THE ECONOMICS OF WATER-BASED OUTDOOR RECREATION: A SURVEY AND CRITIQUE OF RECENT DEVELOPMENTS

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IWR REPORT 71-8 THE ECONOMICS OF WATER-BASED OUTDOOR RECREATION

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A Report Submitted to the

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FOREWORD

A. Purpose.

Corps of Engineers water resource projects have experienced heavy use of the recreational facilities. Justification for the investment in recreation facilities and the necessary operation and maintenance funds rest upon methods for estimating probable use (attendance) and the social value of that use. Currently a number of methods are used for making these estimates including interviews to determine potential users and observations of paid attendance at comparable recreational facilities within the project area.

Considerable effort has been applied to improving the methodology for recreation evaluation as the relative influence of outdoor recreation on project and program design and justification has increased. Some success has been achieved by the Sacramento District of the Corps through development of statistical models for identifying comparable projects and in development of a modified "Clawson" approach in determining the willingness to pay (hence value) in terms of national income benefits through use of money and time costs of travel to the recreational facility. However, these approaches do not currently provide an adequate basis for projecting future attendance and require a substantial investment in data gathering and analysis, particularly since the predictive functions estimated for one region cannot readily be transferred to other regions.

This research was undertaken to survey and critique the literature and practice of estimating use of and benefits from outdoor recreation for the purpose of determining the direction of further Corps efforts in this regard.

B. Findings.

Kalter carefully outlines the variety of methodologies in use, delineates the statistical problems in separating supply and demand functions from observed use rates, and suggests promising approaches in methodological practices which explicitly identify supply and demand functions. His approach is methodical and systematic with respect to the underlying economic theory of allocating resources to the production of public goods. He also discusses the problem in the context of other than national economic objectives of public investment.

C. Assessment.

The report accomplishes its purpose. Kalter specifically addresses the difficulties in applying the Clawson approach and suggests various strategies for separating the demand and supply functions which are used and for performing parametric analysis of the factors which shift demand and supply. This would allow easier transfer of results from one area to another and lead ultimately to a general solution for determining optimal allocation of recreation under national economic efficiency criteria.

D. Status.

It is anticipated that there will be follow-up research which will test the efficacy of the more promising approaches suggested in Kalter's paper.

This research represents an independent judgment of the researcher. His conclusiond are not to be construed to necessarily represent the Corps of Engineers. Policy and procedural changes which may result from this research will be implemented by directives and guidelines provided by the Chief of Engineers through command channels.

PREFACE AND ACKNOWLEDGEMENTS

Over the past decade a substantial amount of research effort has been directed toward the topic of outdoor recreation. The research has been broad in scope and, as such, encompassed widely different disciplines and areas of concern. The physical, biological and social sciences have all participated. In terms of the implications for planning and evaluating proposed governmental investments in recreational facilities, however, topics pertinent to the "economics of outdoor recreation" have been one of the more important research areas.

Studies on numerous economic issues relevant to outdoor recreation have been completed. However, the application, to the public planning and investment evaluation process, of many concepts and ideas developed by this research has been slow and difficult. This failure stems from diverse reasons. Included may be the following. First, research results on particular areas of interest are often confusing and contradictory. Second, although improved methodology has been developed, data sources have often not been identified to the extent that these methods can be implemented empirically in planning circumstances. Finally, it requires time to change methods which have been legitimatized by existing institutional rules. Currently, the evaluation of outdoor recreation components of proposed federal water resource investments follows the procedures set forth in Senate Document 97 and its Supplement No. 1. To change this type of guideline requires not only a demonstrated improvement in method and data but the passage of sufficient time to have such improvements widely accepted.

With respect to water related recreation investments, this time may be close at hand. Both the Army Corps of Engineers and the Water Resources Council have recently raised questions regarding currently used procedures. Although additional research may be called for in certain situations, the current need appears to be one of consolidating proposed methodology and identifying appropriate data sources. A survey of relevant literature which would draw together the pertinent research results produced over the past decade appears to have substantial merit. From such a survey, recommendations on improved methods of economic evaluation, including data sources available to agency field personnel involved in outdoor recreation planning, could be made. Future research and data collection efforts, especially those with a high probable payoff, could also be suggested. This is the rationale for the effort reported on here. To the extent possible, the numerous issues centering on the estimation of recreation demand and its associated economic value, as well as the complex variety of impacts (nationally, regionally and sectorially) resulting from the expression of that demand, will be reviewed and the relevant research on them critiqued. Hopefully, this will play a small role in improving the criteria and procedures used to evaluate water related recreation investments.

Special thanks is given to Mr. N. A. Back and Mr. L. G. Antle of the U. S. Army Corps of Engineers Institute for Water Resources for their assistance throughout the course of the study. Dr. Lois Gosse had major responsibility for that portion of the study dealing with market demand functions and assisted generally in the report's preparation.

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INTRODUCTION AND PURPOSE

Planning and evaluation procedures for proposed federal water resource investments are continually undergoing refinement and change. This is true in general, as well as for specific functions like outdoor recreation. As an example, over the past two years a Special Task Force of the Water Resources Council has been investigating the possibility of replacing Senate Document 97, including Supplement No. 1, [U. S. Congress 1962; Ad Hoc Water Resources Council 1964] with improved planning guidelines. Included in their various recommendations [U. S. Water Resources Council 1969; 1970, Principles and Standards] have been suggestions which would influence the evaluation of recreation components of federal resource investments. At the same time, efforts have been underway by the Army Corps of Engineers to seek improved approaches to the evaluation of national economic benefits from the provision of recreation opportunities by such investments [U. S. Army Corps of Engineers 1969 (2); 1970 (2)].

The work of the two agencies, in this area, provides a logical backdrop for a discussion of recent research results pertinent to the "economics of outdoor recreation." Although the efforts of the Water Resources Council relate to all proposed investments in water and related land resources regardless of function(s), their recommendations would indirectly affect the evaluation of outdoor recreation components of such investments. The Council would make fundamental changes in project planning and evaluation procedures by replacing the traditional emphasis on national economic efficiency with a multiple objective planning framework. Economic efficiency would be retained within this framework but additional criteria for investment, based primarily on equity and environmental issues, would be added. Thus, in addition to estimates of efficiency impacts resulting from investment in recreational facilities, new information on other factors would be required. Of primary importance for economic evaluations would be the net impact on regional economies (from both an income and employment perspective) and the distribution of economic gains and losses among relevant social classifications (such as income classes and economic sectors).

More directly, both the Council and the Army Corps of Engineers have suggested improvements in the mechanisms presently utilized to measure primary or national efficiency benefits from and demand for the provision of outdoor recreational opportunities.[1] Those improvements basically center on two issues. First, recreation evaluation methodology should be developed which recognizes the interrelationship between price (cost of recreating) and demand. Efforts to construct demand functions which are specifically related to proposed plans and the use of willingness to pay concepts, as derived

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[1]Such estimates can also serve as a basic element and data source for the quantification of various equity impacts. This assumes that one is willing to accept current prices as indicators of value and that relative prices will not be substantially affected by an investment caused change in the distribution of income. The latter is not an unrealistic assumption when the magnitude of a potential change caused by a particular water resource project or program is viewed against the change required to substantially effect a distribution profile. Obviously, the relatively small absolute impact of particular governmental expenditures on overall income distribution does not diminish the need for quantitative information on such impacts [Kalter *et al.* 1969]. The former assumption is capable of easy modification if adequate externally defined indicators of the marginal utility of income by distribution class can be defined and the value judgment needed to use such approximations can be made [Haveman 1965, Chap. 7].

from such demand functions, to quantify the economic value being added by a specific proposal, would improve the evaluation procedures. Under the currently used procedures a single unit value is assigned to each recreation day regardless of the activity being participated in,[2] the type of occasion, the size of the project being analyzed or its anticipated use. Second, efforts to reduce the possibility of double counting recreation demand when evaluating projects should be made. It is recognized that such double counting can take place under either current procedures or those utilizing "demand" analysis. In essence, the problem stems from estimation methods which are exclusively site[3] oriented and which fail to account for market demand. When this occurs, the competition for that demand from alternative sites and the potential substitution between activities can be ignored and result in double counting.

The position taken here is that a substantive review of recent studies pertinent to the areas mentioned can play a role in improving current evaluation procedures as they are applied to the outdoor recreation component of water related investment proposals. Thus, our survey begins with the basic concept underlying most recreation investment evaluation questions. That is, the accurate forecasting of recreation demand for the proposed investment site, other factors remaining constant. Correspondingly, the national efficiency benefits

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[2]Current guidelines [Ad Hoc Water Resources Council 1964] do provide for a distinction between "general" and "specialized" activities and for the use of different monetary values for each. This classification, however, is far too aggregated to be meaningful and does nothing to bring out the price-cost relationship.

[3]As used in this report, the term "site" will generally refer to individual investment projects, as a whole, and not to individual public use areas for recreation (of which there may be more than one per project).

associated with the provision of services to supply that demand are considered. A survey covering models of consumer behavior with respect to recreational usage of water resources is carried out and techniques that can be utilized to estimate site demand for recreational activities evaluated. Stemming from such an analysis, methods of estimating primary benefits of public investment in recreational facilities are suggested. The determinants of demand, including issues relating to the substitution of activities and location of participation, are considered. Finally, the data requirements needed to implement the various techniques and potential sources of such information are discussed.

Second, a discussion of supply concepts with respect to outdoor recreation is undertaken. Studies of the capacity of recreational facilities under various environmental conditions and over specific time periods are surveyed; and their relevancy to the economic planning and evaluation process considered. In other words, production functions for recreational services and the possibility of deriving such functions for use in the planning process are discussed. The need for a critique of research in this area stems from the fact that although demand functions enable use projections to be made for new recreational facilities, the realization of such projections in actual practice is dependent upon both the establishment of those facilities and their capacity. Economic benefits should not be accorded to a project for service which it is incapable of supplying. The point of this discussion, then, is to show the relationship between site capacity and demand functions in the investment evaluation process.

Third, a survey and critique similar to that on site demand relationships is conducted on recent research pertaining to market or population centered demand functions. This serves to highlight possible alternative methods with which to evaluate specific project proposals and points up the need for market information designed for comprehensive regional recreation planning. To obtain maximum utility from such estimates, however, information on the linkage between regional site capacities and market demand is needed. Only in this way can adequate account of appropriate alternatives be taken in the decision making process. In addition, models which could be utilized to show the pertinent relationships may also have implications for substitution questions, particularly substitutions which can take place between sites or facilities. In order to consider these questions, a review of the possible formulations of transportation or spatial allocation models, which can be applied to outdoor recreation, is undertaken. Then, recommendations regarding the use of market demand functions and the associated spatial allocation models in the planning process are made.

Fourth, the additional economic objectives to be used in plan evaluation, as proposed by the Water Resources Council, require new methodology and data needs. One concern is the effect of recreation development on regional growth. To improve the estimation of such impacts, several diverse sets of data are required. First, forecasts of use by regional residents and the associated user benefit is a regional effect. Second, knowledge of the change in expenditures in the region as a result of the project is needed. It is clear that such expenditure streams differ from the concept of primary benefits discussed previously. Primary benefits usually encompass a willingness to pay principle that includes components of consumer surplus. The expenditure stream, however, refers to actual costs incurred (money spent) by users of recreational facilities. Research on the magnitude and regional distribution of those costs and on the degree to which such expenditures are substitutes for other spending alternatives is surveyed. In addition, the proportion of such expenditure streams which accrue as increased income and their impact on regional employment is discussed. Third, the regional multiplier implications of such expenditures are suggested and methods of measuring them explored. Fourth, the effect of a recreational investment on regional capital gains and losses, such as may occur through changes in land values is considered. Finally, the effect of reimbursement requirements on regional gain is brought out. Although substantial literature exists on a number of the questions posed under this objective, the regional specificity of the research makes it difficult to draw conclusions of general applicability. Thus, this survey seeks to explore the methodology needed to show the effect of recreational projects on such issues and attempts to point out data sources appropriate for use by planning personnel.

Finally, equity issues of a different sort, namely those relating to groups classified by personal income or other classifications, will also take on importance if the new Water Resources Council's procedures are implemented. Factors similar to those mentioned under the regional objective should also be considered here. Although most research on such impacts is relatively recent, a review is undertaken and recommendations for future work (as well as data collection efforts) are made.

It should not be anticipated that a review and critique along the lines discussed can bring forth a single comprehensive methodology or model to account for all the impacts and implications mentioned. The issues are diverse and not necessarily consistent conceptually. Therefore, only occasionally can it be expected that the suggested methods are capable of integration. For example, use of site and market demand functions for projection will usually not lead to similar results except under simplifying assumptions. On the other hand, several of the lines of inquiry discussed are complementary in the planning process. For example, projections of market demand should provide guidelines within which site demand projections can be utilized. Similarly, data on site capacities is needed when utilizing demand functions for the forecasting of future economic value stemming from a proposed investment.

In completing this report, recent professional literature pertaining to the previously discussed topics was reviewed. Indices to recreation literature and research [U. S. Bureau of Outdoor Recreation 1967-69, Index; U. S. Bureau of Outdoor Recreation 1966-70; Burdge 1967, Bibliography; Cooperative State Research Service 1969; Centre D'Etudes Du Tourisme 1970] and to the American Economic Review, American Journal of Agricultural Economics, Water Resources Research, Natural Resources Journal, Land Economics, and The Journal of Leisure Research were surveyed for pertinent articles on the economics of outdoor recreation. Other references were obtained from the bibliographies of the various manuscripts reviewed. Then, an analysis of the literature pertaining to each topic in the report outline was made. A concise summary was prepared outlining the major issues, how they have been approached, the empirical results obtained and recommendations for possible agency implementation of such techniques in the near future. In addition, suggestions concerning data sources needed for implementation and future research requirements were made. Finally, in addition to discussing the advantages and disadvantages of the various procedures, the relevance of performing sensitivity analyses was discussed. Such analyses can be utilized to provide improved evaluation of proposed public investments under conditions of risk and uncertainty. Although recommended procedures were outlined in detail when necessary, empirical testing or verification of the results reported was not carried out. However, the appropriateness of suggested data sources was checked and attempts were made to ascertain whether such sources could be utilized in a planning situation.

PROPOSED WATER RESOURCE INVESTMENTS, RECREATION DEMAND, AND ECONOMIC VALUE

Public activity in the field of outdoor recreation results from society's rejection of private market decisions affecting recreation. Such a rejection may stem from diverse reasons, all of which pyramid to place recreation in the category of an accepted public good [Knetsch 1966; Davidson, Adams, and Seneca 1966; Steiner 1969]. For example, market imperfections, such as the existence of high transactions costs, lumpiness in provision or the inadequacy of market information, may result in demand for collective action. Of perhaps equal importance is the well known inability of private market mechanisms to handle externality situations. Thus, the provision of a good or service may produce side effects whose value is not reflected in the prices of private market sales. In addition to traditional externality concepts, the notions of option and opportunity demand are important here [Weisbrod 1964].

> "Option demand" reflects a value of the resource to those who wish to maintain "the option to consume in the future," even though they are presently not participating in the enjoyment of the resource. "Opportunity demand" reflects the future value possibly to arise from the use by those who may learn to enjoy a facility or service which they are presently not using. [Stoevener and Brown 1967, p. 1296]

Closely parallel to this situation is the case where it is virtually impossible for a market to exclude individuals from the use of a resource. A number of recreational activities utilize a resource base whose nature exhibits degrees of this collective good phenomenon [Cicchetti et.al. 1969, p. 32]. Finally, a private market solution for particular goods and services may result in other impacts which society feels are unacceptable. For example, the distribution of recreational opportunities under a private market scheme may not be in keeping with society's preference for such a distribution. Alternatively, the quality of services produced may differ from a collective value judgment about the environment. Provision of recreation opportunities can, thus, be classified as one of Musgrave's merit goods [Musgrave 1959; Robinson 1967]. For these and other reasons, most recreational services are publicly provided [Kalter and Gosse 1969, Appendix I].

Public provision of a service like recreation means that the built-in discipline provided by the private market in the allocation of resources is largely lost [Knetsch 1969]. The normal price incentives of such a market are submerged to a significant degree because they produce an outcome largely unacceptable to society as a whole. On the other hand, the demise of a system of private market indicators for large portions of the outdoor recreation market has historically let public decisions affecting the provision of outdoor recreation services be made in an information vacuum. The result can be public programs which are no more acceptable than the private market alternative.

Increased data on the impacts, particularly of an economic nature, associated with the public provision of recreational opportunities was needed for improved decision making [DeHaven and Hirshleifer 1957, p. 360]. Many, however, argued during the 1950's and 1960's that it was impossible to value recreation in a manner similar to other goods and services [Prewitt 1949; Clawson 1951; Eckstein 1958, p. 41 and 188; Beazley 1961, p. 647; Devine 1966]. This viewpoint stems from pessimism over both empirical difficulties and conceptual problems in accounting for the pitfalls implicit in private market evaluation of recreation [Seckler 1966; McKean 1968].

As pointed out above, one such failure of the private market evaluation process may be with respect to external effects. To the extent that such effects are important,

> ... methods for estimating the value of outdoor recreation underestimate the value of these services. However, the mere existence of external effects does not invalidate the use of statistical demand functions. Rather, existence of external effects means that efforts should be made to quantify such effects. ... Obviously, this shortcoming is not unique to demand analyses for extra-market goods. [Stoevener and Brown 1967, p. 1296]

Therefore, to reject some form of recreation valuation meant leaving the public resource allocation process with no economic basis. Moreover, the insistence that recreation was unlike other goods and services, if carried to its logical conclusions, would place the estimation of future recreational use on a conceptual foundation which would inevitably result in inaccurate forecasts and public misallocation of resources [Clawson 1959; Crutchfield 1962; Davis 1963, Recreation Planning; Knetsch 1963; Clawson and Knetsch 1966, p. 46]. Thus, the very provision of recreation as a public good, which the proponents of recreation's intangible nature promote, could not be systematically carried out in a way that would promote the objectives making up society's social welfare function. This was clearly unacceptable when dealing with a constrained public budget, which by necessity has to be used for competing social uses. Recreation obviously had no superior claim over other proper functions of government. The need was for planning and evaluation of proposed expenditures; but society's multiple objectives had to be considered.

As the discussion pertaining to the public provision of recreational opportunities increased with increasing pressure on existing facilities and the recognition of growth factors which would lead to further increases in demand [ORRRC 1962, Study Report 26], the argument over whether recreation could or should be valued for the public decision making process has receeded as an issue [Lerner 1962; Norton 1970]. The conclusion of most professionals also became a matter of official policy. As Supplement No. 1 of Senate Document 97 states:

> Equitable consideration of recreation as a purpose, however, requires that a monetary value be assigned to the tangible recreational service provided by the project. Recreation benefits include the monetary values of increases in quantity and quality of use by outdoor recreationists and any enhancement in land values attributable to project recreation. [Ad Hoc Water Resources Council 1964, p. 1]

Recognition of this need opened the door for the development of conceptually sound techniques for forecasting demand and estimating its economic value, at least to the extent that such value was related to the objective of economic efficiency [Stoevener and Brown 1967]. However, an end to the argument over whether recreation can be given a value or, in fact, forecast with respect to future magnitudes has not led to the use of measurement methods which have a sound basis in economic theory. Following the guidelines set down in Supplement No. 1 of Senate Document 97, the recreation component of a proposed federal water resource investment is evaluated by considering two factors. First, an estimate of annual visitation, for purposes of recreation, to the proposed facility during its economic life is made. Second, the primary economic benefit from this visitation is quantified by assigning simulated market values. Thus, annual use value is the product of the estimated number of recreation visitor days multiplied by a single per day unit value which can fall between \$.50 and \$1.50 for most forms of recreation. The result is both unacceptable from a conceptual economic and a practical planning viewpoint. It is well known that theoretically the quantities demanded of any good or service over a specific time span are not independent of their cost per unit [Leftwich 1961]. The guidelines suggested incorrectly separate this quantity-price calculus. As Cicchetti points out:

> After estimating the number of users for a particular recreation site, as best one is capable of doing, ... a group of experts chooses an acceptable price which when multiplied by the estimated quantity of users would determine total tangible benefits in dollar terms. This chosen price would be, of course, a measure of value in exchange, if the price chosen by the experts represents the true equilibrium price. The implicit rationale of this suggested approach appears to be that in the absence of empirical market price information, the planners are more able to estimate subjectively a single equilibrium price than to try to develop a complete demand curve. A demand schedule, the traditional device utilized in the economic analysis of total benefits, would, of course, provide a far superior measure of the value of alternative situations since total economic benefits are normally defined as the entire area under the demand schedule - the so-called value in use. [1969, p. 7]

Knetsch further elaborates by stating:

> The major difficulty is that this procedure is simply inadequate to reflect major differences in the economic value of alternative recreation opportunities or alternative development of recreation resources. ... The point is that the criteria outlined in Supplement 1 to Senate Document 97 does not allow for the vast differences that exist in the shapes of the appropriate demand curves which reflect the differences in willingness to pay on the part of users for different kinds of recreational opportunity.
>
> When the same or even similar unit values are used to estimate the value of recreation development alternatives the official procedure is effectively rigged, for the greatest value among the alternatives must be shown to be associated with the greatest number of people attracted. The evaluation simply reduces to a head count (which is itself usually a poor estimate), whereas quite a different result might be obtained when using the willingness to pay measure based upon varying shaped demand curves. [1969, pp. 1097-98]

As Knetsch implies, of perhaps equal importance is the fact that the procedures outlined by Supplement No. 1 do not specify how recreational usage is to be estimated. It merely lists six factors affecting "the extent of total recreation use." Not one of the six mentions, directly, the cost of recreation as being important to total use [Ad Hoc Water Resources Council 1964, p. 3]. Use prediction, then ignores an important causal factor, and consideration of pricing or reimbursement policies as a means of limiting demand (and financing facilities) has been inhibited. In fact, the conceptually appropriate concept of "demand" is usually not considered in the economic evaluations of water-based recreation projects.

What is often called demand is confused with the extrapolation of consumption data [Clawson and Knetsch 1966, p. 115]. Thus, annual visitation projections are too often based on observed use rates for a population and then multiplied by projected increases in that population. Such a procedure ignores both the host of factors which affect overall demand and those influencing its affinity for a particular site. This perpetuates the confusion over what is being measured. The concepts of supply and demand are not separated.[4] As Wantrup points out:

> If demand is to serve as a principle of orientation for land and water policy - that is to help in planning on the supply side - problems of demand and supply need to be separated conceptually and in empirical investigation, variables pertaining to

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[4]As Knetsch states: "The number of visits in a given year is not the demand for those facilities in that year, but rather the total attendance or use made of the facility. It refers to the quantities taken at the prevailing recreation opportunity conditions, for consumption depends both on demand and availability of supply." [Clawson and Knetsch 1966, p. 115]

> demand must be differentiated from those pertaining to supply. [1960]

As implied, "demand" refers to the functional relationship between quantity and socio-economic factors. One task for planning is the empirical estimation of this relationship. Such a relationship, when correctly derived from existing situations, may permit estimates of future use and associated economic value to be calculated for proposed investments.[5] When estimated for a proposed investment site, these values provide a portion of the information needed for its economic evaluation. This section will review and discuss one type of recent research relevant to this area. This is the widely suggested approach of estimating site demand functions. The use of market models will be discussed in the section entitled "Recreation Markets, Demand Allocation, and Facility Planning."

Site Demand Functions: The annual value of recreation opportunities that may be provided by a public resource investment can be derived from the appropriate site demand function.[6] The appropriate function(s), in this case, is one which is estimated for the activity(s) to be provided at the site and the unique characteristics or quality of the site. The construction of such a demand function is obviously impossible because the required data will not exist for a proposed site. Thus, what is usually desired is sufficient data on existing facilities with characteristics and quality factors similar to those being proposed [Ullman and Volk 1962]. The demand relationships can then be estimated for such locations and inferences made about the

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[5] Other methods have been suggested as a means of estimating future attendance but they are unable to provide appropriate value estimates [Cesario 1966].

[6] This assumes sufficient capacity will be available at the site to accommodate the projected use.

proposed site, assuming the relationships don't change over time or between sites and that the relevant socio-economic variables can be projected for use with coefficients derived from past experience [Clawson and Knetsch 1966, p. 62 and Ch. 1].

Defining the demand function for a particular good or service to be the relationship between quantities desired and causal factors [Clawson and Knetsch 1966, Chs. 4, 5, 6] leads to model specification. This permits the structural relationships to be empirically estimated by econometric methods. As Kalter and Gosse point out:

> Quantification of specific demand functions does, however, require a sound foundation in economic theory so that a functional relationship between an observed dependent variable and observed independent variables, as well as unobserved disturbances, can be specified for statistical testing. For although the demand function is a cause-and-effect relationship, the statistical tools available for estimating this relation do not show causation, but only correlation. Thus, an appeal to theory or intuition must be made to say which, if any, among a group of variables would be expected to affect the level of any of the other variables. [1969, p. 5]

Recreation Demand and Its Causal Factors: For the most part, recreation demand is influenced by the same factors influencing the purchase or use of other goods and services [Knetsch 1963]. Thus, an individual's demand for outdoor recreation is a function of the costs (monetary or others, such as time) incurred to engage in an occasion, his tastes and preferences, his socio-economic characteristics (which may affect preferences), and the availability and cost of alternative goods, services or uses of constrained budgets (money, time and energy). Demand for a particular recreation facility obviously depends on these factors as they relate to the relevant market population and to the size of that population. In addition, the attractiveness of the site (the quality factor) will influence the shape of the demand function for it. Some of these causal factors are easily defined while others are subject to the interpretation, and often the inventiveness, of the researcher. Although other factors of importance may not have been identified or may become important in the future, all those mentioned (somehow defined) have been statistically shown as being correlated with recreation "demand" [Clawson 1959; Brown et al. 1964; Cesario 1966; Clawson and Knetsch 1966, Ch. 5; Gillespie and Brewer 1968; Grubb and Goodwin 1968; Cicchetti et al. 1969; Kalter and Gosse 1969; Pankey and Johnston 1969].

Endogenous Variable: Irrespective of the definition accorded to the various independent variables contained in a demand function, the measure of use at a recreational facility (the dependent variable of the site "demand" function) has been characterized by a lack of rigor in definition [Crane 1970]. The only standardized practice has been to measure participation in terms of time, as opposed to other potential physical measures. Often, participation of any duration during a day is counted as a visitor or activity day and becomes the standard unit of measure. Without more explicit definition, however, such distinctions encounter two problems in application. The first is the time duration of participation required to qualify for a unit of measurement. Second, the appropriate policy to follow when participation in more than one activity occurs during a given time duration is not readily apparent. Moreover, no unit measure of recreation involving time specifies the temporal distribution of participation within the specified period under investigation. For example, demand functions for a facility are often quantified on a quarterly or annual basis. Planning for such a facility, however, requires knowledge of the distribution of such demand by peak periods. Moreover, the common practice of considering participation of any duration during a twenty-four hour day as a valid unit of use requires knowledge of daily turnover rates for planning purposes [Kalter and Gosse 1969].

In an effort to standardize the definitions used in recreation planning, Supplement No. 1 defined a "recreation day" as a:

> A standard unit of use consisting of a visit by one individual to a recreation development or area for recreation purposes during any reasonable portion or all of a 24 hour period. [Ad Hoc Water Resources Council 1964, p. 3]

Research carried out by the Corps of Engineers has added to the standardization by further defining an "activity day" as:

> One person's involvement in a single activity during any part of a period of attendance at a recreation area (an individual participating in several activities during a single day would result in a measure of several activity days of use). [Crane 1970]

Additionally, the often used "visitor-day" measure was defined as:

> A visitor-day is a time stack of presence at a recreation area. An aggregate total of 12 visitor hours is one visitor-day. [Crane 1970]

The latter definition is at some variance with the normal interpretation of a visitor day. Often, that term is used synonomously with what has been called "activity" and "recreation" days. The above definitions do, however, serve to add rigor to this area even though being of little value in solving the intertemporal and visitation duration problems mentioned above. The solution to those problems, however, is not readily available by an improved definition of the units used to measure recreation use. Any satisfactory change along these lines would reduce the advantages of current measures by increasing the difficulties involved in their estimation and by, perhaps, making comparisons across various types of recreation more difficult. Therefore, the remainder of this report will adopt the three definitions of use as outlined above. The choice among the three depends upon the focus of the research effort under consideration and the purposes to which its results will be put. This distinction will be clarified further in the following discussions.

As indicated above, the demand for outdoor recreation can logically be expected to respond to most of the same factors that affect demand functions for other goods and services in the economy. Model specification involves making decisions on which of these factors are most important and how they are to be defined for purposes of applied analysis. Before critiquing the applied research on site demand, we will briefly review how some of these factors can be handled.[7]

Exogenous Variables: Independent or exogenous variables are those with values determined outside the model structure but used to explain the behavior of the model's dependent variable. Therefore, other things being equal, the cost of a good or service to the consumer becomes one of the most important factors in its demand function. Normally, all other costs in terms of money, time and bother are neglected as being of small magnitude relative to the purchase price. Such costs can be called "transfer costs" [Brown <u>et al.</u> 1964] and include any cost associated with the process of exchange.[8] Thus, the demand for a particular recreational facility or site, other things being equal, would depend upon the price charged for admittance (entrance fee). However, such fees for many of the most popular recreationsl activities are very low or even nonexistant. Public facilities are often entirely supported by tax revenue or charge only a small fee for entrance or parking. Also, private landowners often permit free

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[7]This section is largely adapted from Kalter and Gosse [1969].

[8]For recreation, transfer costs include such items as cost, time and distance of travel, and increased cost of meals and lodging.

use of their land for recreational purposes. Because of such factors, the transfer costs for outdoor recreation often outweigh the market price (entrance fee) required to participate in an activity. Therefore, attempts to quantify the demand for and monetary value of individual recreational sites, based upon past experience, cannot be carried out directly because of the lack of price information resulting from their public provision. Because of this fact, recreation demand function estimation has utilized a two step process. First, all variable costs, including transfer costs, are summed to obtain a composite figure for the cost of the "whole recreation experience."[9] As indicated by others [Clawson and Knetsch 1966; Wennergren 1967], the relevant transfer costs include only variable costs of a trip because fixed costs can be considered "sunk" once spent and will not affect the quantity of activity days demanded. From such component cost figures <u>and</u> data on the associated use or participation, demand functions for the entire experience are derived [Clawson and Knetsch 1966]. Then, inferences with respect to the demand for the resource itself can be made. The methodology to carry out this two step process will be explained in more detail below. The point to be made here is that the isolation of the cost variable for purposes of deriving a demand function for a <u>particular public recreational site</u> is not as straight forward as for normal demand functions derived for private market goods or commodities.[10]

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[9] The overall recreation experience, as defined by Clawson, includes anticipation, travel to, experience on the site, travel back, and recollection. Clawson has maintained that these component parts of a recreational experience cannot be meaningfully separated from each other. Therefore, the costs of this entire experience must be used initially in any study of demand [Clawson 1959].

[10] Moreover, the necessity of initially using transfer

Cost data defines a demand function only when all other variables can be considered as given. However, this is not often the case when such functions are to be used for projection purposes. Consumer tastes and preferences should be included as one such factor but are difficult to measure or quantify. Some socio-economic characteristics would appear to be influential in determining the types and amounts of recreation desired. However, socio-economic status, as a single characteristic associated with each person, is a complex variable. For example, age, sex, place of residence, as well as income, have all been associated with changes in recreation demand [ORRRC 1962, Study Report 26; Brown et al. 1964; Boyet and Tolley 1966; Merewitz 1966; Gillespie and Brewer 1968; Kalter and Gosse 1969; Pankey and Johnston 1969]. Other elements may include occupation, education, family composition and race [U. S. Bureau of the Census 1963]. Other studies have also indicated various components of a person's socio-economic status are possibly correlated with his tastes and actions [Mead 1957; Havinghurst and Feigenbaum 1959; Tittle and Hill 1967; Williams 1967]. Because groups of persons who have similar socio-economic characteristics tend to have a common outlook on life, such variables may have some predictive value with respect to consumer actions. Consequently, demand being a function of tastes and preferences may thus be a function of socio-economic variables. Obviously, these variables may have an independent effect in addition to their influence on tastes

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costs as a means of deriving demand functions for particular recreation resources results in peculiar identification problems. For example, although the time spent participating in the entire recreation experience and the distance traveled may be highly correlated with monetary costs, these variables may interact so as to cause misestimation of the appropriate demand function if the interaction is not accounted for [Brown et al. 1964; Cesario and Knetsch 1970].

and preferences. In either case, the statistical significance of such variables in explaining recreation demand must be verified empirically.

Socio-economic variable definition, however, can be critical to model specification. Certain variables such as age, sex and race are straight forward and present no discernible problems. Others such as place of residence and family composition give the researcher considerable latitude in classification. Still others, such as personal income, present both conceptual and empirical problems. Although income is usually said to be a determining factor in the demand for any commodity or service, total income is probably not the most relevant measure of buying power. The correct definition to utilize in empirical estimation is not obvious, however [Clawson 1959; Copp 1964; Stoevener and Brown 1964]. Perhaps a better measure than total income, and one that is often suggested, is disposable income. However, from the perspective of data availability, total income and not disposable income is usually more readily available.

The prices and range of all other goods available to the consumer are another major influence on the demand for any given commodity or service. Of particular concern here, are the other recreational activities which are compliments or substitutes to the activity or use being studied. Since the total per day costs of such activities to an individual would reflect the current supply of facilities available to him, identification of these costs could be useful in accurately determining the way in which such factors operate in the demand function. Collection of this information, however, would be difficult and alternative ways of handling the problem may be needed.

One method may be to ignore the prices of all other recreational activities. Thus, the resulting demand relation for a site, or a given activity at that site, would provide an estimate based upon a particular mix of alternatives. In forecasting for proposed sites, a demand relationship which most closely approximated the conditions existing with respect to alternatives could be utilized.

A similar means could be utilized to handle the quality factor and its influence on demand forecasts at proposed recreation locations. Alternatively, attractiveness indexes may be a possible addition to the demand formulation [Cesario 1966]. The quantification of such an index, however, is not well established and is subject to a number of conceptual and empirical problems.

Finally, derivation of demand functions for particular sites, and the use of those functions in forecasting, requires recognition of the influence of population size. Normally, however, population is associated with the dependent variable of the demand function rather than entering the model as an explanatory factor. Thus, demand functions are often placed on a recreation, activity or visitor-day per capita or per 1000 population basis. The model can then be easily used for projection purposes and the problems of scaling are reduced. Easier comparisons among sites and activities can also be made. Such a procedure can be justified on the basis of other studies that have shown population coefficients, obtained by using population as an independent variable, which do not differ significantly from unity [Boyet and Tolley 1966].

<u>Recreation Demand Studies</u>: Achieving an efficient allocation of resources to meet outdoor recreational needs requires an estimation of the associated demand relationships. As indicated previously, one often used, but conceptually incorrect, method of approaching this problem was the estimation of consumption functions and their use for predictive purposes [ORRRC 1962, Study Report 26]. More recently, those in

operations research have dealt with models to predict recreation travel flow from population centers to recreational sites [Cesario 1969]. Although not often recognized as such, these latter approaches are nothing more than the consumption function or use projection method applied in a more sophisticated manner. Because the travel flow models are estimated and refined under an existing price system, they show only one point on the conceptually correct demand curve. However, with some alterations and sufficient data such models could be modified so as to derive demand functions for particular park sites in a recreational system [Cesario 1969]. When this is carried out, travel flow models become another version of the models now widely accepted by economists to estimate recreation demand relationships. Because of this fact, the subsequent discussion of recreation demand studies for specific sites will concentrate on the latter line of development. In addition, it should be noted that use of the travel flow methods appear to require more unrealistic assumptions (such as the need for estimates of market demand and the normal assumption that this will be proportional to the population) and stringent data requirements (such as acceptable measures of site attractiveness) than other formulations. We will, however, return to market demand and spatial allocation models in the section entitled "Recreation Markets, Demand Allocation, and Facility Planning."

The basic elements of demand theory discussed above provided the foundation for the development of methodology necessary to estimate recreation demand relationships. Development, however, has been slow and, at times, inconsistent. In 1947, the National Park Service conducted a study to determine the economic benefits of national parks. The suggestion that travel costs, in conjunction with visitation data, might serve as a measure of the minimum benefit that people derive from visiting particular recreational sites was put forth by

Harold Hotelling. In Hotelling's words:

> By a judicious process of fitting, it should be possible to get a good enough approximation of this demand curve to provide, through integration, a measure of the consumer's surplus resulting from the availability of the park. [1949]

He felt that such an approach would be useful providing an assumption could be made that all individuals valued a site equally. The unrealism of the assumption as well as the data difficulties imposed by such a method caused the Park Service to ignore the suggestion and to consider recreation as an intangible benefit of public activity. As late as 1958, Eckstein [1958] supported this notion.

The first attempt to implement the suggestion of Professor Hotelling was made by Trice and Wood [1958]. Using cross-sectional data, they attempted to estimate the monetary value of some water-based recreational facilities in California. Their estimates were derived independent of facility costs and consisted of a single value which applied to all "recreation" days taken by recreationists using the facilities. The method (travel-cost) involved an analysis of the points of origin of visitors to a given recreational area. Potential visitors were divided by geographical zones surrounding the recreational site. Such zones could be thought of as being concentric circles which would include groups having similar costs of travel to the park under consideration.[11] The entire monetary cost per recreation day from the most distant zone defined an upper limit to the value of the facility to any visitor. Therefore, the consumer surplus to those in each zone could be determined by "first subtracting its average cost from the average cost of the most

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[11] Interestingly, an attempt was made to account for the fact that long trips are often of a multi-purpose nature [p. 204]. This problem will be considered in more detail in the discussion of subsequently developed methods.

distant (and most costly) travel group or zone then multiplying that figure by the number of persons in the zone likely to visit the park during any given period of time."

The Trice-Wood approach assumed, as did the original suggestion by Professor Hotelling, that "people enjoy parks to a similar if not identical extent." Thus, the cost of visitation to the furthest distance zone established the maximum benefit derived by individuals participating from other distance zones. The Trice-Wood methodology, however, actually approximated the demand relationship associated with the "whole recreational experience" and not one for the facility itself. In other words, the full price-quantity relationship for a site was not considered. This, along with several other restrictive assumptions [Hines 1958; Lessinger 1958; Crutchfield 1962] made the Trice-Wood approach conceptually inappropriate for making value estimates. Its potential usefulness for estimating park attendance was submerged by such problems.

In 1959, Clawson rescued the original Hotelling suggestion and conducted a study to derive monetary values for outdoor recreation [Clawson 1959]. Information collected at four national parks listing the place of residence of park visitors in 1953 was used. Mileage from various distance zones to the park under consideration was estimated and a cost figure associated with that mileage. Given that information, the cost per visit was plotted against the number of visits[12] per 100,000

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[12]Visits would not be the same as "activity or recreation days" because the length of stay is unknown. As we shall see, there is a considerable difference of opinion amongst the various empirical studies as to which is the appropriate definition of the dependent variable (perhaps because of data problems). Although never openly discussed, the choice has important implications for using the various results. Data on either "activity" or "recreation" days gives more specific information than does a formulation concerned with "visits." Moreover, models using the former (activity days) definition can provide

population in the various distance zones giving a graph which Clawson felt approximated a demand curve for the entire recreation experience rather than the demand for the park as a resource. The original Hotelling assumption that all individuals retained an equal valuation of the site under consideration could then be dropped [Clawson 1959].

To get the value of the recreational resource, itself, Clawson derived a second graph that related increases in entrance fees to the total number of park visits. He assumed that park visitors would consider higher entrance fees in a rational way. In other words, in estimating the effects of the schedule of entrance fees, using the demand function derived for the whole recreational experience as a basis, higher fees had to be regarded as no more serious than an increase of equal magnitude

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information necessary to making decisions on the activity mix of facilities within and among projects. As Crutchfield indicates, the alternative is to:

> ... lump together all recreational benefits offered by a particular area. Although this is offered as an advantage it leaves some practical and frequently critical problems unsolved. It implies, first, that recreational benefits are additive (or complementary) or are available only in fixed portions. They are frequently competitive, however, particularly with respect to fishing and hunting on the one hand, and other recreational uses on the other, in which case the "mix" becomes important. ... Even when recreational benefits are additive the emphasis on various uses can almost always be varied and unless all are exactly equal in value different aggregate benefits would result from different types of development. [1962]

A definition of the dependent variable as "activity" or "recreation" days leaves the definition of the cost variable open. Usually a comparable definition would be suggested. However, many cost items do not vary with time, only with the distance travelled [Lerner 1962, p. 74]. Thus, length of stay per trip could be related to distance travelled. Normally, this factor is assumed to average out over all trips taken within a particular time span.

in any of the other costs associated with visiting the site. Also, the experience of users from one location was assumed to provide a measure of what people in another location zone would do if the money and time costs of a park visit were the same. Thus, it was assumed that the composite preference functions would be the same between zones and not that individuals would have identical functions [Knetsch 1963, p. 391]. For a given increase in fees, the per capita visits for each distance zone were read from the original curve at points corresponding to the increase in the costs originally associated with each of the zones. The total visits from each zone at the higher entrance fee were derived by multiplying by the zone population. The total number of visits at the new fee was estimated as the sum of the various distance zone totals. In this way, a demand curve was constructed for the specific recreational site under consideration.

A simple hypothetical example will serve to illustrate how the method could be applied. Assume that the potential visitors to our hypothetical park can be divided so as to reside in three distinct mileage or distance zones around the park. Assume further that the populations of the three distance zones vary and that the entrance fee to the park under consideration is zero. Transfer costs, then, become a major concern to potential visitors. Since transfer costs can be assumed to vary with the distance from the park to the population center involved, the data in Table 1 could be typical of the situation. As expected, the number of visits per unit of total population decreases as costs increase. This relationship can either be graphed as in Figure 1 or be represented by a simple two-variable equation of the form:

$$V = f(C)$$

where V is the rate of visitation per unit of population and C

TABLE 1.--Hypothetical Annual Visitation Data for a Typical Park

Distance Zone	Population	Cost/Visit	No. of Visits	Visits/1000 Population/ Year
1	2000	$ 2	800	400
2	4000	6	800	200
3	8000	8	800	100
			2400	

is the cost per visit. The function represents the demand curve for the whole recreational experience. To construct a function which relates the number of visits to the recreational site to variations in the entrance fee for that site requires an additional step.

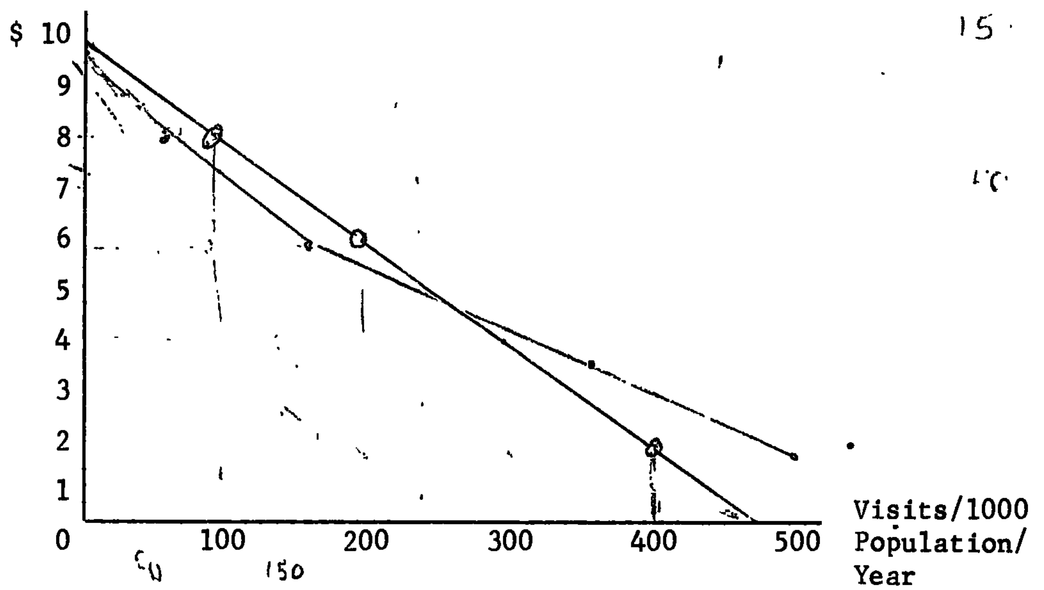

FIGURE 1

Hypothetical Cost-Visit Rate Relationship

As indicated by Table and Figure 1, 2400 visits would take place with no entrance fee. This delineates the first point on a demand curve for the recreational site itself. Namely, it is the quantity demanded at a zero price. When an increase of $2 in the entrance fee is assumed and that increase is treated as an increase in transfer costs, the total cost per visit from each of the distance zones would increase by this amount. The expectation would be that such an increase would cause a reduction in the number of visits from each distance zone. Such a reduction can be estimated from the original cost-visit relationship. The original cost per visit from distance 1 was $2 per visit with a visitation rate of 400 per 1000. An additional $2 cost would make the total cost $4 and would reduce the visitation rate to 300 per 1000 (Figure 1). Likewise, the visitation rate from distance zone 2 drops to 100 per 1000 and that from distance zone 3 drops to zero.

The total visitation at a $2 entrance fee is, therefore, reduced to 1000 visits. Correspondingly, an increase to $4 per visit would result in 400 total visits while the $6 entrance fee would reduce visitation to zero. This demand schedule can be plotted as a second relationship which shows the demand curve for our hypothetical recreational site (Figure 2).

From the site demand function, estimates of the economic value of the recreational site can be derived. Such estimates depend upon the underlying assumptions and, if based upon projected population values, the consistency of the underlying coefficients over time is assumed. Methods of deriving such value estimates will be discussed in a later section.

Assuming all other factors constant, the Clawson formulation can be utilized to forecast attendance at recreational sites. In order to do so, estimates of the visitation rate per unit of population in the various distance zones surrounding the facility under consideration, the forecast zone

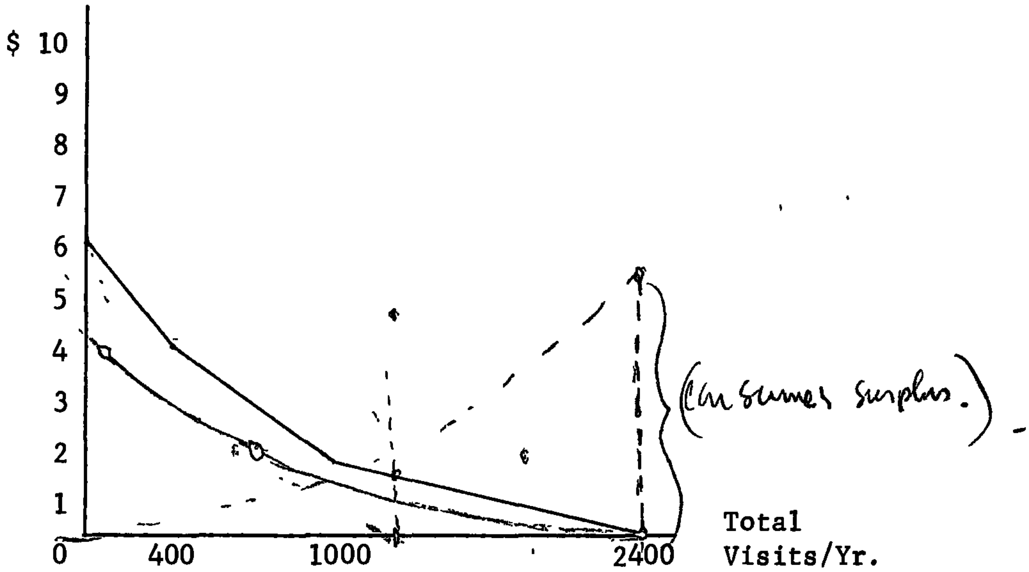

FIGURE 2

Hypothetical Site Demand Curve

population and the costs per visit of recreational participation at the facilities to individuals in the various zones would be needed. Assuming that the cost-visits relationship estimated from previous data would hold, such information would permit the derivation of total demand for a specific site. This use of the first stage Clawson model parallels the original Trice-Wood methodology and possesses some of the same limitations. We will now turn to discussion of these and their possible solution.

Clawson pointed out that zone differences with respect to distribution of income and other socio-economic variables were ignored in his original analysis because of data deficiencies. As we have pointed out above, such factors may be important in defining a demand relationship. If the various socio-economic characteristics differ among the distance zones, the true demand schedule for that zone could be expected to differ from other zones. Thus, the implicit assumption that the demand schedule is essentially the same for all distance zones needs to be modified. Such a modification would largely mitigate the original basis of identical composite preference functions between zones. This is easily accomplished by explicitly incorporating such variables into the analysis. In order to do so, data requirements would be increased to the extent that additional variables are added and the use of the resulting multi-variable demand functions for projection purposes would be come more difficult because projections of all the independent variables incorporated would be needed. As we will see, however, most of the empirical work which followed development of the Hotelling-Clawson methodology utilized this more complex formulation [Brown et al. 1964; Boyet and Tolley 1966; Merewitz 1966; Pankey and Johnston 1969].

A second factor of importance in estimating the demand relationship for an individual recreational site is the availability of close substitutes [Knetsch 1963, p. 390]. The importance of substitute visitation areas obviously increases with the increase in distance from the site under consideration. In general, the presence of substitute areas would tend to give a downward bias to the demand relationship estimated. Although the effects of alternatives are reflected in the actual visitation rate for the entire recreation experience, their presence will affect the estimation of the demand relationship for the resource itself. As Clawson and Knetsch point out:

> However, when we estimate the demand for the recreation resource, we raise the visit cost for the nearby groups to that of more distant population groups and ascribe the latter's visit rate to the former. To the extent that more alternative recreation areas are in fact available to more distant groups, the visit rate of the less distant group would not go down to that of the more distant group because of money cost increases. Consequently, the visit rates will be estimated with a bias ...; the number of visitors at different price levels is underestimated. [1966, p. 88]

The effect of this downward bias would be to underestimate the economic value stemming from a recreational area and to misrepresent the effect of entrance fee imposition at a particular area but not to misestimate attendance with no price increase. Knetsch has suggested that knowledge of the number of alternatives, their location, size and quality would be needed to incorporate such effects into the demand relationship. He has suggested that such information could be utilized to weight the cost values, "where the weight might be determined by the data in such a way as to increase the C [cost] value for areas having readily available alternatives." The effect would be to indicate fewer visits from distance zones with higher costs or more alternatives. The weights would increase with an increase in the number, size or quality of the available alternatives [Knetsch 1963, p. 391]. Others have added a gravity variable to the estimating equation [Grubb and Goodwin 1968; Pankey and Johnston 1969] in an effort to empirically determine the relationship. Cesario has used the gravity variable in conjunction with a model to estimate recreational attendance which followed the lines of the traffic flow models discussed above [1966].

In addition to the question of substitutes, the allocation of trip costs among the various possible purposes of a longer trip is a problem. Clawson assumed that all costs of the main trip were borne by the site being considered and that visitation of the site was the main purpose of the trip. Only costs (distance) over and above those of the main trip were allocated to other activities. As Clawson and Knetsch have stated:

> The direct costs of seeing a particular place, such as travel off the main route, meals, lodging, etc., in the particular area, should of course be charged to this experience. But family satisfactions at each place must yield some surplus above direct costs of visiting that place, if the "overhead" or main trip costs are also to be offset, or more, by total trip satisfactions. One might attempt to allocate general

> costs against each of the attractions visited, but numerous questions would arise in such a division. The results would necessarily be somewhat arbitrary, but might still provide the best possible approximation of relevant costs. [1966, p. 72]

Empirically, this problem has not been handled in a consistent way primarily as a result of data and definitional problems. Most studies have ignored the situation and worked with total trip costs, or usually with distance only, regardless of whether or not the trip was multi-purpose in nature. Others [Clawson and Knetsch 1966, p. 73] have attempted to use methods which would permit distinctions to be made between the purposes for which costs are accrued.

Another factor, which was ignored in the original Clawson formulation, is that of site congestion and other factors influencing the quality of the overall recreational experience. In principle, variables accounting for these influences could be introduced into the demand function. In practice, as with the substitution question, this has been a conceptually difficult and perplexing problem [Cesario 1966]. Part of the problem has been the inability to quantify the meaning of the terms "congestion" and "quality." It has, thus, been commonplace to assume away these factors. When using estimated relationships to make inferences on the demand and value of different areas, qualitative value determinations are made concerning the similarities of the new area with that used to estimate the demand coefficients. Alternatively, the estimated relationships from various situations could be utilized for projection so as to obtain a range of potential values for the site in question. This range could then become the basis for a sensitivity analysis. It should be pointed out that the quality considerations relate to more than just the quality of the site itself. Road conditions and other similar factors also affect the quality of the entire recreation experience.

Closely related to the congestion problem is the question of what is being measured when "consumption" data are used for the dependent variable. Obviously, an identification problem is implicit if the site for which the "demand" relationship is being estimated is utilized to capacity (for a given level of site quality, congestion develops, queuing occurs or those wishing to recreate at the site are unable). When that takes place, use data underestimates actual demand and, therefore, economic value. Only when the site is not utilized to capacity (at a given quality level) can the "consumption" data be used. This problem is seldom discussed and the implicit assumption contained in the relevant literature is that capacity has not been exceeded for the site being considered or that quality is a sliding index which allows the "demand" function to be derived at the current quality level (no queuing or turn aways occur). These are heroic assumptions but the ability to handle the problem quantitatively faces issues similar to those discussed in the previous paragraph. For this section, we will assume that the data used to derive a Clawson model are reasonable approximations of "demand" rather than "consumption." We return to the relationship between site demand and capacity in the following section.

Several other limitations of the Clawson methodology should be noted. First, it needs to be reemphasized that the demand function derived for a specific site is indirectly inferred and as such assumes that, on the average, consumer reaction to costs is constant regardless of the type of cost. In other words, we have assumed that the reaction to an increase in entrance fees would be the same as an increase in transfer costs. Second, the formulation utilizes cross-sectional data to derive a demand function. Because variability in price can be ascertained during a single time period, this is possible and appropriate [Kalter and Gosse 1969]. However, it should be noted that such a formulation suppresses information on the change in demand coefficients over time. As Knetsch and others have suggested, it may be possible to build into the model factors which take account of changes in this demand structure [Knetsch 1963, p. 392; Seneca 1969]. In any case, the effect of such factors is on projection rather than the coefficients estimated for a particular time period. Third, the form of the dependent variable (visits) used by Clawson would not seem to be the most useful for planning purposes. Use of the "recreation or activity day" forms would seem to provide more appropriate information.

Finally, one limitation of the Clawson methodology has caused a great amount of comment [Knetsch 1963; Brown et al. 1964; Clawson and Knetsch 1966; Cesario and Knetsch 1970]. The limitation pertains to the question of what factors constrain the number of visits to a recreational area. The original Clawson formulation utilized distance as a proxy for monetary costs. Except to the extent that it is directly related to such cost figures, the factor of time, both for travelling and engaging in the activity, is, therefore, suppressed. Again, failure to recognize this factor would most likely shift the demand curve to the left as the total cost of a park visit increases. Brown et al. have empirically shown the correctness of this presumption [1964]. While the assumption is not critical for those who live near the park, the time necessary for a round trip from distant points may press against available leisure time and affect the demand function in a way similar to that of substitutes. If the effects of time were considered, the demand response by visitors from more distant points would be less for a given change in gate fees than would be estimated for the demand schedules that neglect the effects of time. As Knetsch points out:

> Those having the higher monetary costs of access will almost invariably have the higher time cost and both cause the rate of use of a park to be lower than for a group located nearer to the recreation area and having lower time and money costs. Thus when we postulate an addition of money cost to the low money cost and low time cost group, as we do in constructing a demand curve, we alter but one of the decision factors. We estimate, therefore, that this group visit rate will go down but it will not necessarily go down to the rate of the group having the high money and time cost. [1963, p. 395]

The principal problem connected with the lack of consideration given to the time constraint is the resulting underestimate of <u>economic value</u> for a particular area. The bias in the demand curve increases with higher prices and thus the estimation of attendance at the original or zero entrance fee is not in error. Like the substitute question, then, the time constraint problem affects the second step in the analysis. Methods of handling the problem will obviously be difficult since the time effect may deviate significantly depending upon the circumstances. We will discuss this in more detail under our coverage of value estimation techniques.

Although the limitations of the Hotelling-Clawson methodology appear to be substantial, it provides a conceptually satisfying approach to the recreation demand problem. At least some of the limitations can be easily handled through the addition of variables other than cost to the demand relationship. Of perhaps more importance to this section, is the fact that the important limitations apply directly to the second step of the analysis. For purposes of attendance projection, at no increase in the original transfer and entrance fee costs, the first stage of the methodology can be utilized (assuming away the site capacity problem). When used for forecasting attendance, the major limitation is the comparability of the conditions in the area for which coefficients were estimated to those in the area being forecast. If careful attention is paid to this fact and a number of functions estimated for varying conditions, the method has substantial potential for planning purposes [Clawson 1959; Knetsch 1963].

The Clawson formulation of the Hotelling idea provided, then, the basis for numerous empirical studies on outdoor recreation demand. Ullman and Volk presented an empirical study of lakes in Missouri which utilized a crude form of Clawson's first step model [1962]. Knetsch [1965, Economics of Including Recreation] derived a demand function for the John H. Kerr project of the Corps of Engineers. He utilized travel costs as a proxy variable for price and defined the dependent variable as the number of "visits" per thousand population in the zone of origin. A log log function was used and explained 97 percent of the variation in visit rates. The demand schedule for the site itself was derived by converting the mileage figures per visit to cost figures by assuming an operating cost estimate of 5.16 cents per mile. No other independent variables were utilized.

A refinement of the Clawson approach was presented by Brown, Singh and Castle [1964]. They divided the concentric distance zones surrounding the recreational area under consideration into income subclasses. Thus, explicit account was taken of income as a demand shifter. However, because the average per capita income per zone was derived from respondents to questionnaires (who were participants in the activity being considered) rather than the actual average for each distance zone, the demand curves derived for the "whole recreation experience" were probably biased. The conceptual underpinnings of the demand formulation were improved by including both the average miles and variable monetary costs per activity day in the first step formulation.[13] Adoption of this formulation recognized that travel costs were only a special case of the more general phenomenon of transfer costs. Obviously, the distinction between variable and fixed transfer costs is important [Gosse 1970, p. 27]. The Brown et al. study included only variable costs. This study also was the first to utilize the Clawson methodology to estimate the demand for an activity which was not confined to any one location but was satisfied in a broad geographical area. By establishing distance zones based upon the "average" distance travelled by fishermen in specific areas, they were able to approximate the same relationship as Clawson hypothesized for a particular site. The importance of such an approach lies in the need to estimate recreational demand for such resources as free flowing rivers of considerable length. Such estimates are necessary to compare with alternative uses of specific river reaches which would destroy the original character of the overall resource.

Brown et al. also introduced simultaneous equation models of the market in an attempt to derive the appropriate coefficients pertaining to recreation demand and supply. Their effort, however, met with little success. The authors explained this failure by indicating that for most commodities price and quantity tend to be interdependent because producers and consumers are differing groups. In the case of outdoor recreation, the price or cost per unit taken may be predetermined by the income and spatial location with respect to the recreation site of participants.

A study by Boyet and Tolley presented two methods for

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[13] Note that an improved definition of the dependent variable was utilized for this study. In addition, individual observations rather than aggregations by zone were used as the basic data for the regression model.

estimating demand functions for outdoor recreation [1966]. First, they utilized an expanded version of the Clawson model to estimate the total number of visits to a park. However, rather than utilizing concentric distance zones around the facility in question, they chose state boundaries to define their zones. The distance from each state to the park was taken as a proxy variable for costs. The rationale was to minimize the problems in obtaining data on population and socio-economic variables such as income. Published data is available on such statistics along state lines but it is often difficult to obtain for the normal concentric distance zones utilized by Clawson. Thus, in addition to the distance variable, Boyet and Tolley were able to include per capita and median values for several socio-economic variables of the respective zones in their demand function.

Their second approach assumed that the demand for recreation could not be represented by a single mathematical function even though it was affected by a number of socio-economic variables. Therefore, classes of individuals were defined so that each class had a unique combination of values for the independent variables of income, distance and vacation time. Participation rates were associated with each class for several outdoor recreational activities by observing the use patterns of that class. This allowed the distribution of income and other variables to have a more pronounced influence on demand than would take place in the single equation approach. This occurs because the single equation approaches utilize the average of such variables rather than accounting for different levels of the explanatory variables. As an example, a given change in an admission fee may affect income groups differently [Seckler 1966]. Moreover, the authors felt that changes in income distribution may be more important to future projections of demand than changes in average per capita income. Use of Boyet and Tolley's second model for projection, however, involves several unique assumptions. Obviously, all persons in a particular class must be assumed to have similar demand patterns, and only when a person moves to a different class will his demand pattern change. Like other techniques, the rate of participation for a given class is assumed to hold in the future. However, the greatest drawback to the use of the method for projection is that joint distributions of the independent variables would be needed to estimate the number of persons falling into each of the classes in the future. Considering the difficulties of obtaining forecasts for single variable distributions, such forecasts would be difficult to obtain unless current correlations among the independent variables are assumed to hold. Such an assumption would be unrealistic and would probably result in a substantial bias to the projections forthcoming from the analysis. Moreover, if the effect of income distribution on demand forecasts is desired, zero-one variables representing different income classes could be incorporated into a single equation demand model or separate functions for each income class could be derived.

The Boyet and Tolley study included two other innovations. First, independent cross section and time series data were pooled in an effort to derive demand coefficients which took account of trends over time. Second, an effort to estimate the cross elasticity between recreational facilities was undertaken. Variables were added to the regressions which allowed data on the distances from the respective states to the recreational facility for which cross elasticity estimates were desired to enter the formulation. Empirical estimates of the cross elasticity coefficient were then derived.

The authors used both of their suggested methods to project the 1980 demand for visits to national parks and an area recreation complex in western North Carolina. In making such projections, they assumed the supply of recreational facilities would be perfectly elastic. In addition, quality factors were assumed away, as was the issue of multiple purpose trips. Previous projections of population and per capita income by state were utilized. These forecasts were obtained from a report completed for the Outdoor Recreation Resources Review Commission [1962, Study Report 23] and from National Planning Association studies [1962].

Boyet and Tolley made no attempt to derive value estimates from their statistical demand functions. In essence, they stopped at the end of the first stage of the Clawson methodology. In a similar study, Merewitz [1966] simulated a demand curve for recreation at the Lake of the Ozarks, Niangua Arm. Cross sectional data were used which permitted variations in transfer costs to simulate price variations for the recreation commodity. In addition, a number of socioeconomic variables were taken into account in the demand formulation although several were found to be insignificant statistically and dropped in the final formulation. Merewitz, however, went beyond the study of Boyet and Tolley and attempted to use the formulated demand function to derive the consumer surplus value for the recreational site.

This study, like those of Clawson and Boyet and Tolley, assumed the dependent variable to be visits rather than "recreation or activity days" and used observations aggregated by distance zone. Merewitz also used Missouri counties as the appropriate boundaries for his distance zones rather than Clawson's concentric circles. This ignored visitation from outside the state. He had little success in incorporating variables which would represent the availability of alternative sites. In explaining this, he felt that failure to consider the quality of alternative sites may have accounted for the inability of these indices to explain much of the variation in attendance. His approach ignored the time factor problem discussed above and assumed, as do other similar studies, that the population sampled was homogeneous except for those socio-economic characteristics incorporated in the model.

In a pioneering article, Stevens [1966] attempted to show the relationship between recreation benefits and water quality by using an expanded form of the Clawson model. In essence, his conceptual model was formulated around the proposition that a change in water quality would result in a shift of the demand schedule for a particular recreational activity using a water resource. Thus, separate demand equations would exist for different degrees of quality in a recreation experience. Stevens recognized that in addition to the quality of the recreational site, itself, a specified quality level for a recreational activity would depend upon a host of other factors related to the entire recreational experience. As a first approximation, he implemented an empirical model which ignored these other factors and concentrated on differences in water quality at a particular site. The quality of the site was measured through a proxy variable defined as the angling success per unit of angling effort by sports fishermen. He felt this was a quantifiable variable which was also relevant to the decisions made by anglers. Stevens also considered separate fisheries on the basis of species. In general, the study is useful for pointing out that quality considerations must be accounted for when utilizing estimated demand coefficients for projection purposes. Care should be taken to make inferences from coefficients stemming from studies made on facilities of similar quality to the one being forecast. Although the quality factor can be considered a demand determinant, it is more appropriate in current planning circumstances to think in terms of different quality levels for a recreational experience and derive a demand function for each level. The subjective nature of the quality influence makes the handling of this variable difficult in any case.

Hastings [1970] also attempted to bring the quality factor into an analysis of recreation demand. He used acres per visitor as a proxy for quality and attempted to derive a relationship between the distance which would be travelled in reaching a particular site and the acres per visitor available at that site. In general, his analysis is of little value for purposes of this study. Rather than associating the quality variable with the notion of recreation demand, Hastings derived a "demand function" for space. Because of the methodology used, however, it would be difficult to apply to a proposed improvement in recreational facilities. One problem is that distance is used as the dependent variable rather than additional space. Another is the difficulty in determining how data could be derived to empirically verify such a relationship. The space per visitor at any given facility would seem to be highly variable and depend upon a number of factors which could not be easily quantified.

The principal value of the analysis may be in conjunction with market rather than site demand studies since the distance-space function pertains to how a given population would value increased or additional availability of recreational areas. Even here, however, the analysis was dependent upon a peculiar set of geographical features (Long Island) and would not seem to be applicable to a more general planning situation. The conclusion of the Hastings study, however, supports that of Stevens; namely, that separate demand functions for different quality levels need to be estimated. This can be carried out by adding a quality variable to the expanded Hotelling-Clawson demand formulation and, if appropriate data are available, estimating the shift in the demand function when only the quality factor is allowed to vary. The difficulty obviously lies in obtaining appropriate data and a solution to this problem does not appear readily available. In the absence of such data, derivation of demand functions for recreational areas which can obviously be said to vary in quality and their use in a sensitivity analysis of proposed sites may be the only alternative.

In a study of reservoirs in Texas, Grubb and Goodwin [1968] made the first large scale demand analysis of recreation at reservoir sites.[14] Their study utilized historical data from Corps of Engineers recreational sites and from a comprehensive survey of recreational users at eight such sites during 1965. The study objectives were to estimate a recreation "visitation prediction equation applicable to the reservoirs," generate recreation demand curves for proposed reservoir sites from such equations, and calculate estimates of recreation benefits for proposed reservoirs at "each decade between 1970 and 2020." A Hotelling-Clawson formulation was utilized and, like Merewitz, the authors utilized county boundaries within the state to delineate distance zones. Thus, out of state visitors were ignored and this resulted in a downward bias to the estimated equation.

The dependent variable was defined as recreation days rather than visitor or activity days. Explanatory variables in

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[14] Others [Van Doren 1960; Brown et al. 1964; Merewitz 1966; and Seneca et al. 1968] have carried out analyses on water based recreational areas. However, none encompassed more than one location and most were not related to man-made reservoir projects or reservoir projects established by the Army Corps of Engineers.

the recreation visitation prediction equation included per capita income, cost of travel, reservoir size, proximity to competing reservoirs and population. Population was included as an independent variable rather than by the normal mechanism of association with the dependent variable. Travel time was not included in the model because the authors assumed that travel time and costs were highly correlated in the Texas situation. Travel cost was defined to include only the cost (per visit) of transportation to and from the recreational site. Only variable transportation costs were considered to be appropriate to the analysis. The assumption made concerning travel time doesn't eliminate the problem discussed previously. Correlation of time and costs, although not a problem for the visitation prediction step of the analysis, does cause biases when the derivation of a demand function for the site itself and its recreational value are estimated [Cesario and Knetsch 1970].

Lack of data prohibited a quality factor from being incorporated into the model. Also, no time trend variable was utilized although sufficient historical data appeared to be available to do so. Such a variable could account for structural changes in the demand coefficients over time. The substitution question was handled by the addition of a "gravity" variable "constructed to reflect the competitive effect of other reservoirs available to visitors of the county of origin upon visitation to the study reservoir." The addition of such a variable was significant in that it was the first successful attempt to incorporate substitution questions into a demand formulation for outdoor recreation. As Grubb and Goodwin point out:

> The gravity variable, X_4 has been constructed for each Texas county, and includes competing lakes within 100 miles of the center of each county. The

1965 survey data used in this analysis indicated that more than 90 percent of visitors originated within 100 miles of each sample reservoir, thus the choice of a 100-mile radius for purposes of this analysis. The assumptions underlying this variable are as follows: (1) the larger the number of reservoirs near a county, the less likely residents of that county will visit a particular reservoir; (2) the reservoir's surface size is an important factor in attracting recreationists. The gravity variable was determined as shown ...

$$X_{4j} = \sum_{i=1}^{n} \frac{\log_{10} S_i}{d_i}$$

where X_{4j} is the gravity value for county j, S_i is surface acre size of the conservation pool in reservoir i, and d_i is the distance from reservoir i to the center of county j. There are as many terms in the gravity equation as there are reservoirs within 100 miles of the center of county j (n equals the number of reservoirs within 100 miles). In the calculations, the logarithm of reservoir size has been weighted by distance, in miles, to each respective reservoir. Large numeric values associated with the gravity variable are expected for counties having large reservoirs nearby, while counties having few reservoirs nearby are expected to have smaller numeric gravity values. The sign of the regression coefficient of the gravity variable can be expected to be negative. Appropriate numeric gravity values associated with each respective county are important factors in estimating visitation from that particular county to new recreation projects, since the gravity variable is expected to reflect the competition from other available reservoirs. [1968]

Average per capita incomes of the county of origin were utilized as an independent variable rather than the income of individual respondents to the survey questionnaires. Thus, the study follows the lead of all other studies which have included income as an independent variable except that of Brown <u>et al.</u> [1964]. Data on the income of each respondent was collected, however, and could be used for other analytical purposes. For example, such data would be important to ascertaining the income distribution impacts of a recreational project, deriving separate demand functions for income classes, or incorporating a set of dummy variables for income into the recreation prediction model. The authors did not utilize the data in such a way, however.

Double logarithmic equations provided the best fit to the available data. Others also seemed to agree upon this functional form when estimating recreational demand functions [Brown 1964; Boyet and Tolley 1966; Merewitz 1966; Kalter and Gosse 1969]. Although the R^2 value was only 0.41, no sensitivity analysis was performed on the results. A demand function derived from the composite data obtained at the eight reservoir sites was utilized, however, for projecting future use and value of 54 proposed reservoirs in Texas.

Seneca _et al._ [1968] and Seneca [1969] have posed a model to estimate recreational visitation which is at some variance with the accepted Clawson formulation. In essence, their proposition is that users respond to increases in supply and a reduced form equation which merely incorporates demand as a time trend variable should be utilized for planning purposes. Although they admit the normal necessity to independently evaluate demand and supply functions, their position is based upon a supposed lack of price data by which a demand function can be formulated and the inability to acquire time series data for recreation. It is unclear whether they feel that time series data is a requirement to the estimation of a recreational demand function or whether it is necessary only to account for the trends over time taking place in recreation demand. They would utilize an equation of the form:

$$V_t = a + hF_t + iA_t + kT + U_t$$

where V_t is the visitation rate per unit of time, F the investment in man-made facilities, A the physical area of recreational locations, T a time trend variable and U a random error term. They hypothesize that if changes in F and A are introduced into the model, given an estimation of the appropriate coefficients from historical data, the number of additional recreational visitor days generated at each site can be estimated. Seneca admits that the time parameter k must be a valid indicator of demand influences in each area and have a constant effect on recreation visits over time. He further admits that this is a weak assumption and that such a demand parameter may "bias the supply coefficients and thus distort the equation and subsequent analysis" [1969]. A solution to this problem may be the pooling of independent cross sectional and time series data. He maintains that this could solve several econometric problems as well as the identification problem involved with the initial formulation. As others have pointed out, this will not be the case.

> Such methods rest on the assumption that the effect on <u>use</u> of a given increase in facilities is constant, regardless of the <u>magnitude</u> or <u>location</u> of such an increase. Because of the nature of such models, a clear reading on <u>demand</u> in its true economic sense cannot be obtained and the end result will be yet another aspect of the identification problem. [Kalter and Gosse 1970, p. 44]

Although the studies empirically implementing the reduced form methodology have been related to market areas, the results of such analyses are said to justify specific increases in supply (the addition of new facilities through governmental investment) and are thus important to this section. Demand, value, quality and capacity issues, however, are ignored. The formulation by Seneca [1969] is an improvement over previous attempts to use reduced form equations, but its primary applicability is to market oriented questions and, even there, the method gives no information on the value of outdoor recreation or the impact of a change in fees across a market area. We will return to explore the formulation in more detail in the section on market demand, however.

Planning Needs: The studies discussed above provide a review of one approach for estimating demand at recreational sites or, alternatively of models needed for the forecasting of recreation attendance or use. Several other empirical studies have been carried out but they all follow formulations similar to those discussed above and none make any breakthroughs with respect to data or definition of variables used [Gray and Anderson 1964]. As a careful reading of the previous section will point out, the studies reviewed undertook empirical investigations of demand relationships for specific recreational facilities or recreational activities taking place within defined geographical areas. In so doing, they developed, improved and verified a set of procedures for the estimation of recreation "demand" functions which have become widely accepted by both professional economists and practitioners in the field of outdoor recreation. Although a number of limitations remain, many of those discussed above have been satisfactorily mitigated while others are the focus of additional research effort and comment. We will return to this question shortly. However, first some remarks concerning the usefulness of the past studies to the recreational planning process as carried out by the U. S. Army Corps of Engineers are in order.

The techniques discussed provide an obvious improvement over those which have been utilized by governmental agencies in the evaluation of recreation investment proposals. However, the fact that the methodology is proven and widely accepted does not mean that it can be adopted as part of future planning procedures. All the studies reviewed utilize different sources of data as well as somewhat different formulations of the core methodology developed by Clawson. Moreover, often consistency between the definition of variables, both dependent and independent, is absent. It became obvious that improvements could not be made until consistent data sources were obtained. As Crane pointed out, "an investigation of existing data applicable to empirical analysis showed that adequacy and statistical reliability of such data was highly questionable" [1970].

However, the recreation facilities built by a particular agency, such as the Army Corps of Engineers, normally are utilized by a population whose characteristics differ from those of a representative sample of all recreationists. Therefore, improved planning by such an agency would require information from the relevant population using that agency's facilities. Recognizing this, the need for a consistent data source, and the definitional problems, the Army Corps of Engineers undertook a data gathering program with respect to outdoor recreation in 1963. Begun by the Sacramento California district office of the Corps, the data gathered in this undertaking was to be utilized for developing explanatory and predictive recreational visitation models that could be utilized in their planning process. It is the position of this review, after careful analysis of the data problems, that such a unified and consistent approach to data collection is required for the proper application of the techniques reviewed above to the planning process. The Corps has recently directed its division and district offices to implement new methodology for the estimation of recreation use which stems directly from this data gathering and subsequent evaluation process [Pankey and Johnston 1969; U. S. Army Corps of Engineers 1969 (2); U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation].

We will now turn to a review of the data underlying this effort and the procedures recommended to replace those previously used. Following from this discussion, we will return to a discussion of the limitations of the Clawson formulation, in general, and to their relationship to the revised Corps evaluation process in particular.

Data: A large scale data collection program and storage system was pretested and initiated in the Sacramento District Office of the Corps of Engineers beginning in 1963. In 1966, the data collection system was improved and extended to 52 reservoir projects in 11 states (seven Corps districts). Data were collected at these reservoirs during 1966, 1967, 1968 and 1969. The Sacramento District Office of the Corps was assigned the task of maintaining the data file and was to:

> (a) evaluate the data collection procedures and recommend methods for improving the statistical accuracy of such data and applying a standardized data collection program on a Corps-wide basis, (b) develop methodology for recreation-use prediction with preliminary methodology to be developed as soon as possible in a long range research program to be initiated for improvement of such methodology, and (c) develop methodology for determination of the number and type of recreation facilities needed to serve a given number of recreation days of use (facility load criteria). [U. S. Army Corps of Engineers 1969, Tech. Rept. 1, p. 1]

The first task was completed and reported on in an April 1969 Corps Report [1969, Tech. Rept. 1]. The second task was reported on in two publications by the Sacramento Office of the Corps [Pankey and Johnston 1969; U. S. Army Corps of Engineers 1969, Tech. Rept. 2] and will be reviewed in more detail below. The third task has not been completed as of this writing.

The report evaluating survey techniques "considers the limitations of the experimental survey design and evaluates the possible methods for improvement. Potential data requirements for planning and development and organizational, statistical and monetary limitations were considered in developing the alternative survey design modifications proposed" [1969, Tech. Rept. 1, p. 2]. In brief, the original survey design was based upon the criteria of uniformity and least cost. The evaluation of the original survey results recommended that additional criteria of reliability (achievement of a probability sample as a basis for measuring the precision of estimates), efficiency (least cost per given level of precision or maximum precision per given level of cost), and fit (compatability with previous surveys) be added. The evaluation of the statistical sampling technique, however, appears to have verified its soundness and reliability for purposes of collecting needed data on recreation participation. A complete discussion of the initial data collection procedures and recommendations for improvement, following the survey design criteria mentioned, are contained in the technical report.

Certain changes in the type of questions asked during the survey were suggested, however, that are of importance here. For example, the suggestions for a modified survey questionnaire included questions on income and total vacation time per year available to the party being surveyed. Information on transfer costs was not included in either questionnaire and information on entrance fees was only included in the original survey design. Also, neither questionnaire provided information on other socio-economic variables of users or attempted to stratify or classify the reservoir projects surveyed by quantitative quality indexes. As indicated previously, lack of data on the socio-economic characteristics of participants does not seriously affect the formulation of a recreation use prediction model. This stems from the fact that such variables are properly included in the Hotelling-Clawson model only when they refer to the appropriate distance zones around the recreational site and not to the actual participants from those zones.[15] In other words, the average income (education, etc.) for the distance zone of origin rather than the average for the participants from that zone should be used to derive the demand function for the "entire recreational experience." Socio-economic variables of the participants would definitely be of interest for other types of analysis and evaluations but are not particularly helpful in estimating demand functions of the type sought here. Exceptions occur when separate functions are sought for those possessing a particular characteristic (such as a given level of income) or when dummy variables representing various levels of a characteristic are used to develop a composite function. Because of the other types of analysis being suggested and the need to experiment with more complex formulations of prediction models, additional socio-economic data (especially income information) should be collected. In addition, more information on the quality factor, transfer costs and the type of occasion for which the visit was made could be helpful in future evaluations.[16]

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[15]As would be expected, the market areas for the reservoirs varied substantially depending upon whether day use or camping (overnight) visitation was under consideration. For the 52 projects for which data was collected by the Corps, only 15 had market areas for day use visitation of over 100 miles; while 44 projects had market areas for camping visitation of over 100 miles [Crane 1970, p. 10].

[16]For example, the National Recreation Surveys classified occasions as trips (occasions requiring overnights away from home), vacations (the season's longest trip), and outings (a day use occasion). Although elements of these classifications are included in the Corps survey questionnaires, the specificity with respect to the distinction between vacations and trips is not clearly brought out. In addition, estimates of transfer costs could be helpful supplemental information to the distance from origin variable and a classification along quality lines could be helpful in deriving distinct demand functions for sites of different quality.

Recreation Use Prediction: In an effort to determine the factors influencing recreation use at reservoir projects and to aid in future use projections, a study was completed for the Corps of Engineers by the University of California, Davis. That study utilized the survey data collected at seven California reservoirs and a substantial number of socio-economic variables associated with the appropriate populations in various distance zones. Also, variables relating to reservoir characteristics and other factors thought to be of importance were tested. The Clawson first step model was utilized with distance from the site being a proxy variable for price. Alternative formulations were compared with this procedure. The results of the study are summarized by Crane [1970] and in two publications by Pankey and Johnston [1968; 1969]. Unfortunately, the results were not as clear cut as one would hope.

Composite demand functions for three types of occasions (day use, overnight use, and total use) were derived from the data obtained over nearly a four year period at the seven reservoir sites. The dependent variable was defined as "use" or "visits." The effect of this definition on estimates of "recreation days" depends upon the length of stay for those participating in an overnight occasion. Estimates of overnight or camping use, however, were one step towards disaggregating composite recreational usage into activity usage. In general, prediction models utilizing logarithmic transformations of both the dependent and independent variables provided the best fit to the data in terms of the R^2 value, coefficient of variation, and distribution of residuals. Zero observations were dropped.

It was found that distance was a major factor in explaining use rates. In estimating the effect of distance on use, alternative definitions of the distance zones were used. The traditional Clawson distance zone idea was compared with the use of counties as the unit of observation. Although the results were not directly comparable, the indication was that both forms gave "significant results." The use of counties as the unit of observation was suggested as a preferred approach because:

> ... of the relative ease of assembling information about other variables necessary for the analysis and because it enables the specification of additional variables such as density and recreation alternatives, both of which were found to be significant in explaining use. [1969, p. 33]

In making such a suggestion, Pankey and Johnston followed the lead of several other studies reported on above [Boyet and Tolley 1966; Merewitz 1966; Grubb and Goodwin 1968]. In general, for purposes of planning and projection, the county or political subdivision boundary appears to be a superior alternative to use in <u>constructing</u> demand functions for the entire recreation experience when variables other than distance are thought to be important and for <u>using</u> all functions.[17] The study also tested an alternative measure of distance to either distance zones or counties as the unit of observation. The use of air distance was compared to that of actual road mileage. In general, road mileage appeared to be a statistically superior definition of the variable.

Because of the availability of time series data, a time trend variable was introduced in those equations using distance zones as the unit of observation. In most cases, no significant effect was found. Seasonal differences in use

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[17] A subsequent report [U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation], still in draft form, appears to have utilized modifications of this approach with some success. Counties were used as building blocks from which uniform sized areas were formed by aggregating to multi-county units or disaggregating to county census divisions. "With these modifications, the efficiency of conformance with census boundaries could be maintained, and an advantage of distance zones, controlled size, could be introduced." [p. 12]

were identified in several equations as being important, however.

No statistically significant effect of various socio-economic factors on recreational usage was identified by the study. This is at some variance with previous studies of a similar type [Merewitz 1966; Grubb and Goodwin 1968]. As Crane [1970] points out, a check on the socio-economic factors by the various geographical regions used indicated a high degree of similarity between market areas. Thus, their influence may not have been discerned because of a lack of variability. However, the market areas that would utilize a particular proposed reservoir site may differ substantially from those sampled for the study being discussed. If this were the case, and the derived coefficients are used for projection purposes, errors in projection could result.

Alternative recreation opportunities were found to be a significant variable in explaining recreational usage in some cases. The form of the gravity variable utilized to approximate the effect of alternative or competing sites differed from that used by Grubb and Goodwin [1968] and Cesario [1966]. It required the specification of a priori coefficients to reflect population responses to alternative recreational areas and, thus, involved a degree of judgment (and possible bias) by the researcher. Alternative forms of the gravity variable should continue to be explored so as to better ascertain the effect of competing sites on recreational use.

The report correctly pointed out that the introduction of supply characteristics (as opposed to quality factors) into the demand prediction equation could result in a circular effect on use prediction. Thus, the attempt should be made to "evaluate use disregarding facilities, in the hope of finding estimators useful for planners independent of facility commitments" [p. 23]. To do otherwise is to accept Say's Law as being appropriate to the recreational market. However, a more sophisticated model might distinguish between use that resulted in construction of new facilities and use which occurred after facility construction. Some form of lag model would appear appropriate and should be investigated for this purpose.

When population was entered as a variable into the use prediction model, results were varied. For some equations the elasticity of the coefficient was not significantly different from one, thus indicating that use of a per capita dependent variable would suffice. In others, the population coefficient departed from an elasticity of one. The population parameter in both cases, however, may have been accounting for the effects of other socio-economic variables which were not included in such equations. Finally, the authors reported that quality factors at the site were not significant in explaining usage. Crane points out that the "absence of this verification may be as indicative of inadequate recreation supply as insensitivity of the public to such factors [1970, p. 9]. However, the result may not be surprising if the quality difference between the reservoirs investigated was not significant or if the improper proxy for quality was utilized in the equations. Some attempt was made to indicate that quality did differ between those sites utilized for the study. However, whether the appropriate proxy variables were utilized is impossible to determine. Moreover, implications drawn from use of composite data should not be applied to specific sites. Quality factors in a demand formulation for a specific site would obviously not be significant if such a function were being estimated only with respect to a particular quality level.

Unfortunately, the report of Pankey and Johnston uses the information collected from the seven individual reservoirs studies as a composite data source. No attempt is made to derive demand functions for individual reservoirs and compare the resulting coefficients with those estimated from the pooled data. Because the influence of a number of variables that could be important to the demand for a particular site may not be considered by this approach, the results of such a study should be highly suspect for planning purposes.[18]

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[18] If certain variables are felt to be unimportant in explaining demand and/or certain significant explanatory variables are unknown or not quantifiable, the estimates of use resulting from coefficients derived from pooled data will approximate the demand for a site that incorporates the "average" of such features from all pooled sites. Also, this can result in explanatory variables dropping out of equations because pooling causes them to become statistically insignificant (variation is reduced by averaging for certain classifications). Thus, quality factors and certain socio-economic variables could easily be covered up if equations derived from composite data are utilized. Normally, if features distinguishing the pooled observations were known or quantifiable, either separate equations for each class or a single equation, using pooled data, incorporating dummy variables for the classes could be used. As Ben David and Tomek point out:

> The main advantage of estimating a separate equation for each class would seem to be flexibility. This approach allows for changes in all coefficients among classes. Also, while the usual tests of hypotheses assume a common variance for the disturbance terms of the separate classes, the use of separate equations permits estimates of these variances. To summarize, there is less likelihood of specification error, which might arise if the data were pooled using dummy variables.
>
> The main disadvantage, particularly in economics, would seem to be that the separate regressions may be based on a small number of observations. ... Dummy variables permit pooling the data for the various classes, and the net result may be an increase in degrees of freedom. [Ben David and Tomek 1965]

Because of the difficulties in definition and model specification, the dummy variable approach does not appear immediately feasible for recreation work nor required because of sample sizes. <u>However, fruitful research efforts could be directed toward comparing estimated equations for specific sites with</u>

Its value lies in a rather substantial exploration of a number of factors which could affect recreation demand. However, in view of several of its limitations this should not be taken as a definitive effort. The very fact that the results are at variance with those of others in a number of important areas should lead to caution in its use.

Based upon the data and studies discussed above, the Corps has undertaken to adopt a standardized method of recreation use prediction [1969, Tech. Rept. 2]. Crane has succinctly summarized this methodology:

> The separable component recreation use prediction methodology is comprised of the following steps:

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each other, with those from pooled data and using site and socio-economic characteristics to ascertain why they differ and what additional variables could help explain that difference.

Unfortunately, a recent draft report [U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation] appears to encourage, for planning purposes, the use of demand coefficients derived from composite data collected at a number of regional reservoir locations. The announced attempt is to formulate a general model to be useful in estimating use and economic value for a wide range of proposed projects within a region. However, none of the precautions mentioned above are taken. This could result in inaccurate estimates of use for a particular site. Since the specific estimates are what is needed, this approach should not be accepted for planning purposes without further testing. In essence, the approach assumes that all effects not explicitly included in the estimating equation are unimportant, and may cause certain factors to be excluded.

The use of pooled site data to formulate regional estimator functions is subject to the conceptual problems mentioned above and, consequently, its statistical accuracy is difficult to ascertain. If regional estimators are preferred because the "most similar project approach" is thought to be too costly or impractical because similar sites are not available, the market approach to recreation demand, coupled with appropriate spatial allocation models, should be explored as an alternative. This will be discussed in a later section entitled "Recreation Markets, Demand Allocation, and Facility Planning."

> 1. Evaluate proposed reservoir project characteristics including applicable alternative recreation opportunities. 2. Select a similar project or projects by comparing characteristics defined and, in part, quantified, by research studies. 3. Evaluate the day-use market area of the similar project. 4. Determine day-use market area of the proposed project. 5. Select per capita use curve for the similar project or projects. 6. Adjust per capita use curve reflecting dissimilarities between projects. 7. Determine county populations within day-use market area for anticipated year of project operation. 8. Calculate annual day-use from each county. 9. Sum the contribution from each county and define initial annual day-use. 10. Determine the percentage of total day-use in comparison to the total recreational use. 11. Determine the percentage of camping use anticipated relative to similar project or projects as modified by knowledge of the particular area of the project and desires of the local recreation and park agencies. [1970]

In essence, the procedure is based upon the use of a first step Clawson model of the simplest form and follows Clawson's suggestions for its use in planning situations [Clawson 1959]. It utilizes the "most similar project" concept in that projections for proposed reservoirs are derived from the per capita use values which exist for reservoirs of comparable size, operation and anticipated recreation-use characteristics. The 52 reservoirs for which use data have been collected are to be used as the supporting data base for selection of the most appropriate per capita day use curve.

Critique of New Corps Procedures: Although an improvement over previously used methods, the new Corps procedures are not without potential for revision and further improvement. As we have previously seen, without expansion the Clawson formulation contains several limitations and can be implemented under several different definitions of its important variables. It will pay us to reconsider these factors in light of the new procedures.

With respect to definition questions, the following appear to be the most important. First, alternative forms of the dependent variable have been utilized by previous empirical studies. "Visits" was used in the original Clawson report and adopted by others including Pankey and Johnston. However, recreation or activity days, as defined above, provide a more meaningful measure of recreation demand for use in planning and resource management. Many empirical studies have used one of these forms. The Corps methodology is less straight forward. "Recreation days" are used for day use projection but overnight (camping) use projection is based on the proportion of camping <u>use</u> to total <u>use</u> at the base site. The word "use" is not sufficiently defined but appears to refer to visits. If this is the case, the <u>total</u> use projections for a site would be based on a mixture of definitions. The obvious solution is to derive demand functions for overnight use (camping) using recreation days as the dependent variable. This would also place such estimates on a sounder basis.

Several other problems of correct model specification also arise. First, it must be decided whether information on "recreation days" or "activity days" is most desirable for planning purposes. Often, we would like to have data on "activity days" but the composite nature of outdoor recreation makes this data hard to obtain or difficult to interpret. Therefore, "recreation days" are usually used, as in the Corp's revised methodology. When questions regarding the activity mix arise, however, data on activity days may be desirable and consequently efforts should be made to develop more appropriate definitions of outdoor recreation activities for resource management and to estimate demand equations for such definitions. Second, when the coefficients estimated through empirical analysis of participation data are to be used for purposes of projection at proposed reservoir sites, it would be helpful to have the results of the various regressions segregated by type and quality of resource area. For example, Clawson has distinguished recreation areas by type; namely resource oriented, intermediate and day-use [Clawson and Knetsch 1966, p. 38].[19] The type of recreational area involved often influences the factors which affect demand for it. In other words, different demand functions will be obtained for areas of different type and quality. Although the modified Corps procedures supply copious statistics on the characteristics of the various sites investigated and suggest their use in choosing similar sites, no standardized mechanism is available to field personnel for classifying these sites by quality or site characteristics. This provides the respective field offices with substantial discretion in their use of the procedures and may result in widely varying and inconsistent application. Additional research effort needs to be expended in this area.

Closely associated with the definition of the dependent variable is the definition of cost or price used to formulate the basic demand relationship. Obviously, the exact form of this variable in the relationship is a matter of model specification. It would appear *a priori* that comparable definitions to the dependent variable could be utilized. In other words, if recreation or activity days are used to define the dependent variable, the cost variable could be defined as "costs per recreation or activity day." Such definitions would naturally differ from that of "costs per visit" which appears to be most appropriate to use when the dependent variable is defined as "visits." The Corps methodology does, however, utilize total distance from population origin zones to site rather than distance per recreation day as the appropriate

[19] Others have called for a classification based on user-oriented and resource oriented areas [McClellan and Medrich 1969].

definition. Obviously, this presents less data problems and, for day use, is the same as "cost per recreation day." If overnight occasions are of concern, however, this problem should be recognized.

As previously indicated, the allocation of trip costs among various purposes of a longer trip is empirically and conceptually difficult. The problem has usually been ignored but even this implies a specific value judgment. Because distance is calculated as the most direct route between the origin of the participants and the recreational site under consideration, the implication is that the visit is the main purpose of the trip and that only the costs which would be incurred on a direct route to that purpose should be charged against visitation of the site. Although this has worked reasonably well for most studies, the problem becomes increasingly complicated if additional information on actual monetary transfer costs are added to a model. The methodology adopted by the Corps essentially adopts the approach used by most studies. This cannot be faulted with the model in its present stage of development but could become a problem if other cost variables are added.[20] (See

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[20] In a preliminary study, Rugg made a rough attempt to develop survey questions which would delineate more specifically the purpose of a trip to a recreationist [1970]. Two types of diverters were identified - route diverters and multi-purpose travellers. Data on diverters, as well as for those visiting a site on a single purpose trip, were used to derive separate demand functions for the site. However, the base population utilized for diverters was not the population of the counties or distance zones of origin. Rather, nearby highway tourist traffic was used as the base. Although this was thought to be a refinement of the Clawson methodology, it merely postpones the problem of dividing trip costs among purposes and provided little insight into demand from future populations. For example, the proportion of diverter travel costs utilized to travel off the main route to the site under consideration still needs to be segregated from total costs, and projections would require estimates of future use of nearby highway networks. As Rugg

pages 33 and 34.)

Another definitional problem has centered on how distance zones are to be classified. The two approaches utilized have been the original concentric zone idea of Clawson and the use of counties or states surrounding a recreational area. Virtually unanimous agreement exists that the county or state definition is superior when the simple Clawson formulation is to be expanded [Boyet and Tolley 1966; Merewitz 1966; Grubb and Goodwin 1968; Pankey and Johnston 1969]. Comparisons of the two approaches have been made by Pankey and Johnston and the results seem to indicate that either approach provides "statistically significant" results. The revised Corps methodology utilizes the original concentric distance zone approach to derive per capita use rates from existing projects but applies these rates to actual or forecast county population data to make projections. The implicit assumption is that the average per capita rate for a concentric zone can be applied to any area falling within that distance range. Although little objection can be raised against this procedure because only distance is used as an independent variable, it does make the transition to more sophisticated models difficult in that the entire set of distance calculations would need to be recalculated.

A final model specification problem centers on the influence of population. Most empirical work has assumed that population should be attached to the dependent variable and the resulting coefficients estimated in terms of per capita visitation data. Some empirical work has indicated that this is statistically justified since the elasticity of the population

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himself pointed out, the principal implications of his approach were for the optimal location of recreational facilities rather than estimates of their anticipated use.

variable when entered as an independent variable usually is not significantly different from one [Boyet and Tolley 1966; Pankey and Johnston 1969]. This finding, however, has not been universal [Pankey and Johnston 1969]. The revised Corps methodology places use on a per capita basis and thus follows the lead of most studies in this area. However, further research needs to be carried out on this question to see if the elasticity of a population coefficient is consistently not significantly different from one and whether the entry of other socio-economic variables in an expanded version of a recreation prediction model will affect this factor [U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation].

Given some discussion of definitional problems involved, let us turn to several limitations of the new Corps techniques. First, to be most accurate the "most similar project" concept should be extended to include "the most similar market areas" concept. Because the formulation includes only distance as an independent variable, blind application of per capita use rates for projects having similar characteristics ignores the fact that market areas can also differ. For example, the quality of the connecting road network, the socio-economic characteristics of the market population, the range of alternative sites, and possibly the mix of "activity days" (as opposed to "recreation days") and type of occasions (day-use or overnight) can vary substantially. Some of these factors can be accounted for by careful comparison with the pertinent descriptive data on each participating reservoir and the summaries given on recreation use. The new procedures recommend this but do not provide for a systematic way of carrying it out. The essential element of judgment involved in selection of a similar project(s) area(s) makes the use prediction process readily adoptable to sensitivity analysis. Since no existing project can be expected to exactly approximate a proposed recreational area, it would appear important to select an appropriate range of projects and apply their respective equations to evaluate the proposal. In this way, the sensitivity of use and of the resulting value estimate to variations in known characteristics can be ascertained. This would provide the decision maker with a better overall impression of the probability associated with a median selected forecast.

A similar limitation is the absence of socio-economic variables in the prediction formulation. Most studies subsequent to Clawson have modified the technique by adding such variables and virtually all have found a number of them to be statistically significant. The lone exception to this fact is the study for the Corps done by Pankey and Johnston [1969]. However, the composite nature of this study (across 7 reservoirs) and other factors may have caused this result. The Corps modified estimation procedures do not utilize any variables other than distance to estimate recreational usage. Although this appears defensible in view of the high correlations achieved, it does not guarantee the lack of potential influence of such factors. Crane has suggested that the use of standardized models which incorporate a number of the factors felt to be important in estimating recreation demand would be premature for use projection in the planning process. He cites the fact that quantification of such factors is usually in terms of averages and does not account for their distribution. However, this should not deter the use of econometric techniques in use estimation. When the distribution of a particular factor is felt to be significant, methods exist for incorporating it. For example, as in the Brown et al. [1964] study, a particular characteristic or factor can be segregated into subcategories and separate estimates made for each category. Efforts should, therefore, continue to expand the simple formulation utilized to include factors which appear to be important to overall demand for recreational facilities [Hendee 1969; U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation].[21]

Likewise, the question of changes in regression coefficients over time are not covered by the revised Corps methodology. As more time series data becomes available (assuming that the data collection program continues) better efforts should be made to ascertain whether this factor is important and research in this area should be given high priority. Up to this point, only a few studies have attempted to look at this factor [Pankey and Johnston 1969] and usually the effort has had mixed results (see pages 35 and 36).

Two other limitations of the Clawson technique include time constraints and substitution areas for those demanding outdoor recreational facilities. However, as was indicated previously, these two limitations normally affect the estimation

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[21] It needs to be recognized that such an expansion of the model complicates the projection process. Independent projections of all the included explanatory variables for the time periods of interest and the relevant populations are needed. Formerly, only population projections (easily obtained from census estimates) were required along with physical measures of distance between the proposed site and visitor origin zones. Usually estimates of socio-economic and other relevant variables for specific regions are difficult to obtain and diverse sources must be used [Clawson and Knetsch 1966, Ch. 6; Kalter and Gosse 1969, Appendix G]. The problem of obtaining consistent and comprehensive estimates is obvious. Recent efforts sponsored by the Water Resources Council have attempted to fill this gap for some of the more important variables of interest; including population, income and leisure time (hours worked) [Water Resources Council 1968]. Although these projections are for broad water resources planning areas (as opposed to counties), they do appear to provide a consistent set of base data and efforts should be made to expand their coverage and add to their numbers.

of economic value (the second stage of the Clawson formulation) and not the estimation of use at no increase in transfer costs. Therefore, we will defer a discussion of these factors as they relate to the new Corps procedures until the section on economic value.

In general, the limitations of the new Corps procedures should not inhibit their implementation. Rather, the procedures should be thought of as a move in the right direction which can serve as a strong foundation for future efforts. If the decision is made to continue the development of this approach, as opposed to one utilizing some form of regional estimators, gradual modifications in the suggested methodology could be made (as additional data and research become available) to overcome the various problems.

The Question of Alternative Resource Uses: Before proceeding to consider methods of estimating the economic value of a recreational site, one additional problem with respect to use projections needs to be explored. Basically, this involves the alternative recreational uses of a proposed investment site. Although this is a fundamental issue, it is often not considered in plan evaluation or, when considered, is inadequately dealt with. The revised Corps procedures do indicate the importance of estimating existing recreational use at the prospective site under "pre-project conditions." The benefits accruing because of such use, however, need to be compared with those estimated for the investment itself so that the net effect (positive or negative) can be derived. Merely estimating the net change in recreation days because of a project is not sufficient. Because the activities which could take place under pre-project conditions may differ from those taking place after project construction, the shape of the respective demand functions may be substantially different. Also, it is obvious that alternative uses for a site can differ in terms of quality as well as size and activity mix. For example pre-project utilization may provide a recreational experience which exceeds the quality of post project use. Thus, similar demand functions cannot be utilized to estimate both the with and without situations. In such circumstances, the demand functions for the respective activity mixes need to be derived so that correct estimates of use and economic value for both pre and post project situations can be determined and the net economic value, rather than net use, can be ascertained.

For example, as wild river areas become scarce their value should increase even though use per size of physical area will remain relatively small. From a national efficiency viewpoint, whether this value exceeds the value in its alternative use (because of differences in price elasticity) can only be decided if such effects are fully quantified [Knetsch 1969].

As Haynes has stated:

> The main criticism of the present Corps' methodology is that it is site orientated and considers only the demand for reservoir oriented recreation. Also, a hidden problem in outdoor recreation is that supply often creates demand. ... while the methodology does give demand for a site for reservoir oriented recreation, it ignores the value of the site destroyed and the demand for recreation offered by it. [1970]

As Keuhn and Brewer indicate, "development of reservoirs destroys stream resources which many recreationists prefer. Free-flowing streams and their possible improvement are sacrificed without evaluating the resulting negative benefits." They continue: "all alternative projects and combinations should be studied. Methods of estimating attendance and value per activity-day need to be improved and developed for all types of facilities, not for reservoirs alone" [1967, p. 458]. Such a prescription becomes even more valuable when the irreversible character of developing a given water resource is considered.

To account for such factors, data on non-reservoir recreational uses of our natural resources and recreation use prediction models for such activities are required. This would mean an expansion of the Corp's data collection program to areas beyond current Corps responsibility. Accurate estimates of the net attendance and economic value impacts of alternative proposals can only be judged if such information is available. It is urged that data collection and demand analysis on non-reservoir recreation uses commence immediately so as to avoid bias that would be built-in to the planning system toward a specific type of recreation.

Economic Value of Recreation Resources: Prediction of recreation attendance, although useful, does not give an appropriate indication of economic value derived from a particular resource or permit comparison with alternative uses of that resource. To be evaluated on a commensurable basis with other functions of water resource development or other uses of the resources in question, governmental decision makers need value information on outdoor recreation. For example, to realize recreational benefits, an economic cost must be incurred for facilities and other investments. To ascertain which use provides the greatest net benefits, and thus, to determine which type of recreational facility (the mix and/or number of activities provided) is most desireable from an efficiency perspective, the economic value of the alternative uses is required.

Measurement of the primary economic value stemming from the provision of outdoor recreational facilities or services follows naturally from the attendance prediction models examined in the previous section. As pointed out, the Clawson approach can be utilized to derive a demand function for a particular recreational facility and that function, in turn, utilized to estimate its economic value. However, mere derivation of the demand function for a particular site does not specify the appropriate approach for valuing the site. Several alternative approaches have been proposed and utilized in empirical studies. We will return to explore these in some detail after a brief discussion and critique of prior proposals to value outdoor recreation.

<u>Historical Approaches to Economic Value Estimates</u>: The economic benefit or value of providing outdoor recreational facilities was, during the 1950's, often estimated by using ad hoc methods [Trice and Wood 1958]. Although the National Park Service did not, at the time, consider quantifying benefits from the use of recreational facilities a logical undertaking [Prewitt 1949], they and the resource development agencies were often pressured to evaluate recreational benefits for comparison with alternative uses of public funds [U. S. Senate 1957].

Expenditure and Cost Methods: In an effort to place a value on recreation opportunities, the expenditures by those using recreational facilities <u>or</u> the cost of providing such facilities were often used as an approximation of primary benefits. As Trice and Wood point out:

> The expenditure approach assumes that dollars spent for recreation by those persons engaging in it are appropriate measures of recreation benefit. ... It is not a satisfactory method for measuring the intangible values to the persons enjoying recreation. In the first place, many so-called recreational expenditures are normal expenditures made under slightly different circumstances. ... And, in the second place, even those expenditures which are over and above normal living costs are not necessarily measures of the recreational enjoyment but are the price paid for certain goods and services for which there are established market values. [1958, p. 199]

The expenditure method, therefore, assumes that recreation is worth at least as much as a tourist is willing to pay for it. Although the method has been used to estimate both the economic value of recreation to the recreationist and the value to the local community in terms of total expenditures on goods and services, such values do not provide an approximation of the worth of the site itself [Lerner 1962]. In addition, quantification of recreation benefits through the use of such a mechanism does not place recreational value on a comparable basis with other functions of resource investment projects. Therefore, biased comparisons and tradeoffs among functions and between projects would result. What is needed is a measure of net rather than gross economic value.

The cost approach to estimating benefits is without any conceptual basis and of no practical value for evaluation purposes. The thrust of the approach is that benefits would always equal or exceed costs. Obviously, this provides no guidance for purposes of resource allocation. As Brown et al. [1964] have pointed out, this is a good example of circular reasoning since any action is automatically justified. Even though this is the case, the cost method was used by the National Park Service between 1950 and 1957. The principal rationale at the time was to obtain value estimates that would permit cost allocations to take place.

Gross National Product Method: Lerner [1962] has also discussed a third approach suggested for benefit evaluation. This approach attempts to measure the contribution of recreation to gross national product. It takes two forms. The first attempts to measure the social value of recreation by assuming that the value of a day spent in recreation is equal to the gross national product per day per capita. The second attempts to measure the direct contribution of the recreation industry to gross national product. Neither method is intended to be comparable with benefit measures for other functions of resource investment. Moreover, both fail to recognize that the benefits of providing public goods have never been included as a component of gross national product (only investment expenditures). Therefore, basing benefit evaluation on a social accounting system of this type obviously had no relationship to the value of recreation to the individual participant and would, at best, be an inaccurate and misleading indicator for such value. As Lerner points out, these methods attempt to treat recreation as a factor of production rather than as a consumer good [1962, p. 60].

Land Value Method: A fourth approach dealing with land values has often been suggested as a means of evaluating the economic benefits from recreation components of water resource projects [Knetsch 1962 and 1964; David 1968 (2)]. Although grounded in economic theory, the method provides only a lower bound to true economic value. Thus, it has been essentially superseded by the possibility of estimating user benefits from demand functions, and made infeasible by the nature of land use development (public) around many proposed reservoirs. In essence, the method attempts to estimate the impact of reservoirs on surrounding private land values.[22] However, as Knetsch points out, "the value of land adjacent to reservoirs may not be entirely independent of other project benefits, but may represent a capitalization of a portion of the same benefits." Since this is a common occurance, benefit evaluation could not consider both the project's value producing aspects and the land enhancement that would result. To do so would be to double count the value produced [Knetsch 1964]. Knetsch and David both felt that if user benefits were not quantified for recreational facilities, land value increases around reservoirs could be examined and utilized as an approximation of consumer willingness

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[22] Whenever the land value method is used, the evaluation must be carried out on a with-without basis. If a before-after approach is utilized, the effects of other variables on changes in land value over time will not be accounted for and the overall change incorrectly attributed to the project under consideration. For an example of this, see the report by Milliken and Mew [1969].

to pay for recreation use. Although "not all of the recreational benefits produced by a project will be capitalized into land values and therefore will not be measured in land value increases," they could be used when access points to a reservoir were restricted [Knetsch 1964]. The nature of use at most Corps reservoirs would make this a minority occurance, however. Thus, user benefits, measured by willingness to pay, can be considered as largely independent of land values or, when capitalized into land values because of revenues accruing to commercial establishments, double counting would occur if both the user benefit and the land value enhancement benefit were included in an evaluation. While the land value approach can provide useful information to local governments concerned with tax assessment questions, it is of little value in evaluating user benefits from the provision of recreational opportunities by agencies such as the Corps of Engineers [David 1968].

Merit-Weighted User-Days Method: In still another study, Mack and Myers "explored concepts and methods for providing a useful measure of the benefit derived from government expenditure on outdoor recreation" [1965]. They conclude that recreational benefits cannot be given a monetary measure but rather should be calibrated along a utility scale composed of merit-weighted user-days. In essence, the method rejects monetary values as a measure of recreation's worth to society and substitutes what the authors call a physical service unit - merit-weighted user-days. This rejection is based upon the authors' view of both conceptual problems in determining such a value for a diverse service like recreation and empirical problems. Part of their attitude can be traced to a failure to clearly distinguish between conceptually independent objectives of public action and part to the difficulty which they see in incorporating extra-market factors into estimates of shadow prices for recreation. As our previous discussion has indicated, neither of these problems is of such a magnitude as to suggest the rejection of evaluation attempts made through demand analysis. Because of subsequent progress in this area, the Mack-Myers approach has been largely neglected. Moreover, the relatively unsophisticated and judgmental basis suggested for weighting user-days raises the spector that actual differences in value between recreational sites, activities and individuals will not be properly ascertained by the method. Its use for making comparisons among the various functions of government would require that comparable measures of value be provided for such functions. The difficulties implicit in such an undertaking appear to be no less than those of the demand analysis approach. The attempt to derive a direct measure of social welfare from the provision of a government service is conceptually appealing but empirically difficult since "utility" is not susceptible to direct measurement.

Market Value Method: Finally, the market-value method has been suggested as an appropriate means of measuring recreation benefits. Estimated attendance is utilized with a value chosen to approximate prices charged at privately owned recreational areas of similar quality and composition. In essence, this is the method which has been utilized up to the current time by federal agencies involved in the construction of recreational facilities [Ad Hoc Water Resources Council 1964]. However, it is subject to the limitations raised earlier in this chapter and the assumption that prices at private recreation areas are transferable to public areas. For a number of reasons this will probably not be the case [Clawson and Knetsch 1966, p. 227]. As Smith and Kavanagh indicate, "the main difficulty of such an approach is that private recreation facilities tend to offer a different service, namely exclusiveness; a second bias arises by virtue of the fact that public facilities are provided without charge, and this tends to force down the price of private facilities" [1969, p. 319]. Moreover, as Lerner has shown, market values are not used in the evaluation of other publicly provided functions of water resource projects. Thus, a comparison made between functions would be biased when using this method.

Consumer Willingness to Pay: The market value method does recognize the need to evaluate recreational benefits on the basis of consumer's willingness to pay. Conceptually, however, more appropriate ways exist to accomplish such an evaluation. The Hotelling-Clawson formulation discussed previously can serve as a foundation for the derivation of such values.[23] As that discussion indicated, the second step of the formulation (derivation of a demand function for the recreational site from that for the entire recreation experience) needs to be completed before such value estimates can be determined. As Knetsch has pointed out, "While attendance information is useful, large numbers by themselves do not give us complete indications of value which have utility for comparing this use of resources with alternatives" [Knetsch 1965, Economics of Including Recreation, p. 1148].

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[23] In a recent article, Pearse [1968] criticizes the Clawson approach because the base populations utilized to derive the demand function for the entire recreational experience are assumed to be homogeneous. He proposes a method which entails dividing the visitor population into distinct income classes and estimating the consumer surplus they receive by calculating the difference between each visitor's travel cost to the area and the highest travel cost incurred within that particular income group. The latter was defined as the marginal visitor. Norton, however, comments that Pearse in eliminating the homogeneity assumption of the Clawson analysis "merely diverts this fundamental assumption to income groups, with the supposition that visitors within the same income category have identical indifference maps [1970]. Pearse's criticism ignores the potential expansion of the Clawson formulation and use of his approach would make prediction of future visitation rates and economic value difficult.

The rationale underlying the original Hotelling suggestion on recreation demand function estimation was to utilize the results to estimate consumer's surplus for evaluation purposes. As Hotelling indicated:

> It is this consumer's surplus which measures the benefits to the public in that particular year. This, of course, might be capitalized to give a capital value for the park, or the annual measure of benefit might be compared directly with the estimated annual benefits on the hypotheses that the park area was used for some alternative purpose. [1949]

Following Hotelling, many have advocated the consumer surplus approach when using demand analysis. However, this has meant various things to various people. It has been used to indicate a measure of the total area under the demand curve. This is strictly correct only when the price or entrance fee to the facility under consideration is zero. When such is the case, the measure of consumer surplus is the same as the revenue generated to a perfectly discriminating monopolist. The imposition of an entrance fee, however, makes a more specific interpretation necessary. Consumer surplus is, following Marshall, the excess of the price the consumer would be willing to pay rather than go without the item under consideration over that which he actually does pay. Consumer surplus in this case is not the same as the revenue to a perfectly discriminating monopolist. A third formulation, and an alternative use of the demand curve, would be to select the price and quantity that would maximize revenue to a non-discriminating monopolist.

Both Hotelling and Knetsch accept the use of the discriminating monopoly return while Clawson [1959], and Brown et al. [1964] and Crutchfield [1962] appear to favor the non-discriminating monopoly return as a measure of value.[24]

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[24]The Trice-Wood formulation was the first attempt to

Knetsch [1963] argues that primary benefits from the recreation component of proposed projects are measured by the entire area under the demand curve. He indicates that such a measure approximates what consumers would be willing to pay for various units of output and is consistent with benefit calculations for other project functions. In other words, the market value of the service provided plus consumer surplus makes up consumers' willingness to pay. In addition, since the increments to supply from such projects are often relatively large and resources immobile, willingness to pay will be poorly measured by a single market price. Initial units of output are valued at a much higher rate than final units. On the other hand, "to the extent that there are readily available areas which can be substituted, the demand curve for the area in question will become flatter, indicating that we are approaching more closely

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empirically implement the Hotelling suggestion. It was based upon uniform gross benefits for all recreationists. Rather than using the difference in cost between distance zones as Hotelling suggested, Trice-Wood used the cost difference between percentiles of visitor days as the measure of consumer surplus accruing to participating recreationists. Neither approach, however, measured the consumer surplus accruing from the provision of a particular site. Rather both were based on the derivation of demand functions for an entire recreation experience rather than for the site itself. A true measure of consumer surplus needs to account for the effect of price changes on demand for a given site. The Clawson reformulation of the Hotelling suggestion permitted an estimation of consumer surplus for the site itself.

Merewitz [1966] suggested that consumer surplus defined in its traditional sense, rather than the revenue accruing to a perfectly discriminating monopolist, would be the more appropriate value to use when the measurement was derived from a demand curve for the entire recreation experience rather than for a function relating to the site itself. However, it is unclear that the consumer surplus value would accrue only to the site under consideration. Therefore, the Merewitz approach (namely the estimation of a first stage Clawson model and the derivation of a consumer surplus value from the derived function) has not found substantial support.

the case of most other goods and services which can be appropriately valued at a single price for each unit" [Clawson and Knetsch 1966, p. 219]. Thus, the area under the demand curve is the appropriate measure of benefit and would be consistent with a private market evaluation of such outputs [Knetsch 1965, Potentials of Water-Based Recreation]. As Grubb and Goodwin point out:

> Calculations of other benefits from multi-purpose water development projects, such as flood control, water quality, and water supply, also incorporate features of consumer surplus. The benefits for each single-purpose project are usually considered either equal to the value of the most likely or least costly single alternative when alternative projects could be undertaken, as in municipal water supply, or are based on the potential economic losses to the economy without the project, as in flood control benefits. Neither of these methods of benefits estimation uses the concepts of willingness to pay as would a market price. In practically all cases, the benefits for single-purpose projects are of such nature that consumers either have little choice of whether or not to engage in projects, as in water supply, or must bear high risk, as in flood hazard. The benefits, therefore, are more nearly indicative of the total value of projects to water-oriented recreation consumers as stated here than if the benefits estimates were based entirely on total revenue to be derived from the sale of water or the "book value" of flood damaged property. [Grubb and Goodwin 1968, p. 18]

A site demand schedule can also be utilized to determine the entrance fee that would yield the maximum net revenue to the owner of a recreation area if he were a private market monopolist. The Brown study felt that an advantage to using the value accruing to a non-discriminating monopolist was "that it comes closest to imputing a value to the fishery resource comparable to what its value might be if it were privately owned" [1964]. Such a fee can then be used as a measure of benefits per recreation day. The method, however, does not account for lumpiness in recreation supply nor the obvious problems connected with the derivation of a monopoly price under conditions when demand is inelastic or of constant elasticity over a broad price range. Because of these problems, most evaluation techniques for publicly provided goods and services from natural resource developments utilize the discriminating monopoly revenue method - total consumer willingness to pay.

Conceptually, Marglin has best stated the rationale for this procedure.

> ... the economic pie ... is superior to the concept of national income. The difficulty with national income is that it is too closely tied to market values. ... if a water-resource development made great amounts of electrical energy available for residential consumers at low cost, it would add more to the size of the economic pie than another development scheme which made smaller amounts available at higher cost, even if the national-income value of the latter scheme measured at market prices were to be higher than the former. Such considerations have lead economists to speak of the size of the economic pie in terms of a more fundamental principle, namely economic efficiency. [Marglin 1962, p. 20]

The consistency of this approach with other measures of functional benefit is important when making comparisons among alternatives. As Brown et al. point out, the identification of a proper value measure might be highly dependent upon the decision making situation for which it is to be utilized. Comparison of benefit estimates across functional areas or between two uses of the same resource requires comparable methods of value estimation.

Utilization of willingness to pay techniques to measure recreation value does require that the assumptions of utility maximization and constant marginal utility of income be made. Moreover, benefit evaluation will always assume a given income distribution. Thus, efficiency calculations based upon recreation benefits derived in such a manner should not be the only criterion of choice when making decisions on recreation resource investments [Hines 1958]. Moreover, it should be explicitly understood that the economic value being spoken of in this section is not necessarily consistent with user charges imposed for use of a particular facility [Knetsch 1966].

Measures of willingness to pay (defined as the entire area under the demand curve or consumer surplus plus market value) can, then, be derived if the demand function for the recreational site under consideration is known. Such values do not include estimates of willingness to pay by segments of the population for the "option" of attending the area in question sometime in the future or of the value resulting from externalities caused by recreational participation.[25] The primary national efficiency benefits are thus what is being measured from a site demand function. Again, "demand curves conceptually link such willingness to pay with the estimated value of the resources when used for this purpose. Demand curves, as we noted previously, reflect human choices and aspirations, as consumers weigh one good against another, with incomes inadequate to buy everything that they might desire" [Clawson and Knetsch 1966, p. 216].

Thus, total willingness to pay by consumers can be approximated as the sum of the maximum prices which various users would pay for the various units of output from a proposed investment. This value being a total area under the demand curve can be approximated in the following way. Using our previous example on page 31, 400 recreation days or visits (depending on the definition of the dependent variable) will be valued by those who participate at between 3 and 6 dollars per visit,

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[25] As Clawson and Knetsch have pointed out, however, such factors have doubtedlessly been grossly exaggerrated as to their total worth relative to primary benefits [1966, p. 216].

giving a total value for this segment of visits of 400 times $4.50, or $1800. Another 1000 visits would be valued at between $2 and $3, or $2.50 times 1000. Finally, 2400 visits would be valued at between 0 and $2 or an average of $1 per visit. The sum of these values is equal to $6700 and this can be taken as an approximate measure of the gross economic value provided by our hypothetical example per unit of time.

As an alternative, integral calculus could be utilized to calculate the area under the demand curve. A slightly different approach has been suggested by Wantrup [1952, pp. 241-42] and implemented by Davis [1963, The Value of Outdoor Recreation]. Wantrup's suggestion was that surveys of consumer intentions be made to ascertain reactions to varying fee schedules. From such direct survey samples, estimates of the willingness to pay for a particular resource could then be made. The rationale is similar to that of the Clawson formulation. However, there are obvious problems of bias in the use of such surveys. Difficulties are often involved in obtaining true revealed preferences from a sample of consumers. Skilled interviewing can compensate for some of these problems but the costs of obtaining the required information will generally exceed that of the Clawson approach. By using an indirect approach to defining a site demand function, Clawson attempted to avoid a number of these problems. For this reason, the interview approach to willingness to pay measurement has not been widely utilized. Its primary value has been in suggesting that indepth interviews in conjunction with obtaining travel-cost data may be helpful in improving the application of the Clawson formulation [Knetsch and Davis 1966, p. 141].

Given the clear superiority of the willingness to pay techniques (derived from either simple or modified Clawson type formulations), Crane has recommended that the Corps of Engineers adopt the willingness to pay procedures to estimate the economic value of recreation provided at proposed water resource investment projects [Crane 1970]. Using the willingness to pay technique, alternative investments can be tested for their ability to provide maximum net benefits and choices among these alternatives can be made. As we will point out in more detail in the following section, the benefits calculated in the manner described above should only be utilized if sufficient capacity exists to accommodate the projected number of visitor days with no overall decrease in the relevant quality components. If this is not the case, over-counting will take place and the projections utilized will not be an accurate measure of value to be expected.

Limitations: Utilization of the site demand functions for purposes of estimating economic value, does have certain limitations. Several of these have been discussed previously. The factors most critical to the estimation of the site function itself will now be considered. First, when demand functions are derived with distance as a proxy for price, derivation of a monetary measure of benefit requires that this definition of costs be translated into actual monetary values. The question of which cost per mile values should be utilized is then raised [Smith and Kavanagh 1969]. Often it is suggested that only the marginal cost per mile is the appropriate measure since that is the only value that is directly attributable to the trip under consideration.[26] A cost per mile figure derived from other

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[26] A straight conversion on the basis of cost per mile per visitor-day is not the same as the "marginal operating cost per vehicle-mile because it does not incorporate round trips, groups of visitors riding in the same vehicle and spending several days at the site, the value of travelling time, and a number of other important factors" [James 1968, Evaluating Recreation Benefits]. Boyet and Tolley [James 1968] reply that demand functions resulting from such a conversion would have the same price coefficient but would contain a different constant term. Thus the benefit estimate would change but the

studies is often utilized to make such a conversion. To the extent that this data is an inaccurate representation of what the consumer perceives he actually pays for the experience, an inaccurate total benefit value for the site will be obtained. Although the conversion will not bias the relative values of alternative sites because the elasticity estimate will not change, the comparison among project functions can be misrepresented.[27]

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number of predicted visits would remain the same. In any case, James suggested and Tolley agreed that a more realistic equation for conversion from distance to monetary units would have the following form:

$$C = 2r[(1 + a)m + t/v]/bp$$

"where C is the cost per mile in dollars per visitor-day spent at the site, 2 accounts for round trips, r is the ratio of road to air distance usually found in prediction equations, a is the expense incurred for food and lodging above that spent at home expressed as a fraction of vehicle operating cost, m is the variable vehicle operating cost in dollars per mile, t is the value of vehicle-hour of traveling time in dollars, v is the mean vehicle velocity in miles per hour, b is the number of days visitors remain at the site, and p is the number of visitors per vehicle" [p. 437]. The formulation assumes that air distance was initially used rather than actual mileage, that recreation or activity days are the appropriate definition of the dependent variable, that traveling time can and should be valued in monetary terms for the conversion, and that the costs of a recreation day should be divided among all those contained in a given party. Tolley questions whether "visitors who stay different numbers of days should be lumped together in the same demand curve." He indicates that a better procedure may be to estimate different demand curves for different types of visitors and then sum these to obtain total demand. James further indicates that the total cost derived from the equation should not be applied to "total travel distance from the home of the visitor to the reservoir." In essence, the argument is as we have discussed it previously. Namely, that only a portion of total cost is associated with a given visit when the purposes of the trip are multiple or when route diversion takes place.

[27] Obviously, the price elasticity for the entire recreation experience and that for the site itself will be significantly different. As Knetsch and Clawson point out, "economists have long known that the elasticity of derived

Crane has suggested that the Corps utilize such an approach in converting the first stage distance values to cost figures. Utilizing data from the Bureau of Public Roads in the Department of Transportation, he estimated that a per person cost of $0.0159 per mile travelled ($0.0477 per mile per automobile with three occupants) was the appropriate marginal travel cost involved [Cope and Liston 1968; U. S. Army Corps of Engineers 1969, Tech. Rept. No. 2; Crane 1970]. Utilization of distance as a proxy for price requires such a conversion and when it is made care should be used to obtain accurate and current estimates of marginal travel costs. An improved formulation, however, could be obtained if the appropriate transactions costs were utilized in the first instance rather than distance as a proxy for price. Additional data and research will be needed to carry this out.

Failure to account for time as an additional constraint in the demand formulation will result in an underestimate of economic value derived from the site demand function. As Cesario and Knetsch have argued:

> Perhaps the most serious difficulty of the travel cost method, as it has been applied in the past, is a consistent bias in the derived demand curve. This difficulty results from the basic assumption that the disutility of overcoming distance is a function only of money cost. This assumption is not correct. The effect of distance is likely to be a function of the time

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demand is less for a commodity or service which forms only part of a larger commodity or service than it is for the whole commodity or service; comparatively large variations in the price of the component commodity exert relatively small effects on the price of the larger commodity" [Clawson and Knetsch 1966, p. 85]. The demand for the site or resource will always be more inelastic than the demand for the entire recreation experience. The implication of this fact for reimbursement and financing considerations should be clear. However, the point at issue here is whether comparisons among alternative project functions will be biased.

> involved in making the trip as well as of the monetary cost. Little is known about the significance of the time factor and in past studies it has been effectively ignored in benefit estimates, even though it may be expected that for many if not most recreational trips the effect of time on visit rates is likely to be of equal or even greater importance than the actual monetary cost incurred. [1970, p. 702]

Several approaches to this problem have been suggested. Smith and Kavanagh [1969] have placed an actual monetary value on time, determined the amount of time spent travelling, and added the value of time to the cost of travel in making their demand estimates. Because of the multiple problems involved in placing a monetary value on leisure time, they utilized a sensitivity analysis in their work and formulated the demand function for three different time valuations. Thus, the sensitivity of the final result to a change in the assumption on time values could be ascertained. Their finding indicated that the time bias may "not be as serious as some people may have feared, but it could be significant in a number of cases, where the decision to invest or not to invest is a marginal one" [p. 332]. Their approach, however, requires the heroic assumption that money can be substituted for time in a linear fashion. This may not be the case and has lead to a slightly different formulation of the problem.

Cesario and Knetsch have indicated that the derived demand function could be corrected if time, as a separate variable, was included in the function. Thus, the effects of the two components could be separated, and the respective impacts of the two components assessed by keeping one fixed while varying the other through an appropriate range. The problem has been an empirical one of estimating the separate effects in that high correlations normally exist between travel costs and time making it "virtually impossible statistically to separate the effects of one from the other" [1970].

In an effort to overcome the empirical difficulties, Cesario and Knetsch generalized the approach used by Smith and Kavanagh. Rather than assuming linear tradeoffs between cost (distance) and time, they formulated a tradeoff function between the two components and utilized the resulting coefficient to formulate a new variable which combined elements of time and cost. As they indicate:

> Though the original bias is no longer there, the new formulation does require an assumption concerning the trade-off function between time and money. There is no guarantee, without some empirical verification, that the slope indicated by this particular formulation of the trade-off between time and money is correct. It might also be presumed that different income groups within each population center would exhibit trade-off functions of different slopes. [1970, p. 704]

The Cesario-Knetsch formulation is an improvement over the straight linear assumption of Smith and Kavanagh. However, little information exists on the shape of the trade-off function and, thus, the accuracy of the resulting correction to estimates of economic value is unknown. Additional information is needed on how populations exhibiting various characteristics view the trade-off between time and money.

A final factor which has effects on value estimates similar to that of the time constraint problem is that of substitute or competing recreational sites. As with the time variable, the best means of handling this problem appears to be by the introduction of an additional variable in the demand formulation to account for the influence of substitutes. Several have made attempts empirically to introduce such a factor [Cesario 1966; Merewitz 1966; Grubb and Goodwin 1968; Pankey and Johnston 1969]. Not all of these attempts have been statistically successful, however. In general, all forms have utilized a version of a gravity variable to approximate the effect of alternative sites. For an example of one such formulation see the quotation from Grubb and Goodwin on page 47. As the Clawson formulation is expanded for use by the Corps of Engineers in their planning process, further experimentation with the use of such variables should be continued and additional data collected on substitute sites (including, perhaps, classifications of such sites by quantitative quality indicators) so that improved formulations can be tested.

SITE CAPACITIES, RECREATION DEMAND AND ECONOMIC VALUE

The issue of site capacities arose at two points in our previous discussion. In the last section, it was suggested that the recreational capacities of existing sites vis-a-vis the actual recreational use of those sites can have implications for empirically estimated "demand" equations (see page 35). Only if a site is not being used to capacity will the resulting equations accurately represent the true demand relationship at that point in time. On the other hand, if the data used to formulate demand functions are derived from a site being used to capacity, the effective demand relationship may be underestimated. In this case, consumption (use) is not the same as demand for the site. When derived equations are used for projecting the recreational use and value of proposed sites, biases in the estimating coefficients can give misleading indications of the actual demand to be expected, and consequently, of potential economic value from the servicing of that demand.

A second issue also involves site capacities. Assuming that estimating equations are not biased, the total economic value estimated to result from projected demand cannot be considered a real benefit unless sufficient capacity will exist at the proposed site to accommodate it (see page 4). Moreover, meeting total demand may be impossible physically or the optimum economic capacity of a site may differ from that which would physically accommodate total demand. In other words, the cost of adding incremental increases to site capacity must be compared to the incremental benefits of that provision [James 1970]. Only if marginal benefits exceed marginal costs should the last increment of capacity be added when economic efficiency is the criterion. (Note that capacity, here, could refer to reservoir size and/or investment in supporting shore facilities and that operating costs are ignored.) Knowledge of a recreation production function for the site [Gosse 1970, p. 24] is required to make intelligent decisions on the amount of capacity to be provided and the resulting economic value.

Obviously the two issues discussed above are not independent. Demand for a proposed site may be partially dependent on the size of the supporting recreation facilities while the planned investment in such facilities may be dependent on use estimates derived from data on existing sites. In addition, a number of other factors complicate the rather simplistic view set forth above. For example, relationships between site quality and capacity; between instant capacity, total capacity and the time distribution of use; between complementary facilities and instant capacity; and between recreation capacity and multiple use facilities must all be incorporated into the analysis. Because of circularity and these other problems, it is doubtful that a completely satisfactory approach to the relationship between capacity, demand and value can be formulated for use in practical planning situations. However, bounds can be placed on the problems so that decision information is made increasingly reliable and useful. A discussion of these problems and the relevant research on them is the topic of this section.

<u>Estimated Demand Functions and the Capacity Constraint</u>: As indicated, if demand functions are estimated by using data for existing sites that are being utilized to capacity, an underestimate of the demand function for the whole recreation experience associated with that site will result. Thus, if the resulting equations are used for projecting use at proposed sites, a true reading on demand will not be available to the planner and the ideal separation between the concepts of demand and supply will not be maintained. Planning is more difficult because "demand" projections can be shifted by changing the proposed recreation facilities (assuming a given quality and

activity mix). Facility planning must, then, account for the effect of capacity on visitation rates [James 1970].

If capacity problems did not bias the demand function and an interaction between site demand and facilities was still thought to occur [Merewitz 1966; Pankey and Johnston 1969], this could be accounted for in the normal way. As James points out:

> The empirical equations found in the cited literature for estimating recreation visitors do not include capacity as an independent variable. The data used in their derivation, however, come from specific reservoirs and thus implicitly incorporate the capacity, the natural environment (setting and climate), and the range of activities provided by that site. [1970, p. 22]

Ideally, then, derivation of demand functions from sites not being used to capacity should be attempted. When this is carried out, the "most similar project" assumption can be used to account for the independent effect of facilities on site demand. Since factors important to the "most similar project" choice (including facilities) are constant or relatively uniform, they will not enter an estimating equation derived from a specific site,[28] but must be considered as imposing limits on its application to different projects [James 1970, pp. 17-18].

Knowing whether an existing site is or is not being utilized to capacity, however, is difficult. Capacity is hard to define and not necessarily consistent with normal measures of use. Basically, capacity in outdoor recreation is the

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[28] Capacity variables could enter equations derived from pooled or composite data, however [Pankey and Johnston 1969]. Insights into the type of capacity variables important to demand and, thus, the important factors in judging "most similar projects" may be derived from such equations. Two recent studies by the Corps of Engineers have identified such factors [Pankey and Johnston 1969; U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation].

ability to accommodate participants [Lee 1962]. Thus, capacity (like demand) can obviously differ from use because a site of given or rated capacity can be used to varying intensities. Since capacity (or portions thereof) must be consumed at a site and cannot be stored for future use, we can only speak of instant capacities or instant, rated capacities (the ability to accommodate use at a given moment in time). Of equal importance in measuring "capacity" are two other factors. First, the capacity of any recreation area can vary substantially with the quality of recreation experience offered by management of that area.[29] For example, if one aspect of quality (crowding) is permitted to deteriorate, the capacity of an area will obviously increase although not necessarily at a linear rate. The quality factor is, however, difficult to quantify and, thus, so is determination of capacity at a given quality level. Second, the activity mix at a particular site is related to that site's capacity (at a given level of quality). Activity mixes which permit complementary activities on the same site may increase capacity because of more efficient use of land area or decrease it because timing of particular uses is not uniform throughout a day while use of the site by competitive activities could cause the reverse to happen.

Thus, determination of the extent to which a site's capacity is being utilized is elusive if only from the definitional point of view. Furthermore, since demand is not uniformly distributed through time (for example, over a summer quarter or even within a given day), what may be completely utilized

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[29] Although quality may mean different things to different people, that is not its use here. Rather we refer to a set of identifiable characteristics of a site (including density of use) which can be used to broadly classify such sites for separate analysis. Individuals may have different preferences among such classes.

on one day (or hour) may be substantially underutilized the next. Likewise, quality factors for a given site can vary over time.

No way has been found to handle these problems, as they relate to the estimation of demand functions, in a completely satisfactory manner. It has been suggested that "Recreation capacity can only be estimated by observing peak intensities of facility use in activity areas known to experience capacity crowding ..." [James 1970, p. 19]. To a degree, this is circular reasoning and ignores the quality constraint problem. Recognizing that demand estimates are needed for planning and that partial information may be better than none at all, perhaps the best alternative is to accept the process outline in the previous section but use extra caution in selecting the "most similar project." The worst result would be an underestimate of future use when "demand" coefficients are derived from consumption data (other factors remaining constant).

> An empirical equation to predict visitation from the spatial distribution and other characteristics of the surrounding population can best be used to predict visitation to other reservoirs which have similar natural environment and where the effects of crowding (indexed by the ratio of peak potential hourly visitation to capacity) are approximately equal. [James 1970, p. 23]

If the sizing of proposed facilities is to be based on this process, however, the potential bias needs to be explicitly recognized.

Site Capacity, Economic Value and Optimal Size: Whether or not use projections for a proposed recreation site are biased, decisions concerning the amount of investment at that site to provide for total estimated use or determination of the optimal investment from an economic efficiency viewpoint requires knowledge of the relationship between the capacity provided and various levels of resource inputs. This relationship is also of interest because of the constraint which it can place on estimates of economic value. Although the primary economic value of proposed sites can be estimated by the procedures discussed in the previous section, the realization of those projections is directly dependent on the capacity of the proposed site to handle the projected pattern of recreation.[30] However, a number of the concepts discussed previously in this section also apply here and thus make this a difficult area to deal with quantitatively.

Basically, two approaches have been suggested for providing the link between demand and supply (capacity). First, use standards have been proposed by a number of organizations and agencies. Such standards are meant to identify the magnitude of physical areas and facilities needed to provide a recreation experience at a given level of quality for a given number of recreation days. Often, however, such standards do not refer to instant capacity but rather to total or seasonal capacity requirements. Thus, inter and intra-seasonal variations in demand and the influence of daily turnover rates are ignored. As Daiute indicates:

> The term standards is a misnomer in a sense because at present there are no definitive, simple guides for determining capacity of a recreation area or system. An example of standards are those published by the National Recreation Association on acreage requirements for outdoor recreation in urban places. Standards are related to patterns of land use. ... In this setting attempts have been made to apply simple standards for relating demand to resources and facilities.
>
> It is apparent, however, that whether one is talking about capacity standards for a state, or some other political subdivision, or service area, one is

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[30]For example, if insufficient capacity was planned to accommodate a projected demand level, the estimate of willingness to pay would have to be constrained by a supply (marginal cost) curve which crosses the site demand function to the left of its point of intersection with the X-axis. Only the area under the demand curve to the left of this constraint would be the appropriate estimate of economic value provided by recreation at the site [Seckler 1966].

> actually talking about several standards implicitly. These include what is considered needed in space requirements for given facilities, facility requirements for given recreation activities, travel distance to recreation site as related to proportion of population that will engage in recreation, and so forth. Furthermore, the typical standards imply that no change is taking place in these important variables. Such standards are unrealistic in assuming a uniformity of population and a proper balance of recreation acreage, area-by-area and neighborhood-by-neighborhood. ...
>
> It can be noted, parenthetically, that these standards have origins, years ago, in empirical surveys. Standards have come to be used, however, as cheap and fast substitutes for empirical studies. Standards have oversimplified the solution to the problem of first ascertaining demand; then relating demand to supply; and design features, taking into account capacity factors. However, the actual complexity is not so great as to be unmanageable. [1966, p. 334]

Moreover, standards are usually not adequate to make management judgments on activity mixes. To be carried out properly, the design of an outdoor recreation area must proceed with some knowledge of the activity days (as opposed to recreation days) demanded by the relevant market population. As McClellan and Medrich indicate:

> Much of the literature concerned with the economics of site selection and development is devoted to enumerating standards for different park and recreation facilities. These "standards" are exceedingly arbitrary, based on a "feel for demand" rather than any real measure of it. The Bureau of Outdoor Recreation publishes a typical list, Outdoor Recreation Standards. Drawing from 135 sources, the pamphlet describes literally hundreds of configurations for a wide variety of facilities. ...
>
> While national standards have been developed for most types of facilities (e.g., park space per 100 people, etc.), these vary from one organization to another and they are rarely applicable to the needs of the particular population or space allocated (and/or available) for recreation facilities at a given locality. Nor do current standards recognize that different subsets of the population have different

> recreation needs. For example, the recreation needs of a large number of children are certain to be different from the needs of an equal number of elderly persons. [McClellan and Medrich 1969, p. 178]

Of perhaps greatest importance, however, is the fact that use standards do not provide adequate information upon which to base a marginal analysis. The relationship between varying amounts of capacity and the cost of resource inputs is not taken into account.

Thus, the economist's traditional idea of a production function has been suggested as a means of analyzing capacity questions.

> ... from the production point of view, it is apparent that resources having alternative uses are required in the production of outdoor recreation. And with appropriate adaption to the peculiarities of product, it should be possible to define explicitly suitable production relationships describing output generated by various combinations and levels of inputs. ... the conventional production relation defines a physical measure of product forthcoming from different levels and combinations of inputs of factors of production. It has been suggested above, however, that it is more realistic to regard the thing being produced by the employment of productive inputs at a recreation site as capacity to accommodate outdoor recreationists desiring to participate in a collection of recreational activities. Accordingly, units of "rated capacity" are regarded as the appropriate measure of output in the production relation. Important categories of inputs may be thought of as consisting of labor; operating capital; land (site); and development capital (consisting of capital committed in the development of facilities at the site). [Lee 1962, p. 6 and 11]

However, production relations of this type must account for the level of quality and mix of activities provided at the site. Capacity, in terms of recreation days, can be thought of as a function of both of these factors (as well as others) and if one is allowed to vary the result will be a variation in site capacity. But it is vitally important to note that when changes in quality or activity mixes are made, these factors will influence the demand projected for the site. As indicated in the last section, site demand is usually estimated by assuming that the quality component implicit in the demand equations used for projection will be maintained. If this is not the case, demand coefficients will change and the estimated demand and associated economic value will also vary. Thus, an iterative effect takes place and must be accounted for when production functions are used in the planning process.

Because recreation participants usually recognize no capacity limits (collectively not individually), however, crowding will continue to take place regardless of the "design" capacity of a particular area. Only the quality of the experience will vary [Daiute 1966].[31] Thus, empirical studies of the production relationship have faced major difficulties in isolating the quality factor. For this and other reasons, only a few studies have been undertaken on recreation production functions.

Seneca and Cicchetti [1969] presented a functional relationship between the number of visits (use) and the mix of facility inputs for a given geographic region. As they indicated,

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[31] As Robinson has stated:

> ... demand may be accommodated over some range by way of a quality deterioration in the service supplied. If we introspect a bit, it is almost certainly true that a relatively uncrowded park brings more "pleasure" per unit or per visitor than does one which is overcrowded. What this must be interpreted as meaning in terms of the conventional demand-supply analysis is that the quality of the unit being supplied changes and is itself a function of size and scale of operations. Similarly, it can be argued that the point beyond which planned capacity is exceeded is the point also at which sharp quality deterioration sets in. [1967, p. 77]

knowledge of the "quantity of recreation days that can be generated under different supply expansion plans plus a knowledge of the relative costs of supply inputs can improve the efficiency of decisions on these matters" [p. 239]. They argue that the proper model specification for such a function is the Cobb Douglas or linear logarithmic production relationship because other forms imply unrealistic substitution among inputs. Thus, an equation where recreation visits are a multiplicative function of physical size and facility characteristics of the recreation site is specified. This specification has a constant (non-zero) partial elasticity of substitution of 1 while other conventional relations (linear and input-output) assume either infinite elasticity of substitution between input factors or no substitution at all [1969, p. 240].

The authors used 1964 cross-sectional data from 154 sites in the Appalachian Region to implement the model. They found acres of park land and water, parking places, availability of swimming and presence of an entrance fee all to be positively correlated with "visits" and statistically significant. The resulting coefficients of the relationship can be used to project the effect of a change in factor inputs on capacity given a maintenance of the quality factor as it was implicitly found in the underlying data. Unfortunately, the data was pooled so the quality factor for a particular site of interest cannot be isolated and when the equation is used for projection the results may be applicable to a different quality mix than that for the site under consideration. Also, the estimated equation used "consumption" as a proxy for potential site output (capacity). Therefore, at a given quality level, the actual capacity of the sites used for empirical implementation may exceed that shown. Thus, Seneca and Cicchetti implicitly assume that the demand is sufficient to utilize a site to capacity at all times at a given level of quality. Not only is this subject to dispute but it virtually ignores the distinction between instant and total capacity [Gosse and Kalter 1970].

> ... the term "output" must be carefully defined. A factory has a production function for its products, but knowledge of this function is often not sufficient for estimating product sales. The production function does not forecast sales per unit of time; it identifies an upper bound on sales in the absence of inventory accumulation. Similarly, the production function for a recreation site simply yields an estimate of site capacity, not use. The total amount consumed (total recreation day visits at a park) is not necessarily identical to the total output (capacity) of the park. ...
>
> ... When using equation (1) in the Seneca and Cicchetti article, one must decide whether he is interested in the capacity or the use of a recreational site. When interested in capacity, equation (1) must normally be considered an underestimate of the production function since the coefficients are derived using a sample of actual rather than potential visitation as the dependent variable. If the sites in the test sample are being underutilized for lack of demand, then the true capacity generated by various combinations of inputs will be underestimated. [Gosse and Kalter 1970, p. 131]

Vamos and Geiss have attempted to determine the relationship between instant capacities and physical facilities by using observations from average summer Sunday afternoons [1970]. Again, however, consumption and not potential output had to be the focus. Also, the Vamos and Geiss formulation ignored the implications of their model's functional form (linear) which Seneca and Cicchetti had rejected as an inappropriate form of production relationship for recreation.

For purposes of empirical estimation, use of consumption data to approximate the output variable in a production function for outdoor recreation may be the only alternative. However, research has only begun on this entire area and it would appear to offer potentially high payoffs for future work if the results are properly utilized.[32] Certainly, in their present state of development, production functions for outdoor recreation are not adequate for use in practical planning situations. In carrying out additional research, care must be taken to incorporate a review of not only the most appropriate functional form of the relationship but the influence of quality variations, the distinction between instant and total output (capacity), and the distinction between functions related to individual activities [Vamos and Geiss 1970] and those pertaining to the composite services produced by a recreational site [Seneca and Cicchetti 1969]. Care must also be taken to distinguish production functions appropriate for multiple use areas from those for single purpose recreation areas. Capacity of a multi-use area is obviously under an independent constraint that single purpose areas are not -- namely, the land or water involved may be utilized for other functions which are not necessarily compatible with recreation but can be a higher economic use. Finally, as for site demand functions, production relationships must be derived for <u>all</u> potential uses of a proposed site. Thus, capacity limits can constraint the economic value stemming from the demand for a wild river just as it can for a reservoir development.

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[32] Namely, production functions <u>must</u> be used with demand information, not in place of it, to determine the optimum allocation of resources to recreation projects and to determine the economic value stemming from such projects.

RECREATION MARKETS, DEMAND ALLOCATION, AND FACILITY PLANNING

Most outdoor recreation demand studies have taken a site oriented approach. That is, demand functions are derived with reference to specific recreational facilities or locations. This procedure and the approaches to deriving the economic value of a particular site from such functions have previously been discussed at length. We have noted that site demand equations have a variety of potential uses, among which "projection" is of special interest to this review. However, although demand projections made by using site formulated equations are useful in developing and evaluating recreation expansion plans at proposed sites, they often do not provide sufficient information for comprehensive recreational planning at the regional level or for making the necessary public policy decisions on recreation components of water resource <u>programs</u> [Seneca 1969]. Policy recommendations drawn solely from experience with isolated cases can result in program design and implementation which does not meet effective <u>market</u> demand for recreational services. For example, information relevant to decisions on the spatial distribution of new recreational facilities within a particular geographic area or the appropriate mix of recreational <u>activities</u> to be serviced by such facilities cannot be adequately derived from site demand equations [Kalter and Gosse 1969]. Thus, improved comprehensive planning would be facilitated if decision makers had an overview of an entire market area. Also, project planning based on the "most similar project approach" and utilizing site demand functions may be both more costly and empirically more difficult than an alternative approach based on a regional or market view (see pages 59-60).

Market information, at the very least, can be useful in coordinating the activities of various public agencies (and private firms) involved in the provision of recreation opportunities. Of special importance here is the relationship between market demand data and individual agency program evaluation efforts. The case by case approach to project planning can lead to double counting potential recreation demand (allocating the same market demand more than once to various potential sites) and result in premature excess investment in certain types of facilities [Stern 1971]. Account must be taken of overall market demand and the competition for that demand from potential alternative facilities.

However, studies of the demand for outdoor recreation emanating from an entire population are relatively rare. Unlike demand for most goods and services, the demand for recreation is heavily dependent on transfer costs and is, thus, linked spatially with the site of purchase. The recreation site has, thus, become the natural focus for data collection and demand analysis. Moreover, such a focus has reduced identification problems inherent in the estimation of "structural demand" equations for largely non-market services. On the other hand, market demand studies for outdoor recreation must be based on data collected from people chosen from the entire population rather than just those who visited certain (or even a sample of) recreational sites and sufficient information is needed to handle the identification problem. Not only are such data collection efforts normally not directed at the immediate needs of a particular agency, they are expensive to conduct. The sample must be chosen in a statistically meaningful way and the interviewer may have to travel to the person, a process which can involve a great deal of time and money. However, a representative sample of persons is more easily defined than a representative sample of sites. Moreover, use of individual data is preferred over aggregated data because the effects of different levels of the independent variables often can be determined more precisely for two reasons [Malinvaud 1966,

p. 125]. First, the interactions among the independent variables can be observed more directly when they are not obscured by the aggregation procedures. Second, the values of all the variables will fluctuate over a wider range for individual data than for aggregated data. Thus, if individual data are used, the structural equations can be determined for a wider range of the independent variables than if aggregated data are used. Therefore, it appears that the best type of data for studying market demand for outdoor recreation is information collected from a random sample of households. Only a few such surveys exist.

The Data Base: In the fall of 1959 and the spring of 1960, the Survey Research Center at the University of Michigan conducted household surveys with representative cross sections of American adults [Mueller and Gurin 1962]. Each sample included between 1300 and 1400 observations. The survey, which dealt with many phases of consumer attitudes and behavior, contained one section covering the recreational patterns of the sample person. The sample person was asked about his favorite activities, those in which he often participated, activities in which he would like to participate more often, reasons why he did not participate more often, what he did on his vacation and on other trips, and information on visits to state and national parks in the last five years. For eleven activities, he was asked how frequently he participated over the past year - not at all, once or twice, three or four times, or more often.

The most comprehensive household surveys of recreational behavior which have been conducted, however, are the nationwide studies undertaken by the Bureau of the Census to investigate participation in outdoor recreation by the American public [ORRRC 1962, Study Report 19; U. S. BOR 1967]. Working for the Outdoor Recreation Resources Review Commission (ORRRC) in 1960 and, in 1965 for ORRRC's replacement, the Bureau of

Outdoor Recreation (BOR), it interviewed a sample of Americans 12 years of age and older in order to determine their outdoor recreational activities and preferences. The 1960 study included a separate survey for each of the year's four quarters, while the 1965 study included one survey taken at the end of the summer quarter. Between three and four thousand persons were interviewed each quarter in 1960; over seven thousand persons were interviewed in 1965.

For each sample person in both survey years the following socio-economic variables were recorded: age, sex, race, marital status, education, family income, occupation, size of family, age of youngest child and a weighting factor. Also, for the head of the household to which the sample person belonged, education and occupation were recorded. The home of the sample person was described with respect to the section of the country in which it was located; whether the household was rented, owned, or occupied on a rent-free basis; whether it was urban or rural; and whether or not it was in a Standard Metropolitan Statistical Area (SMSA). Due to the Census disclosure standards, the exact place of residence of an interviewee cannot be determined from the survey data. Only the region of the country in which he resided is given. Weights were assigned to the interviews to account for the differences between the persons actually interviewed and the known characteristics of the nation as a whole with respect to age, sex, race, and farm-non-farm residence.

Both surveys collected a wide variety of information on the outdoor recreational habits and preferences of the interviewed persons. In the 1960-61 surveys, the person was asked to list his three most preferred recreation <u>activities</u> for the most recent season, whether or not he did them as often as he liked, and, if not, what were the factors (such as lack of time, money, or transportation) that prevented him from participating more often. The comparable questions on the 1965 survey requested the same information about the single most preferred activity for each of the seasons of the year. Also, the person was asked if there were any activity in which he would like to participate but for some reason did not. Here again, if he listed an activity he was asked to explain what prevented him from participating.

The sample person was then asked for information about his vacation, overnight or longer trips (the last three were examined in detail) and one-day recreational outings (the last four were examined in detail) taken during the period covered by the survey. The information requested included the number of days he had participated in each type (activity) of outdoor recreation, how many miles he had travelled, his means of transportation, how many days he was away from home, how many people were in his immediate party, and how many of these people were children. In addition, the 1960-1961 surveys asked about the sample person's share of various monetary expenses -- transportation; lodging; food; outdoor recreation fees, including guide fees, entrance or privilege fees, rental of equipment, boats, etc., and other outdoor recreation fees; other recreation and entertainment; all expense tours and other package fees; and miscellaneous costs. Also, the 1960-1961 surveys asked the sample person to distinguish between those activities in which he participated on privately owned land and those in which he participated on publicly held land. Finally, information on participation in various activities on other occasions when the respondent had been away from home only a few hours was obtained for both survey years.

The 1960-1961 surveys concluded with questions about the hunting and fishing rights of the sample person; types of hunting, fishing and camping engaged in; recreational equipment owned by the person; questions about the person's health; and a series of questions about the leisure time and time spent on outdoor recreation by the sample person on the last weekday, on one day of the last weekend, and on the last major holiday.

The final questions on the 1965 survey asked the person how many days he had participated in different activities during the rest of the survey year. Since he might have difficulty remembering the exact number of days that he engaged in an activity, he was simply asked to choose among categories: one to five days, six to ten days, and more than ten days for each activity in which he had participated.

It should be noted that all the surveys discussed were cross-sectional in nature. Naturally, repeating a given survey over time would eventually result in a time series of data on recreation preferences and behavior by a population. However, as of this date, this has not occurred in the recreation field. Therefore, our previous discussion relative to using cross-sectional data for deriving recreation demand functions is relevant here. Studies concerned with market demand for recreation have used data from the previously discussed surveys. Because the nature of recreation is such as to generate variability in its price data, even within the confines of one time period, this is both possible and appropriate [Kalter and Gosse 1969, p. 11]. The studies that have used these sources of data for estimating market demand equations will be discussed below. First, however, several other approaches to the recreation market question will be briefly reviewed.

The Consumption Function Approach to Recreation Markets: One method of circumventing the problem of low or nonexistant entrance fees (prices) for outdoor recreation has been to use a "consumption function" approach; i.e., to use socio-economic and other variables and leave costs (prices) out of the calculations. For example, one such study makes use of data on per capita visits to national parks from 1929 to 1960 [ORRRC 1962, Study Report 26]. The number of visits is expressed as a linear function of per capita real disposable income, per capita intercity automobile travel, weekly hours of leisure, and time. A major disadvantage of this approach is the way in which the independent variables usually have moved together over time. Because of the relatively small number of observations, the averaging of individual differences and the large trend component of each of the independent variables, the intercorrelations among these variables is more serious than in the case of microeconomic models. Moreover, use of such models for forecasting will result in projections of consumption (use) and not the conceptually correct values for demand.

Another consumption function study used the data from the Michigan Survey Research Center's cross-sectional surveys of recreational preferences and participation. Mueller and Gurin [1962] present an extensive discussion of the relationships between socio-economic variables associated with the sample persons and various measures of their preferences, participation, and desire for more and/or other forms of outdoor recreation. Using a multiple classification analysis, they sought the relationship between the activity score that was assigned to each sample person, based on his participation in a group of outdoor recreational activities, and the socio-economic variables associated with the sample person. They noted that their technique, like all regression techniques, could not separate the effects of intercorrelated variables with complete accuracy, but that the estimates are fairly reliable as long as the observed intercorrelations can be expected to remain unchanged when the estimated parameters are applied to another population - either in another location or in another time period. Even though their measure of participation was quite rough, nine socioeconomic variables accounted for almost 30 per cent of the observed variability in the participation scale.

Gillespie and Brewer also attempted to measure the effects on participation in water-oriented outdoor recreation of socio-economic variables [1966; 1968; 1969]. Using data from a random sample of households in the St. Louis area, they regressed the annual number of recreation days per family on various formulations of income, education, sex, race, age, and occupation. They felt that some of the variables that would normally be expected to influence the demand for outdoor recreation - such as leisure time, transfer costs, and quality variables - would not exhibit enough variability in cross-sectional data so that their effects could be measured accurately with statistical techniques. Therefore, they left these variables out of their analysis by assuming that transfer costs were the same for all sample persons; that the array of facilities, and thus the quality of the recreation sites, was the same for all sample persons; and that the leisure time variable could not be measured. They stated that their "demand" (or participation) functions did not contain the market variables normally found in demand functions. Because of the abundance of recreational facilities in the St. Louis area, a case could be made for calling the Gillespie and Brewer results an estimate of the "saturation demand" for water-oriented outdoor recreation, although they did not mention this.

The Planning Bureau of the New York State Office of Parks and Recreation developed equations of the recreation market for eleven activities in which they regressed a zero-one variable expressing participation or lack of participation in an activity as a function of a set of socio-economic variables associated with the sample persons [Anderson and Harvey 1970]. The study was modeled after the Mueller and Gurin effort. One of their primary interests, however, was the need for greater emphasis on a "design day" rather than on annual attendance. The main source of data was a home survey of recreation participation and population characteristics taken in Onondaga County, New York in 1968. Using their model to estimate the number of participants in each of the activities in a marketing area, a fairly good fit was obtained in an equation that expressed the number of people from the county in the market for outdoor recreation at typical intermediate types of recreation facilities as a function of the number of swimmers and the number of motorboaters in the county. They felt that this equation would be useful in predicting recreation attendance (use) on an average summer Sunday at typical day-use recreational facilities maintained by the State.

Two other studies that looked into the relationship between participating in outdoor recreational activities and socio-economic variables are Green's [1966] analysis of questionnaires mailed to people who participated in camping, boating, fishing, and hunting in Indiana; and Burdge's [1967, Outdoor Recreation Studies] study of the recreational patterns of a sample of persons who live in or around Pittsburgh, Pennsylvania. Such studies, as well as those discussed earlier in this section, are useful in determining the non-price variables to be included in demand studies, but, of course, are not themselves studies of the market demand for outdoor recreation.

<u>Other Approaches to Recreation Markets</u>: Several studies that are not strictly demand studies, but which are of interest to those working with the market demand for outdoor recreation, deal with the identification of socio-economic groups served by facilities for different activities, and the identification of groups of activities that are complements or substitutes as viewed by the consumers.

Haynes [1970] has begun work on the use of discriminant analysis as a means of analyzing socio-economic characteristics that influence recreation preferences. An index was developed as a function of the socio-economic characteristics associated with those persons who prefer two different activities. If the two groups of persons are distinctly different, the index values associated with the members of the respective groups should form mutually exclusive groupings. Haynes' preliminary work has not, however, provided clear empirical evidence of the applicability of discriminant analysis to recreation market questions.

A new approach to the general theory of consumer behavior was suggested by Lancaster [1966]. He hypothesized that each good possesses some level of a number of characteristics, and that a person's utility function depends upon the extent to which these characteristics were available as a result of consumption and not directly upon the consumed goods themselves [Gosse 1970, pp. 16-22].

Lancaster's method of analysis may be applied to the problem of describing consumer behavior in the area of leisure activities. If it is possible to redefine the attractiveness of participation in a multitude of leisure activities in terms of a limited number of characteristics, then the analysis may be greatly simplified. Examination of the characteristics vectors associated with various types of leisure activities should clarify the relationship between outdoor recreation and other activities and hobbies. Also, those characteristics which are unique to outdoor recreational activities could be identified. Changing the focus of recreational planners from the provision of specific <u>activities</u> toward the provision of the desirable <u>characteristics</u> generated by the activities could lead to more rational recreational planning. If it is possible to identify the desirable characteristics that are associated with certain activities, planners in areas that lack the natural, facility, or monetary resources needed to provide these activities may still be able to provide the same level of satisfaction for the recreationists by providing alternative facilities which can generate the same characteristics.

In order to apply Lancaster's methods, it is first necessary to identify the characteristics produced by various activities and to measure the level of satisfaction associated with different levels of participation in the activities. Such a problem is within the province of factor analysis, a branch of statistical theory which is concerned with "the resolution of a set of ... variables in terms of a small number of categories or factors" [Holzinger and Harman 1941, p. 3].

Using data from the 1960 summer quarter of the National Recreation Survey, Proctor [ORRRC 1962, Study Report 19] applied the methods of factor analysis to participation data for fifteen outdoor recreational activities. On the basis of his analysis, Proctor chose four factors, which he tentatively identified as (a) passive pursuits, (b) water related activities, (c) physically demanding activities, and (d) backwoods activities. Factor loadings were developed which theoretically showed the relationship between the four "underlying factors" and the 15 observed participation variables for the sample persons. On the basis of the factor loadings, factor scores were assigned to each sample person as a function of his participation variables. Finally, Proctor regressed the individual factor scores on the socio-economic variables associated with the sample persons. One would hope that a refinement of the type of analysis performed by Proctor could be used to assign factor scores to a future population, given projections of the socio-economic characteristics of the population, and that this information could be translated into the demand for different types of recreation. Current difficulties in applying factor analysis in the case of outdoor recreation are the lack of controlled testing conditions; the fact that the variability in supply, which is a factor in determining participation, is not taken into account; the large number of zero entries in the calculations because of the limited number of activities in which most people participate; and the necessarily subjective identification of the factors.

Finally, Wennergren has attempted to derive an individual's market demand curve for a recreational activity by summing the person's demand curves for all of the various sites available to him [Wennergren 1964]. However, such procedures are invalid, since the curves that are being aggregated in such cases are not independent. The demand for any particular site is likely to depend in a fairly complex way on the whole array of prices associated with all the other sites.

The Demand Analysis Approach to Recreation Markets: Recent empirical studies on recreation markets have attempted the derivation of functions which more closely approximate the economist's traditional ideas of what constitutes a "demand" schedule. Thus, either costs are incorporated into the "demand" model or reduced form market clearing equations are estimated.

Davidson, Adams, and Seneca [1966] estimated the demand for three types of outdoor recreation activity - swimming, boating, and fishing - by means of a two step model. Using data from the Michigan Survey Research Center's study on outdoor recreation [Mueller and Gurin 1962], they first estimated the probability that a person would participate in a particular type of activity as a function of socio-economic and facility availability variables. These equations, along with estimates of the mean number of days of participation per participant, were used to estimate use of recreation facilities by the population of the Delaware estuary region in 1960. Using projections of some of the socio-economic variables for 1975 and 1990, assuming the same number of days of participation per participant, and using two sets of assumptions about the availability of facilities to the residents of the estuary region, they projected the use of recreational facilities by residents of the region for 1975 and 1990 for each of the three activities.

In the form utilized in their study, Davidson et al. found the socio-economic variables to be more important in explaining the probability of participation in the three activities than those variables referring to the existence of facilities near the sample person. For the second step in their analysis, they had hoped to estimate the relationship between the number of days of participation and the same set of variables used in the equations estimating probability of participation. However, the Michigan survey data distinguishes only roughly among persons who participated up to four days per year in each activity. All those who participated more than four days were classified as "more often." With such restrictions on the dependent variable, their regressions were inconclusive and they were forced to simply calculate the average number of days of participation per year per participant in each of the three sports rather than retain the functional nature of the second step of their model.

The inclusion of the variables associated with the supply of recreational facilities near the home of the sampled person, by Davidson et al., may be a useful way to estimate the effects of learning-by-doing on the demand for the activities. The variables that measure the availability of facilities to the sample person are the only factors in the model that reflect the effects of market variables on the amount of participation in an activity. Since "availability" implies availability at some "acceptable" cost, it can be hypothesized that if a more refined measure were used of the costs associated with participating in outdoor recreational activities, that the "availability" of facilities would appear to be a significant factor in determining the extent to which a person participates in an activity.

A very extensive application of the model found in the Davidson, Adams, Seneca article is presented in the study by Cicchetti et al. [1969]. In that study, the two step procedure was used first to determine the probability of participation and then, for those who did participate, the variables that determined the *extent* of participation were examined.[33] Both steps were taken to be functions of the socio-economic variables associated with the sample person and the availability and quality of recreational facilities near his home. The 1965 National Recreation Survey data were used [U. S. BOR 1967]. By special arrangement with the Bureau of the Census, the place of residence of the sample person was identified, and a great deal of information on the types and extent of recreational land and facilities in the state and county in which the sample person lived was added to the information obtained from the personal interview.

Since these equations deal with participation, they are identified by Cicchetti *et al.* as reduced form equations with variables from both the supply and demand functions of a recreational market model. They feel that the interaction between supply and demand - via learning-by-doing, via lagged responses of demand to changes in supply, and, as suggested in another article by Cicchetti's co-authors [Seneca *et al.* 1968], via governmental changes in supply as a function of excess demand - make the identification of either the supply or the demand function impossible. They point out that use of demand functions for projections when serious interactions exist between supply and demand is valid only if no new factors enter the market in the future and if the relationship between the shifts in demand and those of supply is constant over time. However, a major limitation of the reduced form method is also cited by Cicchetti *et al.* "Before a benefit measure for recreation can be obtained, a *structural* demand relation must be established relating quantity of recreation (in user days or visits) to the important causal variables of recreation activity"

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[33] Twenty-four outdoor recreation activities were examined.

[1969, p. 298].

Cicchetti et al. used their model to project 1980 and 2000 participation in each of the activities under two assumptions about the availability of facilities to the recreating public in those years, and projections of the future socio-economic variables of the population. Also, they offered some suggestions for future data collection of the household survey type. They felt that their model's statistical reliability could have been improved if the sampling techniques could have reflected the distribution of recreational resources rather than just being designed to reflect the distribution of population characteristics. They also felt that it would be desirable to include in the interview, questions about the facilities available within certain distances of the sample person's home and the reasons that the sample person did or did not use specific sites. Finally, they suggested that information on leisure time, as well as on the expenses involved in participating in outdoor recreational occasions, should be considered for any future surveys.

A reduced form model was also used to predict the response of recreationists to changes in facilities available at various recreation sites in a region [Seneca et.al. 1968; Seneca 1969]. In particular, the authors of these papers hoped to provide a tool that would help those planning recreational sites to estimate the increases in use that would result from an improvement in the quantity and/or in the quality of recreational facilities. Thus, they attempted to measure the elasticity of use (which is not the elasticity of demand) for changes in variables such as the available water acres per capita and the value of ancillary facilities per capita, with the hope that such measures would indicate to planners the best uses of their limited funds for site improvement. While limited application of the "user response" model may be justified on practical grounds, its theoretical basis is weakened by the decision of its proponents to neglect the difference between "use" and "capacity" [Gosse and Kalter 1970]. Measures of the value of recreational resources could not be derived from the "user response" models, and estimations of such value are a necessary component in decisions on whether or not to make site improvements. Moreover, accurate projections of effective "demand" are impossible because the "user response" or "reduced form" models ignore explicit cost considerations (see page 49 above).

Another two step approach for estimating the demand for specific outdoor recreation activities was undertaken by Kalter and Gosse [1969]. They, however, attempted the derivation of structural demand equations. For this model, the first step expresses the probability that a person would be <u>interested</u> in an activity, i.e., the probability that he would have a positive demand for the activity if all the associated costs were zero. For the second step, given that a positive interest exists, the person would purchase various amounts of the activity under alternative conditions. Both steps are assumed to be functions of the socio-economic variables associated with a person, while the conditional demand relation also is assumed to include market variables (costs) among the independent variables. Such a model is free from the intrusion of supply variables which necessarily enter the first stage of the reduced form models because the probability of <u>participation</u>, rather than <u>interest</u>, is measured.

The necessity of the two step approach in the Kalter and Gosse study is created by the supply conditions in the outdoor recreational market and the limitations on data collection methods. Since the costs of participating in different forms of outdoor recreation vary geographically, the researcher cannot assume that each person is responding to the same supply price for a given type and quality of recreation. Also, most people are likely to be uninformed as to the cost of participating in many activities, so it would not be possible for non-participants to estimate accurately the price for which their demand is zero. However, to completely ignore those persons who did not participate in an activity would be incorrect unless it could be assumed that the supply conditions facing those who did participate in an activity were exactly the same as the supply conditions facing those who did not participate. Since one of the main concerns of public agencies interested in outdoor recreation is to correct imbalances in supply, it is highly unlikely that they would be willing to accept this assumption, or the implied assumption that those who did not participate could have done so, on the average, for the same costs as those who did participate.

Thus, it is necessary to estimate the effects of various variables on a person's demand for an activity and also to estimate the number of persons to whom the estimated function applies. When using a reduced form model, the number of persons would be derived by merely taking the same percentage of the population as was observed to participate in the activity in the period covered by a recreation survey. However, ignoring those who did not participate in an activity would result in an underestimation of the demand for the activity emanating from a given population, and using participation rates ignores the effects of cost changes on demand.

Kalter and Gosse felt that the data from the 1960 and 1965 National Recreation Surveys were the best available for estimating the parameters of the model because of the extensive socio-economic information about the sample persons as well as the detailed information on the sample person's preferences and participation in outdoor recreation. For the five activities studied - camping, swimming, boating, fishing, and hiking - the interest variable was defined as equal to 1.00 for an interviewed person if he had participated in the activity and/or if he listed the activity as one of his three preferred activities. In all other cases, these variables were defined as zero. Because of changes in the questionnaire, the definition of "interest" was more restrictive for the 1965 data than for the 1960 data. Simple linear regressions of the interest variables on the socio-economic variables associated with the sample persons were performed. More complex models that use limited dependent variables, such as probit and tobit analyses, were rejected because they cannot be applied to the market for outdoor recreation due to theoretical differences and data limitation [Gosse 1970, pp. 107-112].

Because of the large number of observations, many parameters could be estimated in the interest equations. Therefore, to avoid rigid assumptions about the functional form of the relationships, dummy variables were defined for each category of the independent variables. Additivity of the effects of the various independent variables was assumed, and no provision was made for interaction of the independent variables, since, after the establishment of the dummy variables, each equation contained 36 independent variables, and, the number of additional variables necessary to provide for interactions would have been beyond the scope of computational feasibility. An advantage of assuming additivity of the effects of the various socio-economic variables is that when using the estimated equation to project the total number of persons interested in an activity from a given population, it is not necessary to cross-classify the population with respect to all the socio-economic variables. Because of their apparently smaller relative errors, the interest equations based on the 1965 data were preferred. The R^2 values for the interest equations ranged from 0.044 for hiking to 0.315 for swimming. However, the R^2 and standard errors associated with these equations are not meaningful in the usual sense because in the case of a dichotomous dependent variable, the measures of goodness of fit that depend upon the sum of the squared deviations of the observed from the calculated values of the dependent variable will reflect not only how well the regression fits the data, but also depend upon the location of the calculated value of the dependent variable along the interval from zero to one. Also, when using a regression program with individual data, the R^2 measures how closely the dependent variable can be estimated for an individual. When planning to use the equations for projection purposes, what is desired is how closely the average value of the dependent variable can estimate the percent of persons interested in an activity, given the distribution of the socio-economic variables for a group of individuals. The variance of the average for a group is smaller than the variance for an individual.

The general form of the conditional demand equations was established after extensive testing of various functional forms on the data for those who participated in camping. Separate equations were estimated for camping on trips and camping on vacations as well as an overall (composite) category. The purpose of estimating equations for the different categories was to test the hypotheses that people view the time, money, and distance costs of camping differently on vacations than on trips. This hypothesis seemed to be upheld and overall equations as well as separate equations for outings, trips, and vacations were estimated for the various activities. Also tested were various definitions of several of the socio-economic variables. In trying to find the best definitions of the cost and distance variables, two methods were tested and both were used. First, all costs of an occasion were assigned to the activity being considered. Division by the number of days of participation in the activity gives the average cost per day of participation. Using the second method, each cost figure was divided by the total number of activity days of participation in all activities for the occasion to obtain the average cost per day of participation. Based on the testing procedures, it was decided that the double logarithmic equation forms would be the most appropriate for formulating the conditional demand functions for each of the activities for each year.

The identification problem was handled by empirically implementing the second stage of the model by using the cost of the "whole recreation experience" as the price variable. It was assumed that when this variable was derived from a:

> ... large cross-sectional sample of households residing in dispersed geographic regions, the price variable would take on a wide range of values because of its dependence on variability in supply [ORRRC 1962, No. 26]. This stems from the fact that the supply function for recreation is somewhat insulated from market forces by the institutional setting from which it is forthcoming. If cross-sectional data are used to estimate the demand relationship, supply variability with respect to any given individual would essentially be removed. On the other hand, the variability of supply among the sample observations helps in identifying the demand function. Regional variation in supply can be used, therefore, as a supply shifter which helps to identify the demand functions. [Kalter and Gosse 1970, p. 54]

The contrast between the equations based upon 1960 data and those based upon the 1965 data was quite striking. The R^2 for almost all of the 1965 equations is substantially smaller than the comparable values for the 1960 equations. A portion of this difference may be explained by the fact that <u>monetary</u> cost data were not available for the 1965 equations (time and distance variables, however, were included). However, the lack of monetary cost data does not appear to be the primary reason for the lower R^2 values, since when the best 1965 equation forms for camping were regressed on the 1960 data, significant increases in the R^2 values were observed over those derived when using the 1965 data. Also, when the 1960 equations for camping were run on the 1960 data without using the cost variables, the R^2 of the resulting equations was still higher than the comparable 1965 equations.

The change in the definition of the preference variable between the two surveys seemed to be an important factor in explaining the lower R^2 values associated with the 1965 equations. Thus, it is hoped that in any future recreation surveys the sample person will be able to list more than one preferred activity for each season of the year and that questions on monetary costs can be re-introduced into the questionnaire.

As an example of the types of problems to which the results of the model could be applied, forecasts were made of the demand for the five activities by residents of New York State in 1985. Projections of the socio-economic variables for the whole state and for each of twelve regions of the State were used along with the assumption that the average costs of participating in the activities would remain the same as the base year. In order to understand the magnitude of the resulting figures, the participation to be expected in 1970, assuming the same values for the cost variables, was also calculated for each activity.

Future Research and Data Needs: Both the reduced form equation and "structural demand" approaches to recreation market questions appear to have merit for obtaining an overview of market demand. When used for projection, they can help to provide useful bounds to demand estimates at specific sites and can provide an important part of the data required to make broad policy decisions concerned with the public provision of outdoor recreation. For example, coupled with explicit societal objectives for outdoor recreation, market demand information can be useful in site location questions, determining activity or facility mixes at sites and, most important, in investment timing decisions.

Clearly, the structural demand approach is conceptually preferable to the reduced form methods. Empirically, the question turns on data availability and the ability to overcome the identification problem. The Cicchetti et al. approach assumed that under current conditions, and given the data collected on these conditions, structural demand equations could not be identified. Kalter and Gosse, on the other hand, used assumed variability in supply (cost) across regions to identify the structural demand equation from cross-sectional data. They showed that costs are a statistically significant element in determining recreational use by given populations.

Given the current state of development, it would appear that a moderate amount of additional research effort would enable either approach to be used for practical planning purposes. It should be noted that both models used cross-sectional data from the National Recreation Surveys. Also, both suggested improvements in these surveys if they are to be repeated. Given the experience with NRS data, the over six year period that has elapsed since the last survey, and the need to continue to accumulate time series information about the outdoor recreation preferences and patterns of the American consumer, efforts should be made by the Bureau of Outdoor Recreation (or others if necessary) to conduct another NRS as soon as possible. Such a survey should incorporate suggestions for improvements over past surveys by data users. If such a survey were carried out, its results could be utilized to estimate updated equations of the recreation market.

The Spatial Allocation Question: Site demand projections are single purpose in that they assess only the demand for a given type of investment scheme under the assumption that interactions with other sites are irrelevant. To do otherwise requires two things. First, as the first portion of this section makes clear, accurate information must be obtained on market demand for specific types of recreation which can be supplied at more than one facility. Second, however, projections which take this form must be linked to existing and potential site capacities. When this is done the relationship between sites and market demand, as well as the reverse, can be more adequately explored. Forging this linkage can also provide an approach to the quantification of demand and economic value for proposed recreation investments. This, then, could serve as an alternative to the site specific methodology discussed previously.

Approaches to Spatial Allocation: The literature suggests several potential approaches to problems of spatial allocation. Gravity models and linear systems analysis are basic approaches to the prediction of recreation travel flow [Cesario 1969]. Of these, gravity models are the most widely used [Ellis and Van Doren 1966]. The gravity formula is applied separately to each predetermined origin zone for recreation visitors. It treats the weighted[34] attraction of a given destination zone as a fraction of the total weighted attraction of all destinations. The demand of each origin zone is allocated to destination zones according to these proportions.

In view of this formulation, gravity models have several drawbacks. First, gravity models do not consider all origin and destination zones simultaneously. Because interaction between origin and destination zones should be assumed, a model is needed which simultaneously considers all parts (zones) of the system.

Second, a drawback of gravity models is that they do not consider the capacities of destination zones. Therefore, gravity models could result in a situation where the existing capacity of one or more destinations is exceeded.

Another difficulty arises from the fact that gravity models do not take into consideration some of the main factors

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[34]The attraction index is weighted by distance or travel time raised to an exponent. The index, itself, can take a variety of forms. The most commonly used indicators include total water area and total area of improved facilities available in the respective destination zones.

which determine the demand of outdoor recreation, i.e., the price (distance, time and cost)-quantity relationship. Moreover the correct exponent for travel time or distance is not easily specified. Ignoring such important factors might result in an unrealistic distribution pattern.

Finally, the principal limitation of gravity models is that they assume the same linkages regardless of the nature of the system. This feature results in the same distribution pattern for a given origin zone regardless of the type of occasion (vacations, trips or outings)[35] being considered. Thus, the proportion of visitors from a given origin zone to a given destination zone would not vary by the type of occasion. Perhaps for this reason, the use of gravity models has been limited to the so-called "day use activities." Planners, however, are often interested in both day use and overnight occasions.

The linear systems approach portraits the recreation system as an electric-circuit analog. The components of the recreation system are related by the theory of linear graphs and some fundamental postulates of electromechanical systems theory [Cesario 1969]. The linear system model has been suggested to overcome some of the drawbacks of gravity models [Ellis 1967]. This model, however, does not take account of site capacities, distance to site, travel time and cost involved.

A Linear Programming Approach: To overcome a number of the deficiencies in other approaches, Tadros and Kalter [1971 (2)] have recently proposed a linear programming solution approach to the spatial allocation problem. The model handles simultaneously projected demand by occasion type, capacities of

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[35]This distinction refers to the length of the occasion where an outing occupies less than a day, trips include overnight excursions, and a vacation is the most important trip in any given time period [ORRRC 1962].

visitation areas, and time, distance and cost constraints. The latter help insure compatibility between empirical results and the market demand projections used as data inputs for model solution. Various types of objective functions, including those which permit consideration of quality factors can be used. Moreover, model assumptions can be varied and judgments made regarding the sensitivity of results to them. Policy actions can also be simulated and, thus, the model can be an important tool for decision makers.

Of perhaps equal importance is the fact that model results suggest the need for and best location of additional facilities to meet future market demand that cannot be handled by the capacity of existing facilities. Additionally, the origin, distance and travel time to the site of potential users is an information product of model solution. <u>This information can then be used to derive a demand function for the site in the accepted manner</u> [Clawson 1959]. <u>Willingness to pay values can be derived from such a function and utilized as a portion of the data needed for an economic evaluation of the potential site.</u>

Drawbacks to the approach are the heavy data requirements for implementation, and several arbitrary assumptions required on items like interregional travel flow and consumer behavior with respect to trip lengths for various occasions. The latter, however, are subject to sensitivity analysis. Although exact model specifications cannot be adequately summarized in the space available for this review, it would appear that such an approach should be investigated for planning purposes. Because of its multiple uses and the rather heavy data requirements, however, thought should be given to having an outside agency undertake development and implementation.

RECREATION AND REGIONAL IMPACTS

Benefits of including recreation as a water project component have traditionally been calculated for use with a national economic efficiency (benefit-cost) analysis of the proposed investment. Such an analysis has been the principal criterion used in evaluating federal resource investments in the past. The research studies critiqued in the previous three sections have been aimed almost exclusively at providing data for this type of evaluation. However, investment evaluation which is primarily dependent on efficiency analysis has come under increasing attack in recent years [Haveman 1965; Stoevener and Castle 1965; Allee 1966; Maass 1966; Marglin 1967; Kalter et al. 1969; U. S. Water Resources Council 1969]. Critics have pointed out that economic efficiency is only one aspect of a multi-dimensional social welfare function and/or that knowledge of other project implications is important politically and socially. Thus, resource investment programs are increasingly being evaluated by multiple objectives [Major 1969]. Another social objective or concern (in addition to economic efficiency) is the income distribution impacts of investment projects [Marglin 1962]. This section will discuss one component of the distribution question as it pertains to outdoor recreation -- namely, the regional (spatial distribution) impact of outdoor recreation investment and methods that can be utilized to measure that impact.

Unlike the use of economic efficiency as a criterion of project formulation and choice, the use of other welfare criteria (such as regional impacts) requires the value judgments of the decision maker concerning the appropriate cutoffs for investment to be made openly. For example, the assumptions underlying economic welfare theory permit a project to be automatically deemed "efficient" if it possesses a benefit-cost ratio greater than unity.[36] On the other hand, no comparable theoretical constructs exist to separate or rank projects on the basis of their contribution to income distribution, regional growth, economic stability, political equity, preservation of esthetic or cultural values or potentially numerous other social objectives. In addition, if the social welfare function is considered multi-dimensional, value judgments must be made concerning the relative weights to be used with the various criteria in making final investment decisions. As a result, ethical judgments required in public decision making are quickly brought into the open when multi-objectives become the evaluation focus. This is as it should be [Mishan 1960; Nath 1969]. Thus, such issues should not prevent the analyst from providing adequate data on the various nonefficiency economic objectives so that decision makers can apply their own cut-off thresholds and relative weights to the various criteria when making a judgment on a proposal. This will be the thrust of this section with respect to regional concerns. We will leave to others the question of how an overall social welfare function is formulated.

The Regional Objective: As the Water Resources Council Task Force has indicated, the components of a regional evaluation objective must be carefully defined before analysis can proceed. Evaluation of proposed investments for their regional impacts could embrace "several types of goals ranging from increased total regional income, improved geographical distribution of economic activity, enhancement of the regional economic base, or improved income distribution within the region itself" [U. S. Water Resources Council 1969]. Moreover, the objectives

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[36] Usually the requisite assumptions are not questioned and the framework used is labeled "objective." It is clear, however, that an efficiency evaluation is no more "objective" than any other formulation when its underlying ethical judgments are investigated [Nath 1969].

could change depending on the scope of the region considering the problem. For example, the nation would likely have a somewhat different view of a proposal for a defined region than the region itself. The Task Force suggests, however, that a regional income objective "will be the most critical." As Kalter indicates:

> This implies that use of regional income would receive approval as an indicator of regional progress from a wider set of interest groups and that a regional viewpoint of the situation is implicitly accepted. ... Some have accepted this as a basis for regional analysis [Krutilla 1955]. Others, however, view the situation slightly differently. Perloff points out that measures of regional growth encompass the concepts of both "volume" and "welfare" [Perloff 1963]. For example, total sales, income and employment in the region as well as per capita real income, its changes and stability may be important. What needs to be noted is that a linear relationship does not necessarily exist between those measures associated with volume and those related to welfare. Obviously, however, use of per capita measures would provide a relative gauge among alternatives and would, thus, be a better indicator of project ranking for this objective both within a given region and between regions of various physical and economic sizes. The latter is especially important since regional size will influence the absolute size of project benefits and costs. In any case, regional per capita income or employment effects can easily be determined from total impacts. [Kalter et al. 1970, p. 51]

Thus, our review of research relevant to estimating the regional effects of providing outdoor recreational services will concentrate on the regional income effects that can be forecast with, as opposed to without, a proposed project. Such an analysis can logically be separated into a number of component parts. First, the net primary national income benefits (willingness to pay) which accrue to the region(s) being considered must be measured. Second, knowledge of direct increases in regional income resulting from project recreation components are needed. For example, recreation is often of interest to a region because of its export characteristics (non-residents spend money for use of the region's resources). In addition, recreation facilities may create employment opportunities for the regionally umemployed or, perhaps, result in improved regional productivity. Third, the regional multiplier implications of any direct income effects need to be investigated. Fourth, the relationship between recreation investment, changes in land values, other components of regional impact and overall regional gain need to be considered. Finally, project cost sharing and its regional implications must be incorporated into the analysis. The following discussion will follow the above format. First, however, a brief digression on the question of regional definitions must be made.

Regional Definition: How a region(s) is(are) defined for purposes of evaluating regional impacts of proposed investments is a major issue that will not be fully treated here, because it is usually considered as an overall problem connected with project evaluation (not with the recreation component only) and is largely independent of measurement tools (although not of data availability). Rather, several brief points with respect to the classification of regions will be made. First, the delineation of a region for analysis ultimately depends upon the purposes of that analysis. However, as Antle and Struyk point out, criteria of choice may be conflicting [1970, p. 9]. Ultimately, then, the analyst (or decision maker) must make a value judgment on the proper definition or definitions to use [Kalter et al. 1970, pp. 52-53].

Second, the magnitude of economic benefits going to a region can be very sensitive to the economic size of the region defined. Thus, "the size of a region can be arbitrarily varied so as to adversely affect computation of regional benefits from viable alternatives which differ in nature or location from a given course of action" [Kalter et al. 1969, p. 9]. Moreover, interregional transfers of benefits and costs can occur for any project. For this reason, Castle has suggested that:

> A system of regional accounts might be established that would make explicit the regional transfers of income that accompany the development of such projects. It is relevant to know how much a region benefits from a project, it is also relevant to know which regions, if any, have sacrificed potential benefits to make this possible. [Castle 1969]

Antle and Struyk also point out that regional delineation has a significant influence on the absolute level of benefit and cost estimates for the regional account. They state that:

> ... evaluation procedures for multiobjective planning require careful conceptual and analytical definition of relevant regions. It has been forcefully argued that impacts which represent a net of zero (an algebraic summation of positive and negative impacts) from the national standpoint are not irrelevant to the evaluation process. Regional delineation of such effects offers important information to the understanding of potential investment impact upon various interest groups, whether they are interested solely in national income, regional distribution of income, environmental issues or any mix of these impacts. [1970]

Thus, in reviewing methods needed to ascertain the regional impacts resulting from recreational investments, care must be taken to identify approaches that can be utilized for regions defined by various criteria <u>and</u> which permit interregional impacts to be estimated. Structuring of such methods, however, must be carried out in light of potential data sources for empirical implementation.

<u>Regional Willingness to Pay for Project Recreation</u>: An often overlooked regional benefit of governmental investments is the willingness to pay or national primary impacts of the project which accrue to residents of the defined region(s). The calculations of such beneficial impacts presents no particular problems, however. For recreation, the same methodology described on pages 77-83 for use in quantifying the willingness to pay value (from the national point of view) for a particular site

can be utilized. In this case, the gross regional income benefits are merely equal to the willingness to pay of users who are residents of the specified region(s) [Major 1969]. As with national benefits, this type of regional benefit is not necessarily reflected in increased gross regional (national) product but is a benefit in kind to regional residents provided by the activity of government.

Thus, only the distance zones and associated costs relevant to the region being considered are used in the derivation of the site demand curve for that region. The use experience of higher cost zones will obviously need to be used, however, in constructing the entire regional demand schedule. For example, assume the demand function for the entire recreation experience (for all users) at a site was constructed by considering the experience of populations in twenty separate origin zones. Further assume that only the five closest (lowest cost) zones are contained in the region of interest. Then, the derivation of a site (second stage) curve would proceed as explained on page 31, but would consider only the reactions of populations in those five zones to progressive price increases. As before, these reactions are drawn from the actual experience of other zones which are already at a higher price point (due to increased travel cost). Naturally some of these latter zones may lie outside the regional boundaries.

Other regional definitions, say the fifth to tenth distance zones in our example, can be handled in a similar way. In essence, separate sets of demand functions for the site are generated - one for each region of interest. Each function in such a set will lie to the left of that for the country as a whole and the area underneath it will approximate the willingness to pay of regional residents for the site.

One problem involved in carrying out the above procedure is an empirical one. Although no additional data beyond that discussed previously is needed, the size of a particular region of interest may impose limits on the derivation of distance zones. Data on use may need to be classified more specifically as to geographical area of origin so that sufficient regional origin points exist to map the function. This may require a less aggregated data source and more detail built into recreation data surveys. Perhaps origin definition using minor Civil Subdivisions should be investigated for this purpose.

Use of site demand functions for regional projections again requires the "most similar project" assumption to be applied. However, in this case a region of comparable physical and economic size to that being analyzed needs to be used. When this is done, the methodology discussed can be utilized to derive the gross willingness to pay for a particular site by the regional population of interest. Alternatively the market function approach coupled with appropriate spatial models might be modified to account for sub-regional demands and value. In either case, the net regional benefit must be obtained by subtracting any charges imposed on the region for project costs or output and for their portion of the project's national costs. We will return later in this section to investigate how these negative impacts can be handled.

Direct Regional Income Impacts: A second type of regional impact from outdoor recreation is that resulting from increased regional income due to direct expenditures for associated goods and services or from productivity changes. The former can take two forms. First, the regional impact in terms of facility construction must be considered. When a recreation facility is wholly or partially financed by non-regional funds and some of those funds are spent on inputs supplied by the region, the economy of the region is benefitted [Nathan 1966]. If all construction funds were raised regionally or had to be paid back by regional interests only an internal transfer effect would occur, unless regional savings patterns were changed [Leven 1969]. Second, increased expenditures in the region by recreationists who are non-residents or increased expenditures by residents through reduced savings or interregional reallocation of consumption patterns can beneficially affect a regional economy [Knetsch 1965]. Of course, both of these factors must also be offset by reimbursement considerations, taxes due directly to project construction, and increased taxes required to finance additional public services in the region resulting from use of the recreation area (i.e., increased police and fire protection, etc.). Moreover, increased regional expenditures are not the same as increased net income to the region. Account must be taken of needed inputs and their origins (local vs. non-local) before ascertaining the direct net regional income or employment impacts [Clawson and Knetsch 1966].

Productivity change can result in the region by placing immobile and unemployed labor to work as a result of the project or by causing an increase in productivity of the existing work force. The latter would be difficult to measure, however. As another report has pointed out with respect to all water project outputs:

> Regardless of the exact circumstances of production, if one is considering the impacts of a water project, the industry demand functions for firms using water services must either be assumed perfectly price and income elastic or of known elasticity before an increase in national [regional] income can be ascribed to a reduction in a water constraint [lack of recreation facilities]. In fact, depending on the market structure of the industry and the elasticity of the demand function, a net reduction in industry revenue could occur. The assumption of perfectly elastic demand for industry output is unrealistic, however, and the empirical problems involved in determining the shape of demand functions for specific industries are such that this type of sub-analysis should be considered only if a strong a priori case can be made that shortages of water services act as a constraint on more

> optimal production or that a water project will bring about technological change. [Kalter <u>et al.</u> 1970, pp. 23-24]

Likewise, it has been argued that it is empirically impossible to ascribe reduced regional unemployment in water related industries to a project [Kalter et al. 1970; Schmid and Ward 1970]. Only direct use of otherwise unemployed labor by the project should be counted as a regional gain.[37] In any case, such impacts are normally small and relatively inconsequential [Allee 1966].

On the other hand, increased regional expenditures for recreation related goods and services can be substantial. Although they are usually classified as transfer effects from the national viewpoint [Knetsch 1965], they can be real gains or losses from the regional standpoint. Moreover, because of their export characteristics and high income elasticities, sales of goods and services associated with recreation usage are often sought by regional areas. However, to the extent a region is successful in attracting this type of expenditure, it will be detrimental to other areas. Thus, data on sales distributions across regions is needed to accurately assess their full implications.

For planning purposes, information on the spatial distribution of actual project construction and operating expenditures is relatively easy to obtain. Because such expenditures are usually made by the interested agency, their incidence is readily available. Several studies have addressed aspects of this question [U. S. Department of Labor 1964; Haveman and Krutilla 1968]. If multi-purpose projects are being reviewed,

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[37] In such cases, the regional gain is equal to the wages received by workers that would have been unemployed minus reduced welfare payments raised outside the region.

however, and only the recreation components are of interest, only the separable recreation facility costs should be included in the calculations. No legitimate economic method exists to allocate joint project costs to functions [Eckstein 1958]. Moreover, only the net regional income effects should be considered a regional benefit (as opposed to changes in gross sales). Thus, data on value added by relevant industry or business would need to be obtained from Census or other sources.

Data on recreationists' expenditures and their regional distribution is more difficult to obtain. The concern here is largely for the increased expenditures of nonresidents in the region(s) of interest and the interregional reallocation of recreation expenditures by regional residents due to provision of additional recreation opportunities in the region.[38] Although it has been suggested that the savings-expenditure ratio of consumers may change because of new recreation facilities [Leven 1969, p. 260], this would be difficult to empirically verify and would probably be inconsequential if it could be confirmed.

For consumer recreation expenditures, several items are of interest. Clawson [ORRRC 1962, Study Report 24] and Clawson and Knetsch [1966] state that it is important to know how much of the expenditure (recreationist's dollar) stays in the local area (however defined); who in the area receives it and who benefits most from recreation expenditures; the relationship of recreation-vacation business to the local tax burden; and most important, the employment and wages generated by such expenditures. Of most interest, however, are the total, type and place of travel and recreation expenditures. For example, investment in capital equipment for recreation would generally take place in the home community. Variable trip costs will occur

[38] No published research directed toward the latter question was found, however.

throughout the journey as necessary and a large portion of them are directly related to the time involved in travel. Although the relevant cost to the individual is the difference between what is spent for the trip and what would have been spent at home, the relevant cost to a region, which is not the residence of the family making the trip, would be the total purchase of goods and services.

A large number of tourist and recreation travel surveys have been made over the past twenty years. As indicated previously, one impetus of these studies was to obtain an estimate of the primary value provided by recreation facilities. As we have seen, this is an inappropriate use of such data. The question is whether such data can be used for determining direct regional impacts of recreation. In their 1958 article, Trice and Wood [1958] summarized a number of expenditure studies carried out to that time [Pope 1939; Utah State Road Commission 1950; Crampon and Ellinghaus 1953; Child 1955; Copeland et al. 1955; Decker 1955; Pelgen 1955; Montana Highway Commission 1956; Texas Highway Department 1956; U. S. Department of Interior 1956 (3)]. These studies provided expenditure information related to participation in various types or combinations of recreation activities and were conducted at various points in time, all prior to 1960 [Clawson 1958]. This alone makes the empirical results unusable for current planning or evaluation efforts. However, the methodology utilized by these studies provided a basis for future work.

Studies of actual expenditures by recreationists at different times, in different places and for different activities continued during the 1960's [Keeling 1961; Copeland 1962 (3); Henrick et al. 1962; Brown et al. 1964; Hancock 1965; Staniforth et al. 1965; Kite and Schutz 1967; Williams and Schermerhorn 1968]. Usually, however, "expenditures" have not been carefully defined. Often state promotional agencies reported on tourist expenditures [State of Wisconsin 1965]. Because of their purpose, these surveys often exaggerated expenditures reported in more careful studies [Clawson and Knetsch 1966, p. 244].[39] Some studies include only those expenditures made away from home [Crampon 1962] or in the immediate vicinity of the park being studied [Keith 1964; Drake 1968]. Others dealt explicitly with given activities [U. S. Department of Interior 1965]. Some were based on information from retailers and other businesses [Bird and Miller 1962; Milliken and Mew 1969] while others obtained their information directly from the tourist [Fine and Werner 1961; ORRRC 1962, Study Report 19]. Some reported only annual totals [U. S. Department of Interior 1965] while others broke data down on a per trip or per day basis [Hutchins and Trecker 1961]. Some distinguished between gross expenditures and income or employment [Moore 1964; Stipe and Pasour 1967]. Most studies were general in nature, rather than for a specific type of facility, while all varied in their geographic coverage and date conducted (resulting in comparison problems due to inflation).

Thus, consistency between studies is impossible to obtain. However, Clawson has shown that the percentage, as opposed to absolute, distribution of expenditures among categories is evident from the surveys.

> Food, including restaurant and grocery store expenditures, accounted for about one-third of the total; lodging for about one-fourth; transportation, which probably means primarily gas for the family automobile, about one-fifth; and "other," undoubtedly made up a

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[39] In 1959, an unofficial organization was formed to improve such survey methods [Committee for Research Methods 1963]. However, Clawson and Knetsch point out that such surveys are still subject to deficiencies including: obtaining information only on expenditures within a sample area; definitions of expenditure items are not necessarily consistent; and the impact of reported expenditures on the local community is not studied (employment and income information is not obtained nor are the increased taxes resulting from such expenditures identified) [Clawson and Knetsch 1966, p. 245].

> wide variety of items, for the remainder, roughly a fifth.
>
> While differences appear from area to area, the general similarities are far more striking than the differences. Data of this type would be immensely more useful if (1) the various studies employed comparable known definitions of expenditures, and more detail were included as to specific items of expenditure instead of broad categories; (2) the expenditures included all items, including either cash-cost or estimated depreciation charges for equipment; and (3) data were included on expenditures at home preparatory to the trip, and expenditures en route to the recreation area were separated from those at or near the site. Data to these specifications would obviously be somewhat more difficult to get, primarily because most recreationists have only a vague idea as to how much they spend for what and where. But it might be possible to devise some means of estimating these items. [Clawson and Knetsch 1966, p. 234]

Clawson [1962], however, proceeded to utilize available surveys to obtain rough estimates for 1960 of per person per day expenditures for visitors to specific types of public recreation areas. For federal reservoirs, the total for all items came to $9.75 per day; with $2.00 for food, $.50 for lodging, $1.25 for transportation, $1.50 for "other" and $4.50 as a "reasonable charge for use of equipment." Clawson also estimated the percentage distribution of each category of expenditures for federal reservoirs and other types of parks by location (in the park, en route, in the home community). However, the exact definitions of the boundaries of these three areas was not provided; probably because the figures were merely educated guesses in the first place.

A comprehensive, but somewhat dated, source of recreation expenditure information is the 1960 National Recreation Survey [ORRRC 1962, Study Report 19]. Average expenditures per activity day are available for various expenditure categories and for vacations, trips and outings. Also, variations in such expenditures because of the distance travelled can be ascertained. The data clearly point out that substantial variations exist in expenditures by activity, type of occasion (vacation, trip or outing) and mileage travelled [Stevens and Kalter 1970]. No information is provided, however, on the type of facility visited (national park, state park, federal reservoir, etc.) and whether expenditures per day vary by such a breakdown.

What is lacking in all potential data sources on recreation expenditures is current (or updated) values for recreationists who utilize federal reservoir facilities[40] and the precise distribution of such spending among a meaningful set of defined regions. This type of data, taken from a representative sample of visitors to such projects, is needed for regional impact evaluations of Corps of Engineers projects. With properly structured questions, it could be obtained as part of a third National Recreation Survey (if one is conducted) or in conjunction with Corps surveys of recreationists at their facilities. Care should be taken in defining what is to be included in "expenditures" (for example, expenditures made near the respondents home that are not in excess of normal expenditures should not be counted as an impact on that region) and in obtaining a breakdown by expenditure category [Brown et al. 1964].

The latter is especially important for several reasons. First, expenditures, as defined here, are the gross direct effects on a region of recreation activity. To determine the net income and tax effect on the region(s), information on the value added and retained by the region would be needed.[41] A better

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[40]The impact of spending on vacation homes which are built as a result of the recreation area should not be ignored [Ragatz 1970].

[41]It should be noted that sales, income, and employment all tend to move together and maintain similar relative magnitudes [Kalter 1967; Kalter and Lord 1968]. However, since income and employment are the more appropriate measures, they should be utilized when possible to avoid the "tyranny of large numbers" resulting from expenditure values. In other words, the real

approximation of such values, and their employment effects, can usually be obtained on an industry by industry basis [Clawson 1962]. For example, Dun and Bradstreet reports, Census information and data from banks can be utilized for this purpose.

Second, expenditures by recreationists are made on specific items, thus routing the direct impacts on a few economic sectors (mostly retail and service). Moreover, the particular type of recreation facility results in a unique pattern of expenditure. For example, lodging will not be a large item in the budget of recreationists using day-use facilities.

Finally, all the direct expenditure patterns discussed above result in a multiplier process. From the national point of view, these so-called "secondary impacts" have been discussed at length [Kalter and Lord 1968; U. S. Dept. of Agr., ERS 1970; Kalter and Stevens 1971]. However, the issue here is the regional and interregional implications of such round by round effects of recreation spending. Certain tools available to ascertain, quantitatively, these impacts require knowledge of the breakdown among economic sectors of any direct expenditures. This will be the next topic considered.

Regional Multiplier Impacts of Recreation Expenditures: Knowledge of direct expenditures in a region enable estimates of the multiplier or indirect impacts to be made. Of course methods must be used which account for the leakage of expenditures outside the region being considered [Clawson and Knetsch 1966, p. 240]. The more economically self-contained the area, the greater will be the multiplier value since less of the initial and subsequent round expenditures will flow to other regions. The leakage can obviously vary from sector to sector. It should also be noted that both leakages and spatially transposed expenditures will have

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economic impact of recreation on a region can be misrepresented by expenditure values.

initial and multiplier effects on other regions in our set of regions.

A number of approaches have been investigated as a means of deriving regional multiplier values, including economic base studies, simple Keynesian models and regional interindustry models, and more recently simulation models [Back and Waldrop 1966; Office of Appalachian Studies 1969; U. S. Dept. of Agr., ERS 1970]. However, the first two types do not permit the multiplier effects of direct expenditures in individual sectors to be estimated nor are they readily adopted to interregional questions. Thus, the round by round impacts are calculated for an "average" regional economic sector (no allowance is made for variations in import and input patterns among sectors). Examples of such studies include Tiebout [1962], Nathan [1966] and Clark [1970]. The Nathan study, for example, derived multiplier values for each county in Appalachia using employment data. They showed that the multiplier will vary in size directly with the economic size of the county.

On the other hand, interindustry and simulation models identify impact sectors explicitly and, at least interindustry models, are capable of application to interregional problems [Isard 1951]. Simulation models have generally been formulated at a more aggregative level than the interindustry type and have not dealt as explicitly with industrial and other economic sectors [Back and Waldrop 1966; Hamilton _et al._ 1969]. Thus, for natural resources planning and evaluation, primary attention has been focused on the input-output model. Over the past ten years, a large number of these have been implemented for individual regional areas and/or discussed as potential tools for planning. Some have taken the form of the Leontief input-output model [Jansma and Back 1964; Gamble and Raphael 1965; Hinman 1967; Kalter and Allee 1967; Bills and Barr 1968; Canion and Trock 1968; Battison and Jansma 1969; Green 1969; Malone and Detering

1969; Lofting] while others have used a from-to approach [Kalter 1966, 1967 (2), 1968 and 1969, An Interindustry Analysis]. Several of these studies have been carried out with the express purpose of determining the secondary impacts of outdoor recreation [Gamble 1965; Kalter 1966; Stevens and Kalter 1970].

However, as has been pointed out, care should be taken in using such results to measure regional growth effects.

> This stems from our definition of regional growth and the assumption made concerning regional employment. If full employment is projected for the region over the project's time horizon, multiplier effects can merely result in a labor inflow to the region with no necessary improvement in regional per capita incomes. On the other hand, if full employment is not forecast or if slack (underemployment) exists in the regional labor markets, multiplier impacts can cause a real change in regional per capita incomes. Also, a redistribution of labor resources toward higher valued occupations because of the project could result in improvement in the average per capita income regardless of the rate of unemployment.
>
> Thus, if per capita rather than total regional income is important, the assumptions the analyst makes on these issues is critical to the evaluation results. Moreover, most empirical situations would tend to present a mixture of conditions rather than one of the polar cases outlined above. Little research exists to resolve this problem. [Kalter *et al.* 1970]

These problems, along with conceptual issues relating to the model itself (such as the assumptions of linear homogeneous production functions and stable technical coefficients through time), dictate caution in its use. Yet, if the basic objective is to develop a procedure to determine the indirect and induced economic effects of government investment, this appears to be the best method currently available. As Kalter and Lord have stated:

> When used in conjunction with other studies, [interindustry] models provide a practical tool which can be used to estimate the magnitude and distribution of such economic effects. Given an independent estimate of the initial (direct) impact of a proposed investment, we can derive estimates of net regional benefits (regional

> benefits minus regional costs) from the income transactions matrix of the ... model and the associated inverse matrix and income multiplier values. More specifically, given adequate supporting data, we can estimate the regional benefits accruing during the year of model formulation as well as make projections of future benefits. [Kalter and Lord 1968]

Moreover, the interindustry approach permits an interregional (set of regions) view to be formulated [Leven 1970]. This corresponds with our previous notions on regional analysis; namely that impacts should be identified for a set of regions and that transfer impacts should net to zero across all regions. An interregional model, while highly restrictive in terms of data requirements, may also enable sufficient planning resources to be mobilized to overcome a similar problem with models of individual regions. As Leven indicates:

> We started our research with the notion that it would be of little use to water resource investment decision making to develop the data and calculations in great detail for a single test area, including complete instructions, say a detailed handbook, of how to reproduce such a model for other areas. While this could have been done, the point is that building even a two final demand sector model in an interregional interindustry context is a very laborious and time consuming task. In short, we rejected the notion that it would be feasible for the Corps to build a new model every time their focus of concern shifted to a different geographic area. Accordingly, we have, herein, tried to develop a single model which, without major new data collection efforts, could calculate interregional impacts for a wide variety of situations. [Leven 1970, pp. 154-155]

Obviously, such a model would be useful for measuring more than the regional multiplier impacts of outdoor recreation. Because of the magnitude of the model formulation task, the operating and updating requirements of such a model, and the variety of uses for it, an outside agency such as the Office of Business Economics in the Department of Commerce should probably be given the task of model implementation.

Finally, neither the direct expenditure or regional multiplier impacts stemming from recreation investment should be considered apart from the problems they may create for particular regions. For example, employment in many economic sectors servicing recreation is highly seasonal, low paid and often recruited from outside the area. Requirements for government services may increase (including off season unemployment benefits), causing increased taxes. To the extent possible all such impacts should be quantified and incorporated into the analysis.

Regional Land Enhancement Benefits of Recreation Investment: As indicated in a previous section, land enhancement benefits due to an activity often reflect the more direct economic implications discussed above. To the extent this is true, considering both in a regional evaluation would be double counting. However, knowledge of the increase in land values may be important in ascertaining the effect of recreation development on local taxes. Methods used to consider this question [Knetsch 1964; David 1968 (2)] have, however, been discussed previously and will not be repeated here (see pages 74-76).

Regional Cost Impacts of Recreation Investment: The foregoing has been mainly concerned with regional benefits. However, not only must expenditure increases (direct and indirect) be translated to gross income impacts as indicated, but actual cost increases due to the project need to be ascertained and netted out. Moreover, this needs to be carried out for all the various regions in the set. If the costs included only the indirect payment via taxation by the region for the project, the regional cost question would reduce to a tax incidence study. However, direct reimbursement questions are often involved, complicating the issue.

Kalter and Stevens [1971; Kalter *et al.* 1970, pp. 33-50] have recently discussed a conceptual framework within which this type of question can be handled. The framework is of general applicability to any definition of distribution classes (regions, income groups, etc.) and explicitly incorporates the factors of time, present values, and reimbursement or cost sharing. As applied to a set of regions, net benefit to region j is expressed as:

$$\text{Net Benefit}_j = \sum_{t=1}^{T} \frac{B_{jt}}{(1+i)^t} - \left[Z_j + \left(\sum_{t=1}^{T} \frac{R_{jt}}{(1+i)^t} - K_j \left(\sum_{t=1}^{T} \frac{\left[\sum_{j=1}^{J} R_{jt} \right]}{(1+i)^t} \right) \right) + \sum_{t=1}^{T} \frac{O_{jt}}{(1+i)^t} \right]$$

where B_{jt} represents the annual dollar benefit to class (region) j, i the discount rate, T the time horizon, Z_j the portion of the tax payment by region j allocated to project construction, O_{jt} the project's annual operating maintenance and repair cost paid by region j, R_{jt} is the reimbursement paid by region j, and K_j is the proportion of total taxes paid by region j. The first component of the expression represents the present value of benefits to a region when B_{jt} incorporates all relevant benefits to the region under consideration. Thus, both the appropriate (regionally impacting) national economic efficiency benefits, including primary impacts, externalities and productivity effects; and regional transfers (like expenditures and the resultant multiplier effects) would be included in this value. Also, as for national economic efficiency evaluations, account would be taken of any potentially foregone alternatives. The second part of the expression represents the project investment cost to the region, consisting of the initial tax plus an adjustment for reimbursement. The total regional cost is then the investment cost plus the present value of operating, maintenance and repair costs. The "reimbursement adjustment" is measured as a positive or negative deviation from the tax structure or the difference between actual reimbursement and that which would occur if it were proportionate to the tax structure.

Normally, the model would be implemented for an entire project (including the recreation component) but it could be used for any individual component as well. As long as joint project costs are distributed in the same way for the formula as in actual practice, analytical results will not be affected [Kalter and Stevens 1971]. Implementation of the formulation, then, for all regions permits calculation of both the absolute and relative distribution of net present value benefits accruing to the regions.

OUTDOOR RECREATION, DISTRIBUTION OF OPPORTUNITY AND THE INCOME DISTRIBUTION IMPACT

During the 1960's increasing concern was voiced over the distribution of recreation opportunities among the population. Moreover, the net impacts of publicly provided outdoor recreation on the distribution of personal income has attracted increased attention from several points of view.[42] First, aside from a partially documented unequal distribution of recreation opportunity [Clawson 1964; Hunt 1969; Barkley], it has also been suggested that the public outdoor recreation program may not have neutral effects on the distribution of income in society [Hunt 1969]. Accurate, quantitative information was needed to ascertain whether this was the case and, consequently, whether it should be a concern for public decision making on recreation investment. Second, it has been frequently suggested that the income distribution impacts of public investment (assuming they are not neutral) are important to a public decision making function and, therefore, need to be accounted for [Marglin 1962; Weisbrod 1968; Kalter *et al.* 1969]. With respect to planning for water resources projects, the Water Resources Council has recently suggested adoption of such an approach [Water Resources Council 1969 and 1970 (2)].

The Earlier Studies: Concern for the distribution of recreation opportunities and the income impacts of publicly providing those opportunities was fostered by several of the ORRRC studies. For example, the Commission's main report questioned the geographic distribution of recreation land vis-a-vis our population. With

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[42] Income distribution aspects of publicly provided outdoor recreation obviously refer to "income in kind" and not actual monetary income [Robinson 1967]. However, this is not inconsequential when the provision of such a public good at a price below willingness to pay releases private resources for other uses [Kalter and Stevens 1971].

a "large percentage of the people in the East," most of the recreation land is located in the West. Even within states, most recreation land "is located just beyond the range of mass recreation use for the people" of urban areas.

More specifically Mueller and Gurin [1962] found that income and recreation participation were highly correlated. Naturally, income was found to be correlated with both education and the availability of leisure time. Others have also shown this to be true [Burdge 1967, Outdoor Recreation Studies]. In another 1960 study, Reid [1963] suggests that recreation participation is largely the province of middle income groups. Knetsch notes that:

> By and large the present supply of free public parks in this country is less adequate in crowded city areas where people are poor than in the suburban and higher income residential areas where the people concerned are more nearly able to pay for their own outdoor recreation. On a state or national basis the discrepancy is even worse -- the really poor people do not own private automobiles which are necessary to get to most state parks and to all national parks and national forests, nor can they in most cases afford other travel costs of such visits. [1966]

The Knetsch concern was, however, not to be laid to rest by the strict "market" approach to recreation investment allocation (which incidently has largely been advocated by Knetsch). Seckler [1966] was concerned that use of willingness to pay techniques for estimating recreation benefits would bias investment allocations to areas benefitting those with <u>effective</u> demand. Stoevener and Brown [1967] counter that, even though distribution issues may be important, the evaluation-reimbursement dichotomy should be preserved and income distribution questions are irrelevant for an efficiency analysis.

Although the latter is certainly true, it is precisely whether efficiency evaluations should be used as a sole decision criterion that is at issue. Another issue which remained unclarified by these earlier discussions was whether the unequal distribution of recreation opportunities was synonomous with unequal income distribution effects of their provision. Hunt clearly feels so:

> It becomes clear that if the lower classes are to take advantage of most outdoor recreation facilities and opportunities, they must give up a greater portion of their income than the middle classes. Assuming the absolute costs of visiting [recreation areas] are the same for all classes (which they are not, since the lower class is generally located further from the opportunity than the middle class) then it is reasonable to assume that the cost, as a proportion of disposable income, will increase as income decreases. The costs for the lower class become even greater when considering that many do not own automobiles or other recreation equipment which makes access to, and use of, [recreation areas] easier and more convenient. [Hunt 1969]

However, such a discussion is inadequate. Clearly the actual income distribution impacts depend not on "if the lower classes take advantage" but whether they take advantage and on the source of funding for the investments. Regarding the latter, several papers have suggested that the overall tax structure is regressive [Seastone and Feather 1966] and, therefore, the poor tend to subsidize the recreation of the middle class [Clawson 1964]. Without more explicit data on both tax incidence and recreation participation, however, this cannot be proved for specific circumstances.

Recent Empirical Work: Using the 1960 data from the ORRRC studies [1962, Study Reports 3 and 5] and estimates of tax incidence, Barkley made a very rough (by his own admission) study of the distribution of use of Federally sponsored recreation facilities among income classes. For federal reservoirs, he found the 1960 percent of visits and percent of tax payments by income class to be the following:

Income Class	Tax Payments	Fed. Reservoir Use
Less than $ 3,000	6.2%	7.5%
3,000 - 4,999	11.9	16.9
5,000 - 6,999	15.9	30.7
7,000 - 9,999	18.7	24.2
10,000 - 13,999	16.3	13.5
14,000 and above	31.0	7.2

He, therefore, assumed the high income classes were subsidizing the middle, and to some extent the lower, income classes, at least in regard to recreation investments at federal reservoirs. The results, however, measured neither the opportunity to participate nor the income distribution effects. The former was not the purpose of the study but the latter could not be derived from the data used. Barkley implicitly assumed that the recreation benefits during 1960 were equal to investment <u>and</u> other expenses of recreation paid by the government during <u>that</u> year. Reimbursement issues, the effect of investments over time and actual <u>benefits</u> (willingness to pay) of recreation provision were all not considered. Moreover, visits rather than recreation days were used to quantify participation or "use." Therefore, the length of the trip was not considered and this could be assumed to vary across income classes. Also, it should be noted that Barkley implicitly used the benefit principle of taxation in making his judgments on the relative distributional impacts.

Seastone and Feather [1966] in a wide ranging study of the impact of tax burdens and government expenditure on income distribution in Colorado also considered recreation. However, they virtually dismissed it for lack of data by assuming that the benefits of its provision were proportional to the reference distribution of income.

In an ex post analysis of a Corps reservoir project, James [1968, A Case Study] considered the income redistribution impacts of its construction. His approach was superior to previous attempts at such assessments because he explicitly accounted for the time factor and willingness to pay benefits.[43] However, recreation benefits were distributed to income classes by allocating them regionally (by county and state) and assuming "the income distribution of the visitors from an area to the reservoir to equal the income distribution of area residents as a whole" [1968, p. 503]. He justifies this by indicating that no positive correlation was found between income and visitation. This does not prove or show, however, that reservoir visitation is proportional to the income distribution in origin areas. Obviously, these are different phenomena and to use the stated approach for benefit allocation biases the results. James also ignored reimbursement questions in his analysis although it is not clear if they were a factor in the project.

In any case, James proceeded to derive gross recreation benefits and costs by income class for the recreation component of the project and to calculate a benefit-cost ratio for each class. Only separable recreation costs were allocated to the cost side. Results showed that net recreation benefits were "relatively greatest for the lowest income group. This group makes widespread use of the reservoir but pays a small share of the total taxes" [1968, p. 504]. The last statement, however, is curious in light of the rather arbitrary means used to allocate benefits. Moreover, the data indicates that all classes, except the over $10,000 class, received positive net benefits from the project.

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[43] James, as well as a subsequent study [Kalter and Stevens 1971], implicitly assumed that any distribution change caused by the project would not substantially effect relative prices and, thus, efficiency benefits could be used in a distribution evaluation. This is not an unrealistic assumption given the magnitude of most projects being evaluated vis-a-vis the movement necessary to substantially redistribute the income profile.

James also experimented with weighting factors to ascertain what proportion distribution benefits were of efficiency benefits. In doing this the principle of equimarginal sacrifice was assumed and marginal progressive income tax rates were used to calculate the weighting factors [Haveman 1965]. Using this approach and considering the impacts of time on the composition of the classes, it was found that redistribution benefits were equal to 18.2 percent of efficiency benefits for the project as a whole.

In a detailed study, Shabman and Kalter [1969 (2)] investigated the income distribution impacts of the New York State outdoor recreation program. Using fiscal 1968 data, they utilized and compared several different conceptual approaches to the problem. The first utilized a classical flow of funds form of analysis, tracing the redistribution effects of all state revenue devoted to outdoor recreation in a given year. Recreation expenditures were treated as gross transfer payments and, for each income class, were netted against tax and fee burdens imposed. The second approach is of more interest for investment evaluations. It analyzed the present value equity impact of incremental state investment in recreation facilities. Projected annual benefits of such investments, measured by a proxy for willingness to pay and converted to a present value basis, were used to estimate gross equity impacts and, for each income class, were netted against discounted costs. Data from the National Recreation Surveys were used to estimate the income classes of recreation users, by activity. An indepth tax and fee incidence study was undertaken to allocate burden.

The analysis showed that the upper income group ($15,000 plus) realizes negative net benefits from the investment program while the four lower classes realize positive net benefits. However, positive benefits are the smallest for the lower class (less than $3,000). Over 80 percent of the positive benefits were shown to accrue to the $3,000 - 14,999 brackets. The authors point out, however, that the analysis was based on the benefit principle of taxation and does not account for the opportunity (or lack of it) to participate in outdoor recreation. The data did show, for example, that the lowest income class does not utilize State provided recreation facilities to the extent of other classes on either an absolute or per household basis. They conclude that:

> Given the value judgment that state provided recreation services should be available to all income groups on an equal opportunity basis, this would appear to indicate that the lower income class, largely urban in New York State, either doesn't care to participate or lacks the opportunity for participation because of the inability to pay transportation costs and/or purchase equipment associated with recreation participation. [1969, p. 1519]

Shabman and Kalter also estimated welfare weights to use with their analysis in an effort to relax the assumption of constant marginal utility of income among classes. The approach to weight determination first used by Haveman [1965] and applied by James [1968] was implemented. Although the absolute magnitudes reported by the study were altered by the use of such weights, the basic conclusions were not.

Finally, the study by Kalter and Stevens [Kalter <u>et al.</u> 1970; Kalter and Stevens 1971] was aimed at specifying a conceptual approach and empirical methodology to determine project income distribution impacts at the planning and evaluation stage. Utilizing an authorized but unconstructed Corps reservoir project, they applied the conceptual model outlined on pages 146-147 above to personal income classes. They, however, departed from previous studies in several ways. First, they postulated that income distribution is "changed by federal resource investments whenever the distribution of project <u>net</u> benefits is nonproportional to the income distribution projected to occur without the project" (or, practically, the original income distribution) [1971]. Thus, net impacts of a project on classes were compared with an outside reference. Second, the model explicitly incorporated reimbursement and cost sharing considerations. Third, the problem of joint cost allocation among functions was considered and incorporated into the analysis. As with the James and Shabman and Kalter studies, time and willingness to pay considerations were considered. The assumption of equal marginal utility of income was also discussed in a similar fashion.

Empirically, a tax incidence study was used to allocate costs and benefits were distributed in various ways depending on the project function. For recreation, the National Recreation Survey data was again used for allocation purposes. Net recreation benefits from the project were skewed heavily toward the middle income classes of the region immediately surrounding the project, although all classes received some positive net impacts.

All the empirical studies lacked accurate data on one essential parameter. That is, the distribution of gross recreation benefits among income classes. All used data collected by the National Recreation Surveys or other ORRRC studies for this purpose. However, this information is either out of date and/or not specific to recreation areas at federal reservoirs. As indicated previously, however, the problem can be easily solved. By simply broadening the Corps recreation surveys at their sites to include a question on the income of the respondent, valuable information could be obtained that would permit a more accurate assessment of distribution impacts. This data used in conjunction with a model similar to that proposed by Kalter and Stevens would provide the necessary results to assess the income distribution impacts of Corps recreation investments.

CONCLUSIONS

The objective of this report has been to review, summarize and critique recent economic research pertinent to outdoor recreation. The focus has been public policy issues important to the planning and evaluation of potential alternative governmental actions affecting the provision of recreation services. As such, this review has been structured to reflect a multiple objective planning approach. In other words, it was assumed that public planning requires that cognizance be taken of social preferences which are usually expressed in terms of multiple objectives. With respect to economic preferences, these can include national economic efficiency and equity-distribution concerns, like regional and personal income impacts.

In this concluding section, no summary of the foregoing will be attempted. The curious reader has no choice but to read the full report, for to summarize what is already an abbreviated account of rather technical material would be of little instructional value. Rather, this section will pull together the various findings and conclusions spread throughout the report, and spell out their implications for empirical implementation of new planning procedures and directions for future research. More specifically, this will be carried out with reference to the requirements of the Army Corps of Engineers project planning process. As an aid to exposition, the discussion will be divided along the lines of the three economic objectives usually considered important for a social welfare function -- national economic efficiency, regional development and income distribution impacts.

<u>The National Economic Efficiency Objective</u>: Any economic evaluation of proposed investment alternatives requires a knowledge of the demand schedule for their outputs (see pages 11-16).

This is the foundation of an analysis based on economic efficiency, but also provides data prerequisites for the use of other evaluation objectives. From such information, projections of use and the associated economic value under various conditions and assumptions can be made and compared with appropriate costs. This is no less true of recreation even though it is usually considered a publicly provided good.

Although conceptual and empirical difficulties have inhibited the empirical estimation of recreation demand functions, the search for meaningful substitute approaches to provide economic planning data has not been successful. Other methods have not been able to adequately consider all the factors relevant to the demand for and economic value of recreation; nor have they been able to distinguish between the different values associated with different types and qualities of recreation experience.

Several approaches to the recreation demand issue do, however, exist. The most widely accepted is to use transfer cost information (in conjunction with "use" data) to estimate demand schedules for individual recreation sites [Clawson 1959] and utilize such schedules for projection at "similar" proposed locations. This has been the focus of substantial research and has largely been the focus of the Corps of Engineers in their efforts to provide improved planning tools for this area. At the more aggregative level, however, the site specific approach has the limitation of ignoring overall "market" demand and, thus, could result in double counting projected use and value when a number of proposals for recreation expansion are being considered for a given region. A solution to this problem is to constrain the results forthcoming from site oriented functions by use of market information derived from market or population specific demand schedules [Cicchetti et al. 1969; Kalter and Gosse 1969]. Alternatively, as was shown earlier (see pages 123-126), market demand forecasts can be coupled with spatial allocation models to provide estimates of use and associated economic value for proposed recreation investments at specific sites [Kalter and Gosse 1969; Tadros and Kalter 1971]. The latter approach is less well developed for planning purposes but appears to offer some advantage to site specific methods in that comprehensive planning information can be obtained and sensitivity analyses are more easily carried out, without the disadvantage of potential double counting.

Numerous difficulties, however, attend the use of all the approaches to quantifying recreation demand schedules. The research literature identifies appropriate model specification and data requirements for empirical implementation as the main limitations. The former includes both the specification of variables for inclusion in a demand model and their precise definition. Although a number of variables may be correlated with recreation demand and can be suggested from knowledge of economic theory, the data and statistical techniques to show that correlation may be absent, resulting in the specification of less complete models and potentially inaccurate forecasts due to their use. For example, inclusion of appropriate socio-economic demand "shifters" like income, education, sex and race into a prediction model for recreation demand; inclusion in the model of important cost factors (like money costs, time and distance) which go to specify a demand schedule; and consideration of other demand "shifters" like quality and competition by alternative uses of resources can all be considered important to model specification. Moreover, for purposes of public policy, one would often like information corresponding to different definitions of "use" variables than the available data can provide (see footnote 12, pages 26-27). Thus, the appropriate definition of recreation "use" to permit identification of activities and/or the length of the recreation visit can be important. Much of the research over the past ten years has been concerned with these sorts of issues, as well as a means of utilizing recreation demand models to forecast the economic value of proposed recreation investments.

Following the work of Clawson, cross-sectional data, which reflected varying cost conditions because of differing distances between recreationists and recreation sites, has been used to formulate demand functions for the "entire recreation experience." When formulated from data derived from a specific site, these functions can be used to project recreation attendance at the site (at no increase in costs). A second demand function can, then, be derived for the site itself (see pages 27-30), and used to derive its economic value. The simplest formulation of this model merely correlates visitation with costs (usually distance) but the model can be expanded to include other important parameters like those mentioned above. Most empirical investigations using this method have utilized some form of the more sophisticated model specification. However, while studies along these lines provide obvious improvements over the techniques currently used by government agencies for recreation evaluation, they have not necessarily been consistent with respect to data sources, model specification or variable definition.

For its planning needs, the Army Corps of Engineers required adequate and statistically reliable data from the relevant population expected to use agency constructed facilities; as well as a standardized method to project recreation use and value (see pages 50-51). Recognizing this, the Corps undertook efforts to accomplish both purposes in 1963. This resulted in a series of research studies and, recently, the implementation of new methodology for estimation of recreation use [Pankey and Johnston 1969; U. S. Army Corps of Engineers 1969 (2) and 1970, ER 1120-2-403].

It is the conclusion of this review, and of the Corps itself [1969, Tech. Rept. 1], that the statistical reliability of the data sampling technique (sample surveys of recreation users at the site) used for these Corps data collection efforts is sound, but that future surveys should be structured to provide increased data for planning. Included should be additional information on socio-economic variables like income and leisure time (and others potentially important to recreation preferences), transfer (travel) costs and entrance fees, site and trip quality factors and the type of recreation occasion engaged in by the respondent. All but the first are directly useful for site oriented recreation use prediction models. Socio-economic variables are properly included in a Clawson type model only when they refer to the appropriate distance zones around the site and not to actual participants from those zones. However, such data can be useful for other types of analysis, or when separation of recreationists possessing a particular characteristic is desired for demand analysis, and should be collected as a portion of the overall effort (see pages 53-54).

Using the recreation data collected between 1963 and 1969, the Corps developed a standardized, interim planning methodology for recreation use prediction [1969, Tech. Rept. 2] and began a long range research effort to improve such techniques [Pankey and Johnston 1969; U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation]. Since the results of these two efforts differ they will be discussed separately. First, the new interim methodology is based upon a first step (use prediction) Clawson model of the simplest form (correlates use and distance only); and uses the "most similar project" concept in that projections for proposed reservoirs are derived from per capita use values which exist for comparable existing reservoirs. Thus, the questions of model specification raised above are not considered. However, the procedures should be thought of as a move in the right direction which can serve as a strong foundation for future efforts. The basic decision to be made now is whether this particular approach should continue to be developed (along with market estimates to act as constraints), as opposed to one utilizing some form of regional estimators--either through pooled site data (see below) or by the use of market demand functions in conjunction with spatial allocation models. If the site oriented approach is to be improved, more attention needs to be given to the appropriate definition of recreation use (see pages 62-63), the influence of quality factors on recreation use, the addition of appropriate socio-economic variables to the prediction formulation, the issue of alternative or substitute sites, the role of time constraints as a cost variable, and the means by which "similar" project sites are ascertained (see pages 64-68). Gradual modifications to the methodology can be made to reflect these concerns as additional data and research becomes available to overcome the various conceptual and empirical problems.

The Corps research [Pankey and Johnston 1969; U. S. Army Corps of Engineers 1970, An Analysis of Day Use Recreation] designed to improve recreation planning techniques, however, has taken a somewhat different path than the interim procedures. Although utilizing the site collected data as a base, that data was pooled and efforts were made to derive composite demand functions which could serve as "regional estimators." However, this approach results in a demand function that incorporates the "average" of all features for the pooled sites not included in the model. Also, it can result in explanatory variables dropping out of equations because pooling causes them to become statistically insignificant due to averaging. More importantly, no attempt has been made to compare the coefficients derived from pooled data with those derived for individual reservoirs making up the sources of that data. If this were done, efforts could be made to ascertain why functions derived by the two techniques differ (if they do) and what additional variables would help explain that difference. Since the results of a pooled data approach would be used to make specific projections for proposed sites, this approach should not be accepted for planning purposes without further testing since it assumes that all effects not explicitly included in the estimated equation are unimportant, and could cause certain explanatory variables to be excluded from the prediction model. If regional estimators are preferred because the "similar" project approach is thought to be too costly or impractical because similar sites are not available, the market approach to recreation demand coupled with spatial allocation models should be explored as an alternative (see pages 60-61). Continued use of site functions will require exploration of market oriented demand models in any case because of the double counting problems.

Before turning to consider the market approach, several other points pertinent to the site oriented approach need to be covered. Obviously, the prediction of recreation attendance through the use of such methods, although useful, does not give an appropriate indication of economic value derived from a particular resource or permit comparison with alternative uses of that resource. Measurement of such values (which is vital to an economic efficiency analysis) flows naturally from site demand functions. Historically, other techniques have been utilized but none provided a conceptually correct or practical measure of recreation value. However, economic value can be estimated from demand functions under several different views of the recreation market. Of the various suggestions, three stand out. Following Hotelling, many have advocated the consumer surplus approach. This approach can be subdivided into two different concepts. When the price or entrance fee to a facility under consideration is zero, consumer surplus is the same as the revenue generated to a perfectly discriminating monopolist.

Upon imposition of an entrance fee, however, consumer surplus is, following Marshall, the excess of the price the consumer would be willing to pay rather than go without the item under consideration over that which he actually does pay. A third formulation would be to select a price and quantity which would maximize revenue to a non-discriminating monopolist. The largest consensus seems to exist over the use of a consumer willingness to pay measure which would be defined as the entire area under the demand curve. This would be the same as the return to a perfectly discriminating monopolist but it would also be consistent with benefit calculations for other water project functions. In addition, since increments to supply from water projects are often relatively large and resources immobile, actual willingness to pay by consumers would be poorly measured by the single monopoly price approach. Thus, initial units of output should be valued at a higher rate than final units. Because of this lumpiness condition, the area under the demand curve is both the appropriate measure of benefit and consistent with private market evaluations of such outputs [Knetsch 1965, Potentials of Water-Based Recreation].

Willingness to pay measures can be easily derived from the demand function for the recreational site under consideration. Such values would include only the primary national efficiency benefits and not encompass a valuation of relevant externalities produced by the project or the willingness of the population to purchase an "option" of future attendance (see pages 82-83). Although this approach could be utilized with the interim Corps procedures (or with an expanded version of them), this has not as yet been recommended. This review agrees with the suggestion by Crane [1970] that the willingness to pay procedures be adopted to estimate the economic value of recreation provided by proposed projects, and that this be carried out in conjunction with the interim methods utilized to project use. This would place the estimation of economic value from the provision of outdoor recreation services on a conceptually correct basis and, therefore, improve the economic efficiency analyses of proposed investments.

Of course, such a technique also contains limitations, especially when implemented through the use of the rather simple demand formulation suggested by the Corps' interim planning procedures. A number of these limitations have already been discussed with reference to the use prediction portion of the technique. Of particular importance to the estimation of economic value by such techniques is the relevance of the time constraint in the demand formulation and the problem of effects from substitute or competing recreational sites. These two issues become important in the measurement of economic value because inadequate incorporation of them in the first step of the Clawson formulation will result in a bias to the second stage function. A third limitation of importance is the empirical problem of translating distance and time values into monetary values so that dollar estimates of site worth can be derived from the demand functions. All these concerns have recently become the subject of additional research effort [Grubb and Goodwin 1968; Pankey and Johnston 1969; Cesario and Knetsch 1970; Crane 1970]. If the Clawson type of formulation is expanded for use by the Corps in their planning process, further experimentation and research on such issues should be given high priority.

A final problem involving the use of site demand functions needs special consideration. It is an issue normally not mentioned in the research literature but which can be vitally important in the estimation of unbiased functions and associated economic value. The concern is with site capacities. On the one hand, the capacities of existing sites vis-a-vis the actual recreational use of those sites can have implications for empirically estimated demand equations. Only if a site is not being used to capacity will the resulting equations accurately represent the true demand relationship at that point in time. If the reverse is true, the effective demand relationship may be underestimated since consumption (use) is not the same as demand for the site. This can lead to misleading projections of future use and economic value.

On the other hand, even assuming unbiased estimated equations, the total economic value estimated to result from projected demand cannot be considered a real benefit unless sufficient capacity will exist at the proposed site to accommodate it. Thus, site capacities are important from this perspective. Obviously, the two thrusts are not independent since demand may be partially dependent on site size while investment may be dependent on use estimates. More importantly, the relationships discussed are complicated by considerations of site quality, the time distribution of use, and the relationship between various potential activities using the site. Because these problems interact, it is doubtful that a completely satisfactory approach to the relationship between capacity, demand and value can be formulated for use in practical planning situations. However, bounds can be placed on the problems so that decision information is made increasingly reliable and useful.

With respect to estimation of the demand function, this may require reliance on improved methods of selecting the "most similar project" since problems related to variable site quality and the uniformity of recreation use through time are not easily handled empirically. In any case, the normal result of deriving "demand" coefficients from consumption data would be an underestimate of future use and value when such functions are used for projection. If sizing of proposed facilities is to be carried out with such information, however, the potential bias needs to be explicitly recognized.

The constraint which site capacity places on economic value, requires knowledge of the relationship between capacity and various levels of resource inputs. In essence, two approaches can be utilized to obtain this information--use standards or traditional production functions. The former provides inadequate information upon which to base a marginal analysis by failing to account for the relationship between capacity and resource input costs. Moreover, quality considerations and the timing of recreation use are not well handled. However, the few studies carried out on the production relationship for outdoor recreation have faced major difficulties. This is due to the inability to isolate the quality factor and the problem of separating consumption (use) from site output (capacity). For purposes of empirical estimation, use of consumption data to approximate the output variable in a production function for outdoor recreation may be the only alternative. However, additional research in this area is needed and would appear to offer potentially high payoffs if the results are properly utilized. So-called recreation production functions, in their current state of development, are not adequate for use in practical planning situations.

Turning to market demand approaches to recreation use and value projections, both reduced form (market clearing) equations and "structural demand" techniques have been investigated and appear to have merit for obtaining a market overview. Clearly, the structural demand approach is conceptually preferable to the reduced form methods. However, empirically the question turns on data availability and the ability to overcome problems of function identification. Several recent studies [Kalter and Gosse 1969; Cicchetti <u>et al.</u> 1969; Kalter and Gosse 1970] have improved the state of the art with respect to these questions and it would appear that a moderate amount of additional research effort would enable either approach to be used for practical planning purposes. However, since the data base for such studies must by necessity come from cross-sectional samples of household populations in the United States, nationwide surveys are required to obtain data. The previous survey of this type was taken in 1965 and because of the six year period that has elapsed and the need to continue accumulation of time series information, efforts should be made to conduct another survey in the near future. If this is carried out, it should incorporate suggestions for improvements over past surveys made by various researchers and data users.

Updated market demand functions can be used for projection so as to provide useful bounds to demand estimates from site specific functions. They also can provide an important part of the data requirements to make broad policy decisions concerned with the public provision of outdoor recreation, including site location questions, activity and facility mixes at sites, and investment timing. Of perhaps greater importance, market demand projections when linked with a linear programming type of spatial allocation model can also be used for these purposes and offer other detailed planning information. Coupling the two tools in this manner provides information that can be used to derive demand functions <u>for the site</u> in the accepted manner and, consequently, provides the necessary economic evaluation information for potential investments. This approach, however, has heavy data requirements and requires the use of several arbitrary assumptions for implementation. On the other hand, it can be utilized rather easily for sensitivity analysis, and merits further research development and discussion.

Finally, regardless of the approach taken to projections of recreation use and economic value, the Corps of Engineers needs to place increasing emphasis on the estimation of benefits from foregone recreation alternatives (see pages 69-70). Most sites utilized for water resources development have alternative recreational uses. Any losses of this nature must be subtracted from projected project gains. Since the activities which take place under pre-project conditions may be substantially different (in type and/or quality) than those taking place after project construction, the shape of the respective demand functions may vary. Consequently, it becomes necessary to utilize for projection demand functions appropriate to the respective activity and quality mixes. This will require collection of data on non-reservoir recreation uses of our natural resources and the formulation of demand functions for such uses. It is recommended that such an effort be commenced immediately so as to avoid the bias which could otherwise be built into the planning system.

The Regional Development Objective: The income distribution effects of public investment projects can be analyzed in several ways. One component of the distributional question is the regional (spatial distribution) impact. The quantification of such impacts requires data and tools of analysis which go beyond those used for the national economic efficiency objective. However, since regional income effects are normally the focus of such evaluations, many of the principles discussed in the previous three sections also apply here. Five component parts of a regional analysis are highlighted by this report and will be summarized below. First, however, it needs to be pointed out that this discussion will not treat the problem of regional definition since it is largely independent of recreation questions per se. What should be pointed out is that any regional evaluation needs to consider both favorable and adverse effects from a number of different viewpoints. Thus, a system of regional accounts which permits the impacts on more than one regional area, and the interregional tradeoffs which would result from project construction, to be quantified may be the best overall method of structuring such an analysis.

Returning to the component parts, it should be clear that the willingness to pay (national primary benefits) which accrue to residents of defined regions must be considered as regional impacts. Quantitatively, this presents no great problems. The gross regional income benefits are equal to the willingness to pay of users who are residents of the specified region(s). Methodology similar to that utilized to calculate such impacts for an economic efficiency analysis can be implemented here (see pages 132-133). For regional analysis, this may require that more specificity with respect to the recreationists geographical area of origin be utilized when constructing the demand function.

The second form of regional impact results from changes in regional income due to direct expenditures for recreation associated goods and services or from productivity changes stemming from the provision of recreation services. Expenditure changes can take place through the spatial reallocation of funds used for project construction; or through changes in regional expenditures by recreationists who are non-residents of the region and by regional residents who change consumption patterns because of the project. In all cases, care must be taken to ascertain the net income impacts rather than changes in gross sales. Regional productivity changes can result from a project because immobile or unemployed labor is put to work or because an increase in the productivity of an existing work force is fostered. Both effects are difficult to quantify empirically and most research results suggest that only the direct use of otherwise unemployed labor because of a project should be counted, from a practical point of view, as a regional gain. Although such impacts are normally small and relatively inconsequential, regional changes in expenditures for recreation related goods and services can be substantial. Normally classified as transfer effects from the national viewpoint, they can be real changes (gains or losses) from a regional standpoint. Appropriate and accurate data on the recreationists component of such effects are difficult to obtain, however. A large number of surveys relevant to such issues have been undertaken but little consistency exists between studies with respect to definition, expenditure categories enumerated, or the date of the studies. A substantial research effort needs to be mounted to consider such problems (see pages 134-140).

The third component of any regional analysis is the multiplier impact of direct expenditures. With respect to outdoor recreation, such multiplier impacts result from the direct expenditures discussed under the previous impact component. Knowledge of these direct effects enables estimates of the multiplier or round by round impacts to be made. A number of approaches have been investigated as a means of deriving the required multiplier values, including economic base studies, simple Keynesian models and regional interindustry models. The latter possess many practical advantages for planning purposes but require substantial amounts of data and research expenditures to properly implement. Moreover, such models are useful for measuring more than the regional multiplier impacts of outdoor recreation. Because of the magnitude of the model formulation task, the operating and updating requirements, and the variety of uses for them, an outside agency such as the Office of Business Economics in the Department of Commerce should probably be given the task of model implementation.

A fourth component of a regional analysis, which is often considered, is the effect of project implementation on land values. However, such effects may often reflect no more than the direct economic implications discussed above. Thus, they become capitalized into land values and considering them for a regional evaluation would involve double counting.

Finally, a fifth component of a regional analysis (or any distributional issue) requires that the incidence of costs (both direct and reimbursement) be considered in the evaluation. Recently, a model incorporating such considerations has been suggested (see pages 145-147).

The Personal Income Distribution Objective: Of perhaps equal importance to the regional development issue is the distribution of recreation benefits among personal income classes. Both the opportunity to participate at publicly provided outdoor recreation facilities and the actual effects of that provision on the distribution of income (including publicly provided benefits) in society have been considered relevant to this question. Most of the empirical work completed on this topic, however, has either not correctly conceptualized the problem or has had insufficient data to properly evaluate the issue (see pages 148-155). The principal deficiency is lack of information on the distribution of recreation benefits among income classes. All studies have utilized gross assumptions on this point or information from the National Recreation Surveys. However, this information is either out of date and/or not specific to recreation areas at federal reservoirs. Fortunately, the problem can be easily rectified. By simply broadening the Corps recreation site surveys to include questions on the income of the respondent, valuable information could be obtained that would permit a more accurate assessment of distributional impacts. Use of such information in conjunction with a model similar to that proposed by Kalter and Stevens [1971] to consider cost sharing factors would substantially improve evaluation results.

In summary, this report has attempted to both critique past research results pertinent to the economics of outdoor recreation and suggest future thrusts for planning and research. Although the means of economically evaluating recreation investment alternatives has progressed rapidly since the late 1950's, the use of this knowledge at the grass roots planning level has not been substantial. This has resulted from many factors, not the least of which was data availability. However, the stage now appears to be set for a major reduction in the numerous empirical problems. Thus, it is the conclusion of this report that much of our knowledge gathered through research is now ready for implementation at the planning level.

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13. ABSTRACT

This report is a survey and critique of the literature and practice of estimating use of and benefits from outdoor recreation for the purpose of determining the direction of further research efforts by the Corps of Engineers. The report outlines the conceptual and empirical difficulties associated with the various methodologies in use and suggests promising approaches to improved analysis within the framework of multiple objectives of water resources development.

KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Recreation Demand						
Water Resource Investments						
Economic Value						
Site Capacity						
Recreation Markets						
Demand Allocation						
Spatial Allocation						
Regional Objective						
Regional Impacts						
Income Distribution Impact						
Multiobjectives						