

# A VALUATION OF RECREATIONAL BENEFITS

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## ABSTRACT

*This paper attempts to find a minimum value for the recreational benefits of the Kauaeranga Valley, Coromandel State Forest Park.*

*The method used is a variant of the "travel cost method", which was initially developed in the 1950s by M. Clawson. It involved collecting data on distances travelled by visitors, and their socio-economic characteristics. A questionnaire survey was used for this purpose. Demand curves for the "whole recreational experience" are derived using several different values for "price". These include upper and lower estimates of the variable cost of travel, and an estimate of the variable cost of travel time. A demand curve for the site is derived from each "whole experience" demand curve using cross-sectional analysis. The measure of annual return used is total surplus which is equal to the area under the demand curve.*

*The minimum value derived for the recreational return is \$100 000/yr (1981 3rd quarter terms). Assuming this minimum return to remain constant for at least 20 years, the Valley's minimum value as a recreational resource is \$1 million at a discount rate of 10%.*

## INTRODUCTION

Expenditure requires justification. This is true regardless of whether the expenditure is on production forestry with its reasonably defined market values, or recreation forestry, where "values" are much less clearly defined. Currently in New Zealand, recreational expenditure is justified by subjective valuation of benefits. Subjective valuation is cheap and may be accurate, but will also reflect the biases of the valuers. This paper attempts to give management an objective valuation of recreational benefits.

Land, as all capital, has many mutually exclusive uses. For example, interest may develop in mining the Kauaeranga Valley — an activity which may reduce the recreational appeal of the area. In choosing between conflicting land uses, managers must

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know the relative benefits of the choices available. The benefits of mining, as with other market activities, can be eloquently shown in economic terms. However, as stated at the 1978 FRI Workshop on Forest Recreation (Tustin and Kennedy, 1978): "... data on recreation demand ... is generally weak or absent at national, regional and forest levels." Subsequently, recreation's "lack of economic comparability" has been an advantage/dis-advantage (take your pick depending on your biases) in investment decisions. This paper attempts to put recreation in a framework comparable with other investment alternatives.

### SAMPLING METHOD

Visitors to the Valley were sampled over the summer of 1981-2 by self-administered questionnaires in the Park Headquarters. Two previous visitor surveys have been carried out in the Park, one in 1971-2 (refer Kelly and Black, 1972) and one in 1976. The questionnaire used in the 1981-2 survey was based on those used in the previous two surveys, to allow examination of trends in the demographic characteristics of visitors. Cross-reference to demographic characteristics of census data made it possible to determine which changes in the visiting population were due to changes in the catchment population (the "catchment population" refers to the residents of areas from which the majority of visitors come). Conveniently, a national census has been carried out immediately prior to each of the three surveys — *i.e.*, in 1971, 1976 and 1981.

The sampling method adopted in the 1981-2 survey was non-random because:

- (1) Some groups may not have called at the Park Headquarters (although Forest Service signs erected at intervals along the Kauaeranga Valley road urge all visitors to call at the Headquarters).
- (2) Some groups may have failed to complete a questionnaire even though they visited the Headquarters.
- (3) The sampling period covered only the two months of most intensive use, whereas the benefit estimate derived from the survey data refers to a twelve-month period.

The primary advantage of the sampling method is its cheapness, allowing continuous sampling over a long period. Hence the survey aimed for high precision at the possible cost of some bias. Comparison of 1981-2 survey results with the previous two

surveys indicates that bias did occur, which, if uncorrected, would lead to a slight over-estimate of benefits.

### DERIVATION OF THE WHOLE EXPERIENCE DEMAND CURVE

The results of the 1981-2 visitor survey were used for the valuation.

The travel-cost method of recreational benefit valuation was pioneered by Clawson (1959) and has been modified by numerous researchers since. Basically, the method separates visitors by the respective distances they have travelled to the site from "origin zones". A specific cost of travelling to the site can be associated with each origin zone. Hence we have a relationship between quantity (number of visitors) and price (distance from the site) which allows the derivation of a demand curve for the "whole recreational experience" (this includes recreation at the site plus the outward and return journeys). Cross-sectional analysis may then be used to derive a demand curve for the site itself from the whole experience demand curve.

Integrating the site demand curve gives the "total surplus", a measure of benefits, for a recreational site with no admission charge. Refinements of the method include demand determinants other than just distance to give a multi-variate demand schedule. Some researchers have attempted to include the value of travel time in the model.

This study, for simplicity, considers distance as the only variable significantly affecting demand. Previous researchers have found this assumption to be well justified (*e.g.*, Mansfield, 1969). This study tests the sensitivity of the final benefit estimate to the inclusion of the value of travel time.

The Clawson method assumes that recreationists make their trip for the purpose of visiting the site only. But the Coromandel Peninsula is a popular holidaying area. Many groups may, for example, travel to the Peninsula from Auckland for one or two weeks' holiday, and visit the Kauaeranga Valley for only one or a few days, as part of their holiday. Hence, the common practice in previous Clawson studies of classifying users in origin zones by their home addresses would lead to an overestimation of benefits attributable to the site. This bias was reduced in this study by asking respondents where they had begun that particular day's travel to the Park, and classifying them in zones according to their replies.

Careful consideration was given to the number of origin zones in which to divide the catchment area. Gibson (1974) warns against aggregating too large areas into one zone, as the resulting regression (used to derive the demand curve from the data scatter) is left only to explain variation between these large zones. Variation within them is ignored. And there is also the consideration that a minimum number of zones will be required to give a sufficient number of points to determine the demand curve accurately. Clawson and Knetsch (1976) recommended there should be at least 10 zones in a 350 km radius catchment area (an area of this size would encompass the vast majority of visitors to the Kauaeranga Valley). Working against these two good reasons for having many, small zones is the consideration that, in defining a zone, there should be a minimum number of visits from that zone so as to give a smooth picture of demand. Mansfield (1969) used a minimum of 2 visits per zone and this minimum was adopted in this study.

The catchment was divided into 24 origin zones and the number of visits from each zone was determined from the survey data. These visitation rates were weighted by the census population of each origin zone, except for zones on the Coromandel Peninsula. Here estimates of summer populations were used to weight gross visitation rates, instead of census populations which are accurate for 31 March only.

Return zonal distances were calculated from the approximate centre of population of each zone to the Park Headquarters via the most direct road route.

To carry out a linear regression of distance versus weighted visitation rates, the negative-exponential scatter first had to be transformed to a linear form. After considering a number of feasible transformations, the following regression was adopted:

$$\ln Y = a - bX^{0.5}, \quad r = -0.8572$$

Where  $Y$  = weighed visitation rates (group visits/000 population)

$X$  = distance (km)

$a, b$  are regression coefficients.

The final stage in forming the whole experience demand curve was to convert the distance variable ( $X$ ) to a price variable ( $P$ ). This can be done simply by multiplying  $X$  by the variable cost of travel.

The average variable cost of travel for respondents (excluding travel time) was calculated as a weighted average of the running

costs (excluding repair and maintenance costs) of different sizes and types of vehicles used by visitors to the Valley. Harrison and Quarimby (1969) concluded from several English case studies that the average imputed travel cost is slightly more than the cost of petrol. This is why repair and maintenance costs were excluded in this study. Common (1973) disagrees with this practice. He argues that other project valuations are based on actual rather than imputed costs. Hence using imputed travel costs would bias investment against recreation (assuming that imputed costs are less than actual costs). Since the aim of this study was to produce a firm minimum value of benefits, it was decided to use imputed costs.

The variable cost of travel thus arrived at was 0.054-0.094 \$/km at 95% confidence. Each zonal distance was multiplied by the minimum limit (\$0.054/km) to form a price variable ( $P_1$ ). A regression was calculated and the following function obtained (significant at 99%):

$$\ln Y = 5.99459 - 0.984083 P_1, r^2 = 0.735 \quad (1)$$

Similarly, for the maximum travel cost (\$0.094/km) the following regression was obtained (significant at 99%):

$$\ln Y = 5.993297 - 0.745102 P_2, r^2 = 0.734 \quad (2)$$

Cesario (1976) summarized several empirical studies by saying that the value of travel time for the average person appears to be very approximately one third of the average wage rate. Using this premise, the cost of travel time for the average group visiting the Valley was estimated at \$0.062/km per group. No pretence is made that this is an accurate calculation of the travel time value. It is only intended to give an indication of the true value, with which to test the sensitivity of the final benefit estimate to the inclusion of the value of travel time.

The time value estimated was added to the minimum vehicle operating cost of \$0.054/km to give \$0.116/km. This value was multiplied by each zonal distance to give the price variable  $P_3$ , and the following regression derived (significant at 99%):

$$\ln Y = 5.994115 - 0.671650 P_3, r^2 = 0.735 \quad (3)$$

#### DERIVATION OF THE SITE DEMAND CURVE, AND ESTIMATION OF BENEFITS

The demand curve for the site can be obtained from the whole experience demand curve by cross-sectional analysis, and

the method is outlined in Clawson and Knetsch (1976). These authors note (p.84) that:

"... The conversion from demand for the whole recreation experience to the demand for the recreation resource is relatively simple and does not introduce errors of its own."

The cross-sectional analysis requires that the number of group visits at the current admission price (\$0) is known. This was estimated at 23 639 group visits per annum, using a traffic counter and a regression estimator to convert gross number of axles to the number of recreational groups entering the Park.

Site demand curves were calculated from each of the whole experience curves (1) — (3) derived above. A fourth site curve was calculated from the lower 95% confidence limit of regression (1), and will hereafter be referred to as "(4)".

The four curves were integrated to give the total surplus estimates shown in Table 1.

TABLE 1: THE BENEFIT ESTIMATES

<i>Site Demand Curve</i>	<i>Total Surplus (\$/yr)</i>
(1)	157 500
(2)	260 000
(3)	325 000
(4)	102 300

*Origin of Curve*

- (1) Minimum Vehicle Operating Cost (V.O.C.).
- (2) Maximum V.O.C.
- (3) Minimum V.O.C. plus cost of travel time.
- (4) Lower 95% confidence limit curve of (1).

## DISCUSSION

We are confident that the benefit estimate from site demand curve (4) (approximately \$100 000/yr) is the minimum value of the true figure. This is in spite of the previous conclusion that the sampling method may have caused bias resulting in a slight overestimate of benefits. The following conservative decisions were made in arriving at site demand curve (4), and the tendency of these decisions to underestimate the true benefit figure will more than outweigh the slight upwards bias that may have been introduced by sampling:

- (1) The imputed rather than actual running cost of vehicles was used. The actual cost (which equals the imputed cost plus

the cost of repairs and maintenance) is slightly more than double the imputed cost.

- (2) The minimum limit with 95% confidence for the estimate of imputed vehicle operating cost was used to derive benefit estimate (4). Contrast benefit estimate (2) (\$260 000/yr, Table 1) which used the maximum rather than the minimum limit of the imputed operating cost.
- (3) The value of travel time is assumed to be zero in benefit estimate (4). Contrast benefit estimate (3) (\$325 000/yr, Table 1) which includes the value of travel time.
- (4) Site demand curve (4) is taken from the 95% lower confidence limit of the mean values of the regression for the whole experience curve. Contrast benefit estimate (1) (approximately \$160 000/yr, Table 1) which simply uses the regression itself rather than the lower confidence limit.
- (5) Benefit estimate (4) does not include the value of option demand.
- (6) Benefit estimate (4) does not include secondary benefits.

Management will also be interested in the value of the Valley as a recreational resource *per se*, that is, its "resale value" as opposed to its annual return. A tentative guideline is presented in Table 2. These estimates rest on the assumption that the real

TABLE 2: TENTATIVE ESTIMATES\* OF THE VALLEY'S RECREATIONAL VALUE

Discount Rate $r$	Value (millions of 1981 dollars) (Assumes minimum return of $a_i = \$100\ 000/\text{yr}$ )
-2%	—
0%	—
2%	5
5%	2
10%	1
15%	0.7

\*The discounted sum of all future returns converges to simply  $a_i/r$  where  $r > 0$ .

annual return will remain constant for at least the next 20 years (and longer for the lower discount rates). It seems reasonable to assume that the present returns will probably not decrease, and may well increase, over this period because of the following trends:

- (1) The population of the catchment area is still rapidly increasing.
- (2) Public awareness of health and fitness is increasing.
- (3) Average leisure time is increasing due to technological innovation and other causes.

However, this is largely conjecture, and the projection of future recreational demand merits further research.

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