as it may to this greatest total.

It is apparent that in taking the social approach the economics

⁶ Disinterest in the sense that the welfare of no single group in society is regarded as more important than that of other groups. A bias, however, in the sense that the social welfare is arbitrarily given priority above the individual welfare.

⁷ Ralph W. Marquis, *Economics of Private Forestry* (viii + 219 pp.; New York and London, 1939).

of forestry is obliged to look beyond forestry to the other segments of the economy and to see forestry in relation to these other segments. This is necessary because forestry is only one of many branches of production, all of them to some extent competing for the use of the same land, the same labor, and the same capital; and all of them turning out products to be consumed by the same society. Thus a second coördinating function of economics is added to that described in the preceding section: the function of evaluating action within a single field or area in the light of conditions in other fields and areas, the function of appraising the problems of forestry in their relation to one another and to the balance of the economy. This is the function of economics because the common denominators needed for such an appraisal are of an economic order.

This necessity for dealing with many considerations outside the specific field of investigation is not peculiar to economics or the economics of forestry. It is a characteristic of most applied sciences. The forester making studies in the field of planting uses as equipment the data, laws, and techniques of a variety of physical and biological sciences, including not only forestry in a limited sense, but also soils technology, plant physiology, chemistry, and engineering. The forester making studies in the field of fire protection uses methods and knowledge proper to such fields as meteorology, physics, and even psychology. The forester making studies in the field of economics is no more of a generalist than these others.

OUTLINE OF SUBJECT MATTER

To complete this tentative definition of the economics of forestry, the subject matter with which it deals will be outlined. The field is here divided into five main branches: forest land, forest production, industry, distribution, and consumption. Many general topics within the field — for example, income, international aspects, government programs — are given no special mention. The finer subdivisions of each subject, too, are omitted.

I. Forest-land economics

A. Land use

1. Competition of forests for the use of land

2. Competition among the forest uses
 3. Forest-land classification
 - B. Land institutions
 1. Tenure
 2. Taxation
 3. Public or private regulation or other programs
- II. Economics of forest production
- A. Forest enterprise
 1. Initial decisions with respect to use of capital
 2. Forest administration and protection
 3. Forest labor and employment
 4. Forest insurance and credit
 5. Supplementary relationships with other enterprise
 6. Forest valuation
 - B. Forest management
 1. For timber and other tree products
 2. For watershed purposes
 3. For forage
 4. For wild life
 5. For recreational and aesthetic products
- III. Economics of forest industry
- A. Industrial organization and operation
 1. Location
 2. Integration
 3. Institutions and policies
 4. Labor and employment
 5. Technology, efficiency, and competition
 - B. Industrial processes
 1. Logging and other extraction
 2. Manufacture
 3. Transportation
- IV. Distribution and prices of forest products
- A. Marketing
 1. Geography and transportation
 2. Agencies
 3. Methods
 4. Labor and employment
 5. Private or public institutions
 - B. Prices
 1. Determining factors
 2. Product interrelationships

V. Economics of consumption of forest products

A. Demand

1. Relation to time
2. Relation to price and other factors

B. Use and requirements

1. Choice among types of forest product
2. Choice between forest and other products

CHARACTER OF THE ECONOMIC PROBLEMS OF FORESTRY

GENERAL DEFINITION

Some people dislike the word "problem." They feel that to deal with "problems" is to be unduly concerned with the dark side of things — like the problem monger, who possesses a species of pathological attachment for the dismal. Also they feel that "problems" are too commonly used to conceal vagueness of thought. Perhaps it is unfortunate that no other word of common acquaintance, but without these invidious associations, comes to hand as a substitute for "problem." However, most of the difficulty to which the word may be subject arises only in the absence of a precise definition. The need for such definition is apparent, particularly in view of the variety of connotations that are open to the user of the word.

Of course, to define a problem is not necessarily to remove its dismal connotation. Whoever is concerned with the course of social action is likely to take as the goal of such action the betterment (however defined) of existing conditions. If betterment is the goal, then the starting point must be considered less good, which is to say that we are now contemplating a situation which, by comparison with some alternative, is unsatisfactory.

ALTERNATIVE DEFINITIONS

Basically, a problem is a question posed for solution. Hence, it is anything perplexing: a troublesome situation: a condition the existence of which is regarded as undesirable and the means for improvement or correction of which are sought. This last is the sense in which the word will be understood here.

Problems may be defined either *subjectively* or *objectively*.

In defining problems subjectively, a person uses a changeable set of rules to decide whether conditions are or are not problems. What particular rules are used to judge a given condition depends upon two factors: first, upon the number and kind of sets of rules which that person carries in his kit, as determined by his past experiences; second, upon the relation of the given condition to that person, such as whether and how the condition affects himself or any individual or group materially or emotionally related to him. Thus, in subjective definition, whether a given condition is judged to be a problem depends upon who does the judging, even assuming that everyone is fully rational in his application of rules.

In defining problems objectively, a person uses a single set of rules previously determined. In this case, whether a given condition is judged to be a problem depends, ideally, only upon the set of rules: it does not matter who does the judging, assuming that he is fully rational in his application of rules. The objective definition of problems will be followed here.

Within the field of problems objectively defined, numerous alternative sets of rules offer themselves. These rules all state the standards against which judgment will be made. Standards may be of various types. For example, some may relate to *things*. One may adopt as a standard the bright and shiny condition of metal parts and pieces used for all purposes. Under this standard a problem consists in the dirtiness or rustiness of such metal. Dirt, tarnish, and rust constitute the problems to be dealt with. A program to solve these problems would include such things as protection of machinery from the weather by means of permanent structures and canvas covers; filing down or replacing old, rusty nails; and maintaining brass rails and name plates in well polished condition. The standard used here is a *physical* standard.

In forestry, physical standards may be used in problem analysis. Maximum volume of timber per acre is such a standard; maximum yield per acre per unit of time is another; prevention of soil loss, another. Here the problems are, first, understocked forest stands; second, failure to achieve maximum physical output; third, loss of soil from forest land. The standards upon which these problems are judged are like the metal-polishing standard in that they deal with a physical goal, set up without reference to cost. Here the physical goal for forestry is maximum output

from each unit of the fixed factor, presumably possible only at some loss in unit output of other factors of production and only at the cost of general maladjustment, wherein identical factors of production earn widely different rates of remuneration (assuming that these are based upon marginal product) in different occupations.

This reference to physical standards in forestry is of more than academic interest. Physical standards are actually implicit in much work done in such fields as silviculture, forest-fire protection, forest influences, and many others within forestry; and their use has had a profound effect upon the orientation of both research and action programs in those fields. In the last report of the National Resources Planning Board dealing with forestry,⁸ the major objective of public works in the forest-management field is stated to be "more and better timber" — although elsewhere⁹ it is said that "the general objective of a national program of forest-land use is to . . . meet current and future needs for forest products and services," and that "attainment of this objective does not require, nor would it be economically justifiable to seek, maximum timber production from *all* forest land." (Italics not in the original.) Again, with reference to the timber harvest, Fernow states that "in a well-developed forestry system every stick is expected to be utilized."¹⁰ And again, V. E. Johnson says, "The aims of forest management are to obtain the maximum results from forest areas in the production and growth of the forest and the fullest possible utilization of their products."¹¹

Fairness demands, of course, that distinction be drawn between physical standards pure and simple and those standards really intended to reflect economic values, but where the economic yardstick is so unmanageable that resort is had to a rough physical expression of the point of economic adjustment. Thus the report of the fire-control committee at the 1930 Washington conference of district foresters of the United States Forest Service¹² sets up

⁸ U. S. Nat'l Res. Planning Bd., *Public Works and Rural Land Use* (vii + 167 pp.; Washington, 1942), p. 123.

⁹ *Public Works and Rural Land Use*, p. 90.

¹⁰ Fernow, *Economics of Forestry*, p. 170.

¹¹ V. E. Johnson, "Post-War Forestry Problems of the Pulp and Paper Industry," *Forestry Chronicle* 20:1: 46-57 (1944), p. 50.

¹² U. S. Dept. Agr., Forest Service, *Committee Reports Approved by the Wash-*

physical standards for fire control, in terms of the maximum allowable percentage burn for each type of forest. These standards, however, were based upon rough judgment of some of the economic factors bearing upon intensity of fire control: (1) timber value, present or potential; (2) destruction of site value by fires; (3) the difficulty of reestablishing the forest after fire; and (4) the creation of future fire hazards. The two most valuable forest types, white pine and spruce, were assigned a percentage of 0.1. The committee then "set up a scale representing the relative areas which can be burned in each type with equal loss."

Other standards for problem analysis, dealing with *people* rather than things, may be concerned with *spiritual* or *cultural* values. Training and participation in religion is such a standard. Under this standard people's laxity of attention to religious values and religious forms constitutes a problem. Moral conduct as a standard defines the problems of immorality, unmorality, and non-morality. Standards of education are partly of this same category, and under these standards illiteracy and the various other degrees of cultural incompetence may be problems. If the agrarian "good life"¹³ is set up as an objective of social policy, then the existence of a materially poor subsistence-farming class may not be regarded as a problem. It would, however, be regarded as a problem if full productive employment were taken as a standard.

In forestry, examples of spiritual and cultural standards may be found in a number of instances. Aesthetic values are one. The goal may be determined of creating forest stands that are satisfying for people to look at or to play in or to live in or near. Forest stands of low aesthetic value in this case constitute a problem. Again, the goal may be management of forests in such a way as to encourage among people a high level of social consciousness and sympathy and an appreciation of their identity in a commu-

ington Conference of District Foresters and Comments by the Forester (101 pp.; Ogden, Utah, 1930), pp. 50-54.

¹³"Should the nation have more or less people living on the land? Undoubtedly the need is for more people, but not for more commercial farmers. The need is for more people with the rural philosophy of life, more real homes, more economic security, more children, more loyalty to the family and to the national ideals. The land is the foundation of the family, and the family is the foundation of the State." O. E. Baker, and T. B. Manny, *Population Trends and the National Welfare* (28 pp., processed; Washington, 1935), pp. 1-2.

nity and nation of varied physical and human resources. Failure of forest policy to approximate these ends would then be a problem. Fernow remarks that

the immaterial influence of the forest is claimed to extend in at least four or five . . . directions [one of which is] upon the ethics of a people. This . . . influence is one which we cannot measure or even argue with any determinable force, but which we ourselves may feel more or less strongly, according to the degree to which our emotions in general are susceptible.¹⁴

Such spiritual and cultural standards will not be used directly in defining the problems to be analyzed in this book. Nevertheless it will not be possible or desirable to shun them completely.

What may be regarded as an offshoot or degeneration of the spiritual standard is the *emotional* standard, wherein the forest is endowed with human qualities, and its own welfare, or wellness, set up as the goal. In a sense, this is a physical standard. It has been employed in much thinking about the problems of forest conservation, both by laymen and by professional foresters.

There is something in each of us that instinctively cries out against the destruction of forests, no matter for how useful an end. And when this instinctive, often illogical, love for tree cover is strengthened by some economic justification, the result has ever been an emotional urge to keep intact and inviolate those wide stretches of forest that were once our home and very life.¹⁵

The language of the emotional standard is illustrated in the following: "A healthy condition exists in central Kentucky where only a slight wound has been inflicted on the forests in that area. It can be healed before it develops into a gangrenous condition."¹⁶ Fernow cites the public overemphasis upon conservation problems of game and fish as "a good illustration of the fact that emotion rather than reason, sentiment rather than argument, are the prime movers of society."¹⁷ The emotional standard will be discarded for present purposes.

¹⁴ Fernow, *Economics of Forestry*, pp. 65-66.

¹⁵ Arthur N. Pack, *Forestry an Economic Challenge* (161 pp.; New York, 1933), pp. 10-11.

¹⁶ Harry Nadler, *Report on the Timber Situation in the State of Kentucky* (36 pp., processed; U. S. Dept. Agr., Forest Service, 1942), p. 15.

¹⁷ Fernow, *Economics of Forestry*, p. 9.

Another sort of standard dealing with people is the *economic*, which has to do with the value and price aspects of human behavior. One may set up the standard of maximum net profit to an individual firm during a year or a period — for example, the combination of productive factors available to a forest enterprise in such a way as to maximize the net returns to its owners. Another standard might be the maximization of returns to forest enterprise in general; another, the maximization of the net product of forest land. This sort of standard, an economic standard, will be employed to define the problems analyzed in following chapters.

A DEFINITION FROM THE ECONOMIC POINT OF VIEW

A problem will here be defined in terms of the following standard: maximum total economic welfare. The term, economic welfare, is used in the sense developed by Pigou, who defines it generally and provisionally as “that part of social welfare that can be brought directly or indirectly into relation with the measuring-rod of money.”¹⁸

To avoid such ambiguity as might consist in the word welfare, and to by-pass insofar as is possible and not detrimental the general issues involved in welfare economics, the concept of real income will be used as a substitute. Before this substitution may be accepted, several provisions must be made. While economic welfare certainly is closely correlated with real income in goods and services, it would be unreasonable to assume that the latter is a perfect index of the former. Income is not the equivalent of economic welfare, but its “objective counterpart.”

The two concepts, economic welfare and the national dividend, are . . . coordinate, in such wise that any description of the content of one of them implies a corresponding description of the content of the other.¹⁹

The bridge between economic welfare and real income is constructed chiefly upon four piers. The first of these is the consideration of disutility in income production. Strictly speaking, economic welfare is associated, not with the total product com-

¹⁸ A. C. Pigou, *The Economics of Welfare*, 4th ed. (xxxii + 837 pp.; London, 1938), p. 11.

¹⁹ Pigou, *Economics of Welfare*, p. 31.

prising income, but with the excess of satisfaction over dissatisfaction entailed in producing income. The second is the size and quality of the population. Changes in income may fail to have the anticipated effect upon economic welfare if they are accompanied by counteracting changes in population numbers or in the capacity or efficiency of the people as consumers. The third is income distribution. If the marginal utility of money to individuals increases as their individual incomes diminish, then it may be presumed that a given change in income tends to produce a larger effect upon welfare of lower-income groups than upon that of higher. Total welfare of all groups, then, as it is affected by total income, will be conditioned by income distribution; and any possible increase in income or shift in its distribution will tend to produce a larger effect upon welfare as it favors lower-income groups. The fourth principal pier in the bridge between income and welfare is the content of that income. The content referred to here is the type or quality of goods or services which, in changing, disturbs total money income and the price level in equal degree and has no marked effect upon personal distribution. With these provisions, a problem may be defined as a condition which results in a loss of real income.

QUALIFICATIONS

In order for this definition to be useful in a realistic appraisal of economic problems, some qualifications are necessary. In part, these qualifications relate to matters of theory; in part, to the limitations of the regional approach taken in the present discussion; and in part, to the institutional barriers to literal interpretation of theoretical tenets.

For example, in speaking of income, what social or areal unit shall be chosen? While we have barred the individual enterprise as the unit and have insisted upon taking the social point of view, nothing has yet been said about the boundary to be drawn, beyond which we will not go in the analysis of income. Two types of boundary are in question here. One is the boundary enclosing the chains of economic phenomena which, once set in motion, may have repercussions upon the size of the income under consideration. Here the position will be taken that there is no possibility of establishing such a boundary, and that limitations placed upon

the conclusions of the present study as a result of its restricted scope must be accepted as inevitable. The other boundary is that enclosing the geographic area for which income is to be measured. It might conceivably be placed at the limits of the region studied; or it might be located so as to include the entire globe. If the factors and technology of production within the region were, and would continue to be, in such adjustment with the factors and technology of the outside that no cross-boundary exchange would be necessary in order to maximize regional income in an absolute sense, then even if maximum regional income in this sense were not compatible with maximum income over a broader territory, it might be argued merely from the standpoint of the region that maximum regional income should be established as a standard. But it is virtually inconceivable that no cross-boundary exchange is necessary to maximize regional income, and improbable that without such exchange the income over a broader territory could be maximized. Considering this, and in view of the fact that the boundary of the region dealt with here is purely arbitrary, there appears to be no reason to take a unit less than the nation in measuring the size of income. In many cases, where interactions and outside alternatives are of negligible importance, it will be sufficient to consider income within the region alone, or within the community, or even for the single individual in his present occupation. But national income will still be used as a minimum ultimate criterion. Furthermore, to go beyond the nation is deemed unnecessary for present purposes.

Another qualification concerns the period of time to which the concept of maximum income shall relate. It is necessary to define both the length of this period and its position in the general time scale. Maximum income, so far as that concept is relevant to an analysis of actual problems, exists only in the future. We begin with the stated objective of describing problems, defined as the failure to achieve maximum income during some period as yet undetermined. If that period should be determined as the present point of time and if, again, present income should prove to be already maximized, then the statement that no problem exists would conclude the inquiry. Or if present income should prove not to be maximized, then the statement that a problem does exist would, for all practical purposes, conclude the inquiry, since in

the present instance we are concerned with laying the basis for action and not with historical description. The same considerations bar the determination of any point or period of past time.

The question, then, relates to the length and location of the future period to be determined. To answer this question, the following principle may be adopted: that any future time will be considered only insofar as the income at that time has present pertinence or importance. If a ratio or series of ratios may be conceived, expressing the relative net value of the objective of maximum income at successive points of future time beginning with the immediate future, then these ratios may be used to determine the length and location of the future period in question. If, further, the maximization of immediate income has present value (which may be accepted as an assumption) and if the ratio or ratios just described are all greater than zero,²⁰ then they determine an infinite period beginning with the immediate future.

The ratio here conceived is two steps removed from the family of concepts related to the rate of interest. First, it is the relative value placed upon an ideal without any counterpart in the present. For present purposes this distinction may be dismissed on the ground that there is no logical distinction between an ideal and any other future event, and that the absence of a present counterpart is a matter of degree subject to quantitative expression. Second, the ratio is that between two values which are permissibly different, not only in point of time, but also in amount, for each value in question is the net value of raising to a maximum some quantity of income less than maximum — that is, it is a value measured by the amount by which income, as determined by the existence of problems, falls short of a maximum, due allowance being made for any costs attributable to the raising of income. This is obviously a variable quantity. However, regardless of variations in this value, the condition that the ratio shall be greater than zero will be fulfilled, if problems remain, so long as a finite rate of interest exists, whether negative, zero, or positive. This proposition with regard to the rate of interest may reason-

²⁰ The validity of the concept of such a ratio depends upon the value of zero not occurring. If, in a series, a negative value occurs more than once, the time period determined may be infinite, and its discontinuity alone will not affect the propositions to follow.

ably be accepted and hence, with it, the proposition that we are concerned in problem analysis with the maximization of income over an indefinite period beginning in the immediate future.

The net social value of action based upon problem analysis is expressible in terms of the problem gap just described: the net amount by which income, as determined by the existence of problems, falls short of a maximum. The maximum in question here is that achieved through action and is not necessarily the absolute maximum. The immediate goal of any action designed to follow problem analysis is to maximize the indefinite series of problem gaps commencing with the immediate future. The size of these gaps, and not the size of the income series, measures the value of such action. However, it is obvious that in judging the relative desirability of alternative courses of action expected to produce alternative series of maxima and gaps, it makes no difference whether a comparison is made between the series of maxima or the series of gaps: corresponding series will in either case fall into the same relative ranks among their alternatives and, furthermore, will show the same absolute differentials of advantage or disadvantage as compared with alternatives. That is to say, we may state as a social goal against which to judge the existence of problems, either that a series of problem gaps be maximized or that a series of incomes be maximized (in an absolute sense, subject to the qualifications being discussed). The latter concept, being simpler, will be adopted here.

Attention may be turned briefly to the question of the rate of discount to be applied to a given quantity of income at any point of time in order to make the whole series additive, since it is the sum of the series as of some reference date, and not the absolute value of its members, that concerns us. It may at first be thought that this question is not relevant to problem analysis — that it is relevant only in judging the relative merits of alternative courses of action to *follow* problem analysis, or in measuring the value of such action. If any given factor or combination of factors, without reference to the point of time, always affected income in one direction, this would be true. But it is not true where, as is actually the case, factors exist which tend to alter the distribution of income over time. In such a case the answer to the question whether the existence of a certain factor constitutes a problem

may actually depend upon the rate of discount. This is particularly true in the case of factors that alter the rate of use of resources difficult to replace or that reduce the rate of use of any resources. Only this need be said about the actual rate of the discount itself: that for present purposes it seems reasonable to assume that the rate is positive and low.

The two chief matters discussed thus far under the heading of qualifications have concerned the sphere — of place and of time — within which the definition given to a problem shall be regarded as operating. Other qualifications need now to be mentioned, bearing upon the interpretation to be placed on the concept of maximum real income, set up as the standard by which to judge the existence of problems. If, in a freely competitive society, all units of all factors of production were fully employed in combinations which permitted marginal products of units of equal quality everywhere to be equalized, and if the social functions modifying the environment of economic activity were fully developed and effective in bringing to full fruit the productive potentialities of the people and their capacity to consume, then it would be reasonable to call the resulting real income a maximum. Shall this be the maximum for the judgment of problems, or shall something less be accepted?

Here the position will be taken that the goal described is one to be held in mind, but that it is at best a distant goal and in many particulars unattainable. The long-run character of the goal makes it necessary in many cases to judge current rates of progress rather than current final achievements. The processes of education and of general cultural development must not be expected to accomplish more than a gradual disintegration of the barriers of ignorance and custom. The unattainable character of the goal necessitates making allowance for what are likely to be permanent imperfections or at least chronic ailments of the economy — a lack of complete rationality (not altogether to be frowned upon where emotional values are involved), a lack of complete fluidity in the face of sporadic economic development,²¹ the imperfect divisibility of units of the factors of production,²² and, more important, the persistence, and indeed growth, of mo-

²¹ Pigou, *Economics of Welfare*, pp. 167-171.

²² Pigou, pp. 158-166.

nopolistic elements that bid fair to attach themselves permanently to the economy.

APPLICATION OF THE PROBLEM DEFINITION TO FORESTRY

The definition of a problem now stands, and no further qualifications are needed in order to apply it to the task of forestry-problem analysis. Some cautions, however, are called for.

The standard of judgment is maximum total income, not maximum income to forestry or to forest land, labor, or capital. It is not accurate to speak of the maximum contribution of forests to national income or to social welfare, sometimes described as a goal. Rather, the goal is the contribution of forests and forestry activities to maximum income or welfare. This proposition reinforces what has already been said about problem interrelationships (p. 8).

In practice the distinction between maximum national and maximum forest income is important. The objectives of increasing the acreage of forest land, of intensifying its management, of subsidizing forestry, and of stimulating the consumption of forest products at the expense of other products all have aspects favorable to an increase in income of factors associated with forest enterprise, and all may detract from the aggregate of general income. Another practical case in point concerns price. High returns to the owners of timber products have long been an implied objective in forestry circles, because of their all-important relation, real or imagined, to "good forest management." High price is the special keynote of much literature concerning management of the farm woods.²³ If we lay aside the implication that price manipulation is a good means of encouraging forest management in the public interest (which may be seriously questioned), there appears to be some doubt whether the encouragement of high prices for a basic raw material such as timber would in the long run have any but an adverse effect upon the national real income,

²³ See, for example:

John W. Keller, *Making Farm Woodlands Pay* (Pa. Dept. Forests and Waters Bull. 42; 19 pp.; Harrisburg, 1926).

Wilbur R. Mattoon, "Timber Selling from the Farm to Consumers," *U. S. Dept. Agr. Yearbook for 1926* (Washington, 1927), pp. 714-716.

U. S. Dept. Agr., "Farm Timber Sold Too Cheap," *Weekly News Letter* 2:20 (Washington, Dec. 23, 1914), pp. 5-6.

however well it might serve the temporary interests of timber owners and even of forest labor. Indeed, if the demand for timber products is fairly elastic,²⁴ some lowering of the price might be expected to result both in individual and in social benefit.

It is conceivable that forest income must be sacrificed even heavily to the maximization of general income. But whether sacrifice or benefit, the right combination will presumably be achieved when the factors of production within the forestry field are in adjustment among themselves and with the balance of the economy.

Here is a question with important practical aspects. A goal of maximum national real income has been set up, a goal to be achieved coöperatively by all segments of the economy. The economy is then viewed, for purposes of convenience, as being composed of a forestry segment, and another segment containing the balance of activity. This latter, nonforest, segment may be thought of as moving gradually toward the goal described, through the elimination of successive problems. Some sub-segments may move slower than others and even, for a time, retrogress, but the whole movement may be regarded as that of an average condition and may be assumed to be in a forward direction — that is, in the direction of the goal. It may be supposed that the forestry segment, also, moves forward. If its progress toward the goal is slower than that of the other segment, then the chief objective of forestry policy remains as before — to speed progress toward the goal. But if the progress of the forestry segment, either actually or potentially, is much more rapid than that of the nonforest segment, or if the forestry segment is, at the time of the problem analysis, relatively much farther along toward the general goal than the rest of the economy, complications arise. There appear, in fact, two goals for the forestry segment: the first, for the long run, the combination of factors which would maximize general income if the factors in the nonforest segment were also combined

²⁴ "The price of wood, and its relation to the prices of other commodities, is the controlling factor in determining the amount of timber consumed . . . In the language of economists the consumption of wood is very elastic." W. E. Hiley, *The Economics of Forestry* (xiii + 256 pp.; Oxford, 1930), p. 33.

The elasticity of demand for timber products is discussed less definitively and more carefully (and with more specific reference to the situation in the United States) by Marquis, *Economics of Private Forestry*, pp. 53-59.

and constituted for maximum income; the second, for the short run, the combination of factors which would maximize general income *currently*, factors in the nonforest segment being combined as they are. It is obvious that to maximize a series of incomes beginning from the present, attention must be given to the second, short-run, goal if too rapid progress would result in lowering the early values of the series more than later values might be raised, the rate of discount considered. In its development, the forest economy must keep pace with other segments. And yet, to do so at the expense of its recuperative power — that is, at the expense of general income in the future — must be avoided.

What, for example, is to be the development of forest enterprise, characteristically one of the more competitive enterprises, in a general economy characterized by monopolistic tendencies? It is probable that any too pronounced decrease in the price of wood as a raw material would merely tend to aggravate monopolistic elements in other segments of the economy, and that the trend toward greater efficiency in the forest segment, if it were to result in lower price, might need to be restrained in the interest of long-run welfare. On the other hand, to encourage the introduction of monopoly into forest enterprise is hardly the solution, even in the short run, of the inequities that now exist. Rather, the solution must be found in measures applied within the rest of the economy, to curtail monopolistic elements.

It is to be expected that solution of many forestry problems must be found within the rest of the economy. This would be true merely because of the complex interrelationships that exist, but it is especially true because forestry is, after all, only a small part of the whole economy (see Appendix). The general conditions of supply and demand for the factors of forest production, even the factor of land, are overwhelmingly determined by events that take shape beyond the realm of forestry itself. In order to see forestry problems in their proper perspective, it is necessary to keep constantly in mind that forest production is a minor economic activity. However vital may be this small cog in the economic machine, it will not do to overemphasize the importance of the little defects that may exist therein.

DEFINITION OF FORESTRY PROBLEMS REVIEWED

The standard set up for forestry is optimum contribution to maximum national real net income over an indefinite period beginning in the immediate future. Those elements of the forestry situation that interfere substantially with achievement of this goal are the economic problems of forestry. The fields of forestry within which these problems operate are the fields of land use, forest production, industry, distribution, and consumption,²⁵ with their sub-fields, as already defined (pp. 8-10). The form they take is maladjustment, expressed in inefficient application of factors to productive processes — that is, in (1) underemployment of factors (their failure to be used fully) and (2) misdirection of factors (their failure to be used in the most productive way). The consideration of the application of factors subsumes (1) the social allocation of factors to the various fields of production, of which forest-product production is one (the determinants of this process are largely exogenous to forestry); (2) the allocation of factors among productive enterprises within the forestry field (the determinants of this process are largely endogenous to forestry); and (3) the combination of factors within productive processes (the determinants of this process are largely endogenous to the individual forest enterprise).

ECONOMIC PROBLEMS OF FORESTRY CLASSIFIED

A broad outline of problems, arranged according to the classification of the forestry-economics field set down in the first section of the introduction is given below, and will be followed in much of the problem analysis. The outline is not intended to be exhaustive. It is suggestive, and emphasizes some items of regional importance.

I. Problems of forest-land use

A. Uneconomic allocation of land and cooperating factors of production to major uses or combinations of uses

²⁵ In the field of consumption the economics of forestry is still concerned primarily with production aspects, as is problem analysis in forestry economics. For example, such questions as consumer preferences and advertising to alter preferences, insofar as these bear upon the allocation of factors to production, and the question of income from forest-product production as it bears upon the level of

- B. Uneconomic allocation of forest land to forest uses
 - C. Problems in land tenure
 - 1. Uneconomic size of land holdings
 - 2. Operation of the pattern of ownership or holding of rights to deter full use of forest resources
 - 3. Uneconomic use of farm woodland resulting from the conditions of farm tenancy
 - D. Forest taxation as a factor in the misuse of forest land
 - E. Problems arising from public conventions or programs
 - 1. Conventions regarding land use
 - 2. Conventions regarding resource management
 - 3. Educational programs of agricultural institutions
 - 4. General public programs of action or research
- II. Problems of forest production
- A. Problems of public forest administration
 - 1. Interrelationships between public administration and over-cutting of privately owned timber
 - 2. Undercutting of publicly administered forests
 - a. Through overly conservative policy
 - b. Through the nature of cutting requirements
 - 3. Problems in multiple-use forest management
 - B. Problems of private forest management
 - 1. Problems associated with farm ownership
 - a. Forces of custom and habit
 - b. Owners' lack of information
 - c. Owners' poverty
 - d. Small size of operations
 - 2. Problems associated with small, nonfarm ownership
 - a. Absenteeism
 - b. Problems common to all small holdings
 - 3. Problems associated with industrial ownership
 - a. Unfavorable position of forests in administration of industrial capital
 - b. Owners' lack of social consciousness and responsibility
 - c. Absenteeism
 - 4. Failure of the private good to correspond to the public good

living of income recipients, are a legitimate concern of the forest economist. But the question of consumption standards as related to the allocation of consumers' funds to various alternative purchases is not his immediate concern.

- C. Problems in the silvicultural condition of forests
 - 1. Low density of forest stands
 - 2. Low quality of standing timber
 - 3. Unsatisfactory representation of tree species
 - 4. Unsatisfactory age and size characteristics of timber
 - 5. Deteriorated forest sites
 - 6. Denuded forest land
 - D. Special problems in the management of forests for other than timber or tree products
 - E. Protection problems
 - 1. Fire
 - 2. Insects, disease, and other harmful agencies
 - F. Forest labor problems
 - 1. Underemployment
 - 2. Misapplication of labor to productive processes
 - 3. Under-remuneration of labor other than that resulting from underemployment or misapplication
- III. Problems of forest industry
- A. Logging problems
 - 1. Logging chance as an element in low economic productivity
 - 2. Logging equipment problems
 - B. Processing and storage problems
 - 1. Inefficient equipment
 - 2. Inefficient methods of processing, handling, or storing
 - 3. Inefficient financial methods
 - 4. Problems of plant location
 - 5. Institutional problems
 - 6. Problems of protection from destructive agencies
 - C. Problems peculiar to vertically integrated production
 - D. Labor problems
 - 1. Underemployment
 - 2. Misapplication of labor to productive processes
 - 3. Under-remuneration of labor other than that resulting from underemployment or misapplication
 - E. Problems arising from public programs of action or research
- IV. Problems in the distribution and prices of forest products
- A. Transportation problems
 - 1. Defects in physical systems
 - 2. Defects in equipment

3. Defects in financial organization
 4. Maladjustments arising from tariff rates
 - B. Maladjustment on the side of the product
 1. Kind of product
 2. Quality of product
 3. Quantity of product
 - C. Maladjustment in sellers' contact with the market
 - D. Maladjustment in buyers' contact with the market
 - E. Price inequity resulting from other market imperfections
 1. Monopolistic elements
 2. Imperfect knowledge of the product
 3. Disadvantageous financial position of buyer or seller
 4. Institutional deterrents to marketing
 - F. Absence of a legal market transaction (theft)
- V. Problems in the consumption of forest products
- A. Maladjustments arising in the rival relationship between wood and other goods
 - B. Maladjustments in use of wood by timber owners
 - C. Maladjustments in wood procurement by industrial agencies
 - D. Maladjustments resulting from the dynamic character of demand
 - E. Maladjustments arising from public programs

PRIMARY AND SECONDARY PROBLEMS

It should be noted that the problems considered in the present instance are limited to primary problems — that is, those representing conditions in need of adjustment — as opposed to secondary problems, which are those of research or action designed to facilitate such adjustment. For example, it may be assumed that the existence of a certain acreage of denuded forest land impedes maximization of income. Denuded forest land, then, is a primary problem. It is not known whether natural or artificial restocking of this land is to be preferred, or, in either case, what particular technique of regeneration is best; and therefore research is called for. Ignorance of the best technique, on the part of research groups, is a secondary problem. Ignorance of the means by which a program of reforestation may be inaugurated, after the best technique has been determined, is also a secondary problem, upon which, again, research may be needed.

Such secondary problems directly motivate much research. Nevertheless, it is toward the solution of primary problems that the research is ultimately directed. Furthermore, primary problems are all-inclusive; secondary problems are subtended to them and not parallel to them. Given acquaintance with the scope of a field and the extent of knowledge in the field, outlining a research program then requires only an understanding of primary problems.

**THE ECONOMIC PROBLEMS OF FORESTRY
IN THE APPALACHIAN REGION**