IMPROVED PROCEDURES FOR VALUATION OF THE
CONTRIBUTION OF RECREATION TO NATIONAL ECONOMIC DEVELOPMENT

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ABSTRACT

IMPROVED PROCEDURES FOR VALUATION OF THE
CONTRIBUTION OF RECREATION TO NATIONAL ECONOMIC DEVELOPMENT

Improved procedures are presented for evaluating the contribution of recreation to national economic development. These procedures are to replace those outlined in the *Principles and Standards for Planning Water and Related Land Resources*. Desirable criteria for valuation procedures are specified. Variation procedures currently used by federal agencies make almost exclusive use of the "interim unit day value approach," sometimes augmented by point systems. This approach has little theoretical or empirical justification and does not encourage efficient allocation of resources. Revision and modification of the "interim unit day value approach" and the use of point systems is not a useful method of developing improved procedures. Rather, it is recommended that models be developed to predict individual willingness-to-pay for many types of recreation as functions of site characteristics, the characteristics of the individual user (including the history of previous use), the availability of substitute activities and sites, and the location of the individual in relation to the resources under study. The total value of the resource would then be a function of these variables, the number of users, and the distribution of users within the market area. These functions may be derived from regional travel cost demand functions (which would also provide estimates of use) or could be explicit willingness-to-pay functions derived from the survey method (which must be supplemented by a use estimate). Examples of the desired models are provided along with guidelines for their development and use. Needs for further research are identified.

PREFACE

This report was initiated in response to a problem faced by planners concerned with water and related land resources. The *Principles and Standards* of the Water Resources Council establishes a national economic development objective, to which recreation contributes. The study presented in this report concerns the estimation of this contribution.

The guidelines and procedures for estimating recreation's contribution to national economic development that are provided in the *Principles and Standards* are vague and in some instances misleading. Agency planners have not made significant progress in developing improved guidelines and procedures to supplement the *Principles and Standards*. Consequently, there has been no generally agreed upon or universally accepted method of estimating recreation's contribution to national economic development.

The problem was outlined by William H. Honore of the Division of Water Resources, Bureau of Outdoor Recreation in a presentation to the *Tenth Annual Water Resources Research Conference* in Washington, D.C. on April 9, 1975. Dr. Glenn E. Stout, Director of the Water Resources Center at the University of Illinois, subsequently brought the problem to the attention of researchers at the University of Illinois.

A research proposal was prepared and submitted to the Office of Water Research and Technology and, after appropriate modification, funded by the Office of Water Research and Technology under Title II of the Water Resources Research Act, Grant No. 14-34-001-6237.

The study was guided, in part, by a team of eight nationally recognized consultants and the Recreation Benefit Evaluation

Committee, which includes 17 representatives of federal agencies. The consultants and the Recreation Benefit Evaluation Committee commented on three previous drafts of this report. In addition, a *Recreation Benefit Evaluation Conference* was held at George Washington University on December 2 and 3, 1976. The Conference was attended by the research team, consultants, and 40 representatives of federal agencies, including the Recreation Benefit Evaluation Committee.

All conference participants were furnished a draft manuscript entitled "Guidelines For Valuation of Water-Based Recreation" three weeks before the Conference to provide background for discussion. That document was, in essence, a preliminary draft of this report. The Conference focused on key issues concerning recreation's contribution to national economic development.

Thus the authors have benefited from the advice of a large number of knowledgeable individuals. This report reflects that advice, but the conclusions are not necessarily endorsed by all of the consultants, members of the Recreation Benefit Evaluation Committee, or participants at the *Recreation Benefit Evaluation Conference*.

Three outstanding colleagues, Marianne Bowes, Randy A. Nelson, and David J. Ravenscraft made major contributions to the development of this report. Without their help, guidance, and insight this report could not have been written.

The authors wish to acknowledge the excellent advice and assistance that they have received; we alone, however, bear sole responsibility for this report and the recommendations that it contains.

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J. F. D.

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CHAPTER I
INTRODUCTION

Recreational use of water and related land resources contin-
ues to demand increased attention from planners. Population
increases and gains in income, mobility, and leisure for large
segments of the population have contributed to growing parti-
cipation in recreation. At the same time, concern for the
long-term well-being of the natural environment and for the
management of water and water-related land resources has risen
dramatically as a public issue. Perceived conflicts between the
several benefits and costs of recreation development pose a
major challenge for planners.

PURPOSE

The aim of this report is to provide a basis for improved
procedures for evaluating the contribution of water-based recre-
ation to national economic development. The revised guidelines
and procedures in this report suggest replacements for and
supplements to the guidelines presented in the *Principles and
Standards for Planning Water and Related Land Resources*[1] (subse-
quently referred to as the *Principles and Standards*).

SCOPE

The Water Resources Council established the *Principles and
Standards* in 1973 to aid the public planning and decision making
process. The *Principles and Standards* provides a framework for
analyzing the beneficial and adverse impacts of an alternative

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[1]Water Resources Council. 1973. Water and Related Land Re-
sources: Establishment of Principles and Standards for Planning.
Federal Register, Vol. 38, No. 174, Part III.

on recreation and other outputs[2] through four categories or
accounts: national economic development, environmental quality,
regional development, and social well-being. The first two
accounts correspond to the two objectives identified by the
Principles and Standards. The other two accounts are not objec-
tives, but measures of attainment are specified for them. The
procedures for evaluating the contribution of recreation to
national economic development, and analyses based on these
guidelines, have been the object of criticism. This report ex-
amines these procedures and criticisms and develops improved
procedures and guidelines for their use.

It is important to recognize at the outset that the scope of
this paper includes one output, recreation (both positive and
negative impacts on recreation), and considers only one objec-
tive, national economic development. By choosing this focus, we
consider only one facet of the potential contribution of recre-
ation to the quality of life.

BACKGROUND

It is useful to look at recreation's contribution to national
economic development in terms of benefit-cost analysis and the
system of accounts established by the *Principles and Standards*.

Benefit-Cost Analysis

Evaluating the contribution of a project to national economic
development is generally done in explicit form in a benefit-cost
analysis. Benefits represent the value of the goods and ser-
vices derived from the alternative, while costs are the value of
goods and services that could have been produced had the re-
sources not been withdrawn from other uses. In the case of

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[2]These outputs include water supply, flood control, land stabili-
zation, drainage, power, transportation (navigation), recreation,
and fish and wildlife.

recreation, this "opportunity cost" should include the monetary costs of development and maintenance of the site or area, along with an accounting of benefits lost by withdrawing water and related land resources from their present uses.

The difference between benefits and costs is termed *net benefits*. Strict application of a benefit-cost criterion would require that in choosing among feasible alternatives one be chosen that maximizes net benefits, with net benefits positive. Fulfillment of this benefit-cost criterion should ensure that it is possible for those who benefit to make sufficient payments to fully compensate the losers such that no one person is made worse off, and at least some people can be made better off. If such compensation were to be made, that would seem to make the benefit-cost criterion a reasonable basis for project choice. In fact, it is unlikely that full compensation ever occurs, and it becomes the task of the decision maker to judge the acceptability of the actual incidence of losses and gains. Note, however that with this motivation of the benefit-cost criterion it is reasonable and necessary to use willingness-to-pay to measure gains, and desired compensation to measure most losses.

Benefits and costs are ordinarily measured by the sum of each individual recipient's valuations. Thus, in terms of national economic development, and leaving aside the distribution of this gain, a dollar of benefits enters with the same weight, regardless of who derives the benefits. In order to include distribution effects in benefit-cost analysis (i.e., to evaluate the distribution of benefits and costs among the population), some consensus on the weights to be attached to the gains and losses of each individual would be required. In the absence of such a consensus, the distributional impacts should be considered separately.

System of Accounts

While accounts other than national economic development are outside the scope of this study, an understanding of the system of accounts is essential for subsequent discussion. The following section provides a general definition of each account.

National Economic Development. This account measures changes in the value of goods and services provided. All changes which can be evaluated in monetary terms should be included in this account. Recreation's impact on this account is indicated by the willingness of participants to pay in order to engage in the recreation activities created by the alternative being evaluated, as well as the full costs of providing recreation including net benefits lost at displaced facilities.

Environmental Quality. This account measures changes in the character of an area's physical and biological environment. These changes are measured in terms of physical, biological, and ecological criteria. Recreation's impact on this account is indicated by alterations in the physical extent of open and green spaces, wild and scenic rivers, lakes, beaches, shores, wilderness areas, estuaries, and other areas of natural beauty; changes in archeological, historical, biological, and geological resources and selected ecological systems; changes in the quality of water, land, and air resources; and irreversible commitments of resources to future uses. As with the national economic development account, these impacts reflect changes in the values of goods and the efficiency with which they are provided. The difficulty in establishing monetary values for these impacts and the potentially overriding importance of negative environmental repercussions argue for this separate account.

Regional Development. This account measures the regional impact that changes may have. Included are changes in employment, population distribution, economic base and stability, and environmental quality. Recreation's impact on this account would include direct and indirect economic impacts in areas near recreation developments. Expenditures by recreationists for supplies and services and the establishment of recreation-related business are examples of impacts that are represented in this account. Such indirect expenditures and changes in employment should not enter into the national economic development account if they reflect shifts in economic development between regions. That is, there is no change in the total value of goods and services if tourist expenditures increase in one region at the expense of reduced expenditures elsewhere.

Social Well-Being. This account measures changes in the distribution of real income among classes, individual well-being, the availability of opportunity, and other social factors. This account should, ideally, include changes in the opportunity to participate in recreation, an accounting of the impact of recreation on individual and social behavior, and an analysis of how the benefits of a project will be distributed among income classes.

Application of the System of Accounts

Under the framework provided by the *Principles and Standards*, planners are to analyze the contribution of alternative plans to the four accounts and choose the recommended plan by weighing these four contributions. The weighting given the various accounts should be based on the priorities and preferences of all those likely to be affected by the plan. Public projects are designed to promote the public's welfare. However, the ambiguities and internal contradictions inherent in the concept of social welfare preclude the development of a single

objective function which would have overall validity. Multiple criteria such as those presented in the *Principles and Standards* are therefore required.

APPROACH

The report contains nine chapters including this introduction. Chapter 2 presents the concepts that are the necessary basis for the subsequent chapters dealing with the development of economic models. Chapter 3 outlines standards and objectives for procedures to evaluate recreation's contribution to national economic development. Current procedures are described and their inappropriateness is pointed out. Examples of improved procedures are then presented and their use is demonstrated. Chapters 4 and 5 describe how the "survey" (Chapter 4) and "travel cost" (Chapter 5) methods are to be used to evaluate recreation's contribution to national economic development. In each case, the basic concepts of model construction are presented and guidelines for model development and use are outlined. The concepts, models, and guidelines presented are based on the best procedures currently available. Chapter 6 summarizes guidelines for evaluation of recreation's contribution to national economic development. This chapter highlights the findings of Chapters 4 and 5 and also presents guidelines for choosing between the travel cost and survey methods in different types of planning situations. Chapter 7 presents revised guidelines to supplement and replace those in the *Principles and Standards*. Chapter 8 presents recommendations for implementing revised procedures. These recommendations are based primarily on the *Recreation Benefit Evaluation Conference* held at George Washington University on December 2-3, 1976. The Recreation Benefit Evaluation Conference is discussed in Appendix A. Chapter 9 suggests additional research that would improve procedures for evaluating recreation's contribution to national economic development.

CHAPTER 2
CONCEPTS OF VALUE

Recreation benefits must be evaluated according to the same definition of national economic development and with the same criteria for measuring attainment of this objective as other outputs. This point is critical because the analysis of management alternatives often involves the evaluation of trade-offs among different mixes of outputs. In order to make a valid analysis of these tradeoffs, the concepts used for estimating the contribution of recreation to national economic development should be consistent with the concepts used for other outputs. The following discussion outlines recreation benefit estimation concepts that meet this criterion. See Appendix C for more detailed definitions of the benefit measures used here and for descriptions of various measures of benefit, some of which we reject as being inappropriate or incorrect.

WILLINGNESS TO PAY AS A MEASURE OF BENEFITS

The *Principles and Standards* specify that positive benefits arising from increases in the output of goods and services are to be measured in terms of willingness of users to pay for each increment of output provided. The relevant concept of willingness to pay for recreation benefit estimation concerns payment by participants specifically for the use of a site or area. In our usage, willingness to pay includes entry and use fees actually paid and also an estimate of the maximum amount in excess of these charges that users could be induced to pay. It is not appropriate to include payment for equipment, food, travel, or lodging that may be made in conjunction with the recreation experience, since these payments are not specifically for site use. We refer to willingness to pay in excess of actual charges as "net willingness to pay." This is the

appropriate measure of additional benefits received by those
individuals who gain from the use of a recreational facility.

Willingness of participants to pay for site use does not
include certain positive benefits which may be relevant to
national welfare. However, this approach is consistent with
the current definition of the national economic development
account and thus meets our criterion of consistency. Many
goods and services associated with historical sites, urban
recreation, wilderness, and free-flowing rivers have value to
those who do not presently consume them. These values, al-
though conceptually equivalent in importance to user benefits,
may not be expressed easily in monetary terms and are there-
fore to be entered in other accounts. Since there is pres-
ently no method for evaluating their monetary significance in
terms of national economic development, the *Principles and
Standards* specify that these considerations be entered in the
environmental quality or social well-being accounts. These
values are not considered to be within the scope of this
study.

WILLINGNESS TO PAY

An approximation of willingness of users to pay for partic-
ular recreation opportunities can be developed from a demand
curve or schedule which indicates the quantity of use that
buyers (participants) in a market would be willing and able to
purchase at each price. A demand schedule is illustrated by
the line AB in Figure 1. Demand curves generally have a down-
ward slope (although they are not necessarily straight lines)
because increasing amounts of a good or service are desired at

lower prices.[1] For consumer goods or services, willingness to pay is related to the area under the demand curve. Willingness to pay may be described as the sum of two components: the actual market expenditure plus any excess amount which consumers might be induced to pay. As long as demand is downward sloping, this excess amount will be positive. We define this quantity as consumers' "net willingness to pay," that is, total willingness-to-pay net of actual expenditure. It is the appropriate measure of the extra benefits of those individuals who have gained as a direct result of a project. It is defined more carefully as the maximum amount that users would pay to ensure that they will not be excluded from a project. It is an amount in *excess* of those costs (opportunity costs) which would actually be incurred after the project is developed. For example, for a concession stand operator it would be the extra *profit* that could be made at this location, compared to the next best location. For a consumer, it is the monetary value of the *extra satisfaction* gained from this site, compared to the next best alternative.

In order to envision the existence of this excess willingness to pay, it is helpful to imagine a perfectly (price)

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[1]The amount of a good that purchasers choose to buy is a reflection of the price of the good, the price of substitutes and complements for the good, the income of consumers, and consumer tastes and preferences. A change in the price of a good results in a movement along its demand curve, while a change in other variables results in a shift of the demand curve. For example, an increase in income may increase the quantity that a consumer is willing and able to buy at each price. An illustration of a demand function is as follows:

$$q_d = f(P_x, P_s, P_c, Y, T)$$

Where:

q_d = quantity demanded

P_x = prices of the good

P_s = prices of substitute goods

P_c = prices of complementary goods

Y = individual's income

T = individual's tastes

discriminating monopolist who could charge a different price
for each unit of a good that he sold. He would charge as much
as the consumer was willing to pay for each unit purchased.
The downward slope of a demand curve indicates that consumers
are willing to pay greater amounts for initial units of a good
than for later units. The monopolist would take advantage of
this and extract the full willingness to pay. This is an
amount, in total, approximately equal to the full area under
the demand curve up to the quantity demanded. That is, total
willingness to pay is a measure of gross consumer benefits
which includes actual market expenditure, and may be approxi-
mated as the area under the demand curve for a good (or ser-
vice) up to the quantity demanded. Net willingness to pay may
be approximated as the area under the demand curve above mar-
ket price (i.e., excluding actual market expenditure). Approx-
imated, since if, in fact, initial units were sold at higher
prices, the consumer would find himself in a situation similar
to having his income reduced by the amount paid in excess of
the normal market price. The demand might pivot to the left
around the point of intersection with the vertical axis. Such
a demand schedule (income-compensated) is represented by the
dashed line AD in Figure 1. The shift is referred to as an
"income effect." If the income effect results in the curve
shifting to the left (positive income effect), then total
willingness to pay will be somewhat less than the approximated
area under the demand curve.

CONSUMERS' SURPLUS

Benefits are usually approximated by an area under the
actual demand curve. If in Figure 1, OQ units were consumed
at price P, benefits would be measured as the area ACQO. This
includes the actual expenditure PCQO, plus an approximation,
ACP, of what consumers were willing to pay. This area ACP is
referred to as consumers' surplus since it approximates net
benefits to consumers, or the willingness of consumers to pay

in excess of their actual payment. Because of convenience for
later discussion, we define consumers' surplus as the area
under the demand curve above the price (area ACP). In fact,
consumers' surplus is used in the economics literature to
refer to any of several measures of net consumer welfare gains.

FIGURE 1. THE DEMAND CURVE
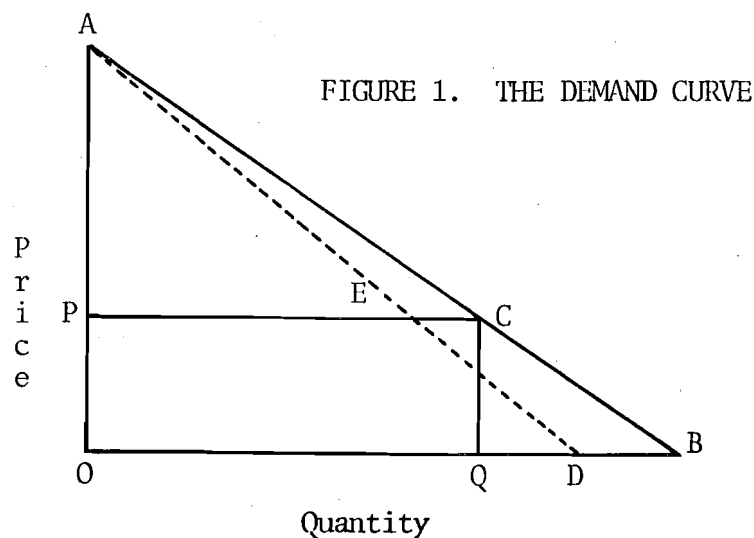
Using the area under the demand curve as an approximation
of willingness of users to pay is satisfactory only under cer-
tain conditions, but these conditions are almost always met
for the recreation output of resource management alternatives.
The approximation is satisfactory if extracting the full will-
ingness to pay for each unit of the good from consumers would
not raise expenditure sufficiently to cause any shift in the
demand curve (i.e., there would be a small income effect). In
this case, the usual demand curve AB would nearly coincide
with the income-compensated demand curve AD. If the income
elasticity of demand for a good is low and the ratio of con-
sumers' surplus to income is low, then consumers' surplus plus

the actual expenditure,[2] ACQO, will closely approximate the
total willingness to pay measure of benefits, AECQO.[3]

WILLINGNESS TO SELL

Willingness to pay provides a theoretically correct measure
of the positive benefits directly associated with the outputs
produced by a new project. However, for evaluation of bene-
fits lost by elimination of existing resources, (e.g., water-
fowl hunting opportunities lost when wetlands are drained), it
may be more appropriate to measure the lost benefits in terms
of willingness of users to sell their existing right to use
the resource.

The *Principles and Standards* require that adverse effects
of a project be measured by the value of the resources (used
by the project) in their best (most likely) alternative use.
It is common to consider the opportunity cost of labor and of
capital development to be merely their monetary cost. That
is, it is the compensation required by labor and capital

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[2] In the case of recreation, expenditure refers only to site
(or resource) use fees, not to accompanying trip costs.

[3] Willig (1975) provides the following formula for the case of
constant income elasticity of demand, indicating the error in
approximating net willingness to pay by the area under the
demand curve, above price.

$$\frac{CS - Wp}{CS} = \frac{CS \cdot N}{2M}$$

WP = net willingness to pay
CS = consumers' surplus, area under the demand curve
     above price
N = income elasticity of demand
M = initial level of income

For example, if elasticity = 1.1, and $\frac{CS}{2M} = \frac{\$500}{\$20,000} = .025$

then the percent error in using consumers' surplus is 2.75%.
This holds quite closely if $\frac{CS \cdot N}{2M} \leq .04$

Exact formulas are also provided for more general cases.

inputs in order that they will be available for this project
rather than for some other alternative use (i.e., the "will-
ingness to sell" of input suppliers). Similarly, land and
water inputs can be valued at a level reflecting the minimum
compensation required by those who have existing ownership
rights to these resources. This amount may or may not be
accurately reflected in the purchase price of these resources.
If the land were private land and were freely sold under mar-
ket conditions, then the purchase price would be an adequate
reflection of the value of the land to the owner in its
present use.[4] If, however, the land were to be transferred
from one public use to another, then the value of the land in
its existing use must be evaluated. As long as the government
resources are viewed as publicly owned, the value is the mini-
mum compensation required by those who use the present facil-
ities. We have, therefore, defined "willingness to sell" as
the *minimum* compensation required to fully compensate present
owners for the value of resources allocated to the project.
This compensation is defined to be an amount such that they
would be no better nor worse off after receiving this compen-
sation that they were without this project. Whether or not

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[4]This is complicated by the case of unwilling sellers. The
theoretically correct concept is the minimum compensation
which would make the seller no better nor worse off than he
was with the land originally. This may not be adequately re-
flected in the price which the owner is forced to accept when
the government purchases the land under eminent domain rights.
Another issue arises if the private land is presently being
made available at no or a low price to recreational (or other)
users. In that case, the additional willingness to pay of
these users reflects lost user benefits which need to be con-
sidered. That is, the resource value should be adjusted to
reflect the stream of net earnings which the land owner could
have made if he had been able to extract (at no additional
cost to himself) the additional willingness to pay of these
users. This is the maximum additional amount that users would
pay to the owners to ensure that he preserve the land in its
present use. This amount may not be reflected in the sale
price because of the infeasibility of the owner collecting
such payments.

such users have any legal entitlement to actual receipt of compensation is quite another matter; here the measure of welfare gains and losses is at issue.

If costs are measured in this manner, the fulfillment of the benefit-cost criterion assures us that those who gain are willing to pay enough to compensate adequately those who incur the costs. That is, it would be possible to arrange compensation payments so that no one was made worse off and at least some people could be made better off. Thus, the use of willingness to sell to measure lost benefits is fully consistent with the use of willingness to pay to measure increased benefits, and, in fact, is basic to the spirit of benefit-cost analysis.[5]

Willingness to sell, like "net willingness to pay," may be approximated by the area under the demand curve above price (consumers' surplus). As with willingness to pay, explicit bounds may be set on the estimate of willingness to sell if consumers' surplus and income elasticity of demand are known. For consumers' surplus of the size expected from the majority of recreation sites and with the likely low income elasticity of demand, the approximation seems acceptable.[6] However, for

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[5]More conventional economic terminology is available, but can be quite confusing and is so often misused that we avoid it. "Net willingness to pay" is the "compensating variation" associated with a welfare gain (e.g., from a price decrease). "Willingness to sell" is the "compensating variation" associated with a welfare loss (price increase).

[6]Willig (1975) provides the following formula for the simple case of constant income elasticity and $\left| \dfrac{CS \cdot N}{2M} \right| \leq .04$:

$$\frac{WS - CS}{CS} \approx \frac{CS \cdot N}{2M}$$

WS = willingness to sell
CS = consumers' surplus, area under the demand curve above price
N = income elasticity of demand
M = initial income level

especially desirable or unique sites, willingness to sell may be higher than the appropriate area under the demand curve and that approximation will be, at best, a lower bound.

Empirical evidence obtained from surveys of recreationists (Hammack and Brown, 1974) indicates that willingness to sell exceeds willingness to pay by amounts far in excess of the expected difference. It should be stressed that the measures are well defined, and given the knowledge of demand for a given good and income elasticity they can be exactly measured. The difference observed is not a failing of theory. Some explanations of this may be: (1) The good we are asked to sell is no longer the same good that we have bought. That is, taste changes are induced by greater access to a resource. When a consumer sells the right to use an area he also seeks compensation for the years of experience and emotional attachment to a site, while a new site is of uncertain value. The definitions of consumer theory presume that the good gained or lost is identical. (2) The survey was not effectively administered, in the sense that the true valuation was not found. (3) There is in fact a substantial income effect, and the income elasticity of demand changes dramatically as consumption is reduced to near zero. However, the precise explanation for the wide difference is not yet known. While accurately measuring willingness to sell may present difficulties, there is no question that in some situations it is the proper measure of lost gross benefits. From a practical standpoint it is probably best to present consumers' surplus as the best lower bound estimate of lost net benefits from destroyed resources with the recognition that this may be a poor estimate of the lost value of especially desirable or unique resources.

DISTRIBUTIONAL IMPACTS

Demand is influenced by the income distribution of the potential participants. This may be an important factor in

public decision making. However, it does not necessarily diminish the usefulness of estimated willingness to pay as an input to public decision making.

Even with an initially equitable distribution of income, consumers with higher incomes may express a higher willingness to pay for some types of recreation than those with lower incomes and may thus generate projects which provide disproportionately greater benefits for higher income groups. Since users of public recreation resources are not ordinarily charged their entire willingness to pay, relying exclusively on willingness to pay as the decision criterion may in some cases lead to an inequitable distribution of net benefits. This situation should be guarded against by using the system of multiple objectives and accounts established by the *Principles and Standards* as guides for decision-making.

With an inequitable distribution of income, the problem of income distribution is more complex since it is no longer reasonable to add different individuals' consumer surpluses as we have done implicitly above. We can no longer assume that a dollar to one consumer is equivalent to a dollar to another.

The solution to the distributional problem is perhaps not entirely satisfactory, but it is usual to assume that for the purposes of a given project the distribution of income is taken as socially sanctioned and redistribution is dealt with more directly at another decision level.

SUMMARY

The correct use of the benefit-cost criterion should be to compare the generated gross benefits of a project, measured in terms of total willingness to pay, to the cost of bidding the necessary resources away from alternative uses. When an alternative plan creates additional recreational sites or

areas, the appropriate concept for valuation of the recreation output is willingness of users to pay. This is an amount exceeding actual on-site expenditures. Willingness to pay may be estimated by the area under the demand curve for the site or area in question.

When an alternative plan destroys or otherwise makes recreation opportunities unavailable, the appropriate concept for valuation of the lost recreation output is the minimum compensation required to bid the land and water resources away from their present use. For privately owned resources this is often best reflected by the selling price of the land. If the land is presently public land then the minimum compensation required by present users of the site or area is the appropriate valuation concept. However, at present there is no generally satisfactory method for accurately evaluating such willingness to sell. The area under the demand curve above cost is at best a lower bound on lost net benefits from destroyed resources.

Use of the survey method to estimate net willingness to pay and willingness to sell from responses to questions is discussed in Chapter 4. Actual on-site expenditures are added to net willingness to pay to get the measure of gross benefits to a new site. Chapter 5 will discuss use of the travel cost method to develop a demand curve from which consumers' surplus may be estimated. Again, actual on-site expenditures are added to the consumers' surplus to approximate the total willingness to pay for a new site. We concentrate on the problem of evaluating the positive benefits of new sites. That is, our focus is on the approximation of willingness to pay. But before these approaches are discussed, Chapter 3 presents an analysis of the current problem with respect to recreation benefit estimation and outlines the recommended solution.

CHAPTER 3
THE PROBLEM AND AN OVERVIEW OF THE SOLUTION

This chapter provides a general outline of the recommendations for evaluating the contribution of recreation to national economic development. Desirable characteristics of valuation procedures are provided. Current agency procedures are described and their deficiencies outlined. Suggested procedures are introduced and examples of their application provided. Thus the stage is set for the remainder of the report which describes the development and implementation of recommended improvements.

CRITERIA FOR RECREATION VALUATION PROCEDURES

To provide for the efficient allocation of resources, procedures for estimating the contribution of recreation to national economic development should meet the following criteria:

1) Estimates of value should be developed that are consistent with and have a level of precision similar to the estimates of value derived for other goods and services produced by alternative plans.

2) The procedures should be readily applicable to evaluating proposed changes in the availability of the specific recreation opportunities affected by the projects being analyzed. This includes the opportunities expected to be created or destroyed by alternative plans.

3) Estimates of value of existing sites are useful if the analysis is used to develop models to value a proposed change in the availability of similar opportunities.

Valuation procedures and models should be easily applicable to proposed alternatives involving recreation of differing qualities, for which there may be different ranges of available substitutes, and different distributions of population in the market area.

4) Individuals facing an easily accessible range of highly desirable alternatives will presumably be willing to pay less for use of a particular area than individuals with fewer and less desirable alternatives. Consequently, the values derived should reflect the availability of a broad range of alternative opportunities.

5) It should be recognized that different values may be placed on recreation participation by different subsets of the total population. Relevant subsets may be based on income, past participation, family structure, distance from facilities, and other factors. If they are found to be significant, these variables should be reflected in the estimation procedure.

6) The procedures should if possible, and with further refinement, take into account the possibility that the total level of use of an area may, due to crowding or congestion, have an influence on the value of that site to an individual. The creation or destruction of recreation opportunities may affect the level of use (i.e., congestion) of other areas. Changes in the value due to different levels of congestion are appropriately attributed to the alternative that induced them.

CURRENT VALUATION PROCEDURES

Valuation procedures currently used by federal agencies do not meet any of the criteria outlined above and there is a strong need for revised procedures. At present, most agencies estimate recreation's contribution to national economic development by choosing a value from the range of unit day values

provided in the *Principles and Standards* and multiplying that value by an estimate of expected use.[1] This procedure will be referred to as the "interim unit day value approach."

In presenting the interim unit day value approach, the *Principles and Standards* indicates that "in the interim, while recreation methodology is being further developed, the following schedule of monetary unit values may be used in the preparation of plans." A similar interim approach was presented nearly a decade earlier in Supplement 1 to Senate Document 97[2] (subsequently referred to as S.D. 97, Suppl. 1). A recreation day, while not defined in the *Principles and Standards*, was defined in its forerunner, Supplement No. 1 to Senate Document 97, as: 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.

With the interim unit day value approach, as outlined by the *Principles and Standards*, a single value per recreation day is assigned regardless of the number of activities that an individual engages in. That value may reflect both the quality of activity and the degree to which opportunities to engage in a number of activities are available. Recreation days are divided into two categories and a range of unit day values is assigned

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[1]The *Principles and Standards* do not require that the interim unit day value approach be used. The travel cost method is described and it is indicated that other methods for estimating willingness to pay are available. However, federal agencies have chosen to rely almost exclusively on the interim unit day value approach. A discussion of agency procedures is presented in Appendix B of this report.

[2]Supplement No. 1 To Senate Document 97. Evaluation Standards For Primary Recreation Benefits. June 4, 1964.

for each. The categories are as follows:

	Range of Unit Day Values
GENERAL	$0.75–$2.25

> A recreation day involving primarily
> those activities attractive to the
> majority of outdoor recreationists
> and which generally require the
> development and maintenance of con-
> venient access and adequate facil-
> ities. This includes the great
> majority of all recreation activities
> associated with water projects such
> as swimming, picnicking, boating, and
> most warm water fishing.

SPECIALIZED	$3.00–$9.00

> A recreation day involving primarily
> those activities for which opportu-
> nities in general are limited,
> intensity of use is low, and which
> may also involve a large personal
> expense by the user. Included are
> activities less often associated with
> water projects, such as big game
> hunting and salmon fishing.

The *Principles and Standards* indicates that higher unit values may be assigned to those activities for which fewer alternatives are available and for which generally higher costs are incurred by participants. However, no additional guidance is provided for selecting values within the range of unit day values.[3] Departure from the range can be made if a "full ex- planation" is given, but the basis for such an explanation is not specified.

Many of the major problems encountered with the interim unit day value approach have their origins in the lack of a clear

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[3] Supp. 1 to S. D. 97 (the forerunner of the *Principles and Standards*) indicated that choice of a value within the range should depend on the degree of development of facilities, the quality of the aesthetic experience, and the existence of alter- native recreation opportunities.

explanation of the method or guidelines for its use. These
problems may be summarized by six points.

1) No theoretical or empirical basis for the table of unit
day values is given. They might be interpreted as the market
price of somewhat similar opportunities offered by private
operations, average willingness to pay, or some other measure
of value. There is no explanation of the procedures used to
develop the two ranges of values provided.

2) The range of unit day values provided is wide and no clear
guidance is specified for selecting values within that range.
As a result, the value chosen is likely to show little economic
reality and will thus almost certainly lead to a misallocation
of resources.[4]

3) A departure from the range of unit day values is permis-
sible, "if a full explanation is given." No criteria are
specified for either the departure or the explanation required.

4) Procedures for updating the ranges of unit day values are
not provided. Adjusting the range upward to account for infla-
tion does not necessarily solve the problem since, over time,
the supply and demand may have risen at different rates for
recreation activities than for other goods and services.

5) No definition is provided for a recreation day, the unit
by which the unit day values are to be multiplied in order to
obtain an estimate of value.

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[4]The procedures by which unit day values are selected from the
range are generally not presented. This point has been clear
from examination of agency documents and discussion with Mr.
William H. Honore and Mr. Thomas L. Ervin of the U.S.D.I. Bureau
of Outdoor Recreation, Division of Water Resources, who review a
large number of agency analyses.

6) Procedures for estimating the number of recreation days by
which a unit day value is to be multiplied are not outlined. If
an accurate use model were available, it would provide more use-
ful information about demand, and, as a result, about willing-
ness to pay, than would an arbitrary table of values.

A REVISED UNIT DAY VALUE APPROACH?

One approach to improved benefit estimation procedures would
be a revised unit day value method. A meaningful revision of
the interim unit day value approach must deal with the six prob-
lems outlined above. Some of the problems are definitional in
nature and can be dealt with quite easily. The unit day value
should be interpreted as average willingness to pay (problem 1).
Average willingness to pay is derived by dividing total willing-
ness to pay by amount of use. Thus, when the unit day value is
multiplied by an estimate of use it will produce an estimate of
total willingness of users to pay. The appropriate measure of
use (problem 5) is the recreation day, defined by S.D. 97,
Suppl. 1 as, "a visit by one individual to a recreation develop-
ment or area for recreation purposes during any reasonable por-
tion or all of a 24-hour period." Problem 6, which concerns
estimation of the level of use, can be dealt with in part from a
definitional standpoint. The appropriate level of use to be
multiplied by the unit day value is the amount of participation
at whatever entry or use fee is charged. Estimating this level
of use is not an easy task and it represents one of the major
empirical problems with which we will subsequently deal.

The basic problem with the interim unit day value approach is
that it is, for the most part, not based on valid evidence of
the actual willingness of participants to pay for recreation.
The ranges of values presented were apparently based on charges

at private areas.[5] Average willingness to pay may not be
closely related to private market prices for comparable recrea-
tion. Prices charged for use of private resources are heavily
influenced by the existing low price for public resources, and
private opportunities may not be closely comparable to public
opportunities. It should also be clear that, if consumers' sur-
plus is to be ignored, it is market price minus cost which is
the next best approximation of the net benefit of a unit output.
However, the limits on the range of values presented in the
Principle and Standards represent 50 percent increases in the
limits that were contained in Supp. 1 to S.D. 97 and this large
unexplained change tends to make them appear arbitrary. The
absence of valid procedures for choosing a value from within the
ranges adds another degree of arbitrariness to the approach. In
many cases, planners are free to make arbitrary (and sometimes
fallacious) selection, definition, and application of valuation
criteria. Use of such arbitrary values is likely to lead to in-
efficient allocation of resources.

Federal agencies have at various times attempted to provide
guidance for selecting a value from the range of unit day values
(problem 2) by developing point systems. These systems specify
a number of criteria by which to rank an alternative. The al-
ternative is assigned points on the basis of the degree to which
it possesses characteristics that measure attainment of each
criterion. The points assigned for the various criteria are
summed, and the total is associated with a particular unit day
value (or very narrow range of values). For an example of the
use of a point system, see Chart I on page 28.

Although they are widely used by federal agencies, there is
presently little theoretical or empirical justification for

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[5]This interpretation is based on a letter to the authors from
Dr. Robert K. Davis, Office of the Secretary, U.S. Department of
the Interior, on September 24, 1976.

these point systems. There is little consistency among agencies
or among the offices within some agencies in the choice and
weighting of criteria. None of the schemes is adequately based
on a theory of recreation demand or empirical demand studies.
The definition of point system criteria and indicators of their
attainment are unclear. Consequently, different planners apply-
ing the same point system to a particular alternative may not
get similar values. Subsequent discussion provides a more de-
tailed analysis of point systems.

The crucial problems associated with the development of point
systems are choosing the criteria for inclusion in the system,
deciding how to "rate" an alternative in terms of each criterion,
determining the functional relationship between the criteria,
and assigning weights to each. These problems are in addition
to finding an appropriate range of values. Some idea of how
these problems are handled by systems currently in use can be
gained from Charts I and II, which are based on material con-
cerning point systems provided by the Bureau of Outdoor Recrea-
tion, the Corps of Engineers, and the Soil Conservation Service.
A brief definition of the criteria listed in the chart follows.
These definitions are sketchy because the point systems them-
selves are sketchy:

Access—The amount of access and the quality of roads to and
within the project.

Facilities—The amount and quality of man-made facilities
available, with greater facility development receiving more
points.

Recreation activities—The number and quality of activities
available at the site.

Aesthetics—In some cases this category refers to the natural
environment, i.e., the pleasantness of the landscape. In others
it refers to the "quality of the recreation experience." Envi-
ronmental quality is sometimes included under this heading.

Environmental quality—The extent to which the project area is free of pollution or environmental degradation or deterioration.

Alternative recreation opportunities—The extent to which other water-oriented and/or general recreation sites can be found in the vicinity of the project, with more alternatives resulting in fewer points.

Radius of RMA (Recreation Market Area)—The radius (in travel time or miles) from which the majority of the project's users are expected to come. Normally the RMA is defined to include 80% or more of expected visitation. Two of the three point systems incorporating this criterion assign more points for a higher radius; the other assigns more points for a smaller RMA.

Project operations—For reservoir projects, the extent of drawdown or variation in water surface area during the recreation season. An extreme change in surface area means fewer points because the quality of recreation is likely to suffer.

Fish and wildlife—The extent to which opportunities for observation of wildlife or hunting and fishing will be available.

Level of significance—Historic or scientific significance on a state, regional, or national level. This criterion is often included under aesthetics.

Site modification—The degree to which site improvements are designed for protection of the site rather than the comfort of users; the lower the comfort and convenience, the higher the points.

It can be seen from Chart II that while a number of criteria have been included in these point systems, several are common to most of the systems listed. On the other hand, weighting schemes for the criteria vary widely. About half the systems weigh each criterion equally, while the other half assign varying weights to each of the criteria. All presume that the

CHART I.   EXAMPLE OF A POINT SYSTEM AND ITS USE

CRITERIA		
A. Quantity and quality of access and recreational facilities provided	Limited access provided to one area only. No recreational facility development. Points 1—3	Access to one area w/token rec. facil. dev. (sanitation only, i.e., trash, chemical toilets). Points 4—6
B. Number of recreational opportunities available.	Sightseeing only. Points 1—3	No water contact allowed. Land based recreational activities limited. Points 4—6
C. Aesthetic, scientific and educational values.	Aesthetic values of low quality. Extensive environmental disturbances; pollution, erosion, logged area, fire, dredged, pit mined, garbage dump. Points 1—3	Some aesthetic values of local significance. No major environmental disturbances. Points 4—6
D. Level of significance	Local Points 1—3	County Points 4—6
E. Operations	Extreme changes in water surface during recreation season considerably affecting recreation potential. Points 1—3	Extreme changes in water surface during part of recreation season with some effect on recreation potential. Points 4—6
Dollar value assigned each recreation day	$0.50 or $0.75	$0.75 or $1.13

Example of the use of this system: Project: Bowes Reservoir

Criterion	Points
A	9
B	11
C	6
D	3
E	13
Total	42

Average $\frac{42}{5} = 8.4$

Matrix for Quantifying Recreation Values
(Used by BOR Southeast Region)

JUDGMENT FACTORS		
Access to more than one area w/low quality facil. dev. or high over use factor probable.	Access to several areas one of which has high quality recreational facil. development.	Access to several w/ high quality facil- ities (flush toilets, landscaping, stove, table, multilane ramps, and campground).
Points 7-9	Points 10-12	Points 13-15
Conditions permit multiple activities but opportunity limited.	Conditions suitable for multiple activities.	Conditions highly conducive to multi- ple activites.
Points 7-9	Points 10- 12	Points 13-15
Aesthetically pleasant. Of regional signifi- cance	Attractive; aesthetic values high. Some archeo- logical, ecological, geological or his- torical values present.	Highly attractive; aesthetically re- warding. Unique or outstanding archeo- logical, ecological; geol., or historical values.
Points 7-9	Points 10-12	Points 13-15
Regional	State	National
Points 7-9	Points 10-12	Points 13-15
Moderate change in water surface dur- ing recreation season with some effect on recre- ation potential.	Moderate change in water surface dur- ing part of recre- ation season with minor effect on recreation potential.	Stable water surface for recreation as primary purpose.
Points 7-9	Points 10-12	Points 13-15
$1.00 or $1.60	$1.25 or $1.88	$1.50 or $2.25

From the table it can be seen that averages between 7 and 9 are assigned a unit value of $1.60 under the current range of $.75 to $2.25 per recre- ation day.

DERIVED FROM: Information prepared by the Environ- mental Resources Branch, Planning Division, Army Engineering Division, South Atlantic

CHART II. POINT SYSTEMS FOR CHOOSING A UNIT DAY VALUE[1]

Criteria and Their Weighting

Agency Using the System	Access	Facilities	Recreation Activities		Aesthetics	Env. Quality	Alternative Rec. Opp.	Radius of RMA	Project Operations	Other
			Number	Quality						
Bureau of Outdoor Recreation Midcontinent Region Northwest Region	25	25	25		25		25	25	25	Fish & Wildlife (25)
U.S. Forest Service	16	14		16	18	20	16			Specialized Values Guide also included
Corps of Engineers	20[2]		10		25		15	30		
Calif. Dept. of Fish and Water Resources				100*	50				50	*This category depends also on the quality of access and facilities
Pacific Southwest Inter-Agency Committee	18	14	30			20	18			
Bureau of Outdoor Recreation Washington Office		†			†	†	†	†	†	†This system rated the project in one of 3 dollar ranges (low, median or high) rather than assigning points
Bureau of Outdoor Recreation Southeast Region	15		15				15		15	Level of Significance (15)
Corps of Engineers		5		5	5			5		
Soil Conservation Service		30			30	20				Site Modification (20)

[1]These systems, with the exception of the second one, refer exclusively to general recreation days.
[2]Numbers between two criteria indicate that the two were evaluated together.

variables contribute to willingness to pay such that positive, additive weights can describe the relationship.

The criteria and weights used for point systems present a number of problems. They are based on the judgments of planners rather than the expressed preferences of users. They lack empirical justification and are in many cases not consistent with the results of previous investigations of recreation behavior. The criteria are not well defined and different planners may interpret them quite differently, and thus derive significantly different values for the same project.

However, even if the criteria could be adequately selected and defined, there are still further problems of evaluation principles with point systems, such as the following. Again, these problems are in addition to selecting the appropriate range of values to use in conjunction with the point system:

1) Many point systems assume that unit day values (average willingness to pay) increase with the size of the site and the number and diversity of man-made facilities. While it is likely (although not certain) that increasing the size or facilities at a site will increase number of visits and total willingness to pay for the site, it is not clear that average willingness to pay will necessarily increase. It is not clear that larger sites will always increase attendance. Recreationists may not use all of the capacity provided. This could be the case for little-used wilderness areas. On the other hand, average willingness to pay would decline with increased size or facilities if use were to increase at a faster rate than total willingness to pay. For example, there may be fewer people interested in participating in wilderness activity than visiting a highly developed recreation facility. Yet the wilderness users may be willing to pay a large amount for the opportunity to enjoy a more unique setting and for having an experience free of crowding.

2) The availability of substitutes is reflected in many, but
not all, point systems. Where substitutes are included, a low
number of close substitutes results in a greater number of addi-
tional points being awarded. However, substitutes cannot be
handled adequately with an additive term in a point system.
Regardless of how many points are gained from other categories,
if a site faces competition from equal or better sites which are
more advantageously located with respect to users, then willing-
ness to pay should approach zero. This will not be reflected
with an additive point system.

3) The influence of the spatial distribution of users on unit
day values may not be easily captured by a point system. Con-
flicting effects on average willingness to pay may be at work.
For example, consider two similar sites (each with the same
market population), one with the bulk of the population located
closer to the site. Both total use and total willingness to pay
may be higher for the site near the population concentration.
While it is most likely that average willingness to pay will
also be higher, the effect is uncertain, depending on differ-
ences in use and total willingness to pay. This effect is not
easily captured without more explicit demand information.

It can be concluded from this discussion that the spatially
localized effects of the determinants of demand make it diffi-
cult to generalize about average willingness to pay. The exist-
ing point systems seem to have been based on intuitive feelings
of the direction of the effect of various criteria on total,
rather than average, willingness to pay. The effect on average
willingness to pay is much more complex and clearly not a simple
linear relationship among criteria.

In sum, if a point system is to be used as anything more than
an arbitrary means for choosing within the range of unit day
values, much work must be completed, both in collecting data and
in devising a specification for unit day values in terms of the

relevant and significant demand variables. Such variables would include the distribution of population, the distribution and relative attractiveness of substitute sites, and the distribution of preferences. Without such work, the unit day value approach is an unsatisfactory method for evaluating benefits due to its arbitrary nature. Further, since many variables which affect demand have ambiguous or complicated relationships to average willingness to pay, there seems little point to directing future effort in this direction. The empirical demand studies which would be required to provide a satisfactory basis for a unit day value method can be more directly used to estimate both use and willingness to pay. This is the preferable approach.

RECOMMENDED IMPROVED PROCEDURES

Two general methods are presently available for developing models to estimate the user benefits from recreation: (1) the travel cost method, and (2) the survey method. The travel cost procedure estimates willingness to pay from the actual behavior of participants. The survey procedure uses responses of participants to questions as a means for estimating their willingness to pay. These methods have been used in a number of studies to develop models to estimate the willingness of users to pay for recreation. It is usual to estimate net willingness to pay which is added to expenditures on entry and user fees to estimate gross willingness to pay. In order to compare these studies with the interim unit day value approach presently being used by federal agencies, a number of published studies have been examined that permit calculation of average willingness to pay per day. This calculation is not necessary for valuation since it is total values that are sought; however, it is useful for comparison here. These studies are summarized in Table 1 in the appendix to this chapter. Similarly, another group of studies which only provided sufficient information for finding

average willingness to pay per trip are summarized in Table 2 in
the chapter appendix.

While most of these studies deal with what would be classi-
fied as "general recreation," more of the values lie outside the
current range of $.75—2.25 than within. Unfortunately, few of
these figures are fully comparable for a number of reasons:

1) Different models are used (i.e., different variables or
specifications of the functional form of the relationship among
variables).

2) Different values are used for variable travel cost per
mile and time cost per hour (where time is included).

3) Different distributions of population exist in the market
areas of each site.

4) Different ranges of alternatives are available to users of
each site.

5) The tastes and socio-economic characteristics of users may
differ in each market area.

6) The studies were carried out in different years. During
this time period, prices, incomes, leisure times, and tastes may
well have changed.

Another problem with a few of the previous studies arises
from the fact that some of the figures presented seem not to
have been calculated correctly. Errors include: calculating the
consumer's surplus of the person incurring average travel costs
rather than average consumer's surplus (for example, Gibbs and
McGuire, 1973; Levenson, 1971); using one-way rather than round-
trip travel costs, leading to an underestimate of benefits
(Smith and Kavanagh, 1969); and using operating costs per
vehicle to convert distance traveled into travel costs without
dividing by the average size of party (Mansfield, 1971).

The empirical studies outlined in Tables 1 and 2 do not pro-
vide a sufficient background for estimating willingness of par-
ticipants to pay for the recreation opportunities. As has been

pointed out, the studies have not used consistent methodology. Furthermore, they have not dealt with a sufficiently wide range of recreation opportunities to encompass all aspects of planning for water and related land resources. The wide range in values most likely reflects the varying circumstances at each site. Since these circumstances are not always identified in the estimated model, few conclusions can be drawn.

However, the best of these studies provide a sound background for the additional empirical work that is necessary for the development of valuation procedures. Such procedures are essential in order that agencies can properly assess proposed changes in the availability of recreation opportunities. The research that has been done to date and that is currently underway will be an invaluable aid in the final development of these procedures. Detailed guidelines for use of the travel cost and survey methods to develop the needed models for predicting willingness to pay are presented in Chapters 4 and 5. The recommended procedures are introduced here.

What is necessary to estimate recreation's contribution to national economic development is the development of models (equations) to predict willingness to pay. This is not a proposal for a radical new approach; rather, it is a recommendation to make the best use of procedures and models that are presently available. These equations would explain individual willingness to pay for many types of recreation as functions of site characteristics, the socio-economic characteristics of the individual user, the availability and quantity of substitute activities and sites, and the location of the individual in relation to the site under study. Note that it is the *individual demand behavior* that is less ambiguously related to these variables than is *average willingness to pay* over all users. Total willingness to pay for a site would then be a function of these variables, the number of users, and the distribution of users within the market area. These functions could be derived from travel cost demand

functions (which would also provide estimates of use) or could
be explicit willingness-to-pay functions similar to those which
are derived by Davis (1963) using the survey method (which must
be supplemented by use estimates). These approaches are dis-
cussed in detail in Chapters 4 and 5 and guidelines for their
use provided. The functions need not be estimated at each site.
Once the models have been developed, they can be used to evalu-
ate new projects with only minimal data collection.

Using the procedures outlined in this report, a central data
bank of the results of demand studies for specific regions could
be developed for use in evaluation of alternatives, again by
region. The results should be stored in a form which could be
applied to predict the willingness to pay of specific users of a
planned site within the region, without requiring newly esti-
mated models for each site. This data bank would be of immense
use to planners. The development of the data bank and other
efforts to facilitate the implementation of the recommended pro-
cedures is discussed in Chapter 7. Prediction of willingness to
pay at the individual level based on empirical studies of simi-
lar sites should be significantly better than an attempt to
estimate the average willingness to pay by a modified unit value
approach. By predicting at a disaggregated level we avoid the
problems in predicting the average willingness to pay which
arise because of varying spatial distribution of users, substi-
tute sites, and tastes that make current point systems invalid.

Model construction involves the sampling of users and some
statistical and economic expertise. However, once the models
have been developed, it is a fairly simple task to gather the
necessary data for applying the model to a new site, substitute
it in the model, and generate an answer. The use of these
models is well within the expertise and time constraints of
agency planners, and the models will provide estimates of will-
ingness to pay that are conceptually far superior to those cur-
rently being developed with the interim unit day value approach.

Past efforts at model construction have indicated that a
fairly small number of variables have a significant impact on
recreation use and value. This simplifies model construction
and use. Much of the needed data is readily available from
agency records or census documents. Federal agencies will most
likely find it highly useful to share available data, models,
and expertise. Model construction can start with one or two
major influences, e.g., the users' proximity to the site; then,
as experience and data develop, models can be made more inclu-
sive. Even fairly simple models that can be developed and used
at very low cost would be a great improvement over present
procedures.

The following discussion presents four examples of models
that can be used to estimate the willingness of users to pay for
recreation. The first two models (Davis, 1963; Hammack and
Brown, 1974) were developed from the survey method and are based
on the responses of users to questions. The next two models
(Knetsch, Brown, and Hansen, 1976; Corps of Engineers, 1976)
were based on the actual behavior of recreationists (i.e., the
travel cost method).

THE SURVEY METHOD

The following models illustrate the use of the survey method
to estimate willingness of users to pay.

The Value of Recreation In The Maine Woods

In a study of the value of recreation in a part of the Maine
Woods, Robert K. Davis developed the following equation to ex-
press the willingness of a household to pay for a visit (Davis,
1964, p. 397). Davis used the survey method to develop his

model. The model, which was based on 185 interviews, has the
following form:

$$W = -48.57 + 2.85Y + 2.88E + 4.76L$$
$$(1.52) \quad (0.58) \quad (1.03)$$

Where:

W = household willingness to pay an additional amount
    for a visit
E = years of acquaintance with the area visited
Y = income of the household in thousands of dollars
L = length of visit in days
Standard error of the equation is 39.7057
Standard errors of the coefficients are shown in
    parentheses.

Thus, using the equation described above, one could estimate
the willingness of households to pay for recreation in a part of
the Maine Woods (or a similar area) provided that the number of
households expected to visit the area was available along with
estimates of their income, years of acquaintance with the area,
and length of visit. This estimation would require an addi-
tional larger survey of the user population. The equation would
provide estimates of the additional willingness to pay of each
household for a trip. These would be summed for all users to
derive an estimate of total net willingness to pay.

Davis (1964) also applied his model to the valuation of big
game hunting on a 500,000 acre private forest in Maine. To
apply the model to this particular situation (which differed
slightly from the circumstances under which the model was devel-
oped) information was required on the income, length of stay,
and years of experience for the hunters. This information was
collected by a questionnaire administered to a systematic sample
of hunters stopping at the traffic checking station. Usable
questionnaires were obtained from 390 hunters. The entire
hunter population was then distributed according to the sample
distribution of income, length of stay, and years of acquaint-
ance with the area. Total willingness to pay was then estimated
for the hunter population.

Thus, once a model such as that developed by Davis is available, the evaluation process is as follows: 1) the planner selects the appropriate model, in this case the one developed by Davis; 2) gathers information on the appropriate variables; and 3) plugs the data into the model and generates an estimated willingness of participants to pay. We now turn our attention to another application of the survey method to estimate willingness of participants to pay for recreation.

The Value of Waterfowl

In their study of the value of waterfowl hunting, Hammack and Brown (1974) developed the following equation for estimating the value of a season of hunting. They developed their model from 2,455 responses to mail questionnaires distributed to waterfowl hunters in the seven western states that lie wholly within the boundaries of the Pacific Flyway. This includes the states of Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington.

$$\ln V = 1.44 + 0.466 \ln Y + 0.168 \ln S + 0.141 \ln C +$$
$$(8.7) \qquad (4.5) \qquad (5.3)$$

$$0.308 \ln (K/D) + 0.480 \ln D$$
$$(7.0) \qquad (12.5)$$

Where:

V = net value of a season of waterfowl hunting
Y = household income (after taxes) in thousands of dollars
S = number of seasons of waterfowl hunting
C = cost of a season's waterfowl hunting
K = waterfowl shot and bagged during the season
D = number of days hunted during the season
( ) = t value

Note that the equation resembles the one developed by Davis (1963) in that income, experience, and amount of hunting were significant variables. A planner applying Hammack and Brown's model to analysis of an alternative that would affect hunting would need to develop estimates of the following types of

information about the hunters affected: number of hunters, household income after taxes, number of seasons of waterfowl hunting, waterfowl shot and bagged during the season, and the number of days hunted during the season.

A variation of the model developed by Hammack and Brown was used in a *Migratory Bird Habitat Preservation Study* conducted by the U.S. Department of the Interior's Fish and Wildlife Service in 1975. Data on income (Y) and expenditures (C) of waterfowl hunters were taken from the *1970 National Survey of Hunting and Fishing*. Data on waterfowl bagged were obtained from the 1970 survey of waterfowl hunters. The estimated number of seasons a hunter had hunted was obtained from the Hammack and Brown study. Note that in this instance very little data collection was required.

The models developed by Davis and Hammack and Brown estimate individual net willingness to pay. Use of the models requires some indication of the number of individuals expected to be affected by the alternative. This information may be developed from another survey, which was the procedure followed by Davis (1963), or another approach such as the travel cost method.

THE TRAVEL COST METHOD

We now turn our attention to travel cost models that simultaneously derive estimates of use as well as value of this use. The previous models were developed from interviews and present estimates of an individual's net willingness to pay. It is also possible to estimate willingness to pay from the actual demand behavior of recreationists. This is the approach taken with the travel cost method. The basic model in this procedure estimates the number of visits that residents of a particular area (usually a county or town) will make to a particular site.

The Value of Reservoir Recreation

A travel cost model was developed by the Corps of Engineers for a series of reservoirs in California. The model, which was based on users of seven reservoirs in the Corps of Engineers Sacramento District (including 168 pairings of origins and destinations), may be expressed by the following equation (Knetsch, Brown, and Hansen, 1976, p. 109). The data for constructing this model were obtained from a survey of users and facilities.

$$V_{ij} = -4577 + [P_i/D_{ij}][(-2.52 + 0.0013A_j + 27.13\ S_{ij}^{-2})]$$

Where:

V_{ij} = the number of visitors from origin i to reservoir j

P_i = the population of origin i

D_{ij} = the distance in miles from origin i to reservoir j

A_j = the size (in acres) of the recreation pool)

S_{ij} = the number and proximity of substitute recreation areas available to the populations of various origins (i) with respect to reservoir j

In addition to predicting use, the above equation can be used to estimate willingness to pay. The model is used to estimate a demand curve for the site and then the area under that curve is an estimate of willingness to pay when entry fees are zero. If actual on-site fees exist, expenditure fees should be added to net willingness to pay to derive gross willingness to pay.

Expected use of a particular site at existing fee structures, which is one point on the demand curve, is calculated by estimating the use from each origin (using the above equation) and then summing the use from all origins to get total use of the site. Use from any origin is estimated by substituting the population of that origin (P_i), the distance from the origin to the reservoir (D_{ij}), the size of the reservoir

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(A_j), and the measure of the availability of the alternative water sites (S_{ij}) into the equation.

Other points on the demand curve are estimated by successive recalculations of the use by incrementing D_{ij} by a fixed amount and calculating a new estimate of total use. Successive increments and summations yield additional points on the demand curve for the facility at issue. This procedure essentially increases the variable travel costs faced by residents of each origin. This increase in cost, which is viewed as a proxy for price paid or entry fee, reduces estimated use (quantity demanded at that price) and permits construction of a demand curve which estimates total participation at various prices. The area under the derived demand curve is then an estimate of net willingness to pay.

In applying the travel cost model to the valuation of a proposed reservoir, the planner would develop a demand curve for the new facility by the same procedures described above. This requires that the planner (1) identify the origins from which users are expected to come (i.e., define the unit of observation as distance zones, counties, etc.), (2) obtain population estimates for those origins (from census sources), (3) calculate the distance from each origin to the reservoir (from a road atlas), (4) obtain an estimate of the expected size of the reservoir, (5) identify an index of alternatives available for each origin, and (6) identify the dollar and time expenditures required by the residents of each origin in order to reach the reservoir. The previously estimated travel cost model is used and the evaluation of the site demand curve for the new facility is based on mechanical substitution.

The Value of Urban Parks

The Corps of Engineers (1976) has developed the model presented below for predicting total activity hours visitation

from an origin to an urban park as a function of the population at that origin, the size of maintained turf area at the destination, and the median road mile distance between origin and destination. It represents another application of the travel cost approach. The model was based on analysis of five parks and 40 origins which provided 200 pairings of origins and destinations.

$$V_{ij} = -207.4 + 65.27 P_i^{1/2} D_{ij}^{-9/10} T_j^{1/3}$$

Where:

V_{ij} = total activity hours of visitation from origin i to destination j

P_i = population of origin i

D_{ij} = distance in miles from origin i to destination j

T_j = acres of maintained turf at destination j

This model can also be used to develop an aggregate demand curve as D_{ij} is incremented for each origin by fixed amounts and estimates of use are derived.

The data requirements for evaluating an existing or proposed facility are particularly low. The planner needs only to determine (1) the origins from which users are expected to come, (2) the population of each origin, (3) the distance from each origin to the park, and (4) the number of acres of maintained turf at the park.

SUMMARY

Desirable criteria for procedures to estimate recreation's contribution to national economic development have been outlined. Current estimation procedures which make almost exclusive use of the "interim unit day value approach," sometimes augmented by point systems, do not meet these criteria and are inappropriate. Revision and modification of the "interim unit

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day value approach" is not a useful means of developing
improved procedures. Instead, models which estimate the will-
ingness of individual participants or groups to pay for recre-
ation must be developed. These models, examples of which have
been given, can be developed from the survey or travel cost
approaches. The models can be used by agency planners to
develop appropriate estimates of recreation's contribution to
national economic development. Subsequent chapters will
describe how these models can be developed and used.

APPENDIX
TO
CHAPTER 3

This appendix presents the results of a number of recent studies of recreation benefits. Table 1 contains studies for which unit day values could be derived, while Table 2 presents studies for which unit visit values were derived.

TABLE 1. UNIT DAY VALUES DERIVED FROM EMPIRICAL WORK

Source	Location and Date of Survey	Type of Activities*	Model†	Auto cost*	Time cost*	Average consumers' surplus
Beardsley (1971)	Colorado—1966	camping, fishing, picknicking	not given			$1.07 (for 12 hours)
Brink (1973)	Utah—1968–9	hunting	$\ln \frac{V}{P} = B_0 + B_1 \ln C$	8¢/mi		$1.11 (Bear River) $ .59 (Farmington Bay)
		non-consumptive recreation	"	"		$ .63 (Bear River) $ .24 (Farmington Bay)
Brown and Hansen (1974)	Fort Worth District— 1966–9	reservoir	$V = B_0 + \frac{P}{D}\left(B_1 Q + B_2 D + \frac{B_3}{Y} + B_4 T\right)$	1.7¢/mi per person	convex time—money trade-off	$ .98–$3.33 (median $2.59)
	Sacramento District— 1966–9	"	$V = B_0 + \frac{P}{D}\left[B_1 + B_2 Q + \frac{B_3}{T}\right]$	1.5¢/mi per person	"	$ .65–$3.75 (median $3.20)
	"	"	"	"	$1.65/hr.	$ .40–$2.80 (median $2.00)

†For description of variables see end of Table 2.
*Where specified.

TABLE 1. CONTINUED

Source	Location and Date of Survey	Activities*	Model	Auto cost*	Time cost*	Average consumers' surplus
Brown and Hansen (1974)	Southwestern Region— 1966–9	reservoir	$V = B_o + \dfrac{P}{D}\left[B_1Q + B_2Q - \dfrac{B_3}{T}\right]$	1.6¢/mi per person	convex trade-off	$2.25—$4.45 (median $3.95)
"	"	"	"	"	$1.65/hr	$1.25—$4.30 (median $3.25)
Burt and Brewer (1971)	Missouri— 1966	rivers and lakes	$\dfrac{V_j}{P} = B_o + \sum_{i=1}^{n} B_iC_i + B_{n+1}Y$, where $C = a+bD$	5.5¢/mi		$2.43
Cesario and Knetsch (1976)	Pennsylvania— 1967	state parks	$V_j = B_o + B_1\ln P + B_2\ln Q_j + B_3C_j + B_4\ln[\Sigma Q_i \exp(B_3C_i)]$	6¢/mi	$2.10—$2.76 per hr	$.05—$4.31 (median $.32)
"		"	"		convex trade-off	$.07—$5.10 (median $.46)
James and Lee (1971)	Kentucky— (no date)	reservoir	$\ln V = B_o + B_1\ln P + B_2\ln D$	2.1¢/mi per person	$1.50/hr	$1.53

†For description of variables see end of Table 2.
*where specified.

TABLE 1. CONTINUED

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Source	Location and Date of Survey	Type of Activities*	Model[†]	Auto cost*	Time cost*	Average consumers' surplus
Kalter and Goss (1969)	New York State 1960 (projected to 1985)		$\log \frac{V}{P} = B_0 + B_1 \log Y$ $+ B_2 \log C + B_3 \log D$ $+ B_4 \log R + B_5 \log A$ $+ B_6 \log X + B_7 \log S$ $+ B_8 \log E$	10¢/mi		$6.50 (camping) $7.35 (boating) $15.95 (hiking) $5.56 (fishing) $6.52 (swimming)
Levenson (1971)	Hempstead, New York— 1965		$\ln \frac{V}{P} = B_0 + B_1 \ln D$	10¢/mi		$2.68 (boating) $2.26 (fishing)
Mansfield (1971)	Lake District, England— 1966	full-day trips	$\frac{V}{P} = B_0 + B_1 O + B_2 C^{-2}$	3¢/mi	$1.02/hr per car	$2.59
"	"	half-day trips	"	"	$1.11/hr per car	$1.51
Merewitz (1966)	Missouri 1950—54, 56	fishing, boating, surfing, water-skiing	$\ln V = B_0 + B_1 D + B_2 \left(\frac{1}{D^3}\right)$ $+ B_3 P + \ln PD$	1.5¢/mi per person	$.86/hr	$1.09

[†]For description of variables see end of Table 2.
*Where specified.

TABLE 1. CONTINUED

Source	Location and Date of Survey	Type of Activities*	Model[†]	Auto cost*	Time cost*	Average consumers' surplus
Moncrief (1972)	Michigan 1970—1	fishing	$\frac{V}{P/1000} = B_o + B_1 \, \ell nC$ (AuSable River)			$2.18
	"		$\frac{V}{P/1000} = B_o + B_1 \, \ell nC$ (Jordan River)			$1.03
Moncur (1975)	Hawaii 1972	resident demand for urban parks	$\frac{V}{P}j = B_o + \Sigma B_i C_i$			$.35—$1.37 (median $.76)
Texas Tech. College (1967)	Dallas— 1966	playgrounds	not given			$.23—$.41 (median $.32)
	"	playfields	not given			$.11—$.27 (median $.24)
	"	golf				$4.51
Ullman (1968)	Missouri— 1950—54, 56	hypothetical reservoir	value of visitor miles saved on diverted and generated trips	$1.5¢/mi per person	1.5¢/mi per person	$.59

[†]For description of variables see end of Table 2.
*Where specified.

TABLE 1. CONTINUED

Source	Location and Date of Survey	Type of Activities*	Model[†]	Auto cost*	Time cost*	Average consumers' surplus
Ullman and Volk (1962)	Missouri— 1950—54, 56	hypothetical reservoir	value of visitor miles saved on diverted trips	$.6¢/mi per person	$.85/hr	$1.94

[†]For description of variables see end of Table 2.
*Where specified.

TABLE 2. UNIT VISIT VALUES DERIVED FROM EMPIRICAL WORK

Source	Location and Date of Survey	Type of Activities*	Model†	Auto cost*	Time cost*	Consumers' surplus per visit
Common (1973)	Grafham Water, England—1967 (see Smith and Kavanagh)	trout fishing	$\ln V = B_0 + B_1 \ln C + B_2 \ln P,$ where $C = a + bD$	$1.2¢/mi		$3.14
Davis (1961)	Maine—1961	Hunting	$w = B_0 + B_1 L + B_2 D$			$10.32 per household
Gibbs (1974)	Florida—1970	Kissimmee River Basin	$\ln L = B_0 + B_1 C_1 + B_2 C_2 + B_3 Y + B_4 \frac{1}{N}$			$21.62
Gibbs and McGuire (1973)	"	"	$\ln L = B_0 + B_1 C_1 + B_2 C_2 + B_3 Y + B_4 \frac{1}{N} + B_5 G_1 + B_6 G_2 + B_7 G_3$	7¢/mi		$59.91
Gum and Martin (1975) (also in Martin, Gum, and Smith 1974)	Arizona—1970	hunting	$V = B_0 + B_1 C + B_2 D + \ldots$			$6.39–$57.43 per household trip (median $23.89)
		fishing	"			$45.92–$50.13
		general recreation	"			$66.54

†For description of variables see end of Table 2.
*Where specified.

TABLE 2. CONTINUED

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Source	Location and Date of Survey	Type of Activities*	Model[†]	Auto cost*	Time cost*	Consumers' surplus per visit
Knetsch (1964)	Virginia and North Carolina— 1963–4	reservoir	$\ln\left(\frac{V}{P} + .8\right) = B_o + B_1 C$	5.2¢/mi		$3.10 per party visit
Knetsch and Davis (1966)	Maine— 1961	hunting, fishing camping	interview method: $W = B_o + B_1 L + B_2 D$			$6.16
"	"	"	travel cost method	5¢/mi		$6.72
Mansfield (1971)	Lake District, England— 1966		$\ln\left(\frac{V}{P} + 1\right) = B_o + B_1 \ln D$	3¢/mi	90¢/hr per car	$9.36
Smith and Kavanagh (1969)	Grafham Water, England— 1967	trout fishing	$\log\left(\frac{V}{P} + 1\right) = B_o + B_1 \log C$	3.8¢/mi	0	$4.54
"	"	"	"	"	66¢/hr	$5.47
Smith (1970)	" 1968	"	"	"	0	$4.37

[†]For description of variables see end of Table 2.
*Where specified.

TABLE 2. CONTINUED

Source	Location and Date of Survey	Type of Activities*	Model[†]	Auto cost*	Time cost*	Consumers' surplus per visit
Sublette and Martin (1975)	Arizona—1972	camping, fishing, picnicking	$\frac{V}{H} = B_o + B_1 C + B_2 C^2 +$ $B_3 D + B_4 D^2 + B_5 A$ $B_6 A^2 + B_7 E + B_8 E^2 +$ $B_9 Y + B_{10} Y^2 + B_{11} F +$ $B_{12} F^2$			$26.14 per household-day (Luna Lake) $42.14 (Black Canyon Lake) $46.93 (Knoll Lake) $9.85 (Horsethief Basin)
	"	.camping, hiking	interview method: $V \cdot L = B_o + B_1 W + B_2 W^2$			$1.49 (Brushy Basin)
Wennergren et. al. (1975)	Utah—1973	boating	not given	10¢/mi		$29.24

[†]For description of variables see the next page.
*Where specified.

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Variables Used in Tables 1 and 2

A	= age
B_i	= regression coefficients
C	= cost of reaching a site
C_1	= travel cost
C_2	= daily on-site cost
D	= distance
E	= education
F	= days of paid vacation
G_1, G_2, G_3,	= seasonal dummies
H	= household
L	= length of stay per visit
N	= size of recreation group
P	= population
PD	= population density
Q	= index of quality
R	= index of preference
S	= sex
T	= index of alternatives
V	= visits
$\frac{V}{P}$	= visits per capita
V·L	= days of recreation
W	= willingness to pay
X	= race
Y	= income

CHAPTER 4
THE SURVEY METHOD

The survey method is used to estimate the value of a recreation experience from responses to a questionnaire or a personal interview. The method might perhaps be more appropriately called the interview self-estimate method since some type of survey (usually including a questionnaire) is also used for the travel cost method. However, the term survey method in the context used here is widely understood by recreation planners. The method has significant advantages over the travel cost method in situations that involve: (1) considering the value of small changes in quality at existing sites which would not be expected to affect the travel costs of visitors nor their number of visits, particularly if these changes have implications for recreation experiences at a number of sites; (2) estimating the value of a site or area that is one of many destinations visited on a trip; and (3) considering the effects of congestion (crowding) on site benefits. Examples of the first category would include efforts that enhance waterfowl or fish populations which then move to a variety of sites where they contribute to recreational experiences.

Two surveys are required to evaluate a particular recreation area. An initial survey is conducted with a sample of users of existing sites or recreation areas. This survey is aimed at eliciting the users' valuation of the recreation area and collecting data on variables which are expected to explain individual differences in valuation. The results of this survey are used to develop an equation which can be used to predict any other user's valuation of a particular recreation area (in terms of willingness to pay entry fees) based on the particular values of the explanatory variables for that individual.

A second survey should be aimed at a larger sample of the user population in order to estimate the values of the explanatory variables for the complete user population. Using the results of this survey and applying the estimated equation which explains individual willingness to pay, the valuation of each user is calculated and these are summed to provide an estimate of total willingness to pay. This procedure presumes that the size of the user population can be identified. To do so may require further statistical procedures.

In principle, the willingness-to-pay equation may be estimated in one recreation area and applied to proposed developments elsewhere. In that case, the second survey would be aimed at identifying user characteristics (value of the explanatory variables) for potential users of the new recreation area. Obviously the problem of identifying the potential user population of a new site is somewhat more difficult than identifying the users of an existing site.

User information for the same explanatory variables should be collected in both surveys. These should be variables which are expected to explain differences in individual valuations. For example, they may include standard demographic information (age, sex, income, education, family size, etc.) as well as number and length of visits, years of experience with the site, distance traveled to the site, information needed to derive a measure of the accessibility of substitute sites, and (perhaps) a physical measure of the success of a trip (such as number of waterfowl bagged, or whether a deer hunting trip was successful). The choice of variables will depend upon their appropriateness in the specific application.

We should stress that at present there is not a very large amount of practical experience in applying the survey method to the valuation of recreation areas. In particular, there is little experience in evaluating the expected value of proposed

projects. The inclusion of variables reflecting distance traveled and an index of accessibility of alternatives would seem to be helpful additions. They would allow application of the estimated models to newly-proposed projects which might differ in location relative to the user population and substitute sites.

There is, however, renewed interest in the use of the survey method. In the following sections we discuss some issues in the use of the survey method and present examples of existing applications of the method.

The survey method is predicated on two key assumptions: (1) that consumers can assign an accurate value to the recreation experience, and (2) that this valuation can be elicited from them with a properly constructed question or series of questions.

The recreation survey literature has not given a great deal of attention to the first assumption. Instead, the focus has been on the second assumption, concerning the ability of the survey to elicit the valuation from the participant. This second assumption has generated considerable debate. The arguments may be categorized into two areas: (1) the values that the questions actually measure, and (2) the effectiveness of the survey in getting unbiased answers to the questions. We will now turn our attention to the two major assumptions of the survey method. The initial discussion focuses on questions that can be raised with respect to the consumer's ability to assign values.

THE ABILITY OF CONSUMERS TO ASSIGN VALUES

The survey method poses some difficult questions for participants. They are asked to make explicit dollar valuations on the basis of descriptions of hypothetical circumstances. The

challenge in using the survey method is to assist the consumer
in thinking in terms of dollar valuations, and ensuring that
he responds in a manner that reflects what his actual behavior
would be under the circumstances outlined. With the survey
method, participants are asked to assign a dollar value to a
recreation experience. For example, they are expected to in-
dicate the maximum additional amount that they would be will-
ing to pay rather than be excluded from participation. This
presents a question concerning the ease with which individuals
can accurately assign such a value. This question is central
to the development of survey methodology.

In the case of recreation, it is not obvious that a con-
sumer should be immediately able to assign a dollar value to
participation. In part, this is because there is no clear-
cut market price for the opportunity to participate. Recre-
ation activities are often available at no charge or for small
entry or user fees. Furthermore, travel expenses and time are
the major components in the costs of recreation. The consumer
may have difficulty assigning values to these costs and re-
flecting them in an estimate of willingness to pay.

The amount that a participant is willing to pay to use a
recreational resource is conditioned by the availability of
alternatives. Participants may have difficulty identifying
and evaluating the alternatives available, especially when
questioned about a particular activity or site to which they
have become accustomed over a long period of time. Yet these
participants would subsequently switch to alternative activ-
ities or sites if the price of participation at a particular
site increased sufficiently. This point is very important.
The relevant value of recreation that is sought by the survey
is the net value, the extra welfare that is gained from parti-
cipation in a particular activity rather than the next best
alternative. Therefore, the individual must be aware of the

value of the next best alternative and should be directed to think in terms of his available alternatives.

Perhaps the most difficult problem that consumers face with the survey method is with questions which attempt to estimate willingness to sell. Willingness to sell rights to participate in an activity is a highly emotional subject. The type of questions at issue are those which ask individuals to state the minimum amount they would require to give up their rights to participate in an activity associated with a site, area, or resource. Such a question might not produce useful answers since no one offers to give up rights to anything cheaply, and no one has a sufficient conception of what it means to do so. There is reason to believe that the emotional nature of the question may induce an overstatement of the necessary compensation. Hammack and Brown (1974) reach this conclusion after asking (in a mail questionnaire) a sample of duck hunters to state their willingness to pay and their willingness to sell for a season of duck hunting. This is an area which would benefit from future research.

Knetsch and Davis (1966) are optimistic with respect to the individual's ability to make an estimate of willingness to pay. They state that the willingness to pay for a trip is a "sufficiently real and stable phenomenon that the measurement is useful." The reasoning is that many recreation lands have limited access and users have "no trouble visualizing the existence of the power to exclude them." Under these circumstances, they believe that the consumer should be aware of his willingness to pay to avoid exclusion. It is to the problem of eliciting this value with a survey that we now turn.

THE ABILITY OF THE SURVEY TO ELICIT VALUES

The ability of the survey to elicit useful values is strongly influenced by the methodology employed in asking the

question. It is essential that the questions be formulated
with regard to the correct definitions of consumer benefits[1]
and that the individual being interviewed (1) clearly under-
stand the questions, and (2) does not employ a gaming strategy
in responding.

Understanding the Questions

In estimating the individual willingness of participants to
pay for recreation, what is desired is the maximum amount that
the participant would be willing to pay above the actual cost
of participation rather than be deprived of using a site, area,
or resource. It is essential that the participant understand
whether a question is intended to refer to a specific opportu-
nity, such as hunting ducks at a particular marsh, or to a
general activity, such as duck hunting. This point is impor-
tant since water resource management alternatives that are
being evaluated typically involve only a portion of the possi-
ble opportunities for an activity, and the appropriate valua-
tion concerns only those specific opportunities which are to
be affected by a project. It is particularly important that
these circumstances be identified in the estimated model if it
is to be usefully applied to other areas.

The influence of alternatives on recreation benefits is
important and it has yet to be dealt with sufficiently in ap-
plications of the survey method. It should be clear that if
an individual were to be denied the opportunity to use just
one site for which there are many satisfactory substitutes
available, then he has lost relatively little in the way of
benefits because he can shift to the substitutes. It is, of
course, possible that a project may have an impact on many
sites. For example, a single project may have an adverse

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[1]For precise definitions of the various measures of net bene-
fits see Appendix D. This point, which should be evident, is
not discussed below.

impact on the quality of duck hunting over a multistate region. In this case, the net loss of benefits to the user will be greater, but there is no difference in principle. If he were to be completely denied the opportunity to use *all* sites at which a specific activity can be performed he has lost still more. He will, in this case, have to shift to activities which do not give him as much satisfaction as his present recreation activity. In all cases, the relevant value is the difference in welfare gained from participating in the presently available recreation opportunities rather than those which would be used following the development of the recreation management plan that is being evaluated. It would be a potentially serious error to apply a figure intended to reflect a value of the general availability of an activity to evaluate the value of that same activity at a specific site.

Thus the respondent to a question regarding willingness to pay should be made aware of the scale of the site, area, or resource being evaluated and its likely effect on the particular set of recreation activities presently available to him. It should be clear whether it is a specific site or the general availability of a resource over a period of time that is to be evaluated. This is essential from the standpoint of getting a valid response. It is the task of the survey practitioner to make sure the respondent thinks of the alternatives in an appropriate manner; this may be particularly difficult with mail surveys.

It should also be clear that serious potential problems can arise in the application of willingness-to-pay equations to other areas unless the scale of impact is similar. For example, it is not correct to take the value of duck hunting in general as any reflection on the value of duck hunting at one particular site. The value of the particular site will depend on characteristics of that site and its location relative to users and substitute areas.

Gaming Strategy of the Respondent

A second potential problem that must be dealt with in the development and use of the survey technique is biased responses which arise because "it is in the selfish interest of each person to give false signals...to snatch some selfish benefits in a way not possible under the self-policing competitive pricing of private goods" (Samuelson, 1954). This problem, the gaming strategy of the respondent, is particularly difficult because the bias may be upward or downward, according to the manner in which the question is stated or perceived.

Biased responses may be illustrated by the following example. Assume a person is asked to indicate the maximum value (in dollars) that he is willing to pay for use of a public project, and it is implied that the actual entry and user fees that he will be charged will not be influenced by his response. The respondent, as a consumer of project benefits, has a natural incentive to overstate his willingness to pay in an effort to assure that additional opportunities, such as those provided by the project, will be developed. Alternatively, the consumer may be asked to state his maximum willingness to pay to use a project where he perceives that he will have to pay a fee that will be influenced by his response. There is now an incentive for the respondent to answer with a downward bias if he thinks that the project will still be provided regardless of his response. He could then, by citing a low figure, enjoy the benefits of the project and pay a lower fee. This last problem is often referred to as that of a "free rider" (Buchanan, 1968). To pose the question of benefits in one manner may lead to a reply with an upward bias, while another manner may yield a downward bias. An example of the different responses that can be obtained from individuals with respect to various questions is provided by Romm (1969).

Bohm (1971, 1972) has suggested "counter strategic argu-
ments" as a possible solution to the gaming strategy problem.
Bohm surveyed a sample of Swedish television viewers to obtain
estimates of their maximum willingness to pay for viewing a
private showing of a new television program. The respondents
were divided into six groups. Five groups were asked ques-
tions to elicit willingness to pay which might have been ex-
pected to lead to various gaming strategies in the responses.
However, explicit "counter-strategic and moral arguments" were
added to these questions. The questions all indicated that
some stated payment scheme would actually take place if the
aggregate willingness to pay was sufficient to justify the
cost of showing the program. The differences in the mean
values of responses to each of these questions were not sig-
nificant, leading to the conclusion that if the questions are
formulated carefully with counter-strategic arguments, gaming
strategy is perhaps not as important as has been hypothesized.

A question asked of the sixth group was not tied to any
payment scheme; it merely asked the respondent to state his
maximum willingness to pay. This question was the only one to
result in a mean response that was significantly higher than
the mean response to any of the first five questions. Bohm's
conclusion was that doubt should be cast on such questions:
it is preferable to avoid such open-ended questions.

The implication for recreation surveys is that questions
should be more carefully structured than simply asking the
respondent his willingness to pay, as is sometimes done in
applied studies of recreation benefits. Some care must be
taken to place the respondent in a realistic decision-making
framework. Bohm also feels that it would be valuable to use
two questions to estimate willingness to pay, one of which
might be expected to induce some small upward bias and another
which might induce a small downward bias. Hopefully this
would provide a range within which we could be relatively

confident that the true value lies. It may also be useful to
pose questions that can be answered with a simple yes or no.
This presents the respondent with a simple and logical choice,
and provides fewer opportunities for a gaming strategy.

There is much room for improvement in the design of recre-
ation surveys to minimize the problems outlined above.

MULTIPLE VISITS

Some further problems exist which need present no great
difficulty, but which can have significant influence on the
accuracy of the survey method if they are not taken into
account. For example, a sampling problem arises if consumers
make numerous visits or visits of different length. The ini-
tial survey procedure must be structured so that a true cross
section of users is interviewed. Sampling should be made at
different times during the season to reflect the possibility
that the first trip to a site or area during a season may be
valued differently than later trips. The sample design should
reflect the problem of collecting information from a represen-
tative mix of users who make visits of different lengths.
With an appropriate sampling program, and the capability for
estimating total visits accurately, there should be no major
problem.

EXAMPLES APPLYING THE SURVEY METHOD TO RECREATION

The survey technique has been used in a number of instances
to evaluate recreation benefits. The methods used to obtain
information, and the techniques used to derive a dollar mea-
sure of benefits from this information, vary considerably.
The following discussion is a brief review of three studies
which have attempted to elicit directly a measure of consumer
surplus. The purpose of this discussion is to point out some

of the details of applying the survey method to recreation benefit estimation.

The Davis Study

Davis (1963) was the first to use the survey technique to compute a demand curve directly for a recreation site. His pioneering effort consisted of a cross-section survey of recreationists in and around Baxter State Park in northern Maine between June and November of 1961. Users were asked to indicate how their decisions with respect to visiting the site would be affected if their costs associated with using the area increased by certain amounts (Davis, 1963). The personal interviews included a bidding game. The amounts were systematically raised or lowered until the consumer switched his reaction from participation to non-participation or vice versa. The initial questioning was hampered by a gaming behavior induced by the objections of participants to fees. Davis notes:

> The procedure for estimating willingness to pay consisted of selecting a starting figure based on 1 cent per mile traveled and successively doubling and redoubling this figure until the respondent replied that the stated amount would cause him to reduce his use of the area. The extra sum was initially to be called an entrance fee; but this was quickly discarded to avoid understatements by those trying to influence policy and also to avoid getting tangled up with principle objections to fees. (Davis, 1963)

The survey subjects were pooled to include campers, fishermen, and hunters, since multiple regression analysis yielded no significant relationship between activity type and responses to questions.

The type of questions used by Davis which asked the respondent to state their reaction (would you come more often, less often, or no change) to each stated cost increase yielded a

discontinuous, or all-or-nothing, demand curve for each user.
The respondent was found to be willing to pay a maximum sum
for a visit and if costs rose above that amount, to stop com-
ing altogether rather than shorten the length of stay. Davis
argued that the response was realistic in light of the time
constraints experienced by most visitors. The use of the site
was such that visitors could be assumed to make just one four
to five day visit per year. The fact that single visits were
made simplified the evaluation procedure.

The resulting observations were graphed as a frequency dis-
tribution showing the number of visitors who have stated a
common figure as their maximum willingness to pay. These
data, which were obtained from a small sample of the user pop-
ulation, were not sufficient to compute an aggregate willing-
ness to pay for the entire user population. Rather, this was
used to develop a regression equation which explained addi-
tional willingness to pay as a function of user characteris-
tics. A larger sample, aimed at user characteristics, was
used to impute a maximum additional willingness to pay for
each user.

The following regression equation explained 60% of the
variation:

$$W = 48.57 + 2.85Y + 2.88E + 4.76L$$
$$(1.52) \quad (.58) \quad (1.03)$$

Net willingness to pay (W), was found to be a function of in-
come (Y), length of visit (L), and the number of years of
experience with the area (E). As might be expected, all three
variables were positively related to willingness to pay.

Upon cumulating the estimated maximum additional willing-
ness to pay of all users, based on the user characteristics

and the above equation, it was found that the average maximum additional willingness to pay (per individual) was $2.98, with a range of $0 and $16.66.

If it is expected that users place significantly different values on different visits to the same site and visits of different lengths, a more sophisticated sampling technique would be required in order to apply the Davis methodology to sites where individuals may make several visits and visits that may vary in length.

In order that survey information on willingness to pay at an existing site or area may be applied to valuation of a new site, it would be helpful if net willingness to pay were regressed on a greater number of explanatory variables. These variables would include those expressing the availability and relative quality of alternatives as well as the cost in time and money for each individual to reach the site. The travel cost method indicates the importance of these variables in determining willingness to pay. With this explanation of willingness to pay, the information from existing sites could be applied to similar planned sites which differ in location relative to the user population and substitute sites. To do so would require information on the expected rate of use from each visitor origin (such as a town or county in the market area of the planned site) and the relevant characteristics of the expected users. These are the characteristics which are explanatory variables in the willingness-to-pay equations. The travel cost method indicates the importance of distance from the site and relative availability of alternatives as factors influencing willingness to pay. The survey method, unlike the travel cost method, requires a separate estimate of use. That estimate may come from a survey or another method.

At present, the Davis methodology of a bidding game appears to be the most acceptable application of the survey technique.

Among its advantages are the following: only users are inter-
viewed, thus reducing the hypothetical nature of the ques-
tions; care was taken to establish a rapport with the respon-
dent before the bidding game was introduced; the bidding game
required more careful decision making than an open ended ques-
tion and reduces the opportunity for gaming strategy.

The Horvath Study

A second example of using the survey technique to provide a
measure of recreation benefits is the study by Horvath (1974).
Horvath chose a random sample of 12,068 households from 11
southeastern states and received responses from 9,322 of them.
The survey was directed at finding the monetary valuation of
wildlife recreation and the actual expenditures made for out-
door recreation. Responses were obtained to questions
concerning:

  a) the average daily monetary value received from
     participation;
  b) the average daily value assigned by those who did
     not participate during the study year but who
     wanted to do so;
  c) the average daily value required to give up par-
     ticipation; and
  d) the average number of days pay lost because of
     participation.

Questions were aimed at the respondent's monetary evalua-
tion of nine outdoor recreation activities. The questions were
not specified as to site, area, or resource. In all cases,
the monetary values given by actual participants in the activ-
ity were greater than the values given by nonparticipants.
Valuations given by those engaged in activities that required
"wildlife harvesting" (i.e., fishing and hunting) were gener-
ally less than those engaged in "non-harvesting" activities
(i.e., wildlife enjoyment). In all cases, the amounts required

by participants to give up an activity exceeded the maximum
willingness to pay for the opportunity to engage in that
activity. A summary of the daily values per household derived
in the study is given in Table 3.

Horvath computed the gross benefits of the nine recre-
ational activities by projecting his sample estimates to en-
compass the 16.3 million households in the southeastern United
States. The results of the Horvath study differ significantly
from those of Davis. While Davis (1963) found a range of net
willingness-to-pay values from zero to $16.66, with a modal
value between one and two dollars per day per household,
Horvath's estimates of average daily value received by parti-
cipants ranged from $33.58 to $80.30.

Several critical comments can be made on the Horvath study.

1) Horvath states (1974, p. 189) that his daily values are
more useful for policy making than the suggested values in
Senate Document No. 97, Supplement No. 1. In fact, the two
sets of values are not comparable. Horvath's figures are not
valuations of a specific site or of activities available in a
specific region. They are not derived from questions concern-
ing project-specific impacts; rather they attempt to put a
value on the general availability of wildlife. On the other
hand, the value of recreation associated with a water resource
management alternative depends on its particular characteris-
tics and location relative to users and substitutes. The
value of recreation associated with a particular alternative
is not derivable from a measure of overall benefits. The
value for general availability of recreation opportunities,
such as those which Horvath has attempted to estimate, will
exceed the value of that activity at any specific site or area.
There is no valid way for applying these "activity values" to
the recreation opportunities associated with a management

TABLE 3. RESULTS OF THE HORVATH STUDY

Recreational activity	Average daily value received by participants	Average daily value assigned by nonparticipants	Average daily value to give up by participants	Average number days lost for participation (by those losing pay)
Fishing	42.93	28.61	51.76	4.4
saltwater	59.80	43.69	74.47	
warm fresh water	40.84	17.83	49.28	
cold fresh water	33.58	23.35	39.83	
Hunting	47.09	28.25	65.69	3.9
small game	39.14	22.37	54.73	
big game	60.86	41.34	81.98	
waterfowl	48.99	20.48	67.24	
Wildlife Enjoyment	70.71	24.52	91.31	6.3
birds	65.40	27.23	81.00	
animals	83.30	23.81	107.06	
fish	65.99	21.89	90.49	

alternative. In short, Horvath's values are not useful in planning for water and related land resources.

2) Respondents are asked for an average value, rather than a value for a specific trip. Furthermore, it is not clear what these values measure. The average daily value required to give up participation is presumably a measure of willingness to sell. The average daily monetary value received from participation is vaguely defined and cannot be interpreted. The study would gain more creditability if the actual questions were clearly stated and if it were indicated how they related to the appropriate measures of welfare.

3) There is no indication that there was any concern with or awareness of the potential for biased responses.

4) The relevance of the responses of nonparticipants is not clear. Horvath asks what value they would have received if they did use the resource. Since, in fact, they did not use the resource, they received no benefits from use. There may, in fact, be significant nonuser benefits from natural areas. The nature of these benefits is not discussed.

The Hammack and Brown Study

A third study which used the survey technique is Hammack and Brown (1974). A mail questionnaire was sent to a sample of 4,900 waterfowl hunters in seven western states. Usable responses were received from 2,455 hunters. The survey was directed at eliciting both the net willingness-to-pay and the willingness-to-sell measures of consumers' surplus. Respondents were asked to state their benefits from a full season of duck hunting. The survey was not concerned with the value of a specific site. Instead, two models are presented for estimating the value of duck hunting. One model provides

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estimates of the value of a season of waterfowl hunting[2] while
the other is used to estimate the value of an additional duck
bagged.[3]

The following example indicates how the equations developed
by Hammack and Brown would be used to estimate the value of
duck hunting benefits created by habitat enhancement. Assume
that it is estimated that the particular project will produce
1,000 ducks. First it is necessary to identify the number of
these (1,000) ducks that would be harvested, the number of
hunters that would harvest them, and the number of additional
ducks that would be harvested by each hunter. Finally, char-
acteristics of the hunters who would harvest the ducks must be
determined. These would include their household income (after
taxes), number of seasons of waterfowl hunting, cost of a
season of waterfowl hunting, waterfowl shot and bagged during
the season, and number of days hunted during the season.
Either of the equations developed by Hammack and Brown could
then be used. The method would not be appropriate for evalu-
ating very *localized* changes in the quality of duck hunting.

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[2] $\ln V = 1.44 + 0.466 \ln Y + 0.168 \ln S + 0.141 \ln C$
        (8.7)   (4.5)   (5.3)

$\quad\quad + 0.308 \ln (k/D) + 0.480 \ln D$
        (7.0)   (12.5)

Where:

V = value (consumer's surplus) of a season of waterfowl
     hunting
Y = household income (after taxes) in thousands
S = number of seasons of waterfowl hunting
C = cost of a season's waterfowl hunting
K = waterfowl shot and bagged during the season
D = number of days hunted during the season
() = t statistics

[3] $V = e^{1.54} Y^{0.443} S^{0.163} C^{0.149} K^{0.409}$

Where:

$\dfrac{dv}{dk}$ = value of an additional buck bagged

V, Y, S, C, and K are defined in note 2, above.

Such a value would depend on the location and characteristics of the particular site.

The questions asked by Hammack and Brown are consistent with the consumers' surplus principles, which are very thoughtfully discussed in the opening chapters of their study. The two questions (Hammack and Brown, 1974, p. 91) on valuation were:

1) What is the smallest amount you think you would take to give up your right to hunt waterfowl for a season?

2) About how much greater do you think your costs would have had to have been before you would have decided not to have gone hunting at all during that [the previous] season?

These questions were accompanied by statements emphasizing that they referred to purely fictitious situations. The questions with respect to valuation were preceeded by other more general informational questions in order to put the respondent at ease. Hammack and Brown were well aware of the emotional response caused by the willingness-to-sell question and do not claim that they have found a valid answer. However, the net willingness-to-pay response was felt to provide a satisfactory approximation of benefits. Their success at finding a satisfactory equation to explain willingness to pay confirms their satisfaction. The average additional willingness to pay for the season was $247, while the average willingness to sell (after discarding some extreme high values) was $1,044 per season.

The methodology used by Hammack and Brown presents two problems. The question used to elicit willingness to pay is very open ended and does not place the respondent in a market-type decision process. The use of a mail survey to estimate willingness to pay also appears to have a disadvantage over the personal interview which permits the establishment of rapport with the respondent and use of the bidding technique.

Rapport can be established, in part, however, by careful
ordering of the questions.

Evaluation of the Survey Technique

In evaluating the survey technique one must ask, "What does
the technique attempt to do and how well does it do it?" The
answer to the first half of the question is rather straight-
forward: the survey technique attempts to arrive at an esti-
mate of maximum net willingness to pay or, in some cases,
willingness to sell, that is commensurate with other benefit
values. The second half of the question is, unfortunately,
not as easily dealt with.

A problem with the survey technique relates to the possible
biases that may arise if the question is "improperly" worded.
If care is taken to assure the respondent that his answer will
not affect future entrance fees, licenses, etc., (thus min-
imizing the downward bias), and that it will not imply more or
better sites in the future, (thus minimizing the upward bias),
this problem can be reduced in magnitude.

A further problem arises because of the great variability
in responses that can occur with various formulations of ques-
tions aimed at obtaining maximum net willingness to pay. As
the Horvath and Romm studies have shown, the calculation of
recreation benefits depends to a large extent on the type of
questions asked.

For certain benefit studies the survey method has some
clear advantages over the travel cost method which is the
other economic methodology currently available. The travel
cost method, which is discussed in Chapter 5, is difficult or
impossible to apply to sites which are, for many users, one of
many destinations visited on a single trip. Also, the survey
method may have certain advantages for considering the effects

of congestion. The survey method also has an advantage in situations where a project affects alternative recreation benefits at a number of widespread locations or results in a small change in quality at existing sites. An example would be the previously-cited case of an effort that increased duck production in a particular area. In such a case we may wish to value the benefits to duck hunters. The ducks may be shot by hunters in widespread parts of the flyway. It would be impossible to separate the additional ducks from other ducks and likewise difficult to identify changes in behavior of duck hunters attributable to the extra ducks. The most logical approach appears to be a survey such as that undertaken by Hammack and Brown (1974).

The survey method is likely to be costly compared to the travel cost method and requires extra caution in formulating the methodology. Despite a preference by most economists to place more faith in information revealed by what people do rather than what they say, the survey method is useful. It has value, both for evaluating those sites for which the travel cost is inappropriate and also as a check upon the travel cost estimates which themselves have some inherent inaccuracies. If economic values are needed, it is best to use an economic methodology rather than guesswork. Research should be directed toward deriving survey methodologies which maximize the likelihood of accurate responses.

SUMMARY OF SUGGESTIONS FOR USE OF THE SURVEY METHOD

1) The survey method is more acceptable at present for estimating willingness to pay rather than willingness to sell. It is recommended that more research be devoted to procedures for estimating willingness to sell.

2) Estimated equations should be developed to express the relationship between willingness to pay and characteristics of

the users based on information gathered from the survey of users. A larger survey should be aimed at estimating the distribution of these characteristics over the user population.

3) The benefits at planned sites and facilities need to be evaluated using information from existing sites. In order that the willingness-to-pay equations may be applied to proposed sites which may be located differently with respect to users and substitute sites, we recommend that travel distance and accessibility to substitutes be considered as explanatory variables in the willingness-to-pay equations. The travel cost method illustrates the importance of these variables in influencing individual willingness to pay.

4) The survey questions should relate clearly to specific recreation activities that are to be affected by a management alternative. That is, it should be explicitly stated that, when estimating willingness to pay, the respondent should consider the appropriate range of substitute sites and activities. Caution should be used that results are not applied inappropriately to proposed changes.

5) Instructions and questions should be formulated to avoid biased responses which might result from the respondent answering in a manner which he perceives might further his self-interest. The respondent should be placed in a realistic decision framework that simulates a thought pattern that approximates the market process.

6) It is best to survey actual beneficiaries only, in order to reduce the hypothetical nature of the questioning.

7) For sites which involve multiple visits and visits of different length, caution should be taken that a truly representative sample of visits and visitors is chosen.

8) In some cases the best unit to be evaluated may be the single trip. In other circumstances, it may be desirable to value a season of activity.

CHAPTER 5
THE TRAVEL COST METHOD

INTRODUCTION

When the survey method is used to estimate recreation bene-
fits, an estimate of use must be developed to be used with the
estimates of individual willingness to pay. This need for an
estimate of use is also one of the six major problems associ-
ated with use of the interim unit day value approach. These
problems are outlined in Chapter 3. The travel cost method,
on the other hand, is based on a model for predicting use of a
site or area. It will subsequently be shown that the travel
cost method has a number of advantages over the survey method.
Consequently, the travel cost method is strongly recommended
for use whenever appropriate. The circumstances for appro-
priate use of the survey method are outlined in Chapter 4.
Chapter 6 presents recommendations concerning the choice of a
valuation method.

The travel cost model can be described by an expression
such as:

$$V_{ij} = f(C_{ij}, P_i, S_{ij}, A_j)$$

Where:

V_{ij} = the number of site visits or trips from a
population source or center i to a recreation
site j

C_{ij} = trip cost, the cost of travel between the
origin i and the site j, plus entry fees at
site j.

P_i = the population of origin i

S_{ij} = an index of the proximity of substitute recreation areas available to each population source (P_i)

A_j = the attractiveness of site j

Parameters of the model are estimated from information about users at existing sites. The model is then used to estimate expected visitation at a proposed site, provided that estimates of the relevant variables (C_{ij}, P_i, S_{ij}, A_j) are available. The same model can be used to estimate a demand curve for an existing or proposed site within the same region. The travel cost method estimates a demand function for a site or resource by using travel cost as a surrogate for price. The area under this demand curve provides an estimate of user benefits. The original suggestion for this method was made by Hotelling (1949), and early applications to outdoor recreation can be found in Trice and Wood (1958), Clawson (1959), and Knetsch (1963). Significant advances in travel cost methodology include the extensions by Burt and Brewer (1971), Cesario and Knetsch (1976), and Knetsch, Brown, and Hansen (1976). A good explanation of the economic rationale behind the modern travel cost method may be found in Cicchetti, Fisher, and Smith (1976). They present a household production function approach to the demand for recreation, taking travel to be the most significant input into the "production" of recreation. These recent models might be called regional estimation procedures. They provide analytical frameworks which take explicit account of alternative recreation sites. That is, they jointly estimate the demand for existing sites of various quality, thus allowing the prediction model to account for interaction among sites in attracting visitors.

The travel cost model is developed by using actual observations on use and user characteristics from various origins (i) to a site (j). The wide range of costs facing individuals at different distances from a site provides considerable information about the influence of costs on participation. This

information can be used to generate a demand curve (i.e., estimates of participation at various entry fees). A direct measure of site demand would require data relating site use to various levels of user fees. Since actual fees show little variation, and are not charged for many sites, only indirect estimation of the demand curve is possible. An experiment with changing site fees is an obvious way to find the demand curve at an existing site. It might provide a useful check on other methods. The practicality of such an undertaking is, however, subject to question. A discussion of this approach is provided by Stroup, Copeland, and Rucker (1976).

The procedure for developing a demand curve from the estimated travel cost model is as follows. First the model is applied to all origins (i) using actual data for trip cost (C_{ij}) and other variables of the model. With fees initially considered zero, C_{ij} is the travel cost. The predicted use from all origins is summed to obtain an estimate of total use at zero price. It is then assumed that participants will react to an increase in fees just as they do to an increase in travel cost. Therefore, the travel cost for each origin is incremented by fixed amounts (say $0.50) and the model used to estimate use at this new hypothetical fee level. The procedure is repeated, and successive estimates of use at each level of fees obtained. These estimates are then used to plot a site demand curve. Total net consumer willingness to pay for the site or resource is estimated by the area under this demand curve. An estimate of gross willingness to pay may then be obtained by adding total site entry and use fees to net willingness to pay.

There is, however, a source of consistent bias in demand curves derived in this manner because of the failure to capture the effects of travel time. The lower visit rates of more distant centers are due not only to the greater monetary costs of making the longer trip, but also to the greater time

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that is involved. Consequently, if travel time is omitted as
a variable, estimates of use at higher dollar costs will be
understated. Thus, to ignore time leads to an underestimation
of benefits. Methods of dealing with this problem will be ex-
plained in subsequent examples.

THE ASSUMPTIONS OF THE TRAVEL COST METHOD

A number of assumptions have been either implicitly or ex-
plicitly made in the travel cost literature. The three major
assumptions are listed below. These must be satisfied in
order for the method to provide useful estimates of use and
benefits.

1) *Entry Fees*: It is assumed that an individual
   would react to an increase in entry fees in the
   same manner as to an increase in travel costs.
2) *Specification*: The assumption is made that all
   relevant and statistically significant variables
   which affect trip-making behavior are properly
   specified in the travel cost model. Under this
   assumption, unbiased estimates of the slope of
   the site demand curve may be found.
3) *Capacity Constraints*: It is assumed that observed
   data points used to estimate the original model
   are true demand points. That is, there is no
   unobserved demand that is unsatisfied due to
   capacity restrictions.

The implications of these assumptions are briefly discussed in
the following section.

Entry Fees—Site Use Benefits vs. Trip Benefits

The travel cost method provides a demand curve for the com-
plete recreation trip, including travel to and from the site.

This is a result of using the cost of travel as a proxy for the cost of site use. As a result, the benefit estimates will include the net benefits from the complete trip, including travel as well as site use. For the travel cost method to provide an accurate estimate of site benefits, it is required that the consumer's benefits from the travel be offset by the amount paid for travel. That is, net benefits from travel should be zero. If, however, there are many intervening opportunities in which the consumer participates while making the trip, and the consumer received benefits from these in excess of their cost, then the travel cost method would over-estimate site benefits.

In practice, it is usual to ignore the problem of separating site use benefits from other trip benefits. This assumption is probably more acceptable for ordinary sites which draw from a local market area than for those especially attractive sites which draw from a national market area.

Specification

From the point of view of predicting use, it is clear that errors can arise from not recognizing that all sites in a market area compete for the same potential users. As a prediction model, the travel cost method is improved markedly by including variables reflecting the availability and relative quality of substitute sites. Many other variables might be expected to influence demand; among these are travel time, income levels of users, past experience with the activities available at a site, age and family structure, and size of the town in which the potential visitor lives. As with any statistical model building, the process of choosing significant variables and correctly specifying their interrelationship is, partly, an art.

Similarily, the benefits received from recreation cannot be measured correctly without a properly estimated demand curve. In particular, the benefits an individual receives from recreation cannot be evaluated without considering the availability of substitute activities.

The need to correctly specify the model argues strongly for the modern regional estimation approach.

Capacity

In the *estimation* of the travel cost model, data should not be taken from sites which have insufficient capacity to meet demand. That is, data are required that indicate the full demand at existing fee levels. This requirement is not severely restrictive. While most sites are used to capacity at certain peak times, there are usually many other periods when the site is not used to capacity. It is likely that the number of people who are denied entry is small relative to the number of people who do enter. If that is the case, the misestimation will not be serious.

There is no serious problem in *applying* the travel cost method to a proposed site that will have insufficient capacity. The procedure for accomplishing this is discussed in example 2 below.

THE APPROPRIATE USE OF THE TRAVEL COST METHOD

Whenever applicable, the travel cost method is strongly recommended for benefit estimation because of its clear theoretical base. The method explicitly recognizes the spatial characteristics of the recreation market. That is, each individual faces a different range of prices and alternatives depending upon his location. The method also derives benefits based on the actual market behavior of individuals rather than

from responses to questions (i.e., the survey method) or the opinions of planners (i.e., the interim unit day value approach). One clear advantage of the travel cost procedure over the survey method is that the travel cost method does not rely as heavily upon the personal skills of the practitioner in eliciting information from individuals. As a result, the travel cost procedure is probably less likely to yield badly inaccurate answers when implemented in the field. The method also has the advantage of being able to predict both use and benefits.

At present, the best variations of the travel cost method are those of Cesario and Knetsch (1976), Burt and Brewer (1971, 1974), Cicchetti, Fisher, and Smith (1976), and Knetsch, Brown, and Hansen (1976). It is these versions that are strongly recommended for estimating recreation's contribution to national economic development. In subsequent discussion these will be referred to as regional estimation procedures.

In general, the travel cost method is the appropriate benefit evaluation technique whenever: (1) there is sufficient variation in travel costs among users to allow estimation of demand, (2) the proposed changes being evaluated are significant enough to alter travel cost to some individuals, or to alter the number of trips that will be made at the existing travel cost, and (3) the travel expenses have been made mainly for the purpose of recreation at the resource which is to be evaluated. The travel cost method seems much more broadly applicable than the applied literature indicates, although clearly it will be most successful for rural sites where users may come from a wide range of distances.

However, the travel cost method is difficult to apply accurately in some situations. (1) The travel cost method will be most successful when users come from a wide range of distances. It may be less useful for urban parks where there

might be too little variation in travel costs to allow for demand estimation.[1] Urban parks are also likely to provide significant benefits to non-users by creating a more attractive local environment. This benefit will not be captured by either the travel cost method or the survey method.[2] (2) If travel is not made for the single purpose of visiting the site which is to be valued, then it is difficult to decide how much of the travel cost should be attributed to that particular site. This problem will be most severe for those unique or widely-known sites that attract users from a very large market area, and for other sites in the vicinity of these unique resources. (3) When it is necessary to evaluate the impact of congestion on site benefits, a survey procedure may be preferable. (4) When small changes in the facilities or quality of recreation occur which would have little impact on trip-making behavior but might alter the individual's valuation of the recreation experience, the survey method is most appropriate. (5) Finally, it is difficult to apply the travel cost method to resources that are large or have a large number of widely separated points of entry. This is a problem of data collection; the method is applicable as long as sufficient variation in travel costs is observable (and the other qualifications do not apply).

In other cases, particularly for rural sites which attract users from a local market area, the travel cost method is strongly recommended as the best available method for evaluating recreation benefits. In order to be acceptable, the travel cost procedure must take explicit account of the

[1]See, however, U.S. Army Corps of Engineers (1976) which has applied the travel cost method to an urban park. Zip codes were used as origins.

[2]The benefits of urban parks have been measured by the change in land values attributable to the presence of a park. See Knetsch (1964), Darling (1973), Hendon (1973), and Appendix C of this study.

availability and quality of substitute resources. The simple
form of the travel cost method which does not take substitutes
into account is not acceptable in cases where substitutes
exist (i.e., most cases) because it can lead to serious inac-
curacy in use prediction and benefit estimation. An accept-
able procedure for evaluating the recreation benefits associ-
ated with a proposed project should also evaluate the lost
benefits arising from transforming a site from its natural
state. It should also be realized that the travel cost
method (and also the survey method) identifies user benefits.
If significant nonuser benefits also exist, these additional
benefits should be evaluated by other methods, where possible.
These nonuser benefits are often not included in the national
economic development account.

We now turn our attention to the basic procedure of build-
ing a travel cost model and applying it to the valuation of a
proposed site. The discussion focuses on a series of examples
that starts with very simple cases and works up to the modern
regional travel cost approach.

THE BASIC TRAVEL COST METHOD

The following sections introduce the basic procedure of the
travel cost method and indicate how it can be used to evaluate
the benefits of a planned site. These introductory examples
are heavily simplified and do not consider the importance of
the availability of alternatives, the distribution of tastes,
the effect of travel time or the displacement of existing
facilities by a planned project. These examples are represen-
tative of early uses of the travel cost method, and are pre-
sented here only to introduce the basics of the method.

Subsequent discussion will indicate the necessity of modi-
fying the basic procedure to deal with the availability of
alternative sites, travel time, and other significant

influences on demand. It is concluded that this is best
accomplished by a regional estimation procedure in a form from
which the demand for any specific site or area may be derived.

*Example 1. Development of a Simple Travel
Cost Model from an Existing Site*

The travel cost method is applied to existing sites in
order to develop models for predicting recreation benefits
associated with the planned development of sites. The travel
cost model is usually presented as a two-stage process. In
the first stage, the trip demand curve is generated to show
the number of visits that the individual would make at various
levels of trip cost. Its derivation requires data on: (1) the
total number of visits made from several (not necessarily all)[3]
population origins at different distances from the site;
(2) the total population at each origin; (3) the trip cost
from the origin, including round trip monetary travel cost,
expenditure for use of the site, and any differential among
individuals in necessary costs apart from those for site use.[4]
The total number of visits is measured over a specified time
period such as a season or year. The origins for trips are
often taken to be towns, counties, or concentric rings around
the site. To facilitate subsequent discussion, we will assume
that towns are the points of origin. Individual observations
provide the most information, and any aggregation of observa-
tions must be made in light of the tradeoff between lower

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[3]Data are required on a sufficient number of origin-destination
combinations to define the demand curve. Total use from the
origins may be estimated from a sample of households.

[4]Only differentials in cost are important for development of
the model. Costs which are common to all origins may be
neglected without loss. It would be most correct to subtract
from all costs, other than site costs, any element of consum-
ers' surplus. Hammack and Brown (1974, pp. 9-12) provide a
good discussion of appropriate costs.

costs of data handling and having a reduced amount of information available.

Some hypothetical data are presented below (Table 4) followed by a diagram of the region in which the site is located (Figure 2). In this simple example we assume that users come from one of three towns and all users from a particular town face the same travel costs. The entry fee is taken to be zero. If there had been an entry fee, it would have been added to the travel cost. The resulting estimate of willingness to pay for the site would be net willingness to pay. Gross willingness to pay may be estimated by adding the total spent on entry fees to net willingness to pay.

TABLE 4. BASIC DATA FOR THE SIMPLE TRAVEL COST METHOD

Origin	Population	Number of Visits	Visits per Capita	Trip Cost
A	1,000	2,000	2	$8
B	2,000	8,000	4	$6
C	3,000	24,000	8	$2

The first step is to derive the trip demand curve or the first-stage demand curve shown in Figure 4.

Stage 1—The Trip Demand Curve. Plotting visits per capita against cost (from Table 1) gives three points, one for each origin. Extending a line through these points provides a function that is used to predict an average visit rate for an individual facing a specific trip cost (Figure 3).
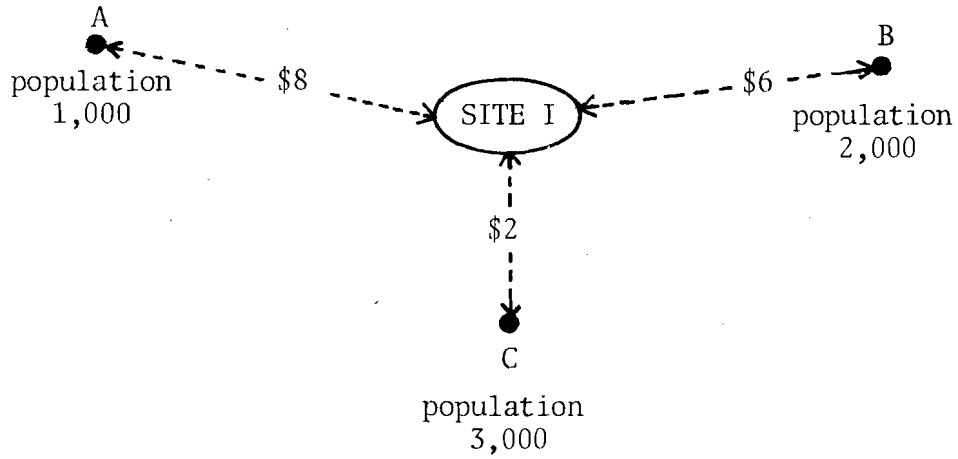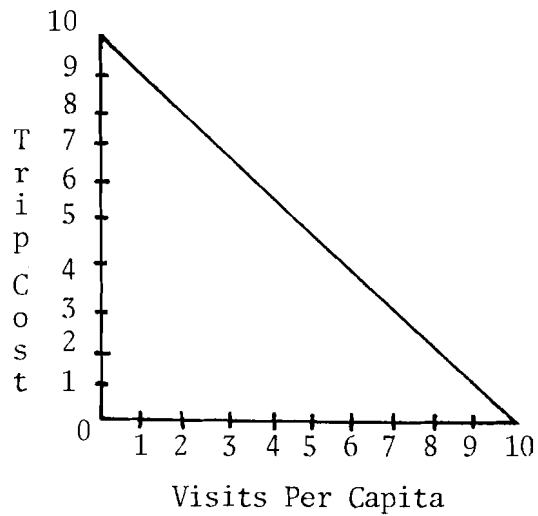
FIGURE 2. THE MARKET AREA FOR SITE I

FIGURE 3. THE TRIP DEMAND FOR SITE I

Visits Per Capita

This trip demand function can be expressed by the equation:
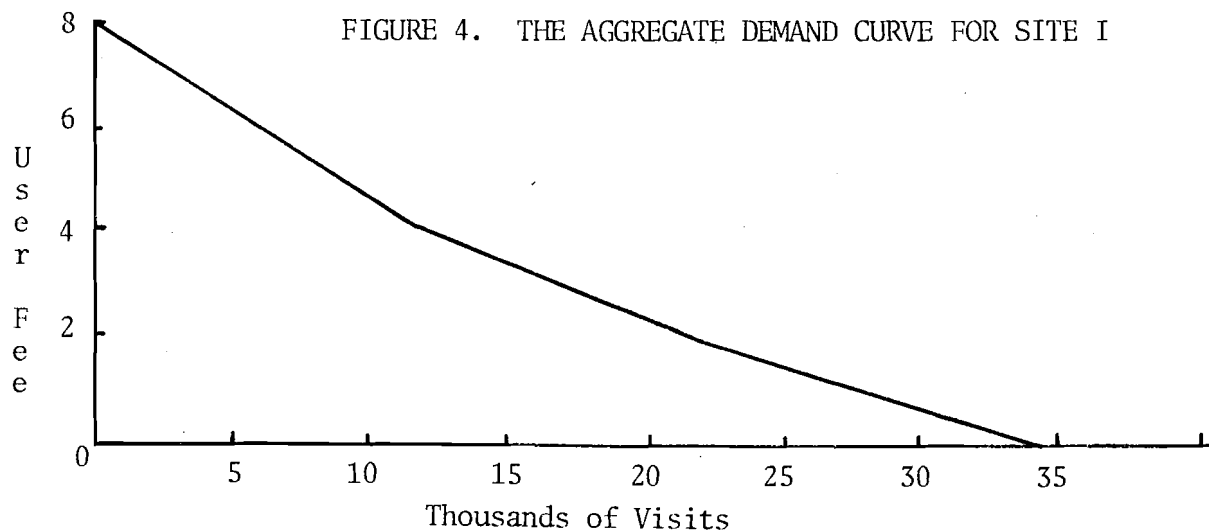
$$v_{ij} = 10 - c_{ij}$$

Where:

j = I, i = A, B, C,

v_{ij} = visits per capita from origin i to site j

c_{ij} = the travel cost of traveling from origin i to
site j

Use of a straight line demand function is for simplicity only.
A more complex function would usually be fitted to many data
points (i.e., origin—destination combinations), possibly from
several sites. This demand function which predicts visitation
as a function of travel costs is the basis of the travel cost
method. Subsequent examples will add additional variables and
sites; but the model will be used in essentially the same way.

Stage 2—The Aggregate Site Demand Curve. The second stage
involves construction of an aggregate demand curve (Figure 4)
for the site, showing how many total visits would be made at
various levels of a hypothetical site use fee. It is devel-
oped by a procedure that postulates increments in costs facing
individuals at each origin. Then, using the first stage
curve, the per capita visit rate for each individual facing
the new cost is found. This procedure is based on the assump-
tion that if an individual were charged more for site use,
thereby raising his total trip costs, he would then partici-
pate at the same rate (i.e., visits per capita) as an individ-
ual located more distantly from the site who originally faced
that level of monetary trip costs. We are actually dealing
with average participation from an origin and are referring to
average behavior of those located at an origin. Thus if the
visitors from origin C, who face a trip cost of $2 per visit
are charged a fee of $4 per visit, it is assumed that, since
they now face a cost of $6 per trip just like the residents of
origin B, they will reduce their visits per capita to the rate
of residents of origin B. This procedure involves adding the
hypothetical entry fee to the actual cost per trip, and then
solving for v_{ij}, using the trip demand function, $v_{ij} = 10 - C_{ij}$.
It should be clear that this simple assumption is not realis-
tic. The reduced number of trips made by more distant resi-
dents is a result of more than the extra travel cost. The
more distant residents also must spend extra time traveling,
may be closer to substitute sites, and their tastes may be
different.

FIGURE 4. THE AGGREGATE DEMAND CURVE FOR SITE I

The following table shows the construction of the second stage or aggregate site demand curve using one dollar increments in cost. The existing level of user fee is zero. The individual demand for visits is given by $v_{ij} = 10 - C_{ij}$. The area under the aggregate demand curve is $114,000, which is estimated net willingness of users to pay for use of the site. This value can be derived graphically from Figure 4 as the area under the aggregate demand curve for Site I. Equivalently, the areas under every individual's trip demand curve above trip cost may be summed. In this case, there are no entry or user fees and net willingness to pay equals gross willingness to pay.

Points on the aggregate site demand curve, which reflect total use for each level of incremental cost, are found by first multiplying the population at each and every origin by the appropriate per capita visit rate (i.e., at the hypothetical fee level) to find visits from each origin at that fee and

TABLE 5.   THE TRAVEL COST METHOD:
STAGE 2.   THE AGGREGATE SITE DEMAND CURVE FOR AN EXISTING SITE

| User Fees | Origin A | | | Origin B | | | Origin C | | | Total Visits |
	Trip Cost	Visits per Capita	Visits	Trip Cost	Visits per Capita	Visits	Trip Cost	Visits per Capita	Visits	
$0	$ 8	2	2,000	$ 6	4	8,000	$ 2	8	24,000	34,000
$1	$ 9	1	1,000	$ 7	3	6,000	$ 3	7	21,000	28,000
$2	$10	0	0	$ 8	2	4,000	$ 4	6	18,000	22,000
$3				$ 9	1	2,000	$ 5	5	15,000	17,000
$4				$10	0	0	$ 6	4	12,000	12,000
$5							$ 7	3	9,000	9,000
$6							$ 8	2	6,000	6,000
$7							$ 9	1	3,000	3,000
$8							$10	0	0	0

then summing these figures over all origins to get an estimate
of total use at that fee. (see Table 5). Ignored at present
are various sources of inaccuracy that might cause the indi-
vidual to behave differently than is assumed by this (simple)
travel-cost model. The most important sources of such inac-
curacies are differences in the availability of substitutes at
each origin, the different time required to reach the site
from each location, and nonhomogeneity of tastes and income in
the population. These problems will be dealt with in subse-
quent discussions.

Example 2. Application of the Model to a
Proposed Site With No Substitutes

We now turn our attention to applying the results of this
analysis to a new site. The basic purpose of the travel cost
method is to develop models for predicting the value (or use)
of a newly developed site or resource. For simplicity, we
will assume that the site is in a region where it has no sub-
stitutes. Subsequent examples will bring competing recreation
areas into the analysis.

To evaluate the aggregate demand for a proposed site, the
first stage demand curve derived from a similar site and
region is applied to the market area for the proposed site.
It appears most appropriate to apply a curve derived from
existing sites in the same market area in which the new site
is to be built. Under these circumstances we may reasonably
assume that the preferences of the market population served by
the new site will be similar to those of individuals who used
the sites from which the model was derived. That is to say,
tastes will develop a pattern similar to that existing around
the sites on which the trip demand curve was developed.

An important point is that it is the trip demand curve
(i.e., first-stage curve) estimated from another site (or

sites) that is applied to the new site, rather than the other site's aggregate demand curve. The second-stage site demand curve for the new site will depend upon the individual trip demand curve and on the *distribution of population* in the market area. Thus the aggregate site demand curves may differ between sites even though the individual's demand curves and the sites being evaluated are identical. This point was mentioned in Chapter 3 and is dealt with in more detail later in this chapter, since it has important implications for unit day values.

To illustrate the point, this example uses the individual's trip demand curve derived in Example 1 and applies it to the same total market population, but in a new market area consisting of two towns represented by Figure 5 and the data in Table 6 below. The resulting estimate of willingness to pay is quite different from the previous example and the difference is entirely due to the different spatial distribution of the population. The individual's trip demand is taken to be $v_{ij} = 10 - C_{ij}$. Table 6 shows the population of the two towns served by the proposed site and the expected trip costs to the site from each. That data is required for every origin of users and is the only additional information needed to apply the basic travel cost model to a proposed site. Table 7 below details the construction of the demand curve. A user charge of zero is assumed in this and all subsequent examples. If there had been a user charge, it would be added to the trip cost for each origin. The second stage demand curve would then provide an estimate of net willingness to pay. Actual user charges would be added to net willingness to pay to derive an estimate of gross benefits.

To derive the aggregate site demand curve (Figure 6) using the method described, total visits are plotted against hypothetical levels of a site user fee (from Table 7). The area under the demand curve is $18,000, which is estimated

willingness of users to pay. Note that this differs signifi-
cantly from the $114,000 estimated willingness to pay that was
obtained for Site I. Use is 14,000 visits.[5] The same indi-
vidual's trip demand curve was used for each site and both
sites served the same population. However, the distribution
of the population served by each site differed.

FIGURE 5. THE MARKET AREA FOR SITE II
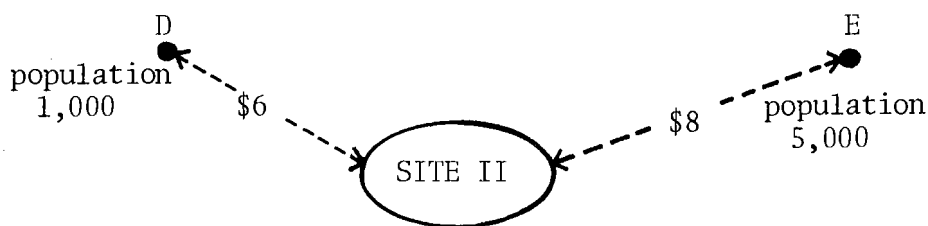
TABLE 6. DATA FOR APPLYING THE SIMPLE TRAVEL COST
MODEL TO A PROPOSED SITE

Origin	Population	Trip Cost
D	1,000	$6
E	5,000	$8

In sum, it is a relatively simple procedure to derive an
aggregate demand curve for a new site. An existing trip
demand curve is applied to the population of the new area.
With a more realistic model which reflects substitutes, travel
time, etc., additional calculation to find the values of these
would be required; but the procedure is essentially the same.
As indicated in the example, the aggregate demand curves will

[5]It may be that the planned capacity of the proposed site is
less than 14,000 visits. If this is the case, the estimated
average consumers' surplus per trip ($18,000/14,000 = $1.29)
should be multiplied by site capacity. This procedure is
valid as long as the rationing of entry reduces trips from all
origins by the same percentage. See Cicchetti, Fisher, and
Smith (1976) for an example.

be influenced by the spatial distribution of the population as well as the individual demand curve. This has some important implications for benefit evaluation. In particular, it makes it rather difficult to choose a unit day value for recreation with any degree of economic rationality. This matter will be discussed later. The following section discusses the evaluation of a proposed site which will compete with an identical substitute site.

TABLE 7. THE TRAVEL COST METHOD—EXAMPLE 2: APPLICATION OF THE MODEL TO A NEW SITE

User Fee	Origin D			Origin E			Total Visits
	Trip Cost	Visits per Capita	Visits	Trip Cost	Visits per Capita	Visits	
$0	$ 6	4	4,000	$ 8	2	10,000	14,000
$1	$ 7	3	3,000	$ 9	1	5,000	8,000
$2	$ 8	2	2,000	$10	0	0	2,000
$3	$ 9	1	1,000				1,000
$4	$10	0	0				0

FIGURE 6. THE SITE DEMAND CURVE (STAGE 2)

Thousands of Visits
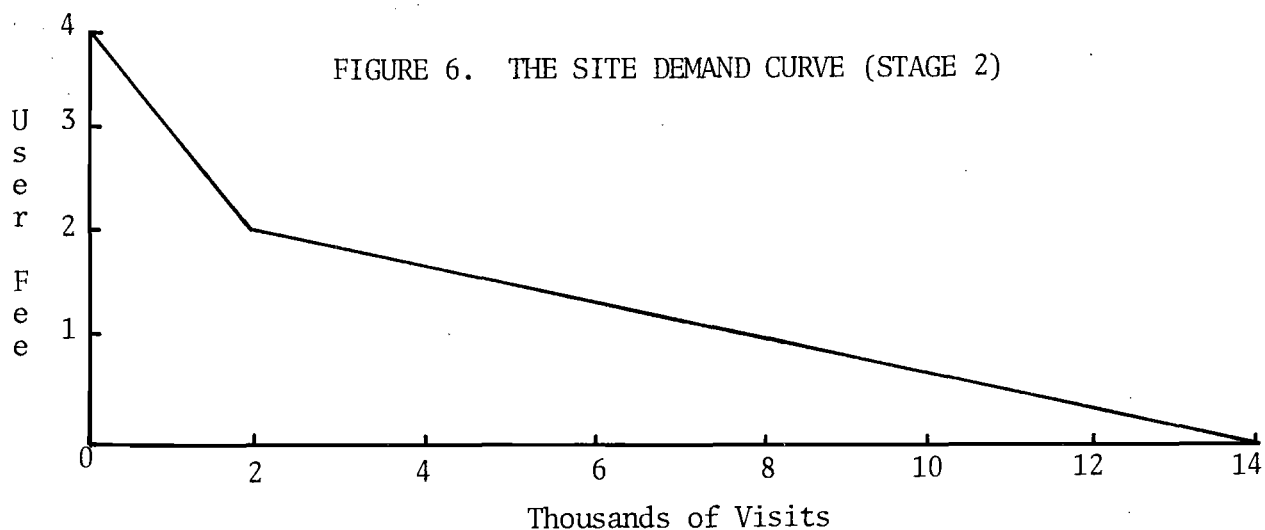
*Example 3. Application of the Model to a
Proposed Site in Competition with an
Identical Substitute Site*

In order to predict use of a new site successfully, it is
necessary to recognize that all sites compete for potential
users. In predicting site benefits, it must be realized that
the availability of a substitute sets some upper bound on an
individual's willingness to pay for a particular site. If the
fee at one site is raised high enough, we would expect that
users would shift to another site rather than pay this fee.
The importance of considering the effects of substitutes in-
creases as a wider choice of alternatives becomes available to
the market population.

We will now consider how Example 2 might have been altered
if the new site, Site II, were to be built in the vicinity of
an identical site, Site I. The trip demand function estimated
at Site I is $V_{ij} = 10 - C_{ij}$ and this is to be used to evaluate
the proposed site. The market area is drawn below (Figure 7),
and the relevant data are summarized in Table 8. The market
area around Site I will be changed for the purpose of this
example. The two additional towns, D and E are taken to be
within this market area, but it is assumed that the same trip
demand curve is valid. If we had included these towns in
Example 1, total benefits would have been $122,750 for Site I
without Site II being developed, and total use of Site I at
zero cost would have been 44,000. This continuation of the
introductory examples is, again, highly simplified in order
to point out basic concepts. The demand curve has no vari-
able to indicate the effect of a substitute site. That is
not so critical here because the simplifying assumption is
made that, because the sites are perfect substitutes, the
market will divide between the two sites on the basis of
travel cost. That is, an individual will choose to use the
site that can be reached at least cost. Subsequent examples
will introduce substitutes into the trip demand function.

FIGURE 7. THE MARKET AREA FOR SITES I AND II
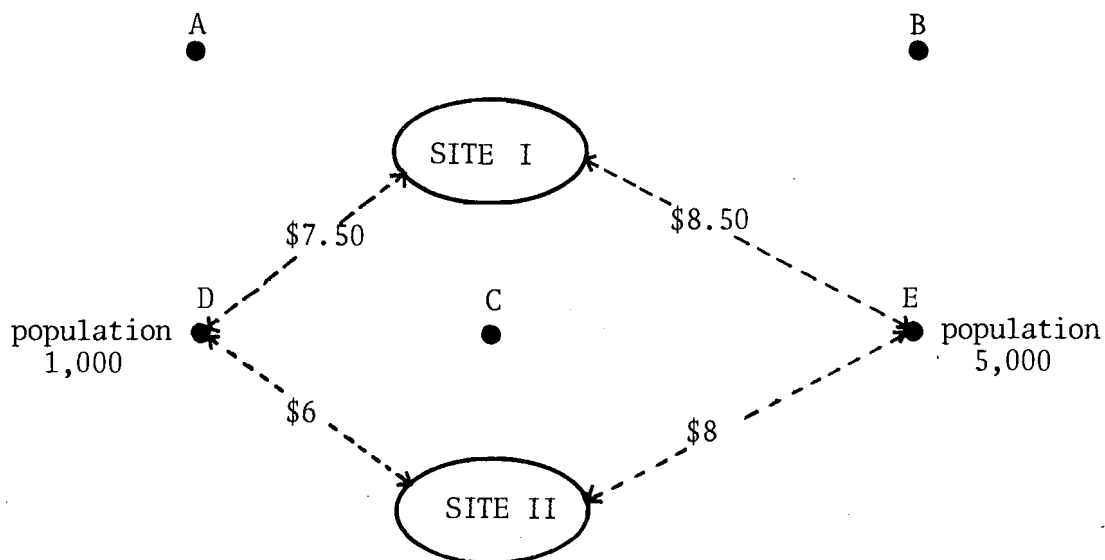
TABLE 8. THE TRAVEL COST METHOD—EXAMPLE 3:
APPLICATION OF THE MODEL TO A NEW SITE WITH A SUBSTITUTE

| User Fee | Origin D | | | Origin E | | | Visits |
	Trip Cost	Visits per Capita	Visits	Trip Cost	Visits per Capita	Visits	
$0	$6	4	4,000	$8	2	10,000	14,000
$0.50	$6.50	3.5	3,500	$8.50	1.5	7,500	11,000
$1.00	$7	3	3,000	$9.00[†]	0		3,000
$1.50	$7.50	2.5	2,500				2,500
$2.00[*]			0			0	0

*Once the trip cost exceeds $7.50, residents of origin D will switch to Site I.

†Once the trip cost exceeds $8.50, residents of origin E will switch to Site I.

Residents of towns D and E presently face travel costs of $7.50 and $8.50 to Site I (Figure 7) and the trip demand curve $v_{ij} = 10 - C_{ij}$ indicates that they make an average of 2½ and

1½ trips respectively to that site. They will begin using
Site II when it is developed.

Table 8 details the construction of the Site II demand
curve. A zero charge is assumed. The aggregate demand curve
is derived by the usual method, although it should be noted
that demand from an origin drops rapidly to zero once the fee
for the site is raised sufficiently high so that the substi-
tute can be used at less cost. That is to say, when the sub-
stitute can be consumed at a lower total cost (entry fee plus
travel cost) than the site being evaluated, users will go to
the substitute site.

The site demand curve in Figure 8 should be compared to
Figure 6 which shows the site demand curve derived for Site II
without considering substitutes. The area under the present
site demand curve (Figure 8) indicates that willingness to pay
is reduced to $9,250 compared to the $18,000 derived (Figure 6)
when substitutes were ignored. Predicted use at a zero fee is
still 14,000, but estimated use at higher fees is reduced be-
cause users would switch to the substitute site (Site I)
rather than pay the higher fees at Site II. Clearly, the
presence of even more readily accessible substitutes could
steeply reduce both the use and benefits of a new site.

The new facility would have two effects on consumers' bene-
fits. First, there would be the cost savings on shifted
demand in the form of the trips which were being made from
town D and E to Site I, but would now be made to Site II at a
lower cost. This savings is a benefit because these consumers
use fewer resources in traveling for recreation, and the saved
resources may now be used elsewhere. The second source of
benefits would be from induced demand. The closeness of the
new site and the reduced travel cost will result in extra
recreation trips by residents of D and E. They gain consumers'
surplus from these new trips. The difference between the

present example and previous example (Example 2) arises from
the presence of the substitute site.

FIGURE 8.   THE SITE DEMAND CURVE (STAGE 2)

Thousands of Visits
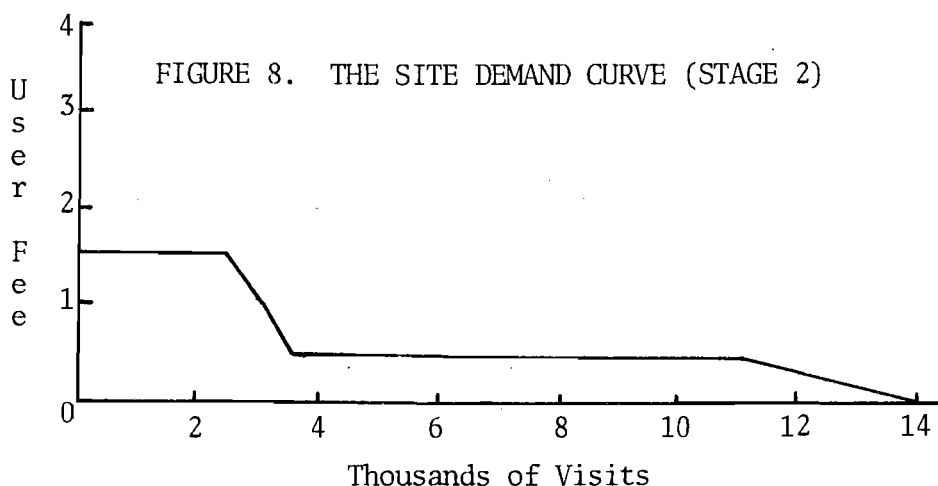
The apparent loss in benefits attributable to reduced use
of Site I should not be of concern.[6]   Any benefits attribut-
able to reduced congestion at Site I should be considered.
These benefits, which have yet to be measured successfully,
are appropriately attributed to the new site.

We have neglected the value of the present use of the site
that is to be developed.   Any loss of benefits to present
users of the site should be subtracted as an opportunity cost
of development.

In summary, it should be clear that substitutes influence
use and benefit prediction.   They influence the shape of the
demand curve for each specific site, and their influence on
benefits may be very significant.   A simple procedure, such as
that described in this example may provide a useful first

[6]For a discussion of this point, see Knetsch (1977).

approximation to the results of more complex models and would
be greatly preferable to ignoring substitutes.

SUMMARY OF INTRODUCTORY EXAMPLES

The preceding three examples introduced the travel cost
method in its simplest form. The first stage, or trip demand
curve, and the second stage, or aggregate site demand curve,
are derived for an existing site. It was shown to be a simple
procedure to derive an aggregate demand curve for a proposed
site using a trip demand curve estimated at an existing site.

Consumers' surplus is presented as an appropriate measure
of net benefits. Procedures for deriving consumers' surplus
from the site demand curve are demonstrated for the case of
zero entry fee. More generally, consumers' surplus is the area
under the site demand curve above the actual fee level (if any).
Gross benefits or willingness to pay may be found by adding
the consumers' surplus to the expected fee receipts (if any).

The examples illustrate three important points concerning
benefit estimation: (1) the significance of the location of
the user population with respect to the proposed site; (2) the
importance of substitute sites; and (3) the complexities in
choosing a unit day value. We will now examine these points
in more detail.

The Location of Users

Examples 1 and 2 illustrate the importance of the location
of the user population relative to the recreational facility.
Given the trip demand curve, it can be noted that a new site
will be more valuable the closer it is located to its users.
This is the result of greater total use due to lower travel
expense, and also to the greater net benefits to individuals

who can make visits at less travel expense than they would be willing to pay.

Substitute Sites

Substitutes were introduced in Example 3. The conclusion is that it is misleading to consider one site in isolation from others. To do so can lead to a significant overestimate of use and benefits.

Unit Day Values

Average willingness to pay per day has been presented as the most appropriate basis for unit day values. Examples 1, 2, and 3 point out the complexities of choosing a unit day value. Assuming trips of one day, average consumers' surplus per day (unit day value) is calculated by dividing total consumers' surplus by the number of trips. The three examples all deal with an identical site and it is assumed that all users have the same tastes and preferences (i.e., the same trip demand curve). However, unit day values for the three examples are as follows: Example 1 = $3.35, Example 2 = $1.29, and Example 3 = $0.66.[7] Example 2 has a lower unit day value than Example 1 solely because of the spatial location of the population relative to the site. The average user of Site II must travel a greater distance than the users of Site I and consequently incurs greater travel expenses. As a result, his net benefits (willingness to pay in excess of present costs) are reduced. The site in Example 3 is identical to and has the same spatial distribution of population relative to the site in Example 2; however, the introduction of an alternative

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[7]For Example 1, $\frac{\$114,000}{34,000} = \$3.35$; Example 2, $\frac{\$18,000}{14,000} = \$1.29$;

Example 3, $\frac{\$\ 9,250}{14,000} = \$0.66$.

site reduces the unit day value considerably. Thus, it is
clear that it is difficult to select an appropriate unit day
value without analyzing demand. Average consumers' surplus is
not easily predicted, even for very similar projects.[8]

SUBSEQUENT EXAMPLES

The examples that follow detail some actual (regional)
travel cost models. They illustrate more general approaches
to substitute sites (which are not necessarily perfect sub-
stitutes) and also present methods to account for the effect
of travel time. There is a severe bias in the estimation of
site demand curves if time, alternatives, and other signifi-
cant variables are omitted from the specification of the
travel cost model. Following the examples there is a general
discussion of the potential errors which may arise from ex-
cluding such variables. The section begins with an outline of
the data requirements and calculations necessary for the
development and use of regional travel cost models.

REGIONAL TRAVEL COST ESTIMATORS

At various points in this report it has been suggested that
regional estimators which focus on a system of sites are
highly desirable. It is essential to study a system of recre-
ation sites in order to estimate the interaction between sites
in influencing the behavior of participants, and to have suf-
ficient data to estimate the effect of relevant variables such
as availability of substitutes, and variations in tastes.

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[8]Burt and Brewer (1974) make much the same point. They state
(p. 1) that "not only do the unit values lack an empirical
basis, being largely subjective estimates, ...but the deter-
mination of (total) value must logically precede calculation
of a unit day value." Their chart (Figure 9) provides a use-
ful indication of how per capita benefits may vary with dis-
tance from a site or substitute sites.

Examination of too small a region or too few sites will prevent the inclusion of necessary variables.

At present, there are two broad classes of regional travel cost models. First, there is the model based on a linear system of interrelated demand equations, illustrated by the Burt and Brewer (1971, 1974) studies and also used by Moncur (1975), and Cicchetti, Fisher, and Smith (1976). Secondly, there are the single equation models based on a gravity model approach to demand. These latter models are illustrated by the model developed by U.S. Army Corps of Engineers (Knetsch, Brown, and Hansen [1976]), and by the model developed by Cesario and Knetsch (1976).

The development and use of both classes of regional models share certain common needs in data collection and analysis. These general procedures are outlined below.

Model Construction

1) Demand Survey: A survey of recreation behavior over a wide geographic region is required. This may be either an on-site or household survey depending on the needs of the particular model. The survey should be directed at finding for each trip: (a) length and purpose of visits to any site under consideration, (b) travel time, (c) expenditures specific to the trip (excluding auto cost which is to be calculated separately), (d) mileage traveled, or origin of user in order that mileage may be calculated, (e) income, (f) other demographic variables that are expected to influence demand (in particular, family structure and past experience with the site).

2) Classification of Sites: All models require that some distinction be made among sites on the basis of the quality of the facilities and the expressed tastes of users. The single equation methods require the computation of an index of

attractiveness which may be based on a measure of the available facilities and possibly an estimate of user preferences based on the initial demand survey. For multiple equation methods, it is necessary to classify all sites (including the proposed site being evaluated) into a limited number of categories based on similarity of facilities and quality of the opportunities provided.

3) *Subarea of Observation:* Subareas of origin, such as distance zones, counties, towns, or, possibly, individual households, must be defined. These subareas should be chosen such that demographic information on average income and population is available and the data handling is manageable. The areas should also be uniform enough and small enough so that it is reasonable to attribute the travel cost and average demographics from the subarea to all users within the area. It is also necessary that sufficient observations be retained for estimation of the model; too much aggregation will result in loss of information.

4) *Travel Cost:* It is necessary to have, or to calculate, the road mileage traveled by users. In practice, a single point in a fairly aggregated subarea (such as the center of a town or county) is used to represent all users in the subarea. Distance traveled is converted into travel cost by using available data on the cost per mile of travel. The travel cost should be on a per person round trip basis. That is, if two people travel in one car, each is considered to have made one round trip at one half the total round trip travel cost.

5) *Time:* Round trip travel time for each user origin may be available from the demand survey, or may be derived from mileage traveled and average road speed. The time spent at the site (i.e., length of the visit) should be available from the demand survey.

6) Substitutes: The effect of substitutes depends on the
travel costs from the subarea of origin to the substitute site,
and also on the relative attractiveness of each site. Various
indices and methods of dealing with substitutes reflecting
travel costs and effectiveness are described in the subsequent
examples.

7) Demographics: Population, income and other relevant
demographic variables may be derived from census data or the
demand survey.

8) Demand Estimation: The econometric procedures will depend
on the chosen model (i.e., single equation or multiple equa-
tion, linear or non-linear).

Evaluation of a Proposed Site

Regional travel cost models can be used to evaluate the
demand for, and the benefits of, a new site which is to be
developed within the region in which the model was developed.
Once the model has been developed, little additional informa-
tion is required and no further demand estimation is needed.
The basic procedures are outlined below.

1) Classification of the New Site: For the multiple equa-
tion models, the new site must be assigned to one of the
categories specified in the model. For the single equation
models, the expected index of attractiveness of the new site
must be computed, based on the facilities that will be
available.

2) Delineate the Market Area of the New Site: While the
initial model might have been estimated over a large region,
the planner can now focus on the zone around the new site, in
which demand is likely to be positive. Within this region an

all-inclusive set of subareas of origin, such as distance
zones, are defined as before.

3) Travel Costs: Distances from the areas of origin to the
new site can be estimated using road maps. As noted pre-
viously, this should be converted into average per capita
round trip travel cost.

4) Time: Estimates of round-trip travel time from each sub-
area of origin to the new site should be made.

5) Substitutes: No further information is required. The
existing sites on which the demand estimation was based will
be the substitutes facing potential users of the new site.
The procedure by which the model reflects substitutes will
depend on the demand specification and is illustrated in sub-
sequent examples.

6) Benefit Estimation: The procedure for evaluating the
benefit of a new site is analogous to that described in the
introductory examples (Examples 1, 2, and 3). A site demand
curve is derived and benefits are calculated from the area
under this curve. The site demand curve is derived from the
travel cost model in the following way. The travel cost model
will give an estimate of demand for a site from each area of
observation at a given level of travel cost, given the appro-
priate values for the other variables in the model. This de-
mand is then summed over all areas of observation to get the
total site demand at the given cost. By starting with the
actual travel cost for each origin and successively raising
this cost by equal amounts everywhere (while holding travel
time and other variables fixed) the site demand curve may be
derived.

EXAMPLES OF REGIONAL TRAVEL COST ESTIMATORS:
I. BURT AND BREWER (1974): A LINEAR SYSTEM
OF PER CAPITA DEMAND EQUATIONS

This study was aimed at evaluating the recreation benefits
of a proposed reservoir project, the Pattonsburg Reservoir, to
be developed in Missouri, 60 to 70 miles northeast of Kansas
City. Five Corps of Engineers impoundments are located within
125 miles of the proposed reservoir. In addition, four other
reservoirs were under construction at the time of the study,
and others had been proposed. Thus, the availability of sub-
stitutes appeared to be an important factor in determining the
value of the proposed reservoir. Two separate analyses of the
value of the proposed reservoir were performed, one assuming
that the nearest site under construction (Smithsville
Reservoir) was completed, and the other assuming this site did
not exist. The study was performed in 1973 and was designed
to reflect, in a simple manner, the substitution effects of
new sites.

The system of five interrelated demand equations of the
form indicated below was estimated. Each equation is linear
in travel costs and income, and explains per capita demand for
trips to a particular type of site. Per capita participation
from origin i to site j is taken to depend on the cost of
reaching the nearest site of each type, as well as on the in-
come of individuals at origin i.

Equations:

$$q_{i1} = a_1 + \sum_{k=1}^{5} B_{1k} \; P_{ik} \; c_1 Y_i$$

$$q_{i2} = a_2 + \sum_{k=1}^{5} B_{2k} \; P_{ik} + c_2 Y_i$$

$$\cdot \qquad \cdot \quad \cdot$$
$$\cdot \qquad \cdot \quad \cdot$$
$$\cdot \qquad \cdot \quad \cdot$$

$$q_{i5} = a_5 + \sum_{k=1}^{5} B_{5k} \; P_{ik} + c_5 Y_i$$

Subscripts:

q_{ik}: visits by individual i to the nearest site type k.

P_{ik}: trip cost to individual i, to reach nearest site of type k.

Y_i : family income of individual i.

a_j, B_{jk}, c_j: coefficients to be estimated subject to the constraint $B_{jk} = B_{kj}$.

Variables and parameters:
i = 1, 2, ..., n sample observations
j, k = 1, ..., 5 types of sites

Procedure

1) Demand Survey: The sample was derived from direct interviews of over 2,000 Missouri households in the autumn of 1966. The purpose of the survey was to identify actual outdoor recreation behavior during 1966. The respondents were initially contacted to solicit their cooperation in keeping records of the necessary information. Usable information was collected from 2,031 households. The information used in constructing the model was: (a) the number of days spent at specific sites, including travel time; (b) expenditures specific to the trip, excluding auto cost; (c) mileage driven on each trip; and (d) family income. Other socio-economic variables were gathered, but found of little use.

2) Classification of Sites: The sites attended by those responding to the demand survey were classified into 5 types

or categories on the basis of facilities and quality. These were (a) Lake of the Ozarks, considered unique; (b) Table Rock and adjoining lakes on the Arkansas border, also viewed as unusual in quality; (c) other large lakes constructed by the U. S. Army Crops of Engineers; (d) other lakes greater than 200 acres; and (e) rivers of the Ozark Mountain area. It is assumed that the sites within a class are perfect substitutes for each other. The proposed project, Pattonsburg Reservoir, would be in the third (c) category. Data were intially gathered on other categories; but these were subsequently discarded as not significantly related to the five primary classes.

3) Subarea of Observation: Individual households were the unit of observation for demand estimation. Travel costs, however, were not calculated for each individual but based on an average over geographical clusters of individuals. It should be noted that while the household sample was from within Missouri alone, some sites in adjacent states were considered as the destinations of these individuals. These sites were classified into one of the five classes or categories.

4) Travel Cost: A computer program was developed to convert distances into travel costs. Distances traveled were available from the demand survey. Per capita round trip costs were computed.

5) Time: Burt and Brewer do not make a correction for travel time.

6) Substitutes: Within each category the sites are considered as being perfect substitutes. Sites in different categories are viewed as different commodities. Separate demand equations are derived for each category. Each demand equation includes, as variables, the trip cost to the nearest site of each type and thus reflects the location of substitute sites.

The five equations are jointly estimated in order to further reflect the interrelation between demand for each type of site.

7) Demographics: Demographic information was obtained from the demand survey.

8) Demand Estimation: The actual demand equations estimated are given below:

$$q_{i1} = .5366 - .0355\,P_{i1} + .0130\,P_{i2} - .0222\,P_{i3} - .0097\,P_{i4} + .0251\,P_{i5} + .0181\,Y_i$$

$$q_{i2} = .7218 + .0130\,P_{i1} - .0388\,P_{i2} + .0301\,P_{i3} + .0108\,P_{i4} - .0120\,P_{i5} + .0780\,Y_i$$

$$q_{i3} = .3193 - .0222\,P_{i1} + .0301\,P_{i2} - .0775\,P_{i3} + .0170\,P_{i4} + .0210\,P_{i5} + .0104\,Y_i$$

$$q_{i4} = .9742 - .0097\,P_{i1} + .0108\,P_{i2} + .0170\,P_{i3} - .0368\,P_{i4} + .0062\,P_{i5} + .1024\,Y_i$$

$$q_{i5} = .4677 + .0251\,P_{i1} - .0120\,P_{i2} + .0210\,P_{i3} + .0062\,P_{i4} - .0291\,P_{i5} + .0369\,Y_i$$

Classification of sites:
1 = other lakes greater than 200 acres
2 = Lake of the Ozarks
3 = other large Corps of Engineers lakes
4 = Table Rock and adjoining lakes
5 = rivers of the Ozark Mountain Area

The five separate equations are estimated using a generalized least squares procedure which takes into account some of the interrelations between the separate equations. Details of the procedure may be found in Burt and Brewer (1971) and the estimation of a similar set of equations is detailed in Cicchetti, Fisher, and Smith (1976).

Evaluation of the Proposed Site

1) Classification of the New Site: The proposed site is in the third (c) category, large Corps of Engineers lakes.

2) Delineation of the Market Area of the New Site: The region of influence surrounding the site of the proposed Pattonsburg Reservoir was defined as the locus of all points which are as close to the proposed reservoir as to an existing reservoir belonging to the same category. This region was then divided into population subareas. Each city of over 5,000 population and each county (excluding those cities) was treated as a subarea.

3) Travel Cost: Measurements of distance are calculated from the center of each subarea to the closest site in each category. Direct distances are converted in road distances based on an average factor. Road distances are then converted into travel cost. This is converted to average per capita travel cost per round trip. Two sets of data are eventually required, one as if the new site did not exist, and one as if it did exist. Only distances to the third category (c) of sites will be altered by the construction of the Pattonsburg Reservoir. Burt and Brewer calculated these figures, both under the assumption that the reservoir presently under construction, Smithville Reservoir, existed, and that it did not exist.

4) Time: Time was not incorporated into the model.

5) Substitutes: The demand equations include, as variables, the cost of reaching the nearest site in each category. The changes in the travel costs which result from the construction of new sites reflect the changed availability of substitutes. No calculation of indices of substitutes is necessary.

6) Demographics: Updated population figures were found from the 1970 census. Incomes were updated based on the 1970 census and inflated by the consumer price index to 1973 levels.

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7) *Benefit Estimation*: The method Burt and Brewer use to evaluate benefits is equivalent to the procedure described earlier in this chapter. That is, once they have identified the market area that is predicted to use the new site, a second-stage site demand curve could have been calculated in the usual way and the area under this curve calculated to determine benefits. Rather than calculate this second-stage curve, they have instead worked directly with the first-stage curves. They evaluate the consumers' surplus of the average individual at each origin using the individual trip demand curves, then sum these benefits over all individuals. The procedure is explained in Burt and Brewer (1971) and Cicchetti, Fisher, and Smith (1976). The result is that with the assumption that Smithville Reservoir is built, the estimated annual benefits from recreation at Pattonsburg Reservoir are $730,000. Without Smithville, the estimated benefits are raised to $1,200,000. Thus, the substantial impact of future construction (substitutes) on the stream of annual benefits is indicated.

The Burt and Brewer (1971) study uses the same set of estimated demand equations to evaluate planned reservoirs elsewhere in the state of Missouri. The procedure is easily applied once the system of demand equations is estimated.

II. CESARIO AND KNETSCH (1976): A SINGLE EQUATION MODEL

This study develops a comprehensive use and benefit evaluation model for a system of existing sites as well as any new sites within the region. The model reflects the availability of substitutes and includes a correction for time costs. The model was applied to several existing state parks in northeastern Pennsylvania. It was not directed towards evaluating the benefits of a new site, although it can be used for that purpose.

Equation

The equation estimated was of the form below. It is non-linear in the coefficients. It explains total visits (by parties rather than individuals) from an origin, rather than per capita visits as was the case with the model developed by Burt and Brewer. Each site is assumed to satisfy the same trip demand function, differing only in terms of the variables reflecting quality and accessibility relative to substitute sites.

Equation:

$$V_{ij} = b_o P_i^{b_1} A_j^{b_2} \exp{(b_3 C_{ij})} \left[\sum_{k=1}^{M} A_k^{b_2} \exp{(b_3 C_{ik})} \right]^{b_4}$$

Variables and parameters:

j, k: 1, 2, ..., M recreation sites

V_{ij} : the number of visits per unit of time made to site j from population center i

P_i : population of center i

A_j : the attractiveness of park j, a measure of the combined effects on recreation trip-making of certain characteristics of recreation site j (e.g., acreage, parking space)

C_{ij} : the generalized cost of travel time from i to j (reflecting travel time and trip expenses)

b_o, ..., b_4: parameters to be estimated (plausible signs $b_3 < 0$; $-1 < b_4 < 0$; b_1, $b_2 > 0$)

exp : the exponential function, i.e. $\exp{(x)} = e^x$.

While the model appears complex, its application is quite simple once the model is estimated. However, it is uncertain whether the gains of using such a complex model outweigh the costs arising from technical difficulties with estimation. It would seem that less complex one-equation models similar to those used by the Corps of Engineers (Knetsch, Brown, and Hansen [1976]) are better starting points for agency model development.

Procedure

The procedure necessary for estimating and applying the demand equation is illustrated below.

1) Demand Survey: The data on visits were collected from onsite surveys at 84 state parks in an area including most of Pennsylvania, and parts of New York and New Jersey. The survey was designed to gather information on: (a) the origin of the visitor; (b) motive of the trip (i.e. activities, main destination of trip); (c) number of members of the party; and (d) family income. It was taken over seven days during July and August 1967. Usable responses were collected from 31,000 individuals. These data were then extrapolated to estimate a full season of visits based on historical patterns of seasonal use. The analysis considers only those visits which were day-use visits with a specific park as the main destination.

2) Classification of Sites: A park attractiveness index, A_j, was formed. This variable was intended to reflect the activities available, the quality of the facilities available for each activity, and the satisfaction that users receive from each type of facility.

The attractiveness index for each site, A_j, was of the form:

$$A_j = \sum_k u_k q_k a_k$$

Where:

u_k = relative utility of having activity k available, as indicated by popularity weights obtained from data on participation in activities in response to the demand survey.

q_k = quality of the facilities available for activity k, as subjectively rated by a team of researchers, with q_k on a range of 1 to 10.

$a_k = \begin{cases} 0 \text{ if activity k is not offered} \\ 1 \text{ if activity k is offered} \end{cases}$

The attractiveness index is the sum over all activities considered.[9]

3) *Subareas of Observation*: The units of observation for trip origins were counties. The destinations were state parks. Total visits from 23 contiguous counties to each of 38 recreation sites provided 874 observations (V_{ij}) for estimation.

4) *Travel Cost*: Road distance over the most likely route between the centroid of each county i to the entrance of a park j, is calculated. This is multiplied by a constant travel cost of $0.06 per mile. Presumably this is intended to reflect total round trip monetary costs.

5) *Time*: The generalized cost, C_{ij}, reflects an assumed tradeoff between time and money costs. Two methods of calculating this variable were used:

Method I $\quad C_{ij} = (\$0.06 \ D_{ij}) \ (\gamma_i T_{ij})$

Method II $\quad C_{ij} = \$0.06 \ D_{ij} + \gamma_i T_{ij}$

Where:

$\$0.035 \le \gamma_i \le \$0.046$ = a fraction of the county wage rate[10]

D_{ij} = the road distance from origin i to site j

T_{ij} = travel time in minutes from origin i to site j (based on average travel speed over various road types)

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[9]Other studies have found that total acreage of water is a reasonably good index of attractiveness for reservoir recreation (Knetsch, Brown, and Hansen [1976]), and acres of maintained turf is a reasonably good indicator of the attractiveness of urban parks (Corps of Engineers, 1976).

[10]For adults one quarter to one half the wage rate, and for children, 25 percent of the level chosen for adults.

The number of trips taken will decrease with distance from the site due to both the higher monetary cost of travel and the greater time required to make a visit. To derive an accurate site demand curve it is necessary to separate out these two effects and to estimate the effect on demand of increases in monetary costs alone. If a reasonable approximation of the tradeoff between time and money costs can be specified, then it is possible to develop the site demand curve. Once the model is estimated, all that is necessary is to evaluate the second stage site demand curve in the usual way. That is, demand at each origin is evaluated at various increments in monetary costs; all other variables, including time, are kept at their actual level. While there is no solid justification for the tradeoffs chosen here, in the absence of evidence to the contrary, the linear tradeoff seems most acceptable on the basis of existing empirical work. The linear tradeoff results in lower estimates of benefits than the curvilinear tradeoff.

6) Substitutes: The role of substitutes is reflected through the term $\left(\sum_{k=1}^{M} A_k^{b_2} \exp{(b_3 C_{ik})} \right)^{b_4}$ which includes both the attractiveness index and the location of (trip cost to) each site. An increase in attractiveness or accessibility of competing sites would be expected to reduce visits to a particular site.

7) Demand Estimation: Parameters of the model were estimated by a non-linear least squares method. The results for the linear time-money tradeoff are,

$$V_{ij} = \exp{(-11.078)} P_i^{1.123} A_j^{3.271} \exp{(-0.071\ C_{ij})}$$

$$\left(\sum_{k=1}^{38} A_k^{3.271} \exp{(-0.071\ C_{ik})} \right)^{-0.591}$$

with $C_{ij} = \$0.06\ D_{ij} + \gamma_i T_{ij}$, $\$0.035 \leq \gamma_i \leq \$0.046$

and for the multiplicative tradeoff,

$$V_{ij} = \exp(-10.932)P_i^{1.012} A_j^{3.431} \exp(-0.944\ C_{ij})$$

$$\left[\sum_{k=1}^{38} A_k^{3.431} \exp(-0.944)\ C_{ik}\right]^{-0.575}$$

$$\text{with } C_{ij} = (\$0.06\ D_{ij})\ (\gamma_i T_{ij})$$

Evaluation of a Proposed Site

1) *Classification of the New Site*: Based on the planned facilities at the proposed site and an updated survey of user preferences, the index of attractiveness, A_j, is computed.

2) *Delineation of the Market Area*: Initially the full study area may be considered the potential market area of a new site unless it is clear that demand from some areas will be negligibly small. The population subareas delineated for estimation purposes that are within the market area would be used to evaluate use of the proposed site.

3) *Travel Cost*: Measurements of distance from each population center in the market area to the new site should be converted into the average per capita round trip cost.

4) *Time*: The travel time from each origin to the proposed site should be estimated.

5) *Substitutes*: Given the information on travel cost, travel time, the attractiveness index, and the estimated demand curve, the presence of a new site is easily reflected. The term reflecting competing opportunities is adjusted to reflect the new site, the M + 1th, by adding

$A_{M+1}^{b_2} \exp(b_3 C_{i,\ M+1})$ to the present index of competing

opportunities, thus changing the term $\left[\sum_{k=1}^{M} A_k^{b_2} \exp(b_3 C_{ik})\right]^{b_4}$,

to $\left[\sum_{j=1}^{M+1} A_j^{b_2} \exp(b_3 C_{ij})\right]^{b_4}$. No new estimation of parameters

is required.

With plausible values of the estimated parameters, a new
site will result in increased total trips in the market area
while reducing trips to each of the presently existing sites.

6) Benefit Estimation: The method of benefit evaluation in
the one-equation models is similar to the second stage site
demand curve method of the simple travel cost procedure.
First, note that the aggregate visits to one particular site j
can be found by summing V_{ij} over all origins, i = 1, 2, ..., n,
for a given j.

$$V_j = \sum_{i=1}^{n} V_{ij}$$

By postulating various increments in the monetary cost (D_{ij})
to each individual using site j, an aggregate site demand
curve is found. The area under this curve is taken to be the
measure of site benefits. Only the monetary component,
\$0.06 D_{ij}, of the generalized trip cost, is incremented; time
and other variables are held constant at the actual level.

A new site (the (M + 1)th) is evaluated similarly by de-
riving the aggregate visit curve, based on hypothesized values
for $D_{i, M + 1}$, $T_{i, M + 1}$, and $A_{M + 1}$. That is, for various
increments to monetary cost, total visits to site M + 1 are

evaluated by the following equation:

$$V_{M+1} = \sum_{i=1}^{n} V_{i,M+1} = \sum_{i=1}^{n} \left[b_o P_i^{b_1} A_{M+1}^{b_2} \exp(b_3 C_{i,M+1}) \left(\sum_{k=1}^{M+1} A_k^{b_2} \exp(b_3 C_{ik}) \right)^{b_4} \right]$$

Benefits are approximated by the area under this curve.

The Cesario and Knetsch (1976) study did not evaluate a specific proposed site. They do present estimates of visitation at existing sites generated by their model, and compare these to actual attendance. They also present estimates of benefits derived from existing sites.

THE CHOICE OF TRAVEL COST MODELS—SPECIFICATION ERRORS

In choosing whether to use the simple travel cost model (Examples 1, 2, and 3) or the regional travel cost models, it is necessary to consider the errors that arise from misspecification of equations. In particular, it is necessary to judge the seriousness of the errors in use and benefit prediction that will arise from the omission of significant variables from consideration. Our conclusion is that the omission of any consideration of time is a source of error which should be corrected for, even if the regional models are not used. Failure to do so will tend to result in underestimation of benefits of proposed or existing sites. The explicit consideration of substitute sites is also preferable. The errors that arise from failure to consider the competition of other sites will be most severe when many substitutes exist. Failure to consider such competition from substitutes in situations where many substitutes exist will lead to overestimation of the use and benefits of proposed sites. In order to consider substitutes sites, it is necessary to use the regional travel

cost models or a relatively crude method such as that described in the earlier Example 3. An indication of the nature of specification errors is illustrated in the following two examples.

Time

Estimating an equation with relevant variables omitted can result in bias in the estimates of the coefficients of the remaining variables (Johnston 1972, pp. 168-169). The extent of the bias depends on the significance of the omitted variable and on the correlation between the omitted and retained variable. The stronger the correlation, the greater the bias. If monetary travel costs and travel time are positively correlated (i.e., those with high travel costs have high travel time), the slope of the trip demand curve may be expected to be underestimated (i.e., the true curve is more negatively sloped) when travel time is omitted.

It can be reasonably argued that travel time is a significant variable, negatively influencing recreation demand. Time, as well as money, may be a constraint on recreation activity, since a significant amount of time may have to be spent traveling to the site. Also the correlation between monetary travel costs and travel time is observed to be high and positive. People from more distant zones must in general spend more time *and* more money getting to a site, than people who live closer. As a result, it should be expected that when time is ignored, the travel cost method would estimate too flat a trip demand curve.

Unfortunately, the correlation of travel cost and travel time is likely to be so nearly perfect that it is not possible

to estimate the separate effects of the two variables.[11] As a result, it has become a common procedure to assume a known tradeoff between time and money. No generally accepted formulation of this tradeoff has yet been established in empirical work. The linear tradeoff is most widely used and seems to be most supportable. An example of the use of this method is presented below. The example extends the simple travel cost method of Example 1 and uses the same data, with the addition of travel times.

EXAMPLE 4: THE SIMPLE TRAVEL COST MODEL— CORRECTED FOR TRAVEL TIME

Some hypothetical data are presented below (Table 9) reproducing the data of Example 1, with the addition of a column presenting travel times from each origin to Site I.

TABLE 9. DATA FOR THE SIMPLE TRAVEL COST METHOD INCLUDING TRAVEL TIME

Origin	Population	Number of Visits	Visits per Capita	Trip Cost	Travel Time
A	1,000	2,000	2	$8	3.2 hrs
B	2,000	8,000	4	$6	2.4 hrs
C	3,000	24,000	8	$2	.8 hrs

As before, we assume that all users come from one of three towns. The site entry fee is taken to be zero. In order to derive the trip demand curve (the first-stage demand curve) it is necessary to assume a time—money tradeoff. Here, it is

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[11]That is, the problem of multicollinearity exists (Johnston 1972). Some researchers have suggested that if individual data were used for estimation (rather than the more common procedure which uses aggregated zones such as counties), then the problem might be reduced. If possible this would be the most satisfactory approach. See Brown and Nawas (1973), Gum and Martin (1975), and Sublette and Martin (1975).

assumed the tradeoff is linear. We assume the generalized
trip cost from origin i to Site I, K_{iI}, is as given below,

$$K_{iI} = C_{iI} + .4T_{iI},$$

with .4 representing some fraction (about 1/4 to 1/3 is reason-
able) of the wage rate of users.

Stage 1—Trip Demand

A trip demand equation consistent with the above data can
be expressed by the equation:

$$v_{ij} = 10 - .862 \, K_{ij},$$

or upon substituting the assumed form of the generalized trip
cost this is expressed as:

$$v_{ij} = 10 - .862 \, C_{ij} - .344 \, T_{ij}$$

Where:

j = I, i = A, B, C

v_{ij} = visits per capita from origin i to site j

C_{ij} = the travel cost of traveling from its origin i to site j.

T_{ij} = the travel time in hours of traveling from origin i to site j

The appropriateness of this demand function is most easily
seen by substituting in the data from Table 9, to check for
consistency. If trip demand curves are drawn relating visits
to travel cost, then each origin will have a distinct demand
curve. That is, the travel variable is evaluated at its actual
level for each origin and the following three trip demand
curves (Table 10) are found. The demand curves for each
origin are drawn in Figure 9. The dashed line in Figure 9
is the erroneously estimated demand curve from Example 1,
$v_{ij} = 10 - C_{ij}$, which is produced when the effect of travel
time is ignored.

TABLE 10.   TRIP DEMAND EQUATIONS—TRIPS PER CAPITA
VS. TRAVEL COST

Origin	Equation
A	$v_{ij} = 10 - .344 \ (3.2) - .862 \ C_{ij} = 8.9 - .862 \ C_{ij}$
B	$v_{ij} = 10 - .344 \ (2.4) - .862 \ C_{ij} = 9.17 - .862 \ C_{ij}$
C	$v_{ij} = 10 - .344 \ (.8) - .862 \ C_{ij} = 9.72 - .862 \ C_{ij}$

FIGURE 9.   THE TRIP DEMAND CURVE
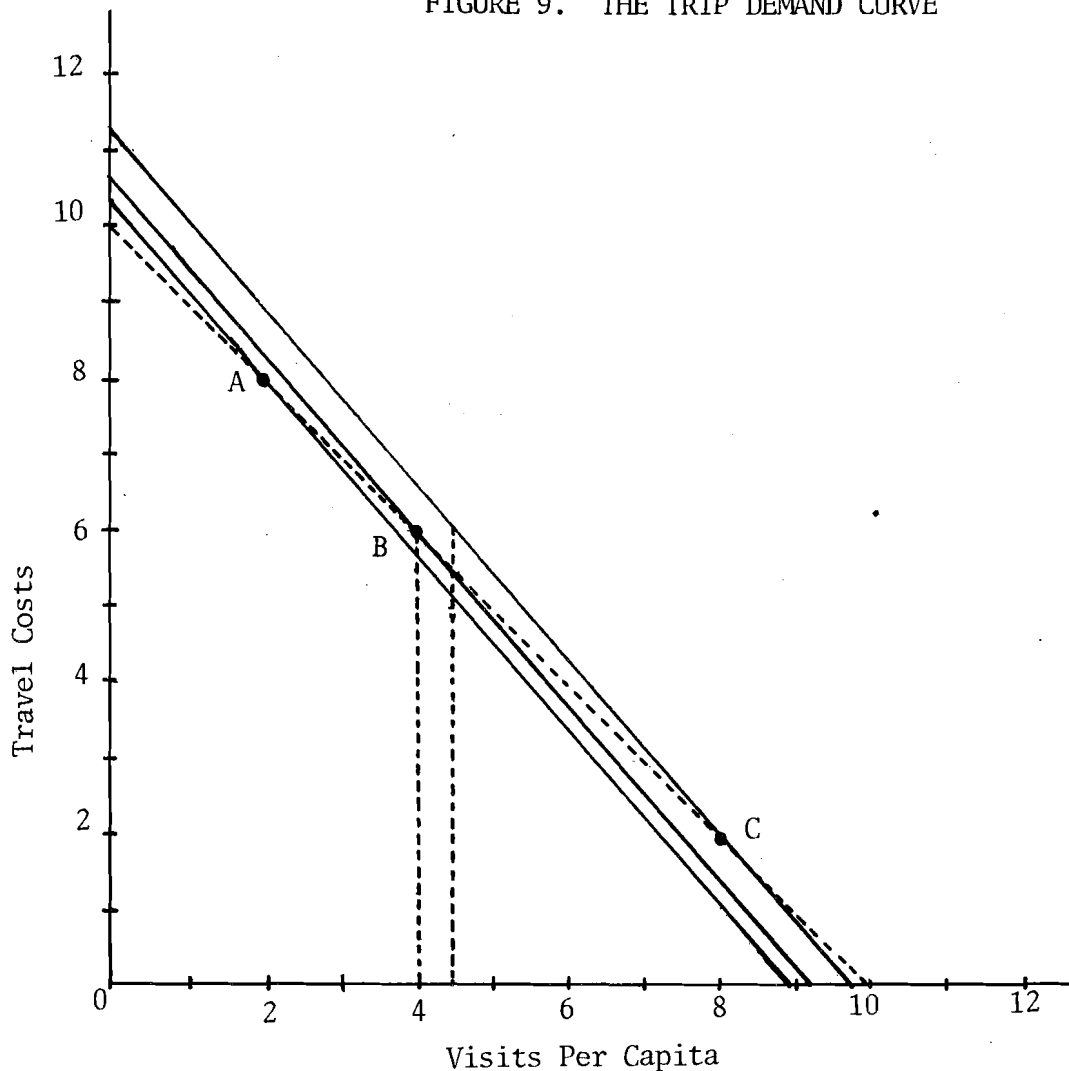
The results are easily interpreted. The "true" demand
curve for an individual from origin C, shown by the solid line
through C, indicates that visitation will not decrease at

higher costs as fast as was predicted by the demand curve
which ignores time. If entry fees were raised to $4 so that
trip costs to individuals at origin C were $6, they would not
reduce their visits to 4, as previously predicted, but only to
4½. This is because individuals at C do not have to spend as
much time traveling as did individuals at B who faced a $6
trip cost and made 4 visits. The extent to which the slope is
misestimated when time is ignored is the missing variable
bias. The greater that error the poorer the estimates of use
and benefits.

Stage 2—Aggregate Site Demand

The second stage curve is developed by the method described
in Example 1. Demand from each origin is evaluated at various
levels of a hypothetical use fee. The use fee alters the trip
cost only; travel time is not altered, and is kept at the
actual level facing each origin. After construction of this
aggregate site demand curve, the area beneath may be calculated
and is a measure of site benefits. Evaluation of this curve
will show that the same use is predicted for a zero fee, while
at any higher fee the use prediction will be greater than that
in Example 1. Estimated benefits will be greater; the total
benefits are now estimated to be $132,240, compared to $114,000
in Example 1. The same conclusions and procedure are valid
for applying this travel cost model to a new site.

In summary, corrections for travel time are easily made.
There is no additional difficulty in applying a correctly
specified model to a new site. The only additional data
needed are estimates of travel time from each population cen-
ter. Despite misgivings about the need to choose a time-money
tradeoff, we feel that a linear tradeoff, with the value of
travel time chosen to be some fraction of the wage rate, is an
acceptable procedure at present.

SUBSTITUTES

The missing-variable bias is also likely to be important if variables reflecting the presence of substitute sites are omitted. Again, the extent of the bias depends on the significance of the omitted variable in influencing demand and on the correlation between the omitted and retained variable. If there is a systematic positive correlation between availability of substitutes and distance from the site when substitutes are not considered, the slope of the trip demand curve may be expected to be underestimated (i.e., the true curve has a steeper negative slope than the estimated curve). If there is systematic negative correlation (i.e., those individuals located closer to the site have a wider choice of substitutes), then the result of omitting the variable is to estimate too steep a demand curve. As long as substitute sites are available, it should be expected that they are indeed significant influences of demand, and that some error will result from neglecting their effect. The following graphical example illustrates the missing variable bias.

EXAMPLE 5: SUBSTITUTES

The following graphical example (Figure 10) indicates the problem that arises when trip costs and availability of substitutes are positively correlated and the demand function is misspecified by ignoring substitutes. The result is similar to that of the previous example on travel time.

We may observe use-points A, B, and C corresponding to the data from Example 1. The dashed line represents the demand curve which would be estimated, neglecting substitutes. Using this curve, we would predict that if the trip costs were raised to $6 for individuals at origin C they would make 4 trips. That is, we predict they would make the same number of trips as the more distantly located individuals at B, who

presently face trip costs of $6. However, if substitute sites
are more readily available at a greater distance from the site
under study, then the decline in trips with distance from the
site is due to both the high money cost of travel and the
wider choice of sites. That is, an individual at B might have
made 6 trips to the site, rather than 4, if he had not had
such a wide choice of substitutes. In particular, if he had
the same choice of substitutes as individuals at origin C,
then he might have consumed at B'.

FIGURE 10. THE TRIP DEMAND CURVE
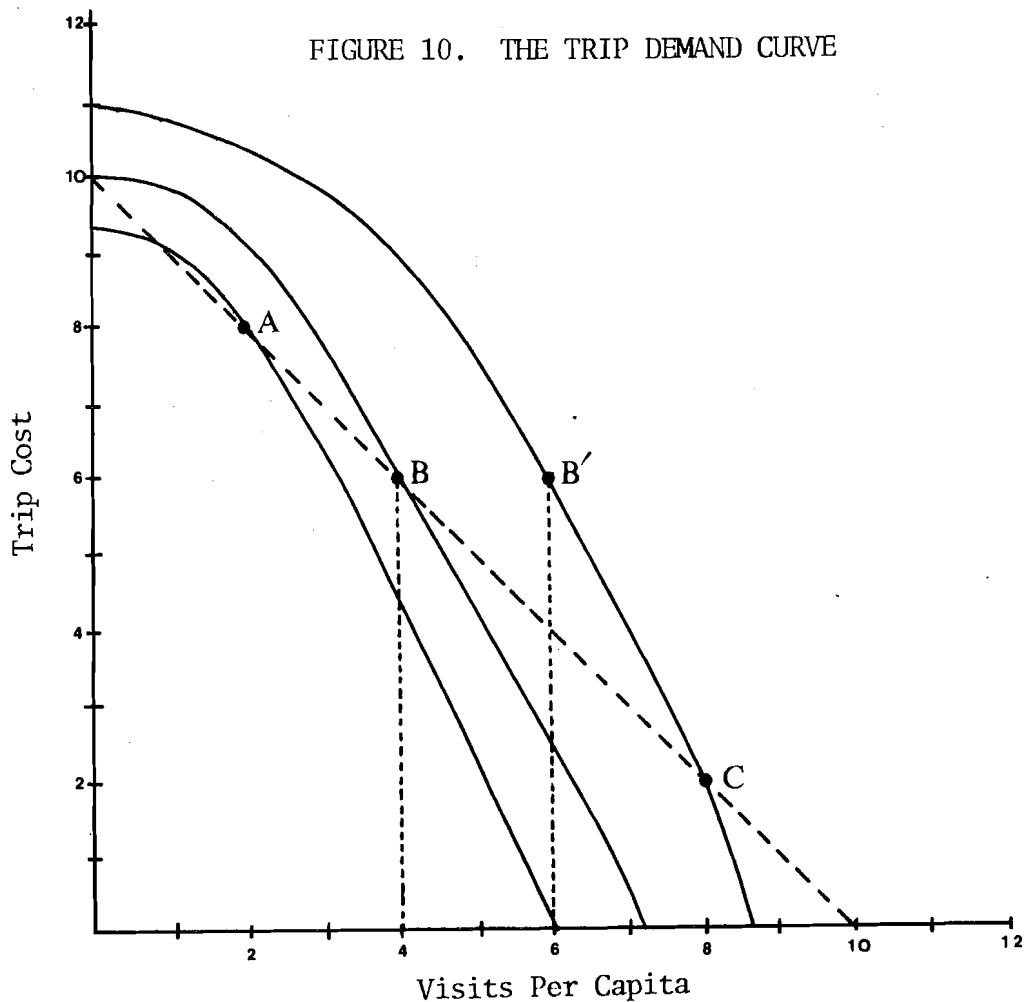
Such behavior might lead to the demand curves illustrated in
Figure 10. Each demand curve represents how users at each

origin would react to a change in trip cost when alternatives
are held constant at the actual level. The shape of these
demand curves will depend greatly upon the particular specifi-
cation of the equation and the "substitute" variable. How-
ever, as long as the positive correlation of substitutes and
trip costs holds, it is certain that at points A, B, and C,
the new demand curves will be steeper than the misspecified
demand curve of Example 1.

The results for benefit and use estimation are not clear
cut. Rather, error will depend on the curvature of the true
demand curves, the extent to which the alternatives are per-
fect substitutes (see Example 3), the location of the popula-
tion relative to the site, and the extent of the correlation
between distance and availability of substitutes. Examples
can be constructed which show errors in either direction. In
the application to new sites, it is most likely that use and
benefits will be overstated if an improperly specified demand
curve is applied to a site which faces competition from many
substitutes.

Methods such as those described under regional travel cost
estimators eliminate the source of bias and are recommended
for that reason.

EVALUATION OF THE TRAVEL COST METHOD

The travel cost method is an approach to recreation benefit
estimation that is widely accepted and relatively easily applied.
Among methods which use observations of behavior to impute
benefits, the travel cost methodology is the best. Cicchetti
(1969) concludes:

> In summary, the travel-cost approach is a signifi-
> cant theoretical effort aimed at meaningful policy
> recommendations to estimate both demand equations

and dollar benefits generated by outdoor recreation.
As the methodology stands, it represents both a
theoretically valid and empirically feasible method.

The variations of the travel cost procedure may seem to have
become somewhat more complex in appearance as the methods to
deal with time, alternatives, and site quality have been
developed. However, the resulting computation necessary to
use the models should not be significantly more difficult, and
the advantages in more accurate benefit evaluation should be
great. Even the most basic travel cost procedure should be
far superior to the present practice of choosing arbitrary
values without attempting a demand analysis. The present need
is for a program of data gathering and application of existing
demand methodology to sites in several representative market
regions. It is probably the case that, for sites for which
the travel cost method is appropriate, demand for recreation
trips can be estimated, using existing methodology, with an
accuracy that equals or exceeds that usually expected from
demand studies for other goods. This is a result of the very
useful characteristic of recreation, in that travel cost is
the major component of the cost of consumption. Travel costs
can be expected to have a wide variation over a cross section
of individuals, making accurate estimation of the response to
cost differentials quite easy.

Application of travel cost demand curves to a new site is
in most cases a relatively simple matter. It should be empha-
sized that it is not necessary to estimate a new travel cost
model for each new site. Rather, all that is necessary is
minimal data collection for use in existing models. The pro-
cedure is in all cases equivalent to deriving an aggregate
site demand curve from individual trip demand curves. Some
care must be taken to see that site-specific demand is con-
sidered. Models such as that of Burt and Brewer (1971) esti-
mate demand for a type of site, while the model developed by

Cesario and Knetsch (1976) estimates the demand for specific sites.

The travel cost method only evaluates user benefits, and only this issue has been addressed. If there are significant non-user benefits or loss of benefits arising directly from the site (increased land values for nearby residents, environmental quality changes) these should be evaluated separately. Some problems are inherent in the travel cost method. It will always yield the benefits of the whole travel experience rather than for site use alone. This cannot be corrected without evaluating and separating out the benefits received or lost from intervening opportunities or travel. Except for unusual cases, this should not be a major source of error. The travel cost method has a number of advantages over the survey method, and is recommended for use in almost all cases.

The direction for further research should be in accumulating benefit studies in representative market areas using the best methods which are presently available. The role of congestion, the form of demand equations, indices of quality and substitutes, individual differences, theoretical formulations, and the relation between the time and income constraints all would benefit from further research. However, wide experience with the travel cost method is already available and its usefulness is clear. There is no justification for continued use of the interim unit day values.

SUMMARY AND COMMENTS

1) The major relevant variables to include in the travel cost method are trip costs to the site under study and to substitute sites, attributes of the site relative to substitute sites, and time cost of a trip.

2) If significant variables that are strongly correlated with the included variables are omitted from the travel cost method, there will be some error in the benefit estimates.

3) It is preferable to account for the interrelation among sites within a market area. Different sites compete for the same potential customers. Joint estimation of the demand for all sites in the market area of the study site accounts for the interrelations. Regional estimators are preferable.

4) The proper unit of quantity is trips (visits).

5) Estimation of separate travel cost demand curves for different activities can lead to double counting and should be avoided. Experience indicates, however, that it may be desirable to estimate day use trips separately from longer visits.

6) Benefits can be approximated by the area under the site-specific demand curve.

7) To apply the method to a new site is relatively easy. The demand curve estimated for a similar site, preferably within the same market region as the new site, is applied to the population which will use the new site. The distribution of the population relative to the new site and existing substitutes, the socioeconomic characteristics of the population, and the relative quality of the new site will influence the estimated benefits.

CHAPTER 6
SUMMARY OF RECOMMENDATIONS CONCERNING VALUATION CONCEPTS, VALUATION METHODS, AND AGENCY PROCEDURES

VALUATION CONCEPTS

The correct use of the benefit-cost criterion should be to compare the gross positive benefits generated by a project, measured in terms of total willingness to pay, to the costs of bidding the necessary resources away from alternative uses, as measured by the value of these resources in their best likely alternative use. When a plan creates additional recreational opportunities, the appropriate concept for estimating the contribution of that increase in output to national economic development is the willingness of users to pay. Willingness to pay should be interpreted as willingness to pay entry or use fees for the specific site, area, or resource involved with the alternative being evaluated. Willingness to pay includes entry and use fees actually paid plus an estimate of the amount in excess of these charges that users could be induced to pay. This is a measure of gross user benefits.

The costs of a project should be measured as the value of the required resources in their best existing use. It is common to consider the opportunity cost of labor and capital to be merely their monetary cost. This payment should adequately reflect the value of these inputs in alternative uses. Their value, then, is the minimum compensation required to attract the inputs away from alternative uses.

Similarly, land and water inputs should be measured by the minimum compensation required by those who have ownership rights to these resources in their present form. We define this compensation as the "willingness to sell" measure of

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value. When the resources are presently owned by the public, the appropriate value is the willingness of users to give up the opportunity to use the resources in their present state. When the land and water resources in their present form are privately owned, the price at which the owner freely sells the land is most likely an adequate reflection of the value of the land in its existing use.[1]

If cost and benefits are measured in this manner, the fulfillment of the benefit-cost criterion assures that those who gain are willing to pay enough to adequately compensate those who incur costs. That is, it would be possible to arrange compensation payments so that no one was made worse off and at least some people could be made better off. Thus the use of willingness to sell to measure costs is fully consistent with the use of willingness to pay to measure increased benefits, and is in fact basic to the spirit of benefit-cost analysis. Whether those who incur costs have any legal entitlement to actual receipt of compensation is quite another matter; here the measure of welfare gains and losses is at issue.

Willingness to pay, the measure of gross consumer benefits, may be approximated by the sum of actual on-site expenditures plus consumers' surplus. This may be evaluated as the area under the demand curve up to the quantity demanded. Willingness to sell as a measure of net benefits lost may be approximated by consumers' surplus, the area under demand curve above price. However, it should be stated that for especially desirable or unique resources, this measure may significantly understate the actual value of lost benefits.

A measure of consumers' surplus gained from particular recreation opportunities can be developed from a demand curve or schedule which indicates the quantity of use that buyers (participants) in a market would purchase at each price. In

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[1]For an exception, see p. 13, note 4, above.

the absence of market evidence of the demand for recreation
(i.e., the quantity of recreation consumed over a wide range
of user fees), it is necessary to estimate demand and value by
indirect approaches such as the travel cost and survey methods.
The travel cost method estimates a demand curve for specific
recreation opportunities associated with a site or area. An
estimate of consumers' surplus is then obtained by calculating
the area under the demand curve. With the survey method, a
sample of users is questioned in order to develop estimates of
an individual's actual valuation. These estimates may be
thought of as points on a curve similar to a demand curve for
a recreation opportunity, but it is not necessary to construct
such a curve. Rather, estimates of individual values are
summed to find total net benefits.

VALUATION METHODS

The survey and travel cost methods have been used to
develop models for estimating the willingness of users to pay
for a site, resource, or area. These methods can, if properly
applied, develop models that will provide estimates of value
that are highly useful for planning purposes. The precision
of these estimates may equal or exceed that for values of
other outputs of projects involving water and related land
resources.

It is not necessary to undertake a new travel cost or sur-
vey study for each project or action that is evaluated.
Rather, these methods can be developed at existing sites,
then applied to estimate willingness to pay for new facilities
and sites. It will often be possible to use a particular
model to evaluate a number of projects. In each case it is
only necessary to gather appropriate data to enter into the
model. Once a model is selected for use, the appropriateness
of the model for the situation to which it is applied must be
clearly documented. This documentation must convey a clear

understanding of the model, the recreation opportunities, and the population of users to which it is being applied.

The Survey Method

1) The survey method is at present more acceptable for estimating willingness to pay than for estimating willingness to sell. It is recommended that more research be devoted to procedures for estimating willingness to sell.

2) Equations should be developed to express the relationship between willingness to pay and characteristics of users based on information gathered from the survey of users. A larger survey should be aimed at estimating the distribution of these characteristics over the user population.

3) The benefits at planned sites and facilities need to be evaluated using interviews from existing sites. In order that willingness-to-pay equations may be applied to proposed sites which may be located differently with respect to users and substitute sites, we recommend that travel distance, and accessibility to substitutes be considered as explanatory variables in the willingness-to-pay equation. Applications of the travel cost method illustrate the importance of these variables in influencing individual willingness to pay.

4) The survey questions should relate clearly to specific recreation activities that are to be affected by a management alternative. That is, it should be explicitly stated that, when estimating willingness to pay the respondent should consider the appropriate range of substitute sites and activities. Caution should be used that results are not applied inappropriately to proposed changes.

5) Instructions and questions should be formulated to avoid biased responses which might result from the respondent

answering in a manner which he perceives might further his self-interest. The respondent should be placed in a realistic decision framework that stimulates a thought pattern which approximates the market process.

6) It is best to survey actual beneficiaries only, in order to reduce the hypothetical nature of the questioning.

7) For sites which involve multiple visits and visits of different length, caution should be taken that a truly representative sample of visits and visitors is chosen.

8) In some cases the best unit evaluated may be the single trip. In other circumstances, it may be desirable to value a season of activity.

The Travel Cost Method

1) The major relevant variables to include in the travel cost method are trip costs to the site under study and to substitute sites, attributes of the site relative to substitute sites, and time cost of a trip.

2) If any significant variables which are strongly correlated with the included variables are omitted from the travel cost model, there will be some error in the benefit estimates.

3) It is preferable to account for the interrelation among sites within a market area. Different sites compete for the same potential customers. Joint estimation of the demand for all sites in the market area of the study site accounts for the interrelations. Regional estimators are preferable.

4) The proper unit of quantity is trips (visits).

5) Estimation of separate travel cost demand curves for different activities can lead to double counting and should be avoided. Experience indicates, however, that it may be desirable to estimate day use trips separately from longer visits.

CHOOSING A VALUATION METHOD

The travel cost method has a number of advantages over the survey method. Some of the major advantages are as follows:

1) An estimate of use of a proposed site is developed as well as an estimate of total willingness to pay. With the survey method, a separate estimate of use is required in addition to the estimate of individual willingness to pay in order to estimate total willingness to pay.

2) The travel cost method has been applied to recreation benefit estimation in far more instances than has the survey method. Consequently, there is a larger amount of information available on how to apply the method most effectively to recreation benefit estimation than is the case with the survey method.

3) The travel cost method is based on observation of actual behavior of recreationists rather than their responses to questions concerning hypothetical circumstances. Consequently, the travel cost method tends to yield more reliable and consistent estimates of value.

4) Data gathering for the travel cost method is easier to accomplish with field personnel than is the case with the survey method. Establishing appropriate rapport with respondents and asking questions in a way that does not induce biased responses to survey questions may be difficult for personnel who have not had special training.

5) The travel cost method can be checked by comparing predicted use with actual use. There is no such test for the accuracy of the survey method.

Consequently, it is recommended that the travel cost method be used wherever possible and that the survey method be used in those cases where the travel cost cannot be used.

There are several instances in which the travel cost method can not be used and the survey method should be applied. These are:

1) When resources, areas, or sites that are being evaluated are likely to be one of many destinations for a trip for a major portion of the users.

2) For considering the value of small changes in the quality of existing sites which would not be expected to affect the travel costs of visitors or the number of visits that they make, particularly if these changes have implications for recreation experiences at a number of sites.

3) When urban sites or other areas are evaluated where the distances traveled by users do not show sufficient variation to facilitate use of the travel cost method.

4) Possibly, for evaluating the effects of congestion on benefits.

Thus, it is likely that the travel cost method will be used far more often than the survey method to estimate recreation's contribution to national economic development, but there will be cases where the survey method will be used.

If new demand-based valuation methods are developed that provide estimates of the willingness of users to pay use or

entry fees, these methods may be employed under circumstances where they are demonstrated to provide estimates of value that are equal to or exceed the precision of estimates that would be provided by the travel cost and survey methods.

AGENCY PROCEDURES

Valuation procedures currently used by federal agencies do not make use of the travel cost or survey methods but, rather, use the "interim unit day value approach." This approach suffers from a number of major problems concerning both its definition and its conceptual and empirical basis. Estimates of willingness to pay from the "interim unit day value approach" will not encourage efficient resource allocation.

Improving the unit day value approach would require substantial theoretical and empirical effort. Rather than expend such effort, however, it seems reasonable to utilize other methods which have already been developed.

What is necessary for estimating recreation's contribution to national economic development is the development of regional models (equations) to predict the willingness of users to pay. This is not a radically new approach; rather, it makes the best use of procedures and models that are presently available. These equations would explain individual willingness to pay for many types of recreation as functions of site characteristics, the socio-economic characteristics of the individual user, the availability and quantity of substitute activities and sites, and the location of the individual in relation to the site under study. Prediction of willingness to pay at the individual level based on empirical studies of similar sites should be a significantly better approach than an attempt to estimate the average willingness to pay by a modified unit value approach.

Regional models will give estimates of total willingness to pay for a new site as a function of these variables, as well as for the number of users, and the distribution of users within the market area. These functions could be derived from travel cost demand functions (which would also provide estimates of use) or could be explicit willingness-to-pay functions similar to those that are derived by Davis (1963) using the survey method (which must be supplemented by use estimates). They may be applied to evaluate proposed projects with only minimal effort.

It is recommended that these procedures be implemented by a cooperative effort among federal agencies. This would include the sharing of data and expertise. Using the procedures outlined in this report, a central data bank of the results of demand studies should be developed. The results should be stored in a form which would permit planners to select the best model for predicting the willingness of users to pay for a planned site. This data bank would be of great use to planners.

The interim unit day value approach should be abandoned. Furthermore, under no circumstances should such other erroneous methods based on gross or net expenditures by recreationists, gross national product, the cost of providing recreation, or the market value of fish or game harvested be used to estimate recreation's contribution to national economic development. These methods do not provide an estimate of the willingness of users to pay use or entry fees and they are based on a misunderstanding of economic concepts; they are therefore inappropriate. These methods are presented in Appendix C, where their inappropriateness is pointed out.

CHAPTER 7
REVISIONS FOR THE PRINCIPLES AND STANDARDS

The following is presented as a modification for the *Principles and Standards* based on the results of this study. The modifications concern (1) a replacement for section II. F.e., dealing with principles and standards for estimating the beneficial effects of recreation on national economic development, and (2) an addition to section II G.a., dealing with principles and standards for estimating the loss in national economic development resulting from the displacement of recreation resources.

REVISED SECTION II.F.E.

(e) Recreation. For the most part, outdoor recreation is provided publicly and distributed without charging user fees or prices. While the private provision of recreation opportunities has been increasing in recent years, analysis of recreation needs is conducted without benefit of any substantial amount of feedback from effectively functioning markets to guide the evaluation of publicly produced recreation goods and services. Under these conditions—and based on a with and without analysis—the increase in recreation provided by a plan, since it represents a direct consumption good, must be measured or valued on the basis of estimated willingness of users to pay entry or use fees. The appropriate concept of willingness-to-pay includes entry and use fees actually paid, plus an estimate of the amount in excess of these charges that users could be induced to pay.

At present, there are two acceptable methods for estimating the willingness of users to pay: the travel cost method and the survey method. Equations developed with these methods at existing facilities can be used to estimate willingness

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of users to pay for the recreation outputs associated with a proposed alternative.

The travel cost method estimates a demand curve for specific recreation opportunities associated with a site or area based on the behavior of users. Additional willingness of users to pay can then be estimated from the area under that demand curve. Adding actual expenditure to this figure will yield an estimate of total willingness to pay. The survey method bases estimates of an individual's additional willingness to pay on direct questioning of a sample of users. Estimates of these individual values and actual expenditures are summed to find total willingness to pay. With each approach, a model for predicting willingness to pay is developed from existing sites, areas, or resources and then applied to the valuation of pro- posed plans. Thus the models are applied to *proposed changes* in the output of recreation and it is not necessary to develop a new model for each application. However, it is necessary to document carefully the appropriateness of the model for the situation in which it is applied. This documentation must convey a clear understanding of the model, the alternative being evaluated, and the appropriateness of the model for evaluating that alternative. It is preferable that the models be applied to new sites within the same region in which the original willingness-to-pay model was initially estimated.

It is desirable that the methods estimate a participant's willingness to pay as a function of site characteristics, the socio-economic characteristics of the individual user, the availability and quality of substitute activities and sites, and the location of the individual in relation to the site under study. Because of the inability of the commonly used "interim unit day value approach" to accurately reflect these variables, its use should be abandoned and the willingness-to- pay models used instead.

Choice of Method. The travel cost method has several advantages over the survey method in estimating willingness to pay. The travel cost method provides an estimate of use for a proposed site or area as well as an estimate of willingness to pay. With the survey method, a separate estimate of expected use is required in order to estimate total willingness to pay. The travel cost method has been applied to recreation benefit estimation more often than the survey method and, consequently, more information is available about the most effective way to apply the method. The travel cost method is based on actual behavior of recreationists rather than on their responses to questions concerning hypothetical situations. Consequently, the method tends to give more consistent estimates and is more easily applied by field personnel.

However, under certain circumstances the survey method has advantages over the travel cost method. These circumstances include: the evaluation of resources, sites, or areas that are likely to be one of many destinations for a trip; for valuation of small changes in quality at existing sites when these changes would not be expected to affect the travel costs of visitors or their number of visits, especially if they have impacts on recreation behavior over a wide area; for the valuation of urban sites or other areas where distances traveled by users do not show sufficient variation for use of the travel cost method; and, possibly, for evaluating the effects of congestion on benefits.

The Travel Cost Method. It is preferable in developing the travel cost model that the following variables be considered: trip costs to the site under study and to substitute sites, attributes of the site and of substitute sites, and time cost of a trip. The proper unit of quantity to estimate when using the travel cost method is trips. It is often necessary to account for the interrelationship among sites within a market area, since these sites compete for the same potential

customers. In order to do so, it is preferable to estimate
the demand jointly for all sites in the market area of the
study site. Regional estimators are preferable.

The Survey Method. It is essential that the respondent to
a question clearly understand which specific recreation activ-
ities or areas he is being asked to evaluate. Questions
should not simply ask the consumer to state his willingness to
pay. It is preferable to devise less open-ended questions
which ensure that responses will be realistic and accurate.
Instructions and questions should be formulated to avoid
biased responses which might result from the respondent an-
swering in a manner which he perceives might further his self-
interest.

4) Other Methods. If new valuation methods are developed
that provide demand-based estimates of the willingness of
users to pay use and entry fees, these methods may be employed
under circumstances where they are demonstrated to provide
estimates of value that are equal to or exceed the precision
of estimates that would be provided by the travel cost and
survey methods.

The interim unit day value approach should be abandoned.
Furthermore, under no circumstances should methods based on
gross or net expenditures by recreationists, gross national
product, the cost of providing recreation, or the market value
of fish or game harvested be used to estimate recreation's
contribution to national economic development. These methods
do not provide an estimate of the willingness of users to pay
use or entry fees and are therefore inappropriate.

ADDITION TO SECTION II.G.A.

When a proposed plan destroys or otherwise makes existing
recreation opportunities unavailable, the appropriate concept

for valuation of the lost recreation output may be willingness
of users to pay or the willingness of users to sell their
rights to use the site or area. Willingness to sell, or the
compensation required by present users if the site or area
were made unavailable to them, is the appropriate valuation
concept for publicly-owned recreation facilities.

It is therefore recommended that, unless better procedures
become available, consumers' surplus be presented as the lower
bound on lost net benefits from destroyed resources with the
recognition that the actual value will exceed this estimate.
Thus the procedures outlined in Section II.F.e. as amended by
the first part of this chapter, are to be used to estimate the
value of lost recreation outputs. It should be stated, when-
ever this measure is used, that it is used because of the lack
of a presently satisfactory method of measuring the appropri-
ate value and that it may significantly understate the costs.

CHAPTER 8
RECOMMENDATIONS FOR IMPLEMENTATION

This report recommends abandonment of the interim unit day value approach and the development and use of models, based on travel cost and survey methods, for estimating the willingness of users to pay for recreation. This will make recreation benefit estimation less dependent on the unaided judgments of agency planners and base it on the observed behavior and expressed preferences of recreation participants. The result should be a more objective measurement of recreation benefits and a more efficient allocation of resources.

This approach will provide federal agencies with a number of significant benefits: (1) They will be able to make a more efficient allocation of resources. (2) Their analyses will stand the scrutiny of other agencies and the public. (3) A great deal will be learned about the preferences of the users that they serve. This information, in turn, will facilitate a number of aspects of planning.

There will, however, be costs associated with data acquisition, model construction, and model use. An initial effort will be required to implement the approach, and subsequent updating will be necessary. But when we appreciate that large investments are made in projects involving water and related land resources, and that a large and increasing share of the cost of these projects is allocated to recreation, the gain in efficiency involving one large project could finance many years of such research applicable to all projects being planned during that period.

The following recommendations will, however, increase the efficiency and effectiveness of these efforts.

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1) Models for estimating willingness to pay, whether developed with the survey or travel cost method, should predict individual willingness to pay as a function of site characteristics, the socio-economic characteristics of the user, the availability and quality of substitute activities and sites, and the location of the individual in relation to the site under study. This type of model is far more useful for estimating values of alternative plans than a method which attempts to estimate average willingness to pay directly (unit-day-values). Functions for predicting individual willingness to pay can be derived from travel-cost-demand functions or from explicit willingness-to-pay functions developed from the survey method. Total willingness to pay for a site would then be a function of these variables, the number of users, and the distribution of users within the market area.

2) Particular emphasis should be placed on the development and use of regional models which account for the interractions among sites in an area.

3) It would be most helpful if federal (and state) agencies were to engage in cooperative data collection programs and share or exchange data. This effort would strengthen the models developed and reduce cost. It is likely that several agencies will have similar data needs. This effort might also bring about much-needed standardization of definitions and data collection procedures among agencies.

4) It would be helpful if agencies could share expertise in model construction. For example, the Corps of Engineers has applied some highly developed versions of the travel cost method to reservoir recreation. The Corps has also recently applied the travel cost method to urban parks. The experience that Corps personnel have gained in the development of these models would be most useful to other agencies. At the same time, the survey method has in many instances been applied to

valuation of wildlife. It is likely that this will continue
to be the case in the years ahead. Thus it may be reasonable
for the Fish and Wildlife Service to take the lead with re-
spect to the survey method. It would seem highly worthwhile
to establish a committee of technical experts from each of the
federal agencies concerned with planning for water and related
land resources to help disseminate new ideas and results, as
well as to coordinate agency efforts.

5) The models developed for estimating willingness to pay
(described in item #1 above) should be stored in a central
file or location that is readily accessible to agency planners.
Perhaps the Bureau of Outdoor Recreation could take leadership
in developing and updating the file. The planner would out-
line basic parameters of the situation being evaluated, such
as site characteristics, the socio-economic characteristics of
expected users, the availability and quantity of substitute
sites and activities, and the location of expected users with
respect to the site. The system would then furnish the most
appropriate model for estimating individual willingness to
pay.

SUMMARY

In sum, considerable data collection and model construction
are called for. This effort should be aimed at developing
models to predict individual willingness to pay as a function
of site characteristics, the socio-economic characteristics of
the individual user, the availability and quantity of substi-
tute activities and sites, and the location of the individual
in relation to the site under study. Use of these models will
improve the public planning and decision-making process and
provide considerable information about the behavior and prefer-
ences of recreationists.

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Data acquisition, model construction, and use of the models will be greatly facilitated by cooperation among agencies. A central file of equations for predicting individual willingness to pay should be constructed and made readily available to agency planners.

CHAPTER 9
RESEARCH NEEDS

The highest priority for research aimed at improving procedures for estimating the contribution of recreation to national economic development should be given to empirical studies. These studies should make use of the guidelines presented in this report. The studies should be aimed at developing models useful for evaluating the types of alternatives that water resource planners are facing.[1] Past studies have focused on a relatively small subset of recreation outputs; but the travel cost and survey methods are applicable to the broad spectrum of alternatives that planners now face and are likely to face in the years ahead.

In addition to the above needs, there are a number of areas where improvements in recreation benefit estimation metnodology would be useful.

SURVEY QUESTIONS

It has been indicated that the response to questions concerning maximum willingness to pay for use of a particular site depends heavily on the way that a question is asked. There is a need for additional research on the best way to structure questions and pose them to the respondent. Considerable effort should also be directed towards developing

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[1]For example, some of the planning alternatives presented at the *Recreation Benefit Evaluation Conference* included: wild, scenic, and recreation rivers; urban streams; "linear parks"; urban flood plains; floating down a stream; improved water quality; national recreation areas; regulation of a reservoir; steelhead fishing; instream values of water; and level A, B, and C planning studies.

methodology for applying survey willingness-to-pay equations
to evaluate new projects.

CONGESTION

The level of congestion at a site may have a significant
impact on user benefits, but it is yet to be effectively eval-
uated in the travel cost or survey models. If congestion is
not taken into account, the benefits of reducing congestion at
existing sites will be neglected when the benefits of develop-
ing a new site are evaluated. If congestion is not taken into
account when a demand function derived from an existing site
is applied to a new site, it must be assumed that congestion
affects both sites in a similar manner and also that popula-
tions of both market areas have similar dislikes for conges-
tion. Estimating the impact of congestion on willingness to
pay for a proposed site is particularly difficult because
the cost of congestion at an existing site may not be a useful
guide. The survey method may provide the most useful approach
to evaluating the impact of congestion on willingness to pay.

INDIVIDUAL DIFFERENCES

It is reasonable to expect that individuals' responses to
recreation opportunities vary significantly. If such differ-
ences are not accounted for in the benefit estimation proce-
dure, benefits of the site will not be evaluated accurately.
An index of demographic variables offers some promise as an
indicator of variations in individual responses. This index
might include some weighted combination of household income,
family structure, age, past experience with the site, and size
of the town in which the household resides. The model devel-
oped by Cesario and Knetsch (1976) seems adaptable to future
efforts to evaluate individual differences. A regional esti-
mation procedure is also helpful in providing a sufficient
range of data to estimate the taste parameters.

QUALITY

It is not clear what constitutes an appropriate index of site quality. Attempts at deriving such an index have included: some measure of project size, which may be correlated with other quality characteristics; subjective rankings by recreation experts; preference surveys; actual observations of recreationists' behavior; and combinations of these. The approach used by Cesario (1969), which is based on actual observations of recreationists' behavior, shows considerable promise and should be given attention by researchers. Quality is best viewed as an interaction between the tastes of consumers and the facilities or resources available.

TIME

It has been previously indicated that time spent traveling to a site is an important determinant of recreation benefits. To neglect time will generally result in an underestimation of benefits. Unfortunately, the time bias problem has been more easily recognized than solved, and a perfect solution is not yet at hand. Thus far there have been two main lines of approach. The first has been to include time as a variable in the regression equation in order to separate the effect of money and time costs on the number of recreation trips undertaken. This approach has often been frustrated by high correlation between money and time costs of travel which precludes an accurate assessment of the effect of each variable. The second approach has been to assume a particular tradeoff between the money and time costs of travel and incorporate this information into the analysis. A completely satisfactory formulation of this tradeoff has yet to be established in empirical work.

Substitutes

The availability of substitutes is an important determinant of willingness to pay for a site. Neglecting substitutes can result in significant overestimations of recreation benefits. Regional estimation procedures, such as those used by Burt and Brewer (1971, 1974), Cesario and Knetsch (1976), and the Corps of Engineers (Brown and Hansen, 1974) provide a valuable base for further research in this area.

Demand Specification

There is need for a theoretical development of the demand for recreation visits and days considering both time and money constraints. This would provide a better basis for specification of demand functions. It is clear that there is some tradeoff that may occur between the number of trips and the length of each specific trip. It is also clear that time traveling will be viewed differently than time at the site. Time traveling is an essential cost that must be incurred before site use can occur.

Willingness to Sell

At present there is no satisfactory method for estimating willingness to sell. Survey estimates of willingness to sell differ from survey estimates of willingness to pay by amounts in excess of what current theory suggests. There is a need for additional theoretical work on explaining these differences, as well as for experimentation with various ways of estimating willingness to sell.

APPENDIX A
THE RECREATION BENEFIT EVALUATION CONFERENCE

The Recreation Benefit Evaluation Conference was held at
the Marvin Center, George Washington University on December 2
and 3, 1976. The conference was attended by the research
team, consultants, Recreation Benefit Advisory Committee, and
40 representatives of federal agencies.

The purpose of the conference was to bring researchers and
agency personnel together to discuss significant issues con-
cerning recreation benefit estimation. Researchers have been
critical of agency procedures for estimating recreation bene-
fits and have developed more elaborate valuation methodologies.
However, most public agencies have been slow to implement
these developments. Thus, there was a clear need for bringing
researchers and agency personnel together to discuss proce-
dures for recreation benefit estimation. A background paper
was prepared by the research team and distributed to all par-
ticipants three weeks before the conference. An earlier draft
of the background paper was reviewed by the consultants and
the Recreation Evaluation Committee in August 1976. The back-
ground paper prepared for the conference (1) outlined the cur-
rent state of the art with respect to recreation benefit esti-
mation, (2) identified significant issues concerning recreation
benefit estimation, (3) developed preliminary guidelines for
benefit estimation, and (4) indicated areas where additional
research is required. This report is essentially a revision
of that paper, based on our interpretation of discussion at
the conference.

The conference was opened by William H. Honore, Chairman of
the Recreation Benefit Evaluation Committee. He outlined the
origin and purpose of the research effort, the significance of

the issues being addressed, and the purpose and expected out-
come of the conference. John R. Kelly, University of Illinois,
conference moderator, outlined the format and tentative
schedule of the conference. John F. Dwyer, University of
Illinois, presented a summary of the background paper and
highlighted the issues to be addressed.

Each of the consultants then responded to the background
paper and highlighted key issues. Next, all participants were
given an opportunity to present their views, and several did.

Conference participants were then broken down into seven
working groups that focused on the following topics.

1) *Willingness to Pay as a Guiding Concept*—Is willingness
of consumers to pay the appropriate valuation concept? Is
willingness. to sell a more appropriate concept under some cir-
cumstances? To what extent should nonuser benefits be re-
flected in the national economic development account? Is it
necessary to impose the "integrability conditions"? As they
are usually imposed, are the "integrability conditions" appro-
priate for the cross-section data used in the travel cost
method?

2) *The Principles and Standards*—What changes in the *Prin-
ciples and Standards* are called for? What guidelines for
valuation methodology are appropriate? Is an "interim ap-
proach" desirable?

3) *The Travel Cost Method*—What is its usefulness for rec-
reation benefit estimation? Under what circumstances is it an
appropriate method? How is it best applied in these situa-
tions? What guidelines should be specified for its use?

4) *The Survey Method*—What is its usefulness for recreation
benefit estimation? Under what circumstances is it an

appropriate method? How is it best applied in these situations? What guidelines should be specified for its use?

5) The Unit Day Value Method—What is its usefulness for recreation benefit estimation? Under what circumstances is it an appropriate method? How is it best applied in these situations? What guidelines should be specified for its use? How should the quantity by which it is multipled be estimated?

6) Is There a Better Way—Is a completely different approach to recreation benefit estimation called for? What about the alternative cost method?

7) The Continuing Effort—What efforts should be initiated to provide continued improvement in recreation benefit estimation procedures? Should specific responsibilities for analysis be assigned to one or more agencies? What efforts should be undertaken to make fuller use of existing data and take full advantage of new empirical work?

The consultants and members of the Recreation Benefit Evaluation Committee had previously been assigned these topics and were prepared to facilitate discussion of the issues. Participants were assigned to these groups and consultants and members of the Recreation Benefit Evaluation Committee served as discussion facilitators. Each group designated a discussion leader and a recorder. Members of the research team circulated among the groups to provide needed guidance and coordination.

The discussion groups made two interim reports to the entire conference during the afternoon of December 2.

The research team, consultants, and members of the Recreation Benefit Evaluation Committee held a dinner meeting on the evening of December 2 to evaluate the progress of the first day and plan for the second day. It was agreed that

initial progress on the issues had been excellent and that
discussion during the second day should focus on *recommenda-*
tions. It was agreed that participants would be consolidated
into three working groups for the next day. These groups con-
sidered the following problems:

1) What is the appropriate valuation methodology?
2) What revisions in the *Principles and Standards*
   are called for?
3) What continuing efforts are needed to improve
   recreation benefit estimation procedures?

After a brief orientation the next morning, the three
groups met for a working session. Each group gave its final
report to the conference shortly before noon.

The conference was adjourned at noon, but the consultants,
Recreation Benefit Evaluation Committee, and the research team
continued to meet for the remainder of the afternoon. The
discussion focused on summarizing the conference, identifying
needed revisions in the draft report, and developing appropri-
ate plans for implementing the revised procedures.

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APPENDIX B
AGENCY PROCEDURES

An attempt was made to summarize procedures used by federal agencies for estimating recreation benefits for proposed water resource development projects. The purpose of the analysis was to identify promising approaches to estimating the contribution of recreation to national economic development. The analysis was based on documents provided by the following agencies: U. S. Army Corps of Engineers, U.S.D.A. Soil Conservation Service, U.S.D.I. Bureau of Outdoor Recreation, and U.S.D.I. Fish and Wildlife Service. A summary of each agency's procedures is presented below:

U. S. ARMY CORPS OF ENGINEERS

The interpretation of Corps of Engineers procedures was based on the following documents:

1) "A Suggested Method of Determining the Value for a Recreation Day at Corps of Engineers Reservoir Projects" (no date or source).

2) Papers presented at SPD Recreation Orientation Session, 4-8 Nov. 1968.

3) Regulation No. 1120-2-400: "Investigations, Planning and Development of Water Resources," 1 Nov. 1971 (incorporating changes from Oct. 10, 1972 and June 29, 1973).

4) Regulation No. 1165-2-1: "Water Resources Development Programs of the Corps of Engineers," 10 Jan. 1975.

5) *Plan Formulation and Evaluation Studies—Recreation*, Volumes I-V, June 1974.

Two main approaches to the estimation of benefits from recreation at Corps reservoirs were found. The "most similar project" approach, described in Volume II of *PFES* and elsewhere, involves the following steps. First, use of the proposed site is estimated. Data collected by the Corps on a

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sample of 52 reservoirs from 1966 to 1969 is used to select
the project (or projects) most similar to the proposed one.
Next, the day-use market area—i.e., the area from which 80%
or more of day use originates—and the per capita use curve of
the similar project are adjusted for differences in size, pop-
ulation distribution, the number of alternative recreation
areas, and other characteristics of the proposed site. From
the adjusted per capita use curve and current and projected
population figures for the adjusted market area, initial and
future use of the site are calculated.

Total benefits are then found by multiplying estimated use
by a unit day value from the range given in the *Principles and
Standards*. It is noted in Regulation No. 1120-2-400 that the
value of any current recreational use of the project area
should be deducted from project benefits. Two point systems
were found in the material reviewed which could help in the
choice of a value, one entitled "A Suggested Method of Deter-
mining the Value for a Recreation Day at Corps of Engineers
Reservoir Projects" (an NPD rating chart), and one presented
by Jack Bernard at the SPD Recreation Orientation Session. In
each, the proposed reservoir is assigned points on the basis
of such criteria as the quality of access and recreational
facilities, the number of activities available, aesthetic con-
ditions of the project, and competitive recreation areas. The
total of points from all categories is then used to determine
a particular value. Neither table provides guidance for the
choice of a value for specialized recreation activities.

The second approach to the estimation of recreation bene-
fits is elaborated in Volumes III and V of *PFES*. In these
volumes, regional estimators were developed for specific Corps
districts by pooling data from all reservoirs within each dis-
trict. In general these took the form of regressions of recre-
ation days on population, distance from the reservoir, surface
area of the project, and an index of alternative recreation

areas. From the regional estimators, demand curves for particular projects were derived using the travel cost method, incorporating an adjustment for the disutility of time in the form of an assumed tradeoff between money and time costs. Recreation benefits of a proposed site could then be calculated as the area under the derived project demand curve.

Although this method was proposed as a replacement for the most similar project approach, it is not clear to what extent it was accepted by the Corps or is actually being used. The 10 Jan. 1975 regulation still advocates the similar project approach.

<div align="center">SOIL CONSERVATION SERVICE</div>

The interpretation of Soil Conservation Service procedures was based on the following documents:

1) *USDA Procedures for Planning Water and Related Resources*, pp. III-7 to III-8 and V-8 to V-10, March 1974.

2) *SCS Watershed Protection Handbook*, Section 108.05—"Recreation or Fish and Wildlife Benefits," 8/23/74.

3) Preliminary revision of *SCS Economics Guide*, Chapter 9—"Recreational and Fish and Wildlife Development," May 1975 (not yet officially adopted).

4) *SCS Resource Conservation and Development Handbook*, Section 102.6—"Evaluation of RC & D Measures," 9/23/75.

The methodology for estimating benefits from water recreation is described in general by *USDA Procedures* and in more detail in *SCS Economics Guide*. Basically, benefits are to be calculated as the product of estimated visitation and a unit day value from the *Principles and Standards*. It is indicated that any loss of recreation opportunity as well as gains from a proposed project should be assessed.

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The calculation of expected use, i.e., the net activity demand for a site, proceeds as follows. First, an estimate of the project's recreation market area (RMA), i.e., the area from which 80% of day or overnight use is expected, is made. Next, current per capita participation rates for recreational activities within the RMA are multiplied by projected population to determine future demand for these activities. The net activity demand for the proposed site is the difference between future demand and the capacity of already existing sites.

Presuming that sufficient facilities can be provided at the site to accommodate net activity demand, the calculated number of recreation days is then multiplied by an appropriate unit day value, which is interpreted as a measure of the amount users would be willing to pay to avail themselves of the recreation opportunity. For general recreation activities as defined by the *Principles and Standards*, guidelines are provided for choosing within the $.75–$2.25 range in the form of a point system. The proposed site is assigned points on the basis of four criteria—recreation experience, development scale, site modification, and environmental quality—and the total point value is used to determine a particular unit day value.

The guidelines for specialized recreation are as follows: existing data are to be used to estimate man-days of fishing in a project area; the choice of a unit day value depends on the species and type of fishing involved, although no particular guidelines are given.

BUREAU OF OUTDOOR RECREATION

The interpretation of Bureau of Outdoor Recreation procedures was based on the following documents:
1) Water Resources Program Handbook (draft).
2) Memorandum from William H. Honore, October 19, 1976.

The Bureau of Outdoor Recreation employs three methods to evaluate the recreation benefits of a particular project: (1) a point system for selecting a value from the range contained in the *Principles and Standards*; (2) the comparable site method; and (3) the travel cost method. A particular method or variation of a method is used on a case by case basis so that the most appropriate procedure for the available data and characteristics of a particular project is selected. Point systems are the most commonly used approach.

It is the policy of the Bureau that values should be selected on the basis of studies of what people are willing to pay for outdoor recreation—e.g., surveys of entrance and user fees at competing sites and the distance people travel to them—as well as the features of a proposed project. This information should be used in conjunction with the above methods.

U. S. FISH AND WILDLIFE SERVICE

The interpretation of U. S. Fish and Wildlife Service procedures was based on the following documents:

1) "Guidelines for Implementing the Principles and Standards for Planning Water and Related Land Resources in Studies of Federal Waterfowl Refuges," August, 1976, draft prepared by The Fish and Wildlife Service.

2) *Habitat Evaluation Procedures*, July 1, 1976, Division of Ecological Services, U. S. Fish and Wildlife Service, U. S. Department of the Interior.

The estimation of recreation user benefits, including hunting and fishing at proposed water resource development projects, involves two steps: calculating man-days on the project area, and selecting a unit day value. Estimation of use is made on the basis of data on the extent of the activities within the area from which the project is expected to draw

users, the size of the area, the project, and the habitat asso-
ciated with the project. The man-days of use calculated in
this manner are multiplied by a monetary value appropriate for
the type of activity involved. This value may be taken from
the range of values in the *Principles and Standards* or another
source as provided in the *Principles and Standards*. Values
generated by state agencies often are used.

APPENDIX C
VALUATION METHODOLOGY

A number of alternative methods have been advanced for the valuation of recreation resources. This appendix provides a description of some of them. The first section discusses concepts that relate to demand or willingness to pay, while the second discusses concepts that do not directly relate to willingness to pay.

CONCEPTS RELATED TO WILLINGNESS TO PAY

Several methods for valuation of recreation are based on the willingness of consumers to pay, as revealed by a demand curve for a recreation site or activity. In addition to the consumers' surplus measures presented in this report there are those methods which employ market value, maximum revenue of a non-price-discriminating monopolist, maximum revenue of a perfect-price-discriminating monopolist, land values, and alternative costs.

Market Value

In general, market value is an acceptable measure of contribution to national economic development provided the demand curve can be considered nearly horizontal and the market price correctly measures value in exchange.[1] However, this does not mean that prices in private markets are an adequate measure of value for public recreation. If the consumer faces a wide choice of suppliers all providing services at the same price,

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[1]Factors that may limit the usefulness of market price as a measure of value include: monopoly and monopsony elements, subsidies, externalities, unacceptable distribution of income, price controls, and other government regulation.

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or if the change in output generated by a project is small
enough (relative to the market) not to alter market price,
then the demand schedule can be considered horizontal in the
relevant region. When the implementation of a plan results in
a significant change in price or when the existing price is
unacceptable as a measure of social value, then market value
is an unacceptable measure of contribution to national eco-
nomic development.

The recreation industry is characterized by a large amount
of government enterprise. Demand is likely to be downward
sloping because recreation is a product widely differentiated
by location and quality. This, coupled with the large scale
of many recreation sites and the absence of competitive pric-
ing, often makes market price an inappropriate measure of
willingness to pay.

Three major problems limit the usefulness of market value
as a measure of the value of recreation opportunities.

1) The price of similar services in the private recreation
market may be a poor simulation of a market price for public
opportunities. Some important differences between public and
private facilities include the amount of congestion, the level
of quality, and the scale and cost of services provided.
Public sites are often larger, associated with unique scenic
or historic areas, and provide fewer personal services. For
some activities, no private market exists. Even where private
market prices for truly comparable recreation services can be
found they are often depressed by competition from the low
prices of public facilities. Consequently, it is very diffi-
cult to simulate a market price for many of the recreation
activities provided by public water resource projects. The
second and third problems below relate to the usefulness of
market value as a measure of contribution to national economic
development when price can be estimated satisfactorily.

2) Market price reflects only what consumers (purchasers) actually pay. This ignores any consumers' surplus, or the additional amount which consumers could be induced to pay. The sum of actual on-site expenditure and an estimate of consumers' surplus provides a better estimate of total benefits. Consequently, under these conditions market value underestimates the total amount consumers are willing to pay. To illustrate, consider Figure C-1 below in which AB represents a downward-sloping demand curve for a service provided by a firm. If market price were OP and quantity taken OQ, market value would indicate that total benefits are OPCQ; but the total willingness to pay is OACQ. Market value ignores that part of willingness to pay reflected by PAC.
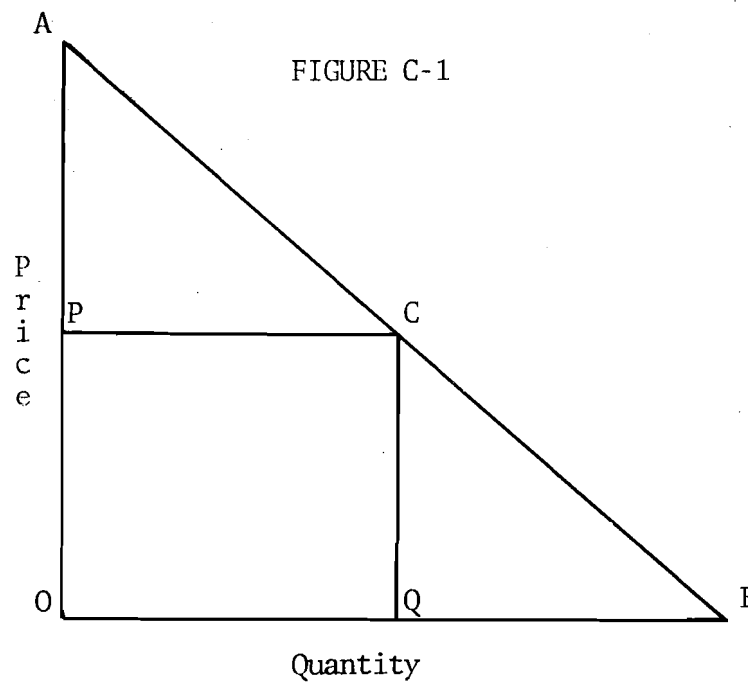
FIGURE C-1

If the demand curve for additional units of the service were nearly horizontal, PAC in Figure C-1 would be nearly zero and market price would accurately measure total willingness to pay. This raises the question of the present and future competitive structure of the market for recreation. Are consumers likely to face a horizontal demand curve? It appears

that they are not. Given certain characteristics of the rec-
reation industry such as site-specific consumption, large-
scale production, and a highly differentiated product, a
spatial form of monopolistic competition is likely to continue
and a downward-sloping site demand curve will exist even if
the private sector dominates a large part of the industry.
Under current conditions, i.e., public provision of recreation
opportunities, a market price is not well defined. Prices at
public sites have little to do with market conditions. In any
case, market price underestimates willingness to pay and the
magnitude of the underestimation increases with the slope of
the demand curve.

3) Market value is associated with a particular quantity
sold at a particular price. Taking market price from one mar-
ket and applying it to another situation presents significant
problems. Each site has a somewhat different market depending
on its location, the characteristics and distribution of
potential users, and the type and costs of services provided.

In summary, a number of factors, including the presence of
a large amount of government enterprise and a downward-sloping
demand curve in the recreation market, constrain the useful-
ness of market value as a measure of total willingness to pay.

Maximum Revenue of a Non-Price-Discriminating Monopolist

Maximum revenue of a non-price-discriminating monopolist is
the most that could be extracted from consumers by charging
one price to all. For the case of zero variable cost, this is
the same as profit maximization. It is indicated on Figure C-2
by the largest rectangle (OPBQ) which can be inscribed under
the demand curve. With a linear demand curve as shown, B
represents the point of unitary elasticity of demand.

FIGURE C-2
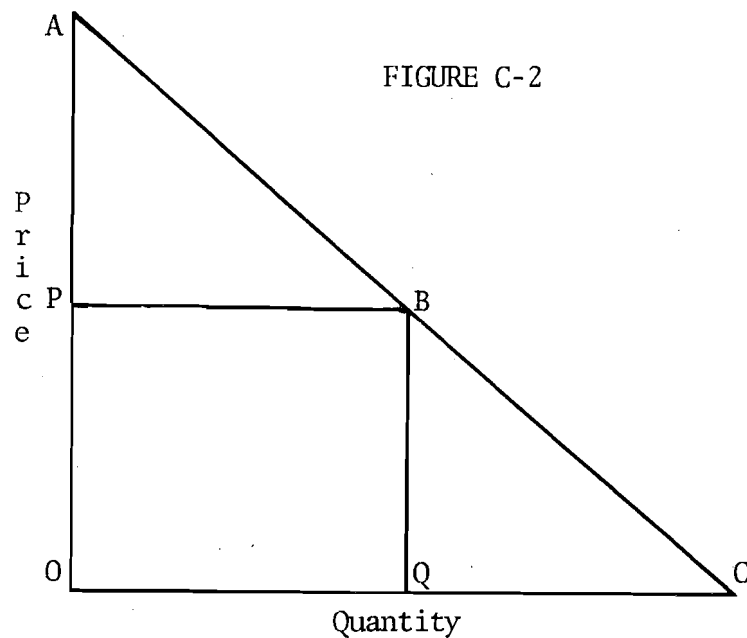
Clawson (1959),dealing with the case of no user charge, suggested use of maximum revenue attainable by a non-price-discriminating monopolist as the value of recreation. Others who follow his suggestion include Castle and Brown (1964), Brown, Singh, and Castle (1964), Stoevener and Sokoloski (n.d.), and Stevens (1966). It was felt that such a method would yield a value most comparable to the value the site would have if it were privately owned. Knetsch (1964) and, subsequently, Clawson (Clawson and Knetsch, 1966) advocated consumers' surplus, rather than monopoly revenue, as the appropriate measure of value under conditions of no entry fee.

A number of researchers have calculated both consumers' surplus and monopoly revenue without choosing either as the appropriate measure of value. These include Brink (1973), Martin, Gum, and Smith (1974), and Sublette and Martin (1975).

Maximum revenue of a non-price-discriminating monopolist does not indicate the full benefits (expressed in terms of willingness to pay) received by consumers facing a zero charge.

These benefits depend, rather, on the amount of the good
supplied and the cost of supplying it. For example, if quan-
tity Q (in Figure C-2) were supplied at no cost, the full
benefit would be OABQ. If there were no cost *and* no supply
constraint, consumers would consume OC and receive additional
benefits given by QBC. Thus if willingness to pay is to be
measured, revenue of a non-price-discriminating monopolist is
not appropriate. Besides the conceptual problem, there are
practical problems with the concept, including its failure to
distinguish adequately between projects. For a further dis-
cussion see Smith (1975). Some examples of these problems are
as follows:

1) With zero variable supply cost and price, (Figure C-3)
what is the benefit from increasing the fixed supply from
Q_1 to Q_2? If revenue of a non-price-discriminating monopolist
were used to evaluate the increase, the net benefit would be
zero. Both Q_1 and Q_2 would be considered to give the same
benefit (OABC) even though more output at the same price is
provided at Q_2.
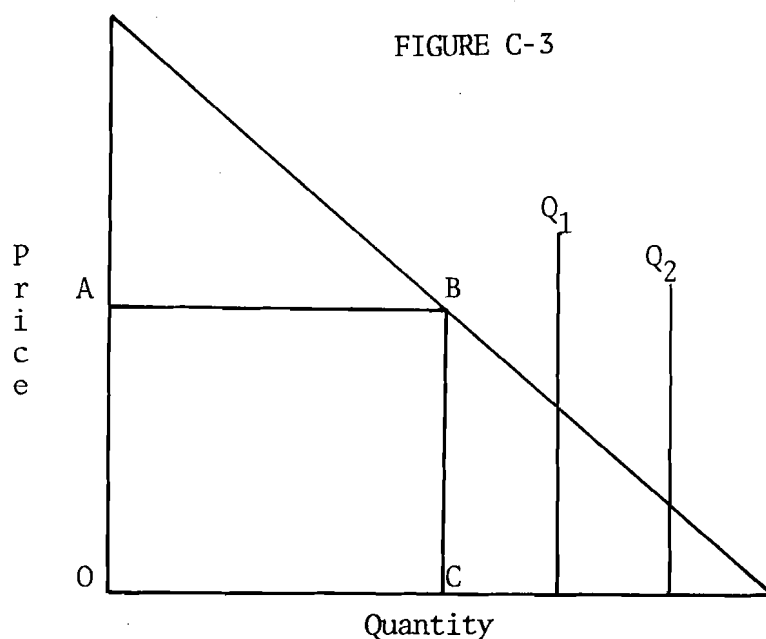
FIGURE C-3

2) Consider the demand curves, D_1 and D_2, in Figure C-4 for two alternate projects.

Revenue of a non-price-discriminating monopolist is the same for both, yet total willingness to pay is greater with D_2.

FIGURE C-4
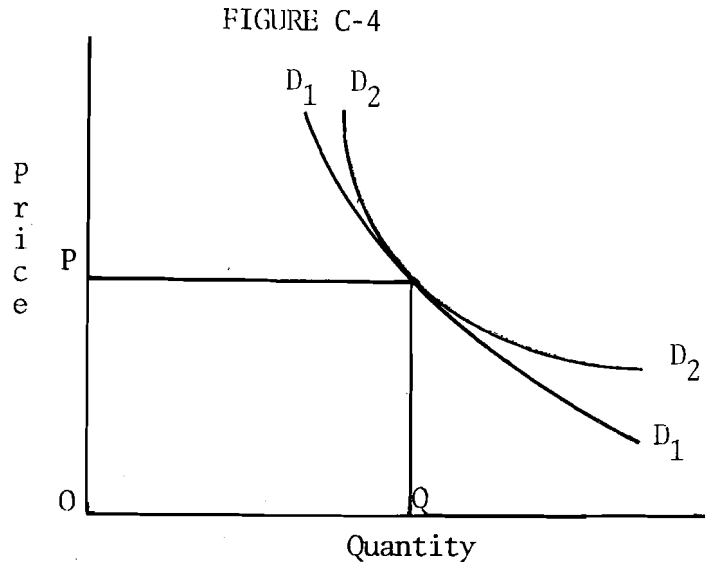
3) If there are positive marginal costs to production, this method may be unable to distinguish between two projects with the same costs even if one would result in greater output at lower price. This is because the method considers the demand curve only, whereas supply may also affect benefits, as shown in the previous example.

Thus, the revenue of a non-price-discriminating monopolist is a weak criterion for ranking investments. It also suffers from lack of comparability with other standard techniques of benefit evaluation for water uses which attempt to measure the full willingness to pay. The use of this method would result in an undervaluation of recreation benefits relative to other project benefits.

Maximum Revenue of Perfect-Price-
Discriminating Monopolist

This procedure provides a measure of benefits which is
identical to evaluating total willingness to pay. A perfect-
price-discriminating monopolist is able to sell each succes-
sive unit of his commodity for the maximum price an individual
is willing to pay for it. Such a monopolist would produce the
quantity at which the price paid for the last unit equalled
the marginal cost of producing it and could capture the full
willingness of consumers to pay, including all consumers'
surplus.[2] For example, in Figure C-5 his revenue from selling
OQ would be ODBQ.

FIGURE C-5
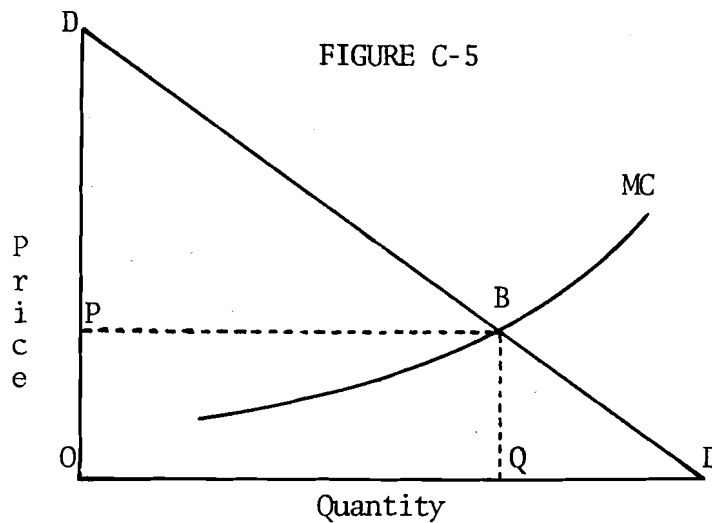
In the special case of zero pricing, the revenue of a per-
fect price discriminator corresponds to the total area under
the site demand curve, provided that income effects are negli-
gible. This last qualification requires that the extraction
of the full willingness to pay should not involve such a
significant withdrawal of income that consumers would be

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[2]Henderson and Quandt, (1971) p. 217.

forced to revise their demand after the purchase of each unit.[3]
Also in the case of zero use fee, such revenue is identical to
consumers' surplus.

More generally, if the fee is set at the level where mar-
ginal cost equals price, revenue of a perfect price-
discriminating monopolist will be equivalent to gross benefits
and will include consumers' surplus along with actual expendi-
tures by consumers. In Figure C-5, ODBQ represents the reve-
nue of a perfect-price-discriminating monopolist or gross
benefits from quantity OQ, equal to consumers' surplus (PDB)
plus expenditures (OPBQ).

The Land-Value Method

The survey and travel cost methods are useful for evalu-
ating the benefits to site users. Neither method attempts to
measure external benefits which arise because of the attrac-
tiveness of living near a recreation area. These benefits
might accrue to non-users as well as users. The use of land
values is a method which attempts to overcome this shortcoming.

Land values are likely to be affected by people's prefer-
ence for proximity to a recreational area. Rent on land
nearest the site will be high, reflecting the fact that those
individuals who locate near a site may enjoy the use and the
view of the area with very little expense or inconvenience.
The increment in local land values is taken as the benefit of
the site. The rationale is based on the classical theory of
rents where rents are established on land affected by the

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[3]This effect occurs mainly with individual demand curves. For
market curves where each individual takes only a small portion
of quantity, the extraction from him of his maximum willing-
ness to pay has no effect upon the maximum willingness to pay
of other users.

project so as to eliminate any consumers' surplus or above-normal profit. Thus, the increase in rents is a measure of the increased willingness to pay due to the project.

Conceptually, the land value method will capture the benefits of both users and non-users and, as a result, would include the benefits measured by other methods. But in practice, the method can only be used for land in the immediate vicinity of a site. The expense of data collection and the multitude of factors which affect land values would make it difficult to estimate the effect of a site on land values at distant locations.

As stated, the method could conceptually capture the benefits to distant users measured by the travel cost procedure. Suppose a new site is developed which reduces an individual's trip expense. This individual will gain some consumers' surplus from cost savings on his present number of trips and from any new trips generated in response to the lower price. This is the benefit found by the travel cost method. The value, to the individual, of his location is now greater. The land owner may be in a position to extract this consumers' surplus by charging higher rents. If this is the case, then the increase in yearly rents will correspond to the yearly benefits of the recreation site.

As indicated, it is not realistically possible to find the effects on land value at very great distances from the site. Usually the land value changes (which are equivalent to the capitalized stream of rent changes) of a smaller area near the facility are considered. This should then be supplemented with the travel cost or survey method to evaluate the benefits to users outside the central area. Clearly the method is most useful when there are significant non-user benefits in the area near the recreation site. If there are no

significant non-user benefits, as may be the case for rural
sites, the travel cost or survey method alone would provide
the same information at less expense. The land value method
is most useful in urban areas, where non-user benefit may be
significant and the range of distances traveled is too small
to make the travel cost method useful.

Some caution should be exercised when using the land value
method. There is some danger of double counting benefits.
First, it should be clear that both the user and non-user
benefits have been found. It is not necessary to compute
benefits by another method for those users located within the
area accounted for by the land value method. Knetsch (1964)
described another problem. To some extent, land values near a
site may not be independent of the willingness to pay of more
distantly located users. The rent on land owned by businesses
may reflect revenues made from sales to these distant users.
This effect on land values should not be counted in benefits.
It either reflects double counting of the benefits already con-
sidered in the willingness to pay of the distant users or a
transfer of spending from a business at another site.

A further problem which is considered in more detail by
Lind (1973) is that there may be a discrepancy between land
values and net benefits. The market for land may be such that
not all changes in consumers' surplus or business profit can
be captured in land values.[4] Lind concludes that, if a number
of similar activities are competing for each parcel of land,
the land value change will capture all profits and surplus. It
is worth comment that the change in rent due to a new site

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[4]For further discussion of the theory of rents and the bene-
fits of public programs see: Rothenberg (1971), Whitbread and
Bird (1973), Vaughan (1974), and Freemand (1975).

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cannot exceed the extra surplus or profit generated by that
site.[5]

There are many applied land value studies. The method is
based on using regression techniques to isolate the effect of
various factors on land values. Some useful applied studies
are Knetsch (1963), Kitchen and Hendon (1967), Hendon (1973),
Weicher and Zerbst (1973), and Darling (1973). These studies
have concentrated on sites in urban areas.

Alternative Cost

The alternative cost method is, in some cases, useful for
providing a measure of project benefits without requiring
estimation of a demand curve. An extensive discussion of the
method can be found in Steiner (1965).[6] In cases where demand
is difficult to estimate, gross benefits of a project are
often taken as the costs of the next best alternative. Equiv-
alently, net benefits are the savings in cost gained by build-
ing the least cost project rather than the next best alterna-
tive. This procedure is acceptable only under certain
conditions.

For the procedure to be acceptable, the following condi-
tions must be satisfied. The alternative must be substan-
tively different from the least cost project, yet must satisfy
the same demand. The demand curve must be perfectly inelastic
(vertical) at the level of output produced by the high cost
project, or else the scale of output of both plants must be
technologically fixed at the same level. Also, demand must be
strong enough that some project or other will certainly be

[5]Wennergren *et al.* (1975) use a measure which they describe as
"rent." It is not rent.

[6]Further discussion can be found in Prest and Turvey (1965),
James and Lee (1971), and Young and Gray (1972).

built, and, if the least-cost project were not built, the next
best project would be.

In Figure C-6a the correct use of the method is illustrated.

FIGURE C-6a

FIGURE C-6b
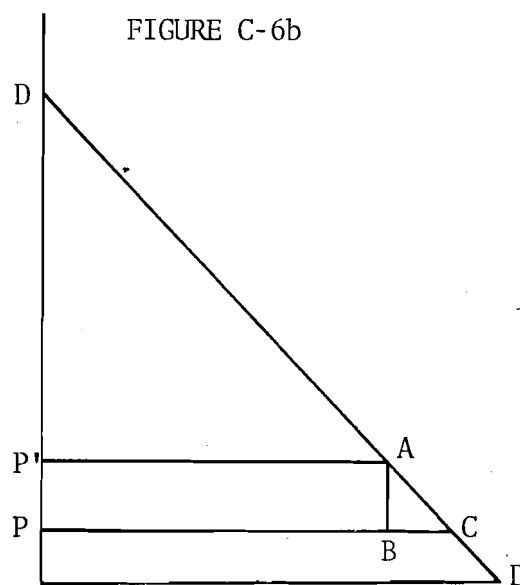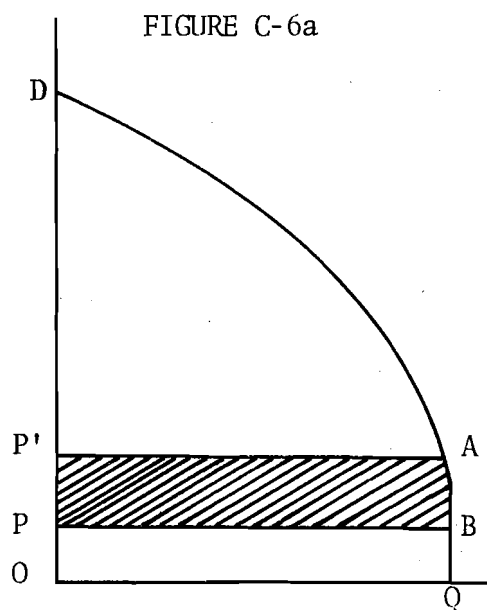
Consider a community which requires an addition to its
water supply, and is committed to build one of two projects,
both of which will satisfy demand curve DQ. The low cost
project has an average cost of P, while the next best alterna-
tive has an average cost of P'. Over the range of cost be-
tween P and P', the demand curve is perfectly inelastic
(vertical). If these conditions hold, the net benefits attrib-
utable to the least cost project are represented by the shaded
area PBAP'. This is equivalent to taking gross benefits of
the low cost project as the cost of the next best alternative,
OQAP'. Gross benefits minus costs, OQBP, equal the net
benefits.

It is of critical importance that the alternative project
would have been built if the least cost project were not. It
is because the top triangle of benefits would certainly be

obtained in the future that only the area PBAP' is described
as the net benefits directly attributable to the low-cost
project. If the next best alternative would not be con-
structed, the full triangle of benefits, PDB, would be direcly
attributable to the least cost site. To evaluate PDB would
require estimation of the demand curve.

The alternative cost method also requires that the projects be
substantively different. James and Lee (1971, p. 170) point out
the problems that may otherwise arise. At one extreme, "the
benefits may be made as small as one might like by comparing
the project with an alternative that differs...only by a very
slight modification." At the other extreme, "it is always pos-
sible to find a more expensive way of building any project."
They suggest avoiding the use of projects with any common elements.

The necessity of a vertical demand curve at the level of
quantity supplied by the higher cost alternative is indicated
by a comparison of Figures C-6a and b. If the lower cost of the
best project were to induce extra demand corresponding to the
difference between Q and Q' in Figure C-6b, then there would
be a triangle of consumers' surplus, ABC, that would not be
accounted for by the alternative cost method. To evaluate that
triangle would require estimation of the slope of the demand
curve in the relevant region.

As a final caution, it should be realized that projects
considered by the alternative cost method will be automati-
cally justified (whether or not they should be). That is, by
taking the benefits of one project to be the costs of a more
expensive project, it will always be the case that benefits
are greater than costs. Such a procedure is acceptable only
if both projects considered would result in total benefits
which would more than compensate for expenses. As an example
of the type of mistake that can be made, it would be faulty to
say that the benefits of providing each consumer with a

Cadillac would be the savings in cost compared to providing
each with a Mercedes-Benz. In fact the expenditure on either
one would be unjustifiable for most consumers; they would pre-
fer a cheaper means of transportation and would spend the
savings on more important goods. If it is not certain that a
project is justified or that its alternative will be built,
there is no avoiding a full evaluation of the demand curve and
a comparison of net benefits among all alternate projects.

The alternative cost method is rarely directly applicable
to recreation. It is not usually the case that the demand for
recreation is so strong that the need for a project is clear.
Suggested uses have not recognized the restrictive requirements
of the method. One suggestion leads to some interesting com-
ments on the combination of alternative cost methods with the
travel cost procedure for evaluating benefits.

The suggestion of Parry and Norgaard (1975) that an appro-
priate estimate of the recreation benefits of the New Melones
dam project would have been the alternative cost of providing
improved facilities for access to existing sites is not
strictly correct. In the absence of any indication that such
a project would have been built or that, in fact, either
project was justified, the alternative cost method is not
appropriate. Their point is well taken, however, in that they
point out that the planners had not considered all possible
alternatives initially.

For recreation the true alternative is not usually another
project that would be built, but rather alternative action by
the consumer. That is, it is rarely the case that there is an
alternative project which will automatically be built, but it
is always the case that, if a new recreation site is not built,
those consumers who would have used it will find some more
expensive or less satisfying alternative. The cost of that
more expensive alternative is the alternative cost; and the

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net benefits to an individual of a new project can be approximated as the savings in cost of using the new project rather than the next best alternative. Such a procedure corresponds to that suggested by Ullman and Volk (1962). It would neglect any induced demand due to lower costs and any consumers' surplus gained from this extra use.[7]

In summary, the alternative cost method is subject to potential abuse if it is not clear that the demand for recreation is strong enough that some project will certainly be built. The theory behind the alternative cost method is useful, however, for pointing out the importance of existing alternate sites to a consumer. The benefits to a consumer can be approximated as the savings in going to a new project, compared to the cost he would have incurred satisfying the same demand if the new project had not been developed.

OTHER VALUATION CONCEPTS

There are four major methods of calculating recreation benefits that do not make use of the demand concept. These include the expenditure method, gross national product method, cost method, and the market value of game method. These concepts do not measure willingness to pay as defined by the *Principles and Standards*—i.e., the area under the demand curve. Their use would almost certainly result in decisions that are not optimal with respect to national economic development.

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[7]The construction of the travel cost method is such that using this form of the alternative cost method would not mean a project is automatically justified. Rather, it only says that the trips by an individual are considered justified. The individual benefits are compared to project costs at a later stage.

Expenditure Method

There are two versions of the expenditure approach to esti-
mating recreation benefits. The first assumes that the value
of a recreation activity to a consumer is at least equal to his
expenditures incurred for transportation, food and lodging,
and equipment in order to engage in the activity. Benefits
are then the sum of all such expenditures. A number of criti-
cisms can be made with respect to this approach. First, while
the values derived may be useful in measuring the impact of a
recreation site on regional expenditures (provided that the
location of these expenditures can be determined), they do not
directly indicate the value of an additional recreation oppor-
tunity to the consumer. That is, they say nothing about how
much the consumer is willing to pay to enter the recreation
area. As Trice and Wood (1958) point out, many expenditures
classified as recreational by this method, i.e., those for
food and lodging, are normal expenditures made in different
circumstances. Moreover, most recreational expenditures are
for the provision of services ancillary to actual use of the
site. In particular, the value of recreational equipment
should not be imputed either to a single site—since use of
the equipment may be spread over a number of sites and a num-
ber of years—or to the overall demand for recreation—since
utility may arise from mere ownership of the equipment or from
non-recreational use.

A second criticism of the gross expenditure approach is
that it does not produce a measure of recreation value com-
parable to other measures such as willingness to pay. It thus
has little value as a guide to public expenditure decisions,
which routinely involve tradeoffs among a number of resources
or a number of uses of a resource. Finally, in calculating
the benefits of an additional recreation site what is needed
is a measure of the net benefit resulting from the added oppor-
tunity rather than its gross value. This is because

expenditures at the site will ordinarily be transferred from other goods and services; thus the net change in benefits may be significantly less than the gross change. In answer to this criticism, the second version of the expenditure method, a *net* expenditure approach, has been developed. This method calculates the value of recreation as the value-added due to recreation expenditures—i.e., the excess of such expenditures over the cost of inputs used in producing the food, gasoline, equipment, and supplies purchased. While this approach results in a measure of net value, it is still subject to the first two criticisms of the gross expenditure method and is more appropriately considered in a regional development account.

The gross expenditure approach has been used by a number of government agencies. In one application the California Department of Fish and Game attempted to estimate the value of striped bass, salmon, and steel-head fishing in 1953 as the sum of expenditures on transportation, food and lodging, services and supplies, and licenses and equipment amortized over the expected period of usefulness (Pelgen, 1955). A similar study surveyed fresh and salt-water fishing in 1955 (Mahoney, 1960). Each calculated the average daily expenditure for different types of fishing, which could be used to estimate the total value of a particular site, given the number of fishermen and the types of fishing.

The net expenditure or value-added approach was employed by Wollman (1962) in comparing alternative uses of water—industrial, agricultural and recreational—in the San Juan and Rio Grande basins of New Mexico. Wollman felt that while primary value-added cannot be derived for recreation as for industry and agriculture because recreation is not sold at a market price, the value-added created in the process of furnishing goods and services to recreationists is comparable to the value-added resulting from sales of inputs to industrial and

agricultural producers. It is not clear that this comparison can be made, since only in a limited sense are recreationists' expenditures the "inputs" of recreation; they are, in part, ancillary to it.

It is interesting to note that Wollman recognized "the production of collective consumer surpluses" as a possible source of undervaluation of recreation benefits, but concluded that whether "the disparity between market valuation and underlying psychic states is greater in the area of recreational expenditures than for other outlays...cannot yet be demonstrated with available methodologies."

Gross National Product Method

The National Income or Gross National Product (GNP) approach attempts to measure the contribution of recreation to GNP in one of two ways: (1) the direct contribution of the recreation industry to GNP is calculated by finding the value-added due to recreation expenditure. This is essentially the net expenditure method described above, and is subject to the same criticisms. (2) The impact of recreation on long-run productive efficiency, or assumed "intrinsic social value" of recreation, is measured by assuming that the value of a day of recreation equals GNP per day per capita (Lerner, 1962). This approach, summarized by Lerner on the basis of discussions with William Ripley of the California Department of Fish and Game, assumes that, in the long run, recreation time is as essential to productivity as working time. According to Lerner, the method is not intended to provide a measure comparable to measures of benefits from other activities. Indeed, it could not be used to judge among alternative uses of a resource, since the value of a day in any alternative activity would equal the value of a recreation day. In addition, it is doubtful that the method provides a true measure of the "intrinsic social value" of recreation or any other activity.

The shortcomings of GNP as a measure of economic welfare have
been well documented. In calculating GNP, private goods are
evaluated at market value and public goods at cost; no attempt
is made to include the net benefits to consumers of either
type of good.

There is no evidence that either of these approaches has
actually been applied to determine the benefits of recreation
in general or at a particular site.

Cost Method

The cost approach assumes that the value of a recreation
site equals or exceeds the cost of providing the site. Be-
sides resting on this rather tenuous assumption, this method
seems inappropriate for decision-making purposes. For one
thing, *any* proposed expenditure on recreation facilities is
justified by the method; for another, it provides no means
for deciding among alternative recreation projects, since net
benefits from any project are zero.

This method was advocated by the National Park Service
during the 1950's, primarily as a basis for cost allocation:
"The Service holds that, provided a proposed reservoir would
not destroy more important conservational and recreational
values, expected benefits...would be greater than specific
costs of developing, operating, and maintaining these facil-
ities. A reasonable estimate of the benefits arising from the
reservoir itself may be normally considered as an amount equal
to the specific costs" (National Park Service, 1950).

Market Value of Game

This approach assumes the value of fishing or hunting
equals the market value of what is caught. The major criticism

is that in most cases the catch alone is not a primary objective of the recreational activity, and, at least, the cost of catching the game should have been subtracted from the market value.

APPENDIX D
EQUIVALENT AND COMPENSATING VARIATION
AS MEASURES OF BENEFITS

In a reformulation of consumers' surplus, Hicks (1943)
proposed four measures of the change in a consumer's welfare
resulting from an actual or proposed price change. These four
measures, the compensating and equivalent variations and the
compensating and equivalent surplus, are all identical under
the assumption of zero income effects. That is, the size of
these surpluses must be small enough, relative to income, so
that a loss or gain of that amount would not affect the level
of consumption of the relevant good. Under this assumption,
the area under the demand curve above price, usually called
the consumers' surplus, will be equivalent to the four mea-
sures proposed by Hicks. If the assumption of zero income
effects is not made, the two Hicksian measures—the compensat-
ing variation and the equivalent variation—are usually the
most relevant. For a beneficial change, the compensating
variation is less than the usual consumer's surplus measured
from the demand curve; the equivalent variation is larger.
For a non-beneficial change, this relation is reversed.

The compensating variation is defined as the amount of
compensation, paid or received, that will leave the consumer
at his initial welfare level following a price change.

The equivalent variation is defined as the amount of com-
pensation, paid or received, to prevent a price change that
would leave the consumer at the welfare level that would have
followed the change.

These definitions can be made clear by reference to a
recreation site. If there are presently no facilitites, and

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the benefits of a proposed facility are to be evaluated, the following measures may be considered. The compensating variation is the maximum amount an individual would pay to have the site developed. The equivalent variation is the amount that he would want as compensation if the site were not developed, in order that he would be as well off as if it were developed.

If there is presently a facility whose elimination is under consideration, the two measures are as follows. The compensating variation is the amount the individual would require as compensation if the facility were destroyed, such that he would be as well off as if it were not destroyed. The equivalent variation is the maximum amount he would pay to stop the facility from being destroyed. These are measures of the benefits lost by eliminating the facility.

It may easily be shown that the compensating variation an individual would pay to ensure a site was built is equal to the equivalent variation he would pay to prevent that site from being destroyed. In order to take advantage of this fact, and to avoid confusing terminology, net willingness to pay has been used in the main body of this report to refer to these two variations. Similarly, an individual's equivalent variation for building a site is equal to his compensating variation for destroying it. These together have been referred to as willingness to sell.

Graphically, the compensating and equivalent variation can be shown using indifference curves. The horizontal axis in Figure D-1 refers to an individual's holdings of good X, while the vertical axis refers to his holding of income and all other goods, Y. The indifference curves represent combinations of X and Y which would provide equal utility to the individual. Curve II is a higher level of utility than curve I. So the combinations of goods and income represented

by A and C provide equal utility. The individual is also in-
different between points B and E, but both these points pro-
vide greater utility than C.

FIGURE D-1
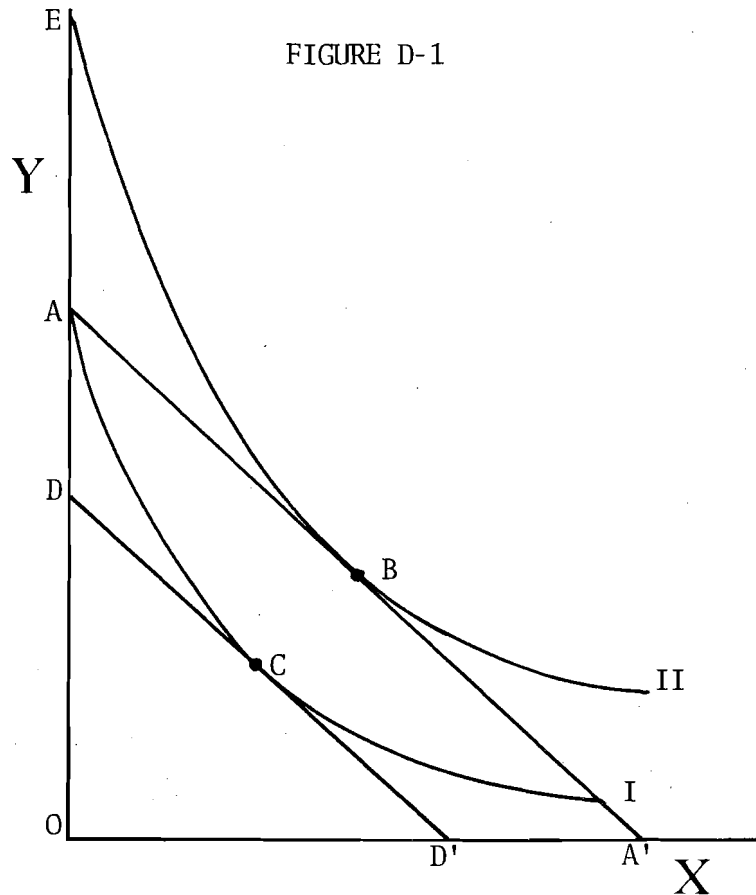
Consider the development of a new site (good X). The indi-
vidual at point A on indifference curve I before the site is
built consumes none of good X and amount OA of the composite
good I. If the site were to be built, and were made avail-
able to this individual at a price such that the individual
could afford to consume any combination of goods on the budget
line AA', then the individual would choose to consume at
point B on indifference curve II, which represents the highest
utility level attainable.

For such a proposed beneficial change, the compensating
variation or net willingness to pay is the amount of income,

AD, that is the maximum the individual could give up and still be on or above his initial level of utility, I, at the new price level. The equivalent variation, or willingness to sell, is the amount of income, AE, required as compensation if the site were not built, such that he would be as well off (utility level II) as if it were built.

For a proposed detrimental change, consider an individual presently at point B on indifference curve II facing a price level such that he is on the budget line AA'. If the site is closed, he will have to consume at point A on the lower indifference curve I. The equivalent variation is now AD, which is his maximum willingness to pay to ensure that the site is not closed. Amount AD is the maximum he could give up and still be as well off as if the site were in fact closed (utility level I). The compensating variation is now AE, which is his willingness to sell. This is the compensation required to keep the individual at his initial level of utility (level II) following the detrimental change. It can be observed that the difference between net willingness to pay and willingness to sell will not be large if distance AE is not much larger than AD. This difference will depend on the curvature of the indifference curves.

APPENDIX E
DISSENTING STATEMENT

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I find I must dissent, in part, from the recommendations of the report, "Guidelines for Valuation of Water-Based Recreation."* I cannot agree with the report's conclusion that the unit day value system is without merit and should be abandoned. I believe that it has an important role to play, even if it is applied only in special circumstances where professionals judge that the intrinsic quality of the resource deserves consideration in the evaluation. I feel that the task force which prepared the report had an obligation to explore ways to improve the unit day value system as well as the other evaluation methods which are reviewed.

In my judgment, the unit day value system was developed to give the natural resources agencies a way to express their professional judgment about the relative value of recreation resources. Many agencies recognized that the values of wild and scenic rivers, for example, or of natural lakes, were greater than the values of reservoirs behind dams, regardless of the numbers of people who visit them or the distance the visitors travel. Measures which rely solely upon numbers of visitors or upon the distance potential visitors live from a recreation resource fail to cope with this concern about the intrinsic worth of the resource.

The Water Resources Council agreed that this dimension needed formal expression in some fashion and approved the unit day value system as an interim measure. It recognized that

*In his remarks which were printed exactly as received, Dr. Ogden is referring to the recommendations contained in this report. He has, however, referred to the report by the title of an earlier draft.

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this is a *legislated* range of values, which the agencies
believe is tolerable given the values which can be ascribed to
other uses of water resources for which a market price can be
determined by empirical research. The Congress apparently
agreed with the Council, for it has accepted the unit day
value system as a legitimate means to express the value of
water based recreation.

The unit day value system, then, is not a substitute for
the travel cost method and does not attempt to measure the
same thing. In most man-made project studies, the travel cost
method clearly is the appropriate analysis tool, because the
measure of worth is comparative volume of use times willingness
to pay.

The appropriate posture for the task force, in my judgment,
should have been to recommend the travel cost method as the
preferred process for most ordinary projects, to suggest the
survey method as a suitable alternative in many instances
where travel costs are not a good surrogate, and to have urged
restriction of the unit day value system to those special
cases where intrinsic values were clearly important, as, for
example, in the case of the Salmon River.

The Task Force is therefore unfair in treating the unit day
value method as though it is simply another way to measure
willingness to pay. The criticisms are based on a false
assumption about the nature and purpose of the system.

The unit day value system merited separate analysis, strict
definition of its appropriate application, and recommendations
for improved procedures. I tried very hard to get the Task
Force to do just that but failed. I therefore must dissent
from the report.

LITERATURE CITED

Anderson, F. J., and Bonsor, N. C. "Allocation, Congestion and the Valuation of Recreational Resources." *Land Economics* 50(February 1974):51-57.

Anderson, R. W. "Estimating the Recreation Benefit from Large Inland Reservoirs." In *Recreational Economics and Analysis,* pp. 75-88. Edited by G. A. C. Searle. Thetford, Norfolk, England: Lowe and Brydone, 1975.

Arthur D. Little, Inc. *Final Report: Research on Water Resources Evaluation Methodology.* Prepared for the Office of Water Resource and Technology, U. S. Department of the Interior, Washington, D. C., March 1975.

Baron, M., and Shechter, M. "Simultaneous Determination of Visits to a System of Outdoor Recreation Parks with Capacity Limitations." *Regional and Urban Economics* 3(November 1973):327-359.

Beardsley, W. G. "Bias and Noncomparability in Recreation Evaluation Models." *Land Economics* 46(May 1971):175-180.

Beazley, R. I. "Some Considerations for Optimizing Public Forest Recreation and Value." *Journal of Forestry* 59(September 1961):644-650.

Bechter, D. M. "Congested Parks, A Pricing Dilemma." *Federal Reserve Bank of Kansas, Monthly Review,* June 1971, pp. 3-11.

Becker, G. S. "A Theory of the Allocation of Time." *Economic Journal* 75(September 1965):493-517.

Berry, D. *Open Space Values: A Household Survey of Two Philadelphia Parks.* Regional Science Research Institute Discussion Paper Series No. 76, October 1974.

Bohm, P. "An Approach to the Problem of Estimating the Demand for Public Goods." *Swedish Journal of Economics* 73(March 1971):55-56.

_____ "Estimating Demand for Public Goods: an Experiment." *European Economic Review* 3(2, 1972):111-30.

Boyet, W. E., and Tolley, G. S. "Recreation Projections Based on Demand Analysis." *Journal of Farm Economics* 48 (November 1966):984-1001.

Brink, C. H. *A Comparison of Consumer's Surplus and Monopoly Revenue Estimates of Recreational Values for Two Utah Waterfowl Marshes.* Logan, Utah: Utah State University, June 29, 1973.

Brown, G. M. "Pricing Seasonal Recreational Services." *Western Economic Journal* 9(June 1971):218-225.

Brown, G. M., and Johnson, B. M. "Welfare-Maximizing Price and Output with Stochastic Demand: Reply." *American Economic Review* 63(March 1973):230-231.

Brown, R. E., and Hansen, W. J. "A Generalized Recreation Day Use Planning Model." In *Plan Formulation and Evaluation Studies—Recreation*, Vol. V. Fort Belvoir, Va.: U. S. Army Engineer Institute for Water Resources, June 1974.

_____ "A Preliminary Analysis of Day Use Recreation and Benefit Estimation Models for Selected Reservoirs." In *Plan Formulation and Evaluation Studies—Recreation*, Vol. III. Fort Belvoir, Va.: U. S. Army Engineer Institute for Water Resources, June 1974.

Brown, W. G. and Nawas, F. "Impact of Aggregation on the Estimation of Outdoor Recreation Demand Functions." *American Journal of Agricultural Economics* 55(May 1973): 246-249.

Brown, W. G., Singh, A., and Castle, E. N. "An Economic Evaluation of the Oregon Salmon and Steelhead Sport Fishery." *Oregon Agr. Exp. Sta. Tech. Bull. 78*, September 1964.

Buchanan, J. M. *The Demand and Supply of Public Goods*. Chicago: Rand McNally, 1968.

Burns, M. E. "A Note on the Concept and Measure of Consumer's Surplus." *The American Economic Review* 63(June 1973): 335-344.

Burt, O. D., and Brewer, D. "Evaluation of Net Social Benefits from Outdoor Recreation." *Econometrica* 39(September 1971):813-827.

_____ "Evaluation of Recreational Benefits Associated with the Pattonsburg Dam Reservoir." Prepared under a contract between O. R. Burt and the University of Missouri, Office of Industrial Development Studies, June 1, 1974.

Carson, W. D., Jr. *An Investigation of the Determinants of Reservoir Recreation Use and Demand: The Effect of Water Surface Elevation*. Davis, Calif.: Research Note No. 2. Engineers, U. S. Army, November 1972.

Caulfield, H. P., Jr., Steele, H. A., and Johnson, S. H. III, eds. *Manual for Training in the Application of the Principles and Standards of the Water Resources Council*. Fort Collins: Environmental Resources Center, Colorado State University, December 1974.

Castle, E. N., and Stoevener, H. H. "Water Resources Allocation, Extramarket Values, and Market Criteria: A Suggested Approach." *Natural Resources Journal* 10(July 1970):532-544.

Cesario, F. J. "Operations Research in Outdoor Recreation." *Journal of Leisure Research* 1(Winter 1969):33-51.

_____ "A Generalized Trip Distribution Model." *Journal of Regional Science* 13(August 1973):233-248.

Cesario, F. J. "More on the Generalized Trip Distribution Model." *Journal of Regional Science* 14(December 1974):389-397.

_____ "A New Method for Analyzing Outdoor Recreation Trip Data." *Journal of Leisure Research* 7(Summer 1975):200-215.

_____ "A Simulation Approach to Outdoor Recreation Planning." *Journal of Leisure Research* 7(Winter 1975):38-52.

_____ "Value of Time in Recreation Benefit Studies." *Land Economics* 52(February 1976):32-41.

Cesario, F. J., and Knetsch, J. L. "Time Bias in Recreation Benefit Estimates." *Water Resources Research* 6(June 1970): 700-704.

_____ "A Recreation Site Demand and Benefit Estimation Model." *Regional Studies* 10(March 1976):97-104.

Cheung, H. K. "A Day Use Park Visitation Model." *Journal of Leisure Research* 4(Spring 1972):139-156.

Cicchetti, C. J. "A Multivariate Statistical Analysis of Wilderness Users in the United States." In *Natural Environments: Studies in Theoretical and Applied Analysis*. Edited by J. V. Krutilla. Baltimore: Johns Hopkins University Press, 1972.

_____ "A Review of the Empirical Analyses That Have Been Based Upon the National Recreation Surveys." *Journal of Leisure Research* 4(Spring 1972):90-107.

_____ *Forecasting Recreation in the United States.* Lexington, Mass.: D. C. Heath, 1973.

Cicchetti, C. J., Fisher, A. C., and Smith, V. K. "Economic Models and Planning Outdoor Recreation." *Operations Research* 21(September 1973):1104-1113.

_____ "An Econometric Evaluation of A Generalized Consumer Surplus Measure: The Mineral King Controversy." *Econometrica* 44(November 1976):1259-1276.

Cicchetti, C. J., Seneca, J. J., and Davidson, P. *The Demand and Supply of Outdoor Recreation.* New Brunswick, N. J.: Rutgers—The State University, Bureau of Economic Research, 1969.

Cicchetti, C. J., and Smith, V. K. "Congestion, Quality Deterioration, and Optimal Use: Wilderness Recreation in the Spanish Peaks Primitive Area." *Social Science Research* 2(March 1973):15-30.

_____ *The Cost of Congestion: An Econometric Analysis of Wilderness Recreation.* Cambridge, Mass.: Ballinger Publishing, 1976.

Cicchetti, C. J., Smith, V. K., Knetsch, J. L., and Patton, R. A. "Recreation Benefit Estimation and Forecasting: Implications of the Identification Problem." *Water Resources Research* 8(August 1972):840-850.

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Cicchetti, C. J., Smith, V. K., Knetsch, J. L., and Patton,
R. A. "The Measurement Costs: An Economic Application to
Wilderness Recreation." In *Theory and Measurement of
Economic Externalities*, pp. 183-199. Edited by S. A. Y.
Lin. New York: Academic Press, 1976.

Clawson, M. *Methods of Measuring the Demand for and Value of
Outdoor Recreation*. Washington: Resources for the Future.
1959. Reprint ed., No. 10.

Clawson, M., and Knetsch, J. L. "Outdoor Recreation Research:
Some Concepts and Suggested Areas of Study." *Natural Re-
sources Journal* 3(October 1963):250-275.

_____ *Economics of Outdoor Recreation*. Baltimore: The
Johns Hopkins University, 1966.

Common, M. S. "A Note on the Use of the Clawson Method for
the Evaluation of Recreation Site Benefits." *Regional
Studies* 7(December 1973):401-406.

Couch, J. D. "Recreation with Neoclassical Economics." In
Recreational Economics and Analysis, pp. 1-14. Edited by
G. A. C. Searle. Thetford, Norfolk, England: Lowe and
Brydone, 1975.

Crutchfield, J. A. "Valuation of Fishery Resources." *Land
Economics* 48(May 1972):145-154.

Currie, J. M., Murphy, J. A., and Schmitz, A. "The Concept of
Economic Surplus and Its Use in Economic Analysis."
Economic Journal 81(December 1971):741-799.

Darling, A. H. "Measuring the Benefits Generated by Urban
Water Parks." *Land Economics* 49(February 1973):327-338.

David M. Dornbusch and Co., Inc. *A Generic Methodology to
Forecast Benefits from Urban Water Resource Improvement
Projects*. Prepared for the Office of Water Research and
Technology, U. S. Dept. of the Interior, November 1, 1974.

Davis, R. K. "The Value of Outdoor Recreation: An Economic
Study of the Maine Woods." Ph.D. diss., Harvard University,
1963.

_____ "The Value of Big Game Hunting in a Private Forest."
Transactions of the Twenty-Nineth North American Wildlife
and Natural Resources Conference. Washington, D. C.: Wild-
life Management Institute, 1964.

DeSerpa, A. C. "A Theory of the Economics of Time." *Economic
Journal* 81(December 1971):828-846.

_____ "Comment—Microeconomic Theory and the Valuation of
Travel Time: Some Clarification." *Regional and Urban
Economics* 2(February 1973):401-410.

Devine, E. J. "The Treatment of Incommensurables in Cost-
Benefit Analysis." *Land Economics* 42(August 1966):383-387.

Dorfman, R., and Dorfman, N. S., eds. *Economics of the Environment: Selected Readings.* New York: W. W. Norton, Inc. 1972.

Driver, B. L., ed. *Recreation Planning.* Ann Arbor, Mich.: University Microfilms, 1970.

Due, J. F., and Friedlander, A. *Government Finance: Economics of the Public Sector.* 5th ed. Homewood, Ill.: R. D. Irwin, 1973.

Dupuit, J. "On the Measure of the Utility of Public Works." *International Economic Papers* 2(1952):83-110.

Fischer, D. W., Lewis, J. E., and Priddle, G. B., eds. *Land and Leisure: Concepts and Methods in Outdoor Recreation.* Chicago: Maaroufa Press, 1974.

Fisher, A. C., and Krutilla, J. V. "Determination of Optimal Capacity of Resource-Based Recreation Facilities." In *Natural Environments: Studies in Theoretical and Applied Analysis.* Edited by J. V. Krutilla. Baltimore: Johns Hopkins University Press, 1972.

Freeman, A. M. "Spatial Equilibrium, the Theory of Rents, and the Measurement of Benefits from Public Projects: A Comment." *Quarterly Journal of Economics* 89(August 1975):470-473.

Frey, J. C., and Gamble, H. B. "Policy Issues and Problems in Outdoor Recreation." *Journal of Farm Economics* 49 (December 1967):1307-1317.

Gardner, B. D. "Discussion: Analytical Issues in Demand Analysis for Outdoor Recreation." *Journal of Farm Economics* 49(December 1967):1304-1306.

Gearing, C., Swart, W. W., and Var, T. *Planning for Tourism Development: Quantitative Approaches.* New York: Praeger Publishers, 1976.

Gibbs, K. C. *A Measure of Outdoor Recreational Usage.* Gainesville, Fla.: Economic Report 52, Food and Resource Economics Dept., Agricultural Experiment Station, Institute of Food and Agricultural Sciences, University of Florida, August 1973.

_____ "Evaluation of Outdoor Recreational Resources: A Note." *Land Economics* 50(August 1974):309-311.

_____ *The Economics of Water-Oriented Recreation in the Kissimmee River Basin.* Gainesville, Fla.: Technical Bulletin 769, Agricultural Experiment Stations, Institute of Food and Agricultural Sciences, University of Florida, May 1975.

Gibbs, K. C., and McGuire, J. F., III. *Estimation of Outdoor Recreation Values.* Gainesville, Fla.: Economic Report 53, Food and Resource Economics Dept., Agricultural Experiment Station, Institute of Food and Agricultural Science, University of Florida, July 1973.

Gibson, J. G. and Anderson, R. W. "The Estimation of Con-
    sumer's Surplus from a Recreational Facility with Optimal
    Tariffs." *Applied Economics* 7(March 1975):73-79.

Golden, K. D. "Recreation Parks and Beaches, Peak Demand,
    Quality, and Management." *Journal of Leisure Research*
    3(Spring 1971):81-87.

Gosse, L. E. H. "The Demand for Outdoor Recreation." Ph.D.
    diss., Cornell University, 1970.

Grubb, H., and Goodwin, J. *Economic Evaluation of Water
    Oriented Recreation in the Preliminary Texas Water Plan.*
    Austin, Tex.: Report No. 84, Texas Water Development Board,
    1968.

Gum, R., and Martin, W. E. "Problems and Solutions in Esti-
    mating the Demand for and Value of Rural Outdoor Recre-
    ation." *American Journal of Agricultural Economics*
    57(November 1975):558-566.

Hammack, J. *Toward an Economic Evaluation of a Fugitive
    Recreational Resource: Waterfowl.* Ph.D. diss., University
    of Washington, Seattle, 1969.

Hammack, J. and Brown, G. M. *Waterfowl and Wetlands: Toward
    Bioeconomic Analysis.* Baltimore: The Johns Hopkins Univer-
    sity Press, 1974.

Haney, D. G. *The Value of Time for Passenger Cars.* Palo Alto,
    Calif.: Stanford Research Institute, 1967.

Harberger, A. C. "Three Basic Postulates for Applied Welfare
    Economics: An Interpretive Essay." *Journal of Economic
    Literature* 9(September 1971):785-797.

Harrison, A. J. *The Economics of Transport Appraisal.* New
    York: Wiley, 1974.

Hastings, V. S., and Tolley, G. S. "Quality of the Recre-
    ational Experience—Estimations of Its Benefits." In *Esti-
    mation of First Round and Selected Subsequent Income Effects
    of Water Resource Development.* By Tolley et al. IWR Report
    70-1 Army Corps of Engineer, Ch. 2, 1966.

Hause, J. C. "The Theory of Welfare Cost Measurement."
    Journal of Political Economy 83(December 1975):1145-1183.

Haveman, R. H., and Márgolis, J., eds. *Public Expenditures and
    Policy Analysis.* Chicago: Markham Publishing, 1970.

Haverman, R. "Common Property, Congestion, and Environmental
    Pollution." *Quarterly Journal of Economics* 86(May 1973):
    278-287.

Hecock, R. D. "Recreation Behavior Patterns as Related to
    Site Characteristics of Beaches." *Journal of Leisure Re-
    search* 2(Autumn 1970):333-341.

Henderson, A. "Consumer's Surplus and the Compensation Varia-
    tion." *Review of Economic Studies* (February 1941):117-121.

Henderson, J. M., and Quandt, R. E. *Microeconomic Theory: A Mathematical Approach*. 2nd ed. New York: McGraw-Hill, 1971.

Hendon, W. S. "Property Values, School, and Park-School Combinations." *Land Economics* 49(May 1973):216-218.

Hicks, J. R. "The Four Consumer's Surpluses." *The Review of Economic Studies* 11(Winter 1943):31-41.

_____ *Value and Capital*. 2nd ed. Oxford: Clarendon Press, 1947.

_____ *A Revision of Demand Theory*. Oxford: Clarendon Press, 1956.

Higgins, M. D. "Concepts of Value for Market Price and Non-Market Resources." Department of Forestry, Purdue University, 1974. (Mimeographed).

Hinote, H. *The Evolution of Methods Used in Evaluating Recreational Benefits of Multiple Purpose Water Resource Projects*. Knoxville, Tenn.: Navigation Economics Branch, Division of Navigation Development, TVA, August 1967.

Horvath, J. C. *Detailed Analysis: Survey of Wildlife Recreation*. Atlanta, Ga.: Georgia State University, March 1974.

_____ "Economic Survey of Southeastern Wildlife and Wildlife-Oriented Recreation." In *Thirty-Ninth Annual Wildlife Conference: 39*, pp. 187-194, Wildlife Management Institute, 1974.

Hotelling, H. "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates." *Econometrica* 6(July 1938):242-269.

Howe, C. W. *Benefit-Cost Analysis for Water System Planning*. American Geophysical Union, Water Resources Monograph 2, 1971.

Idaho Cooperative Fishery Unit. *Sport Fishery Economics, Final Report to the National Marine Fisheries Service on Workshops on Fishery Economics at Moscow, Idaho and Madison, Wisc. Cont. No. N208-0350-72*. Moscow, Idaho: University of Idaho, March 1, 1973.

Isard, W. *Ecologic-Economics Analysis for Regional Development*. New York: Free Press, 1972.

James, L. D., and Lee, R. R. *Economics of Water Resources Planning*. New York: McGraw Hill, 1971.

Jennings, T. A. "A General Methodology for Analyzing Demand for Outdoor Recreation with an Application to Camping in Florida State Parks." Ph.D. diss., University of Florida, 1975.

Johnson, M. B. "Travel Time and the Price of Leisure." *Western Economic Journal* 4(Spring 1966):135-145.

Johnston, J. *Econometric Methods.* 2nd ed. New York: McGraw Hill, 1972.

Kalter, R. J. *The Economics of Water Based Outdoor Recreation: A Survey and Critique of Recent Developments.* IWR Report 71-8, Dept. of the Army, Corps of Engineers, March 1971.

Kalter, R. J., and Gosse, L. E. *Outdoor Recreation in New York State; Projections of Demand, Economic Values and Pricing Effects for the Period 1970-85.* Special Cornell Series, no. 5. Ithaca: New York State College of Agriculture, 1969.

_____ "Recreation Demand Functions and the Identification Problem." *Journal of Leisure Research* 2(Winter 1970):43-53.

Katzner, D. W. *Static Demand Theory.* New York: Macmillan, 1970.

Keith, J. E., and Workman, J. P. "Opportunity Cost of Time in Demand Estimates for Nonmarket Resources." *Journal of Leisure Research* 7(Spring 1975):121-127.

Kitchen, J. W., and Hendon, W. S. "Land Values Adjacent to an Urban Neighborhood Park." *Land Economics* 43(August 1967): 557-560.

Kneese, A. V. and Smith, S. C., eds. *Water Research.* Baltimore: The Johns Hopkins Press, 1966.

Knetsch, J. L. "Influence of Reservoir Projects on Land Values." Ph.D. diss., Harvard University, 1963.

_____ "Outdoor Recreation Demands and Benefits." *Land Economics* 39(November 1963):387-396.

_____ "Economics of Including Recreation as a Purpose of Eastern Water Projects." *Journal of Farm Economics* 46(December 1964):1148-1157.

_____ "The Influence of Reservoir Projects on Land Values." *Journal of Farm Economics* 46(February 1964):231-243.

_____ "Assessing the Demand for Outdoor Recreation." *Journal of Leisure Research* 1(Winter 1969):85-88.

_____ "Federal Natural Resources Development: Basic Issues in Benefit and Cost Measurement." Prepared testimony in *Guidelines for Estimating Benefits of Public Expenditures.* Washington, D. C.: U. S. Government Printing Office, 1969.

_____ "Value Comparisons in Free-Flowing Stream Development." *Natural Resources Journal* 11(October 1971):624-635.

_____ "Outdoor Recreation and Water Resources Planning. *Water Resources Monograph No. 3.* Washington: American Geophysical Union, 1974.

_____ "Displaced Facilities and Benefit Calculations." *Land Economics* 53(February 1977):123-129.

Knetsch, J. L., Brown, R. E. and Hansen, W. J. "Estimating Expected Use and Value of Recreation Sites." In *Planning for Tourism Development, Quantitative Approaches*. Edited by C. Gearing, W. Swart, and T. Var. New York: Praeger Publishers, 1976.

Knetsch, J. L., and Cesario, F. J. "Some Problems in Estimating the Demand for Outdoor Recreation: Comment." *American Journal of Agricultural Economics* 58(August 1976):596-597.

Knetsch, J. L., and Davis, R. K. "Comparisons of Methods for Recreation Evaluation." In *Water Research*, pp. 125-142. Edited by Kneese and Smith. Baltimore: The Johns Hopkins University Press, 1966.

Krutilla, J. V., and Cicchetti, C. J. "Evaluating Benefits of Environmental Resources with Special Application to the Hells Canyon." *Natural Resources Journal* 12(January 1972): 1-29.

Krutilla, J. V., and Fisher, A. C. *The Economics of Natural Environments*. Baltimore: The Johns Hopkins University Press, 1975.

Lancaster, K. J. "A New Approach to Consumer Theory." *Journal of Political Economy* 74(April 1966):132-157.

Lerner, L. J. "Quantitative Indices of Recreational Values." In *Water Resources and Economic Development of the West*, Report No. 11. Western Agricultural Economics Research Council, 1962.

Lessinger, J. "Measurement of Recreational Benefits: A Reply." *Land Economics* 34(November 1958):369-370.

Leuthold, J. H. "The Optimal Congestion Charge When Equity Matters." *Economica* 43(February 1976):77-82.

Levenson, A. J. *Evaluation of Recreational and Cultural Benefits of Estuarine Use in an Urban Setting*. Hempstead, N.Y.: Hofstra University Center for Business and Urban Research, August 1971.

Lime, D. W., and Stankey, G. M. "Carrying Capacity: Maintaining Outdoor Recreation Quality." In *Recreation: Symposium Proceedings*. U. S. Forest Service, Northeast Forest Experiment Station. Upper Darby, Pa.: U. S. Department of Agriculture, 1971.

Lind, R. C. "Spatial Equilibrium, the Theory of Rents, and the Measurement of Benefits from Public Projects." *Quarterly Journal of Economics* 87(May 1973):188-207.

_____ "Reply to Comments by A. M. Freeman on 'Spatial Equilibrium, the Theory of Rents and the Measure of Benefits from Public Projects.'" *Quarterly Journal of Economics* 89(August 1975):474-476.

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Little, I. M. D. *A Critique of Welfare Economics*. Oxford: Oxford University Press, 1957.

Louis Berger, Incorporated. *Methodology to Evaluate Socio-Economic Benefits of Urban Water Resources*. Prepared for the Office of Water Resources Research, U. S. Department of the Interior, June 1971.

Lucas, R. C. *User Evaluation of Campgrounds on Two Michigan National Forests*. USDA Forest Service Res. Pap. NC-44. St. Paul, Minn.: N. Cent. Forest Expt. Sta., 1970.

McClellan, K., and Medrich, E. "Outdoor Recreation: Economic Consideration for Optimal Site Selection and Development." *Land Economics* 45(May 1965):174-182.

McConnell, K. E. "Some Problems in Estimating the Demand for Outdoor Recreation." *American Journal of Agricultural Economics* 57(May 1975):330-334.

_____ "Congestion and Willingness to Pay: A Study of Beach Use." Unpublished Manuscript. February 1976.

_____ "Some Problems in Estimating the Demand for Outdoor Recreation: Reply." *American Journal of Agricultural Economics* 58(August 1976):598-599.

McConnell, K. E., and Duff, V. A. "Estimating Net Benefits of Recreation Under Conditions of Excess Demand." *Journal of Environmental Economics and Management* 2(February 1976): 224-230.

Mack, R. P., and Meyers, S. "Outdoor Recreation." In *Measuring Benefits of Government Investments*, pp. 71-116. Edited by R. Dorfman. Washington, D. C.: The Brookings Institute, 1965.

Mahoney, J. "An Economic Evaluation of California's Sport Fisheries." *California Fish and Game* 46(April 1960):199-209.

Mansfield, N. W. "Recreational Trip Generation." *Journal of Transport Economics and Policy* 3(May 1969):152-164.

_____ "The Estimation of Benefits from Recreation Sites and the Provision of a New Recreation Facility." *Regional Studies* 5(July 1971):55-69.

Marshall, A. *Principles of Economics*. 9th ed. New York: Macmillan, 1961.

Martin, W. E., Gum, R. L., and Smith, A. *The Demand for and Value of Hunting, Fishing and General Rural Outdoor Recreation in Arizona*. Tuscon, Arizona: Agricultural Experiment Station, University of Arizona, June 1974.

Meade, J. E. Review of "Cost-Benefit Analysis," by Mishan. *Economic Journal* 82(March 1972):244-246.

Merewitz, L. "Recreational Benefits of Water Resources Development." *Water Resources Research* 2 (August 1966):625-640.

Miklius, W., Anderson, R. N., and Leuzzi, L. N. "Application of the Cost-Effectiveness Analysis to Selection of Urban Recreation Projects." Draft, University of Hawaii, 1976.

Milan, R. L., and Pasour, E. C., Jr. "Estimating the Demand for an On-Farm Recreational Service." *American Journal of Agricultural Economics* 52 (February 1970):127-131.

Miller, J. R. "On the Use of Unit Day Values in Evaluation of Site-Specific, Water-Based Recreation Benefits." Paper presented at the 46th Annual Conference of the Southern Economic Association, Atlanta, Ga. November 18, 1976.

Milstein, D. N. "Prospective Research Contributions of Economics to Outdoor Recreation," pp. 81-93. In *Outdoor Recreation in the Upper Great Lakes Area*. Proceedings of a seminar in research needs, USDA Forest Service. St. Paul, Minn.: Lake States Forest Experimental Station, Paper 89.

Mishan, E. J. *Cost-Benefit Analysis: An Introduction*. New York: Praeger, 1971.

_____ "The Postwar Literature on Externalities." *Journal of Economic Literature* 9 (March 1971):1-28.

_____ "Flexibility and Consistency in Project Evaluation." *Economica* 41 (February 1974):81-96.

_____ "Welfare Criteria: Resolution of the Paradox." *Economic Journal* 83 (September 1973):747-767.

_____ "Welfare Validity of the Demand for Recreation." In *Recreational Economics and Analysis*, pp. 53-61. Edited by G. A. C. Searle. Thetford, Norfolk, England: Lowe and Brydone, 1975.

_____ "The Use of Compensating and Equivalent Variations in Cost-Benefit Analysis." *Economica* 43 (May 1976):185-197.

Mohring, H. "Urban Highway Investments." In *Measuring Benefits in Government Investments*, pp. 231-291. Edited by R. Dorfman. Washington, D. C.: The Brookings Institute, 1965.

_____ "Alternative Welfare Gain and Loss Measures." *Western Economic Review* (1971):349-368.

Moncur, J. E. T. "Estimating the Value of Alternative Outdoor Recreation Facilities Within a Small Area." *Journal of Leisure Research* 7 (Autumn 1975):301-311.

Mumy, G. E., and Hanke, S. H. "Public Investment Criteria for Underpriced Public Products." *American Economic Review* 65 (September 1975):712-720.

Nautiyal, J. C., and Chowdhary, R. L. "A Suggested Basis for Pricing Campsites: Demand Estimation in an Ontario Park." *Journal of Leisure Research* 7(Spring 1975):95-107.

Nelson, J. R. "The Value of Travel Time." In *Problems in Public Expenditure Analysis*, pp. 78-126. Edited by S. B. Chase, Jr. Washington, D. C.: The Brookings Institute, 1968.

Newberry, D. M. G. "Congestion and Over-Exploitation of Free Access Resources." *Economica* 42(August 1975):243-260.

Nichols, D., Smolensky, E., and Tideman, T. N. "Discrimination by Waiting Time in Merit Goods." *American Economic Review* 61(June 1971):312-323.

Nicholson, J. L. "The Measurement of Quality Changes." *The Economic Journal* 77(September 1967):512-527.

Norton, G. A. "Public Outdoor Recreation and Resource Allocation: A Welfare Approach." *Land Economics* 46(November 1970):414-422.

Norton, V. J. "Discussion: Policy Issues and Problems in Outdoor Recreation." *Journal of Farm Economics* 49(December 1967):1317-1320.

Oakland, W. H. "Congestion, Public Goods and Welfare." *Journal of Public Economy* 1(November 1972):339-357.

O'Riordan, T. "An Analysis of the Use and Management of Campgrounds in British Columbia Provincial Park." *Economic Geography* (October 1973):298-308.

Pankey, V. S., and Johnston, W. E. *Analysis of Recreational Use of Selected Reservoirs in California.* Plan Formulation and Evaluation Studies—Recreation, Contract Report No. 1. Sacramento, Calif.: U. S. Army Engineer Dist., May 1969.

Pearce, J. W. "The Demand for the Value of the Sport Fishery on the AuSable, Jordon, and Red Cedar Rivers." Supplement to *An Ecological Evaluation of Stream Eutrophication.* Edited by L. W. Moncrief. OWRR Project C-3381, August 1972.

Pearse, P. H. "A New Approach to the Evaluation of Non-Priced Recreational Resources." *Land Economics* 44(February 1968): 87-99.

Pelgen, D. E. "Economic Values of Striped Bass, Salmon, and Steelhead Fishing in California." *California Fish and Game* 41(January 1955):5-17.

Pendse, D., and Wyckoff, J. B. "Scope for Valuation of Environmental Goods." *Land Economics* 50(February 1974):89-92.

Peterson, G. L., and Newmann, E. S. "Modeling and Predicting Human Response to the Visual Recreation Environment." *Journal of Leisure Research* 1(Summer 1969):219-236.

Prest, A. R., and Turvey, R. "Cost Benefit Analysis: A Survey." *Economic Journal* 75(December 1965):683-735.

Prewitt, R. A. *An Economic Study of the Monetary Evaluation of Recreation in the National Parks.* U. S. Department of the Interior, National Park Service, 1949.

Robinson, W. C. "The Simple Economics of Public Outdoor Recreation." *Land Economics* 43(February 1967):71-83.

Romm, J. *The Value of Reservoir Recreation.* Technical Report No. 19, A. E. Res. 296. Ithaca, New York: Cornell University Water Resources and Marine Science Center, August 1969.

Rothenberg, J. Review of "Land Market Equilibrium and the Measurement of Benefits from Urban Parks," by R. Lind. In *Proceedings of the Second Research Conference* of the Inter-University Commitee on Urban Economics. 1970.

_____ "The Economics of Congestion and Pollution: An Integrated View." *American Economic Review* 60(May 1970):114-121.

Samuelson, P. A. "The Pure Theory of Public Expenditure." *Review of Economics and Statistics* 36(November 1954):387-389.

_____ *Foundations of Economic Analysis.* Harvard, 1947.

Scott, A. "The Valuation of Game Resources: Some Theoretical Aspects." *Canadian Fisheries Reports* 4(May 1965):27-47.

Seckler, D. W. "On the Uses and Abuses of Economic Science in Evaluating Public Outdoor Recreation." *Land Economics* 42 (November 1966):485-494.

_____ "Analytical Issues in Demand Analysis for Outdoor Recreation: Comment." *American Journal of Agricultural Economics* 50(February 1968):147-151.

Seneca, J. "A Generalized Approach to Estimating Recreation Benefits." Ph.D. diss., University of Pennsylvania, 1968.

_____ "Water Recreation, Demand and Supply." *Water Resources Research* 5(December 1969):1179-1185.

Seneca, J., and Cicchetti, C. J. "User Response in Outdoor Recreation: A Production Analysis." *Journal of Leisure Research* 1(Winter 1969):238-245.

Seneca, J., Davidson, P., and Adams, F. G. "An Analysis of Recreation Use of the TVA Lakes." *Land Economics* 44 (November 1968):529-534.

Seneca, J., and Davis, R. K. "A Cross Section Analysis of State Recreation Activity." *Journal of Leisure Research* 8 (Spring 1976):88-97.

Shafer, E. L., Jr., Hamilton, J. F., and Schmidt, E. A. "National Landscape Preferences: A Predictive Model." *Journal of Leisure Research* 1(Winter 1969):1-19.

214

Shafer, E. L., Jr., and Mietz, J. "Aesthetics and Emotional Experiences Rate High with Northeast Hiker." *Environment and Behavior* 1(June 1969):187-189.

Shafer, E. L., Jr., and Moeller, G. "Predicting Quantitative and Qualitative Values of Recreation Participation." In *Recreation: Symposium Proceedings, Northeastern Forest Experiment Station*, pp. 16-17. Upper Darby, Pa.: Forest Service, U. S. Department of Agriculture, 1971.

Sinden, J. A. *Utility Analysis in the Valuation of Extra-Market Benefits with Particular Reference to Water-Based Recreation*. Water Resources Institute, Oregon State Univ., and Water Resources Research Center, Univ. of Mass., March, 1973.

_____ "A Utility Approach to the Valuation of Recreational and Aesthetic Experiences." *American Journal of Agricultural Economics* 56(February 1974):61-72.

Slater, P. B. "Exploratory Analyses of Trip Distribution Data." *Journal of Regional Science* 14(December 1974):377-397.

Smith, V. K. "The Estimation and Use of Models of the Demand for Outdoor Recreation." In *Assessing Demand for Outdoor Recreation*, pp. 89-123. Washington: National Academy of Sciences, 1975.

_____ "Travel Cost Demand Models for Wilderness Recreation: A Problem of Non-Tested Hypotheses." *Land Economics* 51 (May 1975):103-111.

Smith, R. J., and Kavanagh, N. J. "The Measurement of Benefits of Trout Fishing: Preliminary Results of a Study of Grafham Water." *Journal of Leisure Research* 1(Autumn 1969):316-332.

_____ *The Evaluation of Recreation Benefits: Some Problems of the Clawson Method*. University of Birmingham: Faculty of Commerce and Social Science Discussion Paper, May 1970.

_____ *Measuring Recreation Benefits: The Clawson Method Applied to a Sailing Club*. University of Birmingham: Faculty of Commerce and Social Science Discussion Paper, June 1970.

_____ *Recreational Surveys: Some Comments and Results*. University of Birmingham: Faculty of Commerce and Social Science Discussion Paper, September 1970.

_____ "The Evaluation of Recreation Benefits: The Clawson Method in Practice." *Urban Studies* 8(June 1971):89-102.

_____ "Problems of Interpreting Recreation Benefits from a Recreation Demand Curve." In *Recreational Economics and Analysis*, pp. 62-74. Edited by G. A. C. Searle. Thetford, Norfolk, England: Lowe and Brydone, 1975.

Smith, V. K., and Krutilla, J. V. "A Simulation Model for the Management of Low Density Recreational Areas." *Journal of Environmental Economics and Management* 1(November 1974): 187-201.

_____ *The Structure and Properties of a Wilderness Travel Simulator an Application to the Spanish Peaks Area.* Baltimore: Johns Hopkins University Press, 1976.

Stankey, G. H. "A Strategy for the Definition and Management of Wilderness Quality." In *Natural Environments: Studies in Theoretical and Applied Analysis.* Edited by J. V. Krutilla. Baltimore, Johns Hopkins University Press, 1972.

Steiner, P. O. "The Role of Alternative Cost in Project Design and Selection." *Quarterly Journal of Economics* 79 (August 1965):417-430.

Stevens, J. B. "Recreation Benefits from Water Pollution Control." *Water Resources Research* 2(April 1966):167-181.

Stoevener, H. H., and Brown, W. G. "Analytical Issues in Demand Analysis for Outdoor Recreation." *Journal of Farm Economics* 49(December 1967):1295-1304.

Stoevener, H. H., and Sokoloski, A. A. "Estimation of the Magnitude and Distribution of Benefits from Recreational Resource Management in the Economy of a Small Area." Oregon State University. (Mimeographed). n.d.

Stroup, R. L., Copeland, M. D., and Rucker, R. R. *Estimation of Amenity Values as Opportunity Costs for Energy Related Water Use in Montana.* Report No. 81. Bozeman, Mont.: Montana University Joint Water Research Center, August 1976.

Sublette, W. J., and Martin, W. E. *Outdoor Recreation in the Salt-Verde Basin of Central Arizona: Demand and Value.* In Technical Bulletin 218. Tucson, Ariz.: Agricultural Experiment Station, University of Arizona, June 1975.

Surveys of the Use of Open Spaces, Vol. 1. London: Greater London Council Planning Dept., Sept. 1968.

Sydneysmith, S. "Economic Benefits and Market Areas for Outdoor Recreation: Some Theoretical Aspects." Ph.D. diss., Duke University, 1966.

Tadros, M. E., and Kalter, R. J. "A Spatial Allocation Model for Projected Outdoor Recreation Demand: A Case Study of the General Upstate New York Region." *Search* 1(January 1971):1-22.

Tapiero, C. S. "The Demand and Utilization of Recreational Facilities: A Probability Model." *Regional and Urban Economics* 4(October 1974):173-185.

Texas Technological College. *The Sociological and Economic Impact of Urban Parks in Dallas, Texas in 1966.* Lubbock, Texas: Dept. of Park Adm., 1967.

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Trice, A. H., and Wood, S. E. "Measurement of Recreation Benefits." *Land Economics* 34(August 1958):195-207.

Uhling, H. G., and Bohart, C. V. *An Analysis of Recreation Developments in PL-566 Watersheds.* NETSC, Soil Conservation Service, Broomall, Pa., and MWTSC Soil Conservation Service, Lincoln, Neb., July 1975.

Ullman, E. L. "Geographical Prediction and Theory: The Measure of Recreation Benefits in the Meramec Basin." In *Geography and the American Evnironment*, pp. 135-156. Edited by S. B. Cohen. Voice of America Forum Lectures, 1968.

Ullman, E. L., and Volk, D. J. "An Operational Model for Predicting Reservoir Attendance and Benefits." *Papers of the Michigan Academy of Science, Arts, and Letters* 47(1962): 473-484.

U. S. Army Engineer District. *Analysis of Supply and Demand of Urban Oriented Nonreservoir Recreation.* IWR Research Report 76-R2. Sacramento, Calif.: Submitted to the U. S. Army Eng. Institute for Water Resources, Fort Belvoir, Va., November 1976.

U. S. Congress, Senate. *Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources.* S. Doc. 97, 87th Cong., 2nd sess., May 29, 1962.

_____ "Supplement No. 1, Evaluation Standards for Primary Recreation Benefits." In *Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources*, S. Doc. 97, 87th Cong., 2nd Sess., May 29, 1962.

U. S. Department of the Army, Philadelphia District, Corps of Engineers. *Delaware Bay—Chesapeake Bay Waterway in Delaware, Maryland and Virginia* (Delmarva Waterway). General Design Memorandum, Phase I, 1976.

U. S. Department of Interior, Bureau of Outdoor Recreation. *Assessing Demand for Outdoor Recreation.* Washington, D. C.: U. S. Government Printing Office, 1975.

U. S. Department of Interior, National Park Service. "A Method of Evaluating Recreational Benefits for Water Control Projects." February 16, 1950. (Mimeographed)

U. S. Water Resources Council. *Procedures for Evaluation of Water and Related Land Resource Projects.* Report to the Water Resources Council by the Special Task Force. Washington, D. C. June 1969.

_____ *A Summary Analysis of Nineteen Tests of Proposed Evaluation Procedures on Selected Water and Land Resource Projects.* A report to the Water Resources Council by the Special Task Force, July, 1970.

_____ *Summary Analysis.* Summary and analysis of public
response to the proposed Principles and Standards for Plan-
ning Water and Related Land Resources and Draft Environ-
mental Statement. Washington, D. C., July 1972.

_____ "Water and Related Land Resources, Establishment of
Principles and Standards for Planning." *Federal Register*
38(10 September 1973):Part III, No. 174.

Van Doren, C. S. "An Interaction Travel Model for Projecting
Attendances of Campers at Michigan State Parks." Ph.D.
diss., Michigan State University, 1967.

Vaughan, R. J. *The Economics of Recreation: A Survey.*
September 1974. (Mimeographed)

Vickerman, R. W. "The Evaluation of Benefits from Recreational
Projects." *Urban Studies* 11(October 1974):277-288.

Visscher, M. L. "Welfare-Maximizing Price and Output with
Stochastic Demand: Comment." *American Economic Review* 63
(March 1973):224-229.

Volk, D. H., and O'Neill, A. *An Investigation of Factors
Affecting the Recreational Use of State Parks.* Technical
Report No. 27. College Park, Md.: University of Maryland,
Water Resources Research Center, December 1967.

Walsh, R. G. "Effects of Improved Research Methods on the
Value of Recreation Benefits." Paper presented at the
National Symposium on the Economics of Outdoor Recreation,
New Orleans, 1974 (proceedings to be published).

Watson, P. L. *The Value of Time: Behavioral Models Choice.*
Lexington, Mass.: D. C. Heath and Company, 1974.

Weicher, J. C., and Zerbst, R. H. "The Externalities of
Neighborhood Parks: An Empirical Investigation." *Land
Economics* 49(February 1973):99-105.

Weisbrod, B. A. "Income Redistribution Effects and Benefit
Cost Analysis." In *Problems in Public Expenditure Analysis,*
pp. 177-213. Edited by S. B. Chase, Jr. Washington, D. C.:
The Brookings Institute, 1968.

Wennergren, E. B. "Surrogate Pricing of Outdoor Recreation."
Land Economics 43(February 1967):112-116.

Wennergren, E. B., and Fullerton, H. H. "Estimating Quality
and Location Values of Recreational Resources." *Journal of
Leisure Research* 4(Summer 1972):170-183.

Wennergren, E. B., Fullerton, H. H., Keith, J. E., and Meale,R.
Economic Value of Water Oriented Recreation Quality. Utah
Water Research Laboratory, January 1975.

Wetzel, J. "A Distance Congestion Model for Evaluating Recre-
ation Resources." Ph.D. diss., University of North
Carolina, Chapel Hill, 1974.

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Whitbread, M. and Bird, H. "Rent, Surplus, and the Evaluation of Residential Environments." *Regional Studies* 7(August 1973):193-223.

Willig, R. D. *Consumer Surplus: A Rigorous Cookbook.* The Economic Series: Stanford University, Institute for Mathematical Studies in the Social Sciences, Technical Report No. 98, 1973.

_____ *Welfare Analysis of Policies Affecting Prices and Products.* Stanford University, Center for Research in Economic Growth: Memorandum No. 153, 1973.

_____ *Consumer's Surplus Without Apology.* Bell Laboratories Economics Discussion Paper #22, March 1975.

_____ "Consumer's Surplus Without Apology." *American Economic Review* 66(September 1976):589-597.

Wilson, R. R. "Demand Theory: Time Allocation and Outdoor Recreation." *Southern Journal of Agricultural Economics* 3(December 1971):103-108.

Wollmann, N. *et al.* *The Value of Water in Alternative Uses.* Albuquerque: The University of New Mexico Press, 1962.

Yoesting, D. R., and Beardsley, W. G. "Recreation Preferences, Use-Patterns and Value-Estimation." From *Land Use Planning Seminar: Focus On Iowa*, pp. 235-256. Edited by L. Whiting. Ames, Iowa: Center for Agricultural and Rural Development, Iowa State University. n.d.

Young, R. A., and Gray, S. L. *Economic Value of Water: Concepts and Empirical Estimates.* Final report to the National Water Commission. Arlington, Va.: March 1972.