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MULTIPLE USE DECISION MAKING—WHERE DO WE GO FROM HERE?*

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Considerable attention is being focused on the problems of making multiple use resource allocation decisions about public lands. Private businesses from the corner grocery to General Motors seem to allocate their capital resources without encountering any particular conceptual problems. The criteria for making investment decisions such as pay-out-period, rate of return on investment, or present net worth are appropriately used. However, these tools of private business are deemed inadequate for making resource allocation decisions about federal lands.

I

UNIQUENESS OF RESOURCE ALLOCATION ON PUBLIC LANDS

Problems of allocating resources on public forest lands are of special interest because of two characteristics peculiar to multiple use decisions: (1) their "publicness" and (2) the lack of data for traditional investment analyses.

First let us examine the problems associated with "publicness." A central concept of economics in the capitalistic world is that the price system, operating through the market place, balances supply and demand, efficiently allocating scarce resources among competing uses. The market system, however, does not result in an optimum allocation of resources in all instances.[1] We, as a body politic, have decided that many natural resources are exceptions and have removed some decisions regarding these resources from the traditional market system putting them under public control.

Such decisions need not be arbitrary. There are criteria that may be used to judge the legitimate "publicness" of any resource allocation decision. These criteria arise from the failure of the market system to efficiently allocate resources.[2]

* This article is an outgrowth of a seminar sponsored by the U.S. Forest Service in Portland, Oregon on April 22, 1968. It is an attempt to formalize a statement made by the author at that seminar. At this stage it is difficult to claim originality because the contents have obviously been influenced by the other participants. Also, the author has benefited from the review and comments offered by N.K. Roberts and Darwin Nielsen, both with the Department of Agricultural Economics, Utah State University.

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1. The kinds of decisions that are most efficiently handled by either the market system, the political system, or some central agency are not easily delineated. This issue represents a major difference between capitalism, socialism, and Marxism.

2. For a detailed discussion of the appropriate role of the public sector the reader should see Problems of the Modern Economy (E. Phelps ed. 1962); particularly W. Heller, *Reflections on Public Expenditure Theory*, 124.

The first criterion occurs in conjunction with substantial third party benefits. That is, some goods and services such as education, defense, mental hospitals, etc., offer benefits beyond those that accrue to the direct recipient of the service. The market system, which expresses only the demand of the direct beneficiaries, tends to under-estimate the values received from such services.

The second criterion arises from the fact that some commodities are associated with indirect social costs. Choice examples are water and air pollution. If these social costs are not or cannot be absorbed by the producer of the commodity or its consumer, they may have no influence on the price of the commodity, and they then would not be weighed by the market system.

A third criterion for public intervention occurs with technical monoplies.[3] Postal service, telephone service, and transportation are classified by some economists as technological monopolies, where government may have to subsidize production of the commodity to insure a supply at a price that meets the demands of society.

A fourth criterion arises from substantial differences between the time preference of society as a whole and an individual's time preferences. It rests largely on the greater ability of government to absorb uncertainty in investments in such things as basic research.

Elements of several of the above considerations are relevant to the supply of multiple products from the nation's forest lands. For example, the conservation issue involves the consumption of limited resources over time. It is argued that the time preference of individuals is too limited to weigh adequately the intertemporal value of resources, the use of which straddles several generations. It can also be argued that substantial third party benefits result from the production of water and recreation on forest lands.

This article, however, argues neither for nor against government ownership of vast acreages of forest land. Rather, its purpose is to point out the resource allocation problems that result from public ownership. Regardless of which criteria best justify a public supply of forest-oriented goods and services, the conclusion for investment purposes is the same. Many of the commodities do not command a well established market demand. No market-established prices can represent the values of recreation and water in investment analyses. Despite the established markets for timber and forage in many parts of the country, there has been little study of how closely administered prices of forage approximate market values, nor of how federal timber sale appraisal procedures affect the market price of timber from either federal lands or competing private lands. Thus, the

3. *See* Milton Friedman The Role of Government in a Free Society.

major problem for multiple-use decision makers relative to public lands is the lack of data that are needed if the benefits from the production of certain commodities or combinations of commodities are to be evaluated. For some products we have no measures of market value. Whenever demand for goods and services from public resources is totally, or even partially, free to reflect consumers' desires, any mispricing is quite apparent. If overpricing exists, disuse of the resource develops; with underpricing, "overuse" may emerge. This process, however, offers a decidedly imperfect substitute for market values. Nevertheless, some possible approaches to natural resource allocation or investment decisions can be proposed.

II
DECISION MAKING TECHNIQUES

The most common approach to the dilemma of making decisions without value information is to *avoid the problem*—that is, use a method that does not require value data. Two forms of this approach are:

1) Establish physical production goals at least cost.

2) Maximize physical output for a predetermined level of expenditure.[4]

Hundreds of illustrations of these two procedures have occurred in "public forestry" during the past several decades. The forester, for example, may have had a specific budget item for tree planting and within the limits of his budget he tried to plant as many acres as possible. As a result, the least promising acres were often planted first, because areas such as the poorly producing mid-western sand flats offer inexpensive planting opportunities. Thus, criteria that do not require value data may result in improper investment priorities from any kind of benefit-cost standpoint.

There have been some interesting recent applications of investment criteria that make only limited use of product values. U.S. Forest Service researchers attempted to develop planning models for multiple use management and devised the imaginative Resource Allocation Models. These models have been successfully used with linear programming techniques to determine least-cost solutions for prescribed multiple use goals. The computerized linear program solutions have allowed consideration of extremely complex problems involving many different kinds of costs and physical outputs.

Though these Resource Allocation Models presently offer the best solution to multiproduct output decisions on Forest Service lands,

4. H. Webster and P. Haggenstein, *Economic Analysis of Watershed Management Decisions—What Sort of Guide for Land Managers?*, 61 J. Forestry 631 (1963).

they do not incorporate the important policy issues involved in setting appropriate production goals. Solutions to these models depend upon first setting the physical production goals. That is, water production, timber cut, or animal unit goals must be determined as inputs into the model. The land manager must determine the optimum output from his lands. Thus, even the newest refinements in using cost minimization criteria for solving multiple use decisions do little to guarantee an optimum solution based on measures of public welfare.

Still another way to avoid the value problem—which unfortunately has been used too often—is to claim that no economically rational solution exists. Some would advocate that an uninformed decision in the political arena somehow is superior to other decision making techniques. In truth, however, the best political solution can only be achieved with information regarding benefits and costs.

A second possibility for solving public investment or allocation decisions is what can be called the macroeconomic approach. If a major role of public resource utilization is economic development in its broadest sense, then the techniques of simply minimizing costs or maximizing differences between benefits and costs may not be appropriate to investment decisions on public lands. As Kenneth Boulding states, "the great hiatus in economics . . . is a real link between price theory of any kind and a theory of economic development."[5] If the goal of public resource use is economic development, why not deal with the problem more directly and look at the impacts of certain allocation decisions on such variables as regional or national income, regional or national employment and economic stability?

The stated goals of public land management have not explicity included economic development as a central issue. However, it is implicitly included in justifying certain programs—for example, stabilizing the livestock industry or protecting a certain locality's lumber industry. Thus, employment and local or regional income considerations do seem to influence public land allocation decisions.

Little or no research has been done concerning the regional or national economic impacts of alternative forest land uses. Only recently has some study been directed toward measuring and predicting the impacts of dams and other water developments on surrounding communities. One thing apparent from these few studies is the extreme difficulty of accurately measuring the regional impacts from even multimillion dollar projects.

5. K. Boulding, *The Uses of Price Theory*, in Models of Markets 371 (A. Oxenfeldt ed. 1963).

The size of the region over which impacts are expected has considerable influence on our ability to identify changes due to specific investments. If the relevant region is large, for example a state, one might logically conclude that most measures of macroeconomic variables lack sufficient sensitivity to assess changes resulting from the relatively small investments that characterize forest lands or from shifts in land use patterns. If, however, we are interested in measuring impacts on smaller units, such as communities, the techniques available, which include input-output analysis or economic base analysis, do not seem particularly appropriate for measuring the economic interrelationships that exist within small rural areas. The strong economic dependence of the region under study on distant urban centers tends to cloud the intraregional economic picture.

The macroeconomic (or regional analysis) models for making multiple use decisions seem to have three major shortcomings. First, they are not sufficiently sensitive to measure changes associated with small investments. Second, they do not come to grips with the major policy issue of how much should be invested in the various kinds of development that are possible on public forest lands. At best, we can set criteria that require maximizing the level of employment for a given budget or obtaining a given level of employment at a minimum cost. These suboptimization techniques do not solve the problem of how much money should be invested in various development or use combinations on public lands.

Third, in dealing with aggregate figures for income or employment, the problems of income distribution are often ignored. An apparent increase in regional income may equate with decreased income and employment in other regions. Changes in land use patterns may generate interregional flows of income or they may change the relative contributions of the public and private sectors in supplying resources.

Considering the above shortcomings, most economists would agree that the best approach toward ranking alternative land uses would require some attempt to *evaluate the difference or ratios between benefits and costs.* If evaluation of benefits in relationship to costs is the appropriate criterion, then many analytical models come to the foreground. Benefit-cost ratios, internal rates of return, and joint production models equating marginal rates of substitution between goods, are all methods that can be used to compare benefits and costs of various investment schemes.

Though the mechanics of performing these kinds of analysis are relatively simple, they have been little used in analyzing public investments. The attempts by the Corps of Engineers and Bureau of

Reclamation to apply these methods could at best be called incomplete, unsatisfactory efforts to compare benefits and costs. The dissatisfaction associated with this use stems from the difficulty of assigning a quantitative measure to benefits derived from non-market supplied goods and services. In many instances two of the most important products of water development (and likewise from forest development) are recreation and water for domestic use. Yet neither of these products has an established market value which can be plugged into investment analyses. Methods that approach multiple use decisions from a profit maximizing standpoint have therefore been little used because of the lack of value figures for many of the benefits. This lack has promoted considerable recent research on the problem of resource values. Most of this has dealt with problems of recreation valuation.

III
STATUS OF RESOURCE VALUATION

Before examining the status of resource valuation, it is important to clarify precisely what kind of value we are seeking. Many of the critics of current research in resource valuation are not fully aware of the problems of setting *a value* on a particular resource use. Those critics seem to assume that every good or service has an inherent value peculiar to it and that the researcher must find this single value for each resource use. This concept of a single inherent value for each commodity is false, since every good and service has several values. Each has a value in exchange, that being the number of goods that can be obtained by means of giving up or exchanging one unit of the commodity is question. Each good or service also has a unique value for each individual consumer. This is the amount that the individual's psychic welfare is improved through owning or consuming the particular commodity. A good has a third value that equates with its cost of production.

The fallacy is therefore obvious in an assumption that a particular resource has only one unique value and that the researcher has but to gaze into a crystal ball to find this heretofore hidden number. Rather, determining a value for a particular type of recreation or for the domestic consumption of water is a problem solved by arriving at an index number (expressed in dollars) that approximates one of the above measures of value. Therefore, the many values of a particular resource may each have a possible application in some resource allocation model. The only valid grounds for criticizing a particular proxy value determined through research are: (1) that it is an index of a value not applicable to a particular allocation model; or (2) that

through a flaw in concept or methodology, the index is not an accurate approximation of the value being estimated. Many researchers can and should be criticized, however, for not explicitly stating just what kind of value they are trying to approximate. Without this definition, it is impossible to evalute the prospective usefulness or accuracy of their estimates.

Most of the research currently directed at valuing non-market supplied resources has been devoted to putting a dollar value on recreation. To date several general kinds of approaches have been applied to the problem. These have included:[6]

Expenditure Method—measures the value of recreation in terms of the total expenditures on recreation.

Gross National Product Method—attempts to measure the contribution of recreation to GNP.

Consumers' Surplus Method—attempts to determine the willingness of individuals to pay for various quantities of recreation. Instrumental in this method is developing a hypothetical demand curve for recreation.

Cost Method—uses the cost of supplying recreational facilities as a measure of the benefits derived therefrom.

Monopoly Revenue Method—uses the estimated revenue that would be obtained by a monopolist owning the recreational site as a measure of benefits.

Market Value Method—uses fees charged at private resorts as a proxy value for the value of public-supplied facilities.

Apparently, there is no dearth of ways to evaluate recreation. These methods or modifications of them can be used in valuing other resource uses. Yet, there has only been limited success when the calculated values are inserted in resource allocation models. Although we have made inroads at developing individual resource values, we have yet to develop *value systems* which allow analysis of complex combinations of resources and resource uses. Even though each of the above valuation schemes has its appropriate use in isolated circumstances, their application in resource allocation models must be evaluated on the basis of (1) their appropriateness for measuring benefits in terms of the optimization criteria of the allocation model; (2) the comparability of all measures of value in the allocation model (It is impossible to approach an optimum solution if cattle, timber, recreation, and water are all measured by different indices of value); and, (3) whether the value scheme is empirically quantifiable.

6. For a more complete description of the various methods mentioned see L. Lerner, *Quantative Indices of Recreational Values,* in Committee on the Economics of Water Resources Development, Western Agricultural Economics Research Council, Report Number II, Economics in Outdoor Recreational Policy (1962).

CONCLUSION

An orderly approach to multiple use decision-making requires a reorientation of research toward a broader approach to the development of resource allocation and investment models. The several kinds of values we have noted imply a need for equally as many kinds of allocation models, each using a different value criterion and aimed toward a different kind of policy goal. The current problem in multiple use analysis is that we use only one or two allocation or investment models and restrict ourselves to one valuation system. We start with a valuation system based on exchange or market values of a few goods and services and then attempt to force all goods and services into a like mold. When some uses have not fit this mold, many resource managers have thrown their hands into the air and claimed that it is obviously not an economic problem.

At this juncture it is important to know just what economics and the economist have to contribute to multiple use decision making and conversely, what are the limits of economics. It is presumptuous to assume that economics and economists should or can make allocation decisions on public forest lands. These decisions most often include non-economic goals and require inputs in addition to economic data. To assume otherwise would be to ignore the complex ecological and hydrological interrelationships that influence land management. However, achieving even non-economic goals generally costs society money directly or indirectly in the form of alternative opportunities foregone. Economists therefore have a contribution to make in supplying data inputs to improve the knowledge base on which these decisions are made.

More directly, the economist can perform at least three services to the decision-maker. The tools of economics (1) can tell how best to use a resource to maximize an economic goal; (2) can identify the costs of sacrificing an economic goal to achieve a non-economic one; and (3) are useful in organizing a procedure that will minimize the economic costs of achieving a complex goal. The appropriate role of economics in multiple use decisions therefore depends upon the particular goals of public resource management.

Our current orientation to solving multiple use problems seems to have the proverbial "cart before the horse." We are concentrating on the quantification of values without a clear-cut definition of how derived values will be used. A more logical approach involves three steps, the order of which is critical. Step one must be a realistic and explicit statement of goals for the development and use of the public resource in question. Are these resources to be managed on the basis of some efficiency criterion, regional growth and stability criterion,

national growth criterion, physical output criterion (i.e. a conservation goal expressed in terms of physical output per unit of time) or societal welfare criterion to be evaluated in the voting booth? With an explicit statement of resource management goals, the second step is to develop a valuation system which produces a set of indicies related to the measurement of benefits. This value system should recognize the three criteria previously mentioned as means of evaluating value systems. The third step is, of course, the application of the allocation model and its associated value system to multiple use decision-making.