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An Evaluation of Recreational Benefits and Use Estimating Models for Water Resource Planning

by

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AN EVALUATION OF RECREATIONAL BENEFITS AND USE ESTIMATING MODELS FOR WATER RESOURCE PLANNING

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FINAL REPORT--Project #A.012.DC

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1.0 INTRODUCTION

The investment in facilities for recreation by several Federal agencies is big business. In Fiscal year 1974 alone, the Federal obligations amounted to $500 million (62, p. 258]. However, the evaluation procedures which are used to justify the investments are often crude and inconsistent (62]. The difficulty is related to deriving the-benefits. The key issue to be partially addressed in this report is: what is the basis, i.e., value setting process, to justify the magnitude of federal investment in recreational outputs for multipurpose water resource projects? A corrolary concern is: what is the impact on the process when beneficiaries of the outputs often are provided access to the recreational experience at zero price? Presently, estimated recreation benefits for water-based recreation projects vary widely depending upon-the method of computation. Most often estimated recreation visitor days in conjunction with a simulated price or value per day are used to compute recreation benefits. The benefits are determined. by estimating the site's annual number of visitors and multiplying the amount by fixed rate, specifically an administratively determined price per visitor day, to calculate total benefits. The objectives of this paper are twofold: (a) to collect and analyze available recreational benefit estimating models to deter mine the degree of congruity and generality which exists in the

present body research, and (b) to evaluate the several recreational benefits estimation methods from the point of view of the extent that competition between sites is considered.

To initiate the research review[3], a literature search was conducted through the Water Resources Scientific Information Center and the Department of Interior Library, Bibliographic Services. This search provided more than 300 abstracts related to recreation modeling. Of these, approximately one-fourth refer to water-based recreation from which about 35 of the most germane were selected for reviewing. About 10 additional studies were obtained with the assistance of the U. S. Water Resources Council through an information exchange network composed of recreation researchers, academicians, government and private industry researchers.

The major criterion for selecting studies was to assess the extent that the literature supports the call of the Water Resources Council for the use of regional models, as expressed in the "Manual of Procedures for Evaluation of National Economic Development Benefits and Costs in Water Resource Planning" and in subsequent directives (64]. The Manual, published on December 14, 1979 the Federal Register (72892) (55), indicated that:

> The Water Resources Council (WRC) will periodically publish a list of available regional models that may be used to evaluate proposed projects and will indicate the types of project, kinds of recreation activity, and regions) of the country for which each of the models is appropriate."

This report is intended to provide water resource development planners with access to the available recreation use and benefits estimation models, to assist the federal agencies in developing enhanced cooperation, to provide access to the available literature,

and to improve the efficiency and effectiveness of benefit evaluation.

This final report is divided into three parts. First, a description of the several benefits and/or participation methods is provided. Second, the results of the literature survey are presented and evaluated. Third, several conclusions and recommendations for further research are presented.

2.0 METHODS FOR ESTIMATING RECREATIONAL BENEFITS

The ultimate objective of any recreational model is to provide a basis for the estimation of net benefits resulting from a recreation development investment. In this section several recreation benefits evaluation estimating techniques and their relevance to regional recreational models is established. The techniques reviewed are (1) the Travel Cost Method, (2) the Stratified Travel Cost Method, (3) the Survey or Contingency Valuation Method, and (4) the Unit Day Value Method..

2.1 The Travel Cost Method

The Travel Cost Method (TCM) was actually first proposed by Hotelling [9, 61]. According to Hotelling's 1974 letter to the

National Park Service:

> If we assume that the benefits are the same, what the distance, we have, for those living near the park, a consumers' surplus consisting of the differences in transportation costs.

According to the TCM recreation benefits are calculated by comparing:

> the cost of coming from a zone with the number of people who do come from it, together with a count of the population of the zone,.(which) enables us to plot one point for each zone on a demand curve for the service of the park. By a judicious process of fitting, it should be possible to get a good enough approximation to this demand curve to provide, through integration, a measure of the consumers' surplus resulting from the availability of the part [61, p. 8].

With the TCM recreational benefits are evaluated using a recreation demand curve. The first Hotelling model was later refined by Clawson-Knetch [9], Cesario [5J, Cicchetti [7, 8], and modified to accommodate regional analysis requirements, that is, Vickerman [56], Burt-Brewer [3], and Gum-Martin [19]. In the context of a regional analysis the TCM is generally formulated as:

$$Q_{ij} = f(C_{ij}, p_i, S_{ij}, A_j, r_{kj}, K_i, l_j, m_{ij}) \qquad (6)$$

where

Q_{ij} = the quantity of recreation demanded from individuals at point of origin i, i=1,2,...m at site j; j=1,2,...N

C_{ij} = trip cost, the total cost of travel between the origin i and site j

p_i = population at origin i

r_{kj} = index indicating whether site j is the final destination $k \neq j$ (multiple visits). When k=j, site j is the final destination, but when $k \neq j$ indicates that on the way to k, j was visited.

S_{ij} = index indicating the availability of substitute sites available to recreationists from i^{th} origin

A_j = relative attractiveness of recreation site j

K_i = socioeconomic characteristics of population origin i, including income factors

l_j = entrance fee at site j, and other expenditures within the site while receiving recreation

m_{ij} = behavioral characteristics of point i recreationists for site j. For example, this factor would consider the disutility of a recreationist by visiting the same site again and again. This factor might incorporate overcrowding. The literature completely ignores this factor.

Normally, the Q_{ij} function may be decomposed to:

$$Q_{ij} = g\ (p_i,\ r_k\ ,\ S_{ij}\ ,\ A_j\ ,\ K_i\ ,\ m_{ij}\ )\ C_{ij}^{-b}\ ,\ l_j^{-}b_2 \qquad (7)$$

to indicate the deterrent effect of both total travel cost and entrance charged at the site. Recreation benefits are estimated by measuring consumers' surplus, the so-called willingness to pay. It should be noted that the formulae (6), and (7) are quite ideal and none of the studies reviewed use either of them.

Factors ki, 1j, mij and $_{.}r_k$ are usually disregarded, mainly because it is difficult to incorporate in analysis. So the resulted model is(15, p. 791.

$$Q_{ij} = f(C_{ij},\ p_i,\ S_{ij},\ A_j) \text{ or } (8)$$

in a decomposed (separable) form

$$Q_{ij} = g(pi,\ Sij,\ Aj.)Cij^{-b,} \quad (9)$$

The implicit assumptions underlying formulae (8), (9) are as follows: (15, pp. 80-86; 61, pp. 10-15).

1. Distance from the site is the only factor in travel cost variation.

2. No consumer differences in recreation tastes are considered. All recreationists are assumed to have the same tastes for a specific recreation site. Furthermore, no income differences nor socioeconomic factors are explicitly considered.

3. Recreation overcrowding is not explicitly considered. We are not certain of the extent that A_j, and,S_{ij} do incorporate overcrowding.

4. If there are any entry fees it is assumed that a.n individual would react to an increase in them in the same manner as to an increase in travel costs.

5. It assumes no disutility on the part of the recreation
   1st by visiting again and again the same site.

6. All sites are treated as if they were final destinations. Passing visitors/recreationists
   are not properly accounted for.

The TCM involves three distinct steps, (1) a sensible estimation of Qi7 functional relationship, (2) the statistical estimation of Q.ii's parameters (usually from either household surveys or information developed-by site administrators), and (3) the estimation of the recreational benefits as the consumers' surplus with the help of the QiJ estimated recreation demand curve. The reader is referred to [15, 61] for complete description of the TCM.

2.2 Stratified Travel Cost Method (STCM)

STCM is the term we assigned to a method originally proposed by Pearce [461 and also applied in a recreation analysis context by Norton [44]. Pearce-- expressed discontent with the assumptions necessary for the demand schedule method, as proposed by Hotelling Clawson-Knetch-Cicchetti (that the TCM), whereby a physical demand function of visitors per base population and the distance travelled is used to derive the site demand schedule in monetary terms. Pearce suggested a method that entails dividing the sampled visitor population into several income groups and estimating the amount of consumers' surplus each group receives.' This approach directly addresses the income distribution questions ignored by the classical TCM, as described in formulae (8) or (9). By removing the assumption that the willingness-to-pay is constant, income differences may be considered. Pearce suggests stratification of income groups for more accurate results:

> The rigidity of the assumption about constant willingness-to-pay within income groups might be mitigated if data were available to permit further stratification of recreationists by occupation, age, and other characteristics that may be found significant in determining the strength of demand [46, p. 951.

Building on the work of Pearce (461, Norton (441 included behavioral characteristics (by examining recreationists' behavior) in his recreational benefits estimation model. Norton also criticizes the consumers' surplus based benefits estimation methods since they provide-estimates that are, to a certain extent, arbitrary because of the constancy assumption of the willingness-to-pay involved. Both studies of Pearce (461 and Norton [441 do not consider interaction among competing recreational sites, hence the studies provide no insight from a competitive site or regional point of view. To summarize, according to STCM the following discrete steps should be undertaken:

1. Stratify the population of potential recreationists

2. Estimate the willingness-to-pay for all recreationists strata

3. Sum up all the willingness-to-pay derived numbers to estimate the total benefit of a recreation site.

Note that this method assigns equal weight to recreation consumption by any income stratum, hence only partially addresses the variance in participant’s income.

2.3 The Survey (Contingency Valuation) Method

A survey may be used in conjunction with any of the above methods for estimating recreational benefits. Potential recreationists may be asked to indicate: what is the maximum amount they would be willing to pay (TCM or STCM) in order to use a particular recreational resource? In a regional analysis, questionnaires

should incorporate substitutes in the analysis. The major draw back of the survey method is the gamesmanship it introduces between the surveyor (recreation planning agency) and the potential recreationist. Bishop and Heberlein point out that:

> people who are asked hypothetically what they would be willing to pay for extramarket goods may recognize two different incentives to distort their responses. Perceiving that they. will not actually have to pay and that their responses may influence the supply of an extramarket good or bad, people may respond in ways that are more indicative of what they would like to see done than how they would behave in an actual market. On the other hand, if people believe (correctly or incorrectly) that their responses will influence actual fees they may be more concerned about keeping their fees low than revealing their true values to the investigator [61, p. 3].

Even if consumers are willing to fully cooperate their ability to assign comprehensive values may be seriously questioned. The respondent may not be able to accurately forecast his future behavior; additionally, he/she may not understand the question, or the question itself may not be properly worded for eliciting the necessary information. The foregoing are some of normal complications with the survey method without the additional complications when a-regional analysis or multiple visits are involved in the survey.

2.4 The Unit Day Value Method (UDVM)

According to the UDVM, the benefits of a recreational site are-estimated by multiplying estimated-participation with a predetermined unit day, value; or a set of unit day values, if disaggregated by activity. The unit day values correspond to a standard unit of recreation participation which is defined by the Supplement No. 1 to Senate Document 97 as: A standard unit of use

consisting of a visit by one individual to a recreation development or area for recreation purposes during a reasonable portion of a 24-hour period (15 p. 24].

Unit day values are administratively determined and they may be uniform when measuring the same recreation activity. Each federal agency has the authority to establish its own schedule of unit day values. The UDVM has not received much attention in the literature. However, the UDVM is favored by most practitioners and recreation planners, nevertheless most academicians favor the willingness-to-pay based methods[$]

A weighted-average unit day value approach has been introduced by Martin and Thackston (30]. Their study is concerned, with the Cumberland River Basin in Tennessee. If we denote by P_K; K = 1, 2, ... p, total participation at activity K during a specified time period; by X_K , the unit day value assessed for activity K; then

$$W = \frac{P_1X_1 + P_2X_2 + \ldots + P_KX_P}{X_1 + X_2 + \ldots + X_P} = \frac{\sum_{K=1}^{p} \{P_K X_K\}}{\sum_{K=1}^{p} \{X_K\}}$$

where W is the weighted average unit day value according to the Martin-Thackston model. The advantage of the weighted approach over the ordinary unit day value method, is that it may incorporate several'unit day values in a simple manner by using their weighted average. The major difficulty of the UDVM is the derivation of sensible unit day values. Market prices of privately provided recreation may be quite useful for the establishment of appropriate unit day values. Potentially UDVs could be derived from

experience in the private sector. In the state of Texas there are several private recreation enterprises providing activities such as fishing, boating, swimming and others (53, p. 15] which are similar to publically provide water based recreation enterprises. However, privately provided recreation is not limited in the range of activities as is publically provided water resource based recreation.

Professor D. M. Odgen suggests that recreation may be valued by the agencies considering the uniqueness of the resource itself. He made this point in his dissenting statement in the University of Illinois-study as follows:

> In my judgment, the unit day value system was developed to give the natural resources agencies a way to express' their professional judgment about the relative value of recreation resources. Many agencies recognized that the values of wild and scenic rivers, for example, or of natural lakes, were greater then -the values of reservoirs behind dams, regardless of the numbers of people who visit them or the distance the visitors travel. Measures which rely solely upon numbers of visitors resource fail to cope with this concern about the intrinsic worth of the resource ... [15, p. 1991.

Further, it could be assumed that all society members are equal shareholders in the public recreation resources which are available. On this basis a value per share may be derived, and recreational benefits should be based on that value. To illustrate, assume that M acres of recreation resources are equally distributed over N persons for a period T. Then each society member is entitled to M/N•T recreation resources .(this is the recreation unit). Also, further assume that society has politically established a per recreation unit value S. Thus if there are R visitors during T at a specific site then the recreational benefit B should be equal to:

$$B = [\,(M/N.T)\,S\,]\,.\,K \qquad (11)$$

In conjunction with Formula (11) market prices may be used for the estimation of S. The UDVM as expressed by Formula (11) represents an alternative benefits evaluation method because it would provide access based upon equal ownership of public recreation resources. Based on these equity considerations, UDV should be equal for all activities. UDV would be equity rather than market oriented. Furthermore, it is less costly to implement the UDVM compared to. the TCM or Survey approaches. The needed information is recreation participation at the site, that is, N, which may be relatively easily collected by the site's administrators.

2.5 Regional Recreation Models

In terms of the inclusion of the impact of substitutes there are two classes of benefits/participation estimation models, regional and site specific.

The key ingredient of a-regional model is-interaction. Generally, a regional model is a benefits/participation estimation model which-takes into account substitutional effects among specific reservoir sites. Conversely, a recreational model which does not take into account competition among individual sites is defined as site-specific Although the term regional model has been frequently used in the literature, different interpretations are attached to it. Often in the literature geographic regions are used as for example in [11, [551 and [631. According to this approach, only the reservoir sites within a specific geographic region (be it county, or state) would be considered as interacting

with each other. Thus the interaction to be considered between sites may be limited by arbitrary geographic boundaries, all other things being equal there is no reason that a resident of Delaware would not equally prefer to recreate in either Delaware or New Jersey reservoirs. To illustrate, consider the case of Figure 1. The geographic region approach would not consider interaction between sites S_{ly} and S_{21}, with respect to point of origin 01, because they are not in the same geographical region. On the other hand, and with respect to the same point of origin, the geographic approach would normatively consider interaction between sites S_{15} and S_{13} (Figure 1), despite the fact that due to distance such an interaction may not exist.

Recently in a Water Resources Council (WRC) memorandum [64] the concept of a region was defined as follows:

> The region must be determined by a combination of factors based on relevant activities (functional), types of recreation resources, geographical boundaries (spatial), geographic, distribution of prospective recreation users, etc. A helpful step is to take into account existing or future sites 'that may be significant substitutes for the proposed site(s). Thus, the concept of -the region, as defined in the NED Procedures, is-not to use pre-established areas, but to define regions iteratively during the study as planners develop parameters for a 'cross section of the proposed sites: Planners should choose a sample containing a representative number of sites so that the variables will have predictive power ... [64].

The concept is a quite general definition since it indicates that in defining a region existing or future sites that may be significant substitutes for the proposed sites should be consider ed. Moreover, the above definition does not specify the level of aggregating at which every recreational study should be conducted. The level of aggregation is independent from regional considerations.

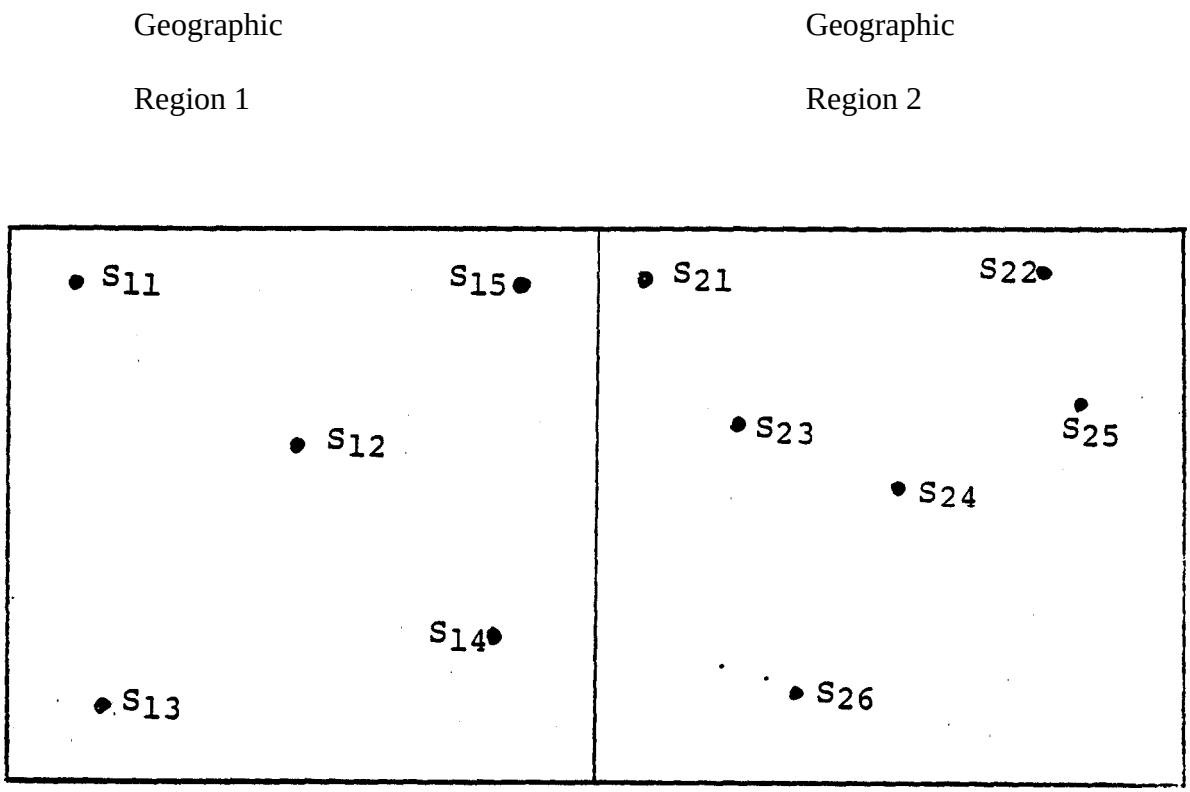

Figure 1 The limitation of the Geographic Region approach S_{ij} points indicate Recreation areas.

A study may be at high/low level of aggregation with respect to point of origin (zip code or state) and destination area (specific activities or clusters of activities).

The most rigorous method would be to consider every individual or even household as a point of origin with the specific activities at one or more recreation areas as competing with each other's destination areas. However, such an approach would be rather formidable due to the size of the resulted model. Accordingly, it is thought that some aggregation is both justifiable and necessary. As an example, approximation would be to conduct modeling on state level. In this case the net water based recreation demand (total demand minus demand satisfied out of state) plus demand from nearby state will have to be allocated to the several reservoir sites considering interaction between them. Allocation may be done using either linear programming or distance and site attractiveness functions, or even judgment. Also, substitution effects ought to be taken into account.

3.0 LITERATURE REVIEW FINDINGS

3.1 Regional models

Fifteen studies [3], [8], [10], [12], [19], [34], [35], [36], [37], [38], [39'], [40], [41] ; [52] , [56], have been identified which explicitly take into account substitutes, that is, interaction between recreational sites. Of these eight --- [34], [35], [36], [37], [38], [39], [40], and [41]--are Midwest Research Institute (MRI) studies that estimate participation using either COMPATRAX or MAVEN I.[4] Both COMPATRAX and MAVEN I are regional recreation

participation computer adaptable models. They have been developed by MRI and they are closely interrelated. In a sense, COMPATRAX, (341, (351, (361, [371, (381, [391, (401, (411, is a macro model (it can incorporate over 200 recreation origin points and over 200 recreation destinations, and minimal values are required for its operation), whereas MAVEN I [371 may be adapted for smaller size applications. Both models relate participation to demographic characteristics, site specific and alternative site attractiveness and activity analysis, and cost analysis from the view-point of the recreationist. Figure 2 shows a schematic representation of COMPATRAX and MAVEN I structure and input/output data. Basically, both models consist of six major sections: a preprocessor, a demand allocator program, an activity analysis, a visitation analysis, expenditure analysis and a market report (34, p. 1361. The MRI studies do not detail the procedure by which the input data showed in Figure 2 is combined to obtain visitation and market analysis, however, it is possible that the Travel Cost Method has been used. Essentially, COMPATRAX and MAVEN I are demand allocation models which possess the following disadvantages (assuming that everything in the black box works well):

No consideration is given to conjustion effects

There are no input data concerning participants' activity preferences

There are no input data regarding participants income distribution

There is no way to handle visitors to a site other than the final destination site.

In the Gum-Martin study [191 the Travel Cost Method is modified to take into account interaction between recreational

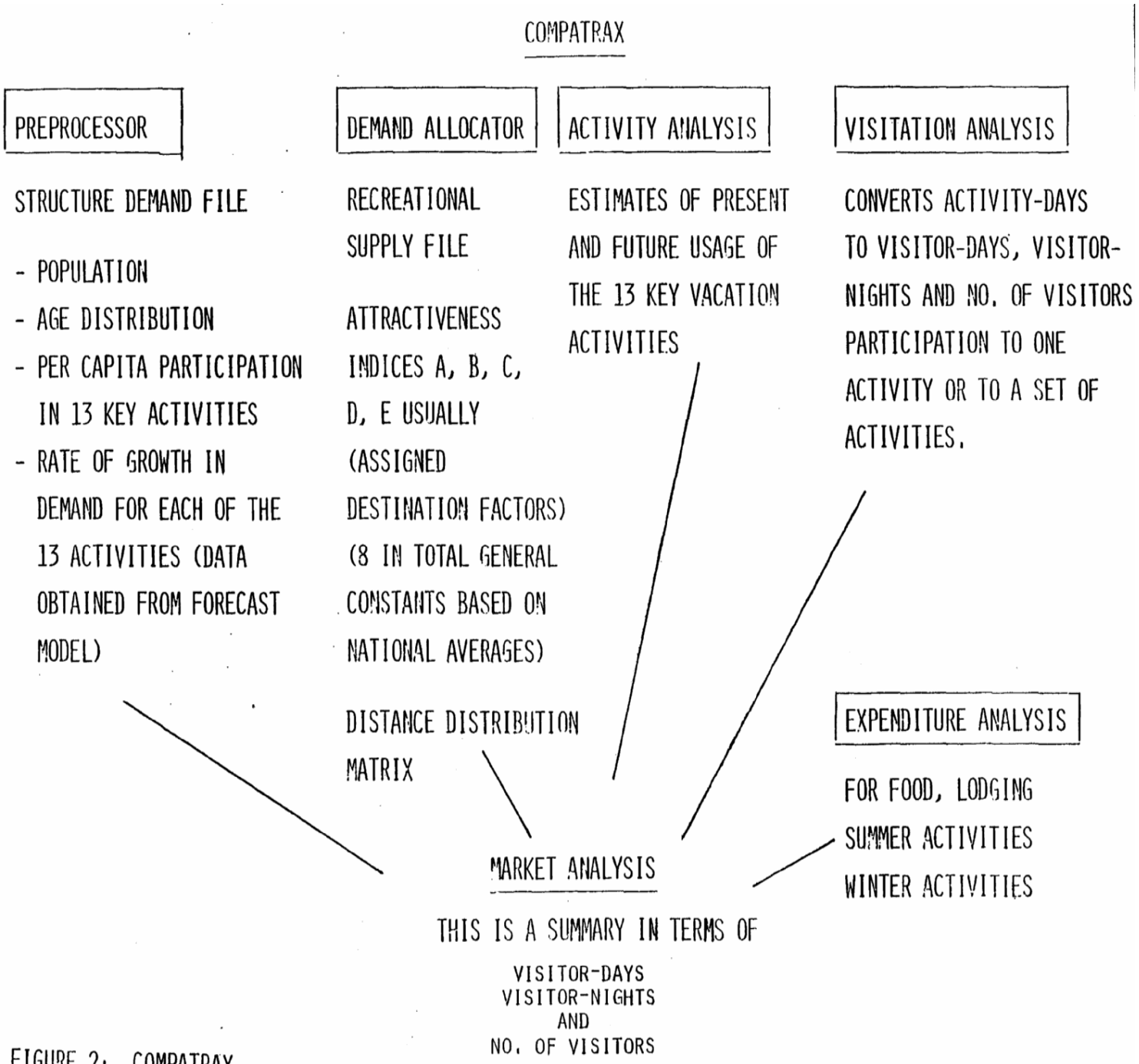

FIGURE 2: COMPATRAX

sites. This modification is accomplished by incorporating into the analysis the average variable cost of the recreation trips to a set of sites for a specific point of origin. The study (19] includes the calculation of price elasticities (partial and total) between activities at different sites. Linear regression is used for statistical analysis, but the sample size is very small(0.6% of the assumed population).

There are five regional recreation benefits estimation models, Burt and Brewer (3], Cicchetti [8], Couch (10], Daubert and Young [121, and Vickerman (56]. The Couch [101 and Vickerman [56] stud ies are highly theoretical based on individual utility functions. There is nal application in the Couch study [10], while the Vickerman study [56] contains a rather crude application using data from the National Travel Survey in Great Britain. Burt and Brewer [3], Cicchetti (8], and Daubert and Young [12] conducted econometric studies oriented to the estimation of the demand function for a recreation site via regression analysis. They are all based on,the Travel Cost Method, and the recreation benefits are set equal to the willingness to pay which in turn is equal to the consumer's surplus, (Figure 3). Referring to Figure 3, the area APD is defined as the consumers' surplus since it approximates , net benefits to consumers or the willingness of consumers to pay in excess of their actual payment OPDQ (15,p. 111. The Cicchetti study [8] deals with the econometric estimation of the demand curve of the Mineral Ring recreational project in California considering substitute sites. Benefits were estimated using the consumers' surplus, while careful consideration is given by the

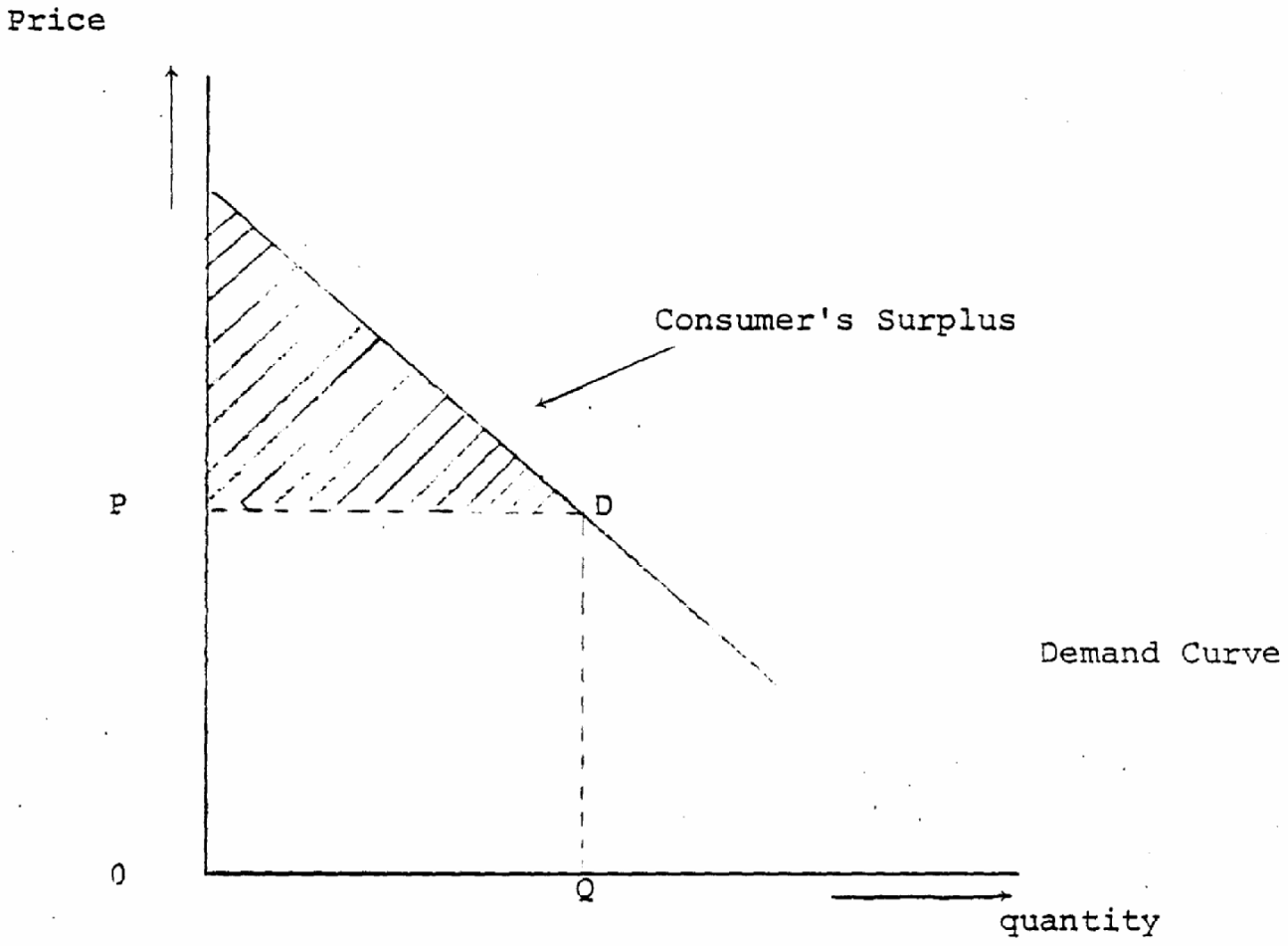

Figure 3. The Consumer's Surplus

author to the implications of travel cost changes. Because the resulting net present value of the project is a negative 9%, it is recommended that it should not be undertaken.

The Burt-Brewer study (3] is also directed towards the econometric estimation of the demand function. It specifically deals with the derivation of benefits attributed to the development of a new recreation site, taking into consideration the influence that existing recreation developments had on the demand for services from the newly developed site. An application including several water-based recreation sites in the State of Missouri are included. The travel cost is estimated at $0.055/mile, while the average consumers' surplus per capita at $2.43.

The Daubert-Young study [12] is a regression analysis intend ed to estimate willingness-to pay for in stream flow. Data were collected using the survey method and site interaction is included as an independent variable in the regression equation. It is a very rigorous analysis of total willingness to pay for access to Poudre River, Colorado.

The independent variables include: river flow, activity days, substitute days, experience, income, age, and education, as numerical variables, and site; sex, occupation, employer, population, and date of interview as zero-one dummy variables. An interesting result is that the fact that the aggregate total willingness to pay is a concave function with respect to flow, achieving its maximum value of about $7,000 for a flow of about 450 cubic foot/second. The Daubert-Young study (12) appears to be more complete and rigorous than the other benefits estimation regional recreation studies because it contains a rather

complete set of independent variables including income distribution characteristics. However, a full description of the accounting for substitutes is not given. Furthermore, a survey method was used which introduces variances of undefined and unknown degree.

The following summarized the findings from the review of regional models:

> The survey of recreational studies show the lack of generally acceptable regional models.
>
> The validity and reliability of the models are undetermined. No expost analysis of the model results has been conducted.
>
> Several models are based on inadequate input data collection methods, and small sample size, e.g., [3] and [121.

There are two studies which consider substitute activities within the same site; Cicchetti, et. al. [7], and Caswell and McConnell [4]; however, consideration of substitute activities within the same site does not quality a model as regional'.

Finally, there are two pseudo regional models, viz., Gibbs [16], and Wolka [63]. The Gibbs study is a recreation participation study that solely deals with the Kissemee River basin, a sys tem of about 20 lakes in Florida. A linear regression is used in. which water level, temperature; rainfall, and wind velocity are used as independent variables.

The Wolka., et. al. [663] study is a. prediction participation model that was developed to estimate the expected-number of recreational visits to federal reservoirs in Indiana. A computer adaptable program is devised, RESPEC. This program can calibrate reservoir recreation network parameters from

past data or forecast visits using the model with estimated future data values. A complete description of RESPEC files and simulation runs are included.

3.2 Site specific models

Except for the aforementioned fifteen recreational regional models, all others are considered either as site specific or general recreation studies. The site specific models include [1], [2], [7], [4], [11], [13], [14], [16], [29], [24], [25], [27], [28], [30], [33], [32], [42], [45], [47], [49], [50], [51], [59], [60], [61] and [63] of these [1] , [4] , [14] , [16] , [24] , [25], [32], [45], [47], [49], [50], and [63] are use or participation estimation studies while the others are-benefits estimation ones. All site specific models deal with participation or benefits estimation without considering interaction from other sites. Generally site specific models are not pertinent for regional, analysis because interaction with other sites do occur. The assumption makes site specific models frequently unrealistic.

Finally, there are several other studies which may be considered either as general studies or theoretical/conceptual models. These are [5], [6], [10] , [9] , [15] , [18], [20] , [21] ,[22], [26], [43], [44], [46], [48], [58], [61] and [62]. These studies are used herein for developing the theoretical background necessary to deal with the several site specific and regional models.

3.3 Independent variables

Consider the recreation function R, as a function of several independent variables x_l, x_2," …. x_n, that is,

$$R = f(xl, X_2,...x_n) \quad (4)$$

R may be a recreation' use or benefits estimation function. Generally, the literature reviews revealed classes of independent variables--socioeconomic variables, site quality variables, and distance factors and expenditure factors, while participation and/ or benefits are the most commonly used dependent variables. Except for the study of Dauber and Young [12] income distribution factors are not explicitly included in the set of independent variables. Several studies place different emphasis in some of the classes of independent variables. For example, the studies of O'Leary and Dottavio [25] and the Office of Water Resources and Technology [45] place major emphasis on socioeconomic variables. Site quality and attractiveness characteristics are very much emphasized by Gibbs (16], Labadie [23], Sargent [47], and Seneca [49].. Other studies take a more balanced approach toward the use of independent variables, e.g., [7], [13], and all the Midwest Research Institute studies (341, (351, (361, [37], [38], [39], [40], and [41]. Independent variables by class are shown in Tables 1, 2, and 3. Generally, income factors are not always considered, e.g., for [19] and (24]. Moreover, transforms of the independent variables listed in Tables 1, 2, and 3, such as the square of income also may be used in the regression analysis.

3:4 Statistical Analysis

Many recreation studies are, essentially, econometric studies. These studies involve two essential steps. First is the specification of the appropriate form of the recreation function, R, (Equation 4). Second is the statistical estimation of the

TABLE 1

Most Commonly Used Socioeconomic Variables

1. Ag e
2. Sex
3. Marital Status
4. Race
5. Community Size
6. Education
7. Family Background
8. Income

TABLE 2

Most Commonly Used Recreation Site Quality Variables

1. Water Surface
2. Acres per person
3. Number of encounters between visitors
4. Climatic characteristics.
5. Activities available at the site
6. Environmental quality of the site
7. Substitute activities within the site
8. Availability of lodging facilities and, general services

TABLE 3

Most Commonly Used Distance Traveled Variables

1. Average variable cost of trip
2. Average round trip mileage
3. Average variable cost of recreation except traveling
4. Average round trip time.

quantitative parameters of R using actual recreation observations. Recreation data are partially based on surveying of recreationists, i.e., socioeconomic data, relative attractiveness of site, or consumers' willingness to pay for the specific recreation experience. Surveying is not only used on conjunction with the contingency method, but also with the Travel, Cost Method.

The next paragraph examines the methodology used in the statistical analyses:

1. Sample size. The sample size in several studies is very small, e.g. [11] , [16] , [11] , [19] , [24] , and [51] , while for several others no information is given on the sample size, i.e, [8], [13], [50], and [56]. Generally, the average sample size lies between 0.5% and 1% of the estimated total population of recreationists. Small sample size may lead to poor estimation of the actual recreation function.
2. Model specification: All the studies employ linear regression for the statistical estimation of the parameters of the recreation function R (Formula 4). This is restrictive because it, assumes a priori linear relationships. Further no evidence was presented that income and/or education, or 'family size are linearly related to the amount of recreation sought by society members. Moreover, if $u_2(Rj)$ is the utility function of individual i with respect to the recreation function of site j, then, conceptually $u_i(R_j)$. is, concave:

$$\frac{\partial u}{\partial R} > 0 \quad \text{and} \quad \frac{\partial u^2}{\partial R^2} < 0; \qquad (5)$$

With respect to R_j. Also, travel cost may not be linear with respect to distance as it is usually argued, e,g., [5]. In Dufflied's study (14] it appears that the data is nonlinear however the author developed linear models for the data. See Figure 4 for an illustration of the case. The dependent variable "% of.cases" refers to recreation participation, and it appears the dependent variable is nonlinear with respect to distance (see data points).

3.5 Test of models

No expost analysis has been conducted on any model results. All studies are exante. Hence evidence is not provided on the validity and reliability of these elegant models.

3.6 Operations research models

There are several studies aimed at the application of operations research modeling techniques (mainly linear programming, and simulation), to recreation problems, namely (6], [26], (28], (32l,-[521, and (631. Simulation models may provide useful insight for the amount of recreation demanded and benefits of a specific recreational site. 'Moreover, these models-may incorporate the stochastic aspects of the study. The drawback of simulation based studies is that they do not provide analytical cause-effect results, and that the volume of output data may be formidable. A representative operations research model based recreation study is Tadros and Kalter (52].

The linear programming recreation demand allocation model developed by Tadros and Kalter considers site conjustion effects.

The model is a gravitational one, and its major components follows:

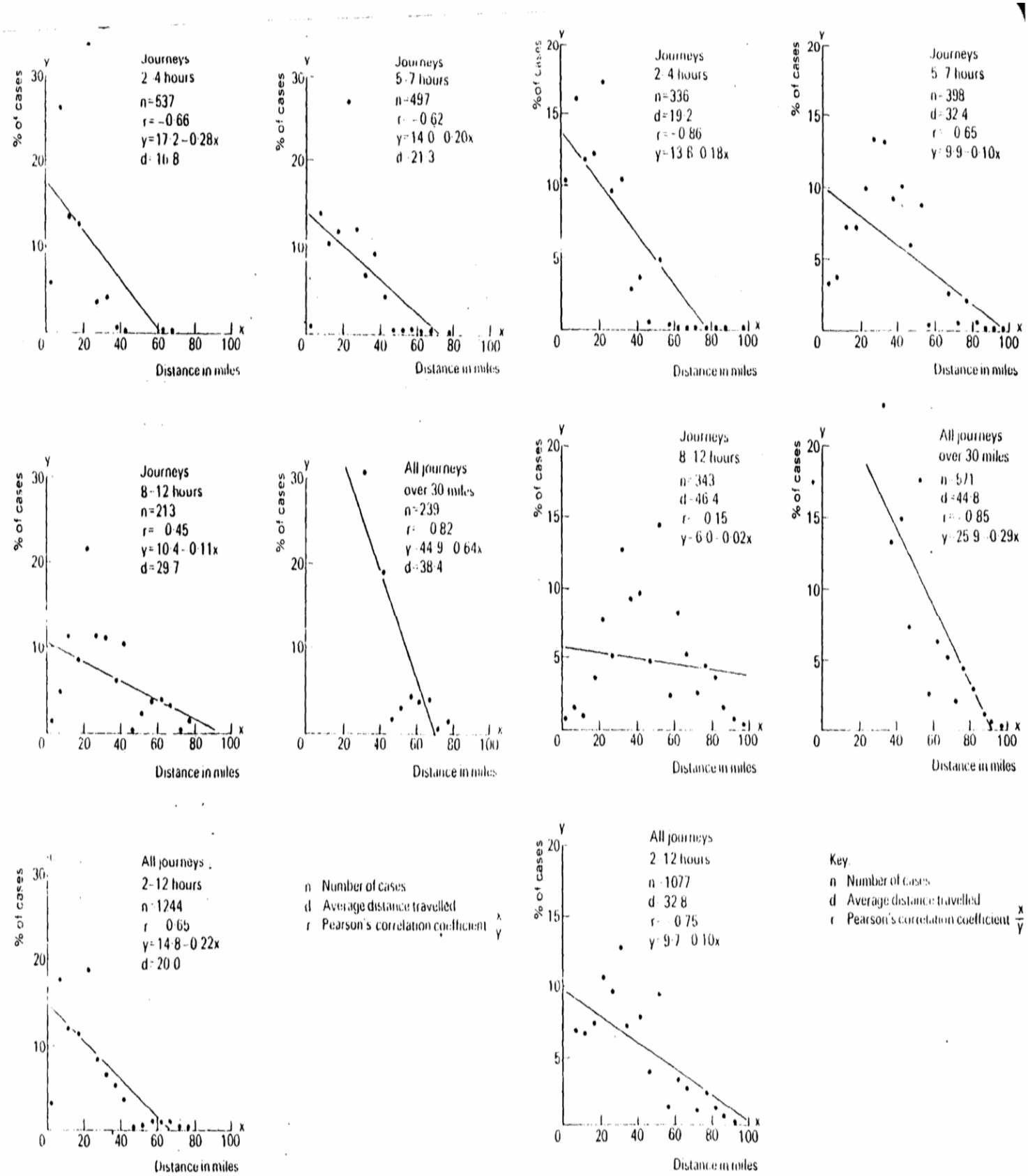

Figure 4. [18 pp. 24-5]: Innapropriateness of linear regression models.

- Decision variables: A visitor (visitor day) from the ith population zone to the jth zone to engage in the kth activity; X_{ijk}

- Objective functions: Two objective functions are separately considered. The first is to minimize total travel time, distance traveled, or cost involved by all visitors from all population zones. This objective is based on the assumption that recreation sites are of approximately the same quality. The second is to maximize the number of visitors traveling to more attractive sites.

Input data

° Recreation site capacity
° Distances
° Travelling costs and time
° Number of expected visitor days demand
° Participants' activity preferences
° Site attractiveness Indices

Constraints

° Overcrowding
° Distance
° Travel time
° Travel Cost of a visit

The Tadros-Kalter model has been applied for recreation analysis in 22 countries in central upstate New York, and according to the authors the empirical results were in accordance to model structure. A major, advantage of the linear programming formulation is that it allows the analyst to perform sensitivity and parametric analysis using the linear programming theory. On the other hand, the Tadros-Kalter model [52] does not explicitly incorporate socioeconomic characteristics, and it has the general drawbacks of, all mathematical .programming models [31], namely:

1. Lack of consideration of-all appropriate objectives. Cost minimization, or usage maximization considered in [52] may not be fully acceptable from a social point of view since they

do not take into account distributional impacts. A multi-objective[5] approach may be more pertinent in water-based recreation planning. Little multi-objective recreational planning literature exists, and so this is a potential area for future studies. A study by Lohani and Adulbhan [26] illustrates the application of goal programming[6] (a multi-objective planning tool) to a regional water.quality management problem. Two objectives are considered, namely, (a) to minimize the total cost of waste water treatment and (b) to maintain the water quality goals close to the minimum level stated in stream standards. However, this study [26] is not pertinent from a recreation benefits and/or participation point of view.

2. Static mode. All operations research models do not account for dynamic consumer (recreationist) behavior. That is, tastes may change,, and site preference may vary depending upon level of visitation.

3. Choice of decision variables. Are the decision variables of the Tadros-Kalter model acceptable? Ideal decision variables are those which may be manipulated by the decision making authority. In that respect visitation to a specific site may be only influenced by federal authorities and not directly manipulated.

4. Stochastic elements. None of the mathematical programming models' account for the probabilistic nature of the recreation participation decision. All cause-effects relationships (if they do really exist) are believed to be stochastic in nature.

5. Consideration of undesirable events. Recreation participation is'subject to general economic and social conditions. The sensitivity of participation depending on several values (and especially worst case values) should be examined. Again none of the mathematical programming models includes such consideration.

In the aforementioned Water Resources Council memorandum[64], the following are cited regarding recreation model application and capability:

> The model should be able to be applied to sites rather than to market areas because water resource planning is designed to produce changes at specific locations rather than to abstract area-wide markets of recreation goods and services. The estimates of value to be obtained from the model should be consistent with and of a level of precision similar to the estimates of value derived for other goods and services produced by a plan.
>
> The procedures should be readily applicable to evaluating proposed changes on the availability of the specific recreation opportunities affected by the plans. For example, can the model estimate the benefit of an additional opportunity of a recreation activity at a particular location? Have questions concerning the relevant resources and sites been included in the household or similar surveys?
>
> When meaningful to the resource situation being evaluated, the consideration of substitution should account for choices among (a) recreational and non-recreational activities, (b) alternative recreational activities, and (c) alternative sites for identical activities.
>
> By following these guidelines, the regional recreation models-developed by planners and researchers should be realistic in terms of their applicability to the water based recreation setting being evaluated ... [641

The key elements of the above applications procedure are:

1. The emphasis to sites rather than to market areas.

2. The call for applicability when availability of specific recreation opportunities changes.

3. The consideration of substitutional effects between (a) recreational and non-sites for identical activities, (b) alternative recreational activities, and (c) alternative sites for identical activities.

Based on this review of several recreation modeling studies, it is doubtful that the present population of studies will meet the 6fRC's criteria. Several models do consider one or two of the elements, however no model considers all of them. It is believed that for the implementation of the WRC guidelines a new generation of recreation studies will have to evolve.

The following is a comparative analysis of the efficiency of the several recreation benefits evaluation methods from a regional analysis point of view. This is a rather indicative and subjective evaluation. Three evaluation criteria are used, namely, cost of method, information requirements, and accuracy o£ results.

(a) The Travel Cost Method.

Cost: Very high in cost. Traveling costs must be estimated. Recreation demand curves for each site with respect to each point of origin must be estimated. Capacity constraints must be taken into account. Identification of nonlinear cost relationships.

Information Required:Where did every recreationist originate? Do we have a multiple visits case, or a single visit case. Income of recreatibnist, motive for visit, general socioeconomic characteristics.

Results:If all factors are properly considered, then a rather good approximation of recreational benefits. This assumes that all relevant socioeconomic factors are considered. However, according'to˜our experience not all socioeconomic factors are always considered, and in such a case the willingness to pay will be a biased estimation of recreational benefits despite the high cost of the method.

(b) The Stratified Travel Cost Method

Cost: This method is more expensive from the ordinary TCM since the population of potential recreationists must be stratified according to income categories.

Information Required: Basically, same as with TCM, now accurate income data for the potential recreationists are essential.

Results: Inclusion of income characteristics provides if properly done, a guarantee for a more accurate estimation of benefits.

General Note for Both TCM and STCM:

In the context of a regional analysis some surveying will be necessary in order to get consumers' preferences. However, surveying itself may be very, much complicated due to the presence of multiple sites. We have to question the ability of-both planners to word the questions, and of recreationists to answer them. The perception of several recreation planners with whom we have discussed the subject is that it is almost impossible to effectively use any travel cost based method on a regional context.

(c) The Survey Method

Cost: Very expensive. Almost prohibitive by present budget allowances.

Information Required: Even for its high cost it is 'very difficult to ascertain that the obtained information is correct. Refer to our comments on page 65.

Results: Quite questionable because of the limitations of the method.

(d) Unit Day Value Approach

Cost: Very low because the number of recreation participants at a given site may be very easily determined from administrative records.

Information Required: Number of recreationists during a time period.

Results: When an approach based on the one suggested by Formula (11) benefits are quite accurate.

The following table subjectively summarizes our evaluation of the benefits evaluation methods:

TABLE 5: Evaluation Summary

Criteria METHOD	COST	DATA REQUIREMENTS	ACCURACY OF RESULTS
TCM	Very High	Very High	Good
STCM	Very High	Very High	Excellent
SURVEY	High	High	Questionable
UDVM	Moderate	Moderate	Good

FOOTNOTES

1. A model is, essentially, a depiction of cause-effects relation ships. A model is a representation of some object of inquiry based on abstracting from reality only those aspects pertinent to the inquiry, for the purpose of description, manipulation, and/or prediction.,

2. It is worth pointing out that the term "recreation site" as used in this paper refers to an "ordinary" type of site. In this reasoning a recreation site of the type of Grand Canyon or the Lake Mead would not be considered as "ordinary", and it is, therefore, excluded from our analysis. Our perception is that participation to "non-ordinary" recreation site is the result of more complex and probably impossible to model, decision-making process.

3. To ascertain effective reviewing of this large number of studies a framework has been developed. The objectives of this framework were fourfold: (a) to make apparent similarities and differences among studies, (c) to make apparent points for which addtional information is required, and (d) to permit examination and/or reexamination of work to insure consistency. The framework is divided in discrete steps. These are:

a. Model Identification
   -- site specific vs. regional
   -- benefits estimation or participation analysis
   -- recreation activities considered
   -- year of analysis
b. Model methodology
   -- evaluation method used
   -- assumptions-rationale for -- independent variables
   -- dependent variables
   -- statistical analysis used
   -- data collection process

c. Model evaluating
-- results of the model
-- comparison to results of other similar models
-- test of model structure (export analysis)
-- appropriateness of model in a regional context

4. Although both COMPATRAX and MAVEN I are primarily designed for forecasting recreation participation, they may be used for recreational benefits estimation also. Considering the expenditures file of the basic file of either model a value for the total cost of recreation may be derived if the cost of traveling is added to it. Now this information combined with a demand curve (if the travel cost method is used) may serve as basis for the estimation of the marginal willingness to pay, that is, the consumers' surplus If the latter is multiplied by the number of visitors during a time period, it may provide a basis to estimate recreational benefits. Potentially, the consumers' surplus derived by this may serve as a basis for unit-day value estimation.

5. In a mathematical programming; context a multiobjective problem is formulated as follows:

Max $(z_1, z_2, z_3, \ldots z_p]$
s.t. $\underline{x}$ E X

when zi, i = l, 2, ... p is the ith objective function, X the feasible space, and x the vector of decision variables.

6. Goal programming is a tool for dealing with multiobjective problems. It is a penalty approach. Minima attainment levels are defined for each objective z_i (see Footnote 5) and a penalty' function is devised, where a penalty is assigned for undesirable deviations of the zi from the aspriration level value. Refer to

Hillier and Lieberman, Introduction to Operations Research, 3rd edition. San Francisco: Holden-Day 1980.

7. Basically this is the message of the Dwyer, et al. study (15).

8. This view has been expressed by William Honore in a private discussion.

REFERENCES

1. Abbott Associates, Inc., New York-New England Recreation Demand Study, The Commonwealth of Massachusetts, Publication #11720-66136-1-80-CR.

2. Anderson, R. W., "Estimating the recreation benefit from large inland reservoirs," in Searle G.A.C. (ed.), Recreational Economics and Analysis, New York, Longman, 1975.

3. Burt, O.D., and D. Brewer, "Evaluation of Net Social benefits from Outdoor Recreation," Econometrica, 39 (September, 1971): 813-827.

Estimation of net social benefits from outdoor recreation. TCM,* Statistical estimation of demand. Data obtained by surveying. Regional considerations. Application Water Study included. Highly mathematical. The travel cost is estimated at $.055/mi., while the average consumer surplus per capita at $2.43. Substitutes are considered.

4,. Caswell, M. F., McConnel, K. E., "Simultaneous Estimation of jointly dependent Recreation Participation function," Journal of Environmental Economics and Management, 7 (65-76), 1980.

5. Cesario F. J., "Value of Time in Recreation Benefits Studies," Land Economics, (February 1976): 32-41

It is a survey article discussing the issue of time value in recreation benefit estimation using TCM. No application is included, nor any substitutes are taken into account.

6._____"Operations Research in Outdoor Recreation," Journal o Leisure Research, 1 (Winter 1969): 33-51.

A highly theoretical study without any application, dealing with the various ways operations research techniques may be used in recreation economics studies.

7. Cicchetti, et al., "Recreation Benefit Estimation and Forecasting: Implications of the Identification Problem," Water Resources Research, 8 No. 4: 840-50.

In this article the general indentification problem (estimation of demand, curve) is addressed, and examined from the viewpoint of recreation planning. It is a participation estimation study which does not take into account substitutes, but it considers substitute activities within the same site.

* Travel Cost Method (TCM)

8._____, "An Econometric Evaluation of the Generalized Consumer Suplus Measure: The Mineral King Controversy," Econometrica, 44, (November 1975): 1259-1275.

It is an econometric study for.measuring the recreation benefits. TCM is used but it is modified so to accomodate substitutes. The formal TCM as it was introduced by Knetch, Hottelling and Clawson does not take into account substitutes. The demand curve is econometrically estimated using data from the United States Forest Service. The entire study is closely related to the Mineral King project in California. Benefits are estimated using the consumers' surplus while careful consideration is given by the authors to the implications of multiple price changes. It is concluded that the net present value of the project (at 9%) is negative, and so the Mineral King ski site should be abandoned.

9. Clawson, M., and J. L. Knetch, Economics of Outdoor Recreation, Baltimore, the Johns Hopkins Press, 1971.

A General benefit and'participation estimation book. It is the source for the TCM.

1O. Couch, J. D.,"Recreation with neoclassical economics," in G.A.C. Searle (ed.) , Recreational Economics and Analysis, New York, Longman, 1975.

11. Daubert, J. T., et al., Economic Benefits from In-Stream Flow in a Colorado Mountain Stream, Colorado State University, V Completion Report No. 91, Fort Collins, Colorado, 1979.

This University of Colorado study is concerned with the estimation of the marginal value *of* instream flows for each month of the recreation season in Colorado from a recreation perspective. It is based on the willingness to pay approach and it does not take into account substitutability. Surveying was conducted for obtaining information from recreationists, and then linear regression analysis was used to estimate marginal values.

12._____, and R. A. Young, Recreational Demands for Maintaining Instream Flows: A Contingent Valuation Approach,-Working Paper 80-1, Department of Economics, Colorado State University, Fort Collins, 1980.

13. Darling, A. H., "Measuring the ***Benefits*** by Urban Water Parks," Land Economics, 49, (February 1973): 327-338,

This paper reports the results of an attempt to measure the benefits of three urban water parks in California. It is recognized that TCM may not be applied when it comes to urban recreation areas. The author uses a mix of two methods, namely the property value model, and an interview technique. The two variables that mostly explain the property value that can be attributed to an urban park presence are: (1) the distance of property from the park and (2) the qualities and facilities at the park. The interviews were used as a complement

against the limitations of the property value method. As recognized by the author himself, the major weakness of the study is the small sample size that was available.

14. Dufflied, B. S., "The Nature of Recreational Travel Space," in G.A.C. Searle (ed.), Recreational Economics and Analysis, New York, Longman, 1975.

15. Dwyer, J. F., et al., Improved Procedures for Valuation of the Contribution of Recreation to National Economic Development, Research Report No.128, University of Illinois at Urbana-Champaign, Water Resources Center, (1977).

This is a recreation survey study, examining the contribution of recreation to National Economic Development. It concludes that willingness to pay method based on travel should be used in estimating recreation benefits. Good review reference.

16. Gibbs, K. C., "A Measure of Outdoor Recreational Usage," Food and Resource Economics Department, University of Florida, (August, 1973)$_f$ Gainesville, Florida.

This is a pseudo-regional participation analysis study. It is not exactly regional since it solely deals with the Kissemee River basin, a system of about 20 lakes in Florida. A linear Regression is used with independent variables like Water level, temperature, rainfall, and wind velocity.

17. Gibson, L. J., and R. W. Reeves, "The Spatial Behavior of Camping America: Observations from the Arizona Strip," Rocky Mountain, Social Science Journal, 9, No.2, (1912)¯19-30.

The purpose of-this study is to describe the characteristics of campers patronizing campgrounds on the Arizona Strip (this is a relatively isolated region of Arizona north and Colorado River). This is not a benefit estimation nor a participation study. The-study is irrelevant in a recreation economics analysis.

18. Gibson, J. C., "Problems of measuring recreation benefits with dual pricing systems," in G.A.C. Searle (ed.), Recreational Economics and Analysis, New York, Longman, 1975.

19. Gum, R. L., and W. E. Martin, "Problems and Solutions in Estimating the Demand for, and Value of Rural Outdoor Recreation," American Journal of Agricultural Economics, 57, No.6, (1975) 558-66.

This is a participation estimation study: The TCM is used, but modified to take into account substitute recreation sites. It includes the calculation of price elasticities (partial and total) between activities at different sites. Linear regression is used for statistical analysis, but the sample size is very small (.6%).

20. Institute of Water Resources, (Tolley S. George) Estimation of First Round and Selected Subsequent Income Effects of Water Resources Investment, Alexandria, Virginia, February 1977.

This is a general study of water resource economics. As far as recreation is concerned, there is an attempt to derive demand functions. Furthermore, the authors favor TCM and included there is a heavy criticism against the Unit Day value approach. Refer to pp. 10-27 of the study.

21. Kalter, Robert, J., The Economics of Water-Based Outdoor Recreation: A Survey and Critique o Recent Developments, IWR Report 71-8 Alexandria, Virginia, March 1971.

A general survey study related to the methods for estimating recreational benefits. It is not as complete as [9], and it favors the willingness to pay based methods for benefits determination.

22. Kolter, R. J., and L. E. Gosse, "Recreation Demand Functions and the Identification Problem," Journal of Leisure Research, vol. 2 No.l, (1970), 43-53.

This study deals with the general identification problem (same as [4)) as applicable to recreation economics, that is the estimation of the recreation demand function. After discussing the factors which prohibit an effective estimation of demand functions, the author suggests that a possible solution would be the use of individual cross-sectional data instead of site specific ones. This is a very theoretical study, and contains no application.

23. Labadie, J. W., et al., "Recreational Enhancement of High, Country Water Supply Reservoirs," Water Resources Bulletin, 16, No. 3, (1980).

Considering the many beautifully situated and man-made high-country reservoirs, this article deals with the following issues (which are also the study objectives)

(a) Design a systematic procedure for identifying the factors essential to the selection, planning and management of reservoirs for recreation, and

(b) Demonstrate the physical, biological and legal feasibility and potential for enhancing water recreation opportunities on high country reservoirs.

It is therefore of no value as far as benefits of water based recreation are concerned.

24. Leary, J. T., and G. Pate, An Examination of Frequency of Participation in Water Based Activities by Recreation Consumers in Indiana, Technical Report #114, Purdue University Water Resources Research Center, West Lafayette, Indiana 47907, August 1978.

25. _____, and F. D. Dottavio, Socioeconomic Relationships or Water-Based Recreation Involvement in Indiana, Technical Report *125, Purdue University Water Resources Research Center, West Lafayette, Indiana 47907, September 1979.

26. Lohani, B. N., and P. Adulbhan," A Multiobjective Model for Water Quality Management," Water Resources Bulletin, 15, No. 4, (August 1979): 1028-38.

This paper illustrates the application of goal programming to a regional water quality management problem where the following two goals are considered: (1) minimize the total cost of waste treatment, and (2) maintain the water quality goals close to the minimum level stated in stream standards.' Of no value as far as benefits of water based-recreation are concerned

27. Long Roger, "Primary and Secondary Impacts of a Water Resource Development Project," Water Resources Bulletin, 16, No. 6, (December 1980): 1002-5.

This paper examines the water resource development benefits, specifically with respect to the Boise Irrigation-Project of southwestern Idaho. However, it does not deal at all with its recreational potential, and so it is almost valueless for our purpose.

28. Lucas, R., and M. Shechter, "'A Recreational Visitor Travel Simulation model as an Aid to Management Planning," Simulation and Games, 8, No. 3, 375-88, (1977).

The obj'ective of this study is to devise a wilderness travel simulation model to provide a better way to formulate and evaluate management policies. The devised model is in GPSS version V.

29. Mansfield, N. W., "Recreational Trip Generating" Journal of Transport Economics and Policy, 3 (1969) 152-164.

This is an application of the TCM, for the Lake District National Park in England for the 1966. Included there is an estimation of the consumers' surplus., The study does not include substitutes and it is very theoretical and almost valueless from an operational point of view.

30. Martin, J., and E. Thackston, "A Retrospective Benefit-Cost Analysis of Water Resource Projects in the Cumberland River Basis.,". Water Resources Bulletin, 16; No. 6, (1980): 1006-11.

This is a retrospective benefit-cost analysis of major water resources projects in the Cumberland River basin, Tennessee. In this context recreation benefits are considered too, and a unit day value approach is used. The authors suggest the use of a weighted average of benefits in calculating the value assessed for a user day. Weighted average user-day values calculated using this approach range from $.70 to $1.72. No substitutes whatsoever are. considered.

31. McCormick, G.P., Classroom notes OR-232, Department of Operations Research, The George Washington University, Washington D.C., 20052, Fall 1980.

31. McCool, S.F., et al. , Simulation Modeling as a Tool for Managing River Recreation, Forest Service, USDA.

It is a description of a simulation model (which is a modification of Wilderness Area Simulation Model developed by RFF).* The purpose of the model is to assist recreation managers in devising daily visitation quotas to rivers. No substitutes are considered, nor any recreation benefits are calculated.

33. Mishan, E.J., "Welfare Validity of the Demand for Recreation", in G.A.C. Searle (ed.) Recreational Economics and Analysis, New York, Longman, 1975.

34. Midwest Research Institute, A Leisure Development Program and Strategy for the Western Kentucky Lakes Region, Kansas City, June 1976, project No. 4028-D

The Western Kentucky Region study presents an analysis and recommends a program and strategy for the Kentucky Western Waterland, Inc., to enhance the tourism industry in the aforementioned area. It is a regional model to the extent that it takes into account competition from surrounding reservoir based recreation sites (Lake of the Oarks region, Lakes Country region, Rend Lake and others). The overall objective of the study is ti critically analyze the character of the Western Kentucky Lakes tourism industry and evaluate ways to expand the industry to its fullest market potential. To determine demand for recreation the COMPATRAX model of MRI is used.

35. _____, Benefit-Cost Analysis for the Ten Mile Lake Project No. 4226-D, Kansas City, 1977.

The primary purpose of the Ten Mile Lake at Southern Illinois is to provide an outside assessment and updated benefit cost analysis of the proposed Ten Mile Lake project. Specifically, this study includes a reexamination of engineering plans and costs, analysis of future water needs in the area, evaluation of recreation potential, and a detailed analysis of possible sources of project funding. The COMPATRAX model of MRI (Midwest Research Institute) is used to determined visitation participation. The Ten Mile Lake study is a regional one to the extent that it does take into account competition.

36. _____, Market Analysis and Potential Long Range Development Option for Oakland-Ozark Isle Park, Bull Shoal Lakes, Arkansas, project No. 4208-D, Kansas City, November 1976.

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* RFF: Resources for the Future, Inc. Washington, DC

37. _____, Recreation User Documentation for the MAVEN I Participation allocation Model, project No. 4473-D, Santa Ana, California, March 1979.

This is a description of MAVEN recreation participation model. MAVEN is a regional model, since it takes into account competition, and it is a micro-application of COMPATRAX, since the latter requires minimal values for its operation. Both models, (COMPTRAX, and MAVEN) estimate visitation at a particular site by manipulating five input files,. a structure demand file, a recreational supply file, an activity analysis file, a visitation analysis file, and finally an expenditure analysis file.

38._____, Recreation Participation and Expenditure Analysis or the proposed Middle Fork Reservoir Project, MRI Project No. 4110-D, Kansas City, October 197,5.

39._____, Identifying the Potential for Developing a Natural Resource Park at Castle Rock in the State of Kansas, MRI Project No. 4243-D, Kansas City, October 1977.

40._____, Present and Potential Markets for Attractions that will stimulate tourism expenditures in the City of Hot Springs and Garland County, Arkansas, MRI Project No. 4177-D, Kansas City, April 1976.

41._____, and K. L. Meyer, Coralville Lake, Iowa River, Iowa, Resource Master Plan, vol. I, Design Memorandum, No. 15C, Revision No. 2, Rock Island, Illinois, April 1976.

42. Moncur, J. E., "Estimating the Value of Alternative Outdoor Recreation Facilities Within A Small Area," Journal of Leisure Research'. (Autumn 1975): 301-311.

43. Mumy, G. E., and S. H. Hanke, "Public Investment Criteria for Underpriced Public Products," American Economic Review, 65, (September 1975): 712-720.

This article deals with the underpricing (this is when prices are less from the marginal cost) of public products. It is suggested that project evaluation and pricing procedures should not be separated. The authors favor willingness to pay based methods to deal with underpricing. It is a highly theoretical treatment of the subject, with no special reference to recreation.

44. Norton, G. A., "Public Outdoor Recreation and Resource Allocation: A Welfare Approach," Land Economics 46, (November 1970) : 1317-1320.

The objective of this British study is to analyze on a conceptual basis the recreation benefits. The author criticizes the Consumers' surplus benefits estimation methods that they provide estimates that are, to a certain extent, arbitrary. It is suggested that a more direct approach to the evaluation of public recreation be adopted,

based on the behavior of the individual visitors and their revealed willingness to pay the necessary facilitative costs of a recreation visit. No substitutes are considered, and the author suggests that further research would be needed to support his proposed methodology. The study is connected to Pearce [30].

45. Office of water Research and Technology, Planning for Coastal Recreation Opportunities Near Large Urban Areas, Washington, D.C., July 1975.

This is a background recreation study with special application to water-based recreation, and it Pargely deals with the coasta.1,7ecreation planning process. This OWRT sponsored study, is neither use estimation nor a benefits evaluation one. Rather, the study is directed to the conceptual issues underlying water based or general recreation, namely behavioral characteristics of recreationists, information required, and construction of a recreation supply curve (for this purpose a computer adaptable program is devised, RECTRIP).

46. Pearce, P. H., "A New Approach to the Evaluation of Non-Priced Recreational Resources," Land Economics, 44, (February 1968): 87-89.

The author expresses discontent with the assumptions necessary for the demand schedule method, as proposed by Clawson (this is the TCM), whereby a physical demand function of visitors per base population and the distance travelled is used to derive the site demand schedule in monetary terms [6]. Pearce, suggests that a method which entails dividing the sampled visitor population into several income groups and estimates the amount of consumers' surplus they receive by finding the difference between each visitor's travel cost to the area, and the highest travel cost incurred within that income group, the latter being regarded as the marginal visitor. No application study is included nor any substitutes considered. Closely related to [28].

47. Sargent, F. 0. and P. R. Berke, "Planning, Undeveloped Lakeshore: A Case Study on Lake Champlain, Vermont," Water Resources Bulletin, 15 No. 3, (June 1979): 826-37.

The purpose of this paper is to present an analytical procedure by which underdeveloped lakeshore areas can be classified according to their suitability for private or public use. The fact is that private lakeshore development usually precedes establishment of public lake access. As a result, the best access areas are often occupied before public access is provided. So the public has a problem to provide access for nonriparian citizens.. Physical characteristics of the lake are mainly explored. No benefits nor substitutes are discussed.

48. Sellers, Jackie, and R. North, "A Viable Methodology to implement the Principles and Standards," Water Resources Bulletin, 15, No. 1, (February 1979): 167-81.

This article discusses the water resources allocation decision making process in a multiobjective programming context. Special

attention is given to goal programming. An application study is included (Cross Florida barge Canal). No specific mention to recreation economics and/or planning. Rather, it is a theoretical treatment of the multiattribute considerations in water resource allocatic-) decisions.

49. Seneca, J., "Water Recreation Demand and Supply," Water Resources Research, 5, (December 1969): 1179-1185.

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 Tennesse 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.

50. _____, Davidson, P., and Adams, F. G., "An Analysis of Recreation Use of the TUA Lakes," Land Economics, 44 (November 1968): 529-534.

51. Smith, R. J., "The Evaluation of Recreation Benefits: The Clawson Method in Practice," Urban Studies, 8, (June 1971) : 89-102.

Using the TCM, the author tries to estimate a recreation demand curve for the Grafham water site, in England. No substitutes are considered. To statistically estimate the parameters of the demand function linear regression is used. The consumers' surplus is estimated at 87,000 and gross benefits at 827,000. Like [4] and [15], it too deals with the general identification problem.

52. Tadros, M. E., and R. J. Kalter, "A Spatial Allocation Model for ' Projected Outdoor Recreation Demand: A Case Study of the Central Upstate New York Region," Agricultural Economics, _1 , (1-23), January 1971.

53. Texas outdoor Recreation Plan, Techniques of Analysis, Vol. X,. Texas Parks and Wildlife Department, Austin, Texas, December 1975.

54. U. S. Water Resources Council, 1973. Principles and Standards for Planning Water and Related Land Resources. 38(245) Federal Register 24778, Part III, 167 pp. The recreation section was revised on April 14, 1980 with 45(73) Federal Register 25302, Part 11,,49 pp. These proposed rules simplified the wording of the P&S in the recreation section (25314).

55. U. S. Water Resources Council, 1979. Procedures for Evaluation of National Economic Development Benefits and Costs in Water Resources Planning (Level C); Final Rule, 44(242) Federal Register 72892, Part IX,.83 pp.

56. Vickerman, R. W., "The Evaluation of Benefits From Recreational Projects," Urban Studies, II, No. 3, pp. 277-88 (1975).

This is a British benefits evaluation of recreation projects study. The author. criticizes the Clawson (TCM) method, for not taking into account substitutes. He then proposes a revised TCM that does take substitutes into consideration. Elasticity of substitution between sites is introduced. It is *a very theoretical study, including no application. This is the only one for the derivation of benefits.

57. _____, A Statewide Recreation Information System, Texas Parks and Wildlife Department, Austin, Texas, December 1975.

58. Washington State Comprehensive Outdoor Recreation Plan, Forecasting Recreation Participation: A Theoretical Model, Technical Report No. 2, College of Forest Resources, University of Washington, Washington, 1975.

The objective of this study is to construct a conceptual mathematical model to forecast or project recreation participation rates or consumption for a selected number of recreation activities. No application is included, and it seems -that-only-substitute activities within the same site are considered.

59. Walsh, R. G., et al. Economic value of Benefits from Recreation at High Mountain Resevoirs, Colorado State University, Technical Report No. 4, Fort Collins, Colorado, 1978.

The purpose of this University of Colorado study, is to examine the potential economic value of recreational use of water storage reservoirs located at high elevations of the front range of the Colorado Rocky Mountains. An average unit day value of $15.00 is used. No substitutes are considered. The issue of optimum capacity of reservoir recreation is discussed.

60. Walsh, R. G., et-al. "An Empirical Application of a model for estimating the recreation value of Instream Flow," Completion Report No. 101, Fort Collins Colorado, Colorado State University, October 1980.

This report analyses the public benefits from cold water river fishing, kayaking, and rafting on the West Slope of the Rocky Mountains, Colorado. Survey method was chiefly used. No substitutes are considered and benefits are derived using willingness to pay based method.

61. Ward, F. A., A Review of Problems and Solutions in the Use of the Travel Cost Method or Valuing Recreational Resources, Departmental Staff Report No. 14, Department of Agricultural Economics Las Couses, N. M: New Mexico State University.

This report presents (1) a review of some of the literature involved in the development of the TCM, and (2) two suggested techniques whereby users of the TCM may achieve an improved measure of benefits attributable to the provision of recreational resources. No substitutes are considered, and it includes no specific application.

62. Waters, R. C., "Theory and Reality in Allocating Federal Resources to Water Resources Development," Water Resources Bulletin, 16, (256-60), 1980.

63. Wolka, R. R., et al., Estimating Reservoir Recreational Visits in Indiana, Office of Water Resources Research, June 1979, Washington, D. C.

A prediction model was developed to estimate the expected number of recreational visits to Federal reservoirs in Indiana. So it is essentially a participation estimation model, which does take into account substitutes. A computer adaptable program is devised, RESPEC. This program can calibrate reservoir recreation network parameters from past data or forecast vists using the model with estimated future data values. A complete description of RESPEC files, and simulation runs are included.

64. Water Resources Council, Guidelines for Regional Recreation Models, Memorandum to Recreation Task Force Members, Washington, DC, July 29, 1981.