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ANNOTATED BIBLIOGRAPHY FOR REGIONAL RECREATION DEMAND MODELS

by

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The US Water Resources Council recommended that regional models be developed for evaluation of recreation use and benefits for water resource projects of Federal agencies. This annotated bibliography was prepared as part of an initial effort in the development of a regional recreation demand model for use by US Army Engineer planning and operations personnel in evaluating the change in recreation visitation and benefits resulting from such agency actions as (a) loss of an existing recreation site, (b) development of a new recreation site, which may offer recreation opportunities that are similar or that are different from the existing recreation opportunities, or (c) change in recreation site characteristics, quality of recreation at a recreation area, or quantity of recreation resources in a region.

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PREFACE

This literature survey was conducted as a part of the US Army Corps of Engineers Natural Resources Research Program (NRRP). Funds for the study were provided by the Headquarters, US Army Corps of Engineers (HQUSACE), under Department of the Army Appropriation No. 96X3121, General Investigation. The NRRP is assigned to the US Army Engineer Waterways Experiment Station (WES) under the purview of the Environmental Laboratory (EL). The HQUSACE Technical Monitors for the NRRP were Ms. Judith Rice and Mr. Robert Daniel. Mr. J. Lewis Decell was Manager of the Environmental Resources Research and Assistance Programs (ERRAP) and Dr. Adolph J. Anderson was Assistant Manager, ERRAP, for the NRRP.

The literature search on which this survey is based was prepared by Dr. John R. Stoll, Mr. Lansingh S. Freeman, and Dr. John C. Bergstrom of Texas A&M University. Mr. Jim E. Henderson of WES monitored the literature search effort, summarized the literature documentation, and prepared the text for publication.

The study was performed under the general supervision of Dr. John Harrison, Chief, EL, and Dr. C. J. Kirby, Chief, Environmental Resources Division, and under the direct supervision of Mr. H. Roger Hamilton, Chief, Resource Analysis Group. This report was edited by Ms. Janean Shirley of the WES Information Technology Laboratory.

Commander and Director of WES during the preparation of this report was COL Larry B. Fulton, EN. Dr. Robert W. Whalin was Technical Director.

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CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
acres	4,046.873	square metres
cubic feet	0.02831685	cubic metres
feet	0.3048	metres
miles (US statute)	1.609347	kilometres

ANNOTATED BIBLIOGRAPHY FOR REGIONAL RECREATION DEMAND MODELS

PART I: INTRODUCTION

Background

1. The ability to predict demand for recreation resources is valuable in planning for the development or rehabilitation of Corps of Engineer projects. Similarly, the ability to evaluate the economic benefits derived from recreation enables better decisions to be made about the allocation and operation of natural resources. In providing guidance for evaluation of water resource projects, the US Water Resources Council (USWRC) recommended use of regional models for evaluation of recreation use and net benefits (USWRC 1979, 1983).

2. Choices that the public must make about recreation are made in the context of alternatives to satisfy their demand for recreation. Possible alternatives and substitutes for recreation are normally geographically proximate, and so choices are between resources that are at different places in a region with different recreation opportunities. That is, a regional analysis of recreation demand and recreation resources is required to make decisions about the need for new recreation facilities at a project or to evaluate benefits from changing the mix of recreation opportunities at an existing project.

3. The ability to determine regional recreation characteristics and to project visitation and determine benefits is dependent on development of a regional recreation demand model. The ability to determine demand and evaluate the willingness-to-pay (WTP) for recreation has greatly increased through research to establish reliable measures of use, methods to determine willingness-to-pay, and identification of the natural resource conditions that affect visitor satisfaction. Taking these procedures further to show how recreation demand would be allocated to one project rather than another requires development of a regional model.

4. Interest in development of a regional recreation demand model for Corps planning and operations use resulted in initiation of the annotated bibliography documented here in fiscal year (FY) 1987. That effort was limited to the literature search and compilation of the citations and

abstracts contained in Appendix A. In FY 89, a work unit was initiated to begin development of a regional recreation demand model for Corps use.

5. As a preliminary step to development of a model, the results of the literature search are summarized, along with selected recent publications. The summary of the literature contained in Appendix A will be used to evaluate the strengths and weaknesses in the methodologies and procedures required for development of a regional demand model.

Scope of the Study

6. The literature search identified relevant literature dealing with:

   a. Regional recreation modelling.

   b. Recreation use or participation procedures or models.

   c. Recreation benefits.

7. The computer services of the Texas A&M University library were used to perform a search of literature data bases from the social and natural sciences literature. The resulting citations and abstracts were assembled. For each abstract, a brief statement of the research question addressed or a statement summarizing the study was inserted at the beginning of the abstract. The abstracts were reviewed and concerns about the study methodology or research were identified and included under a section of the documentation designated as "CONCERNS."

8. A summary of the literature was based on information discernible from key words and titles, where abstracts were not available.

PART II: SUMMARY

9. A summary of the literature search is organized by topics that relate to development of recreation use and benefit evaluation for regional recreation models. The summary topics include: (a) regional demand models, (b) use of existing survey data, (c) recreation resources and recreation benefits, (d) methodological considerations, and (e) benefits based on site characteristics.

10. The USWRC provided criteria for regional recreation models, and the criteria provide an alternative way to consider the literature (Vincent, Moser, and Hansen 1986). The USWRC says,

> Specifically, regional recreation models should yield an empirical estimate of demand applied to the particular project of site based on: (1) socioeconomic characteristics of market area populations, (2) qualitative characteristics and uniqueness of the recreation opportunities, and (3) costs and characteristics of substitute opportunities. Models should permit generation of recreation use projections over time that vary with underlying determinants of demand, and allow for evaluation of gains and losses in the study area." (Vincent, Moser, and Hansen 1986).

11. Loomis, Sorg, and Donnelly (1986) identify resource changes or the situations in which regional models would be used, and determine the specific model and approach to be used. These are:

a. Displacement of an existing recreation site.

b. Introduction of a new recreation site.

c. Change in site quality or characteristics.

12. Other considerations in the development of regional recreation models include the types of benefits to be considered and the size of the region. Normally, only user benefits are considered; that is, the willingness-to-pay for use of the recreation site. The benefits to the general population of providing or protecting the natural resources would be difficult to incorporate into a regional model because determining and modeling the option and existence values for the general population would be a highly complex task. Determination of size of the region is based on whether sites in an area act as substitutes or alternatives to the other sites in the region.

Regional Demand Models

13. The literature on regional demand models demonstrates increasing rigor in using recreation data to model recreation use and benefits. The modeling efforts are used for planning studies, for evaluation of the demand and benefits of additional recreation development, and for assessment of the benefits of existing recreation facilities. The literature summarized here served as a regional model for showing recreation benefits and demand through model development to evaluate or maximize benefits and to estimate use or participation.

14. An extensive regional model was developed for 83 reservoirs and other projects in California (Wade et al. 1989). The model used a household survey to estimate use. A travel cost model was used to allocate visitation from different origins to the sites. The distribution of users to different recreation sites was based on travel distances and costs, and the attractiveness of a site and substitutes. Attractiveness of sites was based on site attributes: (a) number of boat launches and slips; (b) natural fish productivity; (c) number of parking spaces; and (d) number of campsites. This model was applied to 12 reservoirs in the Sacramento District (Wade et al. 1989). Estimated visitation was compared to 1985 recorded visitation, showing some overestimation by the model.

15. Overestimation by the model was attributed to the relative remoteness of some reservoir sites, with additional travel time required, and possibly lower actual 1985 visitation due to lower pool levels caused by drought.

16. Models developed to determine the benefits associated with regional recreation facilities identified in this review are based on the Travel Cost Method (TCM). The participation or use rates were derived from both actual use surveys and from household participation studies. Day use at seven Corps reservoirs in the Sacramento District was modeled using data from 3 years of survey information (Knetsch, Brown, and Hansen 1976). Variables in the model were: (a) cost of travel, (b) size of population at the origin, (c) substitutability, and (d) attractiveness in terms of size or facilities. A regional model for 84 state parks in 23 counties and 38 recreation sites was developed for day users in parts of Pennsylvania, New York, and New Jersey (Cesario and Knetsch 1976). A visitor-use model was developed using characteristics of population centers, recreation sites, and spatial separation between sites. The TCM was used to determine benefits of the sites, with a procedure to

include substitution effects in response to price changes and measurement of time costs. A regional model of the Boundary Waters Canoe Area, based on maximizing choice theory, was developed to determine the demand for a single site (Peterson, Anderson, and Lime 1982). Site-specific demand for sites has been determined from other more general models (Smith 1981; Smith, Devousges, and McGivney 1983b). An English study (Anderson 1975) established a regional model for benefit estimation using a number of alternative sites.

17. The TCM has been used to develop regional demand models using destination or use estimation survey data, from site surveys, and participation rates from household surveys. Sutherland (1982) used a gravity model to estimate the number of trips for 197 recreation sites in the Pacific Northwest from each destination in the region. These trip data were used as input to a travel cost analysis. A major finding was that potential recreation benefits are concentrated in a few select areas, which are accessible to large population centers. A much earlier effort by Tadros and Kalter (1971) used a spatial allocation model to allocate recreation demand from structural demand equations.

Benefit maximization

18. Regional models can be used to determine how to maximize recreation benefits based on site characteristics, carrying-capacity constraints, and alternative mixes of recreation opportunities to maximize recreation benefits. In planning wilderness recreation sites so as to maximize benefits, a model of potential wilderness recreation areas in Colorado was developed to allocate recreation, choosing recreation areas and degree of development from an array of proposed and existing sites (Hof and Loomis 1983). The TCM was used for estimating recreation benefits. Benefits were maximized by the differences between gross recreation benefits and travel, investment, management, and site-opportunity costs. An approach to maximizing benefits for an existing reservoir developed an optimization model of operation (Behan, Gross, and Klar 1985). The model utilized the constraints of carrying capacity and other operational considerations to identify the optimal recreation mix and extent of development. The model determined the amount of use (number of participants) that "correspond to maximum net benefits for specific development packages on design days." The recommended recreation mix that produced the maximum net benefits was found to be cost-effective. Another benefit optimization effort was intended to determine the correct facility size to maximize

benefits (James 1970). Facility standards were developed from other projects for determining the size facility to meet visitation projections.

Participation models

19. Regional use estimation or participation models did not show up in the literature in the number that would be expected. A day-use park visitation model in Saskatchewan used the following variables: (a) population, (b) distance, (c) alternative recreation site and activities, and attractiveness (Cheung 1972). The model was developed to estimate use for a proposed site with a known level of development. A site choice model for urban areas was also identified (Peterson, Dwyer, and Darragh 1983). Fesenmaier and Lieber (1985) evaluated the selection of households for inclusion in participation model calculations. A wide variety of statistical results can be produced if the households do not represent the causal factors underlying recreation participation.

Use of Existing Survey Data

20. In considering the use of existing survey data for model development, the valuation data are developed using per capita use rates developed from use estimation surveys. The Rock Island District utilized visitation surveys and a computer program to sort the Zip Code origin data taken from 1983 visitation surveys. These data were then used to develop zones for a Travel Cost Model for each of 30 reservoirs and Mississippi River recreation sites (US Army Engineer District, Rock Island 1985). This allowed the calculation of benefits for the recreation sites operated by the Rock Island District. Miller and Hay (1984) used the 1980 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation to develop values for 30 substate regions for hunting and fishing. A Travel Cost Model was developed for the regions. Data collected by the Idaho Department of Fish and Game were used to develop Travel Cost and Contingent Value Models for fishing in Idaho (Sorg et al. 1985). Average Travel Cost and Contingent Valuation values were calculated for each type fishing trip and recreation fishing day. Estimates were also calculated for each fishing site.

Recreation Resources and Recreation Benefits

21. The relationship between recreation resources and benefits has been addressed in terms of benefits that arise from different resource conditions; e.g., congestion, changes in availability or recreation opportunities, and optimization of recreation benefits. Congestion of recreation users, in terms of other encounters, was the only recreation condition that was valued in the literature identified in this review. The willingness-to-pay for different levels of congestion was determined by Cicchetti and Smith (1973) for wilderness recreation in the Spanish Peaks Primitive Area, Montana. The purpose of the study was to determine the optimal use of the area. This type approach could be used in conjunction with carrying-capacity evaluations for water resource projects. Evaluation of the effect of a new facility on existing facilities is addressed on a conceptual basis by Cesario (1980).

22. Benefits resulting from operation and/or policy changes that alter natural resource conditions include willingness-to-pay for abatement of water pollution problems in a basin to achieve water quality suitable for recreation (Oster 1977; Raucher and Fisher 1982; Russell and Vaughan 1982); and willingness-to-pay for improved air quality in national parks (Rae 1983). The willingness-to-pay for moose hunting (Pattison and Phillips 1971) and for different increments of elk-hunting permits, e.g., one to five elk, were both CVM studies to evaluate potential benefits from changes in the structure of licenses (Brookshire, Randall, and Stoll 1980).

23. Optimization of recreation benefits is addressed in only two studies. The development of Unit Day Values for 16 different hunting and fishing activities was used with the average number of recreation days for each activity to come up with an optimal number of recreation days for the various wildlife activities (Prenzlow, Ashton, and Wykstra 1974). The values were developed by State wildlife personnel and did not reflect public input; generalizing the data for application to the public was questioned. Another optimization effort was the conceptual development of a demand curve for recreational fishing which accounted for joint recreation and commercial uses (Anderson 1983).

24. The economic impact of recreation on local or regional economies, rather than strictly benefit estimation, has become important in decisions on agency actions. The US Forest Service has developed an input-output model known as the Impact Analysis for Planning (IMPLAN) for determining the impact

of expenditures on the different industry sectors of the regional economies affected by recreation expenditures (US Forest Service 1989). Expenditure data collected for the Public Areas Recreation Visitor Survey (PARVS) was used in IMPLAN to test the suitability of PARVS data for use in IMPLAN (Propst 1988) and the potential use of IMPLAN for Corps projects.

Benefit estimation-travel
cost and contingent valuation

25. The studies reviewed using TCM were examined to see if TCM was used to address the visitor issues for which the Contingent Value Method (CVM) has been used so extensively (e.g., congestion). The studies were also examined to see if multiple site visits were ever considered. The literature review identified TCM studies that valued the benefits for salmon fishing in Oregon (Brown, Singh, and Castle 1965); marine fishing (McConnell 1979); freshwater fishing for different fish species (Vaughn and Russell 1982); and recreation at the Lake of the Ozarks (Merewitz 1966).

26. A number of studies addressed valuation of environmental amenities and other effects of site conditions and visitor perceptions of willingness-to-pay as measured by TCM. Scenic degradation and air quality at Bryce Canyon National Park were evaluated by Johnson and Haspel (1983). The effects of congestion were evaluated for the High Peaks Area of the Adirondack Mountains in New York. The time on site exhibited a strong relationship to willingness-to-pay, but size of party and recreation experience did not (Menz and Mullen 1981; Wetzel 1977). The TCM was used to value substitutes among urban parks (Moncur 1975) and for measuring benefits under conditions of excess demand (McConnell and Duff 1976). These studies predate the prevalence of CVM studies commonly used for these types of evaluations. Two studies applied TCM to multiple site evaluations (Bockstael, Haneman, and Kling 1985); and Haspel and Johnson 1982). A British study used TCM to evaluate the effects of the energy crisis on use of a single reservoir. Benefits for different deer hunting sites in Utah were determined by economic site values and wildlife measures of recreation quality, with 85 percent of the benefits related to the quality of recreation sites (Wennergren, Fullerton, and Wrigley 1977). McConnell (1980) discussed the TCM valuation of congested facilities.

27. The CVM has been used to measure the recreation benefits and value of environmental amenities in a variety of settings. For different types of recreation experiences, CVM has determined the willingness-to-pay for: (a) goose hunting (Cocheba and Langford 1981), (b) big-game hunting in a

private forest (Davis 1963), (c) waterfowl hunting in the Pacific flyway (Hammack and Brown 1974), (d) salmon fishing in Washington state (Mathews and Brown 1970), and (e) elk hunting in Wyoming (Stoll 1980).

28. The establishment of minimum instream flows in the early 1980s for the US Fish and Wildlife Service and others resulted in a number of CVM studies. Different types of recreation users (trout fishermen, whitewater boaters), and streamside users (picnickers, campers, hikers) were interviewed to determine willingness-to-pay for different instream flows on a whitewater river in north Colorado (Daubert and Young 1981). Another Colorado study had respondents give willingness-to-pay values for congestion levels in addition to instream flow levels (Walsh et al. 1980). This study included nine recreation sites on cold water rivers on the west slope of the Rocky Mountains, Colorado, interviewing fishermen, kayakers, and rafters. CVM studies that looked at congestion and willingness-to-pay show different behaviors in response to congestion. Deer hunters in Colorado showed that willingness-to-pay increased with increments of hunter success, but generally decreased with increments in congestion; i.e., hunter density (Miller, Prato, and Young 1977). However, hunters refused to pay additional money to gain decreases in hunter density. A study of cross-country skiers in Colorado established willingness-to-pay values for a day of skiing, and incremental values for each additional encounter (Radulaski 1982).

29. Likely the most interesting use of CVM has been for determining intangible values, such as preservation and existence, environmental amenities value, and environmental quality. The debate in the late 1970s and early 1980s over fossil fuel plants and attendant air quality conditions resulted in a number of air quality studies. Schultze et al. (1983) reported on the preservation of air quality for the Grand Canyon and national parks in the Southwest. A study of aesthetics and air quality for the Four Corners and Navajo mine area was done by Randall, Ives, and Eastman (1974). Comparison of methods to determine existence values is discussed by Randall and Stoll (1982) as part of these air quality studies. Preservation values for wilderness and scenic rivers were determined for user and nonuser groups in Colorado (Walsh, Sanders, and Loomis 1985). Wilderness use and preservation values were determined for both Colorado and US wilderness areas using a Colorado mail survey (Walsh, Gillman, and Loomis 1982; Walsh, Loomis, and Gillman 1984).

30. Comparisons of TCM and CVM valuations of the same resources are not as numerous as would be expected. Donnelly et al. (1983) compared the two

methods for steelhead trout fishing trips in Idaho. Willingness-to-pay above actual expenditures for fishing was estimated at $27.87 per trip for TCM and $31.45 per trip with the CVM. The net economic values did not remain equivalent for incremental changes, the CVM estimate was less than the long-run value of improved steelhead fishing as measured by TCM. An early (1966) study compared TCM and CVM values for a day of recreation at Whitney Point Reservoir, New York (Romm 1969). The TCM estimated a day of recreation at $0.29 per person per day, the CVM open-ended model estimated between $0.26 and $0.45 per person per day. The value of the Pena Blanca Recreational Area was estimated at $0.89 by CVM, between $0.48 and $5.11 by TCM, and between $4.43 and $9.83 by the cost difference approach (Heidt 1977). The impact of pine beetle damage to recreation use of the Colorado Forest (Front Range) was accomplished using photographs depicting different levels (13) of tree densities per acre (Walsh and Olienyk 1981) to elicit willingness-to-pay with a CVM approach. The consumer's surplus was then compared to the travel cost values (not reported).

Methodological Considerations

31. The literature dealing with methodological considerations contains those references that address methodological issues of benefit estimation and natural resource use and those references dealing with application of TCM or CVM. Actual studies using the methods are considered above. Evaluations of the three methods for recreation benefit calculation are contained in Johnson, King, and Hay (1979) and Waters and Valderrama (1984). Discussions on public goods allocations, demands, and public choices are contained in Freeman (1979), Hanemann (1984), Norton (1970), and Stoll (1983). Use of revealed preference approaches for valuing outdoor recreation for a number of approaches is discussed by Mendelsohn and Brown (1983).

TCM

32. The most widely referenced documents on TCM, at least within the Corps, are Clawson (1959), Brown and Hansen (1974), Dwyer, Kelley, and Bowes (1977), and Rosenthal, Loomis, and Peterson (1984). The advantages of Travel Cost over Unit Day Values are presented in a paper by Dwyer et al (1979). The application consideration addressed most often in the literature is unequal populations between zones (Bowes and Loomis 1982; Christensen and Price 1982; Strong 1983; and Vaughan, Russell, and Hazilla 1982). The problems caused by

aggregation of data in travel cost models, e.g., multicollinearity and difficulty in estimating demand function parameters, are examined by Brown and Nawas (1973) and McConnell and Bockstael (1984). The handling of the value of time, both in travel and on site, was considered by Cesario and Knetsch (1970), Nichols, Bowes, and Dwyer (1978), and Wilman (1980). Literature addressing other application issues includes: cross-price variable biases (Caulkins, Bishop, and Bouwes 1985); multiple-destination trip bias (Haspel and Johnson 1982); and price variable considerations (Ward 1984).

Contingent valuation method

33. Methodological considerations for CVM addressed different sources of bias and considerations that should go into the development of a hypothetical market and the conduct of bidding. Measurement of consumer surplus and comparison of welfare measures are examined in detail in Bockstael and McConnell (1980). Theoretical relationships are examined between compensating variation, equivalent variation, and Marshallian measures of consumer surplus. Thayer (1981) conducted a CVM analysis of the aesthetic impacts of geothermal energy development in the Jemez Mountain Area of New Mexico. This study specifically examined the hypothetical nature of the survey technique, the questionnaire information structure, and the starting point bias. Comparisons with the site substitution approach (based on travel cost method) yielded comparable willingness-to-pay values, indicating the hypothetical nature of the method was not a problem. Use of question formats with alternative informational content demonstrated the absence of informational bias. Starting point bias was tested by using $1 and $10 starting points, and starting point bias was rejected. This study was the most extensive investigation of the different biases that are attendant to CVM studies. The effects of information quantity, complexity, and display on 'information overload' were examined by Bergstrom and Stoll (1986). Starting point bias is addressed by Boyle, Bishop, and Welsh (1985).

Benefits Based on Site Characteristics

34. The determination of recreation benefits for particular sites is most developed in the Travel Cost literature. Use of TCM to determine the benefits of constructing a new site, benefits from modifying an existing site, and estimating use at existing or proposed sites is explained by Rosenthal, Loomis, and Peterson (1984). An earlier source looked at reflecting site

attractiveness in Travel Cost benefits models (Ravenscraft and Dwyer 1978). The Rock Island District's use of visitation estimation surveys allowed determination of site benefits because the surveys were performed at recreation sites and the travel distances were calculated afterward (US Army Engineer District, Rock Island 1985). Site characteristics and attendant benefits were generally not addressed in the CVM literature, except as in Walsh (1980) where the optimal level of instream flows were identified for Colorado streams, and in Sorg et al. (1985), where TCM and CVM benefits were calculated for Idaho fishing sites, based on the type of fishing, warm or cold water, or species fished.

35. Various models for potential use in predicting site choice and use are reviewed by Stynes and Peterson (1984). This review apparently included both travel cost and other types of models. Several models are of a conceptual or proposed nature, rather than being based on actual visitor data. An early model for estimation of use of wilderness sites was developed by Lucas and Shechter (1977). The model used such things as arrival patterns, travel routes, popularity of the routes, and travel speeds to come up with use estimates in probabilistic terms. Allocation of low density or wilderness recreation use in Montana was developed by Smith and Krutilla (1975). The use of economic rent (rather than consumer surplus) to determine benefits to reflect quality and location values, is discussed in an early article by Wennergren and Fullerton (1972).

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Ward, Frank A. 1982. The Demand for and Value of Recreational Use of Water in Southeastern New Mexico, Research Report 465, Agricultural Experiment Station, New Mexico State University, Las Cruces, NM.

Waters, Robert C., and Moustakis, Vassilios. 1981. "An Evaluation of Recreational Benefits and Use Estimating Models for Water Resource Planning," Technical Completion Report A-012-DC, Water Resources Research Center, University of the District of Columbia, Washington, DC.

APPENDIX A: ANNOTATED BIBLIOGRAPHY

1. Anderson, Lee G. 1983. "The Demand Curve for Recreational Fishing with an Application to Stock Enhancement Activities," Land Economics, Vol 59, No. 3, pp 275-286.

KEY WORDS: Fishing, recreation benefits, optimality, management, conceptual, demand curve model.

ABSTRACT: This paper presents a model of the demand curve for recreational fishing. It is applicable to joint recreation-commercial exploitation, but in this paper only optimization of stock enhancement activities is considered. No estimates or applications are provided.

2. Anderson, Robert W. 1975. "Estimating the Recreation Benefit from Large Inland Reservoirs," Recreational Economics and Analysis, G.A.C. Searle, ed., Lowe and Brydone, Thetford, Norfolk, England, pp 75-80.

KEY WORDS: Recreational benefit, reservoir, planning, travel cost model (TCM), congestion, site specific.

ABSTRACT: What are the potential benefits from recreational use of reservoirs in England? The reservoirs, existing and proposed, are alternative recreation sites to nearby bays. Three categories of recreational use were implemented in the model (full-day, half-day, and holiday trips). A regression equation relating trips per 1,000 zone population to cost of trip and the zonal car ownership rate was developed for each category. The average consumer surplus and the net economic benefits are shown. However, the value units are in English pounds. The congestion model is included.

CONCERNS: This study supplies many estimates by TCM from different locations to different sites; however, the values are in pounds, not dollars.

3. Beardsley, Wendell G. 1971. "Bias and Noncomparability in Recreation Evaluation Models," Land Economics, Vol 46, No. 2, pp 175-180.

KEY WORDS: Methodological bias, allocation model, Colorado, value estimates, benefits, visitor survey, consumer surplus, monopoly.

ABSTRACT: The purpose of this paper is to point out sources of methodological bias in valuation methods and to outline means for correction. The items evaluated are consumer surplus, monopoly revenue, and visitor survey method.

Recreation benefits were evaluated for a 7-mile* reach of a scenic canyon of the Cache la Poudre River in Colorado during June-August, 1966. The area primarily offers camping and fishing opportunities.

The values per visitor day (12 visitor hours) were $1.07, consumer surplus; $.93, monopoly revenue; and $1.11, visitor survey. Corrections for bias are included in these values.

Sources of bias and correction for bias are discussed. Biases are length of stay, nonapportionment of expenditure, travel time on the monopoly revenue demand curve, and the possibility of bias from inequality in visitor incomes.

CONCERNS: The analysis used to obtain the benefit estimates is not presented in this paper. That work was performed in the author's unpublished dissertation.

4. Behan, John J., Gross, Meir, and Klar, Lawrence R., Jr. 1985. "A Net Benefit Model for Recreation Planning at Drinking Water Reservoirs," Water Resources Bulletin, Vol 21, No. 2, pp 297-309.

KEY WORDS: Recreation planning, model, net benefits, Northeast United States, water quality, participation, willingness-to-pay, management, reservoirs, recreation carrying capacity, quadratic programming, resource allocation model.

ABSTRACT: "A management model was developed for determining levels of recreation activities at public drinking water reservoirs. Quabbin Reservoir, located in central Massachusetts, served as a case study for the model. An interdisciplinary research team was formed to study the impact of selected recreation activities, carrying capacity constraints, and the economic cost/benefits associated with increases in recreation at the Quabbin Reservoir. Study variables were integrated into a quadratic programming model, producing the number of participants that corresponds to maximum net benefits for specific development packages on design days.

The recreation mix associated with maximum net economic benefits was found to be cost-effective (assuming the use of reasonable entrance fees) and not deleterious to water quality. However, as a result of the findings of a related study, it was recommended that nutrients, particularly from wastewater, not be permitted to enter the reservoir, since the current phosphorus level may be at

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

a critical point. Management techniques that would safeguard against this occurrence were recommended. The model was sensitive to management objectives; recommendations were limited to activities that would not lower the existing high quality of Quabbin water."

5. Bergstrom, John C., and Stoll, John R. 1986. "Structure, Conduct, and Performance in Contingent Markets," Natural Resources Working Paper Series, Department of Agricultural Economics, Texas A&M University, College Station, TX.

KEY WORDS: Contingent valuation method, bias.

ABSTRACT: Understanding relationships between market structure, conduct, and performance is argued to be important for proper design of contingent markets. Such an understanding may be gained through experimental economics methodology, as demonstrated by a study of impacts of information quantity, complexity, and display on 'information overload' in a simple contingent market.

6. Betson, David M. 1983. "Complementary Strategies for Policy Analysis: Combining Microeconomic and Regional Simulation Models," Regional Science and Urban Economics, Vol 13, No. 2, pp 213-229.

KEY WORDS: Policy analysis, microeconomic simulation, regional modeling.

ABSTRACT: The development of policy analysis by regional models and by microsimulation models is compared and contrasted. Regional models can incorporate locational and market factors into microsimulation models. Simulation models can estimate the effect of governmental policies on individual choices and distributional questions.
The KGB/RESIND model links these two modeling aspects (KGB and the IO model MRIO). This is a recursive model for estimating regional, industrial sector, and income-distribution impacts of an income transfer or tax policy change. The potential benefits of this scheme are illustrated by an analysis of various wage rate subsidies paid to workers. This model is not recreation oriented; however, policy impacts and regional recreation characteristic models may possibly be developed from this model.

7. Bishop, Richard C., and Heberlein, Thomas A. 1979. "Measuring Values of Extramarket Goods: Are Indirect Measures Biased," American Journal of Agricultural Economics, Vol 61, No. 5, pp 926-930.

KEY WORDS: Indirect methods, bias, travel cost method, hypothetical valuation, contingent valuation method.

8. Bishop, Richard C., Heberlein, Thomas A., and Kealy, Mary Jo. 1983 (Jul). "Contingent Valuation of Environmental Assets: Comparisons with a Simulated Market," Natural Resources Journal, Vol 23, pp 619-633.

KEY WORDS: Contingent valuation, environmental assets, method comparison, travel cost method, simulated market, cash offer, bias, goose hunting, bidding, willingness-to-accept compensation WTA), willingness-to-pay (WTP), Marshallian surplus, benefit estimation.

ABSTRACT: The Contingent Valuation Method (CVM) has gained credibility, but there are several anomalies that have not yet been adequately explained. In the authors' view these anomalies result because people dealing with a CVM mechanism do not have well-developed beliefs about how they would behave in real markets for environmental assets. The purpose of this study is to test this viewpoint. An actual study is analyzed to measure to what extent a simulated market (cash offers), hypothetical market (bidding), and a travel cost method provide consistent estimates of the value of goose hunting.

In this study, mail survey instruments were used to value the opportunity to hunt Canadian geese in the Horicon Zone in Wisconsin. Three separate samples were drawn from a population of 13,974 permit holders in 1978: 274 for a simulated market approach; 353 for a hypothetical market approach; and 300 for the travel cost approach. Response rates were 94 percent, 95 percent ($5 incentive used), and 91 percent, respectively. Analysis was performed using a logit model for the simulated market and hypothetical market approaches. The travel cost data were analyzed with weighted least squares procedures and observations were grouped into 11 concentric zones.

The simulated market approach yielded an estimate of WTA equal to $63 per permit. For comparison purposes, the simulated market result was argued to be closest to the true value of a Canadian goose hunting permit and, since WTP should be reasonably close to WTA when income effects are small, $63 was also adopted as an estimate of WTP. The bidding approach estimates for WTA ($101 per permit) and WTP ($32 per permit) were argued to be over- and under-estimates, respectively. The travel cost procedure provided an estimate of Marshallian consumer's surplus equal to $32 per permit. Thus, travel cost estimates were all argued to be under-estimates of WTP (and, thereby, Marshallian surplus).

The results are argued to show that CVM mechanisms tend to underestimate willingness-to-pay and to overvalue environmental assets when the criterion is willingness-to-accept compensation.

CONCERNS: Although the simulated market result was used to represent the true value of a goose-hunting permit, this result is based on a new and unfamiliar market. The travel cost analysis found no significance for the income or other variables indicating tastes and preferences of individuals. Substitute sites were also not accounted for in the analysis.

9. Blomquist, G., and Fishelson, G. 1980. "Water Quality and the Demand for Recreation," International Journal of Environmental Studies, Vol 14, pp 317-321.

KEY WORDS: Demand, recreation, water quality, environmental quality, Illinois, participation.

ABSTRACT: "This paper considers the linkage between one facet of environmental quality and utilization of the environment. Following a simple theory of market demand for recreation sites we attempt to quantify the relationship between water quality and visits to the parks using Illinois data for 1976. The main conclusion is that weak responses of the demand for recreation are detected for changes in water quality parameters leading us to believe that statistical analysis of better data would show stronger responses."

10. Bockstael, Nancy E., and McConnell, Kenneth E. 1981. "Theory and Estimation of the Household Production Function for Wildlife Recreation," Journal of Environmental Economics and Management, Vol 8, pp 199-214.

KEY WORDS: Wildlife recreation, benefits, travel cost method, household production function, conceptual.

ABSTRACT: "The household production function is an intuitively appealing way to model man's interaction with nature. This paper models the interaction between the household's behavior and publicly provided inputs into wildlife recreation. The paper shows how to compute benefits, assuming that the household production is known. The household production approach collapses to the simple travel cost approach when households are unable to substitute their own inputs for publicly provided inputs. In addition, the paper demonstrates the conditions under which the parameters of cost and preference functions can be identified. The conditions for identification are quite restrictive when several choices are endogenous."

11. Bockstael, Nancy E., and McConnell, Kenneth E. 1980. "Calculating Equivalent and Compensating Variation for Natural Resource Facilities," Land Economics, Vol 56, No. 1, pp 56-63.

KEY WORDS: Consumer surplus, willingness-to-pay, willingness-to-sell, comparison of welfare measures, direct interview techniques, Hicksian measures of variation, conceptual.

ABSTRACT: What are the theoretical relationships between compensating variation, equivalent variation, and Marshallian measures of consumer surplus? A theoretical analysis of the equivalence among compensating variation (CV), equivalent variation (EV), and Marshallian measures of consumer surplus is provided in this article. The authors argue that providing or removing public facilities "effectively changes the price at which the services of the facility are available." For instance, providing a recreation site is equivalent to lowering the price of the site from infinity to zero. Thus, it is argued in the article that Hicksian "variations" are the appropriate measures of welfare for changes in the provision of certain natural resource facilities.
The authors agree with Willig's general conclusion that under certain conditions CV and EV are approximately equal. They also support Willig's results which show that even when these conditions do not hold, precise upper and lower bounds on the differences between CV and EV can be estimated. The authors contend, however, that it is difficult to apply Willig's results empirically - particularly with respect to contingent valuation.
It is pointed out in the article that in order to estimate Willig's bounds it is necessary to estimate a Marshallian demand curve and calculate "consumer surplus" and income elasticities. Because Marshallian demand curves are not calculated in contingent valuation, the authors claim that practitioners of this technique cannot scientifically analyze observed differences in willingness-to-pay (WTP) and willingness-to-accept compensation (WTA).
In another section of the paper, the authors explain why it is probably equally difficult to apply Willig's bounds to welfare measures obtained by indirect techniques (e.g., the Travel Cost Method). In light of this, the authors recommend the development of contingent valuation techniques over indirect techniques, because contingent valuation techniques are more versatile.
The article contains an in-depth discussion of the difficulties encountered when attempting to apply Willig's bounds to Marshallian demand curves derived

for natural resource facilities. This analysis is used to support the development of contingent valuation techniques.

12. Bockstael, Nancy E., Hanemann, Michael W., and Kling, Catherine L. 1985. "Modeling Recreational Demand in a Multiple Site Framework," presented at the Association of Environmental Resource Economists Workshop on Recreation Demand Modeling, May 1985, Boulder, CO.

KEY WORDS: Recreation demand modeling, alternative sites, site valuation, site characteristics, discrete-continuous choice model, hedonic travel cost model, regional, recreation benefits.

13. Bowes, Michael D., and Loomis, John B. 1982. "A Note on the Use of Travel Cost Models with Unequal Zonal Populations: Reply," Land Economics, Vol 58, No. 3, pp 408-410.

KEY WORDS: Travel cost model, conceptual, benefit estimates, demand.

14. Bowker, Michael J., and Stoll, John R. 1986. "Toward a Total Value for Whooping Cranes Using Dichotomous Choice Nonmarket Methods," Natural Resources Working Paper Series, Department of Agricultural Economics, Texas A&M University, College Station, TX.

KEY WORDS: Benefits, valuation, wildlife, endangered species, logit model, probit model, willingness-to-pay.

ABSTRACT: The authors utilized binary choice methods to analyze data collected by mail survey regarding the value of the whooping crane resource. A central question is the sensitivity of value estimates to estimation method, model specification, and truncation levels for integration of the distribution functions. Logit and probit estimation methods were shown to result in similar estimates. Specifications considered were two utility-theoretic models of Hanemann (linear and income share) and a nonutility-theoretic logarithmic form.

Estimated models all had respectable fit to the actual data but estimated values varied considerably. Truncation levels chosen also influence values, but the authors argued that adequate pretesting of dichotomous choice survey instruments should reduce the need to choose truncation levels different from those used in the final survey administration. Medians were also estimated as an alternative to means and shown to have additional problems for consideration in applied use.

The authors argue for the logarithmic specification of the Logit model and use of the mean as a value estimator. A variety of estimated values for the whooping crane are presented in the article. The authors stress the importance of reporting the sensitivity of value estimates and clear identification of methods used in applied studies.

15. Boyle, Kevin J., and Bishop, Richard C. 1984. "A Comparison of Contingent Valuation Techniques," Staff Paper No. 222, University of Wisconsin, Department of Agricultural Economics, Madison, WI.

KEY WORDS: Valuation, esthetics, bias, management, Wisconsin, recreation benefits.

16. Boyle, Kevin J., Bishop, Richard C., and Welsh, Michael P. 1985. "Starting Point Bias in Contingent Valuation Bidding Games," Land Economics, Vol 61, No. 2, pp 188-194.

KEY WORDS: Valuation, bidding games, starting point bias, contingent valuation, conceptual, willingness-to-pay, model, survey.

17. Brookshire, David S., Ives, Berry S., and Schulze, W. D. 1976. "The Valuation of Aesthetic Preferences," Journal of Environmental Economics and Management, Vol 3, pp 325-346.

KEY WORDS: Valuation, esthetic damages, environmental quality, demand, bidding games, coal-fired power plant, biases, questionnaire, contingent value, Hicksian measure, visibility, contingent valuation.

ABSTRACT: "This paper reports on a bidding game applied to estimate esthetic damages from possible construction of the Kaiparowits Power Plant near Lake Powell. Three problems associated with the interpretation of bidding games are explored theoretically and empirically: (1) incentives for biased responses, (2) divergences between compensating and equivalent variation and, (3) problems of interpersonal comparison in the aggregation of individual bids."

18. Brookshire, David S., Eubanks, Larry S., and Randall, Alan. 1983. "Estimating Option Prices and Existence Values for Wildlife Resources," Land Economics, Vol 59, pp 1-15.

KEY WORDS: Benefit, option prices, existence value, wildlife, contingent valuation method, hunting.

19. Brookshire, David S., Eubanks, Larry S., and Randall, Alan. 1978. "Valuing Wildlife Resources: An Experiment," Transactions of the Forty-third North American Wildlife and Natural Resources Conferences, Vol 43, pp 302-310.

KEY WORDS: Environment, wildlife management, energy resources, Wyoming, survey methodologies, recreation demand, esthetic impacts, value estimates, "asking games."

20. Brookshire, David S., Randall, Alan, and Stoll, John R. 1980. "Valuing Increments and Decrements in Natural Resource Service Flows," American Journal of Agricultural Economics, Vol 62, No. 3, pp 478-488.

KEY WORDS: Consumer surplus, natural resources, valuation, wildlife, model, benefit, WTP, WTA, bidding, iterative.

ABSTRACT: The focus of this paper is to present a general model which can be used to estimate the value of changes in natural resource service flows. Proposed projects often alter the flow of goods, services, and amenities. The valuation of these changes is needed to determine project benefits and/or costs. The model focuses on total value; however, the case where price is equal to value at the margin may be derived as a special case from this model. The model is described in the paper.

The empirical application deals with the right to hunt elk, but it can be applied to all classes of goods. A total of 108 elk hunters were interviewed. The mean (per hunter) annual value was estimated for the right to hunt elk during 1977-78. This value was influenced by hunting environment and frequency of encounter with elk.

The mean value of WTP for the 0-1 increment in elk encounters is $43.64. For the 1-5-elk increment, the WTP is $54.06. The WTP value is $32.00 for the 5-10-elk increment.

There is a greater difference between estimated values for WTP and WTA than there is between conceptually derived values for these factors. WTA values were not felt to be reliable estimates because consumers were not comfortable with these types of questions.

21. Brown, Gardner M., and Goldstein, Jon H. 1984. "A Model for Valuing Endangered Species," Journal of Environmental Economics and Management, Vol 11, No. 4, pp 303-309.

KEY WORDS: Model, endangered species, valuation, benefits, wildlife, theoretical.

22. Brown, R. E., and Hansen, W. J. 1974. "Plan Formulation and Evaluation Studies - Recreation, Vol. V of V., A Generalized Recreation Day Use Planning Model," Research Report 74-R1, US Army Engineer Institute for Water Resources, Fort Belvoir, VA.

KEY WORDS: Reservoirs, model studies, methodology, recreation facilities, travel cost model, cost-benefit analysis, analytical techniques, approximation method, projections, statistical methods, planning, use, value estimates, participation.

23. Brown, William G., and Nawas, Farid. 1973. "Impact of Aggregation on the Estimation of Outdoor Recreation Demand Functions," American Journal of Agricultural Economics, Vol 55, No. 2, pp 246-249.

KEY WORDS: Recreation, big game hunting, travel cost method, demand functions, benefits.

ABSTRACT: "This research indicates that aggregating data tends to cause multicollinearity and difficulty in estimating the parameters of recreation demand functions. Gains in efficiency of estimation of several hundred percent could often be obtained by using individual observations, rather than the traditional zone averages, as illustrated with an empirical example."

24. Brown, William G., Singh, Ajmer, and Castle, Emery N. 1965. "Net Economic Value of the Oregon Salmon-Steelhead Sport Fishery," Journal of Wildlife Management, Vol 29, No. 2, pp 266-279.

KEY WORDS: Net value, Oregon, mail survey, benefits, alternative uses, wildlife, Clawson (travel cost) method, fish.

ABSTRACT: "Gross and net economic values of the Oregon salmon-steelhead sport fishery were estimated from angler expenditure data obtained by mail survey during 1962. Salmon-steelhead includes primarily Chinook salmon, silver salmon, and steelhead trout. Net economic value was defined as the estimated annual value of the sport fishery resource to a single owner if a market existed for the opportunity of fishing for salmon and steelhead. Net economic value was measured from demand functions. These demand functions were based on the Clawson method but were generalized to take into account income and distance traveled by the anglers. Net economic value was estimated to be about $3 million in 1962. If income and population trends of the past 10 years in Oregon continue, a 50-percent increase in net economic value is predicted by 1972. The methods employed appear promising for estimating economic benefits from wildlife resources."

25. Brown, William G., Sorhus, Colin, Chou-Yang, Bih-lian, and Richards, Jack S. 1983. "Using Individual Observations to Estimate Recreation Demand Functions: A Caution," American Journal of Agricultural Economics, Vol 65, No. 1, pp 154-157.

KEY WORDS: Recreation benefits, demand, individual observations, zone averages, travel cost method, participation, hypothetical, bias, consumer surplus.

26. Burt, Oscar D., and Brewer, Durward. 1971. "Estimation of Net Social Benefits from Outdoor Recreation," Econometrica, Vol 39, No. 5, pp 813-827.

KEY WORDS: Substitutes, lakes, demand, recreation, Missouri, value estimates, net social benefits, travel cost model, direct interview, proposed lakes.

ABSTRACT: The purpose of this paper is to present a model to estimate the net benefits associated with a proposed water-based recreation area. A simultaneous system of demand equations for interrelated recreation sites is used.

27. Capel, R. E., and Pandy, R. K. 1973. "Evaluating Demand for Deer Hunting: A Comparison of Methods," Canadian Journal of Agricultural Economics, Vol 21, No. 3, pp 6-14.

KEY WORDS: Demand, benefits, hunting, contingent valuation, travel cost method, willingness-to-pay, recreation, Canada.

ABSTRACT: "This study compares two methods of estimating hunters' demand for deer hunting in an area in southwest Manitoba. Benefits to hunters are calculated from estimated demand using the concept of consumer's surplus. Methods used to estimate demand are: (1) a travel-cost approach, and (2) an interview on hunters' willingness-to-pay for hunting. The results from the two methods are not identical. Likely reasons for this and suggestions for further research are discussed. Although the two methods probably measure different things and may be subject to different errors, it is felt that use of both methods provides a useful check on the validity of results."

28. Caswell, Margreit, and McConnell, Kenneth. 1980. "Simultaneous Estimation of Jointly Dependent Recreation Participation Function," Journal of Environmental Economics and Management, Vol 7, No. 1, pp 65-76.

KEY WORDS: Recreation, boating, swimming, fishing, Rhode Island, forecasting, participation, simultaneous logit model, mail, site specific, use.

ABSTRACT: The purpose of this paper was to develop and estimate a simultaneous model of recreation participation.
It is hypothesized that participation in one activity is influenced by and influences participation in other activities. The six activities analyzed were boating, saltwater fishing, picnicking, sightseeing, saltwater swimming, and freshwater swimming. Using a simultaneous logit model a high correlation between some activities during the summer in Rhode Island was found. There was a high correlation between boating and fishing, picnicking and sightseeing, and freshwater swimming and saltwater swimming.

29. Caulkins, Peter P., Bishop, Richard C., and Bouwes, Nicolas. 1985. "Omitted Cross-Price Variable Biases in the Linear Travel Cost Model: Correcting Common Misperceptions," Land Economics, Vol 61, No. 2, pp 182-87.

KEY WORDS: Travel cost model, bias, Monte Carlo simulation.

30. Caulkins, Peter P., Bishop, Richard C., and Bouwes, Nicholas W., Sr. 1984. "A Comparison of Two Travel Cost Models for Valuing Lake Recreation," Agricultural Economics Department Staff Paper No. 227, University of Wisconsin, Madison, WI.

KEY WORDS: Travel cost models, benefits, lake, recreation, substitution, Wisconsin, logit model, water quality, consumer surplus, Marshallian surplus, single site.

ABSTRACT: The objective of this paper is to develop two generic lake recreational demand models which explicitly take into account both the relevant substitution and site-specific quality effects. The estimated changes in consumer surplus from each are then compared when water quality is assumed to improve at a given lake.
The first model developed is a two-equation multinomial logit model that estimates choices made by the individual as well as the probability of making those choices. The second model is a travel cost model.
For the multinomial logit model (MNL) the survey data were obtained from a statewide water quality survey. This was a telephone survey conducted in October and November, 1978. Only information from daytrip visits was included in the model because these travel costs were assumed to relate solely to lake recreation. The limits of the water quality variable were determined by the 1975 Lake Classification Index.

For the travel cost model, the values were estimated after using a weighted least squares approach.

To compare the two models, a sample of 60 recreationists was used. These recreationists made 1,305 visits to one lake. In response to a 1-unit water quality improvement, the average consumer surplus (TC) was $10.84; for the MNL model, the consumer surplus was $3.68. Some of the difference may be accounted for by the double log specification of the travel cost model.

CONCERNS: The authors stress using caution in interpretation of the results. Primarily this is due to the assumption that different demand equations may be needed for different activities.

31. Cesario, Frank J. 1980. "Congestion and the Valuation of Recreation Benefits," Land Economics, Vol 56, No. 3, pp 329-339.

KEY WORDS: Models, congestion, benefit, recreation, site expansion, conceptual.

ABSTRACT: This is a conceptual paper that points out the conditions under which the effects of new facilities on existing facilities should be accounted for.

32. Cesario, Frank J. 1976. "Value of Time in Recreation Benefits Studies," Land Economics, Vol 52, No. 1, pp 32-41.

KEY WORDS: Travel time, valuation, estimated benefits, theoretical analysis, costs, parks, recreation facilities, transportation, travel cost method, conceptual, participation.

33. Cesario, Frank J., and Knetsch, Jack L. 1976. "A Recreation Site Demand and Benefit Estimation Model," Regional Studies, Vol 10, No. 1, pp 97-104.

KEY WORDS: Recreation, demand, participation, benefits, consumer surplus, substitution, travel cost, gravity model, time, management planning, region, Pennsylvania, state parks.

ABSTRACT: This paper presents one of the first attempts to model estimates of both the number of visits per unit time attracted to recreation sites in a region and the primary social benefits associated with these sites. The model also incorporates ways to include substitution effects in response to price changes and measurement of time costs.

Application of the model was based on visit data collected with on-site surveys at 84 state parks in most of Pennsylvania and parts of New York and New

Jersey. The survey was administered on 7 consecutive days during July and August, 1967. A total of 31,000 questionnaires were used. The analysis is conducted for the largest user group (those traveling to a park and returning home the same day). The test area included 23 counties and 38 recreation sites.

The visitor component of the model predicts use as a function of the characteristics of population centers, recreation sites, and spatial separation. The benefits component is used to estimate aggregate willingness-to-pay using an extension of the Clawson-Knetsch travel cost technique. The model is nonlinear. Parameters are estimated by use of the Marquadt "compromise" procedure, using a least-squares criterion.

Costs for the demand curve were measured in linear and nonlinear form. For the linear form, annual benefits ranged from $22,000 to $550,000. For the nonlinear form, the benefits are slightly greater ($28,000-$668,000). The reason for the difference is that the nonlinear cost equation is less elastic for visitation with respect to money cost.

Further development of the model is suggested. It is assumed that this would be a worthwhile model for site selection and management of fees, expansion, or analyzing the effects of new highways.

34. Cesario, Frank J., and Knetsch, Jack L. 1970. "Time Bias in Recreation Benefit Estimates," Water Resources Research, Vol 6, No. 3, pp 700-704.

KEY WORDS: Willingness-to-pay, time bias, water resource development, monetary costs, economic welfare, cost-benefit analysis, water management (applied), decision making, planning, feasibility studies, resource allocation, recreational benefit, travel cost method.

ABSTRACT: "Indirect methods are generally necessary to measure outdoor recreation benefits. A widely proposed technique involves estimating demand schedules using travel cost data as a proxy for prices. A major problem involved with this method as it has been applied is a serious conservative bias in the estimates, owing to the improper accounting of the constraint imposed by time costs on recreational visits. The bias is examined and corrections are suggested that could improve the estimates. The degree of ultimate improvement seems to depend on better data and on an understanding of the trade-off function between time and cost outlays for this form of travel."

35. Charbonneau, J. John, and Hay, Michael J. 1978. "Determinants and Economic Values of Hunting and Fishing," Transactions of the Forty-third North American Wildlife and Natural Resources Conference, Vol 43, pp 391-403.

KEY WORDS: Hunting, fishing, direct question approach, expenditure equation approach, mail, telephone, methods comparison, recreational benefits, alternative uses, wildlife, WTP^e, Marshallian surplus.

ABSTRACT: This article summarizes several studies conducted on the economic value of hunting and fishing. Willingness-to-pay data were collected in the 1975 National Survey of Hunting, Fishing, and Wildlife Associated Recreation. The survey was conducted in two stages. In the first stage, 100,000 randomly selected households across the nation were contacted by telephone. Households containing people who had hunted or fished in 1975 were sent a follow-up questionnaire. Respondents were asked in the mail questionnaire to state their favorite hunting or fishing activity. Next, they were asked what it cost to participate in their favorite activity in 1975. Respondents were then asked in a direct question to state how much costs would need to rise before they discontinued participation.

Consumer surplus was also measured by an indirect method: the expenditure-equation approach. In this approach, the demand curves for specific characteristics of hunting or fishing are derived. Characteristics of interest in the study reported here were days engaged in the activity and seasonal bag. The implicit price of each characteristic was calculated by differentiating the expenditure equation with respect to each independent variable.

Average and incremental fish and wildlife values were estimated by the direct question approach. General wildlife values included big game, small game, migratory birds, and other (fox, crow, etc.). Average consumer surplus per day ranged from $19 for "other" hunting to $64 for big game. A day of small game hunting was valued at $25 and the marginal game bagged was valued at $5. Average consumer surplus per day was $18 for freshwater fishing, and $22 for saltwater fishing. Incremental values for freshwater fishing were $8 for a day and $1 for the marginal catch.

Incremental values were also estimated by the expenditure-equation approach. Wildlife valued included deer, other big game, upland birds, other small game, waterfowl, and other migratory birds. The value of a day of hunting ranged from $14 for "other migratory birds" to $94 for "other big game." The value of the marginal unit bagged ranged from $8 for "other migratory birds" to $25 for waterfowl. No bag values were reported for deer and other big game.

Values for freshwater fishing included trout, landlocked salmon, sea-run, bass and muskie, pike and walleye, and "other." Values for a day of freshwater fishing ranged from $38 for "other" to $63 for sea-run. All of the values collected by the expenditure-equation approach reported here include an estimate of the opportunity cost of time.

In general, the expenditure-equation approach resulted in much higher estimates of the incremental value of fish and wildlife than the direct question approach. The direct question approach faced the respondents with a difficult question about increasing costs. The researchers speculated that many respondents may have been unable or unwilling to answer the question. Thus, more reliability was placed on the estimates produced by the expenditure-equation approach. A participation-equation approach to valuing increments or decrements in wildlife populations was also discussed.

CONCERNS: Valuation figures were based on only those people in the sample who considered a certain activity their favorite. This may have systematically biased resulting value estimates upwards. In addition, hypothetical and information influences may be present in the results of the direct question approach.

36. Cheung, Hyme K. 1972. "A Day Use Park Visitation Model," Journal of Leisure Research, Vol 4, No. 2, pp 139-156.

KEY WORDS: Park, visitation, use, participation, planning, travel cost model, attractiveness, recreation, Saskatchewan, alternatives.

ABSTRACT: This research was conducted to develop a model to explain and predict day-use visitation at 12 parks in Saskatchewan.

To explain the relationship between the use variable and the explanatory variables (population, distance, alternative recreation sites and activities, and attractiveness) multiple step-wise regression is used. The analysis results indicate a particular combination of population and distance explains a large amount of the day-use data variance.

A hypothetical application of the model is given to illustrate that estimated use for a proposed site with a known level of development may be derived.

37. Christensen, Jens B., and Price, Colin. 1982. "A Note on the Use of the Travel Cost Models with Unequal Zonal Populations: Comment," Land Economics, Vol 58, No. 3, pp 395-399.

KEY WORDS: Travel cost model, conceptual, benefit estimates, demand.

38. Cicchetti, Charles J., Fisher, Anthony C., and Smith, V. Kerry. 1976. "An Econometric Evaluation of the Generalized Consumer Surplus Measure: The Mineral King Controversy," Econometrica, Vol 44, No. 6, pp 1259-1276.

KEY WORDS: Skiing, regional, travel cost method, California, household production model, consumer surplus, benefit, substitutes, cost/benefit analysis.

ABSTRACT: This study develops a household production model of individual behavior to focus on choices of recreational activities. The travel cost method is used to measure benefits associated with development of a new ski area. Multiple price changes and substitute site considerations are included. The study pertains to the proposed Mineral King project in California. Data were obtained from a 1969 US Forest Service survey.
A linear, six-equation demand model is estimated for six ski sites to examine the impact of a proposed Mineral King development. The authors tested the hypothesis that if symmetry of the cross-price effects is true, then a consumer surplus measure based on the demand functions will be independent of the path of price changes. A test for symmetry was not supported by the data. A multiple-equation generalization of the James-Stein estimator is also used. Benefits were reduced using the estimator, but the authors mention that these results may be "perverse." Even with the more generous benefit estimates, the project was determined to probably exhibit a negative net present value.

39. Cicchetti, Charles J., Fisher, Anthony C., and Smith, V. Kerry. 1973. "Economic Models and Planning Outdoor Recreation," Operations Research, Vol 21, No. 5, pp 1104-1113.

KEY WORDS: Models, recreation, benefits, participation, travel cost method, conceptual.

ABSTRACT: This paper reviews the major economic modeling approaches for forecasting recreation activity, and for measuring the economic benefits. A discussion of the general economic framework for modeling individual participation is included. This is followed by consideration of the meaning and estimation of the benefits from outdoor recreation. There is also a review of types of forecasting models.

40. Cicchetti, Charles J., and Smith, V. Kerry. 1973. "Congestion, Quality Deterioration, and Optimal Use: Wilderness Recreation in the Spanish Peaks Primitive Area," Social Science Research, Vol 2, pp 15-30.

KEY WORDS: Wilderness recreation, congestion, willingness-to-pay, optimal use, direct question, mail survey, remote area, regional modeling, management, benefit.

ABSTRACT: What are the relationships between congestion and willingness-to-pay for wilderness recreation in the Spanish Peaks Primitive Area, Montana? A representative sample of people who had used the Spanish Peaks Primitive Area in the summer of 1970 was surveyed by mail. A total of 600 users were included in the sample. The objective of the questionnaire was to measure willingness-to-pay for hypothetical trips into the primitive areas. The hypothetical trips differed in three quality variables: (a) trail encounters with people (0-3 encounters per day); (b) camp encounters with people (0-4 nights per trip); and (c) length of stay (1-5 days). The three quality variables were combined in different ways to form 60 unique trips. Each respondent was asked to state his or her willingness-to-pay for five of these trips. An additional feature of the questionnaire was that some respondents faced hypothetical encounters with backpacking parties while others faced hypothetical encounters with parties on horseback. This feature was added to test for the relationship between congestion costs and mode of travel.

The response rate to the survey was nearly 50 percent. After discarding unusable questionnaires, data from 195 respondents were available for analyzing willingness-to-pay. The data were analyzed with two nonlinear models specified in semi-log form. One model was specified with a focus on encounters with backpacking parties while the other focussed on encounters with parties on horseback. Generally, the equations indicated that as encounters increased, willingness-to-pay decreased. It appeared that encounters with parties on horseback reduced willingness-to-pay more than encounters with backpacking parties. There was no statistical difference between the effects of trail and camp encounters.

The equations and data were used to determine the optimal use of the Spanish Peaks Primitive Area. After making assumptions about party size and length of stay, the optimal use of the primitive area was estimated at 200 people per day. This optimal level of use implied seasonal benefits of $41,970. Addition of 50 more people per day reduced estimated seasonal benefits to $11,970 while a decrease of 50 people reduced seasonal benefits to $13,657. These results indicate that congestion effects do in fact influence economic benefits derived by recreational users.

The authors state that expectations may crucially influence willingness-to-pay for wilderness recreation. They caution, therefore, against extending their results for the Spanish Peaks Primitive Area to other areas where the tolerance for congestion may be different.

CONCERNS: Approximately one-third of the respondents did not answer the survey question concerning willingness-to-pay. Many of these respondents indicated that they were unable to put a price on wilderness recreation. This inability to state a value may be due in part to the open-ended nature of the valuation question.

41. Clawson, Marion. 1959. "Methods of Measuring the Demand for and Value of Outdoor Recreation," Reprint 10, Resources for the Future, Inc., Washington, DC.

KEY WORDS: Demand, recreation benefits, travel cost method, value, consumer's surplus.

ABSTRACT: This is a classic report about the Travel Cost Method, and its use for measuring demand for and value of outdoor recreation. The major point of this paper is that it is possible and practical to place monetary values on outdoor recreation.

The paper is written around a four-point outline of common concepts applied to recreation: (a) the gross volume of business generated by reason of the outdoor recreation opportunities; (b) the value added by local business, in the above estimated gross expenditures; (c) the demand for outdoor recreation-measured by willingness-to-pay; and (d) consumer surpluses arising from specific outdoor recreation activities.

Ideas postulated about point C are examined by using a data set from visits to Yosemite National Park in 1953. A monetary cost figure from different travel zones was estimated. A time cost was included also; this was measured in days. An assumption was made that the visit to Yosemite was the chief purpose of the trip. Other demand curves, using visits per 100,000 population, cost per visit, and time per visit were constructed. These studies related to the Grand Canyon, Glacier National Park, and Shenandoah National Park. Many crude estimates were made because of insufficient data.

To estimate the value of the recreation site as part of the total experience, two assumptions were made. First, users of the park view an increase in entrance fees rationally. Second, experiences by users from one zone provide a measure of actions of people from other zones, given similar money and time

costs. A new (second-stage) demand curve is constructed that relates effect of entrance fees on visits.

Ideas about consumer surplus and its application to recreation are discussed as well.

42. Cocheba, D. J., and Langford, W. A. 1981. "Direct Willingness-to-Pay Questions: An Analysis of Their Use for Quantitatively Valuing Wildlife," Journal of Leisure Research, Vol 13, No. 4, pp 311-322.

KEY WORDS: Nonmarket valuation, waterfowl, direct question approach, consumer surplus, mail questionnaire, recreational benefits, management, WTP.

ABSTRACT: The study question posed is can the hunter and nonhunter demand for geese be estimated using the direct question approach?

A random sample of 3,332 households was selected from the population of all households in the province of Saskatchewan, Canada. Each household in the sample was sent a mail questionnaire. The questionnaire contained a hypothetical market designed to collect hunter's and non-hunter's willingness-to-pay for increases in goose population. Care was taken in the questionnaire to introduce the problem and appeal for respondent cooperation. Consideration was also given to making the hypothetical market as real as possible, and to reducing the incentives to engage in strategic behavior. General information, which the researchers felt respondents needed to bid accurately, was included also. Respondents were asked in the hypothetical market to state their maximum willingness-to-pay for a 5- or 10-percent increase in goose population. A direct, open-ended question was utilized.

The response rate to the mail survey was 38 percent. However, 24 percent of the respondents did not answer the willingness-to-pay question. An additional 16 percent of the remaining responses to the willingness-to-pay question were declared unusable on the basis of cross-check questions. This left 514 observations for the statistical analysis. Responses were divided into hunter and non-hunter categories and simple means for willingness-to-pay for increases in goose population in 1981 were calculated. Hunters were willing to pay an average of $15.58 and $23.58 for 5- and 10-percent increases in goose population, respectively. Statistical testing confirmed that the average amount hunters were willing to pay for 5-percent and 10-percent increases was significantly different at the 10-percent level. Non-hunters were willing to pay an average of $6.01 and $6.74 for 5-percent and 10-percent increases in goose

population, respectively. Statistical testing, however, indicated that these amounts were not significantly different at the 10-percent level. The researchers were unable to explain why average willingness-to-pay figures for 5- and 10-percent increases were significantly different for hunters, but not for non-hunters. This led them to question their estimates of non-hunter willingness-to-pay. The design of the hypothetical market and the direct, open-ended question used in this study constituted an early form of contingent valuation.

CONCERNS: Almost 24 percent of the respondents were unable or unwilling to answer the willingness-to-pay question. In addition, 16 percent of the respondents who did answer the question gave responses which were inconsistent with answers to cross-check questions. Because of these problems, the researchers questioned the reliability of the instrument they used to estimate willingness-to-pay.

43. Cuddington, John T., Johnson, F. Reed, and Knetsch, John L. 1981. "Valuing Amenity Resources in the Presence of Substitutes," Land Economics, Vol 57, No. 4, pp 526-535.

KEY WORDS: Value comparison, planning, benefits, model, resource allocation.

44. Darling, Arthur H. 1973. "Measuring Benefits Generated by Urban Water Parks," Land Economics, Vol 49, No. 1, pp 22-34.

KEY WORDS: Urban parks, benefits measurement, property value approach, contingent valuation, methods comparison, recreational benefits, model, WTP, site specific.

ABSTRACT: What are the benefits of several urban water parks in California? The three parks studied were Lake Merritt in Oakland, Lake Murray in San Diego, and Lakes La Mesa and Santee in Santee.
The benefits provided by three urban water parks in California were measured by two different nonmarket valuation techniques: the property value approach and the Contingent Value Method (CVM). The CVM was used as supplemental information to offset some of the limitations of the property value method. In the property value approach, data were collected on the value and characteristics of property located within 3,000 ft of the park. An econometric model was used to estimate the portion of total property value attributable to a particular park's influence. The contingent valuation technique was applied by a personal interview survey. A random sample of households located within 3,000 ft of each park was selected for interviewing. Respondents were asked,

via iterative bidding, to state how much more they were willing to pay above current costs of use to continue use of the parks. These figures were interpreted as measures of consumer surplus. Benefits were estimated by capitalizing the consumer surplus figures over a 50-year period at an interest rate of 9 percent.

The value of property attributable to the Lake Merritt Park was estimated at $41,038,000. Consumer surplus benefits for the Lake Merritt park were estimated by CVM at $4,969,000. The value of property attributable to the Lake Murray Park was estimated at $1,439,000. Consumer surplus benefits for the Lake Murray park were estimated by CVM at $198,000. The value of property attributable to the Santee Lakes was estimated at $227,000. Consumer surplus benefits for the Lake Murray park were estimated by CVM at $327,000.

The study represents perhaps the first attempt to quantify the benefits of urban water parks in complex settings.

CONCERNS: The precision of the reported results is questionable because of a complex of factors including several major methodological problems. The property value approach did not measure consumer surplus. Thus, the figures collected by the property value approach are not directly comparable to the valuation figures collected by contingent valuation. The samples for both the property value approach and contingent valuation were notably small. The limited sample size may have contributed to large standard errors observed for the property value estimates. The consumer surplus benefits may have been underestimated because of possible interview bias and the fact that they were based on the use of the parks by households located within 3,000 ft of each park.

45. Daubert, J. T., and Young, R. A. 1981 (Nov). "Recreational Demands for Maintaining Instream Flows: A Contingent Valuation Approach," American Journal of Agricultural Economics, Vol 63, pp 667-676.

KEY WORDS: Trout fishing, white-water boating, streamside recreation, instream flows, contingent valuation, iterative bidding, water recreation, WTP, value estimates, questionnaire, regional.

ABSTRACT: What is the value of instream flow for water-based recreation on a Colorado mountain stream?

A personal interview survey was conducted of recreational users of the Cache la Poudre River in northern Colorado. Three types of recreationists were interviewed: trout fishermen; white-water boaters (kayakers, rafters, and tubers); and persons involved in streamside recreation (picnicking, camping, and hiking). Interviews were conducted on random days throughout the summer of 1978 at various sites along the river. Respondents were asked to state

their maximum willingness-to-pay for use of the river contingent on various levels of instream flow. The different levels of instream flow were depicted by color photographs. Iterative bidding was used to measure maximum willingness-to-pay. Each respondent expressed willingness-to-pay in terms of a percentage increase in the present county sales tax and a hypothetical entrance fee. The survey resulted in 184 interviews. The sample included 49 trout fishermen, 40 white-water boaters, and 45 shoreline recreationists. An example of the bidding question is included.

Benefit functions were estimated by stepwise least squares regression for each activity. The regression equations indicated that sales tax bids were statistically greater than entrance fee bids for all three recreational activities. Total willingness-to-pay (entrance fee) by fishermen reached a maximum of $30.00 per day at an instream inflow of 500 cfs. Total willingness-to-pay (entrance fee) by shoreline recreationists for instream inflows reached a maximum of $10 per day at 700 cfs. Total willingness-to-pay by white-water boaters increased at a constant rate for all levels of instream inflows considered. White-water boaters were willing to pay (entrance fee) approximately $1.90 for an initial instream inflow of 100 cfs, and approximately $.019 for every additional cubic foot per second thereafter. All bids reported here were assumed to be free of congestion and substitution effects.

The article discusses the tradeoff between instream inflows for recreation and off-stream water allocations for irrigation, cities, and industries. During periods of relatively low flows, the estimated instream flow marginal value exceeds the marginal value of water in irrigation.

CONCERNS: Bids were found to be sensitive to the type of payment vehicle used. The entrance fee vehicle may have encouraged understatement, while the sales tax vehicle may have encouraged overstatement (because of the free-rider problem).

46. Davis, Robert K. 1963. "The Value of Big Game Hunting in a Private Forest," Transactions of the Twenty-ninth North American Wildlife and Natural Resources Conference, Vol 29, pp 393-403.

KEY WORDS: Benefits, willingness-to-pay, bidding game, Maine, big game hunting, planning, contingent valuation method.

47. Davis, Robert K. 1963. "Recreation Planning as an Economic Problem," Natural Resources Journal, Vol 3, No. 2, pp 239-249.

KEY WORDS: Recreation planning, alternatives, willingness-to-pay, planning, conceptual.

48. Deyak, Timothy A., and Smith, V. Kerry. 1978 (Mar). "Congestion and Participation in Outdoor Recreation: A Household Production Function Approach," Journal of Environmental Economics and Management, Vol 5, pp 63-80.

KEY WORDS: Participation, recreation, household production model.

ABSTRACT: "This paper examines the effect of congestion on recreational behavior within a household production model of consumer behavior. We assume that congestion affects the household's ability to produce constant quality recreational service flows and derive a reduced-form model for participation decisions in remote and developed camping. Empirical estimates of the effects of a congestion measure on the conditional probability of participation as well as on the level of participation are estimated for each activity by the type of trip using information from the 1972 National Recreation Survey. The findings suggest that congestion was most likely to affect the decision to participate and not the level once that decision had been made. While differences in these effects were observed across the activities studied, it is not clear how they should be interpreted since our congestion measure was a proxy variable likely to perform better for remote camping than developed camping."

49. Donnelly, Dennis M., Loomis, John B., Sorg, Cindy F., and Nelson, Louis J. 1983. "The Net Economic Value of Recreation Steelhead Fishing in Idaho," Rocky Mountain Forest and Range Experiment Station, US Forest Service, Fort Collins, CO.

KEY WORDS: Benefits, recreation, Idaho, fishing, contingent valuation method, consumer surplus, wildlife, willingness-to-pay, regional travel cost model.

ABSTRACT: What is the average willingness-to-pay for steelhead fishing trips in Idaho? A set of dollar values that vary by fishing increments is presented also. The Travel Cost Method (TCM) and the Contingent Value Method (CVM) are both used. Primarily, this comparison was intended to test the effectiveness of both methods.

The population sampled were anglers having an Idaho tag in 1982, including both residents and non-residents. The sampling rate was 1.69 percent, or 427 individuals. A telephone interview was conducted to ask TCM and CVM questions.

Regression analysis was performed. Income and income squared were used because previous studies found that income did not necessarily enter in a linear fashion. However, income did not enter strongly into the analysis. The analysis of the critical function depended on total benefits from an existing set of sites, not estimates of use. Therefore, the natural log of visits per capita was chosen for the model. For calculating TCM benefits, the value of time was set as one-third of the wage rate. Travel costs were computed using three steps. First, mileage was converted to transportation cost on a vehicle basis. Second, with about 2.6 anglers per vehicle, the standard cost per person was figured. Finally, the transportation cost also was estimated using the cost per mile reported by respondents for their last steelhead fishing trip.

Average willingness-to-pay in addition to actual expenditure for fishing was estimated at $27.87 per trip with the TCM, and at $31.45 per trip with the CVM.

These averages are approximately the same, but incremental changes do not necessarily maintain this near equality. If there is an improvement in fishing opportunities to existing anglers, the net economic value in the short run, as measured by CVM, is typically less than the long-run value of improved steelhead fishing opportunities as measured by TCM. Analysis, by TCM, shows an increase in fishing trips of about 238 percent associated with the improvement. Therefore, much of the benefit from a higher quality fishing experience would accrue to new anglers attracted by increased fishing quality.

50. Dwyer, John F., and Bowes, Michael D. 1978. "Concepts of Value for Marine Recreational Fishing," American Journal of Agricultural Economics, Vol 60, No. 5, pp 1008-1012.

KEY WORDS: Recreation, benefits, marine fishing, conceptual, willingness-to-pay, willingness-to-sell, travel cost method, survey approach, consumer surplus.

ABSTRACT: This paper focuses on procedures for estimating changes in marine recreational fishing benefits under resource management options.

CONCERNS: No estimates or theories are presented. Only considerations for valuing marine recreation benefits are discussed.

51. Dwyer, John F., Kelly, John R., Bowes, Michael D., and Bowes, Marianne. 1979. "Needed Improvements in Recreation Benefit Estimation," Journal of Leisure Research, Vol 11, No. 4, pp 327-333.

KEY WORDS: Recreation, benefits, willingness-to-pay, travel cost models, unit-day value method.

ABSTRACT: "The increasing significance of recreation to project and program options involving public resources, the mounting attention given to benefit-cost analysis, and the development of substantial improvements in the procedures for estimating recreation demand call for use of improved recreation benefit estimation procedures. Evaluations of the commonly used interim unit day value approach for estimating recreation benefits indicates that it should be replaced by predictive models based on the travel cost and survey methods. These models estimate the willingness of users to pay for the use of recreation sources."

52. Dwyer, John F., Kelley, John R., and Bowes, Michael D. 1977. "Improved Procedures for Valuation of the Contribution of Recreation to National Economic Development," Research Report No. 128, Water Resources Center, University of Illinois, Urbana-Champaign, IL.

KEY WORDS: Recreation, water utilization, water uses, cost-benefit analysis, value, national economic development, consumer surplus, travel cost method, interview method, willingness-to-pay functions.

ABSTRACT: This publication is a good reference. Examples and guidelines of travel cost and survey methods are provided. Unit day and unit visit values from many studies are derived.

53. Edwards, J. A., Gibbs, K. C., Guedry, L. J., and Stoevener, H. H. 1976. "The Demand for Non-Unique Outdoor Recreational Services: Methodological Issues," Technical Bulletin No. 133, Agricultural Experiment Station, Oregon State University.

KEY WORDS: Methodology, travel cost model. Oregon, questionnaire, recreation demand, value estimation.

54. Fesenmaier, Daniel R., and Lieber, Stanley R. 1985 (Feb). "Evaluating the Stability of Outdoor Recreation Participation Models," The Professional Geographer, Vol 37, pp 15-21.

KEY WORDS: Recreation, participation model, simulation, parameter stability, Oklahoma.

ABSTRACT: Regional participation models can be assumed to be "explained" by the parameters which incorporate underlying regional variations. For the state of Oklahoma, grouping household data into different regional configurations produced a wide variety of statistical results which may be spurious and may not represent the causal factors underlying recreation participation. The results of a simulation model indicate that a variety of models may be constructed which accurately predict the level of participation in outdoor recreation behavior, depending upon which households are included in the respective region. The simulation procedure used in this paper may be helpful in evaluating the contribution of each model component, both in terms of stability as well as performance.

55. Fisher, Anthony C., and Krutilla, John V. 1972 (Jul). "Determination of Optimal Capacity of Resource Based Recreational Facilities," Natural Resources Journal, Vol 12, pp 417-444.

KEY WORDS: Optimal capacity, recreational facilities, wilderness, net benefit, congestion, conceptual, willingness to pay.

56. Freeman, A. Myrick, III. 1979. "Approaches to Measuring Public Goods Demands," American Journal of Agricultural Economics, Vol 61, No. 5, pp 915-920.

KEY WORDS: Demand, benefits, methods comparison, environmental quality, conceptual.

57. Gramlich, Frederick W. 1977. "The Demand for Clean Water: The Case of the Charles River," National Tax Journal, Vol 30, No. 2, pp 183-194.

KEY WORDS: Demand, water quality, direct question approach, mail, personal interview, benefits, questionnaire, WTP.

ABSTRACT: What are the benefits and costs of attaining a swimmable level of water quality in the Charles River located near Boston, MA?
A survey of 165 families in the Boston metropolitan area was conducted. The survey employed both mail questionnaires and personal interviews to gather data related to respondents' willingness-to-pay to improve the water quality of the Charles River from non-swimmable to swimmable. Respondents were asked to state their maximum willingness-to-pay in response to a direct question. Willingness-to-pay was hypothesized to be a function of ability to pay, education, proximity to the Charles River, attachment to the Boston area, and taste

for water activity. The effect of these variables on willingness-to-pay was analyzed using a double-log functional form. A final specification of the regression model was used to estimate mean willingness-to-pay for improved water quality.

Average willingness-to-pay per household for a guaranteed improvement of Charles River water quality to swimmable was estimated to be $30.54 annually. Income, education, increased use of the river, youthfulness, proximity of workplace, graduate student status, and greater likelihood of future residence in the Boston area all appeared to be positively related to willingness-to-pay, as hypothesized. Also, as hypothesized, distance of the family residence from the Charles River appeared to be negatively related to willingness-to-pay.

Aggregate willingness-to-pay to improve Charles River water quality to swimmable was estimated at $8.6 million in 1973 dollars for residents of the river's watershed. For residents of municipalities within 5 miles of the river, aggregate willingness-to-pay to improve water quality was estimated at $16.3 million in 1973 dollars. This last estimate of aggregate willingness-to-pay (benefits) compared well to the estimated $16.68 million cost (in 1973 dollars) of improving Charles River water quality to swimmable. An analysis of Boston area residents' willingness-to-pay to improve water quality in the nation's rivers was included in the article. This analysis led to a procedure for roughly estimating US citizens' willingness-to-pay to improve Charles River water quality.

CONCERNS: The design and wording of the value questions, hypothetical circumstances, and information influences may have been a problem. The effects of these influences were thought to be minimal, although no formal tests were actually conducted.

58. Greenley, Douglass A., Walsh, Richard G., and Young, Robert A. 1981. "Option Value: Empirical Evidence from a Case Study of Recreation and Water Quality," Quarterly Journal of Economics, Vol 96, No. 4, pp 657-673.

KEY WORDS: Watersheds, valuation, water quality, externalities, option value, bequest value, contingent valuation, iterative bidding, personal interview, existence value, WTP.

ABSTRACT: The article explores the quantification of use, option, existence, and bequest values associated with preserving clean water in streams located in the South Platte River Basin, Colorado.

A random sample of households located in Denver and Fort Collins, CO was drawn. The sample, consisting of 202 households, was subjected to a personal interview survey during the summer of 1976. Contingent valuation was employed to collect data on the value of clean water in the South Platte River Basin streams. Respondents were shown color photographs depicting water quality at three stream sites; A, B, and C. The photos were chosen so that three distinct levels of heavy metal pollution from mining activities were shown. Respondents were then asked to state their willingness-to-pay to prevent mining development with the result being that water quality in basin streams would be maintained. Iterative bidding, using either a sales tax or a water bill payment vehicle, was utilized to collect willingness-to-pay. Use, option, existence, and bequest values were collected with different formats developed from the basic willingness-to-pay question.

The results reported here reflect willingness-to-pay an increased sales tax to preserve clean water. It was contended that the sales tax payment vehicle was more effective in reducing "free-rider" effects. The option value of clean water to participants and non-participants in water-based recreation was estimated at $23 per household annually. Use value of clean water to participants was estimated at $57 per household annually. Existence value to participants was estimated at $34 per household annually. Bequest value to participants was estimated at $33 per household annually. It was stated that the estimates of existence and bequest value of clean water to participants should be viewed with caution because of a high probability of upward bias. Existence value of clean water to non-participants was estimated at $25 per household annually. Bequest value to non-participants was estimated at $17 per household annually. Aggregation resulted in an estimate of total annual benefits of clean water equal to $61 million. This figure included $414 million in use value, $165 million in option value, $226 million in existence value, and $153 million in bequest value. Existence and bequest values were estimated from the responses of non-participants only.

CONCERNS: Some evidence of payment vehicle influences was reported. Respondents were more reluctant to participate in iterative bidding with the water-sewer bill vehicle than with the sales tax bidding vehicle. Respondents may have perceived the water-sewer bill payment vehicle as inequitable because tourists do not pay such bills. This fact, combined with recent increases in water-sewer rates, may have biased results downward.

59. Gum, Russell L., and Martin, William E. 1977. "Structure of Demand for Outdoor Recreation," Land Economics, Vol 53, No. 1, pp 43-55.

KEY WORDS: Demand, recreation, benefits, socioeconomic variables, travel cost method, attitudes, Arizona, planning, survey, hunting, camping, fishing.

60. Gum, Russell L., and Martin, William E. 1975. "Problems and Solutions in Estimating Demand for, and Value of Rural Outdoor Recreation," American Journal of Agricultural Economics, Vol 57, No. 4, pp 558-566.

KEY WORDS: Demand, benefits, rural recreation, resource allocation, value estimates, mail questionnaires, travel cost method, Arizona, substitution.

ABSTRACT: The purpose of this paper is to describe a large-scale empirical study of outdoor recreation in Arizona. In this paper, emphasis is placed on methodology. Complete empirical results are reported in Martin, Gum, and Smith, "The Demand for and Value of Hunting, Fishing, and General Outdoor Recreation in Arizona," Arizona Agricultural Experiment Station, Technical Bulletin 211, May 1974.
The total population of Arizona was sampled. Mail questionnaires were selected as the most feasible method of obtaining responses. A total of 2,926 usable responses (19.9 percent of the mailing) were gathered.
In order to reduce any response bias, the respondents were classified into five categories. Demand relationships were estimated for recreational activities. The Clawson-Hotelling approach was used to estimate the demand curve. The price elasticities (partial and total) between activities at different sites were calculated. Linear regression was used for analysis. Resource values were based on estimating individual demand relationships. The average consumer surplus value per household trip for general outdoor recreation in Arizona was $66.54. The value for cold water fishing was $50.13, and for warm water fishing was $45.92.

61. Hammack, Judd, and Brown, Gardner M., Jr. 1974. "Waterfowl and Wetlands: Toward Bioeconomic Analysis," Resources for the Future, Inc., Johns Hopkins University Press, Baltimore, MD.

KEY WORDS: Waterfowl hunting, nonmarket valuation, willingness to sell, willingness-to-pay, direct question approach, mail survey, recreational benefits, contingent valuation method, WTA, WTP, management.

ABSTRACT: What is the economic value of waterfowl hunting in states located in the Pacific flyway? The study setting included seven Western States which

lie within the boundaries of the Pacific flyway. These states are Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington. A mail questionnaire was sent to a sample of 490 waterfowl hunters.

The questionnaire began with background questions such as years of hunting experience and waterfowl species preference. Following these questions were questions designed to estimate consumer surplus from waterfowl hunting. The willingness-to-sell question asked respondents to state the minimum amount of money it would take to compensate them for the loss of their right to hunt waterfowl for one season. Next, respondents were asked to estimate their total waterfowl hunting costs for the 1968-69 season. They were then asked to state how much greater their 1968-69 costs would have needed to be before they would have quit hunting during that season.

Many respondents objected to the willingness-to-sell question; 12.4 percent of them stated that they would not sell their right to hunt waterfowl at any price. An additional 1.4 percent demanded a very high price (e.g., $1,000,000) for their right to hunt waterfowl. Eliminating these very high prices resulted in a mean price of $1,044. The compensating measure of consumers surplus (WTP) therefore was estimated at $1,044.

Respondents appeared to react more favorably towards the willingness-to-pay question. The mean amount that costs would have needed to rise before respondents would have discontinued waterfowl hunting in 1968-69 was estimated at $247.00. This total value translated to a marginal value of bagged waterfowl equal to $3.29. Because it provoked a less emotional response, the consumers surplus value estimated by the willingness-to-pay question was judged to be more reliable.

Various models are presented which promote better management of existing wetlands. These include cost-benefit computations, an analytical optimal control model, and a discrete-time, infinite-horizon model.

CONCERNS: Respondents did not react well to a question asking them to "sell" (WTA) their annual right to hunt waterfowl.

62. Hanemann, W. Michael. 1984. "Discrete/Continuous Models of Consumer Demand," Econometrica, Vol 53, No. 3, pp 541-561.

KEY WORDS: Demand analysis, model, substitutes.

ABSTRACT: "This paper develops a unified framework for formulating econometric models of discrete/continuous consumer choices in which the discrete and

continuous choices both flow from the same underlying (random) utility maximization decision. As a special case, a number of models suitable for empirical application are developed where the discrete choice is among different brands of a commodity. Since these brands are essentially substitutes, the consumer prefers to buy only one brand at any time; the discrete choice is which brand to select and the continuous choice is how many to buy."

63. Haspel, Abraham E., and Johnson, F. Reed. 1982. "Multiple Destination Trip Bias in Recreation Benefit Estimation," Land Economics, Vol 58, No. 3, pp 364-372.

KEY WORDS: Multiple destination trip bias, benefit estimation, alternatives, value, willingness to pay, Clawson-Knetsch travel cost method, method comparison.

ABSTRACT: The purpose of this study is to test a modified travel cost method to account for multiple destination trip bias.

The data used were drawn from an itinerary survey of visitors to Bryce Canyon National Park during the summer of 1980. A total of 508 responses from 38 states were found to be acceptable. Four different regressions using generalized least squares were used to obtain coefficient estimates and to compare results. The first regression was a traditional travel cost equation. The second regression assumes the travel cost is equal to the travel cost of an average leg of a trip. The third regression allows for weighting several stops that are relatively close together. Regression four examines the importance of multiple destinations versus substitutability.

The third regression appeared to be most successful. Estimates for per vehicle willingness to pay on average distance were: regression 2- $91; regression 3- $69; and regression 4- $65. The travel cost method using total distance was almost $2,000 per vehicle.

A willingness-to-pay question was asked on the survey also. The driver of each vehicle was asked the maximum number of additional miles he would have been willing to drive in order to visit Bryce Canyon. These responses were converted to a consumer surplus of $81 dollar per vehicle, including time costs.

64. Hay, Michael J., and McConnell, Kenneth E. 1979. "An Analysis of Participation in Nonconsumptive Wildlife Recreation," Land Economics, Vol 55, No. 4, pp 460-471.

KEY WORDS: Recreation, participation, wildlife, demand, logit model.

65. Heidt, J. D. 1977. "Price Proxies for Estimating the Demand for and Value of Recreational Resources," Ph.D. dissertation, School of Renewable Natural Resources, University of Arizona, Tucson, AZ.

KEY WORDS: Site specific, travel cost method, cost difference approach, iterative bidding, personal interview, methods comparison, substitute recreation areas, demand, recreational resources, Marshallian surplus, Arizona, WTP, benefit, contingent valuation.

ABSTRACT: Are there differences among the values of an outdoor recreational site estimated by the travel cost approach, cost difference approach, and iterative bidding approach?

Contingent valuation was used to estimate the value of outdoor recreation provided by the Pena Blanca Recreational Area, Coronado National Forest, Arizona. Recreational activities offered at Pena Blanca include camping, fishing, picnicking, swimming, hiking, boating, and sightseeing.

The contingent valuation method used was iterative bidding. The method was administered by a personal interview survey conducted at Pena Blanca from December, 1970 to November, 1971. Interviews were conducted 3 days per month throughout the 1-year survey period. On a sample day, enumerators attempted to interview a representative proportion of groups engaged in different activities at each recreational area at the site. Respondents were asked to indicate their willingness-to-pay for the use of the Pena Blanca site. A hypothetical entrance fee (dollars per person) was used as the payment vehicle. Two types of iterative bidding exercises were used to collect willingness-to-pay. In the first, bids were presented to respondents in ascending order. In the second, bids were presented in descending order. Data were also collected in the survey for use in the travel cost and cost difference approaches to nonmarket valuation. Alternative measures of outdoor recreation at Pena Blanca were estimated by these two approaches for comparative purposes.

The survey resulted in 274 usable interviews. The data from these interviews were separated into two groups: 126 day users and 148 overnight users. Because of data problems, comparisons were made between valuation measures for overnight users only. The value of one visit to Pena Blanca was estimated at approximately $0.89 by the contingent valuation method. There was no statistical difference between values obtained by the ascending-order and

descending-order iterative bidding procedures. The value of one visit to Pena Blanca was estimated between $0.48 and $5.11 by the travel cost method, and between $4.43 and $9.83 by the cost difference approach.

CONCERNS: A $5 limit was placed on bids in the iterative bidding exercises. This limit probably biased bids downward. The sample may have been biased towards campers and shore fishermen, since these recreationists were most accessible for interviews.

66. Hof, John G., and King, David A. 1982. "On the Necessity of Simultaneous Recreation Demand Equation Estimation," Land Economics, Vol 58, No. 4, pp 547-552.

KEY WORDS: Recreation demand, travel cost method, substitutes, regional modeling, conceptual, demand estimation, consumer surplus, benefits, alternative sites.

67. Hof, John, and Loomis, John. 1983. "A Recreation Optimization Model Based on the Travel Cost Method," Western Journal of Agricultural Economics, Vol 8, No. 1, pp 76-85.

KEY WORDS: Allocation, model, proposed sites, recreation benefits, management, travel cost method, wilderness, planning, substitute, regional, opportunity, cost.

ABSTRACT: "A recreation allocation model is developed which efficiently selects recreation areas and degree of development from an array of proposed and existing sites. The model does this by maximizing the difference between gross recreation benefits and travel, investment, management, and site opportunity costs. The model presented uses the travel cost method for estimating recreation benefits within an operations research framework. The model is applied to selection of potential wilderness areas in Colorado. This example is then extended to show the model's capability in budget analysis and in planning to meet recreation targets."

68. Howitt, Richard E., Moore, S. F., Moore, C. V., and Snyder, J. H. 1974. "A Simulation Approach to Recreation Planning: A Case of Changing Quality," Annals of Regional Science, Vol 8, No. 1, pp 35-50.

KEY WORDS: Recreation, simulation model, planning, benefits, site characteristics, fishing, California, participation, modeling.

ABSTRACT: A simulation method is used to analyze the effects of changes in the quality of recreational experiences. This model accounts for the use of

quantitative data and subjective input on the qualitative effects. The objective of this study was to project the impact of changing water quality in the Salton Sea on recreational use and the investment climate for recreation facilities in the area.

Since 1966, a downward trend in saltwater sport fishing has continued, principally because of the effects of increased salinity. The qualitative effects were gathered from reactions expressed by recreationists and investors in recreation facilities. The level variables incorporated into the model that affect participation were fishing participation, non-fishing participation, fishing facilities investment, and nonfishing investment. The reference year 1965 was selected. Data were collected for 12 sub-variables and analyzed to provide three reference rates for the level variables. Lag times and multiplier functions were incorporated into the model.

69. James, L. Douglas. 1970. "Economic Optimization and Reservoir Recreation," Journal of Leisure Research, Vol 2, No. 1, pp 16-29.

KEY WORDS: Optimization, reservoir, recreation, planning, visitation, conceptual, use maximization, participation.

ABSTRACT: "Water resources planners seek in project formulation to find the project maximizing benefits net of cost. The procedure requires some way of measuring the increase in benefits achieved by providing a larger facility. Marginal benefits cannot be equated to marginal cost without a marginal benefit curve. Empirical visitation data collected from existing reservoirs to index the capacity of a facility to accommodate visitors and to estimate the effect of capacity on annual visitation provided a first approximation of the necessary relationship. While the empirical coefficients may vary with the geographical characteristics of the reservoir and the socioeconomic characteristics of the surrounding population, the conceptual approach provides a generally applicable methodology for determining an optimum-sized recreation facility from the economic viewpoint."

70. Johnson, F. Reed, and Haspel, A. E. 1983. "Economic Valuation of Potential Scenic Degradation at Bryce Canyon National Park," Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas, R. D. Rowe and L. G. Chestnut, eds., Westview Press, Boulder, CO, pp 235-245.

KEY WORDS: Valuation, environmental quality, surface mining, travel cost, willingness-to-pay, survey.

71. Johnson, F. Reed, King, William E., and Hay, Michael J. 1979. "Measuring Recreation Values: A Status Report," Proceedings of the Multiple Objective Planning Workshop, Russell L. Gum and William E. Martin, eds., Miscellaneous Report No. 7, College of Agriculture, University of Arizona, Tucson, AZ.

KEY WORDS: Recreation values, method comparison, recreation demand, unit day value method, travel cost method, contingent valuation method, net benefits.

ABSTRACT: "This paper describes and assesses three methods of estimating recreation benefits for project evaluation: the travel-cost method, contingent valuation surveys, and unit day values. All three methods have advantages and disadvantages with respect to project planning, and each situation must be considered separately. Nevertheless, unit day values should be used much more sparingly than in the past because of their lack of a sound conceptual basis. Differences in philosophical orientation of planners, differences in perception of job responsibilities, and differences in institutional constraints may influence the adoption of improved techniques. Pressures within the Federal Government to improve valuation methods will ultimately be felt in every agency. It is only a matter of time before this pressure becomes a requirement to use improved methods."

72. Johnston, W. E., and Pankey, V. S. 1968. "Some Considerations Affecting Empirical Studies of Recreational Use," American Journal of Agricultural Economics, Vol 50, No. 5, pp 1739-1744.

KEY WORDS: Recreational use, demand, use, alternatives, reservoirs, travel cost method, California.

ABSTRACT: "The setting of the study is described first and then three major topics are briefly considered: (a) alternative formulations of the observation units, (b) assumptions about per capita use rates, and (c) the specification of distance in analytical models."

73. Knetsch, Jack L., Brown, R. E., and Hansen, W. J. 1976. "Estimating Expected Use and Value of Recreation Sites," Planning for Tourism Development: Quantitative Approaches, C. Gearing, W. Swart, and T. Var, eds., Praeger, New York, pp 103-114.

KEY WORDS: Use, benefits, recreation sites, travel cost model, reservoirs, California, net benefit, substitution.

ABSTRACT: What are the estimated use and net recreational values of reservoirs? This paper reports on results drawn from a research project by the US Army Corps of Engineers. The seven reservoirs are located in the Sacramento District of the Corps. Data were collected on day-trippers only from approximately 38,400 visitor parties from 1966-69.
Parameters of the model are estimated from visitation data for existing parks. Variables included were cost of travel, size of population at the origin, substitutability, and attractiveness in terms of size or facilities.
Over all seven reservoirs, 94 percent of the total attendance was accounted for by the model. For the value estimates, travel expenditures were assumed to be 1.46 cents per mile per visitor. The value of time per hour was assumed to be $1.65 per vehicle. One net benefit estimate is given using a convex tradeoff which includes travel expenditures and incorporates a time factor. A second benefit is estimated with a linear trade-off with just the value of time variable.
The net benefit results for the linear function were lower for all of the reservoirs. The authors feel that these estimates probably understate the willingness-to-pay.
The total values between reservoirs vary widely as does the average value per visitor. The lowest values occur at a reservoir far from large cities and close to alternative sites.

74. Knetsch, Jack L., and Davis, Robert K. 1966. "Comparisons of Methods for Recreation Evaluation," Water Research, A. V. Kneese and S. C. Smith, Washington, DC, eds., Resources for the Future, Inc., pp 125-142.

KEY WORDS: Recreation evaluation, outdoor recreation, forest recreation benefits, gross expenditures method, willingness-to-pay, interview methods, Maine, bidding game, wilderness areas, Travel Cost Method.

ABSTRACT: This paper compares the benefit evaluation procedures and analysis used in the Contingent Value (interview) Method (CVM) and the Travel Cost Method (TCM). The CVM is discussed using Davis's dissertation as an example. The TCM is explained using a hypothetical example.
Estimates of willingness-to-pay were shown only for the interview procedure. To obtain samples, cluster sampling was employed. The interviews were conducted from June through November by visiting areas in privately owned forests. The data were pooled to include hunters, fishermen, and summer campers. For the sample of 185 interviews, willingness-to-pay (per household day)

ranges from zero to $16.66. The model WTP occurs between $1.00 and $2.00 per day per household.

75. Knetsch, Jack L., and Sinden, J. A. 1984. "Willingness-to-pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value," Quarterly Journal of Economics, Vol 99, No. 3, pp 507-521.

KEY WORDS: Willingness-to-pay, benefits, compensation, valuation, indifference curves.

ABSTRACT: "Aside from possible income effects, measures of the maximum amounts people are willing to pay to avoid a loss and the minimum compensation necessary for them to accept it are generally assumed to be equivalent. Unexpectedly wide variations between these sums, however, have been noted in survey responses to hypothetical options. This paper reports the results of a series of experiments that confronted people with actual money payments and cash compensations. The results indicate that the compensation measure of value seems to exceed significantly the willingness-to-pay measure, which would appear to call into some question various rules of entitlement, damage assessments, and interpretations of indifference curves."

76. Lee, L. 1982. "Congestion, Willingness-to-pay, and Recreation Opportunities, Spectrum Zones," M.S. thesis, Department of Economics, Colorado State University, Fort Collins, CO.

KEY WORDS: Hiking, backpacking, congestion, net benefits, iterative bidding, personal interview, recreational benefits, WTP.

ABSTRACT: What are the effects of congestion on the recreation benefits from hiking and backpacking in the Front Range of Colorado's Rocky Mountains? A personal interview survey was conducted of 106 representative hikers in the summer of 1980. The sample was stratified into two subsamples consisting of 73 hikers and backpackers in roadless areas and 33 hikers and backpackers in roaded areas. Respondents were asked to state their maximum willingness-to-pay for the hiking experience contingent on changes in congestion. Maximum willingness-to-pay was measured by iterative bidding. The starting point of the iterative bidding process was the actual congestion level on the day of the interview. An increase in direct trip costs was used as the payment vehicle. Stepwise least squares statistical methods were used to estimate the relationship between willingness-to-pay and congestion.

Regression equations were estimated to analyze the specific relationships between willingness-to-pay for hiking in roadless areas as compared to roaded areas.

In general, it was found that congestion negatively impacted willingness-to-pay for hiking experiences in the Front Range of Colorado. Hikers and backpackers in roadless areas were more influenced by congestion than those in roaded areas. With no other person encountered, average willingness-to-pay was estimated at $10.70 per day for roadless area hikers, and $8.84 per day for roaded area hikers. Average willingness-to-pay decreased with each additional person encountered by $0.25 per day for roadless area hikers and $0.13 per day for roaded area hikers, ceteris paribus. A statistical test for strategic bias in the results was nonsignificant.

The study includes an analysis of the optimum capacity for the hiking areas studied.

77. Loomis, John B. 1982 (Apr). "Effect of Non-Price Rationing on Benefit Estimates from Publicly Provided Recreation," Journal of Environmental Management, pp 283-289.

KEY WORDS: Recreation benefits, hunting, travel cost method, resource allocation, wildlife management.

ABSTRACT: "Using a modified travel cost model, losses in recreation benefits associated with lottery-rationed hunting permits are estimated. The implications of these reduced benefit estimates include less than optimal treatment of these species in land-use resource allocations and in allocation of wildlife management funds. Recommendations such as pricing of permits are made to remedy this situation."

78. Loomis, John B. 1982. "Use of Travel Cost Models for Evaluating Lottery Rationed Recreation: Application to Big Game Hunting," Journal of Leisure Research, Vol 14, No. 2, pp 117-124.

KEY WORDS: Travel cost model, recreation benefits, big game hunting, demand, rationing, lottery.

ABSTRACT: "Modifications of the standard travel cost model are suggested so as to fulfill the assumptions necessary to use travel cost models in recreation benefit estimates for hunting privileges which are rationed by lottery. The potential effects of the lottery on the estimation of the per capita

demand curve are also addressed to suggest further modifications so that resulting benefit estimates are more useful in project evaluation and land-use allocations. Using data on buffalo, desert bighorn sheep, and antelope hunts in Utah, travel cost models with and without the modifications are compared to illustrate the usefulness of the suggested modifications."

79. Loomis, John B. 1980. "Monetizing Benefits Under Alternative River Recreation Use Allocation Systems," Water Resources Research, Vol 16, No. 1, pp 28-32.

KEY WORDS: Benefits, recreational use, travel cost, allocation system, river, optimal capacity.

ABSTRACT: "An optimal capacity, when the binding use constraint is ecological damage, and monetization of recreational benefits, under alternative means of rationing that capacity, were conceptually and empirically developed. The model was developed by first estimating the demand to float Westwater Canyon, derived from a modified travel cost model. Recreational benefits of $6,500 under a hypothetical capacity of 50 trips, when pricing was used to allocate the permits, and a range from as low as $880 to an expected value of $3,690, if a lottery system is used, were estimated using this model. The monetization of the efficiency losses associated with more equitable allocation systems allows managers to be more objective in making the equity-efficiency tradeoffs involved in picking a recreation use allocation system."

80. Loomis, John B., Sorg, Cindy F., and Donnelly, Dennis M. 1986. "Evaluating Regional Demand Models for Estimating Recreation Use and Economic Benefits: A Case Study," Water Resources Research, Vol 22, No. 4, pp 431-438.

KEY WORDS: Regional, model, use, benefits, benefit-cost analysis, travel cost, contingent value, WTP, fishing, Idaho varying parameter approach, site characteristics, demand.

ABSTRACT: The advantages and disadvantages of different types and sizes of regional demand models are presented. After this discussion, the study compares the accuracy of use and benefit estimates of regional models with benefit estimates from single-site methods. The experiment drew data from a survey of 1,952 coldwater fishermen.
Interviews were conducted in 1983, from a total of 51 lakes and streams. The Travel Cost Method (TCM) sites throughout Idaho are used for the regional

model, and results from the single-site model were obtained from TCM and the Contingent Value Method (CVM).

The basic structure for the use model followed the varying parameter approach. For 51 sites, a test of the model predicted participation rates within 2 percent of the actual number of trips. Site-specific models are shown to be better predictors of use at an existing site.

For benefit evaluation, the TCM is used for the regional models, and both TCM and CVM are used for the single-site model. The difference is great for the value estimates. The CVM question utilized an iterative bidding approach.

Method	Total Site	Per Trip
51-site TCM	$2,131	$34.37
3-site TCM	$3,392	$56.15
1-site TCM	$3,205	$66.64
CVM	$3,365	$70.11

The results may indicate that regional models are more desirable for planning issues dealing with evaluation of the benefits of building a new recreation site or improving quality at an existing site.

81. Lucas, Robert C., and Shechter, Mordechai. 1977. "A Recreational Visitor Travel Simulation Model as an Aid to Management Planning," Simulation and Games, Vol 8, No. 3, pp 375-388.

KEY WORDS: Recreation, participation, simulation model, planning, management, wilderness, site specific, use patterns.

ABSTRACT: A wilderness travel simulation model is developed to provide a better way to formulate and evaluate use-management policies. Use patterns can quickly be simulated.

The input data necessary are arrival patterns, travel routes, popularity of those routes, travel speeds, etc. The information is calculated in probabilistic terms. The output for each simulation is a scenario.

CONCERNS: The model is not presented.

82. Majid, I., Sinden, A., and Randall, Alan. 1983. "Benefit Evaluation of Increments to Existing Systems of Public Facilities," Land Economics, Vol 59, No. 4, pp 377-392.

KEY WORDS: Recreation, benefits, Australia, substitution, conceptual model, willingness-to-pay, site characteristics, substitutes, model comparison, option value, existence value, demand theory, iterative bidding, contingent valuation, proposed sites.

ABSTRACT: This study examines the benefit questions raised by the proposal of adding new park areas to an existing Australian park system.
Currently, there are nine established parks. Each of the two proposed parks offers a differentiated attraction. One has rock formations, the other, aboriginal sacred sites. The relevant question is: What is the benefit of changing the land use of each of these areas to provide an increment to the existing system of parks? This includes the sub-question, what are the contributions of visitor values and non-visitor values?
To answer these questions, a demand model is hypothesized and tested. The new demand theory (NDT) is used. With the theory, utility is derived directly, not from consumption, but from characteristics or quality variables. Specifically these characteristics are provided by activities, amenity descriptors, intrinsic activity groups, and activity production technology.
The model described the willingness-to-pay values. These values were collected with the iterative bidding method of contingent valuation. For the two proposed parks, annual WTP data were collected from 140 randomly selected households. Different forms of surveys gathered information on visitation value in isolation, total value in isolation, and incremental total value.
The authors found that nonvisitor benefits exceeded the benefits from visitation. Also, the benefits to any park considered in isolation exceed benefits accrued as an addition to the existing system.

CONCERNS: The dollar figures are assumed to be Australian currency.

83. Mansfield, N. W. 1980. "Recreational Trip Generating," Journal of Transport Economics and Policy, Vol 3, pp 152-164.

KEY WORDS: Participation, recreation, model, alternative sites.

ABSTRACT: "This paper attempts to analyze the demand for day and half-day pleasure trips to a holiday area, by means of a model describing the generation of trips to alternative recreation facilities and holiday resorts.
The main purpose is to make a cross-section analysis of a single year's traffic data in order to determine how much of the observed variations in trip

demand during a single year can be attributed to a few simple factors affecting relative journey costs. The study mak s no pretense at statistical rigour, since the small sample size of the original data meant that only 15 separate observations of trip volume were available. The quantitative results should therefore be interpreted as only general indications of the responsiveness of demand to changes in the variables considered, not as precise estimates of what has happened or may happen in the future."

84. Mansfield, N. W. 1971. "The Estimation of Benefits from Recreation Sites and the Provision of a New Recreation Facility," Regional Studies, Vol. 5, pp 55-69.

KEY WORDS: Recreation benefits, gravity model, proposed site, travel cost method, consumer surplus, demand, trip generation, site specific.

ABSTRACT: "The paper stems from work undertaken as part of the appraisal of a water conservation project in the Morecambe Bay area (N. W. England). It develops the travel cost approach to the measurement of consumers' surplus into the derivation of a "demand model" for an existing major regional recreation area 25 km (15 miles) to the north of Morecambe Bay, and an assessment of the benefits derived from its use in 1966. The model was then used to predict the expected level of visits to the existing area in 1981, and the benefits derived from it in that year. The assumption was then introduced that any new recreation area created on Morecambe Bay would offer the same recreation opportunities as the existing area, and a method was developed to predict the joint demand for the two areas. An assessment was then made of the incremental benefit which would result from recreation on Morecambe Bay. From a comparison of the two areas, it was concluded that present methods of measuring the benefits from recreation are inadequate and misleading, if applied to areas of regional significance in Britain."

85. Mathews, Stephen B., and Brown, Gardner S. 1970. "Economic Evaluation of the 1967 Sport Salmon Fisheries of Washington," Technical Report 2, Washington State Department of Fisheries, Olympia, WA.

KEY WORDS: Sport fishing, salmon, net benefits, direct valuation approach, mail survey, Washington, WTP, WTA.

ABSTRACT: What is the economic value of sport fishing for salmon in the waters of Washington State?

A random sample of 5,000 fishermen was drawn from the population of 435,825 people who had obtained free Washington salmon fishing permits in 1967. A mail questionnaire was sent to each fisherman in the sample during February, 1968. The questionnaire collected data on numbers of days fished, numbers of fish caught, out-of-pocket fishing expenditures, age, income, and education. The questionnaire also included hypothetical questions designed to measure net benefits (consumer surplus) from sport salmon fishing.

The questionnaire began by asking respondents to consider four distinct fishing zones which make up the Washington State salmon fishery. The zones differed considerably with respect to average success per trip and cost of access. Respondents were asked to report the daily direct out-of-pocket costs of fishing in each of the zones. After this, the direct question approach was used to measure net benefits. Two types of hypothetical valuation questions were employed: willingness-to-pay and willingness-to-sell. The willingness-to-pay question asked respondents to state the maximum amount they were willing to pay for the annual right to fish for salmon in each of the four zones. The willingness-to-sell question asked respondents to state the minimum amount of money required to compensate them for the loss of the annual right to fish for salmon in each of the four zones. Respondents were given a list of values to choose from. The amounts stated for willingness-to-pay and willingness-to-sell were interpreted as estimates of the net benefits (consumer surplus) from sport salmon fishing.

Of the 5,000 questionnaires mailed out, 2,665 were returned, for about a 53-percent response rate. A total of 2,146 of the returned questionnaires provided data usable for the analysis. The researchers felt that the willingness-to-pay question produced unreliable data. Consequently, only willingness-to-sell figures were reported. The average annual willingness-to-sell of fishermen who had actually fished in a particular zone was estimated at $199.00, $193.00, $196.00, and $235.00, for zones 1-4, respectively. From these figures, the average values of one day of fishing in zones 1-4 were estimated at $62.84, $47.85, $27.24, and $31.89, respectively. The differences in average value by zone were attributed largely to differences in the average catch per trip by zone. In general, it was found that as average catch increased, average value increased.

CONCERNS: The results from the willingness-to-pay question were judged to be unreliable. A problem arose because respondents were not provided with a payment vehicle. Many respondents assumed the willingness-to-pay question

referred to a license fee - probably because of recent controversy over a proposal to charge license fees to sport salmon fishermen. It was felt that the general confusion over the payment vehicle may have biased the answers to the willingness-to-pay question.

86. McConnell, Kenneth E. 1980. "Comment: Valuing Congested Recreation Sites," Journal of Environmental Economics and Management, Vol 7, No. 4, pp 389-394.

KEY WORDS: Recreation, consumer surplus, congestion, benefits, valuation, Travel Cost Method.

ABSTRACT: "This note discusses the issue of measuring consumer surplus at crowded facilities. It is argued that surplus should be measured with congestion held constant. The area under an aggregate demand curve which has congestion varying has no normative significance. Whether travel cost demand curves estimated for congested facilities properly measured consumer's surplus depends on the sampling procedure and the specification of the demand curves."

87. McConnell, Kenneth E. 1979. "Values of Marine Recreational Fishing: Measurement and Impact of Measurement," American Journal of Agricultural Economics, pp 921-925.

KEY WORDS: Travel Cost Method, Hedonic Price Method, marine recreational benefits, fishing, resource allocation.

88. McConnell, Kenneth E. 1977. "Congestion and Willingness-to-pay: A Study of Beach Use," Land Economics, Vol 53, No. 2, pp 185-195.

KEY WORDS: Willingness-to-pay, iterative bidding, beach use, congestion, personal interview, resource management, recreational benefits, model, WTP, utility function.

ABSTRACT: What are the relationships between congestion and the utility people derive from the use of public beaches? How can knowledge of these relationships improve public beach management?
A model was developed and used as a framework to estimate the benefit functions for six southern Rhode Island beaches. Although located in the same region, the six beaches differed substantially in size and physical characteristics. In August of 1974, a personal interview survey was conducted on each of the six beaches. The survey was conducted over a 10-day period. A total of 229 individuals participated in the study. There was sufficient variation in the type of day (good and bad weather, weekday versus weekend) to

have significant variation in the level of congestion. The model concentrated on the level of demand for a single site, but the process could be expanded to many sites.

The survey employed an iterative bidding approach to elicit the respondents' maximum willingness-to-pay to use the beach on the particular day of the interview. It was hypothesized that willingness-to-pay for beach use depends upon family income, days at the beach per season per individual, air temperature, and congestion. Congestion was the variable of primary interest. A semi-log regression model was estimated in order to test for the significance of these variables.

Congestion had a significant negative relationship with willingness-to-pay for beach usage. Estimated coefficients indicated that an extra 100 people per acre on the average beach reduces the average individual's willingness-to-pay by about 25 percent per day. The estimated coefficients for family income, air temperature, and per season visits variables were consistent with a priori expectations.

Extensions of the estimated willingness-to-pay function to determine optimal beach management was also discussed. Using the willingness-to-pay function, an equation for total short-run benefits was developed. Maximizing a total short-run benefit equation yielded an optimal level of congestion (people per acre). It was noted that optimal congestion may vary with the type of beach considered, e.g., optimal congestion levels may be higher for a "singles" beach than for a "family" beach. Maximum use ranged from 28 to 5,090 persons/acre. Consideration of optimal beach management was primarily done to illustrate the usefulness of the approach used in this study. The author points out that state congestion standards are often set by rather ambiguous methods which can lead to mismanagement of public beaches. His objective was to present a method for determining congestion standards which are more consistent with maximization of net social benefits derived from beach use.

CONCERNS: The author appears to have requested marginal trip values but interprets them as average trip values. This could cause the estimated efficient congestion levels to be underestimated.

89. McConnell, Kenneth E. 1975. "Notes: Some Problems in Estimating the Demand for Outdoor Recreation," American Journal of Agricultural Economics, Vol 57, pp 330-334.

KEY WORDS: Recreation benefits, time, participation, travel cost method, conceptual.

90. McConnell, Kenneth E., and Bockstael, Nancy E. 1984. "Aggregation in Recreation Economics: Issues of Estimation and Benefit Measurement," Northeastern Journal of Agricultural and Resource Economics, Vol 13, No. 2, pp 181-186.

KEY WORDS: Recreation, benefits, participation, aggregation, demand, travel cost method.

91. McConnell, Kenneth E., and Duff, Virginia A. 1976 (Feb). "Estimating Net Benefits of Recreation Under Conditions of Excess Demand," Journal of Environmental Economics and Management, Vol 2, pp 224-230.

KEY WORDS: Benefits, recreation, demand, conceptual, Travel Cost Method (TCM), congestion, benefit estimation, single site, rationing.

ABSTRACT: "The public provision of outdoor recreation necessitates the development of nonmarket measures of the values in the decision-making process. Another aspect of recreation as a publicly provided good is the absence of a mechanism to eliminate automatically excess demand. The absence of such a mechanism has resulted in conditions of excess demand at many recreation sites.

This paper deduces the implications of excess demand for the travel cost method (TCM) of benefit estimation. It shows that when excess demand results in rationing at a particular site, TCM will underestimate the true benefits of the site. The results are important because they help identify the direction of bias of one measure of the benefits from the use of a natural resource."

92. Mendelsohn, Robert, and Brown, Gardner M., Jr. 1983 (Jul). "Revealed Preference Approaches to Valuing Outdoor Recreation," Natural Resources Journal, Vol 23, pp 607-618.

KEY WORDS: Recreation benefits, household production function, conceptual, recreation demand, Travel Cost Method, demand system model, Hedonic Travel Cost Method comparison, revealed preference approach.

93. Menz, Frederic C., and Mullen, John K. 1981. "Expected Encounters and Willingness-to-pay for Outdoor Recreation," Land Economics, Vol 57, No. 1, pp 33-40.

KEY WORDS: Willingness-to-pay, recreation, New York, benefit, congestion, questionnaire, management.

ABSTRACT: This paper examines the effect of congestion by looking at how individual willingness to travel is influenced by pre-trip expectations of interparty encounters at the site.
The study is based on data from the High Peaks area of the Adirondack Mountains in New York. A mail questionnaire in May, 1975, to 600 users yielded 402 observations. Some questions were directed at measuring expected and perceived levels of wilderness conditions for the first trip of the winter season. Only questionnaires submitted by 1974 and 1975 winter users were applied. The survey asked respondents to rate several wilderness conditions on a scale from 0 (none of the conditions desired) to 6 (maximum desired). The hypothesis tested is that WTP for the first trip of the winter season is influenced by expected number of encounters by other groups, family income, education, number of days on site, seasonal visits, number of people in the recreationist's party, experience, and a random component. The (one-way) distance traveled to the High Peaks was used as the proxy variable for willingness-to-pay.
The form for estimating the willingness-to-pay equation was the semilog form. The equations were best estimated by generalized least squares.
The results generally support previous findings. Time on site exhibited a strong relationship with WTP, but the size of party and experience did not. The authors believe that the results point to the need for better flow of information about sites to users. Such information may provide higher user satisfaction if actual conditions are more consistent with expectations.

CONCERNS: No value estimates are presented, only the importance of certain variables.

94. Merewitz, Leonard. 1966. "Recreational Benefits of Water Resource Development," Water Resources Research, Vol 2, No. 4, pp 625-40.

KEY WORDS: Recreational benefits, Travel Cost Method, consumer surplus, reservoir, single site.

ABSTRACT: "Although the major concern to the Federal government is with the character of the facilities provided, the calculation of the efficiency benefits of recreational investment is an appropriate part of the process of design of water resource systems. Recreation is a purpose of water resource development that should be considered in project evaluation. A demand curve was simulated for recreation at the Lake of the Ozarks, Niangua Arm. Using

distance as a proxy for price, the consumer surplus implied by the demand curve was measured. Cross-sectional variations in associated costs simulated price variations for recreation, a nonmarket commodity. The pilot calculation ascertained what basic data are required. A knowledge of a county's population, population density, distance from the site, and mean income of residents was useful in predicting the demand from a county. Factors such as mobility and the availability of alternative recreational opportunity did not appear to be useful in the forms in which they were available. Some relevant considerations in the design of the sample survey are indicated."

95. Miller, John R., and Hay, Michael J. 1984. "Estimating Substate Values of Fishing and Hunting," Transactions of the North American Wildlife and Natural Resources Conference, Vol 49, pp 345-355.

KEY WORDS: Recreation benefits, hunting, fishing, travel cost method, value estimates, planning, consumer surplus.

ABSTRACT: This paper demonstrates the potential for using the 1980 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation to calculate fishing and hunting day values for regions within states.
Approximately 122,000 households were screened to identify participation in fishing, hunting, and nonconsumptive uses of recreation areas. Then a second stage entailed follow-up interviews with 30,000 sportsmen and 6,500 nonconsumptive users.
In all the demand equations, the dependent variable was the natural logarithm of daytrips per year. The opportunity cost is valued at one-third the predicted wage rate. The travel cost measure was based on the interviewee's share of vehicle cost for the trip and opportunity cost of time. Three other variables compose the demand equation; boat ownership, youth residence, and an experience variable. Generally these three variables performed poorly. Excluding outliers, 17 out of 30 regions showed daytrip values between $18 and $38 per daytrip. Comparisons of these values with other studies exclusively for a certain region appeared reasonable.

CONCERNS: When the Travel Cost Method is applied to a region which provides a range of fishing/hunting opportunities, it is not clear exactly what kind of experience is being valued.

96. Miller, R. R., Prato, A. A., and Young, R. A. 1977. "Congestion, Success and the Value of Colorado Deer Hunting Experiences," Transactions of the

Forty-second North American Wildlife and Natural Resources Conference, Vol 42, pp 126-136.

KEY WORDS: Deer hunting, direct valuation approach, mail survey, recreational benefit, Colorado, user preference, benefit, WTP.

ABSTRACT: What are the relationships between congestion, success, and willingness-to-pay for Colorado deer hunting experiences?

Hunters were classified as resident or non-resident, and also by the type of hunting license they possessed: deer, sportsman, archery deer, or muzzle-loading rifle. The deer and sportsman licenses allowed the holder to hunt deer during the regular rifle season. The archery deer and muzzle-loading licenses allowed deer hunting in separate seasons. A sample of 2,508 hunters who held licenses in 1974 was stratified so that a sufficient number of observations could be collected for each license category. Each of the hunters in the survey was sent a mail questionnaire. In this questionnaire, information was collected pertaining to game management units where hunting took place, number of deer harvested, and socioeconomic characteristics. In the questionnaire hunters were also asked to reveal factors which they felt added or detracted from a hunting experience.

A second sample was drawn from the respondents to the first questionnaire. A questionnaire was then mailed to each hunter in this new sample. In the second questionnaire, each hunter was informed of the success ratio and average hunter density for the game management unit in which he had previously reported hunting. This was done to give the hunter a reference point for evaluating alternative hunting experiences. Then the hunters were asked to state their maximum willingness-to-pay for the trip they actually experienced, and eight alternatives which differed in terms of success ratios and hunter density (congestion). The hunters stated their maximum willingness-to-pay through the use of an open-ended bidding question.

Mean willingness-to-pay per resident hunter for the hunting trip actually experienced was $67, $74, $96, and $68 for holders of deer, sportsman, muzzle-loading, and archery deer licenses, respectively. Mean willingness-to-pay per nonresident hunter for the hunting trip actually experienced was $315, $397, $377, and $385 for holders of deer, sportsman, muzzle-loading, and archery deer licenses, respectively. As was hypothesized, the figures indicated that nonresident hunters were willing to pay substantially more than resident hunters. Although not shown, the authors reported that their results

generally indicated that willingness-to-pay increased with increments in success ratios, and decreased with increments in hunter density. Hunters, however, refused to pay additional money to gain decreases in hunter density. The effects of user preferences on willingness-to-pay were examined further by differentiating the sample into "hunter preference types." Eight distinct types of hunter were identified. A type 2 hunter, for example, was described as a "minimum gratification hunter" while a type 7 hunter was identified as being "gung ho." It was found that when preference types were combined with differences in hunting opportunities, the degree of variation in willingness-to-pay was reduced. Thus, the authors concluded that the precision of willingness-to-pay estimates can be increased by differentiating between different hunter preference types. The evidence indicates that public actions which increase the diversity of hunting experiences increase the total utility derived from hunting.

97. Moncur, James E. T. 1975 (Autumn). "Estimating the Value of Alternative Outdoor Recreation Facilities Within a Small Area," Journal of Leisure Research, Vol 7, pp 301-311.

KEY WORDS: Urban parks, benefit, recreation facilities, Travel Cost Method, Hawaii, substitutes, willingness-to-pay, site specific.

98. Mullen, John K., and Menz, Fredric C. 1985 (Feb). "The Effect of Acidification Damages on the Economic Value of the Adirondack Fishery to New York Anglers," American Journal of Agricultural Economics, pp 112-119.

KEY WORDS: Recreation benefits, fishing, environmental quality, New York, travel cost model, net value.

ABSTRACT: "A travel cost model is used to estimate losses in the net economic value of the Adirondack recreational fishery resulting from damages caused by acidic deposition. Annual losses to New York resident anglers are estimated to be approximately $1 million per year in 1976 dollars. Although there are many reasons why these damages understate the full extent of losses to both current users and others, this research represents one of the initial attempts to quantify one type of cost associated with the acidic deposition problem." The mail survey comprised 11,087 licensed anglers. The net economic value per angler day averaged $19.90 for the entire Adirondack fishery.

99. Nichols, Len M., Bowes, Marianne, and Dwyer, John F. 1978. "Reflecting Travel Time in Travel Cost-Based Estimates of Recreation Use and Value," Forestry Research Report No. 78-12, University of Illinois-Champaign, Agriculture Experiment Station, Champaign, IL.

KEY WORDS: Travel cost model, use, benefit, travel time.

100. Norton, G. A. 1970. "Public Outdoor Recreation and Resource Allocation: A Welfare Approach," Land Economics, Vol 46, No. 4, pp 414-422.

KEY WORDS: Recreation, willingness-to-pay, social benefits, conceptual, resource allocation, consumer surplus.

101. Oster, Sharon. 1977. "Survey Results on the Benefits of Water Pollution Abatement in the Merrimack River Basin," Water Resources Research, Vol 13, No. 6, pp 882-884.

KEY WORDS: Recreation benefits, water pollution abatement, willingness-to-pay, noniterative bidding, (open-ended question), telephone survey, New Hampshire, Massachusetts, WTP, use.

ABSTRACT: The purpose of this study is to determine the benefits of cleaning up the Merrimack River Basin. A telephone survey was conducted of 200 residents of the region during the winter of 1973-74. Respondents were asked how much they were willing to pay, either in the form of a tax increase or "out-of-pocket" per year, to improve water quality to a level where boating, fishing, and swimming were possible. This (WTP) was collected by an open-ended question.

The response rate to the survey was approximately 50 percent. Average willingness-to-pay was estimated at approximately $12.00 per person per year. The WTP was positively related to home ownership, income, and family size. Data were also collected on expected use of a clean river. The questionnaire used is included.

CONCERNS: Some problems were encountered with payment vehicle influences.

102. Pattison, William J., and Phillips, William E. 1971. "Economic Evaluation of Big Game Hunting: An Alberta Case Study," Canadian Journal of Agricultural Economics, Vol 19, No. 2, pp 72-85.

KEY WORDS: Big game hunting, extra-market good, willingness-to-pay, direct question approach, mail questionnaires, public policy, recreation benefits, value, Alberta.

ABSTRACT: The article describes a study of the benefits and costs of a government policy which substantially increased the number of moose hunters in Northern Alberta, Canada.

In 1967, the government of Alberta started offering special hunting licenses which allowed nonresidents to take a moose of either sex from Northern Alberta. Nearly 10,000 licenses were sold the first year. A mail survey was used to collect data for calculating the net benefits of moose hunting under the new program. A 10-percent random sample was drawn for non-resident responses. The resident sample was 9 percent.

The total value of the moose to a hunter was argued to be equal to the market value of the license fee, plus an extra-market value (i.e., the value of a moose not accounted for by license fee). The mail questionnaire was designed to measure extra-market value. The technique used was the direct question or Contingent Valuation Method (CVM) approach. Respondents were asked directly in the questionnaire to state how much they were willing to pay over and above actual trip expenditures for the privilege of hunting moose; WTP^e. The sum of all individual values provided an estimate of direct social gross benefits of moose hunting in Northern Alberta.

The average value of the total hunting experience was $115.52 per hunter ($293.45 per nonresident hunter and $79.53 per resident hunter). The value of the moose resource across all hunters was estimated at $42.58 per hunter. For nonresident hunters, the value of the moose resource amounted to $100.03 per hunter - the market portion (i.e., license fee) accounted for $52.00 of this total. For resident hunters, the value of the moose resource amounted to $28.94 per hunter. The license fee portion accounted for $5.76 of the resident total. The total value of Northern Alberta moose hunting to society in general was estimated at $1,099,334.

Indirect benefits from moose hunting were calculated for the province of Alberta. Estimates of indirect benefits were based on hunter expenditures which generated business activity in the province. Expenditures by resident hunters were not considered here because they merely represented transfer payments within the Alberta economy. Thus, only nonresident hunter expenditures generated indirect benefits.

103. Peterson, George, Anderson, Dorothy, and Lime, David. 1982. "Multiple Use Site Demand Analysis: An Application to the Boundary Waters Canoe Area Wilderness," Journal of Leisure Research, Vol 14, No. 1, pp 27-36.

KEY WORDS: Trip demand model, utility maximization, single site analysis, multiple use analysis, travel cost method, substitution, benefits, participation.

ABSTRACT: "A single-site, multiple-use trip demand model is derived from a multiple site regional model based on utility maximizing choice theory. The model is applied to analyze and compare trips to the Boundary Waters Canoe Area Wilderness for several types of use. Travel cost elasticities of demand are compared and discussed."

104. Peterson, George L., Dwyer, John F., and Darragh, Alexander J. 1983. "A Behavioral Urban Recreation Site Choice Model," Leisure Sciences, Vol 6, No. 1, pp 61-81.

KEY WORDS: Urban recreation, model, participation.

105. Peterson, George L., Stynes, Daniel J., and Arnold, J. Ross. 1985. "The Stability of a Recreation Demand Model Over Time," Journal of Leisure Research, Vol 17, No. 2, pp 121-132.

KEY WORDS: Wilderness areas/Minnesota, recreation demand model, trip demand, travel cost elasticity, substitution, Travel Cost Method.

106. Prenzlow, Edgar J., Ashton, Peter M., and Wykstra, Ronald A. 1974. "Identifying Optimal Wildlife Resource Supply Quantities Which Maximize Public Use Benefits," Transactions of the Thirty-ninth North American Wildlife Conference, Vol 39, pp 195-207.

KEY WORDS: Benefits estimates, nonmarket valuation, wildlife, recreation days, Bayesian decision theory, break-even, optimality model.

ABSTRACT: What are the optimal number of recreation days for various wildlife resources that can be provided by the Colorado Division of Wildlife? Sixteen classifications of wildlife resources were considered in the study: (1) deer; (2) elk; (3) other big game; (4) ducks; (5) geese; (6) pheasants; (7) doves; (8) small game mammals; (9) other small game birds; (10) archery big game; (11) furbearers; (12) coldwater stream fishing; (13) coldwater lake fishing; (14) warm water fishing; (15) all sport game species; (16) all sport fishing. Recreation days associated with these wildlife resources were estimated by several methods. A first method was to multiply license sales figures, adjusted for the number of participants, by the average number of days each participant hunted or fished. A second method was to multiply the number

of animals harvested by the average number of days required per kill. The first and second methods were used for big and small game, respectively. A third method, used for fishing, obtained recreation days directly from the Division's Annual Creel Census Reports.

The technique used to value recreation days was based on a Bayesian decision theory. The technique consisted of three steps: (1) a set of values for each type of recreation day were listed; (2) a probability of accuracy was assigned to each value; and (3) mean values were calculated based on these probabilities. Division managers completed a questionnaire which asked them to assign a probability to a range of values for each type of recreation day. The average probabilities for each value range were then estimated.

Values for all recreation days estimated by the Bayesian technique range from $11.79 for small game mammals to $266.00 for elk. Generally, values for all sport game were estimated at $78.69, and values for all sport fish were estimated at $18.68.

Total values were equated with total costs to determine the recreation day break-even point for each wildlife resource.

CONCERNS: Values for recreation days relied on the subjective valuations of a relatively small group of people (division managers). There may be conceptual problems with extending these valuations to recreationists in general. However, the study is unique in that it analyzes the optimal supply of wildlife resources under conditions of uncertainty. It also provides economic values for a broad range of wildlife resources.

107. Propst, Dennis B. 1988. "Use of IMPLAN with Public Area Recreation Visitor Survey (PARVS) Pretest Data: Findings and Recommendations, Miscellaneous Report R-88-1, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

ABSTRACT: The report shows how expenditure data can be used through a bridge table to relate expenditures to changes in the income and outputs of the industry sectors affected by the expenditures. The explicit purpose of this study was to determine if the data collected with the Public Area Recreation Visitor Survey (PARVS) met the requirements for use in the US Forest Service Impact Analysis for Planning (IMPLAN). PARVS is an interagency effort involving four Federal agencies and a number of State agencies. IMPLAN is an Input-Output (I-O) model developed by the US Forest Service to evaluate the economic impacts of various management alternatives. The report explains how the different modules in the IMPLAN model use the PARVS expenditure data to determine

economic impacts in terms of total gross output and changes in income and number of jobs by industry sectors, for each of the counties in the region. For this study, the PARVS pretest data on recreation expenditures were used as input for the IMPLAN model to determine if the PARVS data format met the needs of IMPLAN. The IMPLAN model would thus be used to determine the economic impact of expenditures by visitors to the sites used in the PARVS study.

108. Radulaski, O. "Congestion and Benefits from Cross-country Skiing in Northern Colorado," M.S. thesis (unpublished), Department of Economics, Colorado State University, Fort Collins, CO.

KEY WORDS: Recreation benefits, Colorado, cross-country skiing, congestion, nonmarket valuation, willingness-to-pay, iterative bidding, interview, WTP.

ABSTRACT: What are the effects of congestion on the value of cross-country skiing?

A sample of 60 cross-country skiers were interviewed at two cross-country ski sites in Colorado. One site, Cameron Pass, is publicly managed. The second site, Beaver Meadows, is privately managed. Interviews were conducted from January to April, 1980.

Skiers were interviewed on days of low, medium, and high congestion. The interviewees were asked to state their maximum willingness-to-pay for a day of cross-country skiing contingent on changes in congestion. The iterative bidding or contingent value method (CVM) was employed to solicit maximum willingness-to-pay. The payment vehicle used was cost per day of cross-country skiing. The starting point of the bidding iteration was the actual cost per day of cross-country skiing incurred on the day of the interview. Interviewees first reported their maximum willingness-to-pay for a day of cross-country skiing, given the level of congestion present on the day of the interview. They were then shown photographs depicting five hypothetical levels of congestion.

The response rate to the personal interview survey was 98 percent. The relationship between willingness-to-pay and congestion was analyzed by ordinary least squares regression techniques.

The regression equations indicated that the average value of a day of cross-country skiing with no other person encountered was $17.31 at Cameron Pass, and $19.27 at Beaver Meadows. With all else held constant, willingness-to-pay decreased with each additional encounter by $0.34 at Cameron Pass, and $0.19

at Beaver Meadows. Variables other than congestion which significantly influenced willingness-to-pay were income, age, size of city of residence, annual weeks of paid vacation, annual days of cross-country skiing at the site, miles skied per day, and weather conditions. A statistical test for strategic bias was not significant.

109. Rae, D. A. 1983. "The Value to Visitors of Improving Visibility at Mesa Verde and Great Smoky Mountain National Parks," Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas, R. D. Rowe and L. G. Chestnut, eds., Westview Press, Boulder, CO, pp 217-234.

KEY WORDS: Contingent ranking, visibility, personal interview, national parks, WTP^e, benefit estimation, environmental quality.

ABSTRACT: This article examines the use of contingent ranking for measuring the economic value of visibility at national parks. Contingent ranking was employed to estimate willingness-to-pay for improvements in visibility at Mesa Verde and Great Smoky Mountains National Parks. The contingent ranking method is based on consumer choice theory. This theory states that most goods and services can be broken down into a number of attributes.

It was hypothesized that the contribution of visibility to total utility is revealed when park visitors are forced to make tradeoffs between visibility and the amount of an entrance fee. A sample of visitors to Mesa Verde and Great Smoky Mountains National Parks were subjected to a personal interview survey. In the survey, the interviewee was shown a set of cards. Each card contained a photograph depicting a certain level of visibility in the park, and varying entrance fees. The cards were designed so that increased levels of visibility were associated with corresponding increases in the entrance fee. Interviewees were asked to rank each of the alternative park scenarios depicted by the cards in order of preference. The ranking of alternatives forced the interviewees to make tradeoffs between visibility and entrance fees. A logit-based discrete choice model was used to quantify these tradeoffs. The result of this produced direct estimates of the economic value of visibility.

The sample of visitors at Mesa Verde National Park was asked to rank eight alternatives which differed in the level of visibility and entrance fee (price). Willingness-to-pay for visibility was determined by statistically analyzing the final rankings. Average willingness-to-pay per vehicle was estimated to be about $5.10 to improve visibility from intense plume to clear.

$4.57 to improve visibility from intense haze to clear, and $2.84 to improve visibility from moderate haze to clear. These estimates of willingness-to-pay reflect an assumption that the visibility and entrance fee conditions specified on each card were known in advance of a visit (deterministic case). Willingness-to-pay was estimated also for a probabilistic case. Three cards were presented to the interviewees which described visibility in terms of the percentage number of daylight hours each of the visibility conditions was likely to occur. Interviewees were asked to rank all of the cards presented in order of preference. From the rankings, willingness-to-pay per vehicle was estimated to be about $3.09 for improving visibility from the "existing" condition to the guaranteed "clear" condition, and $0.93 to improve visibility from the "existing" condition to the most improved probabilistic condition. Results from the probabilistic case compared well to the deterministic case. The methodology used to estimate the value of visibility at Great Smoky Mountains National Park was essentially the same as the one used at Mesa Verde. Results from the deterministic and probabilistic cases in the Great Smoky Mountains study were also comparable. Overall results from the Great Smoky Mountains study compared well to overall results from the Mesa Verde study.

CONCERNS: It was suspected that some of the results were biased because respondents did not clearly differentiate between the alternative levels of visibility depicted by the photographers. Where possible, these results were identified and estimated.

110. Randall, Alan, Ives, Berry C., and Eastman, Clyde. 1974. "Bidding Games for Valuation of Aesthetic Environmental Improvements," Journal of Environmental Economics and Management, Vol 1, pp 132-149.

KEY WORDS: Coal, benefits, costs, Appalachia, surface mining, reclamation, environmental impact, benefit-cost analysis, regulatory impacts.

111. Randall, Alan, Gruenwald, Orlen, Johnson, Sue, Ausness, Richard, and Pagoulatos, Angelos. 1978. "Reclaiming Coal Surface Mines in Central Appalachia: A Case Study of Benefits and Costs," Land Economics, Vol 54, No. 4, pp 472-489.

KEY WORDS: Contingent valuation survey, environmental assets, methodology.

ABSTRACT: This paper is a comment on the methodology and prescriptions for the use of contingent valuation.

112. Randall, Alan, Hoehn, John P., and Brookshire, David S. 1983 (Jul). "Contingent Valuation Surveys for Evaluating Environmental Assets," Natural Resources Journal, Vol 23, pp 635-648.

KEY WORDS: Esthetics, power plant, coal, bidding games, valuation, environmental quality, willingness-to-pay, visibility.

ABSTRACT: "An empirical case study of the benefits of abatement of aesthetic environmental damage associated with the Four Corners Power Plant and Navajo mine using the bidding game technique is presented. Bidding games were carefully designed to avoid the potential problems inherent in that technique. The results indicate the existence of substantial benefits from abatement of this aesthetic environmental damage. Aggregate bid curves, marginal bid curves, and estimates of the income elasticity of bid are presented. The effectiveness of the bidding game technique is discussed."

113. Randall, Alan, and Stoll, John R. 1982. "Existence Value in a Total Valuation Framework," Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas, R. D. Rowe and L. G. Chestnut, eds., Westview Press, Boulder, CO, pp 265-274.

KEY WORDS: Valuation, willingness-to-pay, survey, environmental benefits, method comparison, conceptual, option value, existence value.

114. Raucher, Robert L., and Fisher, Ann. 1982. "Measuring the Recreation Benefits of Improved Water Quality: A Comparison of Alternative Methods," prepared for the Southern Economic Association Conference, Atlanta, GA.

KEY WORDS: Recreation benefits, water quality, Travel Cost Method, Contingent Value Method, participation.

115. Ravenscraft, David J., Bowes, Michael D., and Dwyer, John F. 1977. "Dealing with Capacity Constraints in Estimating Recreation Benefits," Forestry Research Report No. 77-8, Agricultural Experiment Station, University of Illinois, Urbana-Champaign, IL.

KEY WORDS: Recreation benefits, demand, willingness-to-pay, capacity constraints, planning, proposed sites, conceptual.

116. Ravenscraft, David J., and Dwyer, John F. 1978. "Reflecting Site Attractiveness in Travel Cost Based Models for Recreation Benefit Estimation," Forestry Research Report No. 78-6, Agricultural Experiment Station, University of Illinois, Urbana-Champaign, IL.

KEY WORDS: Travel cost, recreation benefits, planning, demand, site attractiveness, willingness-to-pay, substitute sites, conceptual.

117. Ravenscraft, David J., and Dwyer, John F. 1978. "Estimating the Influence of Congestion on the Willingness of Users to Pay for Recreation Areas," Forestry Research Report No. 78-5, Agricultural Experiment Station, University of Illinois, Urbana-Champaign, IL.

KEY WORDS: Willingness-to-pay, recreation, congestion, model, interview, Travel Cost Method, household production method, proposed sites, benefits, conceptual.

118. Romm, J. 1969. "The Value of Reservoir Recreation," Technical Report No. 19, Cornell University Water Resources and Marine Sciences Center, Ithaca, NY.

KEY WORDS: Reservoir recreation, nonmarket valuation, travel cost, willingness-to-pay, methods comparison, recreation benefits, use, consumer surplus, consumer preference approach, WTP, Marshallian surplus, contingent valuation.

ABSTRACT: How do recreation benefit estimates yielded by several alternative methods compare to each other and what strengths/weaknesses do these methods have?

A survey of recreationists was conducted at Whitney Point Reservoir, New York, between May 28 and September 11, 1966. Data were collected by direct questioning and by a systematic distribution of questionnaires. Several techniques were employed, including the Travel Cost Method (TCM), a "willingness to travel" noniterative bidding approach (closed-end and open-ended formats), a consumer preference approach, a government investment approach, and a requirements approach.

Responses to the survey were generally good. The data collected were used to estimate average benefits per person per day from use of Dorchester Park. The TCM produced an estimate of $0.29 per person per day. The closed-end willingness-to-pay question generated an estimate of $0.39 per person per day. The open-ended willingness-to-pay question generated estimates between $0.26 and $0.45 per person per day. An estimate of $0.35 per person per day resulted from the "willingness-to-travel" approach. Benefits were estimated by the consumer preference approach at $1.03 per person per day. The highest estimate resulted from the government investment approach; $1.31 per person per day. The estimate of benefits by the requirements approach was $0.75 per day.

The study represents one of the earliest attempts to compare the values of nonmarket goods estimated by alternative valuation techniques.

CONCERNS: Because the survey was conducted over several months in the summer, concern was raised that the differences in results obtained by some of the various approaches may reflect, in part, a change in the recreational experience over the summer, rather than reactions to the different approaches used. The authors also suspected that respondents may have been biased against the entrance fee payment vehicle used with noniterative bidding. As applied in the study, the consumer preference, government investment, and requirement approaches appeared not to generate true consumer surplus figures. It is difficult, therefore, to compare the results from these approaches with those from the approaches which generated consumer surplus measures (such as the TCM).

119. Rosenthal, Donald H. 1987. "The Necessity for Substitute Prices in Recreation Demand Analyses, American Journal of Agriculture Economics, Vol 69, No. 4, pp 828-837.

ABSTRACT: Omitting substitute prices from a travel cost model is shown to cause a significant bias in consumer surplus estimates. Three sets of travel cost models are developed from a common data base representing 60,000 day-users of Corps reservoirs in Kansas and Missouri. The first set of models omitted substitute prices; the latter two sets included them. An analysis of variance test showed that consumer surplus estimates from the first set of models were significantly higher than the other two ($F=26.2$ with 2, 20 degrees of freedom). The theoretical and practical implications of these findings are discussed.

120. Rosenthal, Donald H., Loomis, John B., and Peterson, George L. 1984. "The Travel Cost Model: Concepts and Applications," USDA Forest Service General Technical Report RM-109, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

KEY WORDS: Travel cost model, willingness-to-pay.

ABSTRACT: "The Travel Cost Method model (TCM) estimates the demand and supply curves for a recreation site in a manner commensurate with methods used for other resources. Therefore, dollar values estimated by the TCM are comparable to dollar values for other resources. Because of this, the TCM is well suited for use as an analytical technique in the study of recreation planning issues. Issues benefiting from TCM analysis include: the effect of raising entrance fees on visitation, the benefit of constructing a new recreation site, the benefit of modifying an existing site, and estimating use at existing or proposed sites."

121. Rowe, Robert D., and Chestnut, Lauraine G. 1983. "Valuing Environmental Commodities: Revisited," Land Economics, Vol 59, No. 4, pp 404-410.

KEY WORDS: Conceptual, environmental quality, Contingent Valuation Method, bidding techniques, bias.

122. Rowe, Robert D., d'Arge, Ralph C., and Brookshire, David S. 1980. "An Experiment on the Economic Value of Visibility," Journal of Environmental Economics and Management, Vol 7, No. 1, pp 1-19.

KEY WORDS: Iterative bidding, visibility, compensating surplus, equivalent surplus, starting point bias, vehicle bias, information bias, hypothetical bias, WTP^e, WTA^c, Southwest United States, environmental quality, esthetics, air pollution.

ABSTRACT: This is an application of the iterative bidding technique to value impacts of visibility reductions with special emphasis upon testing for biases and comparability of results with previous valuation studies.
Photographs were taken to represent three different subjectively determined visual ranges (75, 50, and 25 miles). Sets of visibility level photographs (each consisting of three ranges) were used to represent visibility at two scenic areas, Shiprock Monument and La Plata Mountains, both located in the Four Corners Region of New Mexico. The survey instrument was designed to test for starting point bias (used alternative starting points for the bidding process), information bias (used different sets of prior information), strategic bias (by providing a chance to alter final bid when given information on the mean bid of other respondents). Both willingness-to-pay (WTP) and willingness-to-accept (WTA) valuations were elicited in the study. Although sample numbers are not explicitly stated, it appears from tables presented by the authors that 93 residents and 26 nonresidents of the study region were personally interviewed.
The estimated bid equations account for about 42 percent of the variation in bids. Estimated coefficients on income and several socioeconomic variables were significant explanators of bids. In the WTP bid curve, estimation starting point bias and information bias were both found. These authors also found evidence of vehicle bias. Nearly 47 percent of the explained variation in WTP bids arose from survey instrument influences upon bids (i.e., starting points, prior information, and bidding vehicles). It was argued that these effects were not significant for the WTA bids due to the large magnitude of these bids and the number of infinity responses (over one half of the sample). The mean

annual bids to prevent loss of visibility (WTP) were $82.20 and $57.00 for the best-to-worst and best-to-moderate visibility level changes, respectively. Residents were willing to pay $57/year to prevent a decline in visibility from 75 miles to 50 miles. On a monthly basis the estimate was $2.44 for a best-to-worst visibility change. A table was presented which indicated these estimates compare favorably with previous visibility studies by Randall et al. and Brookshire et al. conducted in the same study area.

CONCERNS: Over 50 percent of the respondents indicated that their WTA was equal to infinity for visibility changes. Also, visibility is a difficult concept to value as a commodity, which may explain the finding of significant biases in this study.

123. Russell, Clifford S., and Vaughan, William J. 1982. "The National Recreational Fishing Benefits of Water Pollution Control," Journal of Environmental Economics and Management, Vol 9, No. 4, pp 328-354.

KEY WORDS: Recreational benefits, fishing, participation, water quality, consumer surplus, willingness-to-pay, logit model.

124. Sawyer, Thomas G., and Shulstad, Robert N. 1976. "Economic Feasibility of Developing Additional Public Outdoor Recreation Areas at Beaver Lake, Arkansas," Agricultural Experiment Station, Bulletin 813, University of Arkansas, Fayetteville.

KEY WORDS: Recreation, visitation, net benefit, proposed sites, planning, willingness-to-pay, indirect approach, Travel Cost Method.

125. Schulze, William D., Brookshire, David S., Walther, Eric G., MacFarland, Karen Kelley, Thayer, Mark A., Whitworth, Regan L., Ben-David, Shaul, Malm, William, and Molenar, John. 1983. "Economic Benefits of Preserving Visibility in the National Parklands of the Southwest," Natural Resources Journal, Vol 23, No. 1, pp 149-172.

KEY WORDS: Benefits, national parklands, environmental quality, payment card bidding, personal interview, WTP, preservation, existence values, visibility.

ABSTRACT: What is the economic value of preserving visibility in the national parklands of the Southwest?
A personal interview survey of over 600 people in Denver, Los Angeles, Albuquerque, and Chicago was conducted in the summer of 1980. Respondents were shown sets of photographs of particular Southwestern national park vistas with different levels of visual air quality. The respondents were asked user value and preservation value (user value + existence value) questions based on these

photographs. The user value questions were of three types. The first question asked respondents how much they were willing to pay to improve visibility in Grand Canyon National Park. The second question asked respondents how much they were willing to pay to prevent a deterioration of visibility from the current average in the Southwest parklands region. The third question asked respondents to state their willingness-to-pay to prevent plume blight seen from Grand Canyon National Park. The payment vehicle for each user value question was an increase in the daily park entrance fee over the existing $2.00 fee. The three preservation value questions were basically the same as the three user value questions. The primary difference was that in order to measure user and existence value, the preservation value questions employed a monthly increase in electric utility bills for a payment vehicle. Respondents were provided with a payment card which contained columns representing various bids. For each valuation question, respondents were asked to check the appropriate bid on the payment card.

Mean user values for air quality improvements (across all levels) at the Grand Canyon were estimated at approximately $3.03/visitation day for Albuquerque residents, $4.80/visitation day for Los Angeles residents, and $3.54/visitation day for Denver residents. Mean user values for prevention of air quality deterioration in the Southwest parklands region were estimated at $3.16/visitation day for Albuquerque residents, $4.77/visitation day for Los Angeles residents, and $4.93/visitation day for Denver residents. Mean user values for avoidance of plume blight at the Grand Canyon were estimated at $3.18/visitation day for Albuquerque residents, $4.80/visitation day for Los Angeles residents, and $4.26/visitation day for Denver residents.

Mean preservation values for prevention of air quality deterioration at the Grand Canyon were estimated at $4.09/month for Albuquerque residents, $5.14/month for Los Angeles residents, $3.72/month for Denver residents, and $5.08/month for Chicago residents. Additional willingness-to-pay to prevent air quality deterioration in the entire Southwest parklands region (over and above willingness-to-pay to preserve air quality at the Grand Canyon) was estimated at $4.14/month, $4.50/month, $2.89/month, and $4.23/month for residents of Albuquerque, Los Angeles, Denver, and Chicago, respectively. Mean preservation values for avoidance of plume blight at the Grand Canyon were estimated at $4.25/month for Albuquerque residents, $2.84/month for Los Angeles residents, $2.89/month for Denver residents, and $2.85/month for Chicago residents.

CONCERNS: The article describes one of the early attempts to estimate existence value.

126. Schulze, William D., d'Arge, Ralph C., and Brookshire, David S. 1981. "Valuing Environmental Commodities: Some Recent Experiments," Land Economics, Vol 57, No. 2, pp 151-172.

KEY WORDS: Bias, consumer behavior model, environmental quality, contingent valuations, recreation benefits.

ABSTRACT: Summarization of six case studies that value visibility, wildlife, health, and noise.

127. Sellar, Christine. 1982. "The Value of Recreational Boating at Lakes in East Texas," Ph.D. dissertation, Department of Agricultural Economics, Texas A&M University, College Station, TX.

KEY WORDS: Recreational boating, lakes, Texas, benefit.

128. Sellar, Christine, Chavas, Jean-Paul, and Stoll, John R. 1986. "Specification of the Logit Model: The Case of Valuation of Nonmarket Goods," Journal of Environmental Economics and Management, Vol 13, pp 382-390.

KEY WORDS: Contingent valuation, models, recreation benefits, functional form, logit, demand.

ABSTRACT: This is one of the first studies to examine the proper use of the Logit Model for estimation of nonmarket commodity demand. This is principally a conceptual study. Economic theory is used to show the conditions which must be met by the logit functional form if it is to yield valid estimates of welfare change measures and demand relationships. An empirical example is used to illustrate the argument.
Each boater in the sample was asked whether or not he would pay X dollars for an annual boat ramp permit. The amount specified for X varied from $5 to $300. The number of visits made to the lake in 1980 was used for the quantity variable q. Responses from 70 boaters were used in the analysis.
Recreational boating data were collected using the Contingent Valuation Method (CVM) in Texas. In one instance the demand curve is positively sloped due to the specific functional form chosen. The estimated demand curve for the theoretically preferred functional form has the expected negative slope.

129. Sellar, Christine, Stoll, John R., and Chavas, Jean-Paul. 1985. "Validation of Empirical Measures of Welfare Change: A Comparison of Nonmarket Techniques," Land Economics, Vol 61, No. 2, pp 156-175.

KEY WORDS: Valuation, travel cost, comparative validation, Travel Cost Method, contingent valuation, close-ended format, open-ended format, logistic analysis, noniterative bidding, boating, recreational benefits, WTP, regional models.

ABSTRACT: Do the travel cost and contingent valuation methods result in consistent estimates of consumer surplus associated with recreational boating? A mail survey of 2,000 registered pleasure-boat owners in East Texas was conducted. Respondents were asked to state their maximum willingness-to-pay (WTP) to use the lake the same number of times they had in 1980, and the amount they would pay for half as many visits. The payment vehicle was the annual cost of a launch ramp permit. Two forms of the Contingent Valuation Method (CVM) were employed to measure WTP data: open-ended bidding, and closed-end bidding. Total value curves were estimated from the WTP data. The total value curves, which measure consumer surplus, were specified as functions of income, the number of visits the respondents made to the lake in 1980, and other socioeconomic variables.

Consumer surplus was also estimated by the Travel Cost Method (TCM). The TCM was readily applicable to the study because the study region allowed for sufficient variation in distance. Data needed to fit the travel cost model were collected in the mail survey.

The Marshallian measures of consumer surplus collected by the TCM were then compared to the Hicksian measures of consumer surplus collected by the contingent valuation methods. Demand curves for the recreational opportunities provided by the four lakes were calculated using TCM. The average consumer surplus (Marshallian) for each lake was calculated as the area under the demand curve, and above the expenditure level, at the mean level of visits. The estimates of average consumer surplus are $32.06, $102.09, $24.42, and $13.01 for Conroe, Livingston, Somerville, and Houston, respectively.

Total value curves were calculated from the WTP data collected using two contingent valuation methods. A logit model was used to calculate total value curves from the data collected by the closed-end format. The open-ended format provided data which allowed total value curves to be estimated directly. Differentiating the total value curves provided Hicksian compensated demand curves for each lake. Appropriate areas under these demand curves were

calculated to arrive at estimates of equivalent variation. For the closed-end format, net equivalent variation was estimated at $39.38, $35.21, and $13.81 for Conroe, Livingston, and Houston, respectively. For the open-ended format, net equivalent variation was estimated at -$8.65, $1.09, and -$2.28 for Conroe, Livingston, and Houston, respectively. The TCM and the closed-end format were argued to be consistent measures of welfare change while open-ended measures were not.

CONCERNS: Consumer surplus was not reported for Lake Somerville because of data and statistical problems. Estimates produced by open-ended bidding may be biased because of respondents' unfamiliarity with this type of market or with the launch ramp fee payment vehicle.

130. Seneca, Joseph J. 1969. "Water Recreation Demand and Supply," Water Resources Research, Vol 5, No. 6, pp 1179-85.

KEY WORDS: Recreation demand and supply, model, use, conceptual, optimal capacity, benefit, site specific.

ABSTRACT: "This paper discusses the problems involved in identifying valid demand and supply parameters estimated from sample data on recreation. It is argued that the analysis of cross-section data permits the quantification of the effects of demand variables. Cross-section results can then be pooled with recreation time series to enable the valid estimation of supply parameters. These supply parameters can be used to improve decisions regarding the expansion and development of recreation sites. More refined projections of rates of use can be derived for use as benefit measures in cost-benefit analysis. An example of the pooling technique is presented using demand equations estimated from the National Recreation Surveys and a time series of visitation data at the Tennessee Valley lakes. The results tend to confirm the superiority of the method proposed, particularly in comparison with an analysis using only time series data. Mainly a participation study, where no substitutes are considered."

131. Seneca, Joseph J., Davidson, Paul, and Adams, F. Gerald. 1968. "An Analysis of Recreation Use of the TVA Lakes," Land Economics, Vol 44, No. 4, pp 529-534.

KEY WORDS: Recreation use, Tennessee Valley Authority lakes, model, site specific.

132. Shucksmith, D. M. 1979. "The Demand for Angling at the Derwent Reservoir, 1970 to 1976," Journal of Agricultural Economics, Vol 30, No. 10, pp 25-37.

KEY WORDS: Recreation demand, fishing, benefits, reservoir, travel cost model, England, participation.

ABSTRACT: "This study applies the 'Clawson' method in an attempt to estimate the demand for angling at the Derwent Reservoir. In particular it attempts to assess the effect of changes in real petrol prices during the period. The results of the analysis suggest that the demand relationship is stable, and highly price elastic: consumption was reduced drastically as a result of increased costs. This indicates that, in a wider context, casual day and weekend recreation may be fairly sensitive to any further rises in petrol prices."

133. Sinden, J. A. 1974. "A Utility Approach to the Valuation of Recreational and Aesthetic Experiences," American Journal of Agricultural Economics, Vol 56, pp 61-72.

KEY WORDS: Recreation benefits, esthetic experience, Travel Cost Method, indifference maps, recreation valuation, esthetics, consumer surplus, Ramsey model, method comparison.

ABSTRACT: "A method for valuing extra-market benefits is proposed and tested. The method rests on the empirical derivation of utility functions and indifference maps. Demand schedules were obtained from the indifference maps to provide specific benefit values. The method is compared to the conventional Travel-Cost Method for valuing recreational benefits. It is argued that the utility approach is conceptually superior. Also, the utility data comprised both the benefit values from the indifference maps and direct survey responses as surrogates for utility. These data proved better predictors of consumption than the usual travel cost variables."

134. Smith, Robert J. 1971 (Jun). "The Evaluation of Recreation Benefits: The Clawson Method in Practice," Urban Studies, Vol 8, pp 89-102.

KEY WORDS: Recreation benefits, Clawson method, Travel Cost Method, fishing, site specific, England.

135. Smith, V. Kerry. 1981. "Congestion, Travel Cost, Recreational Demand Models, and Benefit Evaluation," Journal of Environmental Economics and Management, Vol 8, pp 92-96.

KEY WORDS: Travel cost, recreational demand models, recreation benefits.

136. Smith, V. Kerry, Desvousges, William H., and Fisher, Ann. 1986. "A Comparison of Direct and Indirect Methods for Estimating Environmental Benefits," American Journal of Agricultural Economics, Vol 68, No. 2, pp. 280-289.

KEY WORDS: Benefit estimation, contingent valuation, travel cost, water quality.

ABSTRACT: "Two classes of methods are currently available to estimate consumer valuations of improvements in environmental resources - direct and indirect. This paper reports the results of a detailed comparison of the estimated recreational benefits associated with water quality improvements using one member of each class. The findings indicate that while the estimates are quite comparable, analyst judgment played a very important role in the development of both methods."

137. Smith, V. Kerry, Desvousges, William H., and McGivney, Matthew P. 1983. "Opportunity Cost of Travel Time in Recreation Demand Models," Land Economics, Vol 59, No. 3, pp 259-278.

KEY WORDS: Opportunity cost, time, demand, cost analysis, model, dams, lakes, reservoirs, rivers, benefit, household production, site specific, region.

138. Smith, V. Kerry, Desvousges, William H., and McGivney, Matthew P. 1983. "Estimating Water Quality Benefits: An Econometric Analysis," Southern Economics Journal, Vol 50, pp 422-437.

KEY WORDS: Water quality, recreation benefits, model, travel cost, site characteristics.

139. Smith, V. Kerry, and Kopp, Raymond J. 1980. "The Spatial Limits of the Travel Cost Recreational Demand Model," Land Economics, Vol 56, No. 1, pp 1-9.

KEY WORDS: Travel cost, recreational demand, regional limits, recreation benefits.

140. Smith, V. Kerry, and Krutilla, John V. 1975. "A Simulation Model for the Management of Low Density Recreation Areas," Reprint No. 119, Resources for the Future, Inc., Washington, DC.

KEY WORDS: Traffic simulation model, wilderness recreation, Montana, parameterization, participation, region, congestion.

141. Sorg, Cindy F., Loomis, John B., Donnelly, Dennis M., Peterson, George L., and Nelson, Louis J. 1985. "Net Economic Value of Cold and Warm Water Fishing in Idaho," USDA Forest Service Resource Bulletin RM-11, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

KEY WORDS: Recreation benefits, Travel Cost Method, Contingent Value Method, fisheries management, regional model, iterative bidding, site characteristics, Idaho.

ABSTRACT: The objective of this study was to derive recreational values for fishing using data collected by the Idaho Department of Fish and Game. The Travel Cost Method (TCM) and Contingent Value Method (CVM) were applied to measure net willingness-to-pay per trip for cold water, warm water, and mixed species fishing. The overall sample provided information on 14,552 cold water fishing trips, 4,481 mixed species fishing trips, and 1,771 warm water fishing trips.

The data compilation stage consists of removing outliers, aggregating the individual cases into county groups, and calculating measuring of site attractiveness and site quality. Regression analysis is used. The natural log of visits per capita was chosen to evaluate benefits, since estimated visits were fairly close to actual visits.

Fishing Type		TCM	CVM
Cold water:	value/trip	$42.93	$22.52
	value/day	$25.55	$14.25
Warm water:	value/trip	$42.18	$16.35
	value/day	$26.36	$12.02
Mixed species (cold water dominant)		$39.34	
Mixed species (warm water dominant)		$42.44	
Non-primary (multiple) purpose trips			
cold water:	value/trip		$39.71
	value/day		($21.01/day)
warm water:	value/trip		$19.36
	value/day		($11.39/day)

Estimates are also tabulated for each site in regard to doubling the number of fish caught and increasing size by 50 percent.

142. Stoevener, H. H., and Brown, W. G. 1967. "Analytical Issues in Demand Analysis for Outdoor Recreation," Journal of Farm Economics, Vol 49, No. 5, pp 1295-1304.

KEY WORDS: Demand analysis, recreation, externalities.

143. Stoll, John R. 1983 (Dec). "Recreational Activities and Nonmarket Valuation: the Conceptualization Issue," Southern Journal of Agricultural Economics, pp 119-125.

KEY WORDS: Recreational activities, valuation, Travel Cost Method, contingent valuation method, conceptual.

144. Stoll, John R. 1980. "The Valuation of Hunting Related Amenities: A Conceptual and Empirical Approach," Ph.D. dissertation, Department of Agricultural Economics, University of Kentucky, Lexington, KY.

KEY WORDS: Valuation, hunting, wildlife, Wyoming, household production, questionnaire, benefit estimates, contingent valuation.

ABSTRACT: A conceptual framework for the valuation of wildlife-resource-related amenities is presented in this dissertation. The "new theory of demand" developed by Lancaster and previous work of other researchers in household production theory are utilized in the development of this conceptual framework. Activity and existence values for resources are conceptualized. The end product is a framework which can be used in the collection of data, data analysis, and provision of information for wildlife resource management purposes. Hicksian measures of welfare change are also redefined within this framework and a unique notation is introduced for their representation. These measures can be used to determine the impact upon households of changes in wildlife populations. Total value and compensated demand curves for the wildlife resource are defined.

An empirical application is presented and used to estimate values for elk-hunting-related amenities in Wyoming. This application uses the iterative bidding form of contingent valuation. In this case, study mean household willingness-to-pay (WTP) annually for the right to hunt elk is estimated to range from $44.09 to $126.04 depending upon the elk/encounter package. Previous methods of estimating models using iterative bidding results are substantially improved in this study. Theoretically relevant variables are identified using the developed conceptual framework: (1) variables defining the specific consumption package, (2) variables isolating differences in household consumption technology, and (3) variables indicative of differing tastes and preferences. The final estimated model adopted for further use utilized income-categorized data and included variables which allow for

variation in household consumption technology. This model resulted in an estimate of an income elasticity of bid equal to .369 which, in this model specification, is also equal to the price flexibility of income for elk encounters. A new method for handling "poor" respondents to iterative bidding formats is also discussed.
The estimated model is used to determine a total value curve for the right to hunt elk. From this total value curve, a compensated demand curve for elk encounters is derived. The estimated annual marginal value of an additional elk encounter is $3.65 when the household typically encounters five elk. The estimated annual total value of the right to hunt elk is $95.98 when six elk are typically encountered.

145. Stoll, John R., and Johnson, Lee Ann. 1984. "Concepts of Value, Non-market Valuation, and the Case of the Whooping Crane," Transactions of the North American Wildlife and Natural Resources Conference, pp 382-393.

KEY WORDS: Contingent valuation, questionnaire, value estimates, option price, existence value, recreation benefits.

ABSTRACT: These proceedings represent a preliminary analysis of data collected on the value of the whooping crane resource. A combination of mail and handout survey administration procedures are used. Visitors to the Aransas National Wildlife Refuge were given a survey instrument querying them regarding knowledge, preferences, use of the refuge, and value for present and future use as well as existence of the whooping crane resource. A random mail survey to Texas residents and four national metropolitan areas (Los Angeles, Chicago, New York, Atlanta) was also administered.
Response rates were 67 percent on-site and 36 percent for the mail survey. Mean use values for the Refuge were $4.47 and $3.07 for the with and without whooping crane situations, respectively. Estimates of combined option price/existence value were $16.33, $7.84, and $7.13 for refuge visitors, Texas residents, and out-of-state residents, respectively. Existence values alone were estimated to be $9.33, $1.03, and $1.24 for the same respondent groups, respectively. All values are stated on an annual basis. The authors present confidence intervals for each estimate and discuss potential aggregate values. The preliminary nature of these estimates is stressed, indicating that additional work on the estimations is necessary (and forthcoming).

146. Strong, Elizabeth J. 1983. "A Note on the Functional Form of Travel Cost Models with Zones of Unequal Populations," Land Economics, Vol 59, No. 3, pp 342-349.

KEY WORDS: Travel cost models, demand, consumer surplus, analysis comparison.

147. Stynes, Daniel J., and Peterson, George L. 1984. "A Review of Logit Models with Implications for Modeling Recreation Choices," Journal of Leisure Research, Vol 16, No. 4, pp 295-310.

KEY WORDS: Models, recreation, logit models, use, linear model, gravity model, alternatives, substitution, participation.

ABSTRACT: "The use of logit models to predict recreation activity and site choice is increasing. This paper summarizes the properties of binomial and multinomial logit models, reviews applications of these models in recreation, and provides guidance to the technical literature on estimation techniques. Independence from the irrelevant alternatives (IIA) property of the multinomial logit model is discussed and recommendations are made for improving models of recreation choice."

148. Sublette, Werner J., and Martin, William E. 1976. "Outdoor Recreation in the Salte-Verde Basin of Central Arizona: Demand and Value," Technical Bulletin 218, Agricultural Experiment Station, University of Arizona, Tucson.

KEY WORDS: Outdoor recreation, willingness-to-pay, consumer surplus, direct question approach, mail survey, demand, benefit, Travel Cost Method, Contingent Valuation Method, Arizona, multiple-purpose projects, recreation facilities, transportation, participation.

ABSTRACT: The research question asked is "What is the demand for and value of outdoor recreation in the Salt-Verde Basin of Arizona?" Representative sites were chosen which served as stand-ins for similar sites within the Basin. Similarity was determined by vegetative type, location relative to major cities, and recreational activities. All the sites are relatively remote. Recreation activities available at different sites included fishing, camping, boating, and picnicking. Two sites are virtually without any water-based recreation. At one of those, Brushy Basin - Four Peaks, the main activities were camping, hiking, rock-hounding, and cycling.
Five sites were chosen for the study. Value for cumulative recreation activities of the sites was determined by the Travel Cost Method (TCM) for four of the sites. The standard Clawson-Hoteling approach was used. Modifications

for individual households, such as those used by Brown and Nawas (1971) are included. The Contingent Value Method (CVM), by direct question, is used for the fifth site (Brushy Basin).

The data were collected by mail survey from households that had visited the representative sites. Over 5,000 questionnaires were mailed throughout the 1972 outdoor recreation season, with an overall response rate of 51 percent. For analysis, the consumer unit was based on the household, not in terms of an individual user-day or user-trip. Individual observations were used to derive individual household demand functions defining the number of days a household spent at a specific site per year and the associated variable costs. The sample data were then aggregated to derive a demand curve. Average consumer surplus value per household-day for each site follows: WTP at Brushy Basin; Luna Lake, $26.14; Black Canyon Lake, $42.14; Knoll Lake, $46.93; Horsethief Basin, $9.85; Brushy Basin-Four Peaks, $1.49.

Higher net values and larger expenditures are associated with sites that have water-based recreation, considerable development at the sites, and fairly easy access.

CONCERNS: The estimates of consumer surplus under CVM were much lower than comparable values reported in other studies. The author speculated that strategic bias may have been a problem. The apparent use of an open-ended direct question, however, may have been the main source of bias. Research has shown that contingent valuation respondents do not react well to open-ended direct questions.

149. Sutherland, Ronald J. 1982. "A Regional Approach to Estimation Recreation Benefits of Improved Water Quality," Journal of Environmental Economics and Management, Vol 9, No. 3, pp 229-247.

KEY WORDS: Demand, benefit/cost analysis, fishing, swimming, boating, camping, recreational benefits, water quality, Travel Cost Method, Pacific Northwest, gravity model, participation.

ABSTRACT: "Recreation demand and value are estimated with the Travel Cost Method (TCM) for fishing, camping, boating, and swimming on a site-specific regional basis. The model is regional in that 197 sites are defined for the Pacific Northwest. A gravity model is employed to estimate the number of trips from each destination in the region and these data are the basic input in the TCM demand curves. The model is illustrated by estimating the recreation benefits that would result from meeting the national environmental goal of 'fishable and swimmable' rivers. The main finding is that potential

recreation benefits are concentrated in a few select areas, which are accessible to large population centers."

150. Tadros, Mahfouz E., and Kalter, Robert J. 1971. "A Spatial Allocation Model for Projected Water-Based Recreation Demand," Water Resources Research, Vol 7, No. 4, pp 798-811.

KEY WORDS: Recreation-use estimates, alternatives, allocation model, regional, participation.

ABSTRACT: "This paper develops a model designed to distribute spatial recreation-use estimates forthcoming from 'structural demand' equations of a recreation market. To illustrate the model's operation, a description of its empirical implementation for a regional case study area is given. Data needs and sources are specified, empirical results are set forth and policy implications are drawn. The ability to use the model to simulate policy actions is pointed out."

151. Thayer, Mark A. 1981. "Contingent Valuation Techniques for Assessing Environmental Impacts: Further Evidence," Journal of Environmental Economics and Management, Vol 8, No. 1, pp 27-44.

KEY WORDS: Benefits, Contingent Valuation Method, environmental impacts, geothermal energy, esthetics, bias, site substitution, wilderness recreation, New Mexico.

ABSTRACT: A study of esthetic impacts of geothermal energy development is used to examine the existence of starting point, hypothetical and strategic biases in the iterative bidding form of contingent valuation. Three specific issues (the hypothetical nature of the survey technique, the questionnaire information structure, and the bidding procedure starting point) are examined theoretically and empirically to determine their effect on individual bid behavior.

The survey instrument was administered to a random sample of 112 recreationists in the Jemez Mountain Area of New Mexico. The interviews were conducted in the fall of 1976 and spring of 1977. Respondents were subdivided into single day visitors (74) and overnight campers (32). Alternative starting points and prior information were used to test for starting point and information bias, respectively. A site substitution approach based on travel costs was used to compare impact estimates with the bidding approach, thereby allowing

for a test of hypothetical bias. Comparison of means and ordinary least squares procedures was used. The tests were conducted for the entire sample as well as the subgroups. A majority of the article is focused on developing the conceptual basis for these tests of bias, and on discussing previous literature.

The bidding portion of the analysis found that the mean willingness to pay an entrance fee to the national forest area was $2.54 ($2.56 for day visitors and $2.48 for campers). Although not stated in the article, it is assumed that this is a per visit rather than annual fee. The site substitution approach found an estimate of willingness-to-pay which ranged from $1.85 to $2.59 ($1.60 - $2.33 for day visitors and $2.51 - $3.52 for campers) when using travel costs of $0.5 - $0.7 per mile (1976 dollar estimates of variable driving costs from Hertz and AAA). It was concluded that these similar estimates of willingness-to-pay provide evidence that the hypothetical bias from the contingent valuation approach was not a problem. Starting point bias was tested for using $1 and $10 starting points and its existence was rejected in this study (10-percent significance level). Testing for information bias used question formats with alternative informational content and also rejected its existence (10-percent significance level). Estimated equations for respondent bids were not presented due to insignificant explanatory power of the models (R^2 ranged from .04 to .06).

CONCERNS: This study is one of the few which actually attempts to provide comparison of value estimates derived from alternative valuation techniques. It is also among the few which focus specifically upon problems of bias. For these reasons it is noteworthy even though the explanatory power of models used to explain bids is quite low.

152. Trice, Andrew H., and Wood, Samuel E. 1958. "Measurement of Recreation Benefits," Land Economics, Vol 34, No. 3, pp 195-207.

KEY WORDS: Recreational benefits, travel cost, method of valuation, California, reservoir, recreation.

153. US Army Engineer District, Rock Island. 1985. "The Value of Recreation in the Rock Island District, 1983," Rock Island, IL.

KEY WORDS: Travel cost, recreation benefit, visitation, reservoirs.

This study developed travel cost benefit models for the reservoirs and projects in the Rock Island District, Corps of Engineers. Recreation use surveys

were taken during the 1983 recreation season. The ZIP Codes from the surveys were used to develop travel zones of 10-mile widths. The market area, or region of influence, for each project was taken to be the area that provided 90 to 99 percent of the visitation. A regression analysis was used to develop recreation demand equations for each of the projects. The resulting benefit calculations showed a recreation benefit of $11,520,800 for the Rock Island projects for 1983. This study is an example of using visitation data (in conjunction with readily available software) for sorting surveys into zones and developing regression equations to develop benefit models.

154. US Forest Service. 1989. "Impact Analysis for Planning (IMPLAN), Software Manual," USDA National Computer Center, Fort Collins, CO.

IMPLAN is an economic Input-Output (I-O) model developed by the US Forest Service to evaluate the economic impacts of alternative management policies. The data base consists of two parts: (a) a national level technology matrix of 528 industry sectors, with allocation of expenditures and multipliers for each of the sectors, and (b) for each county in the US, estimators of sectoral activity for final demand, final payments, gross output and employment. Economic impacts are determined in terms of (a) gross outputs, i.e., direct, indirect, and induced outputs; and (b) employee income, property income, value added, and number of jobs by sector. Required data for IMPLAN includes the anticipated changes, such as expenditures by recreationist. IMPLAN facilitates alternative evaluation by showing the impact of different alternatives on the different sectors of the economy. IMPLAN is available in a microcomputer format or may be accessed at the USDA National Computer Center.

155. Vaughan, William J., and Russell, Clifford S. 1982. "Valuing a Fishing Day: An Application of a Systematic Varying Parameter Model," Land Economics, Vol 58, No. 4, pp 450-463.

KEY WORDS: Fishing, benefit, model, systematic varying parameter model, willingness-to-pay, Travel Cost Method, site characteristics.

ABSTRACT: The objective of this study is to estimate the value of freshwater fishing for different species of fish. This model depends heavily on the site characteristic variable. The sites studied exhibited either coldwater gamefish (trout) or roughfish angling (catfish). Each site specialized in one species or the other.

A survey was mailed to the operators of 147 fee-fishing sites in 1979. Data were collected on the sites, not on individuals. Previous studies helped to form a list of site characteristic variables to be measured. These are: average number of fish caught per visitor day; average weight of fish caught per visitor day, species of the expected bag; type of water body (flowing or standing); quality of esthetic background, provision of complementary facilities including boat rental, equipment rental, and sanitary facilities; accessibility of site (proximity to a major highway); weather (number of "fishable" days per year); fishable acreage of site; site congestion; rules and regulations (bag, equipment, or time limits, catch and keep rules, extent of competition experience from substitute private and public sites). A maximum market value of 200 miles attempted to limit any multi-purpose trip bias.

The approach employed involves the estimation of a varying parameter travel cost model from cross-sectional data on the sites. Each varying parameter is constructed by the effects of similar characteristics. The two independent parameters are population characteristics and site and market characteristics. The authors were not interested in the effect of any of the characteristic measures. The purpose of the study was to control for the effects to generate a demand schedule for fishing days at a site of average quality for its species type.

The equations were estimated using a GLS approach. Two travel cost variables were used. One did not account for the cost of time spent traveling (TC1). The second accounted for time valued at the median hourly wage by travel zone (TC2).

The average consumer surplus, excluding resource costs, was $10.96 (TC1) and $19.49 (TC2) for trout and $7.00 (TC1) and $12.48 (TC2) for catfish. Changes in the availability of species can also be valued with this technique.

156. Vaughan, William J., Russell, Clifford S., and Hazilla, Michael. 1982. "A Note on the Use of Travel Cost Models with Unequal Zonal Populations: Comment," Land Economics, Vol 58, No. 3, pp 400-407.

KEY WORDS: Travel cost model, conceptual, benefits.

157. Wade, William W., McCollister, George M., McCann, Richard H., and Johns, Grace M. 1989a. "Recreation Benefits for California Reservoirs: A Multi-site Facilities-Augmented Gravity Travel Cost Model," Spectrum Economics, Pala Alto, CA.

This Travel Cost Method was developed to predict the number of activity days and benefits for: boating, fishing, and picnicking and swimming. The model was per user day for 83 reservoirs, lakes, and river areas in California. The model was a gravity travel cost model; that is, the estimates of visitation were developed from a household survey of recreator preferences and not recreator surveys or observations of origin-destination travel patterns. The distribution of users to different recreation sites was based on travel distances and costs, and the attractiveness of site and substitutes. Attractiveness of sites was based on the site's attributes: number of boat launches and slips; natural fish production; number of parking spaces; and number of campsites. The model thus allocates visitors from an origin seeking a particular activity to the site that provides the best available services at the lowest access cost. Evaluation of the model showed in some cases that visitation was underpredicted or overpredicted due to reservoirs close to urban areas (low travel costs) and other site attributes (excessive winds interfering with recreation) that affect the actual visitation.

158. Wade, William W., McCollister, George M., McCann, Richard H., and Johns, Grace M. 1989b. "Estimated Recreation Benefits for California Corps of Engineers Reservoirs," Spectrum Economics, Palo Alto, CA.

The gravity model developed for California was applied to 12 reservoirs in the Sacramento District, and compared to 1985 recorded visitation and site conditions. The model overpredicted by about 15 percent. The reasons attributed to the overprediction were: (a) relative remoteness of some sites and additional travel time required to reach them may not be accurately reflected in the distance matrix, and (b) the average 1985 summer surface acreages (one of the predictors of use) was less than 60 percent of capacity. It is suggested that adding an accessibility parameter to the model and correcting for differences in accessibility to main highways may better predict visitation. Benefits are estimated using the travel cost specification of the original model. Visitation is predicted for the year 2020 using demographic projections.

159. Walsh, Richard G., Ericson, Ray K., Arosteguy, Daniel J., and Hansen, Michael P. 1980. "An Empirical Application of a Model for Estimating the Recreation Value of Instream Flow," Completion Report No. 101, Water Resources Research Institute, Colorado State University, Fort Collins, CO.

KEY WORDS: Reservoir fishing, river fishing, direct question approach, open-ended question, interview, model, benefits, WTP, congestion, water level, site specific.

ABSTRACT: What are the values of fishing in high mountain reservoirs and rivers located in the Rocky Mountains of Colorado?

A sample consisting of 60 river fishermen and 70 reservoir fishermen was interviewed at representative high mountain sites in the summer of 1978. Respondents were asked first to report the direct out-of-pocket costs of the trip made the day of the interview. They were then asked to state their maximum willingness-to-pay for the trip given the level of congestion and water present that day. A direct, open-ended question was employed to collect willingness-to-pay. After this, respondents were asked to indicate how their maximum willingness-to-pay would change with various hypothetical levels of congestion and water. Consumer surplus associated with specific trip scenarios was estimated by subtracting direct costs of the actual trip from maximum willingness to pay.

The value to an average fisherman of a trip during which no other people are encountered was estimated at $20.00 per day. For both high mountain reservoirs and rivers, estimated benefits declined by approximately $.80 to $.90 for each additional person encountered. The average number of actual encounters reported by reservoir fishermen on the day of the interview was 16. Reservoir fishermen were willing to pay an average of $7 per day for a fishing trip with this number of encounters. River fishermen reported an actual number of encounters averaging 12 other people per day. For a trip with this number of encounters, river fishermen were willing to pay an average of $10.00 per day. Both reservoir and river fishermen reported a zero willingness-to-pay for a trip with 30 encounters per day. The congestion-adjusted benefits for fishing reported in the previous paragraph assumed that average water level was 90 percent of maximum bankful capacity of reservoirs and 70 percent of maximum instream flow of rivers. Further results indicated that changing water levels (with congestion held constant) substantially affected willingness to pay. In the range of 25 percent to 100 percent of maximum bankful capacity, the marginal value of an acre-foot of water used for reservoir fishing was estimated at $1.80 per day. The marginal value of an acre-foot of water used for river fishing increased from $0.00 per day with no instream flow to a maximum of $13.08 per day with 35 percent of maximum

instream flow and fell again to $0 per day with 65 percent of maximum instream flow.

The article discusses management policies for maximizing user benefits of high mountain reservoirs and rivers. The focus of the policy recommendations is how to achieve optimal levels of congestion and water.

CONCERNS: Insufficient evidence exists to conclude that open-ended direct questions are as reliable as iterative type bidding formats.

160. Walsh, Richard G., Ericson, Ray K., Arosteguy, Daniel J., and Hansen, Michael P. 1980. "An Empirical Application of a Model for Estimating the Recreation Value of Instream Flow," Completion Report No. 101, Water Resources Research Institute, Colorado State University, Fort Collins, CO.

KEY WORDS: WTP, contingent valuation, recreation, congestion, management, in-stream flow, model, use, water sports, fishing, kayaking, rafting, water allocation, benefits, public access, Rocky Mountains (Colorado), noniterative (open-ended) approach, interview.

ABSTRACT: What are the public benefits from cold water river fishing, kayaking, and rafting on the west slope of the Rocky Mountains, Colorado?

A representative sample of 206 recreation users was interviewed at nine sites during the summer of 1978. The sample included 60 fishermen, 60 kayakers, and 86 rafters. Respondents were asked to report the maximum amount they were willing to pay for their chosen activity contingent upon congestion and instream flow. Six levels of congestion and instream flow were presented to the respondents. Congestion levels were: no other person encountered, and 20 percent, 40 percent, 60 percent, 80 percent, and 100 percent of the maximum acceptable number of persons encountered before discontinuation of participation. Instream flow levels included 100 percent, 80 percent, 60 percent, 40 percent, 20 percent, and 0 percent of maximum bankful. An open-ended direct question was employed to collect willingness-to-pay. The payment vehicle was an increase in total trip expenses. Actual direct out-of-pocket costs reported by the respondents were subtracted from maximum willingness to pay to estimate consumer's surplus.

Ordinary least squares statistical methods were used to determine the relationships between congestion and the net benefits per day from fishing, kayaking, and rafting. Congestion had a negative, statistically significant relationship with all three activities. To adjust for the effects of congestion, net benefits associated with different levels of instream flow were reported, assuming optimal levels of congestion.

The results indicated that instream flow had a substantial effect on congestion-adjusted net benefits. Congestion-adjusted benefits for rivers at 70 percent maximum instream flow were estimated at $11.78 per user day for fishing, $7-$8 per user day for rafting, and $7-$9 per user day for kayaking. At only 35 percent of maximum instream flow, congestion-adjusted benefits decreased to $9.57 per user day for fishing, $5.31 per user day for kayaking, and $4.93 per user day for rafting.
The policy implications of the research results on water management are discussed also.

CONCERNS: At present, there is insufficient evidence to conclude that open-ended direct questions provide results as reliable as those obtained by iterative bidding.

161. Walsh, Richard G., and Gilliam, L. O. 1982. "Benefits of Wilderness Expansion with Excess Demand for Indian Peaks," Western Journal of Agricultural Economics, Vol 7, No. 1, pp 1-12.

KEY WORDS: Hiking, backpacking, congestion, external benefits, iterative bidding, open-ended question, interview, substitution, WTP.

ABSTRACT: Should the value of reduced congestion of an existing recreation site, which would result from substitution for a new recreation site, be added to the net benefits of developing the new recreation site? The Indian Peaks wilderness area near Denver, CO is characterized by excess demand from hikers and backpackers. It was proposed that information regarding the value of reduced congestion at Indian Peaks would help to evaluate the economic feasibility of designating an alternative wilderness area nearby.
A personal interview survey of a random sample of 57 hikers and 69 backpackers was conducted. The interviews were conducted at Indian Peaks during the summer of 1979. The primary objective of the interviews was to measure willingness-to-pay for hiking and backpacking experiences under various levels of congestion. The actual number of encounters with other people on the day of the interview was specified as the base level of congestion.
Respondents were asked first to state the maximum amount they would be willing to pay for their actual trip with base level congestion, rather than forego the experience. Respondents were then asked to indicate how the maximum willingness-to-pay for the trip would change with three levels of hypothetical congestion: low, intermediate, and high.

Willingness-to-pay was collected using both iterative bidding and direct question. A statistical test was conducted to determine if the type of valuation instrument significantly influenced willingness-to-pay. A statistical test was conducted also for strategic bias.

A stepwise least squares approach was used to estimate willingness-to-pay equations for hiking and backpacking. From the equations, average values for a day of hiking and backpacking with no other persons encountered were estimated at $18 and $23, respectively. With all else held constant, the average value of hiking decreased by $0.21 per day and the average value of backpacking decreased by $0.27 per day, with each additional person encountered. It was estimated that 130 encounters per day would reduce the value of hiking to zero. Similarly, it was estimated that 110 encounters per day would reduce the value of backpacking to zero. Other variables which influenced willingness-to-pay (and thus, the value of hiking and backpacking) were income, time at site, distance traveled, distance to substitute sites, residence, and organizational affiliation. Statistical tests indicated that the valuation instrument (open-ended question versus iterative bidding) did not significantly influence willingness-to-pay, and that strategic bias was not present in the results.

Data on visitor days at Indian Peaks showed an annual excess demand of 92,500 visitor days. It was estimated that if this level of excess demand was reduced by substitution of Indian Peaks for a newly designated wilderness area, user benefits could increase at Indian Peaks by $7.40 per day or $740,000 annually due to a lessening of congestion. Discounting these benefits at 7.35 percent would currently result in a value of $10 million being attributable to the newly designated area.

CONCERNS: The personal interview survey required much time and effort. It was therefore only possible to interview a relatively small sample of recreationists.

162. Walsh, Richard G., Gillman, Richard A., and Loomis, John B. 1982. "Wilderness Resource Economics: Recreation Use and Preservation Values," American Wilderness Alliance, Denver, CO.

KEY WORDS: Wilderness, use value, preservation value, willingness-to-pay, noniterative bidding (open-ended), mail survey, recreational benefits, use, WTP, Marshallian surplus, contingent valuation.

ABSTRACT: What are the use and preservation values of wilderness areas located in the state of Colorado?

A mail survey was conducted with 218 resident Colorado households in the summer of 1980. Respondents were asked to state their maximum willingness-to-pay to preserve wilderness in Colorado and throughout the United States. Non-iterative bidding (open-ended) with a preservation fund payment vehicle was employed to collect willingness-to-pay. The procedure was repeated for four levels of wilderness designation in Colorado, and three levels for the United States in general. Respondents were asked to separate their maximum willingness-to-pay for Colorado wilderness into current recreation use and preservation value. Preservation value was further divided into option, existence, and bequest value. Recreation use value was measured also by the Travel Cost Method.

The average recreation use value (consumer surplus) of Colorado wilderness was estimated by the Travel Cost Method at $14.29 per visitor day. The average preservation value from 1.2 million acres of Colorado wilderness was estimated by contingent valuation at $14 annually. This $14 was composed of $4 annual option value, $5 annual existence value, and $5 annual bequest value. Preservation value was found to be related positively to the amount of wilderness preserved in Colorado. Average annual preservation value increased to $19 for 2.6 million acres, $25 for 5 million acres, and $32 for 10 million acres. The present value of annual benefits from preserving 1.2 million acres of Colorado wilderness in 1980 was estimated at $1.5 billion. This figure included a recreation use value of $206.7 million and a preservation value of $287.4 million. The estimates of present value increased at a decreasing rate with additional acreage. For maximum acreage of 10 million acres, the present value of annual benefits was estimated at $3.6 billion. A statistical test for strategic bias in the results indicated nonsignificance.

CONCERNS: A telephone directory was used as the sampling medium for the mail survey. This resulted in some sampling bias, as all Colorado residents are not listed in the telephone directory. In addition, a substantial number of unopened questionnaires were returned by the Post Office because of invalid or incomplete addresses.

163. Walsh, Richard G., Loomis, John B., and Gillman, Richard A. 1984. "Valuing Option, Existence, and Bequest Demands for Wilderness," Land Economics, Vol 60, No. 1, pp 14-29.

KEY WORDS: Recreation benefit, demands, wilderness recreation, option value, bequest value, preservation value, contingent valuation method, willingness-to-pay.

164. Walsh, Richard G., Miller, N. P., and Gilliam, L. O. 1983. "Congestion and Willingness to Pay for Expansion of Skiing Capacity," Land Economics, Vol 59, No. 2, pp 195-210.

KEY WORDS: Snow skiing, congestion, recreation benefits, WTP, Colorado, iterative bidding, personal interview.

ABSTRACT: The article examines the proposition that a new ski area produces external benefits to the existing ski area in the form of reduced congestion due to substitution.

A sample of 236 skiers were interviewed at three Colorado ski areas in February, March, and April of 1980. The sample included 116 skiers at Vail Ski area, 57 at Copper Mountain, and 63 at Loveland Basin. Respondents were asked to state their maximum willingness-to-pay for lift tickets contingent on changes in lift line wait and number of skiers per acre. Nine combinations of lift line wait and slope congestion were specified. Respondents stated their maximum willingness-to-pay for each combination by iterative bidding. The starting point of the bidding game was the lift ticket price actually paid and the average lift line and slope congestion experienced on the day of the interview.

The relationship of willingness-to-pay to congestion and other important variables was analyzed by stepwise regression procedures. The estimated regression equations indicated that willingness-to-pay was significantly related to lift time wait, slope congestion, income, annual days skied at the site, distance to the next-most-preferred ski area, years of skiing experience, sex, age, annual weeks of paid vacation, day of the week, out-of-state residence, skiing quality variables other than congestion, whether expectations were met, and skiing ability. Willingness-to-pay equations were estimated for each of the three ski areas. The equations produced estimates of average willingness-to-pay per day with no lift lines and no slope congestion equal to $22.55 at Vail, $17.88 at Copper Mountain, and $15.40 at Loveland Basin. The equations also indicated that with all else held constant, willingness-to-pay increased with each 1-minute decrease in lift line wait by $0.34 at Vail, $0.30 at Copper Mountain, and $0.27 at Loveland Basin. Willingness-to-pay increased

with one less skier on the slopes by $0.22 at Vail, $0.18 at Copper Mountain, and $0.09 at Loveland Basin.

The results of the study indicated the benefits of reducing congestion at the ski areas studied. US Forest Service figures show that all three areas studied experienced excess demand during the 1979-80 season. The aggregate benefits of allocating excess demand at the ski areas were estimated at $1,058,046 for Vail, $362,828 for Copper Mountain, and 22,521 for Loveland Basin. It was proposed that these benefits would represent external benefits of a new skiing area if substitution of the existing areas for the area reduced excess demand of the existing areas to zero. It was noted that a second type of benefit from reduced congestion would result from expansion of the ski area itself. These benefits were calculated but are not reported here. A statistical test for strategic bias in the results of the study was nonsignifcant.

A methodology for determining optimum skiing capacity is also presented in the article.

165. Walsh, Richard G., and Olienyk, J. P. 1981. "Recreation Demand Effects of Mountain Pine Beetle Damage to the Quality of Forest Recreation Resources in the Colorado Front Range," Department of Economics, Colorado State University, Fort Collins, CO.

KEY WORDS: Recreational benefits, Colorado, insect tree damage, recreation demand, willingness-to-pay, iterative bidding, personal interview, WTP.

ABSTRACT: What is the impact of mountain pine beetle damage to ponderosa pine trees on demand for recreation use of forests in the Front Range of Colorado's Rocky Mountains?

The Front Range of the Rocky Mountains in Colorado is an area of increasing forest-based recreational use. In order to assess the impact of insect tree damage on recreation use, a personal interview survey was conducted of users of Front Range forest recreation sites. Recreation activities studied included developed camping, semi-developed camping, backpacking, hiking, fishing, picnicking, driving off-road vehicles, and staying at resorts.

The sample consisted of 435 users of six forest recreation sites. Interviews were conducted on-site in the summer of 1980. Contingent valuation with iterative bidding was used to measure willingness to participate and willingness to pay for use of forest recreation sites which differed in several forest quality variables. The forest quality variables were described with the aid

of color photographs. Respondents were asked to state the maximum amount they would be willing to pay, in the form of direct trip costs, for recreation trips, with each combination of the forest quality variables of interest. Consumer surplus was calculated by subtracting actual direct trip costs from maximum willingness-to-pay. As a check on the values estimated by contingent valuation, consumer surplus was also estimated by the Travel Cost Method. For each activity, consumer surplus was reported for recreation sites with 13 different levels of tree density ranging from 0-300 trees per acre. For the average site, with 178 trees per acre, consumer surplus per day was estimated at approximately $2.00 for developed camping, $5.90 for semi-developed camping, $8.10 for backpacking, $9.60 for hiking, $10.50 for fishing, $7.70 for picnicking, $12.00 for staying at resorts, and $5.20 for driving off-road vehicles. In general, it was found that consumer surplus from forest recreation would decrease by 0.91 percent with a 1-percent decrease in number of trees at recreation sites. This elasticity with respect to trees reflects the impact on forest-based recreation of mountain pine beetle damage. The Travel Cost Method provided comparable estimates of the effect of tree density on forest recreation demands.

CONCERNS: It was only possible to interview a relatively small sample of users. The sample, however, was found to be representative.

166. Walsh, Richard G., Sanders, Larry D., and Loomis, John B. 1985. "Wild and Scenic River Economics: Recreation Use and Preservation Values," American Wilderness Alliance, Englewood, CO.

KEY WORDS: Recreation benefits, use, preservation values, valuation, wilderness, scenic rivers, Contingent Valuation Method, option value, bequest value, existence value, willingness-to-pay.

ABSTRACT: "The Contingent Valuation Method, recommended by the US Water Resources Council, was applied to the problem of estimating the recreation use and the nonuse preservation value of wild and scenic rivers in Colorado. The study is based on a random sample of 214 resident Colorado households who participated in a mail survey in 1983. Resident households reported that they were willing to pay a total of $95 per year, or $112.6 million total, to protect the 11 rivers recommended for wild and scenic designation by recent government studies. Nonuse preservation values accounted for most of this total value: recreation use value was $18, or $21.3 million: option value, $15, or $17.8 million; existence value, $27, or $32 million; and bequest value, $34,

or $41.5 million. When the present values of incremental benefits and costs were compared, the efficient level of river protection was 14 rivers. The benefits of river protection are maximized where willingness-to-pay for an additional river equals its opportunity costs.

The results provide an empirical test and confirmation of the hypothesis that the general population may be willing to pay for the preservation of unique natural environments, and that their option, existence, and bequest values should be added to the value of recreation use to determine the total economic benefits of rivers to society. It is proposed that project evaluation by State and Federal water agencies include nonuse preservation values. For, in the absence of information of preservation values to all of the people, too few rivers would be protected by wild and scenic river designation in such states as Colorado, where future development of water, mineral, energy and other resources may irreversibly damage rivers. Permanent or long-run loss of unique natural rivers would result from the inability or prohibitive high cost to restore natural conditions."

167. Ward, Frank A. 1984. "Specification Considerations for the Price Variable in Travel Cost Demand Models," Land Economics, Vol 60, No. 3, pp 301-305.

KEY WORDS: Travel costs, demand, models, discretionary costs, price variable, benefits.

168. Ward, Frank A. 1982. The Demand for and Value of Recreational Use of Water in Southeastern New Mexico, Research Report 465, Agricultural Experiment Station, New Mexico State University, Las Cruces, NM.

KEY WORDS: Demand, benefit, recreational use, resource allocation, lakes, Travel Cost Method, New Mexico.

169. Waters, Robert C., and Valderrama, R. 1984. "Derivation of Unit-Day Values for Recreation Benefit Valuation in Water Resource Planning, Based on a Comprehensive Theoretical Framework," Report No. 58, Water Resources Research Center, University of the District of Columbia, Washington, DC.

KEY WORDS: Recreational benefits, willingness-to-pay, contingent valuation, unit-day values, Travel Cost Method, planning.

ABSTRACT: This paper is a qualitative study to determine the best method to evaluate national economic benefits for public recreation sites. The author presents advantages and disadvantages of the Travel Cost Method, Contingent Valuation Method, and the Unit-Day Values Method (UDVM).

The research suggests that Federally provided water-based recreation is in reality a political process, and that the current valuation procedures do not lead to Pareto efficiency. Even with its drawbacks, the UDVM is recognized by these authors as a more realistic approach to a problem that is more than economic.

CONCERNS: Since the results of benefit valuation procedures commonly used are expected to be inputs into political decisions and not final answers, this argument for the UDVM is hard to accept.

170. Waters, Robert C., and Moustakis, Vassilios. 1981. "An Evaluation of Recreational Benefits and Use Estimating Models for Water Resource Planning," Technical Completion Report A-012-DC, Water Resources Research Center, University of the District of Columbia, Washington, DC.

KEY WORDS: Benefit, use, recreation facilities, social aspects, models, planning, general, regional.

ABSTRACT: The objective of the study was (a) to collect and analyze the available recreational benefit estimating models to determine the degrees of congruity and generality which exist in the present body of research, and (b) to evaluate the several recreational benefit estimation methods from the perspective that substitutes to the services provided by the new site are considered. A literature search of recreational modeling articles yielded over 300 abstracts, of which 35 were selected for review. The major criterion was that the article dealt with regional modeling as specified by the Water Resources Council. The review comments about independent variables, tests of the models, and operations research models.

171. Wennergren, E. Boyd, and Fullerton, Herbert H. 1972. "Estimating Quality and Location Values of Recreational Resources," Journal of Leisure Research, Vol 4, No. 3, pp 170-183.

KEY WORDS: Recreational resources, benefits, model, site characteristics.

ABSTRACT: "One topic pertinent to valuation of outdoor recreation which has not received complete analytical treatment is recreation quality. It is this topic which provides the central focus of this paper. Conceptual and empirical procedures are proposed which permit estimation of the separate contribution to resource value attributed to site location and quality characteristics. These are demonstrated using the concept of economic rent. This

approach to quality valuation, however, should be equally applicable where consumer surplus is used as the value measure."

172. Wennergren, E. Boyd, Fullerton, Herbert H., and Wrigley, Jim C. 1977. "Quality Values and Determinants for Deer Hunting," Journal of Wildlife Management, Vol 41, No. 3, pp 400-407.

KEY WORDS: Deer hunting, benefits, Utah, site value, model, site characteristics.

ABSTRACT: "Deer hunting as recreation was analyzed by joint consideration of economic site values and wildlife measures of recreation quality. Economic site values were estimated for both location and quality. For 71 Utah management units, the total value was an estimated $3.3 million annually, of which 85 percent was related to the quality of recreation sites. Eight measures of site quality were used as independent variables in a regression analysis in which economic value was the dependent variable. Variation in hunter success and the ratio of summer to winter range were the only variables which had significant effects (P>0.01). The two variables explained 94 percent of the variation in site quality."

173. Wetzel, James N. 1977. "Estimating the Benefits of Recreation Under Conditions of Congestion," Journal of Environmental Economics and Management, Vol 4, pp 239-246.

KEY WORDS: Natural resources, mathematical models, recreation demand, cost-benefit analysis, benefits, measurements, model studies, recreation, value, congestion, travel cost method, bias.

174. Wilman, E. A. 1980. "The Value of Time in Recreation Benefit Studies," Journal of Environmental Economics and Management, Vol 7, No. 3, pp 272-286.

KEY WORDS: Recreation benefits, time, Travel Cost Method, scarcity value.

ABSTRACT: "This paper examines the role of time costs (both on-site and travel) in models describing recreation behavior, and draws implications for the travel-cost approach to recreation site benefit estimation. The analysis shows that both recreation and travel time are costly. The latter can be valued in terms of its scarcity value, but the former may be most appropriately valued in terms of the 'value of travel time saved.' Although there are cases in which on-site time costs need not be explicitly considered in

recreation benefit models, it is not clear such cases are the rule rather than the exception. Suggestions are made for measuring on-site and travel time costs."