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The Demand for and Value of Outdoor Recreation in the Targhee National Forest, Idaho

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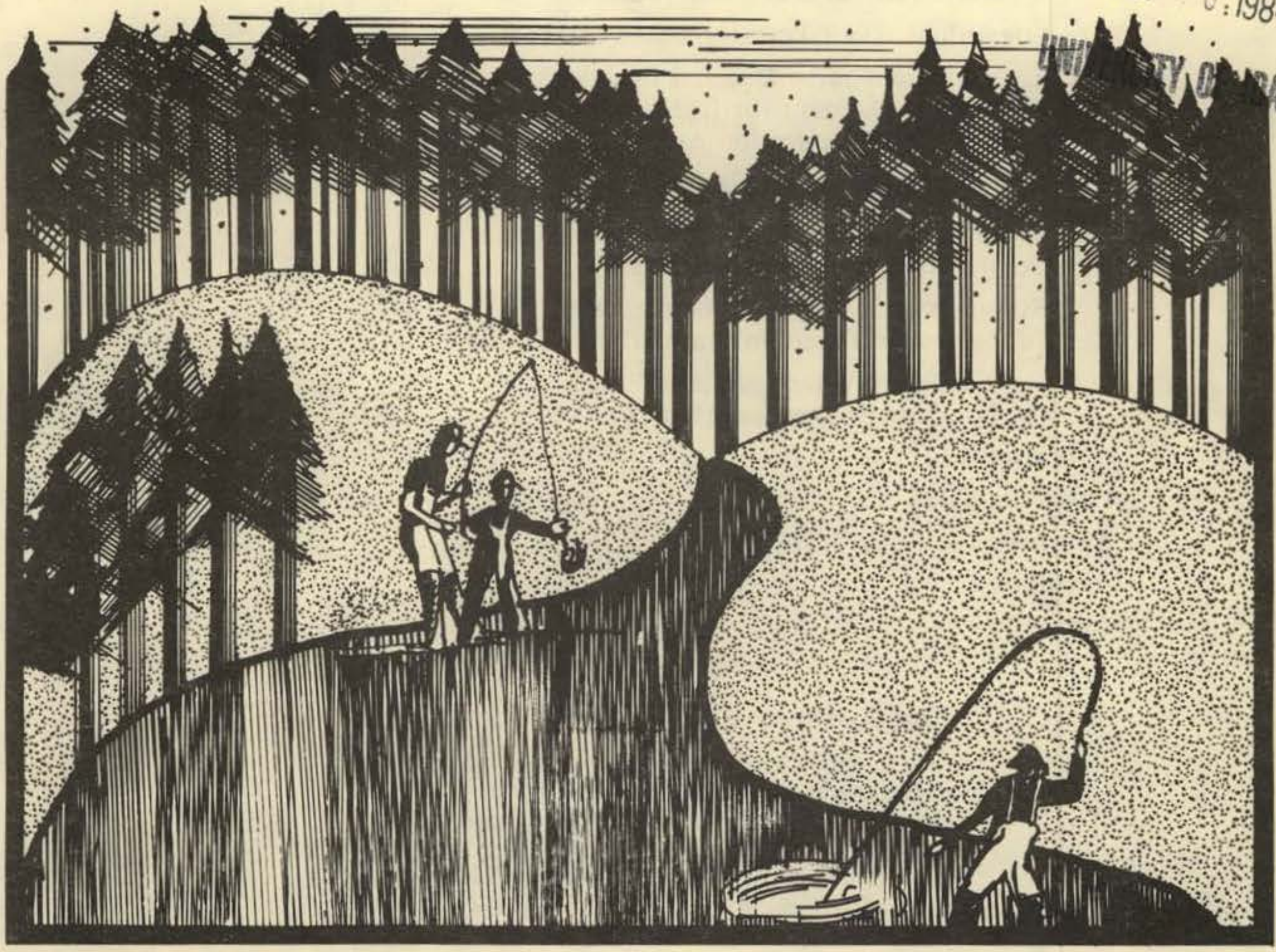

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J. L. Findeis and E. L. Michalson

The demand for outdoor recreation has steadily increased in the past decade with substantially larger numbers of people using land and water resources for recreational purposes. Unfortunately, this increase has meant overcrowding and overuse of many existing recreation areas. As more people seek to spend their leisure time swimming, hiking, camping and participating in other outdoor recreational activities, they create a need for more areas reserved specifically for recreation. Consequently, competition for land and water resources has increased as the public demands more areas be set aside for recreational use. To ensure an efficient allocation of resources between competing uses such as agriculture, timber production and recreation, and to alleviate overuse and prevent environmental degradation of existing recreation areas, both public planners and resource managers should be able to assess the demand for and value of outdoor recreation.

Several estimation techniques have been developed to assess recreation participation demand and to value recreational resources to enable planners and managers to use efficiently limited resources and public lands. Although much research has been done to develop these techniques, however, in general they tend to be either statistically or theoretically weak or both. The inability to estimate accurately demand inevitably leads to a miscalculation of both participatory demand and the value of the recreational resource.

This study improved upon the methodology for estimating participatory demand by examining the demand for recreation in the Targhee National Forest, an area used heavily by both local recreationists and tourists. From the standpoint of both user groups, the Targhee National Forest ranks as one of Idaho's most popular recreational areas, offering camping, fishing, hiking, boating and other land and water recreational opportunities. Located just west of Yellowstone National Park, the Targhee serves to accommodate the overflow of visitors to this often crowded national recreational site and also serves as a popular recreational area for people living in the surrounding region.

The Targhee accommodates a wide spectrum of users with different tastes, preferences and travel characteristics. Two fairly distinct types of vacationers can be differentiated: (1) the local recreationist and (2) the tourist. The mix of these two user groups severely handicaps any accurate estimation of participatory demand.

Objectives

This study recognized the basic differences between local users and tourists vacationing in the Targhee National Forest. Differing socioeconomic characteristics exhibited by each of these two user classifications was explored, and the hypothesis that local users and tourists express different demands for outdoor recreation was tested. If a demand model recognizing these differences could be developed, the demand for recreation in the Targhee National Forest could be more accurately estimated. To accomplish this goal, the following objectives were formulated:

1. To compare and contrast socioeconomic and travel characteristics exhibited by two types of users of the Targhee National Forest — local recreationists and tourists.
2. To estimate, compare and contrast separate participatory demand models for several user classifications: local recreationists vs. tourists, destination vs. nondestination vacationers and in-state vs. out-of-state visitors.
3. To derive a statistically valid net value estimate for outdoor recreation in the Targhee National Forest.

Research Methodology

To analyze the demand for recreation in the Targhee National Forest, two statistical techniques and an application of economic theory were used in addition to the survey method used for data collection. This publication closely follows as a whole the development and application of these three techniques of theory applications. In specific:

1. Discriminant analysis is used to separate and classify users into two separate classification groups: local users and tourists. Local users were defined as those recreationists who (1) viewed the Targhee National Forest as the main destination of their trip; (2) visited few and in most cases no other recreation areas while enroute to and from the Targhee; and (3) traveled only a relatively short distance to vacation in the Targhee area.

   In contrast, those recreationists classified as tourists (1) did not, in general, view the Targhee National Forest as the main destination of their trip; (2) stopped or planned to stop at least at one and usually at many other recreational areas in addition to the Targhee; and (3) traveled a relatively long distance on their trip.
2. A modified travel cost model was developed by applying stepwise regression techniques to the collected data.
3. The economic concept of consumer's surplus was used to derive a value representing the net benefit accruing to the average user of the Targhee.

Survey Methods and Data Collection

The data used in this study were collected via questionnaires in the Targhee National Forest during the summer of 1974. The questions asked were designed to establish the recreationist's socioeconomic characteristics, travel statistics and opinions about the quantity of campground facilities and the quality of the recreational experience.

During June, July and August, when recreational use is highest, interviewers distributed the questionnaires in eight developed Forest Service campgrounds. Sampling was stratified by campground, and the questionnaires were systematically distributed and left for campers to fill out on their own overnight. Because the sampling unit was defined as a group using a single campsite (in most cases a family), only one individual per group was asked to fill out the questionnaire. In the morning, interviewers returned to collect completed questionnaires and to answer questions the interviewee may have had. If questions were left blank, interviewers were instructed to interview directly campers to ensure that all questionnaires were as complete as possible.

No predetermined sampling procedure was used because of the lack of information on recreational use. Because missing data problems have been encountered in previous recreation studies, a large sample size was deemed desirable. A total of 1,061 questionnaires were collected during a 3-month period, with 804 (76 percent) being essentially complete. Questions most often left blank concerned the participant's income, vacation time, travel time and costs; these questions were perhaps too personal or too difficult to answer.

To classify participants as either tourists or local users, discriminant analysis was used. Initially, uses were "classified," those recreationists who could not be definitively classified. Based on local user and tourist responses to certain "discriminating questions," a discriminant function was derived (Nie *et al.* 1975):

$$D_i = d_{i1}Z_1 + d_{i2}Z_2 + \dots + d_{ip}Z_p$$

where D_i is the score on discriminant function i, the d's are weighting coefficients and the Z's are the standardized values of the p discriminating variables used in the analysis (Nie *et al.* 1975). Because only two groups were separated in this analysis, only one discriminant function was derived. Based on this function, "unclassifieds" were reclassified as either local users or tourists. This was accomplished by substituting the values of the discriminating variables for each "unclassified" user into the derived discriminant function, thus determining with which group the user was most likely associated.

Regression Analysis: An Application

Ordinary least squares regression can be used to estimate a demand function. When using the travel cost method (Clawson and Knetsch 1966), or a modification of this approach, the study assumed that a relationship exists between the group's travel costs and either the number of trips made to the particular recreation area or the number of days spent vacationing at the site. This relationship is summarized in an economic demand schedule, and regression analysis can be used to estimate and test this relationship, based on statistical inference. A regression model of the following functional form was used to derive a demand curve:

$$Y = a + B_1X_1 + B_2X_2 + \dots + B_nX_n + £$$

Where:

Y = the dependent variable

a = the intercept

B_j's = regression coefficients

X_j's = independent variables

£ = error term

Regression techniques were used to develop a recreation participation demand model based on the number of visitor-days[1] a group spends at a campground as the dependent variable (Y_i) and travel costs and other relevant socioeconomic and travel variables (e.g., income, travel time, etc.) as independent variables.

Regression analysis is a useful statistical tool for testing whether a relationship exists between certain variables and for estimating economic parameters. Stepwise regression techniques were used to derive demand models for local users, tourists and for the population of recreationists as a whole.

Valuing Recreational Resources Using Consumers' Surplus

Alfred Marshall originally proposed the concept of consumer's surplus, which can be used to derive a net value for recreational resources. Marshall defined consumers' surplus as "the difference between the amount a consumer **would** pay for the quantity of a commodity he buys and the amount he **does** pay" (Watson 1972). Fig. 1 presents this concept graphically.

Consumers' surplus has been extensively used in economic analysis to designate benefits accruing to the consumers above that which is actually paid for the good or service. Integral to this concept is the assumption that the consumers' **demand curve** and **marginal utility curve** are identical in that the ratio of the respective marginal utilities are equal to the price ratios of the recreation consumed. The consumer is assumed to pay up to but not beyond the value of the benefit derived from an additional unit of a particular good or service. The gross benefits accruing to an average user of a particular recreation area can be symbolized by the trapezoid ODEA in Fig. 1.

At first glance, a reasonable assumption to make is to equate the "value" of recreation to the average user with an estimate of the gross benefits accruing to this user. This method, however, ignores the **costs** of recreation to the consumer and, therefore, overestimates the value of an area from a recreational viewpoint. To avoid double-counting of national recreational benefits, trip expenditures must be excluded since this amount likely would be spent elsewhere if the opportunity to recreate in the particular area being studied was not available (Coomber and Biswas 1972).

By subtracting total trip expenditures (area OCEA, Fig. 1), a net benefit estimate can be derived. This estimate is analogous to the consumers' surplus (area CDE, Fig. 1) in Fig. 1 and can be used to represent the value of recreation to the average user.

In this publication, consumers' surplus values were calculated separately for the average user of the Targhee and for local users and tourists. These values may not compare to values from forest uses such as mining, logging, etc., when these activities are valued through deriving consumer's surplus values. Consumer's surplus values for recreation can be useful for comparing and contrasting the value of recreation to various user groups above and beyond costs.

[1]A visitor-day is defined as the use of a facility for a total of 12 person-hours by one or more people (U.S. Department of Agriculture, Forest Service 1967-1975).

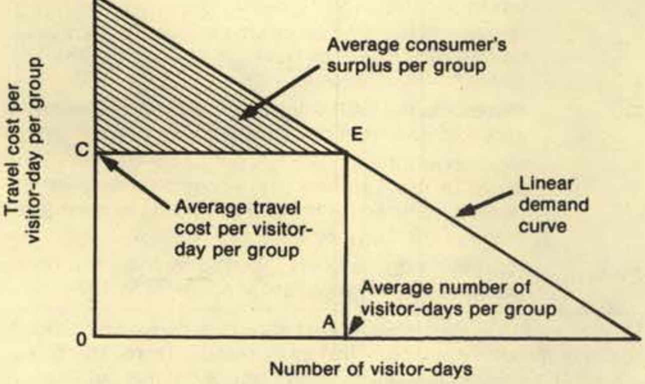


Fig. 1. Hypothetical consumers' surplus for a linear demand function.

Statistical Analysis

As a first approximation, an overall demand function was estimated and critiqued for the entire sample. The study hypothesized that this model, like many recreation demand models found in the literature, could be improved by:

1. Subdividing the entire sample of recreationists into user types (i.e., local users and tourists) and estimating separately linear demand functions for each group.
2. Using logarithmic rather than linear functions to estimate demand.
3. Adjusting the tourist demand model to account for intermediate stops at other recreational areas while enroute to and from the Targhee National Forest.

These adjustments will be examined and analyzed in the next section.

Estimating an Overall Linear Demand Model

Regression analysis was used to quantify the relationship between the number of visitor-days that a vacationing group spent in the Targhee and the travel costs per visitor-day incurred. Variables such as age, income and education, although not essential for quantifying a relationship, were hypothesized to explain consumer behavior as related to recreational demand. Table 1 presents variables examined in this publication.

Table 1. Variables used to develop participatory demand models for recreation in the Targhee National Forest.

Variable	Description
Y	Number of visitor-days per group spent vacationing in the Targhee National Forest in 1974.
X_1	Number of trips made by the respondent to the Targhee in previous years.
X_2	Respondent's age.
X_3	Respondent's sex.
X_4	Respondent's occupation.
X_5	Respondent's paid vacation time in weeks in 1974 excluding holidays.
X_6	Respondent's annual vacation time in weeks in 1974 excluding holidays (includes vacation time taken by retirees).
X_7	Years of education completed by respondent.
X_8	1973 disposable income per group (in thousands of dollars).
X_9	1973 disposable income per capita (in thousands of dollars).
X_{10}	Total travel time in days.
X_{11}	Total trip mileage.
X_{12}	Transportation costs per visitor-day per group member.
X_{13}	Expenditures made in Idaho.
X_{14}	Total trip costs per visitor-day per group, excluding expenses incurred in the Targhee (onsite expenditures).
X_{15}	Total trip costs per visitor-day per group member, excluding onsite expenditures.
X_{16}	Onsite expenditures per group.
X_{17}	Onsite expenditures per visitor-day per group.
X_{18}	Onsite expenditures per group member.
X_{19}	Onsite expenditures per visitor-day per group member.
X_{20}	Group size.
X_{21}	Reciprocal of group size (X_{20})
Discrete Variables	
X_{22}	Variable representing whether it was respondent's first trip to the Targhee.
X_{23}	Variable representing whether respondent had stopped or planned to stop at other recreation areas.
X_{24}	Variable representing whether respondent's visit to the Targhee was the main reason for his or her trip.
X_{25}	Variable representing respondent's opinion regarding the capacity of available facilities.
X_{26}	Variable representing whether respondent planned to return to the Targhee.
X_{27}	Variable representing whether respondent planned to return to the Targhee again in 1974.
X_{28}	Variable representing whether respondent planned to return to the Targhee in future years.

Both "stepwise" and "maximum R^2 improvement" stepwise regression techniques available in the SAS76 computer programs package were used (Barr *et al.* 1976). One stepwise procedure was used to check the results of the other, since each procedure uses different criteria to select an optimal model.

Linear regressions were calculated when multicollinearity was suspected. Because travel time, travel costs and trip mileage are usually highly correlated, multicollinearity was possible. When multicollinearity or linear dependencies between variables exists, regression coefficients of the correlated variables may be biased. T-tests for biased coefficients may indicate that a pair of highly correlated variables are not statistically significant and should be eliminated from the model when actually just the opposite is true. To test if these variables should be included in the model being developed, simple linear regressions can be calculated using the interrelated variables in separate regressions to determine the ability of each variable individually to explain variation in the dependent variable.

The regression equation shown in Table 2 was selected as the "best," overall, linear demand model

Table 2. Overall regression equation developed to predict recreation participatory demand in the Targhee National Forest.

$$(1)\ Y = 9.4063 + \underset{(3.668)}{0.3090X_6^{**}} + \underset{(4.457)}{0.0385X_{10}^{**}} + \underset{(6.334)}{0.0040X_{11}^{**}} - \underset{(-12.855)}{0.3761X_{14}^{**}} + \underset{(18.847)}{0.1696X_{16}^{**a}}$$

R^2	=	0.53
F	=	121.88**
N	=	557

where

Y	represents the estimated number of visitor-days that a group will stay in the Targhee National Forest.
X_6	represents the respondent's annual vacation time in weeks.
X_{10}	represents the amount of time in days that the vacationing group spends traveling to and from the Targhee.
X_{11}	represents the total miles traveled by the vacationing group to and from the Targhee.
X_{14}	represents total travel costs per visitor-day per group spent in the Targhee (travel costs include all expenses incurred on the trip excluding expenditures made in the Targhee).
X_{16}	represents onsite costs incurred by the vacationing group in the Targhee National Forest in 1974.

[a] The numbers in parentheses are t statistics, derived by dividing each regression coefficient (b_j) by its standard error ($t_j = b_j/s.e.(b_j)$). This convention will be used throughout this publication, as will the practice of using single (*) and double (**) stars to denote regression coefficients that are significantly different from 0 at the 5 and 1 percent levels of significance, respectively.

using the entire sample. The model was judged to be consistent with existing recreational demand theories. The regression coefficient for the travel cost variable (X_{14}) was inversely related to the quantity variable (Y) as would be expected when defining a demand relationship. The signs of the annual vacation time (X_6) and site cost (X_{16}) coefficients were also as expected; as the amount of leisure time and onsite expenses increased, the number of days that a group spent vacationing in the Targhee increased also.

The travel time (X_{10}) and miles traveled (X_{11}) variables were also statistically significant with positive coefficients. These results were consistent with earlier recreational demand studies undertaken by Gilmour (1973) and White (1977). For example, tourists who traveled more miles in a longer period of time to vacation in the Targhee tended to stay more days than did local recreationists.

The overall model was judged to be statistically acceptable. T-tests indicated that all five regression coefficients were highly significant, implying that each of the independent variables explained some of the variation in the number of visitor-days that a vacationing group stayed in the Targhee. The model's F-statistic, a measure of the ability of the independent variables to **jointly** explain variation in the dependent variable, was also highly significant.[2] The R^2 statistic for the model, however, indicating the relative fit of the model to the data, was low (0.53), as expected; recreation demand models commonly do not fit the data. Furthermore, multicollinearity was found to be a problem. The correlation between the travel time (X_{10}) and miles traveled (X_{11}) variables were relatively high (0.7121). Table 3 gives the correlation matrix for model 1.

Examination of User Subgroups

Despite the model's low R^2, the model could be used to derive an estimate of the value of the recreational experience in the Targhee. The study hypothesized, however, that the demand for and net benefits accruing from recreation could be more accurately estimated, since the data had differentiated certain subgroups of users such as local recreationists and tourists that have similar characteristics and travel patterns that influence their demand for recreation. By estimating a model for all users, some of the characteristics and facets of human behavior that are important to recreation resource planners and managers may be glossed over. What may be an important determinant of recreational demand for one group may well be inconsequential for another.

[2]The F-statistic also met the stringent criteria sometimes used to judge a regression model; the F-statistic proved to be at least four times as large as the theoretical F value.

Table 3. Correlation matrix for the overall participatory demand model 1 developed to predict recreational demand in the Targhee National Forest.

	Y	X_6	X_{10}	X_{11}	X_{14}	X_{16}
Y	1.0000	0.2414	0.2069	0.2251	−0.1301	0.5627
X_6		1.0000	0.3681	0.3290	0.1244	0.5888
X_{10}			1.0000	0.7121	0.5163	0.0250
X_{11}				1.0000	0.6794	0.1521
X_{14}					1.0000	0.1095
X_{16}						1.0000

Application of the Chow Test To User Subgroup Pairs

To establish that the data were not drawn from a homogeneous population of recreationists, a Chow test was used to determine whether the demand for recreation was better estimated by "pooling" the data collected from all recreationists (as in the overall model previously discussed) or by estimating demand models for **each** selected subsample. The Chow test is an F-test that is used to determine if the regression coefficients for two samples are equal or statistically different. In this study, the two subsamples of particular interest were tourists and local recreationists. To use this test, the study needed to calculate three regressions based on identical variables: one for the first sample (tourists), one for the second sample (local users) and one based on both samples "pooled" together.

Regressions based on the five independent variables whose coefficients were found to be statistically significant for the overall or "pooled" demand model were calculated for the following subgroups:

1. Local users
2. Tourists
3. Destination users[3]
4. Nondestination users[3]
5. Idaho residents (instate users)
6. Out-of-state users (users residing outside of Idaho)

The resulting regression equations are included in Appendix 1.

The Chow test was used to determine if local users and tourists have significantly different demand functions for recreation in the Targhee. The error sum of squares ($\Sigma \varepsilon_i^2$) values for the "pooled" model, the local user regression equation and the

[3]Classification of "destination" and "nondestination" users was based on whether or not the visitor considered his or her visit to the Targhee to be the main reason for the trip.

tourist model were used to calculate an F-statistic based on the following formula:

$$F = \frac{[\Sigma\varepsilon_p^2 - (\Sigma\varepsilon_p^2 + \Sigma\varepsilon_2^2)] / k^6}{(\Sigma\varepsilon_1^2 + \Sigma\varepsilon_2^2) / (n_1 + n_2 - 2k)}$$

Where:

$\Sigma\varepsilon_p^2$ = error sum of squares for the "pooled" model (subsample pairs combined)

$\Sigma\varepsilon_1^2$ = error sum of squares for sample 1

$\Sigma\varepsilon_2^2$ = error sum of squares for sample 2

n_1 = number of observations in sample 1

n_2 = number of observations in sample 2

k = total number of regression coefficients being tested including the intercept; that is, the total number of b_i's for the "pooled" model.

The calculated F ratio was then compared to the tabulated F with k and (n_1 + n_2 - 2k) degrees of freedom to test the null hypothesis that "there is no difference in the coefficients obtained from the two samples"(Koutsoyiannis 1973).

When a Chow test was applied to the local user and tourist subsamples, the calculated F statistic exceeded the theoretical F value at the 1 percent level of significance. Also assumed was that statistically significant differences existed between the demand for recreation in the Targhee by these two types of recreationists. In addition, Chow tests for the destination vs. nondestination and instate and out-of-state subsample pairs yielded similar results.

Estimation of Subgroup Specific Demand Models for Local Users and Tourists

Because the Chow test showed that local user and tourist demand functions differed significantly, the analysis was extended to develop group specific demand models for local users and tourists. When stepwise regression techniques were used to select the best variables from those in Table 1 for local users and tourists separately, the equations in Table 4 resulted.

The model for local recreationists (equation 4) was comprised of exactly the same variables as the model developed previously for the entire pooled sample. In contrast, the best tourist model differed considerably, as is apparent in Table 4. Only the annual vacation time (X_6), travel time (X_{10}) and travel cost per visitor-day per group (X_{14}) variables were common to the models developed for local users, tourists and for the sample as a whole. For tourists, the trip mileage (X_{11}) and onsite cost (X_{16}) variables were dropped, whereas X_{18} (onsite costs per person), X_{21} (reciprocal of group size) and X_{22} (a dummy variable indicating whether this was the respondent's first trip to the Targhee) were added. Apparently, whether this was the tourist's first trip to the Targhee was an important determinant of the tourist's length of stay.

The negative regression coefficient for this variable (X_{22}) implies that tourists who were making their first trip to the Targhee tended to stay longer than those people who had visited the area before. Some tourists, having visited the Targhee before, noted that they were accustomed to "just stopping" in the Targhee on their way to a final destination elsewhere.

The size of the vacationing group for which tourists calculated their costs also appeared to be important for determining how long tourists would stay in the Targhee. The fact that group size appears to be important is intuitive. Edwards *et al.* (1976) developed a demand model that took group size into account, explaining:

> "Indeed, the major feature differentiating one group of recreationists from other groups, aside from price, transportation cost and income differences, is the size of the group. Ac-

Table 4. Local user and tourist participatory demand functions developed to predict recreation demand in the Targhee National Forest.

Local user demand function

$$(4)\ Y = 10.1631 + \underset{(3.273)}{0.2272X_6^{**}} + \underset{(2.445)}{0.2685X_{10}^{*}} + \underset{(4.705)}{0.0148X_{11}^{**}} - \underset{(-18.305)}{2.3870X_{14}^{**}} + \underset{(24.770)}{0.2538X_{16}^{**}}$$

R^2 = 0.67

F = 152.88**

N = 389

Tourist demand function

$$(5)\ Y = 23.5358 + \underset{(2.657)}{0.4173X_6^{**}} + \underset{(4.256)}{0.0470X_{10}^{**}} - \underset{(-6.111)}{0.2257X_{14}^{**}} + \underset{(10.797)}{0.4207X_{18}^{**}} - \underset{(-2.245)}{17.2551X_{21}^{**}} - \underset{(-1.800)}{5.1968X_{22}^{a}}$$

R^2 = 0.58

F = 36.88**

N = 168

where

Y	represents the estimated number of visitor-days that a group will stay in the Targhee National Forest.
X_6	represents the respondent's annual vacation time in weeks.
X_{10}	represents the amount of time that the vacationing group spends traveling to and from the Targhee.
X_{11}	represents the total miles traveled by the vacationing group to and from the Targhee.
X_{14}	represents the total travel costs per visitor-day per group spent in the Targhee National Forest.
X_{16}	represents the onsite costs incurred by the vacationing group in the Targhee.
X_{18}	represents the onsite costs per group member.
X_{21}	represents the reciprocal of the vacationing group's size.
X_{22}	is a dummy variable indicating whether it was the respondent's first trip to the Targhee.

[a]Coefficient significant at the 0.10 level of significance.

cordingly, in order to take this feature into consideration in the empirical analysis and because one can expect that the total cost associated with recreation is a function of the number of persons in the group, the onsite price variable has been defined as the average cost per person per day incurred by the recreation group at the recreation site. The variable representing transportation cost to the site has also been expressed as a cost per person. In addition, a variable $(1 / N_j)$ representing the number of persons in the recreational group has been included in the model as an additional independent variable." (p. 34)

Several of the variables hypothesized to affect the user's demand function in this study were expressed on a per person basis (see Table 1). None of these variables, however, was found to be statistically significant in the models that were developed except X_{18} (onsite costs per person) and X_{21} (reciprocal of group size) that were found to be highly significant in the tourist group model (equation 5). The number of persons in the vacationing group may be particularly relevant for tourists who, in many cases, are traveling extensively and incurring many expenses. When a vacationing group has many people, especially children, a long stay in an area such as the Targhee may be a welcome alternative to road travel. Therefore, larger group fixed costs per person are less.

By varying only the price (X_{14}) and quantity (Y) variables while holding all other independent variables at their mean values, a graph with two-dimensional demand curves for local users, tourists and the "pooled" sample can be drawn. The group specific demand models presented in Table 4 are graphed in Fig. 2.

The method used here of separating user subgroups improves the estimation process by improving the fit of the models to the data by allowing the appropriate explanatory variables for each user subgroup to be included in the analysis. Two other modifications that may also prove useful for estimating recreational demand will be explored in the remainder of this chapter: (1) the use of logarithmic data transformations and (2) the computation of a tourist model that takes into account intermediate stops at other recreational areas.

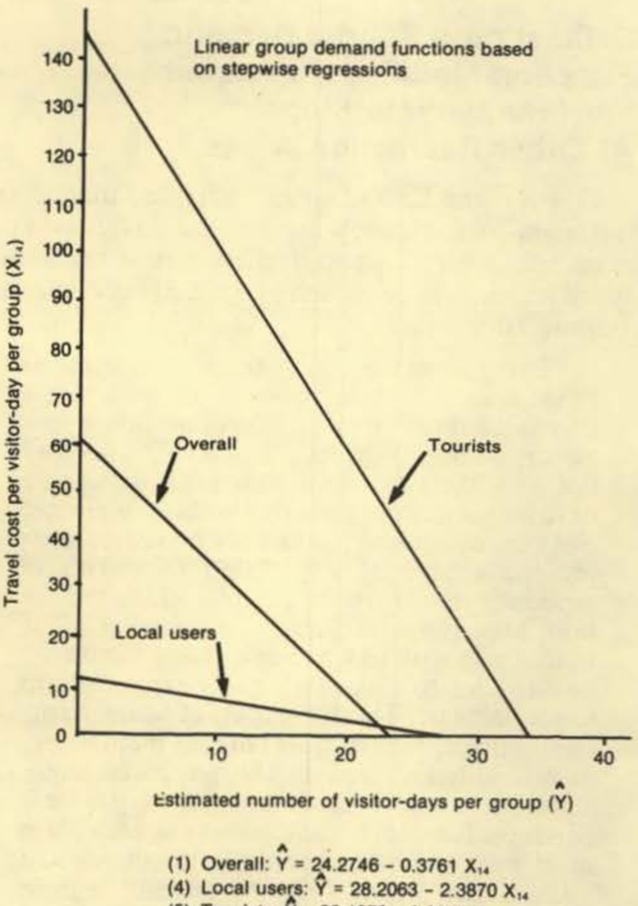


Fig. 2. Group specific linear participatory demand functions for local users, tourists and the entire sample of recreationists.

Logarithmic Data Transformation Models

Data plots of the price and quantity variables indicated that a nonlinear demand function might be more appropriate for estimating recreational participatory demand in the Targhee than a linear model. Specifically, data plots suggested that both the dependent and independent variables be transformed into logarithms so as to improve the fit of the demand functions being specified. By transforming the data, double log models were derived, one or more of which may better estimate recreational demand than the linear models previously specified.

To develop double log models applicable to this study, the variables in Table 1 were transformed into natural logarithms, and stepwise regression techniques were again used to choose the best models. In Appendix 2 the best linear and double log models for local users, tourists and for the entire sample.

The R^2 for the linear models were calculated using untransformed data. The R^2 for the double log models used the sum of squares derived from transformed data. Such R^2 are not directly comparable. Thus, an adjusted R^2 was calculated for the double log models using the sum of squares about the regression (SSE), caused by regression (SSR) and about the mean (SST) based on inverse transformed data.

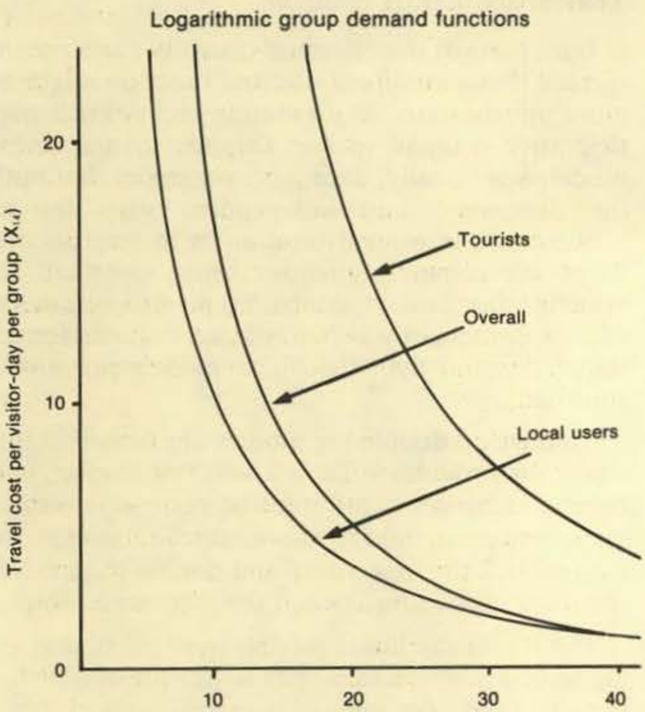
The R^2 statistics were recalculated for the double log models using the following formulas:

$$\text{Adjusted } R^2 = 1 - \frac{\sum_{i=1}^{n} (\text{antilog } Y_i - \text{antilog } Y_i)^2}{\sum_{i=1}^{n} (\text{antilog } Y_i - \frac{\text{antilog } Y_i}{n})^2}$$

$$\text{or adjusted } R^2 = 1 - \frac{\text{adjusted SSE}}{\text{adjusted SST}}$$

Once this adjustment was made, the R^2 statistics for the linear and transformed data models could be compared to determine which regression model best explained the variation in the dependent variable. On the basis of the "adjusted" R^2 statistics, F-ratios and individual t statistics, the double log models for local users, tourists and for the entire sample were judged to be the most appropriate models for estimating the demand for recreation in the Targhee. The R^2 values for the double log models ranged from 0.61 to 0.72, in all cases higher than the R^2 values for the linear models. Similarly, the F statistics were considerably higher for the double log than for the linear models. The calculated F statistic was always highly significant for the double log functions.

The signs of the regression coefficients were also stable; the signs did not change when a double log rather than a linear model was used. Not all of the independent variables found to be significant for the linear model, however, were statistically significant for the double log model and vice versa. In particular, the travel time variable (X_{10}), found to be significant in each of the linear models, was dropped from the double log regressions for all three models being tested.



(6) Overall: $\text{Ln}\hat{Y} = 3.9029 - 0.5512 \text{ Ln}X_{14}$

(7) Local users: $\text{Ln}\hat{Y} = 4.1659 - 0.8804 \text{ Ln}X_{14}$

(8) Tourists: $\text{Ln}\hat{Y} = 4.5117 - 0.5422 \text{ Ln}X_{14}$

Fig. 3. Group specific double log participatory demand functions for local users, tourists and the entire sample of recreationists.

Fig. 3 shows the graphs of the double log demand functions. Again, the demand curves for local users and tourists differ considerably. Note that **at any price**, tourists are apparently able to stay a longer period of time in the Targhee than local vacationers, an observation consistent with the fact that the mean number of days spent in the Targhee by tourists was 14.9 days in contrast to 9.7 days by local users. Further, local users can return more often because of their lower costs.

The method of separating user groups discussed previously was also found to be appropriate when a double log model was used. Similar to the linear models previously developed, the local user double log model had the highest R^2 (0.72), while the overall equation had the lowest (0.61). The tourist model was intermediate with an R^2 of 0.64.

Estimating a Tourist Demand Function Modified To Account For Intermediate Stops At Other Recreation Areas

Clawson and Knetsch (1966) admitted that using a straight-forward application of the travel cost approach is difficult when dealing with a resource-based recreational area such as the Targhee National Forest. They wrote:

> "For recreation experiences at resource-based areas, . . . it is harder to assign a single cost and a single set of satisfactions. Some people on vacations go to a single spot and stay there for their entire vacation; this is the sole or chief purpose of their recreation experience. For others, several places may be visited during the course of a vacation trip. This is especially true when the purpose of the recreation experience is largely sightseeing. The tourist may wish to see several places but would be unwilling to make a relatively expensive trip to see only one. The direct costs of seeing a particular place, such as travel off the main route, meals, lodging, etc., in the particular area, should of course be chargeable to this experience. But family satisfactions at each place must yield some surplus above direct costs of visiting that place, if the "overhead" or main trip costs are also to be offset, or more, by total trip satisfactions. One might attempt to allocate the general costs against each of the attractions visited, but numerous questions would arise in such a division. The results would necessarily

be somewhat arbitrary but might still provide the best possible approximation of relevant costs." (p. 72)

To deal with this problem, Clawson and Knetsch (1966) suggested that only a percentage of the total trip costs be assigned to the site being studied, this percentage varying by distance zone. For example, when studying the demand for recreation in Yosemite National Park, Clawson used the following method for assigning travel costs:

> "For trips of less than 500 miles the whole cost of the trip is charged to Yosemite; the shared cost is therefore the same as the full cost for these trips. On the assumption that trips of more than 500 miles were undertaken only in part to visit Yosemite, costs of trip were charged 80 percent to Yosemite for 500 to 1,000 mile trips, 60 percent for 1,000 to 1,500 miles, 50 percent for 1,500 to 2,000 miles, 40 percent for 2,000 to 2,500 miles and 33 percent for 2,500 and more miles." (p. 74)

Basic to this method is the assumption that vacationers traveling a greater distance to a vacation site make proportionally more stops on their way.

Another method for assigning travel costs was used by Johnson (1977)[4] when studying recreation in northeastern Nevada. He used the following equation to adjust the travel cost variable for visitors who "indicated that the visit was part of a longer trip" (p. 48):

$$TC_{ik} = \frac{(DK_{ik} \times 2) \times .15)^4}{D_{ik}}$$

Where:

TC_{ik} = travel cost of the i^{th} vehicle in the k^{th} campground

DK_{ik} = distance one way from last stop for the i^{th} vehicle in the k^{th} campground

D_{ik} = days stayed in campground on this trip for the i^{th} vehicle in the k^{th} campground

Adjustment of Tourist Data

In this study, mileage, travel time and travel cost data were adjusted for recreationists classified as tourists by employing a method similar to that proposed by Johnson (1977). Respondents were asked to list separately (1) all areas that they **had visited** between the time they left home and their arrival in the Targhee and (2) all areas that they **planned to visit** on the remainder of their trip. Based on these assumptions, two mileage estimates were made for each tourist:

1. The mileage from the Targhee to the area listed as being the user's last stop before arriving in the Targhee.
2. The mileage from the Targhee to the next vacation spot that the respondent planned to visit after leaving the Targhee.

These estimates were made using a direct road route and then summed to arrive at an adjusted mileage figure for each tourist group or family in the sample. Because there are few main highways in Idaho, the task of estimating mileages was made easier, albeit somewhat arbitrary.

Once an adjusted mileage figure was calculated for each tourist listing intermediate stops, the tourist's travel time and travel cost estimates were also modified to reflect the effects of other vacation spots. This was accomplished by first calculating the ratio of each tourist's adjusted mileage to his total trip mileage and then using this ratio to modify the tourist's travel time and travel cost estimates so that a fraction of these estimates was apportioned to the Targhee visit.

Using the adjusted data, linear and logarithmic "adjusted mileage"[5] regressions were calculated for the tourist group. These models are included in Appendix 3. Again, the double log model yielded the best statistical results: the adjusted R^2 for the "mileage adjusted" double log tourist model was 0.65, better than the R^2 for any other tourist model examined.

Figs. 4 and 5 give graphical comparisons of the linear and double log models with and without the data adjusted for intermediate stops. When the tourist data are modified so that only a portion of the travel costs, travel time and mileage is allocated to valuing the Targhee recreational experience, the demand curve becomes more elastic and shifts to the left, indicating demand was previously overstated. These results are reasonable. Estimating tourist demand functions without considering visits to other recreation areas results in a demand curve **for the entire trip**, not simply for the Targhee experience; the demand for the entire trip would be expected to be greater than that for recreation in the Targhee. To isolate the demand for the Targhee recreational experience from the demand for the entire trip, the data should be adjusted as was done here or by using a method similar to those proposed by Clawson, and Knetsch (1966) and Johnson (1977).

Interpretation of Results

Interpreting the economic significance of the recreational demand models estimated in this publication raises several questions. First, what are the economic implications of estimating demand

[4]Johnson (1977) used 15 cents per mile to calculate the travel cost variable.

[5]Demand models based on data modified to account for intermediate stops will be termed "adjusted mileage" models for the remainder of this publication. This terminology will be used to differentiate them from the tourist demand models previously discussed in which no attempt was made to account for intermediate stops.

functions for separate user groups such as local users and tourists, of using double log rather than linear models and of adjusting the tourist demand curve to reflect intermediate stops? And, second, how do these modifications affect estimated consumers' surplus or the net value of recreation in the Targhee National Forest?

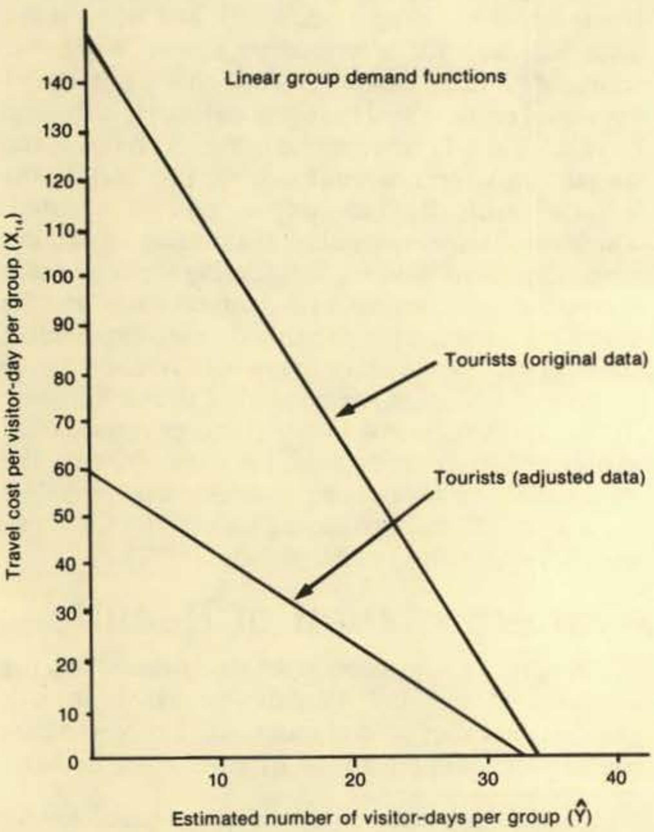
For comparison, the linear and double log overall, local user, tourist and "mileage adjusted" tourist demand models graphed in Figs. 6 and 7 show a negative slope indicating a relationship between the price and quantity variables inverse from that which is expected. Apparently, demand curves for different user subgroups do not coincide: the demand for recreation is much greater for tourists than for local users regardless of whether linear or double log models are used. The differences between the tourist and local user demand curves are lessened when the tourist data are adjusted to account for intermediate stops since the process of adjusting the tourist data to reflect only those costs associated with vacationing in the Targhee has the effect of "netting out" the demand for the Targhee from the demand for the **entire** vacation experience. The "mileage adjusted" tourist demand curves in Figs. 6 and 7, however, still lie to the right of the local user functions, indicating that at any price local users do stay fewer days than tourists regardless of whether the tourist curve is adjusted for intermediate stops.

The observation that the demand for recreation in the Targhee is greater for tourists than for local users may be partially caused by the greater incomes and more leisure time enjoyed by tourists; in general, the greater a consumer's income, the greater the consumer's demand for a particular normal good or service (Henderson and Quandt 1971). Also, the supply of recreation is more readily available to the local users than to the tourists.

Comparisons of Demand Elasticities

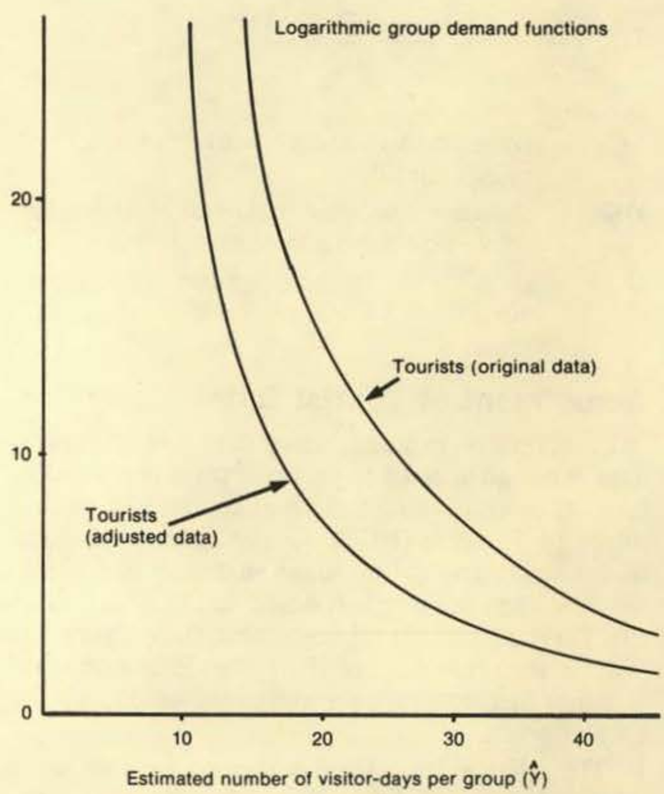
When analyzing demand functions, you should determine and interpret the elasticity of demand,[6] a unitless measure of the responsiveness of the quantity of a good or service taken by consumers to a change in the price charged per unit for the good or service. This concept can be readily applied to the demand for recreation and is useful for better

[6]The elasticity of demand is defined as: $E = (\partial Q / \partial P) \times (P/Q)$ where P and Q are the price and quantity variables, respectively. The elasticities of demand in Table 5 were calculated at the mean values of the price and quantity variables for each model. For the double log models the elasticity of demand is equivalent to the regression coefficient of the "price" variable (X_{14}).



(5) Tourists (original data): $\hat{Y} = 33.1279 - 0.2257\ X_{14}$
(9) Tourists (adjusted data): $\hat{Y} = 32.0868 - 0.5501\ X_{14}$

Fig. 4. Linear tourist models based on original and "mileage adjusted" tourist data.



(8) Tourists (original data): $Ln\hat{Y} = 4.5117 - 0.5422\ Ln_{14}$
(10) Tourists (adjusted data): $Ln\hat{Y} = 4.1633 - 0.6056\ LnX_{14}$

Fig. 5. Double log tourist models based on original and "mileage adjusted" tourist data.

understanding consumer behavior. For example, suppose that the daily campground fee was increased by $1.00. What effect would this increase have on user attendance in the Targhee? Specifically, what effect would this have on the quantity of recreation demanded?

Table 5 shows the elasticities of demand for the linear and double log demand functions. The observed absolute value of the elasticity of demand lies between zero and one for each of the functions, indicating that the demand for recreation in the Targhee National Forest is relatively inelastic for all user groups. That is, if the price of travel increases (decreases) by any given amount, the quantity of days spent vacationing in the Targhee can be expected to decrease (increase) but by a relatively smaller amount. As compared with the demand functions for the tourist group, the local user linear and double log demand curves are considerably more elastic. This indicated that local users are generally more responsive to price changes than are tourists. If the price of travel increases, local users are more likely to cut back on the number of days stayed in the Targhee than tourists.

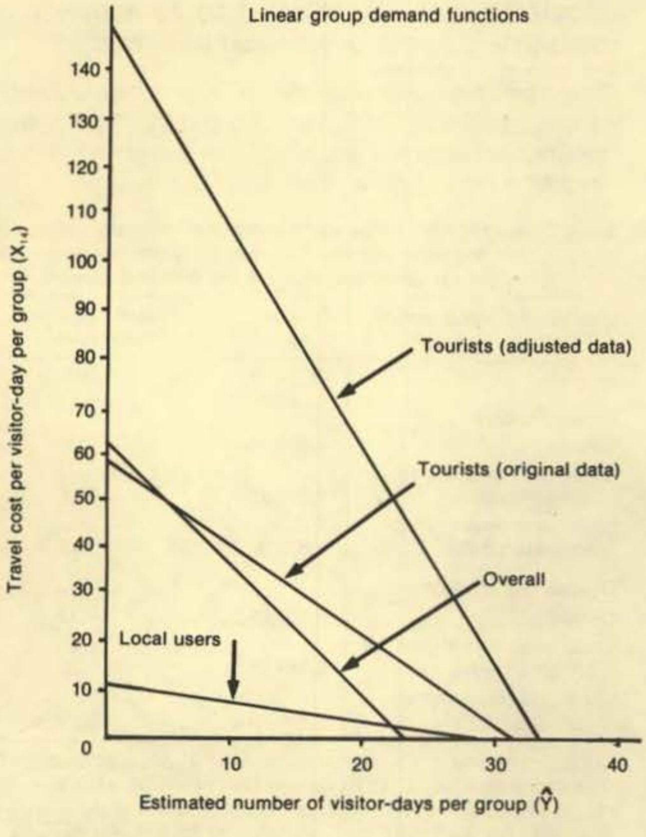
Table 5. Demand elasticities for the linear and double log participatory demand function estimated for the Targhee National Forest.

User classification group	Elasticities of demand[1] Linear functions	Double log functions
Overall	-0.22	-0.55
Local users	-0.67	-0.88
Tourists (original data)	-0.23	-0.54
Tourists (adjusted data)	-0.19	-0.61

[1]For the linear demand functions the point estimates of elasticity are measured at the average number of visitor days consumed by each set of recreationists. In the case of the double log functions, the elasticity of demand would be constant for the whole curve.

Estimation of the Net Economic Value of Recreation Based On Linear Demand Models

The consumers' surplus values derived from the linear function graphed in Fig. 6 serve as estimates of the net benefit accruing to the average vacationing group or family visiting the Targhee. For the linear demand models, the average group's consumer's surplus can be derived simply by finding the triangular crosshatched area shown in Fig. 1. This area is directly dependent on three parameters: (1) the average travel cost per visitor-day per group



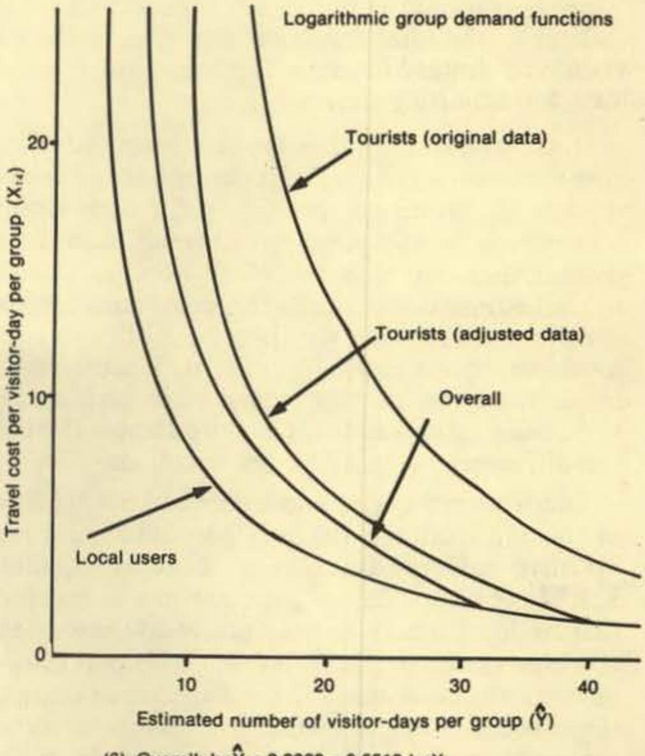
(1) Overall: $\hat{Y} = 24.2746 - 0.3761\ X_{14}$

(4) Local users: $\hat{Y} = 28.2063 - 2.3870\ X_{14}$

(5) Tourists (original data): $\hat{Y} = 33.1279 - 0.2257\ X_{14}$

(9) Tourists (adjusted data): $\hat{Y} = 32.0868 - 0.5501\ X_{14}$

Fig. 6. Overall, local user, tourist and "mileage adjusted" tourist linear demand models.



(6) Overall: $Ln\hat{Y} = 3.9029 - 0.5512\ LnX_{14}$

(7) Local users: $Ln\hat{Y} = 4.1659 - 0.8804\ LnX_{14}$

(8) Tourists (original data): $Ln\hat{Y} = 4.5117 - 0.5422\ LnX_{14}$

(10) Tourists (adjusted data): $Ln\hat{Y} = 4.1633 - 0.6056\ LnX_{14}$

Fig. 7. Overall, local user, tourist and "mileage adjusted" tourist log-log demand models.

(X_{14}), (2) the slope of the demand curve[7] and (3) the maximum amount that an individual group or family would theoretically be willing to pay in travel costs per visitor-day per group. As can be seen in Fig. 6, these parameters differ markedly for the four linear models being examined, the differences affecting the average consumer's surplus estimates derived from each demand model.

Since the demand models estimated are group demand models, the consumer's surplus derived from each model is a measure of the net benefits enjoyed by the average group or family. Because campground use records available from the Forest Service, however, are recorded on a per visitor-day basis, the study should derive a measure of the average consumer's surplus per visitor-day rather than per group; this can be accomplished by dividing the average group's consumer's surplus by the average number of visitor-days. The resulting consumer's surplus per visitor-day represents the net benefits accruing to the individual recreationist staying in the Targhee National Forest per 12-hour period.

If only the overall linear model (equation 1) is used to estimate the demand for recreation in the Targhee — that is, if none of the modifications suggested in the previous chapter were made — the consumer's surplus per visitor-day would equal $8.60. Multiplying this number by 541,500 — the total number of visitor-days of campground use recorded for the Targhee National Forest in 1974 (excluding youth camps) — the total consumer's surplus or the net economic value of the Targhee would equal $4,656,900.

If the overall sample is broken down into local user and tourist groups and separate linear demand models are estimated specifically for each group, however, a lower net value will result than if the overall linear model is used. Based on the demand model estimated specifically for local recreationists, the average consumer's surplus per visitor-day for local users equals $1.09. This estimate is considerably lower than the average consumer's surplus per visitor-day estimated for the entire sample ($8.60), the difference being $7.51 per visitor-day.

Tourists, on the other hand, derived a much higher net benefit from the Targhee than did local users. Tourists enjoyed average net benefits equaling $21.84 per visitor day or over 20 times as much as that of local users. As was previously discussed, however, not all of the $21.84 of net benefits should theoretically be assigned to the Targhee, as some of these benefits are attributable to visits to other recreation areas while enroute to and from the Targhee, or simply resulting from the enjoyment of traveling.[8] Therefore, the "adjusted mileage" tourist model should be used instead of the unadjusted model to derive a relevant value estimate; the average consumer's surplus per visitor-day for tourists based on the "adjusted mileage" tourist model equaled $8.95.

To derive a total net value for recreation based on the local user and tourist consumer's surplus estimates, the study needed to assume that the ratio of the number of local users to tourists in the sample was representative of the ratio for the entire population of users. This ratio was 2.3155 for the sample on which the statistical analyses were based; the study assumed 2.3155 local users to every 1.0 tourist in the entire population of users. Therefore, of the 541,500 visitor-days that recreationists vacationed in the Targhee in 1974, 378,176 visitor-days were apportioned to local users and 163,324 visitor-days were apportioned to tourists. Table 6 shows the net economic values for recreation in the Targhee based on these estimates.

Comparing these estimates to the net benefit figure of $4,656,900 derived from the overall linear model, a **lower** total consumer's surplus or net value will result when the sample is divided into user groups and separate demand and consumer's surplus estimates are derived. This is especially true when the tourist data are adjusted to account for intermediate stops at other vacation areas.

[7]The slope of the demand function is equal to the reciprocal of the regression coefficient for the travel cost per visitor-day per group variable.

[8]The time spent traveling may or may not be a disutility as suggested by Cesario and Knetsch (1970). For some groups, the time spent traveling between recreation areas may be a benefit rather than a cost.

Table 6. Average net value and average net value per visitor-day for recreation in the Targhee National Forest in 1974 based on linear and double log demand models.[a]

User model upon which estimate is based	Net value	Net value per visitor-day
	(dollars)	(dollars)
Linear models		
Overall	4,656,900	8.60
Local user and tourist (original data)	3,979,208	7.35
Local user and tourist (adjusted data)	1,873,962	3.46
Double log models		
Overall	9,709,095	17.93
Local user and tourist (original data)	4,984,268	9.20
Local user and tourist (adjusted data)	2,616,070	4.83

[a]All calculations are based on a total of 541,500 visitor-days for the entire sample, 378,176 visitor-days of which were assumed to be "consumed" by local users and 163,324 visitor-days by tourists. For example, the net value of $3,979,208 derived by aggregating the consumer's surplus values for local users and for tourists was calculated as follows, where $1.09 is the average cost per visitor-day for local users and $21.84 is the average cost per visitor-day for tourists:

$3,979,208 = (378,176 visitor-days for local users × $1.09) + (163,324 visitor-days for tourists × $21.84)

Net Economic Value Estimates Based on Logarithmic Demand Models

Consumer's surplus values were derived from the double log models by integrating each demand function[9] from the mean cost per visitor-day per group to the maximum cost per visitor-day per group response as shown in Fig. 8. Table 7 compares the average consumer's surplus per visitor-day values for the linear and double log overall, local user, tourist and "mileage adjusted" tourist models. For all user groups, the consumer's surplus per visitor-day was discovered to be higher for the double log than for the linear models.

The overall double log consumer's surplus per visitor-day equaled $17.93, and the net economic value of recreation in the Targhee was estimated to equal $9,709,095 based on the overall double log model and on 541,500 visitor-days of use in 1974. This net benefit figure was found to be more than **twice** as large as the net value calculated for the overall linear model.

As was true for the linear models, however, separation of the sample into user groups had the effect of lowering the net benefits estimate; when the local user and tourist double log models were used rather than the overall model, the value estimate dropped from $9,709,095 to $4,984,268. This value was further reduced to $2,616,070 by basing the estimate on the local user double log model in conjunction with the "mileage adjusted" rather than the unadjusted tourist double log model.

[9]The demand functions being integrated are those functions in which all independent variables except the travel cost variable (X_{14}) are held constant at their mean values while the travel cost (X_{14}) and quantity (Y) variables are allowed to vary. The demand curve is integrated with respect to the travel cost variable.

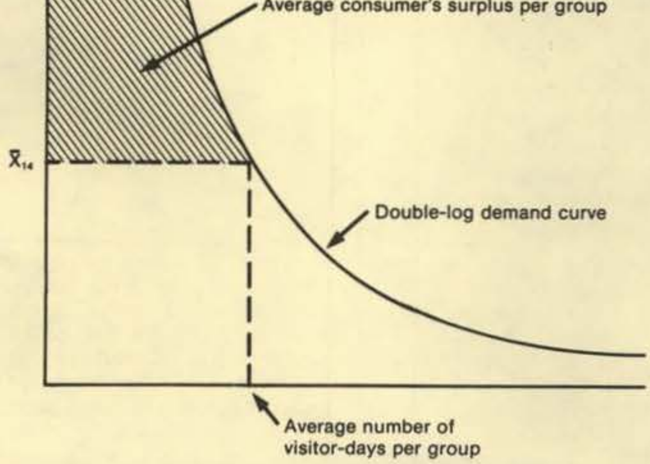


Fig. 8. A hypothetical consumer's surplus for a logarithmic demand function

Table 7. Average consumer's surplus per visitor-day values for linear and log-log demand models

User classification group	Linear functions	Double log functions
	(dollars)	(dollars)
Overall	8.60	17.93
Local users	1.09	2.56
Tourists (original data)	21.84	24.59
Tourists (adjusted data)	8.95	10.09

Conclusions

The conclusion is that the three modifications suggested in the previous section had different predictable effects on the net economic value estimated for outdoor recreation in the Targhee National Forest. The first modification — that of separating the sample into user subgroups such as local users and tourists — consistently resulted in a lower net economic value than that derived from a model based on the entire sample.[10] This downward trend was evident for both linear and double log models.

Second, the method of transforming both the dependent and independent variables into logarithms resulted in relatively high consumer's surplus values regardless of user group. The double log models consistently yielded higher net values than their linear counterparts.

And, lastly, the method of adjusting the mileage, travel cost and travel time variables for tourists making intermediate stops at other recreation areas in addition to the Targhee had an effect. It lowered the net value estimate by assigning fewer benefits to the Targhee visit.

The study concluded that the net benefit of $2,616,070 derived from the double log local user and adjusted tourist models was the most theoretically and statistically appropriate estimate of the net economic value of recreation in the Targhee National Forest. This value was $2,040,830 **lower** than would have been derived if no modifications had been made — that is, if a linear demand model based on the entire sample of users was estimated. The study recommends that these modifications be made when estimating the economic value of recreation if an overestimate of this value is to be avoided.

[10]This was true for destination, nondestination, instate and out-of-state subgroups as well.

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Appendix 1

Table 1. Linear demand models for local users and tourists, destination and nondestination vacationers and instate and out-of-state recreationists based on the independent variables found to be statistically significant in equation 1.

Local user demand function

$Y = 10.1631 + 0.2272X_6^{**} + 0.2685X_{10}^{*} + 0.0148X_{11}^{**}$ (3.273) (2.445) (4.705)

$-2.3870X_{14}^{**} + 0.2538X_{16}^{**}$ (−18.305) (24.770)

$R^2 = 0.67$, $F = 152.88^{**}$, $N = 389$

Tourist demand function (original data)

$Y = 13.7344 + 0.4179X_6^{*} + 0.0377X_{10}^{**} + 0.0023X_{11}^{*}$ (2.507) (2.972) (2.178)

$-0.3308X_{14}^{**} + 0.1577X_{16}^{**}$ (−7.708) (9.890)

$R^2 = 0.54$, $F = 37.47^{**}$, $N = 168$

Destination user demand function

$Y = 10.9423 + 0.4686X_6^{**} + 0.1369X_{10}^{**} + 0.0058X_{11}^{**}$ (4.282) (7.038) (5.237)

$-1.1269X_{14}^{**} + 0.1725X_{16}^{**}$ (−11.226) (14.392)

$R^2 = 0.63$, $F = 118.52^{**}$, $N = 358$

Nondestination user demand function

$Y = 9.2475 + 0.2604X_6^{*} + 0.0291X_{10}^{*} + 0.0034X_{11}^{*}$ (2.056) (2.581) (3.826)

$-0.3112X_{14}^{**} + 0.1675X_{16}^{**}$ (−8.099) (12.100)

$R^2 = 0.54$, $F = 45.35^{**}$, $N = 199$

Instate use demand function

$Y = 7.6984 + 0.1695X_6^{*} + 0.2085X_{10}^{**} + 0.0089X_{11}^{**}$ (2.139) (5.203) (2.949)

$-1.0115X_{14}^{**} + 0.2052X_{16}^{**}$ (−9.381) (17.362)

$R^2 = 0.52$, $F = 70.68^{**}$, $N = 340$

Out-of-state user demand function

$Y = 13.8574 + 0.4914X_6^{**} + 0.0362X_{10}^{**} + 0.0023X_{11}^{*}$ (3.072) (3.060) (2.386)

$-0.3358X_{14}^{**} + 0.1575X_{16}^{**}$ (−8.335) (11.047)

$R^2 = 0.53$, $F = 46.49^{**}$, $N = 217$

Appendix 2

Table 1. Linear and logarithmic demand models for the entire sample of recreationists vacationing in the Targhee National Forest.

Linear demand function

$$Y = 9.4063 + \underset{(3.668)}{0.3090X_6^{**}} + \underset{(4.457)}{0.0385X_{10}^{**}} + \underset{(6.334)}{0.0040X_{11}^{**}} - \underset{(-12.855)}{0.3761X_{14}^{**}} + \underset{(18.847)}{0.1696X_{16}^{**}}$$

$R^2 = 0.53$
$F = 121.88^{**}$
$N = 557$

Double-log demand function

$$\text{Ln } Y = 0.8141 + \underset{(2.504)}{0.0483 \text{Ln}X_6^{**}} + \underset{(20.967)}{0.4042 \text{Ln}X_{11}^{**}} - \underset{(-23.619)}{0.5512 \text{Ln}X_{14}^{**}} + \underset{(23.851)}{0.4090 \text{Ln}X_{16}^{**}} - \underset{(-11.058)}{1.5238 \text{Ln}X_{21}^{**}}$$

$R^2 = 0.61$ (adjusted)
$F = 246.42^{**}$
$N = 557$

Table 2. Linear and logarithmic demand models for local users vacationing in the Targhee National Forest.

Linear demand function

$$Y = 10.1631 + \underset{(3.273)}{0.2272X_6^{**}} + \underset{(2.445)}{0.2685X_{10}^{*}} + \underset{(4.705)}{0.0148X_{11}^{**}} - \underset{(-18.305)}{2.3870X_{14}^{**}} + \underset{(24.770)}{0.2538X_{16}^{**}}$$

$R^2 = 0.67$
$F = 152.88^{**}$
$N = 389$

Double-log demand function

$$\text{Ln } Y = 0.4669 + \underset{(13.003)}{0.3220 \text{Ln}X_{11}^{**}} - \underset{(-25.827)}{0.8804 \text{Ln}X_{14}^{**}} + \underset{(30.407)}{0.5559 \text{Ln}X_{16}^{**}}$$

$R^2 = 0.72$ (adjusted)
$F = 409.34^{**}$
$N = 389$

Table 3. Linear and logarithmic demand models for tourists vacationing in the Targhee National Forest.

Linear demand function

$$Y = 23.5358 + \underset{(2.657)}{0.4173X_6^{**}} + \underset{(4.256)}{0.0470X_{10}^{**}} - \underset{(-6.1101)}{0.2257X_{14}^{**}} + \underset{(10.797)}{0.4207X_{16}^{**}} - \underset{(-2.245)}{17.2551X_{21}^{**}} - \underset{(-1.800)}{5.1968X_{22}^{a}}$$

$R^2 = 0.58$
$F = 36.88^{**}$
$N = 168$

Double-log demand function

$$\text{Ln } Y = 0.3518 + \underset{(2.476)}{0.0927 \text{Ln}X_6^{*}} + \underset{(7.801)}{0.4890 \text{Ln}X_{11}^{**}} - \underset{(-14.650)}{0.5422 \text{Ln}X_{14}^{**}} + \underset{(10.290)}{0.3102 \text{Ln}X_{16}^{**}} - \underset{(-5.285)}{1.5172 \text{Ln}X_{21}^{**}}$$

$R^2 = 0.64$ (adjusted)
$F = 85.64^{**}$
$N = 168$

[a]Coefficient significant at the 0.10 level of significance.

Appendix 3

Table 1. Linear and logarithmic "mileage adjusted" demand models for tourists vacationing in the Targhee National Forest.

Linear demand functions		Double-log demand function	
$Ln\,Y = 18.2587 + \underset{(3.969)}{0.5739X_6^{**}} + \underset{(4.869)}{0.0086X_{11}^{**}}$	$R^2 = 0.57$	$Ln\,Y = 0.5724 + \underset{(3.116)}{0.1223LnX_6^{**}} + \underset{(1.772)}{0.1492LnX_8^{a}}$	$R^2 = 0.65$ (adjusted)
$- \underset{(-5.282)}{0.5501X_{14}^{**}} + \underset{(9.875)}{0.3888X_{18}^{**}}.$	$F = 35.05^{**}$	$+ \underset{(9.817)}{0.3968LnX_{11}^{**}} - \underset{(-12.680)}{0.6056LnX_{14}^{**}}$	$F = 60.43^{**}$
$- \underset{(-2.279)}{17.7594X_{21}^{**}} - \underset{(-1.844)}{5.3860X_{22}^{a}}$	$N = 168$	$+ \underset{(10.036)}{0.3241LnX_{18}^{**}} - \underset{(-4.598)}{1.3614LnX_{21}^{**}}$	$N = 168$

[a]Coefficient significant at the 0.10 level of significance.

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