ESTIMATING THE VALUE AND INCIDENCE OF RECREATION BENEFITS FROM A BEACH EROSION CONTROL PROJECT

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I. INTRODUCTION

A beach erosion control project can provide a variety of benefits. Those which Corps policy recognizes include benefits from "...land loss and other physical damages prevented, emergency and business costs avoided, enhancement of property values, increased recreational usage, and prevention of loss of historic or scenic aspects of the environment. Benefits are measured as the differences in these values under conditions expected with and without the contemplated control measures."[1]

Typically, the value of benefits attributable to the recreational use of beaches accounts for the largest share of total beach erosion control benefits. Without a substantial amount of current and expected recreational use, few erosion control projects are justified under current criteria.

This paper concerns some different ways of estimating the value and incidence of beach recreation benefits and the results of an experiment in the application of the zone-cost demand technique. Here, incidence means the portion of the value of benefits accruing to regions, economic sectors (consumers, business and government) and to income classes of individuals within these sectors (or to other relevant group classes). Estimating total benefit value and benefit incidence are related but distinct measurement problems.

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[1]Department of the Army, Office of the Chief of Engineers, Digest of Water Resources Policies and Activities, EP 1165-2-1, Dec 1972, p. A-108.

II. CONCEPTUAL-SHORELINE RECREATION BENEFITS

1. Current Practice

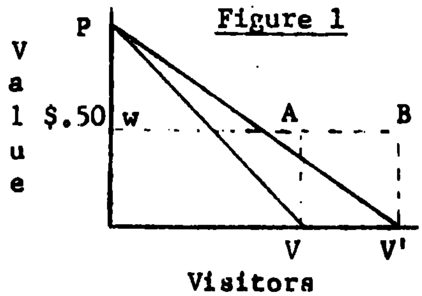
Recreation benefits from beach erosion control projects are estimated by determining expected beach use based on "...the population of areas considered tributary to the beach and the prospective changes in population within the project life."[1] An average monetary value ranging from $.25 to $.75 per visit is used for the benefit value and a minimum of 75 square feet per user is the established planning standard. The value selected for the benefit calculation is determined based on the degree of development of the beach area. Undeveloped areas are assigned a $.25 per visitor day value and highly developed areas with commercial facilities are given a $.75 per visitor day value.

This evaluation method has several shortcomings. A major one is that it is not clear what the arbitrary value per visitor day is supposed to represent. Following are some possible interpretations of the meaning of the fixed value from the standpoint of the economic theory of demand. Generally, the benefits of "free" goods supplied by the government are considered to be the value of users' estimated "willingness to pay." Willingness to pay is often considered to be the area under a demand curve (i.e., consumers' surplus).[2] If we assume that the fixed value ($.25 to $.75) is related to willingness to pay then there are some implied pre-determined and empirically unsupported demand functions involved. Consider the following analysis related to Figure 1.

[1] Ibid., pp. A-121-122.

[2] The conceptual difficulties involved with estimating consumers' surplus or utility via demand curves are ignored in this discussion. It is generally agreed that the measure, though imperfect, is a suitable approximation of value.

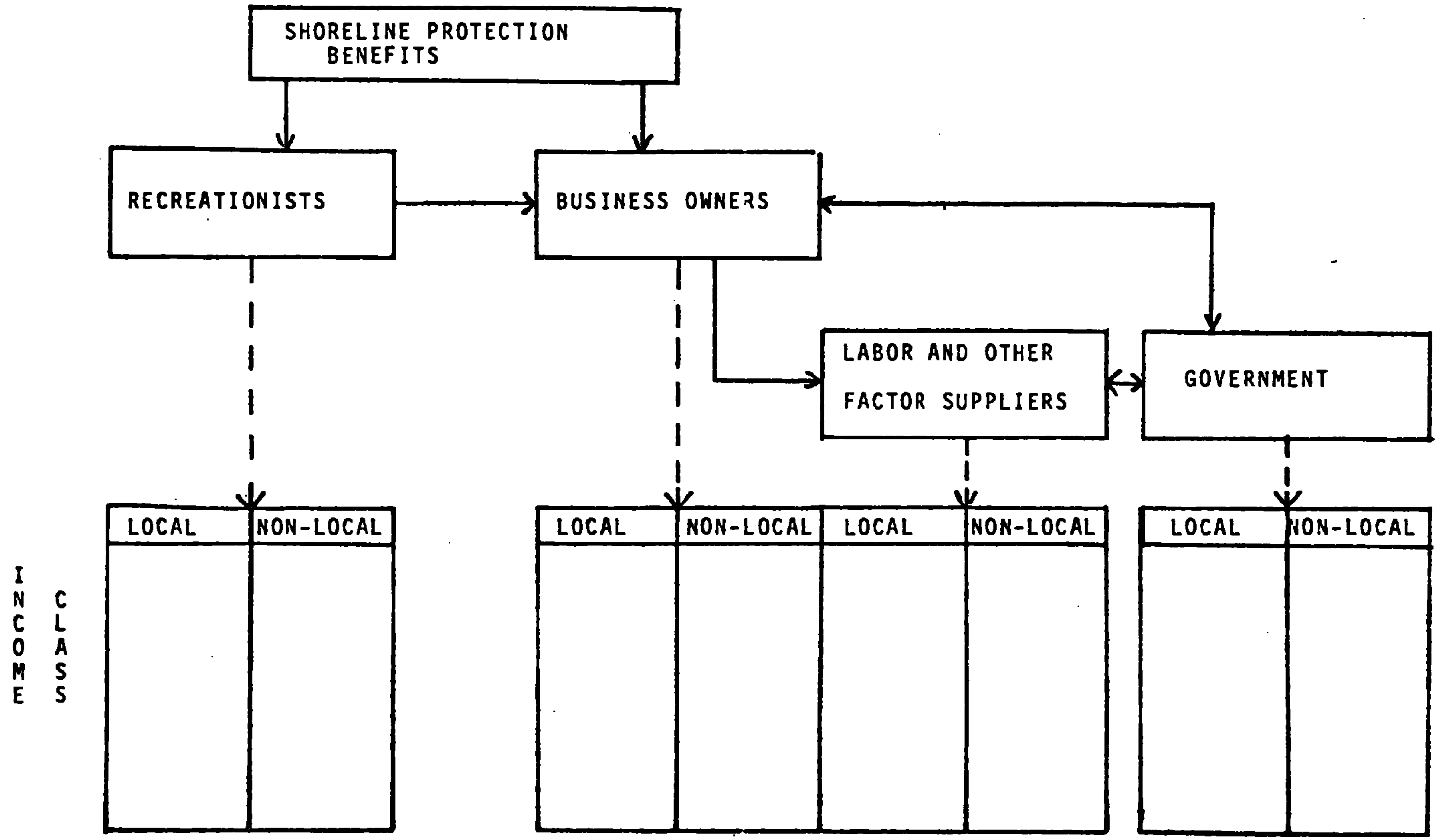
Figure 1



Depicted above in Figure 1 is a hypothetical "with and without" erosion control project situation. Initial visitation is at V and the assigned fixed value for this area is 'w' or $.50 per visitor day. Visitation with the project is estimated to be V' and the implied "with" and "without" demand curves are PV' and PV, respectively. They are implied if it is assumed that $.50 is the average willingness to pay value. The benefit value would be $.50 X (V' - V) or area ABV'V. ABV'V is equal to area PV V' which is the difference in the consumers' surplus with and without the project. The point is, that a fixed value for willingness to pay predetermines demand functions for all beach recreation experiences with and without the project with no real connection between price and quantity consumed. The estimate of expected visitation based on population characteristics is allowed to affect the slope of the implied demand function but the price intercept "p" is fixed given the value selected.[1]

If the fixed value is considered to be a probable market price then something about supply costs would need to be known. Certainly, they would vary with different situations and could not be pre-supposed

[1]This analysis pertains to linear demand functions, however, even if non-linear functions were represented the fixed value method implies some predetermined demand relationship.



HYPOTHETICAL BENEFIT INCIDENCE

FLOW CHART

(figure 2)

as is the case with a fixed value. Also, if the value is intended to be a market price then the consumers' surplus is ignored or demand must be considered to be completely elastic. In the final analysis the fixed value method is supply oriented. That is, benefits are considered to be primarily a function of the physical amount of beach placed. It is obvious that the fixed value method for estimating beach recreation benefits is deficient from a conceptual view but more importantly it undoubtedly leads to gross errors in the estimation of the benefit value of beach recreation considering the time and expense people go to for a shoreline visit. Also, it tells nothing about the incidence of values on user groups.

2. Incidence

Evaluation of benefit incidence is not currently required for beach erosion control projects although it would be helpful for cost sharing arguments. Emerging water resources planning rules do require considerable incidence information. Given an adequate method for determining benefit value, how would a knowledge of benefit incidence be useful.

Figure 2 is intended to show the general nature of the incidence measurement problem and the kinds of information that might be useful. In this hypothetical case assume the shoreline is a resort area. Benefits flow directly to various beneficiary categories. Here they are recreationists (the users) and business owners. For example, users gain in the form of an improved beach experience, say, more room on the beach, better quality, safety, etc. Business owners benefit directly in that property is protected from water damage or even complete destruction. Note too, there are indirect flows of benefits that ought to be considered. In this hypothetical case, recreation based business owners also gain from increased net income as a result of increased user demand. Factor suppliers gain from increased employment and income and government may gain from increased sales, property and income tax revenues.

There are of course more secondary flows, for example, businesses and users might gain from increased levels of public services stemming from the gains in tax revenues.

The next and really most important aspect of incidence is the determination of benefit flows to the sectors shown as local and non-local, and the allocation of these benefits to appropriate income classes. Information about benefits to local and non-local sectors would be a powerful tool for determining and arguing for appropriate and acceptable cost-sharing arrangements. The information about income classes (or other relevant social characteristics) would have obvious significance for social and equity questions, both from a project impact standpoint and a project objective standpoint.

Again, the diagram is hypothetical and the flows and benefit classes would change with different problem areas. Also, whether one would start at the top and work down or at the bottom and work up; or even in the middle and work both ways will depend a great deal on the data that is available.

While this paper deals primarily with benefit incidence it is necessary to realize that the incidence problem involves far more than just tracing benefit flows. The net benefit and cost incidence is the real question involved and benefit incidence itself is only one component of the problem. However, shoreline protection provides a sample problem area where an examination of the question of local versus national perceptions of benefit incidence would be useful.

From the preceding it is apparent that an important step in the process is the determination of the value and incidence of benefits which accrue to recreational users of a shore area.

3. A Demand Approach

A long advocated method for estimating the demand (and thus the value) for outdoor recreation is the Hotelling-Clawson "zone-cost" method. This procedure provides a way of estimating recreation value based on users' willingness to incur travel costs to visit a particular recreation site.

The method is generally known and full explanations of the model and its limitations are available from a variety of sources.[1] The obvious advantage of the method is that it provides a way of relating price and quantity and thus a potential means for comparing marginal project benefits with marginal project costs.

For those not familiar with the zone-cost method of measuring the demand for recreation a brief description of the general concept follows. The method involves calculating the mileage from various distance zones to the recreation site and the cost figure associated with that mileage.

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[1] See, for example; Marion Clawson and Jack L. Knetsch Economics of Outdoor Recreation, Resources for the Future, Johns Hopkins Press, Baltimore 1966, pp. 61-92, or Robert J. Kalter, The Economics of of Water-Based Outdoor Recreation, U. S. Army Engineer Institute for Water Resources, Alexandria, Va., IWR Report 71-8, 1971.

Given that information the cost per visit is plotted against the number of visits per 1,000 population in the various zones, which gives a functional relationship approximating the demand for the total recreation experience. To get at the demand for the recreational experience at the site in absolute terms, a second relationship must be derived which relates hypothetical increases in cost at the site to the total number of visits observed. The experience of users from one zone is assumed to provide a measure of what people in another zone would do if the money and time costs of a visit were the same.

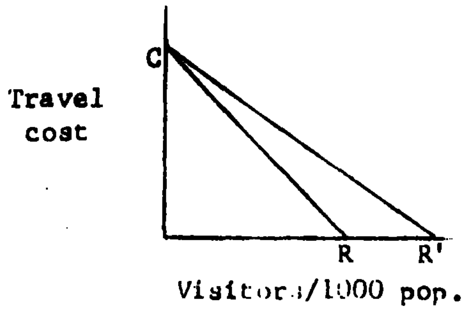
For a given increase in costs at the site, per capita visits for each zone are read from the original curve at points corresponding to the increase in the costs originally associated with each zone. The total visits from each zone at the higher site cost are derived by multiplying by the zone population. The total number of visits at each new cost is the sum of the various zone totals.

This is a very simplified account of the procedure and in actuality a variety of independent explanatory variables other than travel cost and site cost are used to get useful zone visitation rate-cost curves.

a. Benefit Value

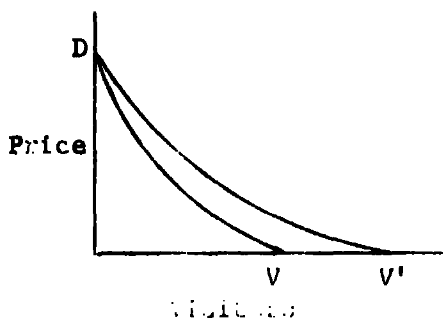
The following section relates the zone-cost method to the beach recreation experience in terms of demand analysis. For this initial case two general conditions apply: (a) beach use is on a day-use basis; (b) no costs are imposed on users at the site. Line CR in Figure 3 below shows a hypothetical zone travel cost and visitation rate relationship for a commercially undeveloped beach in its eroded condition.

Figure 3



A site demand curve can be constructed from this information based on the implied effects of a simulated on-site charge assuming the population in all zones react similarly to the cost increase. The initial hypothetical demand based on CR is shown as DV in Figure 4.

Figure 4

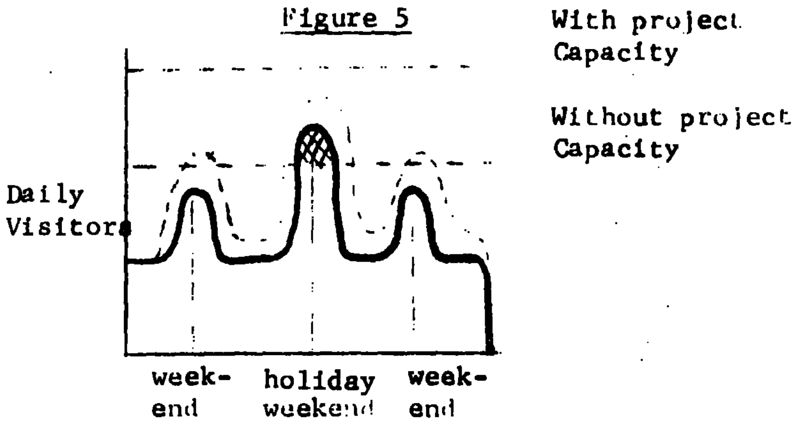


Next, assume the beach is restored and visitation rates increase for all zones; shown as CR' in Figure 3. The new demand there is DV' (Fig. 4) and the benefits of restoration are the equal to the area DVV'; the difference in consumers surplus before and after restoration. In this hypothetical example visitation rates increased by a constant percentage of initial visitation. In reality this change needs to be estimated empirically since there is no a priori function. The changed visitation rates and corresponding shift in demand are due to two factors: (1) the physical area of the beach will be increased, thus allowing greater use in an absolute capacity sense; and (2) the quality of the experience will be improved.

In order to actually measure the change in visitation it is necessary to examine both effects, i.e., the degree to which visitation was physically constrained and the extent that the beach experience improved qualitatively, as reflected in changes in zone visitation rates.

At this point a discussion is in order of what exactly is implied by a "zone-cost" demand curve based on annual visitation that is affected by site physical capacity constraints. Visitation expressed on an annual basis is really a sum of daily visits which are higher or lower depending on the season, the day of the week and the weather. Consider a hypothetical visitation schedule in Figure 5.

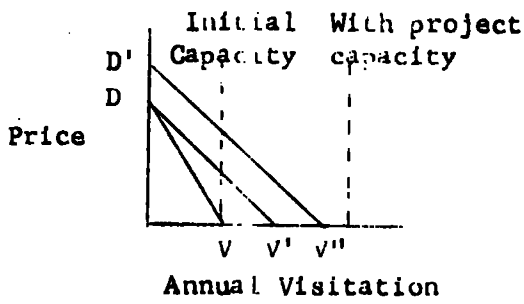
Figure 5



The "season" here is three weeks and peak visitation occurs on the weekends. In this example physical beach capacity affects visitation only on the holiday weekend in which case some visitors are turned away (or more likely they anticipate the likelihood of not getting on the beach and don't bother to show).

This situation when measured in terms of an annual "zone-cost" is depicted in Figure 6 below:

Figure 6



Measured demand would be DV and actual (or latent) demand would be DV'. V' - V is the number of visitors which were turned away on the holiday weekend (shaded area in Fig. 5). Note that the effect is a loss in consumer surplus over the entire length of the demand function. Hence, the portion of benefits from a project which provided room for V' would be expressed by area DVV'. The above is true if those unable to get on the beach were distributed over all zones.

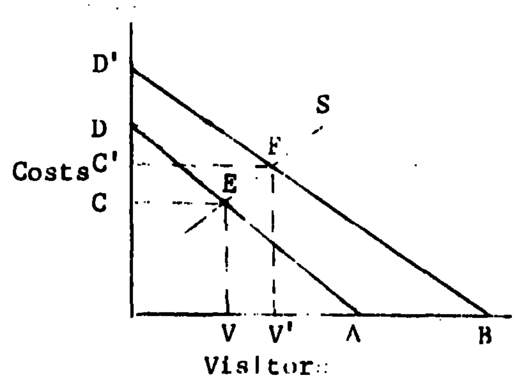
A qualitative shift in demand could be illustrated by increased daily visits over the entire schedule (the dashed line in Fig. 4). So final demand (with project) might actually be D'V" and Area D'DV V" would be the benefit value resulting from both removal of physical constraints and increased quality of experience due to, say, reduced crowding, better quality sand, or reduced safety hazard, etc. The point is that it is necessary to distinguish between absolute physical capacity of the recreation resource and other qualitative effects and is reflected through increased numbers or visits among existing users and new users.

b. <u>A Beach Resort Experience</u>

The "zone-cost" demand approach was originally formulated primarily for recreation experiences which involve a relatively simple package of costs and benefits. That is, a day trip to a state park beach might include only transportation costs and the utility of the beach experience. Even here, though, the analysis might require that the utility of "nearness to the sea" be netted out of the beach value computation. The evaluation of an overnight ocean resort experience involves a complex combination of user costs and benefits which make it difficult to determine the value of the beach resource itself. This is further compounded since the total package is likely to be worth more than the sum of the parts; (i.e., there are externalities stemming from the cluster of facilities and resources, boardwalk, motels, beach, lifeguards, ocean, etc.).

The solution requires an evaluation of the demand for the <u>total experience</u> with and without a beach erosion control project. For discussion purposes it will be assumed that for a hypothetical resort there is presently no beach and that a project would provide a beach area. Graphically, the "no beach" demand as measured by the zone-cost method is shown as DA in Figure 7 below:

<u>Figure 7</u>



The "with" project (beach) demand is estimated as D'B. C and C' must be considered as an average set of costs which face visitors at the resort. They include cost of lodging, meals, amusements, etc. V is the visitation given the "at resort" cost package without the beach. S is a combined supply function which represents the amount (in terms of visitors accommodated) of the resort facilities "supplied" at various prices. V' is the visitation level with a beach and the benefit to users would be equal to area D'C'F minus area DCE; the change in consumers' surplus.

The problem here is obviously how to measure or estimate a "with project" beach demand function; more precisely how to measure the effect of changes in beach area and quality on resort visitation, ceteris paribus and to determine resort supply function information. More of this problem will be discussed later in this paper.

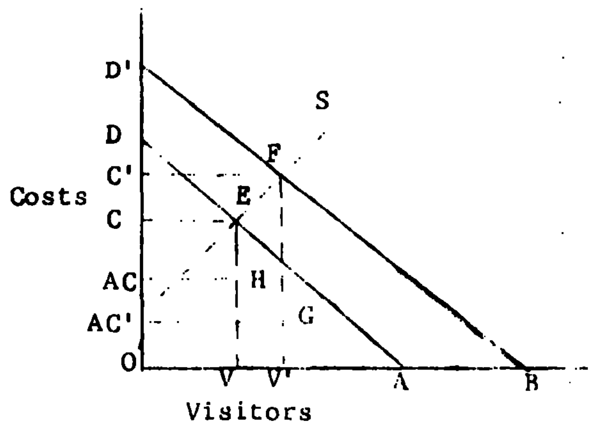
It is emphasized that the preceding static models are useful for explanation only and an empirical estimate of benefits must be a dynamic analysis since demands are constantly shifting due to a variety of factors, and benefits accrue over time which involves discounting. However, the concept that beach restoration is a significant demand parameter (a shifter) is advocated and that in most cases the real benefit value stems from such shifts in demand.

c. Incidence

Thus far, the discussion has centered primarily on the beach erosion control benefits which accrue to the users in terms of changes in consumers' surplus. As discussed earlier, an evaluation of benefit incidence requires that many sectors be considered including business and government. Further, if incidence by income class is desired, the incomes of individuals within the sectors must be determined.

Consider the resort model in Figure 7 which is particularly useful for illustrating multi-sector benefit incidence evaluation. This model with some additions is reproduced below in Figure 8.

<u>Figure 8</u>



The various benefits to sectors can be approximated if the average costs to the businesses are known at various resort facility outputs. AC is the average cost at visitation level V and AC', for V'. Hence, benefits to the users (consumers) are (in Figure 8) equal to area D'C'F minus area DCE. Benefits to the business sector are the net revenue or area C'FC,AC' minus area CEH,AC. Factor payments increase by the amount of area AC',GV'O minus area AC,HVO. This analysis pertains to a monopolistic industry market. It ignores competition between different facility suppliers. An actual study would need to evaluate the characteristics of real resort markets.

Benefits to the government sector would primarily result from increased income, sales and property tax receipts less the cost of increased public services required.

Following the determination of sector incidence the determination of the distribution of benefits within sectors by income class is necessary for equity considerations. This type of analysis requires direct or inferred income distribution information among individuals in each sector.[1] For a proper planning perspective incidence studies might also include an analysis of user characteristics, such as age groups, family participation, activity needs, etc.

III. EMPIRICAL STUDY - MEASURING SHORELINE RECREATION BENEFITS AND INCIDENCE

1. Study Objective

The primary objectives of this empirical study are to examine the feasibility of: (1) estimating the value of the shoreline recreation experience using the Hotelling-Clawson zone-cost demand analysis technique, and (2) estimating the value of the shoreline experience to user subgroups classed by social or economic characteristics as a means of obtaining benefit incidence information. The study applies to a shoreline experience in a resort setting and existing user data were used.

2. The Data

Initially, a sample area was selected for the data search. The area was a stretch of shoreline from Cape Lewes, Delaware to Assateague Island, Virginia, and was selected mainly because of the variety of shoreline development types and the likely variety of uses and activities.

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[1] See Michael R. Krouse, Quality of Life and Income Redistribution: Objectives for Water Resources Planning, U.S. Army Engineer Institute for Water Resources, Alexandria, Va., IWR Report 72-4, 1972, pp. 20-55.

The quest for usable existing shoreline visitor data began with a field trip to the sample area which involved numerous discussions with local, state and federal government officials, planning groups and business interests. It became apparent that in this area there were a variety of unrelated and general statistics about shoreline visitors; each organization keeping a particular set of data. For example, Delaware State parks kept annual data on visitor origin by state and general type of activity data. The National Park Service kept track of visitor activities by means of a daily sample which included such things as the percent of users who fished or swam, hiked, etc. They also had visitor origin data by state.

The city of Ocean City, Maryland, a resort area, had city planning documents available which included a small visitor survey which was somewhat outdated and had only general user origin data by broad location.[1]

However, a set of data which showed some potential for use in the zone-cost and incidence study was available through the Ocean City Health Care Study done for the Maryland Comprehensive Health Planning Agency and the Health Planning Council of the Eastern Shore, Inc., Salisbury, Maryland.[2] This data served as the primary source of visitor information. This study was designed primarily to assess health care needs at Ocean City and also included a visitor survey which was taken August 13-15, 1971. The survey done by direct interview at Ocean City included over 1200 respondents and less than 5 percent of the individuals approached refused to be interviewed. Visitor information from the survey relevant to the shoreline use value and incidence study included the following:

[1] Harland Bartholomew and Associates, The Comprehensive Plan, Ocean City, Maryland, Washington, D. C., 1968.

[2] Maryland Comprehensive Health Planning Agency, A Study and Plan To Meet Health Needs in Ocean City, Maryland, Baltimore, 1972.

1. Age and sex of the interviewee
2. Visitor origin by five digit zip code
3. Purpose of the visit
4. Length of stay
5. Group characteristic (family, friends, alone)
6. Age and sex of <u>family</u> members accompanying interviewee at Ocean City
7. Occupation (coded)[1]
8. Relationship of interviewee to family group (i.e., whether father, mother, son, daughter, or other)

The results of the survey were made available in the form of computer punch cards; one card for each interview. Since there were over 1200 individual cards each containing coded answers to questions related to the above information list, a data management technique was necessary to screen and organize the information. A data management system available through a commercial time-sharing computer service was used to aid the data screening process.

Data were screened and records were removed from the data set if (1) interviewees were summer residents of Ocean City, (2) they were summer workers, (3) no zip code was on the record, (4) answers were inconsistent (e.g., if a yes answer was recorded to the question "are you staying in Ocean City alone?" and an answer was given to "how would you characterize the group you are with?" The resulting "clean" data set contained 966 records (interviews) to be used in the zone-cost analysis.

[1]The occupation classification code key was not made available for this study. Consequently an important user subgroup analysis was not possible.

3. General Approach

The immediate technical objective was to use the Ocean City data to estimate the demand functions for shoreline recreation for various groups of visitors according to their length of stay in one case and for another case to estimate the demand for recreation for groups classified according to whether they are family or non-family.

It was decided to develop demands for various individual lengths of stay because: (1) It has been argued that they represent individual markets, and (2) On-site expenditure data was lacking and a more realistic and revealing price-quantity relationship could be determined by examining each length of stay set of users, assuming an average on-site expenditure for each particular length of stay.

The family-non-family breakdown was made to illustrate the feasibility of socio-economic classification of demand. Specific data on visitor incomes was lacking in this survey and admittedly it would have been more interesting for incidence studies. However, family-non-family markets are useful as incidence information in terms of illustrating the different values to each user group.

Demands estimated represent a single weekend cross-section and not annual demands which requires either more surveys or unsupported assumptions about the constancy of the characteristics of visitors throughout the season.

Essentially the major steps taken were as follows:

1. Allocation of counties to distance zones according to calculated highway distances from each to Ocean City.

2. Calculation of average trip cost for each county and then for each zone.

3. Allocation of observed trips to counties according to five digit zip code.

4. Calculation of visitation rate (trips per thousand population) for each zone, for each length of stay considered, and for the family non-family breakdown (for all lengths of stay).

5. Calculation of average site expenditures for each length of stay and for family-non-family groups.

6. Calculation of other independent variables (zone characteristics) such as percent urban and alternative shore experience travel cost.

7. Regression analysis - visitation rate on trip cost, and other explanatory variables.

8. Generation of trip demand curves using visitation-rate curves.

9. Analysis of demand functions for value and incidence implications.

Following is a more detailed description of the steps listed above:

4. <u>Distance Zones</u>

The distance zones were initially established by grouping counties according to highway distance to Ocean City at approximately 20 mile intervals. The first 9 zones extend out to about 240 miles from Ocean City and the tenth and last zone used out to a distance of about 350 miles. Visitation from beyond that distance was excluded from the analysis since much of those trips were multi-purpose and would tend to distort the demand functions. It is suggested that for project evaluation a fixed percent of total visitation be assigned longer distance visitation. In the sample case about 4 percent of visitors travelled distances greater than 350 miles to Ocean City.

5. <u>Zone Trip Costs and Visitation Rates</u>[1]

Average cost per trip for each zone for each length of stay was calculated as follows:

1. $Cz = \sum (2DiA + Ti)\ Pz/Pi$

2. $Sl = (F + O + M)\ N\ L$

3. $Czl = Cz + Sl$

where:

Cz = average travel cost per trip for zone z.

Di = average highway distance from county i to Ocean City

A = average automobile operating cost per mile

Ti = tolls or other costs involved in getting from county i to Ocean City

Pi = population of county i

Pz = population of zone z, $Pz = \sum Pi$

Sl = average on-site expenditure per person per day for a length of stay l at Ocean City

F = average food expenditure per person per day at Ocean City

O = average overnight lodging expenditure per person per day for length of stay l

M = Miscellaneous on-site expenditures

N = average number in party for length of stay l

L = length of stay in average days

Czl = the total average trip cost for zone z, length of stay l.

Visitation rates for each zone for each length of stay were derived from the sample as follows:

$T = (Ts/Vs)Va$

[1]Average food, lodging and miscellaneous expenditures were derived by updating those given in <u>The Comprehensive Plan, Ocean City, Maryland</u> (ibid.)

Tzl = Tszl(T/Ts)/(Pz/1000)

where

T = the total imputed number of trips represented by the weekend sample (all zones)

Ts = the sample number of trips observed (all zones)

Vs = the sample number of visitors observed (all zones)

Va = the estimated total number of visitors at Ocean City

Tzl = the number of trips per thousand population from zone z, length of stay 1

Tszl = the sample number of trips from zone z, length of stay 1

Table 1 shows the various distance zones, visitation rates and trip costs for each subgroup used in the analysis.

6. The Regression Analysis

In order to develop a smooth set of visitation rate functions for each length of stay regression analysis was used. It was apparent from a plot of the observed zone-costs against zone visitation rates that the basic relationship between them was non-linear. Therefore an initial curve fitting bivariate regression routine was used to establish the fundamental form of each cost-visitation rate function. This "canned" computer routine applied the least squares method to determine which of six curve forms present the closest fit to the entered data (in this case zone costs versus zone visitation rates).

In each case (length of stay) the best estimating equation was used as the transformation of the cost variable in the multiple regression

TABLE 1

ZONE COSTS AND VISITATION RATES

#	ZONE AVER. DISTANCE	ONE DAY RATE	ONE DAY TRIP COST	WEEKEND RATE	WEEKEND TRIP COST	3-7 DAYS RATE	3-7 DAYS TRIP COST	8-14 DAYS RATE	8-14 DAYS TRIP COST	MORE THAN 14 DAYS RATE	MORE THAN 14 DAYS TRIP COST	FAMILY RATE	FAMILY TRIP COST	NON-FAMILY RATE	NON-FAMILY TRIP COST
1	30	2.735	$26	.654	$62	.654	$300	.478	$391	1.427	$1106	4.34	$336	1.61	$214
2	55	.336	32	--[1]	68	.647	306	.659	397	.336	1112	1.98	342	--	220
3	72	.207	36	--	72	.199		.614	401	.398	1116	1.04	346	--	224
4	129	.183	50	.323	86	.579	324	.460	415	.136	1130	1.11	360	.61	238
5	150	.081	55	.357	91	.507	329	.662	420	.179	1135	1.30	365	.49	243
6	174	.029	59	.039	95	.254	333	.107	425	.049	1140	.31	370	.17	248
7	192	.010	65	.056	101	.103	339	.094	430	.018	1145	.24	375	.04	253
8	213	.016	70	.049	106	.049	344	.081	435	.017	1150	.13	380	.08	258
9	227	.007	73	.029	109	.066	347	.036	441	--	1153	.09	384	.05	262
10	325	.003	97	.008	133	.024	371	.033	462	.005	1177	.05	407	.02	285

[1] No observations for that zone.

routine. That is, the visitation rate was regressed against the cost transform, the percent urban population and the alternate shore travel cost.

To illustrate the method a simple symbolic presentation follows:

Assume an initial best regression estimated cost-rate function takes the form:

$$Y = Ae^{-bx} \quad \text{or} \quad \ln Y = \ln A - bx$$

y = estimated visitation rate

A = constant

b = regression coefficient

x = zone cost

The next step adding another variable results in a new regression equation such as:

$$\ln Y = K' + c' U + d' (\ln A - bx)$$

$$\text{or} \quad \ln Y' = (K + d' \ln A) + c' U - D'bX$$

where

K' = a new constant component

U = additional explanatory variable

d' = a new regression coefficient acting on the cost transform

c' = the regression coefficient for the added variable U (prime used to indicate the second step)

In an economic sense U enters into the rate-cost function as a demand parameter (i.e., it becomes a shifter).

The actual final rate-cost regression equations for each length of stay and the family non-family groups are shown below:

One day

$\ln Y = 20.1338 + 2.3437\ U - 6.1818\ (\ln C)$

$R = .959$

Weekends

$\ln Y = -.364843 + 1.84122U - .07967\ (C)$

$R = .900$

One week

$\ln Y = -.123914 + 1.93616U - .07058\ (C)$

$R = .918$

Where:

Y = number of visits
U = % urban population
C = trip cost

Two weeks

$\ln Y = -.162592 + 1.42772U - .063289\ (C)$

$R = .818$

More than two weeks

$\ln Y = .41277 - .0795\ (C)$

$R = .922$

Family

$\ln Y = 1.521668 + .94131\ (U) - .074923\ (C)$

$R = .923$

Non-Family

$\ln Y = .57741 + 1.2365\ (U) - .077407\ (C)$

$R = .879$

7. Demand

The next step given rate-cost functions is to calculate trip demand functions by simulating on-site price increases. This involves calculating the trip demand for each zone and summing for each simulated price level.

In order to show the general nature of each calculated trip demand schedule and to develop a continuous function an estimating equation was derived using the least squares regression technique. Here the calculated sum of all zone trips for each price level was regressed against that price. The resulting equation describes generally the form of the trip demand.

Following is a list of the trip demand functions for each length of stay and the family non-family groups.

TRIP DEMAND FUNCTIONS

One day

$\ln Y = \ln 1303 - .107C$

Weekend

$\ln Y = \ln 322.3 - .082C$

One week

$\ln Y = \ln 6619 - .075C$

Two weeks

$\ln Y = \ln 5941 - .068C$

Family

$\ln Y = \ln 13058 - .078C$

Non-Family

$\ln Y = \ln 5642 - .080C$

Where:

Y = number of trips

C = cost above average site expenditure

Consumer surplus is more accurately estimated by calculating the area under each zone demand curve rather than the area under the estimated total trip demand curve:

I.e., given a rate cost function: $Yi = Ki - bxi$

$$C = \sum_i \int_{X_i}^{X_0} [(Ki - bxi)\ Pi] dx$$

where C = consumer surplus

Yi = visitation rate per capita, zone i

Ki = net value of constants and parameters unique to zone i

b = regression coefficient

Xi = trip cost each zone

Pi = population of zone i

Table 2 lists the calculated consumers' surplus and the estimated expenditures at Ocean City for those visitors represented by the sample. The general interpretation is that consumers' surplus is a small portion of total value except for the one-day users. That is, the facilities' owners extract the largest share of total value of the experience in the form of site expenditures for lodging, food and other services.

An additional point; given the form of the demands estimated a relatively small increase in on-site charges has a great reducing effect on consumer surplus. If, in fact, demand is as elastic as is estimated a pass through cost share for erosion control would greatly reduce surplus value to users.

8. Conclusions

The study does illustrate that recreation value for beaches can be estimated using zone-cost analysis and that individual demands and values

TABLE 2

ESTIMATED SURPLUS VALUE AND SITE EXPENDITURE BY

USER SUB-GROUP

USER GROUP		SURPLUS VALUE	SITE EXPENDITURE	NUMBER OF TRIPS REPRESENTED
One day		$ 14,190	$ 31,450	1691
Weekend		38,725	227,460	4166
3-6 days		86,610	2,131,590	7285
7-14 days		83,310	3,159,940	8229
More than 14 days		20,060	2,496,320	2276
	TOTAL	$242,895*	$8,046,760	23647
Family		$159,020	$6,654,580	17075
Non-Family		68,615	1,392,180	6572
	TOTAL	$227,635*	$8,046,760	23647

* The difference in the total surplus value between the sum of length of stay sub-groups and the sum of the family-non-family groups is due to the use of individual regression estimators for each category.

for different user groups can also be estimated to gain incidence information. However, this first go-round using existing data does indicate some additional data needs and procedural requirements.

As with any zone-cost analysis there are the usual difficulties relating to whether the cost variable is adequately defined. The elasticities implied by the estimated demands in this study indicate that the cost variable was perhaps not adequately defined in the more distant zones. In retrospect a better measure of the costs, particularly the time and trouble involved in making trip to the beach needs to be developed. It is apparent that the differential costs incurred as distance from the beach increases are perhaps greater than the travel cost, tolls and nominal time value indicate. Closely related is the need for a cost of close substitutes variable. For this study alternate distance to a similar resort area was used. However, it did not enter significantly into the regression due primarily to the high inter-correlation with the travel cost and percent urban variables.

Another lesson learned was that rather than using large zones of grouped counties, the counties as individual zones should be used. This method, though involving more work in this case would allow for the introduction of a variety of independent variables available via statistics available on a county basis. Brown and Nawas have argued that using each observation as opposed to grouping into zones leads to an improved demand analysis from a statistical standpoint.[1]

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[1]William G. Brown and Farid Nawas, "Improving the Estimation and Specification of Statistical Outdoor Recreation Demand Functions," Oregon Agricultural Experiment Station Technical Paper No. 3202, 1971.

Another difficulty encountered in attempting to estimate visitor subgroup demands was that the observed data becomes very thin and in some zones for some lengths of stay no observations were available. Apparently a larger sample than would be expected is required. Also it has been indicated by local officials at Ocean City that the character of the visitors changes over the recreation season and more than a one time sample would be needed to impute annual values to subgroups of visitors.

A significant problem relating to the demand analysis of a resort recreation experience involves the need for actual site expenditures for each observation. An accurate measure of user surplus value requires that demand be estimated according to an average site expenditure value within the length of stay group. In other words, lumping all visitors for a particular length of stay under a single average site expenditure figure clouds the actual user response to trip cost differences as well as ignores the idea that there are a variety of qualities of facilities available at the resort.

9. Future Work

The logical extension of this work from a benefit value standpoint is the development of a means to estimate the relationship between beach erosion control qualitative impacts and recreational user valuation of a particular shoreline. That is, how does beach erosion control shift user demand? This work also suggests that a regional market approach including all types of recreation demands is needed which would allow the analyst to put shore recreation into perspective with other recreation. Ideally a model which could develop a range of values applicable to all shorelines would be most useful to the field planners.

While the empirical part of this study concentrated primarily on a single component of erosion control benefits (i.e., to users) there is remaining the larger question of value and benefit <u>and</u> cost incidence estimation for all other sectors. In fact this study indicates that the business sector would likely be the major direct beneficiaries of an erosion control project at a developed commercial beach since they extract the greatest portion of value. The whole question of what incidence information is relevant is still unresolved and consistent procedures for estimating incidence are still needed.

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