EVALUATION OF ENVIRONMENTAL INTANGIBLES

Review of Techniques

by

Nicholas H. Coomber and Asit K. Biswas

Ecological Systems Branch
Research Co-ordination Directorate
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CHAPTER I

INTRODUCTION

The Importance of Intangibles

To permit the accurate evaluation of environmental use, with the purpose of optimizing beneficial outputs, natural resource planning organizations are becoming increasingly aware of the importance of the intangible components of resource utilisation. These elements have been considered until recently to be an immeasurable part of project evaluation, and no monetary value could be imposed on the value of such a resource almost by definition. This extra summation was either ignored, or inserted as a final weighting of the decision making process, on a presence-absence basis (Shelton 1968, p.17). However, this process is no longer adequate for the utilization of 'common property' resources (Crutchfield 1962, p.145; Kneese 1970, p. 191) since it ignored the true social benefits and costs associated with the total effects of resource use. In the evaluation of these social benefits and costs lies the basis of the present report, wherein an attempt has been made to view the development and critical importance to the justification of the conservationist movement to evaluating environmental intangibles.

First, however, the notion of 'intangibles' must be elaborated. The concern here is with all those components of environmental appreciation, entailing either observation or physical exploitation, which are not directly quantifiable, or if quantifiable, cannot be valued by market mechanism (Devine 1966, p. 383; Prest and Turvey 1965, p. 696; U.S. Water Resources Council (U.S.W.R.C.) 1962, p. 8; 1969, p. 27). The net social or 'psychic income' (Prewitt 1949, p. 15; Seckler 1966, p. 489) from resource use in this sense, extends beyond the concept of secondary benefits, and includes psychic and indirect monetary benefits to the user and ultimately to society as a whole. Normally, intangibles accrue from the aesthetic, scientific, educational, historical or recreational aspects of the natural environment. Shelton (1968) generalizes such elements by identifying "uniqueness, diversity and general health or optimum or proper functioning within the environment" (Shelton 1968, p. 17), while Kates (1966, p. 22) more briefly suggests in a Benthamite vein that health, wealth and pleasure are the basis of proper resource management.

It is sufficient justification for the present investigation of techniques used in the quantitative evaluation of intangibles, that they may be incorporated into multiple purpose project evaluation. But apart from this potential there exist further-reaching implications for the quantitative analysis and modelling of many of the qualities of life, and, indeed, of life itself. This theme of scientific analysis is demonstrated in research concerned with the serendipic scientific value of plant and animal communities (Kreig 1964), the values of saving lives (Starr 1968), of aesthetics in art and music (Birkhoff 1933), and of health and education (Prest and Turvey 1965, p. 724). All possess economic value but rarely attain the dubious privilege of a prefixed dollar sign.

The ability to evaluate, in economic terms, the potential of the resource-type described above has obvious advantages for the accurate assessment of optimum resource use. Even now the toll of economic and ecologic blunders has reached crisis magnitude, and it is no longer justifiable to undertake a project on the basis of short-run economic gains. The instances of pollution costs exceeding economic gains are now too numerous to recite, but the development of evaluatory techniques designed to prevent these may also prevent unwise expenditures on the development of intangible resources. To exemplify, Carter (1966, p. 42) has noted that the construction of a new road and parking area for visitors to Daisy Geyser in Yellowstone National Park contributed to the dormancy of the geyser itself. Similarly Marts and Sewell (1959, p.48) recounted in 1959 that "multi-million dollar investments are made in fish passage facilities without being supported by any systematic economic analysis, whereas other investment aspects of the project under consideration will be buttressed with often elaborate economic studies". In addition to the prevention of mistakes and unwise investment, the development of evaluatory techniques may preclude the use of previously misleading calculations of intangible benefits. In Major's (1970) account of the Big Walnut Creek Project, Indiana, previous estimates of the benefit-cost ratio were stated to be as high as 2.3, but almost half of the total benefits were assessed using the completely arbitary value of one dollar per 'visitor-day' predicted (Major 1970, p. 35). The adoption of similarly arbitrary and outdated recreation values is discussed herein, but it may be relevant here to note that from 1950 until 1957 the U.S. National Parks Service adopted the method of assuming that recreational benefits would equal twice the cost of providing the service (U.S. National Parks Service 1950), a technique, perhaps born in desperation, which was obviously untenable since any project was automatically economically justified.

Justification for the development of these techniques may also be found in the basis of Krutilla's 'new conservation' (Krutilla 1967) or Wollman's 'new economics' (Wollman 1967). The intangible benefits of a policy "providing for the present and future the amenities associated with unspoiled natural environments, for which the market fails to make adequate provision" (Krutilla 1967, p. 778), must be recognized and measured through these techniques. Krutilla (p. 780) further lists the irreplaceability of the natural environment (in spite of regenerative ability) compared with the substitutability of mineral resources, the serendipity value of research in biotic communities, and the strength of 'option demand' (see also Pearse 1968, p. 88) as justification for these 'merit wants' (see also Davis 1963, p. 10; Robinson 1967, p. 455).

The crisis in conservation is the culmination, according to Krutilla, of technological progress. The movement toward Pigovian social time preference (Pigou 1920; Eckstein 1958; Reichardt 1969, 1970), which began in the 1920's, has eventually reached open conflict with private entrepreneurship. Kates (1966, p. 22) comments that this is "the Galbraithian thesis of the need to redress the balance between public need and private consumption", while Galbraith (1964, p. 122) himself notices that "as the economic problem is resolved people can be expected to become increasingly concerned about the beauty of their environment". Several authors emphasize the problem of short-run conflicts with 'welfare economics' (Johnson and Huff 1966, p. 70; Galbraith 1964, p. 122), describing the difficulties of defending a common property resource against short-run exploitation.

Intangibles and Benefit-Cost Analysis

Benefit-cost analysis may be regarded as an economist's tool to assess the economic efficiency of a proposed course of action. It has been alternatively labelled as 'investment planning' or 'project appraisal' (Prest and Turvey 1965, p. 683), and is essentially "a way of looking at problems of choice" (Devine 1966, p. 383) in monetary terms. The *Green Book* refers to this as a "guide for effective use of the required economic resources, such as land, labor, and materials, in producing goods and services to satisfy human wants ..." (U.S. Water Resources Council 1969, p. 5) and specifically relates this notion to river basin planning. More generally, it involves the quantification in economic and numeric terms of tangible and intangible benefits and cost associated with project evaluation (Ciriacy-Wantrup 1955). Most discussions assume a fixed budget and a projected social discount rate fixed according to present circumstances (Krutilla 1967). The major problem in application is analogous to that of dynamic programming in attempting to derive a static solution in an ever-changing continuum. Ultimately, because of the many inherent difficulties, some of which are discussed below, in the accurate assessment of total benefits and costs, decisions regarding resource development are often made on a political rather than economic basis. This reaction to non-economic,social and political pressures may, however, constitute an acceptable compensatory factor for the approximations in the evaluation of inestimable or intangible components of a particular scheme. In particular, it may allay some fears that economic analysis of intangibles will invariably understate true values with consequently less political support for conservation than is justified.

Economic analysis of benefits and costs is based on traditional demand and supply theory, as exemplified by Tweeten and Tyner (1966) in their description of the concept of social costs. They reason that, in Figure 1, where curve DD_1 is the market demand, and SS_1 an industry's supply of a marketable good, net social gain is measured by the vertical distance between the two at any given quantity. Total social gain is shown in the shaded area above PeB which indicates producer surplus (x) added to the area below this line which indicates producer surplus (y). For any given quantity or production level, the corresponding part of this area will represent net social gain. This kind of analysis is, however, clearly

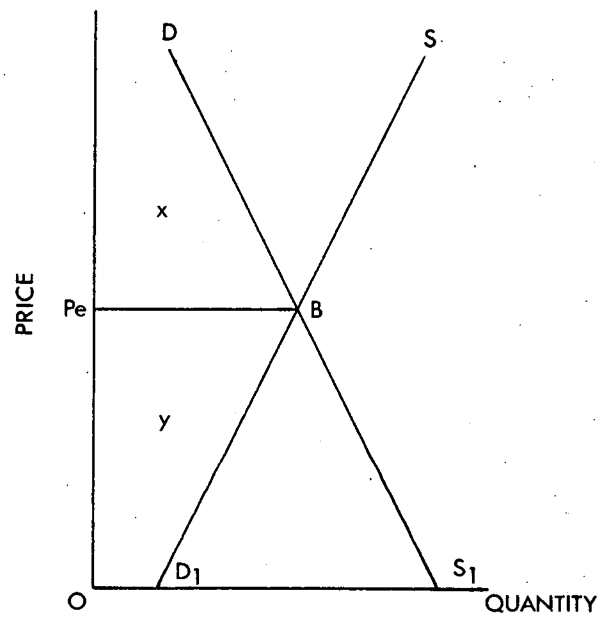

Figure 1. Net Social Gains Derived from Normal Supply and Demand Functions (After Tweeten and Tyner)

untenable by virtue of the nature of the recreational good. For this theoretical framework of social gain to be practical, the good must be marketable and quantifiable, and neither of these characteristics are evident in recreation.

The Outdoor Recreation Resources Review Commission (O.R.R.R.C.) Report No. 24 (1962) describes a slightly more realistic supply function, designed for recreation, which if correctly interpreted may furnish some indication of recreational benefits to users. Assuming that demand for a particular facility is known and its function calculated, it may be regarded, according to the report, as a revenue curve. Other evaluatory techniques have used only this demand curve for estimates of user benefits, but this study attempts to define the optimal level of use for maximum total satisfaction. This is achieved simply by calculating total costs for all levels of use, or for all possible sizes of the facility (Figure 2) to provide a costs curve. Marginal revenues and costs may then be

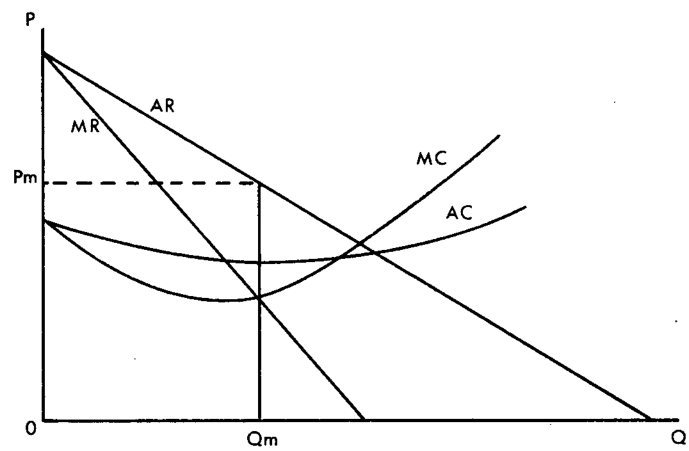

Figure 2. Calculation of Maximum Value of Recreational Unit From Normal Revenue and Cost Curves. (Source: O.R.R.R.C. Report No. 24)

displayed and the optimum levels of P and Q read at their intersections. Assuming that the site then operates at capacity Q_o, and assuming that willingness to pay reflects recreational benefits to users, the optimal level of P reflects the maximum value of the facility to a user, assuming that no expenditures are made. Again, however, the validity of this can be demonstrated most decisively in practice, and in doing so it would suffer from the commonly found overdose of economic theory. The assessment of the demand and supply functions will rarely be accurate and the assumption that demand may represent revenue, or equally that supply may represent costs, may be questioned in many situations. A fuller discussion of developments of this and similar techniques follows below.

The theoretical aspects are mentioned at this juncture to provide an insight into the general application of economic theory to benefit-cost analysis.

The inability to make accurate assessments of intangible or total benefits is explained partly in the realm of secondary benefits (Brewer 1962, p. 89; U.S.W.R.C. 1969, p. 9). The estimation and meaning of these benefits which normally accrue from tangible parts of an innovation, such as irrigation or power, is extremely complex. There are often inseparable practical obstacles to the collection of information of first and subsequent round benefits with which to estimate the multiplier effects on a regional economy (O.R.R.R.C. 1962, No. 24, p. 109-110; Glass and Gamble 1967).

The arbitrary adoption of an assumed interest rate (Hartman and Seastone, 1965, p. 98) or of inconsistent estimates of costs involved in the provision of recreational or other amenities, and the inaccurate calculation of the total marginal utility of a project, seldom result in the accurate assessment of the tangible components of project evaluation (Stromsdorfer *et al* 1971).

Many of these problems arise in the case of marketable and tangible goods, and it is hardly surprising, then, that a non-marketable producçt would encounter even more difficulties. Although there may be quite a market for beauty, as demonstrated by numerous economic exchanges, from art dealing to antique car businesses, intangibles do not respond to a market situation. Kneese (1961, p. 37-42) has demonstrated the imperfection of the market as a device for the evaluation of outdoor recreation, the field where most evaluatory techniques have been developed. Reasons of institutional obstacles associated with property ownership, the existence and influence of monopolies, the lack of incentives for private enterprise to deal in recreation, and the unique difficulties of 'selling' the product, contribute to the distortion of the normal market mechanism. Thus, recreation is not a good which may be sold on an open market, and consequently cannot be given a competitive market price. Even given one, however, there is little reason to expect that it would be a true reflection of the good's value to user, any more than the market price of an automobile reflects its true value to the purchaser (Hines 1958, p. 365). Brewer (196, p. 93-96) argues that any estimates of recreational value are irrelevant in decision-making because of the nature of their origin. This appears, however, to be an extreme and regressive standpoint, and most authors would contend that the application of criteria for optimality of recreational resource use is difficult, but not irrelevant (Hartman 1962, p. 97).

Strictly speaking, recreational amenities may be termed 'common property resources' since they encompass "those valuable attributes of the natural world which cannot be, or can be only imperfectly, reduced to individual ownership and, therefore, do not enter into the processes of market exchange in the price system" (Kneese 1970, p. 191). To clarify the economic semantics further, Merewitz (1966, p. 625) argues that recreation is not a 'collective good' since those not willing to pay need not receive recreational services, nor is it a 'public good' since recreational amenities do exist, and perhaps are preferable, in the private sector. Having labelled the primary component of environmental intangibles 'common property,' it may be relevant to note that the field of economics which attempts to understand this type of resource has been referred to as 'Pigovian Social Welfare economics'. This field functions according to a 'dollar democracy' whereby each person possesses an equal stake in the common property, but where benefits do not accrue equally democratically, and high income earners appear to receive greater benefits.

Most consideration given by economists to intangibles, however, has little connection with welfare economics. Their concern lies mainly with 'spillovers' or 'externalities' whereby the side effects of a scheme on the immediate environment are studied and evaluated (Davis 1963, p. 11; Kneese and D'Arge 1969; Ayres and Kneese 1969; Kneese 1970, p. 192). Only recently have attempts been made to incorporate intangibles into benefit-cost analysis as a part of initial project evaluation, rather than as the evaluation of the effects of a completed scheme. Prior to this, the inclusion of intangibles served only to indicate where a project may, or may not, be beneficial, as decided through subjective decision-making. This nominal rating system implied a vagueness which did not permit ranking of schemes according to their total benefit-cost ratios. This capacity, it has been proposed, might allow some estimate of intangible values where these are ranked among known tangible values that suggest at least the range of values within which intangible elements fall (Armstrong 1971). Economists, however, have increasingly used a system of 'shadow pricing' to impute values of benefits and costs in the absence of a true market price. Unfortunately, in attempting to find a market price of an extra-market good, this process ultimately involves the subjective deliberations of the questionnaire-answering public and simulated bidding techniques and is only a partial solution to the problem (Arrow 1965, p. 5). Moreover,"... the method of imputation requires that comparable goods and services or alternate sources of supplying the services be found in the commercial world" (*sic.* Prewitt 1949, p. 19). It is rarely the case that a market equivalent can be found for a part of the recreational or aesthetic experience.

Past Developments

The motivation for the present high interest in evaluatory techniques has been described above in the discussion of the technological crisis, but the rationale for the previous apathy requires some explanation. In early post-war years, only a nominal value for intangibles was assumed, if they were not completely ignored. This stemmed partly from the popular attitude that aesthetics were of immeasurable value and of infinite worth to society (Milstein 1961, p. 18; Spargo 1964, p. 66; Revelle 1967; Crutchfield 1962). Moreover, it was argued that there was little need to justify the aesthetic aspects of a project, since active public demand was invariably satiated, at least until the more recent democratisation of leisure (Clawson 1966). Governmental policies instituted incidental ad hoc recreational facilities which seemed to satisfy the contemporary level of demand.

A further reason for the delay in incorporating intangibles into benefit-cost analysis may be found in extremists other than those who expound the concept of infinite value. Twardzik (1967) has described this as follows:

> "In the past recreation professionals and certain segments of the conservation movement along with their powerful special interest organizations have successfully resisted attempts to have the benefits of recreation placed within the scrutiny of benefit cost analysis because, it was contended, the benefits of recreation were really intrinsic, personal values that defied objective evaluation."

It would appear that part of this unwillingness has stemmed from the previously complacent state of affairs where qualitative judgement had overstated the true value of environmental quality.

A third group of 'extremists' argued, neither for the infinite value of aesthetic appreciation nor for the immeasurability of an emotional experience, but for the pricelessness of untouched wilderness. Exponents such as Ise (1962) suggest that these areas are of infinite value to future generations by virtue of their virgin condition. Hardin (1969) suggests that they should be left undeveloped and unquantified on the principle of an endurance test, that users will require all their primitive faculties in order to survive in these areas and, in doing so, be able to live a fuller life when returned to civilization. To attempt to estimate the benefits of this 'recreation' for future generations would clearly be a fatuous and unworthy task. Moreover, this caricatures again the more general time preference problem in benefit-cost analysis of weighing present costs against future benefits, having only the present level of demand as a measure (Arrow 1965, p. 4-5).

Strangely, the view that intangible recreational benefits could not be measured because they were too complex does not appear to have been a popular one. Only a handful of authors support this contention which seems to have obvious merit. Prewitt, in 1949, concluded that "... there is no acceptable standard of evaluation that can be used to place a monetary value on recreation that is not arbitrary" (Prewitt 1949, p. 27). Lerner (1962, p. 58) and Sewell and Rostron (1970, p. 8) have more recently discussed attempts to measure secondary benefits of recreation as expressed in the gross national product. Further-reaching effects of recreation are classified as secondary benefits and costs and are an extremely complex field for evaluation. There has been no concerted attempt to evaluate these more social benefits of reduced crime rates, lower political malcontent, stronger family unity or lower accident rates which undoubtedly result from increased recreation. No doubt recreation is not the only possible cause, and these are difficult variables to measure, but there has been surprisingly little specific recognition of these more complicated secondary intangible benefits.

A more popular viewpoint which explains the lack of evaluatory techniques held that it was 'undesirable' to attempt to measure beauty. Clawson (1959, p. 3) admits that he himself had previously adopted this unprogressive attitude in the early 1950's. These medieval ethics were perhaps encouraged by a more inhibited approach to monetary discussions in the past and a prevalent fear that if beauty was scientifically dissected its inimical charm would be lost. Unfortunately, now that conservation has become big business, the artist and politician have accepted economic appraisal. Trice and Wood (1958, p. 197), however, suggested that it was undesirable, not from a moral standpoint, to quantitatively evaluate aesthetics, but because it was likely to underestimate its real value. This has a considerable amount of justification, particularly if their technique was used (Knetsch and Davis 1965, p. 139).

It nevertheless remains true that if aesthetic qualities of the environment are to be preserved, to supply the demands of recreation and conservation, and to satisfy non-users' option demand (Pearse 1968, p. 88; Pearse and Bowden 1969, p. 290; Krutilla 1967, 779), at least some useful quantitative measures of environmental intangibles must be derived. The imperative for recreational and aesthetic valuations is supported by the contention that "any reasonable estimate of value is better than none at all" (Clawson 1959, p. 2). This view may be cautioned, however, to deliberate how reasonable is the definition of 'reasonable'.

A progressive concern with proper landscape use, rather than proper land use (Twiss and Lytton, 1968) finally initiated the development of a number of techniques for the evaluation of alleged intangibles. Sewell *et al* (1961, p. 29) describe three ways in which intangibles associated with recreation may be incorporated in benefit-cost analysis:

(1) where a recreational area is threatened with destruction;

(2) where new recreational facilities may be created in multi-purpose schemes; and

(3) in projects designed only for recreational purposes.

This threefold classification of schemes envelopes the origin of all primary intangible benefits and the authors' preoccupation with recreation is characteristic of most studies dealing with intangibles (Wyckoff 1971, p. 13), but if recreation is defined as the total experience in environmental appreciation, passive observation and appreciation of beauty as well as active participation should be included. Equally characteristic of other studies, is the authors' parallel concern only with benefits. This is based on the assumption that the "cost of an investment is the benefit that could have been derived by using the resources in some other activity" (Arrow 1965, p.1) and is tantamount to a 'benefits foregone' approach expounded by some studies (e.g., Water Resources Engineers (W.R.E.), 1970) in evaluating intangible benefits.

Quantitative Values in Recreation

With the demand for intangible evaluation established, and the framework for its application conceived, it remains to indicate those areas where the process may begin. Monetary values become evident in several phases of the recreational process, and most evaluatory techniques have been developed to focus on these occasional appearances (Reichardt 1970, p. 663). In the case of publicly owned facilities, monetary values are exhibited in the expenditures incurred in a recreational trip; these include costs of travel, time, utility, and opportunity costs and are described in detail in Chapter II. Occasionally, the occurrence of site entry fees is also discussed as a measure of benefits. Second, the costs of establishing and maintaining a recreational site may be a monetary indication of benefits accruing from it, although this is hardly a basis for an investment criterion (Merewitz 1966, p. 626; O.R.R.R.C. 1962, No. 24, p. 67; Lerner 1962, p. 66). Third, the secondary benefits originating from the financial investments which provide a local tax base witness the monetary value of recreation to communities that provide but do not fully utilise facilities (Brewer 1962, p. 89). Fourth, increases in property values in the area of recreational activity, and on-site concession values, reflect a demand for intangibles expressed in pecuniary terms (Brewer 1962, p. 90; David 1968; De Vos 1966; Whitman 1968, p. 223-234). Finally, the increased productivity of the uses resulting from intangible benefits of increased recreation, will be reflected in the gross national product of the total society, and theoretically also in individual income levels (Lerner 1962, p. 58; Sewell and Rostron 1970, p. 8).

In the case of privately owned recreational facilities, additional appearances of economic worth may be perceived. In this situation the site entry fee is a more accurate estimate of the demand for a facility, although it will often be lower than the true market price as a result of competition from free, or nominally-charged, publicly owned sites. Simulated bidding, which is sometimes used to estimate the market value of a public site, may be substituted for real bidding in a market situation (Davis 1963). Again, however, values may be low because of the degree of public monopoly in neighbouring sites and the unwillingness of respondents to pay more than the nominal amount to which they are accustomed.

Nonmonetary values occur more frequently than monetary but are of less direct evaluatory use since difficulties occur in their transformation into economic terms (Devine 1966; Brandl 1966). The values are derived from indices of attractivity, measuring the quantity of various qualitative aspects of a recreational site of scenic area. The most useful single variable used to measure the attractive capacity of an area is that of use rates, frequency and duration of trips being frequently used in regression analysis as dependent variables. It is assumed that this variable reflects a normal consumer reaction to the recreational product and is symptomatic of an area's attractiveness. On occasion, 'observers' preferences' are used as the dependent variable (Shafer *et al.* 1967, 1969; Shafer and Mietz 1970) in lieu of actual participation rates, and in other studies there has been no attempt to explain a dependant variable at all (Leopold 1969, 1969a; Leopold and Marchand 1968).

Numerous independent variables have been hypothesised and tested in analyses and are described in more detail in Chapter III. They are generally of two kinds:

(a) Indices which are directly measurable in known units, such as the number of picnic tables or change-rooms, acreage of lakes, or distance from large population centres. These are not always free of biased measurement, however, as will be demonstrated later.

(b) Indices which are subjectively rated in abstract units, such as water quality, colour tone or climatic suitability. These are not directly quantifiable and their qualitative values are usually rated according to an arbitrary point scheme within a range of values. They are obviously exposed to considerable subjective judgement biases.

CHAPTER II

TECHNIQUES FOR THE MONETARY EVALUATION OF ENVIRONMENTAL INTANGIBLES

The purpose of this chapter is to investigate techniques which have been developed, particularly in the field of recreation, to furnish monetary valuations of intangible benefits associated with the appreciation of the environment. First, some general comments are made concerning the nature of the economic values being measured. This perhaps clarifies some of the subsequent discussion of specific techniques, and demonstrates the difficulties inherent in this kind of analysis. It should be realized that not only are techniques difficult to develop and adopt, they are also inconsistent in their goals, and few authors have attempted to explain exactly what they are attempting to measure. This is followed by a review and critique of some of the most widely acknowledged techniques.

The Use of Demand Curves

A typical Marshallian demand curve may be described as one which reflects the diminishing marginal utility of a product (Samuelson and Scott 1968, p. 486). Normally, the good is tangible, manufactured and marketable. However, recreation, which is the major concern of this report, possesses none of these properties and may only be examined in terms of demand curves through the application of a number of assumptions. The validity of these assumptions is crucial to the validity of many proposed methods. These assumptions include:

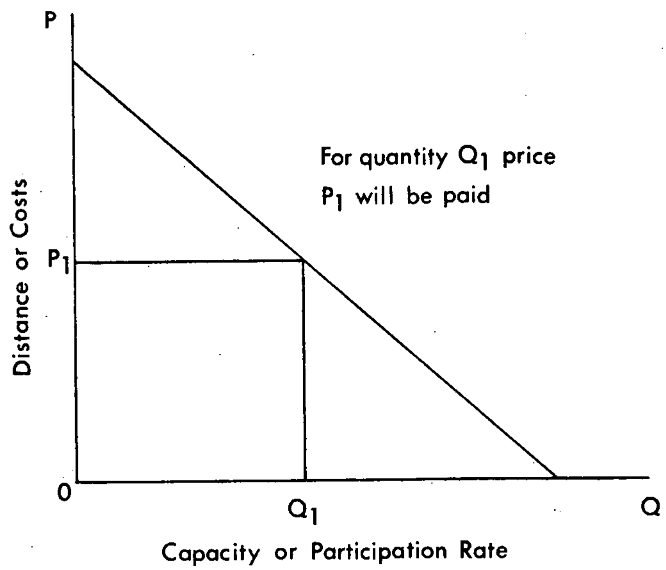

Figure 3. Normal Marshallian Demand Curve with Proxies for P and Q

(a) the willingness of recreationists to incur costs of travelling to a recreational facility, and, thus, distance, is an adequate proxy for the price of a tangible marketable good; and

(b) diminishing marginal utility is accurately reflected in demand curves of this type.

(1) Travel Costs

With regard to the first assumption, it may be useful to introduce the possible analogy between a marketable good such as a radio (Prewitt 1949, p. 13) or an automobile (O.R.R.R.C., No.24, p. 62), and recreation. In return for this investment, the purchaser of a material product receives the property rights to the good and the utility of its function. A purchaser of recreation, however, receives no sole property rights, but receives all returns as utility benefits. It may be suggested that some intangible utility gained in both cases is a 'profit' on their respective investments and that the price paid reflects only the willingness of the purchaser to pay on the assumption that he will receive more for his money. Thus normal market mechanics establish the retail price of a good, but the purchaser receives goods of greater benefit than is reflected in this value. Graphically, this may be illustrated as in Figure 4, where distance is used as a proxy for price. The shaded area of 'profit' may be considered to be true intangible benefit, and its size

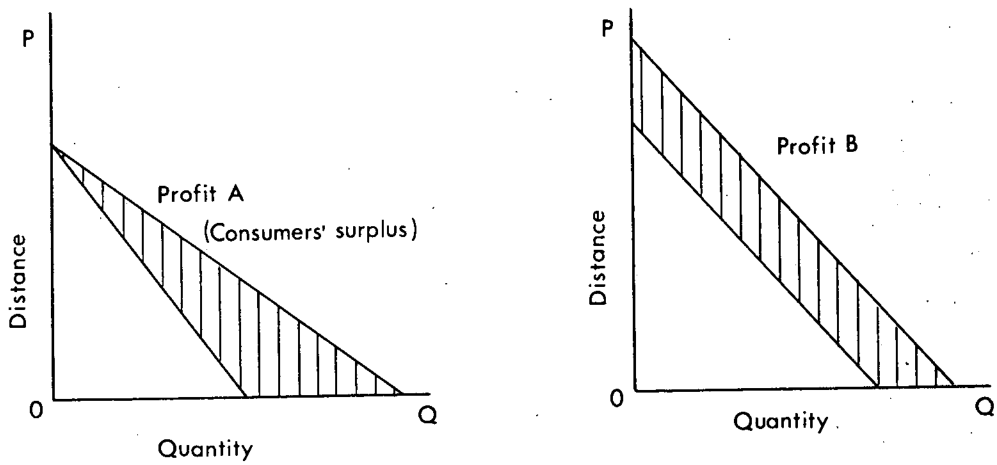

Figure 4. Alternative Profit Margins Over Investments

will vary according to individual preferences. Profit A is referred to in economic terms as 'consumers' surplus' (Samuelson and Scott 1968, p.495). It is applicable to both a marketable commodity and to a common property resource such as recreation. The unshaded area reflects the price of the good to consumer, either a retail price or the amount a recreationist is willing to pay for the use of a facility. In the latter case this is often interpreted as equivalent to the value of recreation to the user and a measure of the intangible benefits of participation. Thus, there are two possible origins of intangible benefits:

(a) those which are derived from the purchase of *any* kind of good where a profit or consumers' surplus is gained for a given investment, and

(b) those peculiar to recreation which are derived from the intrinsically intangible nature of the recreational good and which may be analogous to the sole property rights of a marketable good. There is considerable danger that attempts to assess total intangible benefits will result in the double-counting of these, with subsequent overevaluation of benefits and misconceptions in project planning. It is suggested here that the intangible profit margin should not be measured as an element of intangible benefits, since it is common to all market and extra-market goods. This is discussed at greater length herein.

A further comment on the first assumption concerns the nature of travel costs. Clearly, the cost of maintaining and running an automobile, or other means of transport, which is incurred in addition to normal daily living expenditures, is also an indication of travel costs. However, additional costs of time, utility (Knetsch and Davis 1965, p. 139) and opportunity (Scott 1965), and of site entry fees may (Clawson 1959) be incurred (Figure 5), augmenting the value of the recreational experience and implying greater benefits than those assessed simply through the assessment of monetary outlays in travelling (Cesario and Knetsch 1970). Time costs are proportional to travel costs since they are incurred during travel. They are also incurred during on-site recreation and are inversely

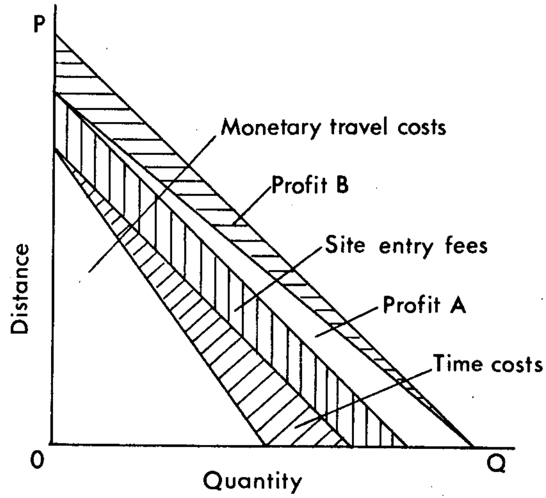

Figure 5. Hypothetical Components of a Recreational Demand Curve

proportional to travel costs. However, it is problematic whether time costs are incurred as part of the total opportunity cost of being unable to undertake an alternative activity, such as work, or, in the case of long distances travelled, the inability to spend longer at the actual site. For this reason time costs are assumed to be proportional to the total length of the recreational experience and therefore to the distance travelled, assuming a proportionate length of stay at the destination.

The actual measurement of the value of time has received little attention from investigators in the field of recreation. The most significant contribution has been by Nelson (1966) who argues that time has varying value according to the person considered, activity, and the time of day. Although a person's salary may be a fairly adequate indication of the total value of his time, his income is not earned or expended evenly through time (Stromsdorfer 1971, p. 278). This implies extreme difficulties in calculating the value of leisure time and its components of preparation, participation, travel to and from the site, or delays due to traffic congestion. Nelson acknowledges, however, the contention that "... in the absence of market imperfections a person will adjust his time budget so that the marginal value of time is the same in all uses (including work). Savings of time should therefore be valued at the marginal wage rate" (Chase 1968, p. 13). This appears to have considerable logic since time itself has no intrinsic variability in quality or value, and the assumption that its users value some hours more than others ignores the possibility that, in retrospect at least, each moment is as essential as the next in participating in 'life's rich pageant.' A salary theoretically reflects a person's value in society, and each part of his wage-earning life being interdependant makes an equal contribution, in the long-term, to perpetuating this position whether it entails sitting in a traffic jam or attending a conference of a board of directors.

If this latter contention is valid, it simplifies the calculation of time costs so that

$$C = \frac{A.S}{365}$$

where C is the value of one recreation-day, A is the number of leisure days per annum for a given person, and S is his annual income. To be accurate, the proportion of days spent participating in *outdoor* recreation and the person's propensity to spend his income on other leisure activities should be included in the calculation.

Utility and opportunity costs have received even less attention in available literature than time costs. Generally speaking, they refer respectively to the cost of expending energy, of annoyance or tension which might be involved in travelling on a recreational trip, and to the cost of being unable to participate in other activities. Ullman and Volk (1962) have devoted considerable attention to the latter, assessing benefits to recreationists according to the distance of an alternative site to the one that they actually visited, but they appear to have little understanding of utility costs. Since these costs seem to be so amorphous that it may be expedient to assume that they are implicit in time costs. Utility costs are incurred only during limited periods of the daily regimen and at other times a person may be enjoying himself. If it is assumed that during a recreational experience, as in daily life, pleasure is balanced by pain, and utility by disutility, then disutilities are not a true 'cost' at all, but merely a part of life. Since utility costs are plainly incurred through a time dimension, as in a working day or a leisure evening, they may be intrinsic in the calculation of time costs which are evaluated through annual income. Without delving greater philosophical depths, it may be concluded that while no clear definition of utility costs exist, they cannot be conceptualised as a discrete part of total costs and may be assessed as a component of time costs.

The final element of recreational expenditures, site entry fees, normally has two characteristics:

(a) They are a regular fee independent of distance travelled by, or willingness to pay of, a recreationist.

(b) They do not reflect an hourly time value of the recreation for which they are levied, but an arbitrary time period.

They are a fixed nominal fee which has little direct meaning in measuring recreational benefits. Clawson (1959) has shown how the effect on attendance of increasing site fees may be estimated from demand curves based on recreationists' willingness to pay, while further attention on this subject has been lavished by Scott (1965) who thoughtfully discussed the pros and cons of fee imposition and elaborates on their usefulness in estimating benefits. However, only in the case of fees imposed by privately owned sites is it possible that recreational benefits are reflected, but the problem of indiscriminately levying a constant fee on users with varying incomes, and thus with varying opportunity costs, will tend to eliminate low income users from visiting the site, producing a distorted demand curve.

(2) Validity of Demand Curves

Most techniques which use demand curves construct distance decay functions of frequency of visits, which decline with increasing distance of the origin from the site. It is then argued that willingness to pay is reflected by distance, since the cost of travel is a function of the distance involved, and subsequently that the marginal utility curve is identical to this statistical demand curve. Seckler (1966) argues against this latter assumption stating that "we do not believe that statistical demand curves measure the utility function of recreational facilities ... they reflect the diminishing marginal utility of income" (Seckler 1966, p. 487). Generally, it is contended that as distances increase only persons with increasingly higher incomes, and thus with decreasing marginal utility of income, will be willing to travel to the site in question. Seckler demonstrates how the demand curve may be corrected to eliminate the influence of variable income, and

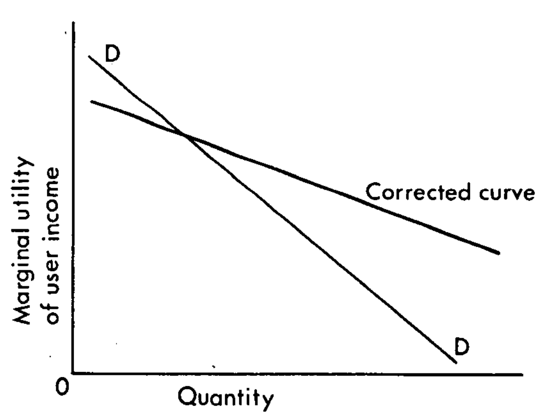

Figure 6. Correction of Demand Curve for Income of Users (after Seckler)

to allow the insertion of a corrected demand curve (Seckler 1966, p. 488, Figure 6). Seckler does not, however, consider the possibility that the corrected curve may have a slope not statistically significantly different from the horizontal, nor that factors other than income may influence the slope of the curve. Variations in education levels, age or sex are undoubtedly influential (Knetsch 1963; Davis 1963; Brown *et al.* 1964; Knetsch and Davis, 1965; Grubb and Goodwin 1968) in increasing and decreasing the willingness of users to pay and the variability of these characteristics over the area of demand would almost certainly distort even the corrected demand curve. To continue Seckler's thesis logically would be to isolate all variables significant in effecting consumers' willingness to pay and deriving a curve which would reflect only the function of distance.

'Ability to pay', according to income, is a significant socio-economic variable effecting willingness to pay, and Pearse (1968) has attempted to eliminate its effect on demand curves. He defines income classes according to empirical data, and calculates total benefits according to the difference between the maximum willingness to pay within each class and the average of each class, multiplied by the size of each. His suggestion that a ten per cent sample of the population would be adequate (Pearse 1968, p. 92), allows only one chance in ten that the true maximum willingness to pay in each class could be discovered, while his inability to describe his method of assigning income hardly lends validity to his claim that this method "avoids assumptions about the homogeneity of base populations from which recreationists are drawn" (Pearse 1968, p. 93).

Scott (1965) has suggested how variations in occupation, as well as income, alter the opportunity costs of travel according to the amount of free time available, concluding the proportions of self-employed, professional and independent income receivers will rise with increasing distance from the site, since opportunity costs will decrease. Although some corrective factors may be introduced in the income variable, it seems more difficult to estimate the effects of other socio-economic variables which influence willingness to pay, and which distort the demand curve into a form incompatible with a curve fitting the diminishing marginal utility of recreation. This will be discussed further in the next section.

Methods of Evaluation Based on Willingness to Pay

(1) Hotelling-Trice-Wood Method

Probably the most discussed and least used evaluatory technique was suggested in 1947 by Harold Hotelling in response to a inquiry by the U.S. National Parks Branch concerning the economic value of national parks (Prewitt, 1949). Generally speaking, the method depends on assumptions of uniform tastes, incomes and enjoyment in visit to a particular recreational site. Travel costs are estimated according to distance travelled by visitors, and assumed to represent the cost of the recreational expense. A demand curve is then established describing the willingness of users to pay for their recreation (Figure 7). The median value of P is ascertained and a 'bulk-line' at the 90th percentile is assumed to represent

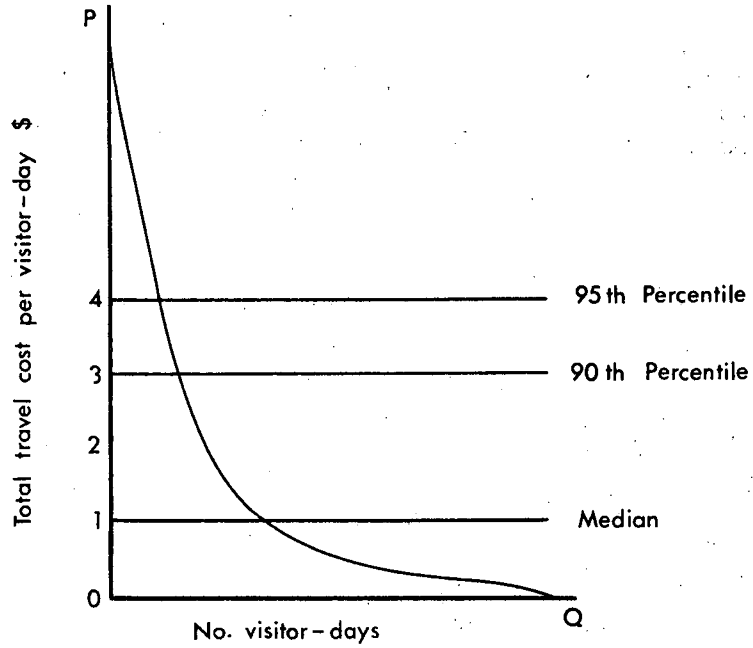

Figure 7. Trice & Wood Demand Curve

maximum willingness to pay, at which price users only break even in enjoyment of their investment. Average benefits are then assumed to be measured by the difference between the bulk-line value and each person's expenditures. Total benefits may be calculated by multiplying the number of users by the difference between the median and bulk-line values. Trice and Wood applied that method to the Upper Feather River Basin in 1956 and calculated values of approximately $2.00 per visitor-day.

This work has been criticised by a number of authors on four general counts:

(a) Measurement of biases,

(b) interpretation of travel costs,

(c) use of 'bulk-line,' and

(d) assumption of homogeneous base population.

A review of the opinions is presented herein in an attempt to synthesize the many minor doubts expressed in their individual works into more significant and coherent criticisms.

(a) Measurement biases - Beardsley (1971), following Lucas (1963), has demonstrated several drawbacks to the data collection methods used by Trice and Wood and subsequent users of this technique. He claims that the number of visitor-days' is a more accurate measure of frequency of use than the number of trips, and that willingness to pay disproportionately increases among long-stay visitors. A weighting system based on length of stay is suggested to correct this bias.

A related problem has been indicated by Spargo (1964) in that the size of the party often distorts the willingness of each visitor to pay, since large parties pay proportionately less per person visitor-day than small parties. The author does not, however, add that the adoption of an inaccurate or arbitrary average party size can lead to extreme misrepresentation of the total volume of use and consequently of the value of recreation using that method.

Clawson (1959) and Scott (1965) have expressed concern over the opportunity costs of travel, and experienced difficulty in deciding whether travel, as part of the total recreational experience, was of benefit or cost to the user. Moreover, the nonapportionment of expenditures made for minor diversions of travel in a lengthy trip has received the attention of Beardsley, (1971) who decided that the proportional allotment of time by recreationists should be the basis for the correction of this 'bias'. These two problems may, however, be difficult to solve both in theory and in the process of an actual survey.

These, and the biases normally encountered in questionnaire surveys, have been mentioned by authors in criticism of the Hotelling-Trice-Wood technique, but are not significant to the total methodology. They are problems only of measurement which may be corrected without substantial modification of the theoretical basis of the method.

(b) Interpretation of Travel Costs - Scott has been the major proponent of the criticism that travel costs do not accurately reflect user expenses. In particular, Scott (1965) mentions opportunity costs of time which are incurred during travel to the recreational site. Utility costs have already been mentioned as a significant expense incurred by recreationists. Both of these costs are proportional to the length of trip and are not incorporated in Trice and Wood's original estimate, resulting in proportionally lower measurements of benefits.

In addition to serious underestimations of users' willingness to pay, and consequently of their supposed benefits, the exclusion of such costs implies a less significant response to distance than may actually be the case. Distance decay functions, which may be derived from demand curves, since they reflect the fall-off of Q over distance which is a proxy for P, would indicate that a larger number of persons are willing to visit a site from long distances than may actually be the case.

The fact that cash, time and utility costs incurred in travelling are all proportional to distance isolates fixed costs such as entry fees. Scott has argued that "a toll will have almost no effect on the visits of those for whom the opportunity cost of travel, ... is the chief constraint" (Scott 1965, p. 34). If true, this has unfortunate implications for Clawson's estimations of the optimal fee chargeable at recreational sites, estimated through the response of demand to changes in cash travel costs only (Clawson, 1959, p. 15). In any case, the Trice-Wood method is not predictive of the effects of tolls.

(c) Use of a 'bulk-line' - Perhaps the area of most consorted criticism, the bulk-line at the 90th percentile appears to have little justification. Lerner (1962) has shown that if the population from which recreationists originated were concentrated into one large centre, the difference between the dollar value representing differential travel costs between median and 90th percentile could be minimal. Consequently, the calculation of benefits would be ridiculously low, and the method would appear to rest on the assumption that the base population is numerically evenly distributed around the site. Clawson (1959), however, in his study of visitors to Yosemite park used participation rates of visitors per thousand population, rather than aggregrate frequencies, to eliminate this problem.

The arbitrary nature of the selection of the 90th percentile has been criticized by Lerner (1962) saying that this was analagous to basing irrigation benefits on returns to the highest quality land (represented by the high value at the 90th percentile). Perhaps more to the point is Scott's (1965) comment that benefits estimated in this way are highly sensitive to arbitrary decision. Presumably, an example of this is the approximate 50% increase in estimated benefits which would occur if the bulk-line was arbitrarily set at the 95th percentile instead of the 90th (Figure 7).

Trice and Wood (1958) justify the use of a bulk-line by arguing that the 10% of visitors excluded from the calculations are the exceptionally wealthy who are prepared to travel the longest distances. However, a more realistic method of excluding typical visitors would be to impose a linear regression curve on the data transformed through a suitable exponent. The 'y' intercept value would then furnish a bulk-line value which reflects all data and is not arbitrarily derived.

(d) Assumption of a homogeneous base population - Following their original publication, Trice and Wood were quickly made aware of the problems involved in their assumption of a homogeneous base population, referred to by Merewitz (1966) as the 'vertical cross-section assumption'. Inequalities of income have received particular attention from a number of authors who argue that this determines the *ability* of users to pay and places a constraint on the distance they are *willing* to travel. Hines (1958), Lerner (1962), Lessinger (1958), Pearse (1968), and Sewell and Rostron (1970) agree that it is likely that persons visiting from greater distances will have higher incomes, since willingness to pay travel costs is assumed to mould patterns of demand. Trice and Wood (1958a) proposed that by using a fixed cost of travel per mile *removed* the distortion produced by income differences. They do not make clear exactly how this is so, and it seems that the most that would be accomplished would be to *avoid* questions of income and taste (Trice and Wood 1958a, p. 368). Seckler (1966) has finalised this argument by demonstrating that a demand curve derived in this manner does not reflect the marginal benefit of recreation to the user, but is largely a reflection of the marginal utility of the income users.

However, the almost universal acceptance of the difficulties involved in this assumption may be questioned on three counts. First, it does not appear that income is a particularly significant determinant of recreational travel. Beardsley (1970, 1971) found that income explained only a non-significant 5% of variance in trip frequencies, while costs of use alone explained 77%. Similar empirical rebuttals of the great importance laid upon income in determining recreational trip frequency have found other socio-economic characteristics to be more influential (e.g. Lerner 1966). Secondly, the demand curves are empirically derived and reflect the actual demand existing for a particular site or area. The determinants of this demand include personal tastes, objectives of travel and socio-economic characteristics, including income, of the base population. The corrections of Seckler (1966) and Pearse (1968), which account for the effects of income in two alternative ways, are therefore inadequate. Scott's (1965) proposal that opportunity costs be included in assessing willingness to pay implies that in the same way income may be the major determinant of willingness to pay cash costs of travel, other socio-economic factors may determine the willingness of recreationists to incur opportunity costs. Apparently, as the significance of each element is found, and corrections made, the demand curve approaches infinite elasticity at the horizontal, suggesting that it may perhaps be advisable to omit such explanatory factors from the empirical derivation of a demand curve. The importance of socio-economic characteristics is acknowledged by Scott, who furnishes a third arguement in showing that "visitors from remote regions have more money than time, their travel costs curve may become steeper ... but their [curve of] opportunity costs per mile may fall ..." (Scott 1965, p.35, Figure 8). Thus, the demand curve derived by Trice and Wood (1958) have less inaccuracy than many authors believe, and the major problems arise only in their interpretation for purposes of benefit assessment.

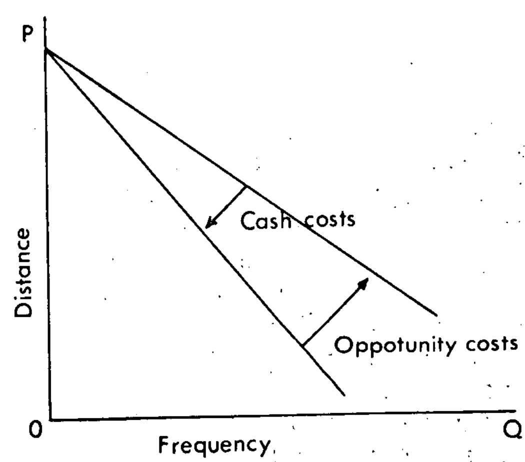

Figure 8. Deviations in Demand Curves for High Income Participants (After Scott)

Lessinger (1958) has argued that the base population will also vary according to residential preference which affects their willingness to pay. He argues that "those who have purchased closeness to regional parks at the cost of urban accessibility would not be willing to pay additional amounts equal to the travel costs of the high cost users" (Lessinger 1958, p. 369). Thus, their valuation of recreation is not reflected only in travel costs incurred in their trips to the nearby parks, but also in their larger additional costs of access to the nearest urban centre. The assessment of willingness to pay must therefore include calculations based on the distances to both recreational and urban facilities weighted according to frequency of use of both.

Finally, a further comment should be made on the use of samples in estimating consumers' surplus. There is a probability, inversely proportional to the sample size, that the maximum willingness to pay will not be recorded by a sample. Recreation consumers' surplus is estimated by subtraction of individual expenditures from the highest expenditure recorded, upon which the participant concerned supposedly breaks even on his investment. Thus, if the highest expenditure is not found, other estimates will be inaccurate. The Trice and Wood method avoids this by using a bulk-line, but Pearse (1968), in his attempt to correct for income disparities, commits this error. He attempts to group incomes into classes, wherein consumers' surpluses are calculated by subtractions from the maximum expenditure recorded. His suggestion of the use of a sample will therefore not only make estimates inaccurate, but also variable in their accuracy, no classes incurring the same degree of error.

(2) <u>Clawson's Demand Curves</u>

A useful development of the Trice and Wood method was published in 1959 by Clawson. It has been widely acclaimed as probably the most applicable and intelligent contribution to the field of evaluatory techniques. Estimating the demand per thousand population for the Yosemite National Park in California and three other major national parks, Clawson attempts to predict the effects of increased entry fees on attendance, and to calculate the value of recreation to the users. The value of this work, however, lies in its relatively comprehensive approach rather than its mathematical accuracy. Clawson considers virtually all notable problems, but unfortunately cannot account for some of the more severe limitations of his computations. Some mention should be made of an apparently comprehensive yet disorganized and unclear array of remarks and arguements.

Conceptually, Clawson may be criticized on at least three points:

(1) Knetsch (1963) has shown that all demand curves will be conservatively biased to the left because only cash costs of travel are included. Clawson admits this and agrees that more emphasis should be placed on time costs.

(2) The use of consumers' surplus may be theoretically invalid. This is discussed in more detail below.

(3) Scott (1965), as mentioned above, has questioned the validity of projecting demand curves based on travel costs to predict the effects of increased fees. It is difficult to see how the derivation of demand curves for the recreational opportunity only overcomes this problem as Clawson appears to believe.

(3) Consumers' Surplus

The concept of consumers' surplus has been mentioned several times above. Its exact nature and relevance to evaluatory techniques are sufficiently important to justify a more detailed discussion, and it is a notion adopted and abused by many authors in this field. Resting on the assumption, discussed above, that the distance decay of willingness to pay reflects diminishing marginal utility of the recreational experience, a normal marshallian demand curve may be established (Figure 9). Total revenues are assessed for any price-quantity relationship, normally that of maximization, by measurement of the rectangle beneath the curve (Clawson 1959; Pearse 1968, p. 92). Where Q_1 represents goods that are sold, total benefits may be assumed to be equal to the area under the curve to the left of Q_1. Consumers' surplus is represented by the triangular area (where demand curve is linear) above total revenues. Thus:

Consumers' Surplus = Total benefits (value) - Total revenues

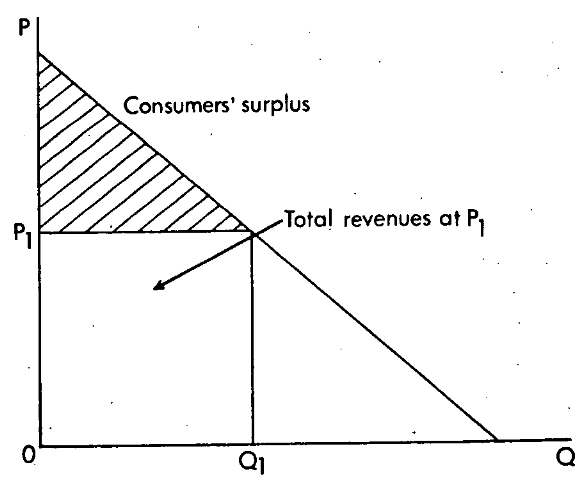

Figure 9. Demand Curve Showing Consumers' Surplus

In Samuelson's words, "... there is a sort of gap between total utility and total market value this gap is the nature of a *surplus*, which the consumer gets because he 'receives more than he pays for'" (*Sic.* Samuelson and Scott 1968, p. 486).

Apart from Merewitz's statement that "consumers' surplus includes all the area under the demand curve, no particular rectangular total revenue" (*sic.* Merewitz 1966, p. 632), there are no apparent misconceptions of the factual nature of this concept. There is considerable dispute, however, concerning its application to the assessment of recreational benefits. This largely stems from the lack of consistency of purpose among researchers. As Seckler has asserted, "The basic question is which is to be used in the evaluation of public outdoor recreation benefits - consumers' surplus or total revenue?" (Seckler 1966, p. 486).

Proponents of the use of consumers' surplus are Wennergren, Pearse and Lerner. Their comments include:

Wennergren:

"It is the consumer surplus captured by boaters that is basic to inputing a value for the resource. In fact, it is the aggregate value of the net surplus which can legitimately be capitalized into the value of the resource" (Wennergren 1964, p. 311).

Pearse:

"The value of the resource to recreationists, in terms of the consumers' surplus they enjoy under free access, consists of the sum of the maximum tolls that they would be prepared to pay in addition to their existing fixed costs" (Pearse 1968, p. 91-92).

Lerner:

"The total benefits ... is then equal to the integral of the estimated demand function between the fee charged, if any, and the estimated price, if any, at which demand would be equal to zero" (*sic.* Lerner 1962, p. 71).

In the opposing camp are a number of even more eminent authors who argue that total revenues, and not the additional consumers' surplus, are the equivalent of benefits. In general agreement are Clawson, Scott, Wantrup, Crutchfield and Merewitz; some of their conclusions quoted below demonstrate their argument that although consumers' surplus may be calculable, it does not necessarily have any meaning.

Scott:

"The concept we seek, therefore, is not the *area* under the demand curve for visits which would imply discrimination, but the largest profit rectangle that can be inscribed, which would imply a single price" (*sic.* Scott 1965, p. 37).

Merewitz:

"Even if it is desireable to calculate consumers' surplus, we should be aware that we are using a dubious if not superfluous concept" (Merewitz 1966, p. 635).

Crutchfield:

> "Perfect discrimination of this type would not yield a net benefit figure comparable to that derived from other uses of the resource which would normally be subject to a single price of single prices for each different class of user" (Crutchfield 1962, p. 151).

To summarize these opinions, some elaboration of the authors' perception of 'economic value' and 'monopolistic revenue' should be attempted. In the first case the economic value of a good is made distinct from its benefit to the purchaser. Thus, while tangible commodities assume an economic value based on price to consumer (Lerner 1962, p. 74), the former body of opinion requires that the economic value of recreation is determined by the inclusion of consumers' surplus. This, in effect, is a measure of total user benefits (consumers' surplus being equivalent to net benefits) and not comparable with normal market prices established for other elements of, for example, a multi-purpose scheme which includes recreational facilities. As mentioned earlier in this chapter this kind of valuation would overstate the true economic value of recreation as recognized for any marketable and tangible commodity.

Monopolostic revenue, however, may be collected in either of two ways, each being coincident with one of the two viewpoints. Simple monopolistic revenue is derived from charging a single price, or entry fee, or by incurring costs at one site only. This total revenue is termed 'monopolostic' for the purposes of simplifying the competitive market situation, and to indicate that all recreational expenditures are assumed to be incurred at a single site. Lerner's (1962) emphasis on discriminating monopolistic revenue typifies a naive assumption made by some authors that to hypothetically collect entry fees according to users' ability to pay would furnish revenues equivalent to consumers' surplus which in turn would reflect user benefits, is as impractical as it is illogical. Consumers surplus reflects benefits which include the intangible 'extra' received by the purchaser of any good, and discriminating monopoly revenue reflects this same level of total benefits.

In conclusion, the use of consumers' surplus in the assessment of recreational benefits by those authors' mentioned is inapplicable unless equivalent estimates of consumers' surpluses are made for all other goods with which recreation is to be comparatively evaluated. Moreover, it is a misconception that techniques similar to the Trice and Wood method actually make use of consumers' surplus. These do not measure the difference between total benefits and total revenues, but the difference between average revenues collectable if all users broke even on their investment (except for the highest-spending ten per cent). This is a distorted form of consumers' surplus and has even less applicability than the true kind equivalent to discriminating monopoly revenue.

Methods based on 'Alternatives'

A technique which has been allowed more confusion than credibility is the use of alternative benefits and costs as a comparative basis for assessing the benefits of a particular scheme. The concern is with opportunity costs defined by alternative foregone benefits (U.S.W.R.C. 1969, p. 34). It has been mentioned how Scott's research has been oriented primarily toward opportunity costs incurred in time spent and disutilities, and which may be classed in two groups:

(1) alternative destination visited opportunity costs, and

(2) alternative use of site opportunity costs

The two may be distinguished by the latter's relation to the opportunity costs incurred by not using a recreational site for another purpose, and the former's concern with alternative sites that recreationsists may visit.

(1) Alternative destinations

Ullman and Volk(1962) have been the main proponent of this technique which assures that the savings accruing from the use of a nearby site are a measure of its attractive capacity relative to a similar but more distant site. The savings are assessed in terms of the number of miles not travelled as a result of the closer location of the alternative site, on which an average value per mile is imposed.

There are several shortcomings to this method. First, a 'direct' approach is necessitated whereby data are collected from visitors concerning their preferences and own valued assessments (Knetsch and Davis 1965; Pearse 1968). This is subject to bias in hypothetical responses to hypothetical questions in much the same way that the Knetsch and Davis technique mentioned above is susceptible. Moreover, it assumes that there is a clear relationship between willingness to travel, or pay, and participation rates, and arbitrary distances of alternative sites used. This is unlikely to be the case. In the third place, it is unlikely that this technique measures actual benefits accruing to user, or indeed anything other than the amount of travel costs saved by visiting an alternative site. It seems questionable that unwillingness to pay is a superior measure to willingness to pay.

The basic confusion in this approach originates from the lack of distinction between the imposition of monetary values on two separate quantities which respond to the use of an alternative recreational site. Benefits are indirectly expressed in both

(a) increased frequencies of trips made to closer sites, and

(b) decreased distances travelled to alternative sites.

Benefits are normally adduced from travel costs foregone, or (b), with no account taken of the increasing frequency with which these benefits are gained.

(2) Alternative site uses

Some attempts have been made to assess benefits accruing from recreation by imputing a value for the site itself, either as a market price for the site, or its potential value in alternative use. Frequently, this approach entails a costs foregone assessment whereby the difference between alternative benefits is used as a measure of benefits for the scheme adopted (Steiner 1965, p. 33-34). This is the basis of the decision-making process employed in the final stages of benefit-cost analysis and needs little elaboration here.

Generally speaking, the imputation of recreational values by assessing the value of alternative uses involves the extraction of the area concerned from public ownership and its hypothetical exposure to private market operations. This 'shadow pricing' (McKean 1968) may involve the assessment of these aspects of the area's value:

(1) market value of total area (Lerner 1962, p. 66-67),

(2) market value of surrounding property (O.R.R.R.C. No. 24 1962, p. 51; Brewer 1962, p. 90), and

(3) market value of the area's produce (Crutchfield 1962, p. 149-150; Sewell and Rostron 1970; Spargo 1965; Knetsch 1965).

In all three cases comparative estimates are made determining the relative values of the area in both public and private ownership.

This approach has the advantage of directly facilitating decisions and of providing a reasonably accurate basis for assessing relative benefits. However, this use may be limited where the amount of public recreation is significant, since the market value of recreational sites will be repressed where a monopoly of publicly owned sites exists (Lerner 1962, p. 67). Only in the areas where most sites are privately owned will any indication of the true market value be apparent through the normal mechanics of market competition, since private areas are not compatible with public areas.

The method is completely unusable, however, where a value for recreation is assumed to be equivalent to the value of the same area used for a different purpose. Some of the finest recreational land, such as the Grand Canyon, are almost worthless for any other kind of activity (O.R.R.R.C. No. 24 1962, p. 67). Moreover, this method assumes that benefits equal costs foregone, an assumption also used in the 'Cost Method' outlined below which is total untenable. Nevertheless Water Resources Engineers (1970, Chapt. III) adhered to this approach in one of the two methods which they proposed in 1970, and Steiner's (1965) modification, which states that benefits were equal to the difference in cost of the first and second most expensive schemes, is no more than a perpetuation of this nonsensical myth.

Other related approaches have been suggested which possess little justification. The report from the Water Resources Engineers (1970, p. 43) mentions a proposal that the costs of reverting an area to its previous state from its developed condition are equivalent to its benefits. Replaceability has been, however, a more plausible basis for efforts by Twardzik (1966) and Cicchetti and Krutilla (1970) to assess the value of unique recreational resource. The former's approach is unfortunately neither specific nor tested, and is not based on alternative values but on the market value of the site as a recreational facility. The latter has little relevance to alternatives and is discussed elsewhere.

Methods Based on Expenses

Closely related to use of consumers willingness to pay for recreation, is the notion of assessing benefits according to actual expenditures made by the consumer or site operator. There are two major approaches entailed here which are discussed separately in the literature:

(1) expenditures by consumers or the 'Expenditures Method', and

(2) costs of site establishment and maintenance or the 'Costs Method'.

Although they contrast strongly in their respective origins of expenditures they are similar in both their simplicity and lack of validity.

(1) Expenditures Method

This approach appears to differ from that discussed in the section concerning willingness to pay in at least three ways:

(a) no demand schedule is established,

(b) only monetary expenditures can be included, and

(c) secondary benefits are implied, in addition to primary (Spargo 1965, p. 59).

There appears, however, to be some problem with semantics, since in spite of these proposed distinctions, consumer expenditures may still be construed to imply minimum benefits accruing to users in much the same way as willingness to pay. Moreover, the normal market price, as argued above, is normally interpreted as the economic value of a product, and there seems little distinction between consumer expenditures made for a tangible commodity and those made for recreation - both would theoretically reflect economic value. This method does not, however, allow the calculation of consumers' surplus (Figure 9, Merewitz 1966) which is discussed above.

Normally this method is adopted to impress possible investors in the size of gross consumer expenditures, but is not an adequate investment criterion because:

(a) it does not reflect net benefits, and

(b) it reflects secondary benefits in addition to primary by including expenses incurred at nearby retail outlets who benefit the local community by adding to the regional income. Clawson (1959), however, argues that this is not a particularly useful property since net income is not indicated.

This method therefore differs only marginally from those associated with willingness to pay, and may reflect consumer benefits, if total monetary expenditures are accepted as equivalent to the minimum (since investment would not be made if returns were not felt to be *at least* equivalent) economic value of the good consumed.

In 1960 the Select Committee on National Water Resources (O.R.R.R.C. No. 24 1962, p. 57) proposed this method which estimated fishing and hunting benefits as represented by an amount equal to the expenditures as participants. However, in the same year, the U.S. Interagency Committee on Water Resources of the Fish and Wildlife Service stated that "... no satisfactory basis was found for arriving at a usual relationship of sportswear expenditures to the net value of the recreational activity" (U.S. Fish and Wildlife Service 1960).

(2) Costs Method

The costs method has been briefly referred to above as probably the least useful technique to be adopted. In contrast to the expenditures method, this technique is concerned only with the costs of supplying recreation. For reasons best known to themselves, the U.S. National Parks Service in 1950 adopted two methods of assessing benefits at reservoirs, one of which was a cost method. They argued that "a reasonable estimate of the benefits arising from the reservoir itself may be normally considered as an amount equal to the specific costs of developing, operating, and maintaining the recommended facilities" (Prewitt 1949, p. 20). Most other authors concerned with recreational benefits have summarily dismissed this method since it *automatically* justifies any project and there can be no valid basis for the assumption than benefits equal costs.

Undeterrred by the weight of opinion, Water Resources Engineers, twenty years later readopted this assumption for their "Benefit Foregone, Subjective Decision Method". They said that "we recognize that this assumption may not always be valid; but we choose as a subjective judgement, to begin the analysis through this method on the basis of that assumption" (W.R.E. 1970, p. 35). With no basis for this choice, and no arguments to support the assumption, this is not a method to be emulated.

Techniques Including Secondary Benefits

(1) Gross National Product

Both Crutchfield (1962) and Lerner (1962) refer in their discussions of techniques to the 'Ripley" method of assigning a daily value to recreation according to its contribution to the Gross National Product. It assumes that a day spent in recreation is equal in value to the G.N.P. per day per capita, and that leisure is as essential as working time to production. There are several objections to this technique:

(a) Lerner (1962) argues that this presents no economic justification for recreational investment because an alternative activity, such as work, would then be assigned the same proportionate contribution to G.N.P. as recreation. There would then be no net increase in the G.N.P. resulting from this investment in recreation. It might be proposed, however that since the size of the G.N.P. is allegedly a partial function of contemporary and past recreational investment, the reflection of economic value in the G.N.P. might be observed in the form of a decrease in production if present recreational investment, in time and money, was reduced.

(b) Crutchfield (1962) has pointed out that the relevant measure is not the G.N.P., if leisure is to be treated as a factor of production, but the wages component of the national income.

(c) Both Crutchfield and Lerner consider that there is little to be gained from considering time to be of uniform value. "This is exactly analagous to computing the average yield of an acre of land by dividing all agricultural output by the total acreage of cultivated land" (Crutchfield 1962, p. 150).

The 'standard method' of using the G.N.P. measures the direct contribution of the recreation industry to the national product. This includes incomes accruing from facility operation and the expenditures made by users on goods associated with recreation. It is supposedly equal to the total economic value of the recreational sector of the economy and a measure of national benefits. However, in addition to problems of data collection, it is questionable whether this method can be used to derive *net* benefits, or a net increase in the national product. All the moneys involved in the calculation would appear in an alternative sector of the economy, if they were not spent in recreation. Thus, the sum of expenditures and incomes in recreation reflects no actual *gain* to the national product, and bears little relationship to the personal benefits accruing to users. Moreover, "the alleged increase in national product, measured according to the standard method, is more nearly an increase in local product, which is largely a transfer from other areas" (Lerner 1962, p. 61). Thus, the usefulness of this technique is dubious in the computation of national, personal and even regional recreational benefits.

(2) Value Added

In an unpublished study of water use in northern New Mexico, Nathaniel Wollman undertook to calculate local benefits in a number of sectors of the economy, including recreation (Clawson 1959). The technique involves the assessment of values by deducting supply costs from gross expenditures made by users. It is thus a partial refinement of the gross expenditures method and bears a resemblance to the G.N.P. method at a local level. The advantage of this method is that it can be applied to other components of a multi-purpose scheme, such as irrigation or electrical power, providing comparable data for a number of sectors of the economy. The disadvantage of recreational values being incompatible with other values is one common to virtually all of the foregoing techniques. However, as Sewell and Rostron (1970) and Clawson (1959) have shown, the amounts spent in contributing the value added are a reflection, not of the value of the recreation opportunity *per se*, but of the provision of other services connected with a recreational facility. It is thus likely that estimates of value added will be high.

Some Conclusions

In this chapter, an attempt has been made to briefly evaluate the most prominent evaluatory techniques applied to recreation and the reader is referred to the texts cited for a complete description of the methods themselves. Of these techniques, the most simple and applicable would appear to be the interpretation of demand curves in much the same way that Clawson has shown. In particular, emphasis should be made on the following:

(a) Demand should be assessed as a 'density'. That is the number of participants per thousand population should be the measure of frequency Q.

(b) On the horizontal axis, costs P should be measured according to the three types of expenditure, monetary, time and utility costs. It is a matter of contention, however, that the latter two are discrete values.

(c) The concept of consumers' surplus should be ignored, since the actions of a discriminating monopolist are purely hypothetical, and because this surplus is not normally assessed for other parts of a multi-purpose project.

(d) The level of P where 'total revenues' are maximized has some relevance to the average benefit enjoyed by consumers.

The concept that minimum user benefits are reflected in user expenditures is essentially valid. This is an extremely simple but important notion. A user will purchase a good as he would invest in a corporate firm and tangible and intangible returns are derived wherever the commodity in question is a marketable good. In the case of recreation, although goods may not be tangible and no property rights are obtained through the investment, returns may be assumed to be *at least equal* to the level of total expenditures. This must be the foundation for future economic analyses, and should be the focus of new developments in the future field of the economic evaluation of recreation.

CHAPTER III

NON-MONETARY EVALUATION OF THE PHYSICAL ENVIRONMENT

In contrast to techniques discussed in the previous chapter, there exists a number of methods for evaluating the total physical environment useful in the quantification of intangible elements for the purposes of decision-making. They are characterized by their non-monetary nature and operate as described in Figure 10. Their role is to produce supposedly objective quantifications of specified areas, either recreational sites or more impromptu scenic attractions. These methods may be used either

(a) as a basis for calculating monetary values, or

(b) as a tool for the comparison of scenic areas.

In general there are two kinds of models which have been developed for non-monetary evaluation, attractivity models and aesthetic measure models.

Attractivity models are based on the demand for an environmental experience as measured in user participation or satisfaction. Where either of these is known and quantifiable for a site or area, the characteristics of each location may be used as independent, or explanatory, variables. Wherever statistically significant correlations are derived between the dependent variables of satisfaction or participation and the independent variables of quantifiable elements of the physical site, it may be concluded that effective indices have been found. The applicability of one set of such indices from one particular site to another is a matter of judgement and has not yet been tested on a sufficiently large scale to derive universal attractivity indices (Merewitz 1966, p. 639). Some attempts to derive localized attractivity indices will be discussed below.

Where no demand for a site or area is directly expressed, various attempts to measure the psychology of stimulation derived from the physical environment have attempted to compensate. These methods entail the correlation of observed stimulation or preferences with quantifications of the object of stimulation, such as a view or photograph. Factors such as method of perception by the individual, survey methodology, and constraints imposed by the variable psychological reactions are observable hazards in this kind of approach. However, some noteworthy efforts have been made

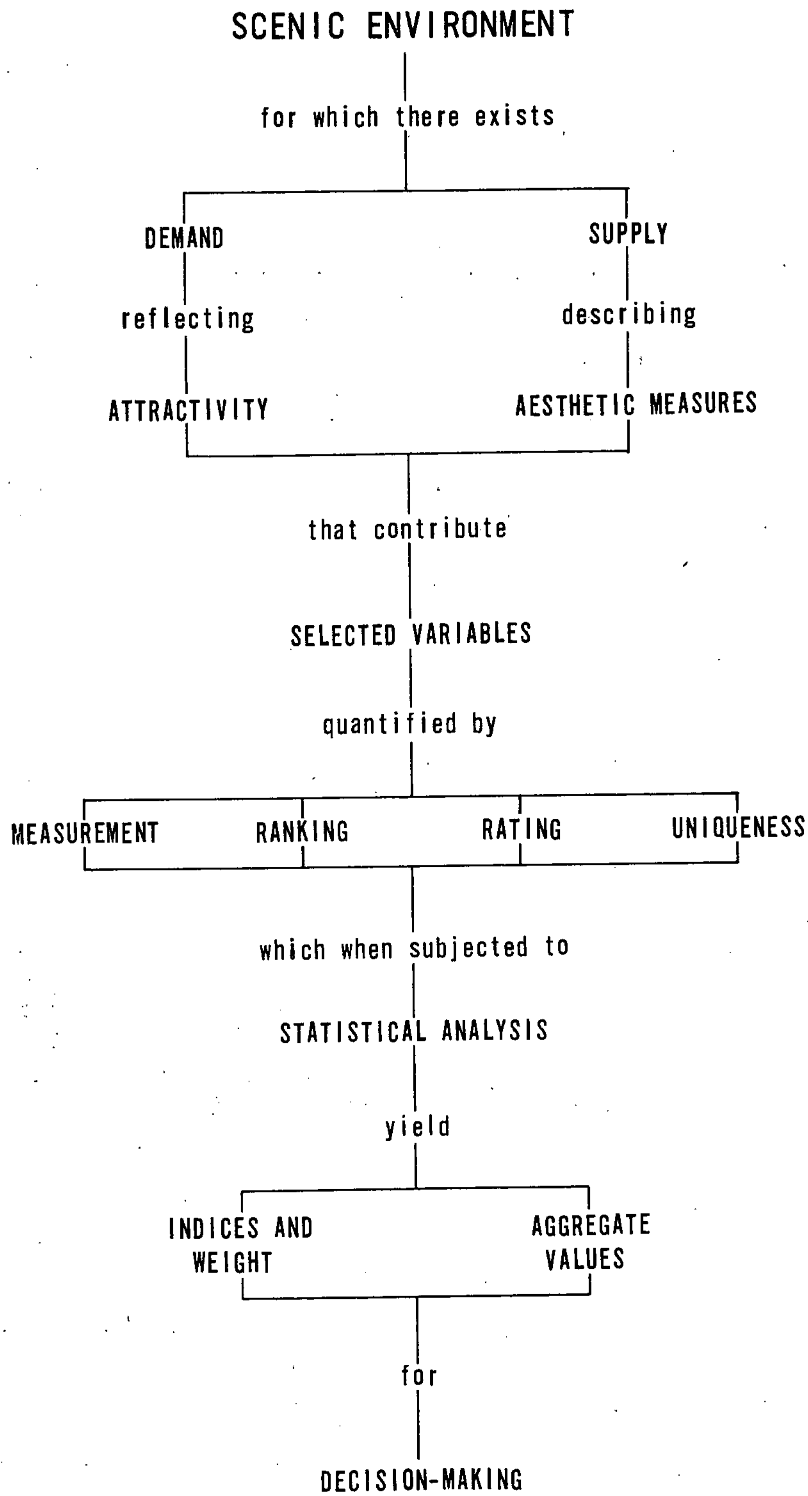

Figure 10. Process of Quantitative Analysis of Physical Environment

in the field of quantitative ecology and artistic appreciation which are briefly discussed herein.

A particular shortcoming of these models is the questionable selection of the original variables. Although correlation analysis may indicate those variables effective in creating the aesthetic experience from among those used, there is no guarantee that the most important indicators will be hypothesized in the first place. For at least two reasons, vital indices may be omitted from the analysis where

(a) they are not accurately quantifiable, and

(b) they were not perceived to be of value.

A discussion of this and other shortcomings will follow.

Four techniques are used in the quantification of environmental variables as shown in Figure 10. Direct measurement in applicable units is possible in both types of models but is the major recourse for attractivity models. Such variables might include acreages of water, numbers of trees, or distance from urban centres, for which ratio data are obtainable. Aesthetic measure models normally depend on systems such as subjective point-scale ratings undertaken by observers, or quantifications dependent on degree of uniqueness.

Statistical analysis of resultant values often entails the multiple regression of indices to explain user response quantified by attendance rates or preference scales. Using this, the most effective variables are extracted and coefficient values derived. More simple statistical analysis may involve the summation of rating scores or some multiple of them. Aggregate values may be found by the latter method, for comparison of areas subjected to the same rating system. From the derived aggregate or coefficient values, a clearer understanding of the physical potential of the areas may be gained for the purposes of decision-making in planning additional facilities.

The Problem of Aesthetic Measure

Beauty, whether it is man-made or natural, can never be accurately measured. There is no reason, however, why it should not be modelled. By defining the variables associated with an object and a subject's perception of it, a reasonable understanding of aestheticism may be attained. Quantification of these variables may also be possible in the way Birkhoff showed in 1933. Concerned primarily with the totality of aestheticism and its stimulus for man, Birkhoff began with the simple formula

$$M = f\left(\frac{o}{c}\right)$$

where M is the aesthetic measure expressed as a function of the ratio of order (o) of the object and its complexity (c). Where M is zero "... the tone of feeling due to the associated ideas is indifferent." These elements are incorporated into diagrammatic presentation of the aesthetic formula where complexity is measured by "weighted automatic motor adjustments" or nervous reactions, and order is measured by "weighted aesthetic associations" or the recall of comparable emotions or objects (Figure 11).

A number of authors have related the problem of human stimulation and aestheticism to the landscape. To Sonnenfeld (1966), the landscape connotes a concrete meaning, a use, an emotional and a symbolic meaning, but he does not attempt to derive any measurable variables to assess the rationale of human landscape appreciation. Wohlwill (1966, p. 32) however, suggests that key elements in environmental aesthetics are novelty, complexity and variation. Similarly, other authors mentioned in Chapter I have attempted to isolate the most influential components of a landscape. Reichardt (1970) has classified variables into six categories including those related to the human environment arguing, after White, that the physical has no meaning without the man's social environment.

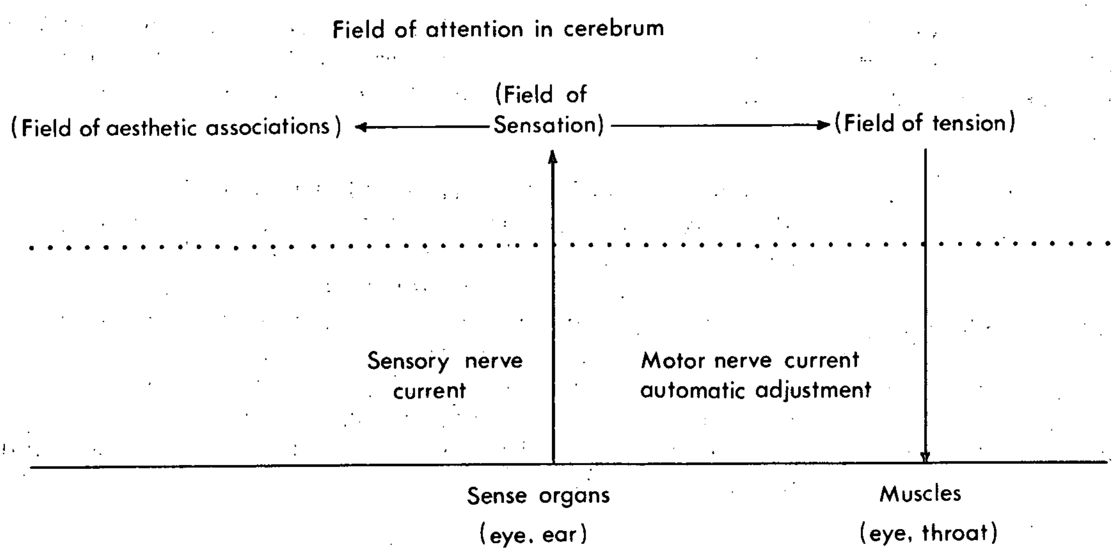

Figure 11 Mechanics of Aesthetic Appreciation (After Birkhoff)

Perhaps of more importance than the content of a landscape are the characteristics of those perceiving it. David Lowenthal is one of the most informed sources concerning environmental perception. However, his work tends to be more empirical than theoretical and cannot be directly applied in environmental evaluation. To demonstrate the problem of varying perceptions it may be useful to observe Wohlwill's (1966) interpretation of an "adaptation level". Apparently, each individual has an adaptation level at which they have adapted to their regular surroundings and to some

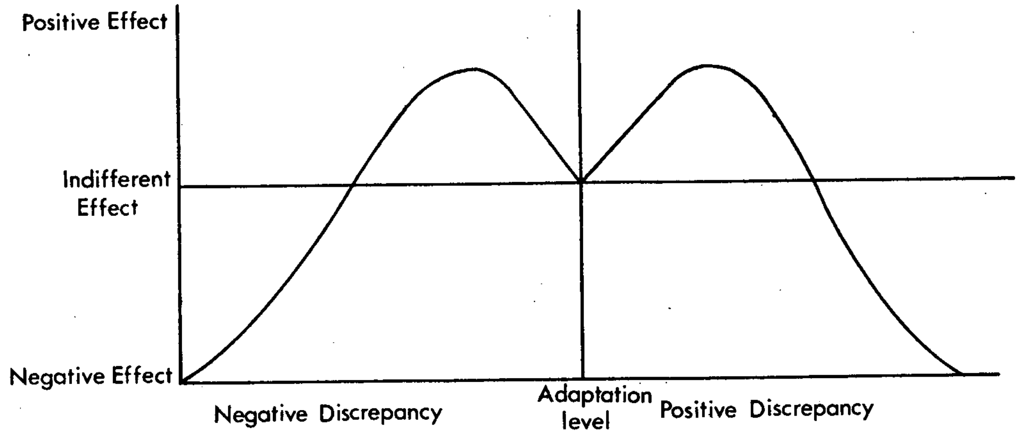

Figure 12. Perceptual Adaptation to Environmental Change
(After Wohlwill)

extent derive pleasure from variations from it. Thus, in Figure 12, the horizontal scale is one measuring the amount of stimulation and the vertical scale is a measure of the affect of that stimulation. Beyond a certain point in either direction from the adaptation level, the effects decrease to a level below the point of indifference. This occurs where the amount of change in the immediate environment of the subject is more than is pleasurable and difficulty of adaptation is experienced. This remarkably simple concept appears intuitively to have empirical proof but since no scaling has been attempted for either axis it cannot be properly tested or used for the measurement of potential environmental stimulation.

The concept, however, serves to illustrate some of the difficulties involved in attempting to assess environmental stimulation to a population of variable susceptability. Persons living in different environments (and everyone's is different ultimately) having varying responses to such stimulation. Thus, even if the physical components of a landscape or a part of the total environment could be measured, its effects and popularity would not be constant. The importance of this, however, should not be overstated. There is a parallel here with the numerous demand studies undertaken in recreation, which demonstrate those socio-economic qualities which are associated with certain participation levels. From a planning viewpoint such findings are not very useful since in a given city average socio-economic characteristics do not diverge greatly from those of another and in any case the characteritics of present users are of questionable importance in projecting for non-users. Consequently planning considerations are unlikely to be altered very much from what the physical environment in the area is able to offer. Similarly, the usefulness of a knowledge of variable adaptation levels may be questioned since it is unlikely that any planning considerations may be structured by such a concept, and particularly by one which lacks any quantified scaling mechanism.

The problem of theoretical measures of aesthetics is unfortunately beyond the immediate scope of this report, but these few illustrations demonstrate the complexity of the field. In general, it is one where an interdisciplinary approach is required, but little of this approach has yet reached the problem of evaluating landscape or perceptual influences. No satisfactory scaling methods have been developed for the assessment of either user reaction or environmental content. Some efforts, however, have been made to develop indices for the quantification of landscapes; these are now discussed below.

Aesthetic Measure Techniques

(1) The Shafer Method

Following an original concern with forest aesthetics and the use of photographs in studying reactions to timber cutting in 1967, Shafer (1969, 1970) developed a model for predicting more general appreciation of landscapes through observed photographs. Realizing most of the drawbacks to using photographs, and particularly their ability to present only a few of the aesthetic qualities of, for example, a forest stand or watercourse, Shafer has presented a convenient method of obtaining user preferences for a number of different scenes over a very large area.

Shafer devised a system of indices which identified measurable parts of the structure of the landscape as shown in the photographs. These measures were then compared through factor analysis to the results of a survey of observer preferences. The variables used were of three kinds:

(a) Landscape zones - Ten zones were depicted to indicate the distance of areas of vegetation or water in the photograph.

(b) Measurements were made of these zones using their perimeters, area, interior size and vertical margins. A grid square was superimposed for this purpose.

(c) Tonal variations, measured by a photometer.

Six variables were found to be statistically significant and incorporated in a fairly successful predictive analysis.

The shortcomings of this technique are immediately apparent. As Shafer states, "the model does not predict landscape appeal directly. Rather it predicts the appeal for a photograph of a landscape." Other sources of bias are mentioned by the author, including interview problems, photographic composition, incomplete measurements of landscape and unrepresentative choice of photographs.

In view of the excellent research approach adopted by Shafer, this technique has much to recommend. In particular, this appears to be a valuable method of isolating key components of a vista as an initial guide to the understanding of total attractiveness. The managability of this type of study using photographs makes it an acceptable *preliminary* step toward the planning and preservation of real scenic areas. The numerous sources of bias should not be considered overimportant. Shafer's awareness and acceptance of them is refreshing in view of the way other researchers tend to brush this kind of inaccuracy under the carpet even when more problems and biases would be encountered than in this technique.

(2) <u>The Leopold Methods</u>

Leopold (and others, 1968, 1969) has developed two methods of assessing environmental quality which deserve attention. These may be named the 'Uniqueness Method' and the 'Matrix Method'.

(a) Uniqueness Method

In Leopold's first attempt to derive a quantitative evaluation of a landscape, he selected 34 variables classified as those of a physical and chemical nature, of biological character and of human use and interest. The qualities of these variables were assumed to vary within a scale of one to five. These scores were then given a uniqueness ratio which reflected the number of other sites under consideration that received the same score. Thus, if only one site received a particular score it would receive a uniqueness ratio of 1.0. If all twenty (if twenty sites are considered) receive the same score, they are each given the uniqueness ratio of 0.05. The summation of these uniqueness scores permitted a comparative appraisal of the uniqueness of each site.

Following Leopold's application of this technique to 24 river-oriented sites in California, it was again used in the evaluation of twelve sites in Idaho. In the second application, the number of variables was increased to 46, but no further significant modifications were made.

The assumptions underlying this technique merit some criticism. The variables are arbitrarily assumed to vary between levels of one and five in scale, to number 46 (in the second application), to be of equal weight, and are applied to an arbitrary number of sites. These arithmetic assumptions may be sufficiently invalid that no meaning can be attached to the absolute value of the aggregated uniqueness scores, while their relative credibility may also be doubted.

Moreover, unlike Shafer, Leopold did not adopt a strictly scientific research approach. A representative sampling technique was not used and no proper sampling system was suggested for future research, only a few general comments on timing and intensity. All sites were water-oriented and the measurement of variables was undertaken from the river bank for reasons of convenience. Leopold acknowledges many difficulties involved in these measurements, but may have defeated the purpose of the technique in his discussion of uniqueness. He states that, "For things *society judges to be desirable,* relative scarcity or uniqueness increases value to society" (our emphasis). He then adds that this technique does not discriminate between what may be desirable and what is not:

> "...it is entirely possible in a nearly natural river that the highest uniqueness score would be given to the site that is most turbid, most crowded, and generally worse in an aesthetic sense, because that site is indeed unique.... Thus the uniqueness score is just a measure of uniqueness and not necessarily a measure of goodness or badness."

Leopold in vain attempts to rescue the method from this criticism by arguing that

> "...we have attempted to avoid consideration of relative desirability, that is 'good' versus 'bad', because it appears that the first need is for a method of description without the bias accompanying the assignment of measures of worth".

Thus, it appears that, perhaps by oversight, the five-point scaling was not adapted to reflect desirability when indeed it should have.

(b) Matrix Method

By 1971, Leopold had apparently abandoned the uniqueness approach, although it might have been altered for greater accuracy and meaning, and adopted an even simpler concept. Leopold has expounded at considerable length the notion of rating individually the magnitude and importance of project impacts on the environment. He designed a matrix of 100 different possible actions resulting from various projects, and 88 environmental characteristics which might be affected. Both magnitude and importance were subjectively rated between 1 and 10 for each interaction between variables. There is no proposed derivation of a total or coefficient, but it is suggested that the matrix, confined to those elements interacting in a particular situation, "...is in fact, the abstract for the text of the environmental assessment."

This technique suffers in the way that most models fall short. It is dependent upon the original input of variables which may or may not accurately reflect all that are relevant. However, in this case there is also particular emphasis placed upon the biases of the person chosen to rate each interaction. Except to say that these weights should be based on factual data rather than preferences, Leopold does not illuminate how this technique achieves any objectivity by being quantitative. The prime value of this method appears to be illustrative rather than analytic.

(3) <u>The Dearinger Method</u>

In 1968, at the University of Kentucky, Dearinger undertook what may be the most comprehensive approach of any quantitative evaluations. The method developed was fairly conventional - a system of assigning arbitrary weights to key elements of recreational activities varying between one and five. These acted as multipliers and were then applied to 92 environmental values of a particular site which were divided among natural and cultural elements. Also included were thirteen 'disvalues' associated with undesirable cultural scenery. The methods adopted to measure each of these variables, although arbitrary, showed indications of greater comprehensive and rationale than many others in this field.

Of particular interest are some of the variables incorporated in this analysis. For example, climatic factors include length of season, number of sunshine hours and measures of the microclimate of nearby streams, while water factors include stream order and pollution values. In addition to the development of this rating system, however, Dearinger undertook a reasonably comprehensive inventory of the test areas in Kentucky. Subsequently, in spite of a dearth of visitation data, he derived a reasonably accurate attractivity prediction equation using step-wise regression. An attempt was made to impute economic values to the derived values to each site according the estimated demand and distances travelled using a value of 3.4 cents per mile-visitor-day as the basis for benefit calculation.

Thus, this study is rare in its comprehensiveness and its combination of aesthetic measures, attractivity assessment and the estimation of economic benefits. No other study, to the authors' knowledge, has combined these three elements. With greater sophistication of the multipliers a greater accuracy may be achieved, but its applicability, once a considerable amount of data collection has been undertaken, has been demonstrated with considerable success.

(4) <u>Other Methods</u>

Apart from the three most applicable and most developed models mentioned above, there are a number of other techniques of scenic evaluation which merit recognition. These methods may be grouped under two general categories of 'Rating Systems' and 'Classification Systems'.

(a) Rating Systems

Craighead and Craighead (1962) developed 14 criteria affecting recreational activities which were rated on a point scale from one to five and these 'environmental point values' were subsequently summed for a particular area and for each activity. The highest ratings indicated the most suitable recreational use. This method was adapted for wilderness areas where it was not necessary to determine whether the area had *any* recreational potential, since such areas invariably have physical potential, if not accessibility. It was therefore a method of assigning most suited activities to an area of wilderness.

The U.S. Geological Service in 1966 devised a twofold categorization of criteria, assessing the hydraulic, geomorphic, water quality, ecologic and aesthetic characteristics of an area. It was strongly oriented towards the water base of recreation which also attracted the attention of Horton (1965). He used eight indices of water quality, such as the amount of dissolved oxygen, chlorine, acidity, and weighted their importance between one and four. Percentile scores were then recorded for each index, multiplied by the relevant weighting factor, and the results summed for each location. Generalized comparisons of water qualities were then made possible from an environmental standpoint.

The notion of using multiplier values of particular aspects of environmental quality has attracted the attention of several other researchers. In particular, Water Resources Engineers (1970) in their non-monetary evaluation method adopted a system of weights for various possible activities which might be developed in a wilderness valley. They were extraordinarily biased, however, and assigned weights varying from 1.0 for power and for fuel and mineral mining to 9.8 for recreation. The serendipic value of scientific research was also ignored.

Simple summed rating values were adopted with reasonable success in two other cases. Trotter (1962) focussed on the principal attraction of a park in organizing criteria for the variables and their values. Encroachments of urbanization reduced scores, and substantial buffer zones of wild land around the principal attraction were rated highly. 15 criteria were established with different value ranges, the ratings being summed for comparison among other parks. Finally, Whitman (1968) developed a simple percentile index for seven major variables, and after each variable had been assessed, scores were again summed for comparison. This study had the merit of being realistically executed in that total scores were rounded to the nearest 5%, while studies such as that of Water Resources Engineers have taken calculations to detailed measurements of incredible accuracy.

(b) Classification Systems

Some attempts to rate environmental quality amount to little more than a classification of various components of a scenic area. Probably the best example of this kind of work is seen in roadside scenery classification by Burke *et al* (1968). Zones were established in this method in much the same way that Shafer assigned distance zones to scenic area and their use of photographs for the analyses constituted a further similarity. A generalized rating was attempted, but no overall values were derived for the total scene, using parts of a view which add or detract from the visual quality. However, the greatest contribution of this technique lies in its use of the road as a focus for classifying scenery. In contrast to Leopold, who used rivers as the viewpoint, Burke uses roads, from which most persons will view the type of scenery he had in mind.

Unfortunately, other classificatory attempts by Sargent (1967), Morisawa and Murie (1966), Taylor and Thompson (1965) and O.R.R.R.C. (No. 5 1962) are little more than the preliminary phase of a quantitative analysis. Dearinger's use of taxonomic inventory of environmental phenomena prior to his scenery analysis is an example of a use for such classificatory schemes, but they are of little use in quantitative evaluation without their adaptation to rating scales.

Some Problems of Aesthetic Measure Models

Many of the problems facing the techniques described above are found in most quantitative models. Much depends on the nature and comprehensiveness of the original variables incorporated and hypothesized to be relevant. Moreover, the accurate measurement of these variables may often be impossible, and due to the type of output provided by these particular models, where no measure of explanatory power is derived, there is little recourse to check at least the first of these problems.

Where a dependent variable such as observer preferences in the Shafer method is derived, independant variables found to be significant may be unreliable. The measurement is of a hypothetical response, not the actual participatory reaction that is used in attractivity models. For this reason, and many others which Shafer himself has pointed out, the results of Shafer's technique should be tested in the field without the use of photographs. In the same way that the direct technique of asking recreationists the extent of their willingness to pay produced hypothetical responses, so is this method susceptible. Thus, the dependant variable in this case is also dependant on the whims of a casual observer.

The variables incorporated in all aesthetic measure models, were, as stated earlier, given equal weight. Without knowledge of the explanatory power of each variable, however, there seems little justification for altering their equality. The problem which follows, however, is obvious. The subjectively derived scores for each variable cannot be summed or averaged to provide a single figure related to a particular site. Leopold's attempt to impose uniqueness values of these subjectively derived figures for twelve different river sites involved such an illegitimate summation. However, not only was it improper to sum these uniqueness scores, but it also severely altered the original order of value of the twelve sites. The average change of rank, between the ranked summation of absolute scores and that of uniqueness scores was 4.2 for twelve ranks. In view of the other criticisms of Leopold's techniques mentioned above, it is difficult to resolve whether such major changes are indicative of greater or lesser accuracy.

Attractivity Models

Attractivity models of aesthetic attraction are derived from the relative demand functions of specific recreational sites. In place of observer preferences used in some aesthetic measure models, user participation rates are incorporated as the independant variable. The underlying assumption is that the attractive qualities of a recreational site are reflected in user response or non-response. Compared with observer preferences, this variable has considerably greater justification in representing the aesthetic power of a site since it is less subject to the whims of questionnaire respondents. The physical effort involved in visiting a recreational site represents a more positive response to attractivity than a merely stated appreciation of such qualities.

The distinction between these two kinds of models lies not only in the measurement of reactions to attractivity but also in the nature of the units used to measure attractivity. In place of the commonly used photograph of an area is the actual site, and in place of what can be seen from a single point is the total functional site unit. Many elements of attractiveness, positive and negative, are obscured from a viewer who looks at only one moment in time from a single standpoint. The measurement of the independant variable in attractivity models involves the measurement of all usable units of each attractive component, and not merely those observable from a distance. There is little need to dwell on the superior representativeness of physical exploration of a site compared with a photographed view of it from the road.

The measurement of participation has been undertaken in a number of different units (Little n.d., p. 11). The most commonly used unit is the 'visitor-day' which measures the total number of days, defined according to a predetermined number of hours, spent by day trippers and long-staying vacationers alike, at a particular site. A rather different system of measuring participation has been outlined by Ross (1971, 1971a) which merits comment. He proposes that attractivity may be measured by the number of visits made to a park by visitors living closer to another park. The number of visits made to the more distant preferred alternative park is, it is suggested, measure of attractivity. This is expressed as an ordinal measure of the probability of a certain park being visited. Matrices can be constructed to describe the attractiveness of parks relative to each other in a certain area, and values derived from these may be used as an 'independant' variable. This has been incorporated into a study of Saskatchewan parks (Ross 1971a) and is currently under review by the National and Historic Parks Branch, Ottawa.

The advantage of these attractivity indices are twofold (Ross 1971, p. 4):

(a) The distance-attendance relationship of site visitation is removed, and with it some of the disadvantages of gravity models.

(b) No predictions of attendance or preference are made beyond the furthest park actually patronized.

There are, however, a number of shortcomings in the adoption of this measurement technique. Data are not, without further manipulations, of an interval scale kind, and are thus difficult to incorporate into regression analyses. Moreover, more data are required to derive attractivity values since a knowledge of respondents' origins must be ascertained and measurements to alternative sites made. Perhaps more serious is the substitution for the explanatory variable of distance in gravity models, of competition in attractivity models (Myles 1967). Instead of measuring attractiveness according to its drawing power over distance, it is measured against alternative competitive sites (Grubb and Goodwin 1968; Brown et al 1964; Krutilla and Cicchetti 1970; Sewell and Rostron 1970, p. 15-18; Highway Research Board 1968; Merewitz 1966; Helliwell 1969). In most regression models distance from population centres and the relative location of alternative destinations are important *dependent* variables which are used to explain the simple aggregate numbers of visitor-days recorded at each site. There may be little gained from this substitution, particularly in view of the loss of detail in participation data.

The Problem of Measurement

Within the twofold distinction between variable values measured according to recognized units and those measured against an arbitrary scaling system, there is little need to comment in depth on the latter, since it is obvious that variables such as colour tone or climatic suitability can hardly be measured with total objectivity. Perhaps less obvious are the difficulties involved in the functional measurement of the former. At least four problems may be encountered in the measurement of variable units associated with aesthetic attractiveness.

(a) Variable Use Intensity

Frequently part of a variable, such as a lake, will be used with varying intensity. In Figure 13 this is presented diagramatically for three major recreational uses of water: swimming, boating and fishing. In all three cases certain parts of the lake are used for each activity with varying intensity. Higher intensity uses may be anticipated near the beach, dock and rocks respectively, with a gradual reduction of use intensity away from these foci. It is apparent that to measure the total acreage of the lake will not produce a figure which reflects the value of the surface area since some parts of the lake are of greater utility than others. Moreover, a comparison of this lake with another of similar area but where only boating was possible, would not be feasible, since the number of recreationally useful acres are clearly different. The calculation of the size of this difference is an additional problem which must be solved by the adoption of measurements of relative intensity, a process beyond the scope of this study.

(b) Multiple Use

Closely related to the problem of the variable intensity of use is the difficulty of measuring values of lake area used for different activities. Many activities are mutually exclusive and do not encroach upon each other, but are of different recreational value. Thus, there are really two problems associated with multiple use:

(i) The assessment of the relative benefits of each activity in its use of the water area.

(ii) The assessment of opportunity costs associated with the reduction of activity of uses in the same area of water, or in the exclusion of one use in a particular area by thorough dominance of another.

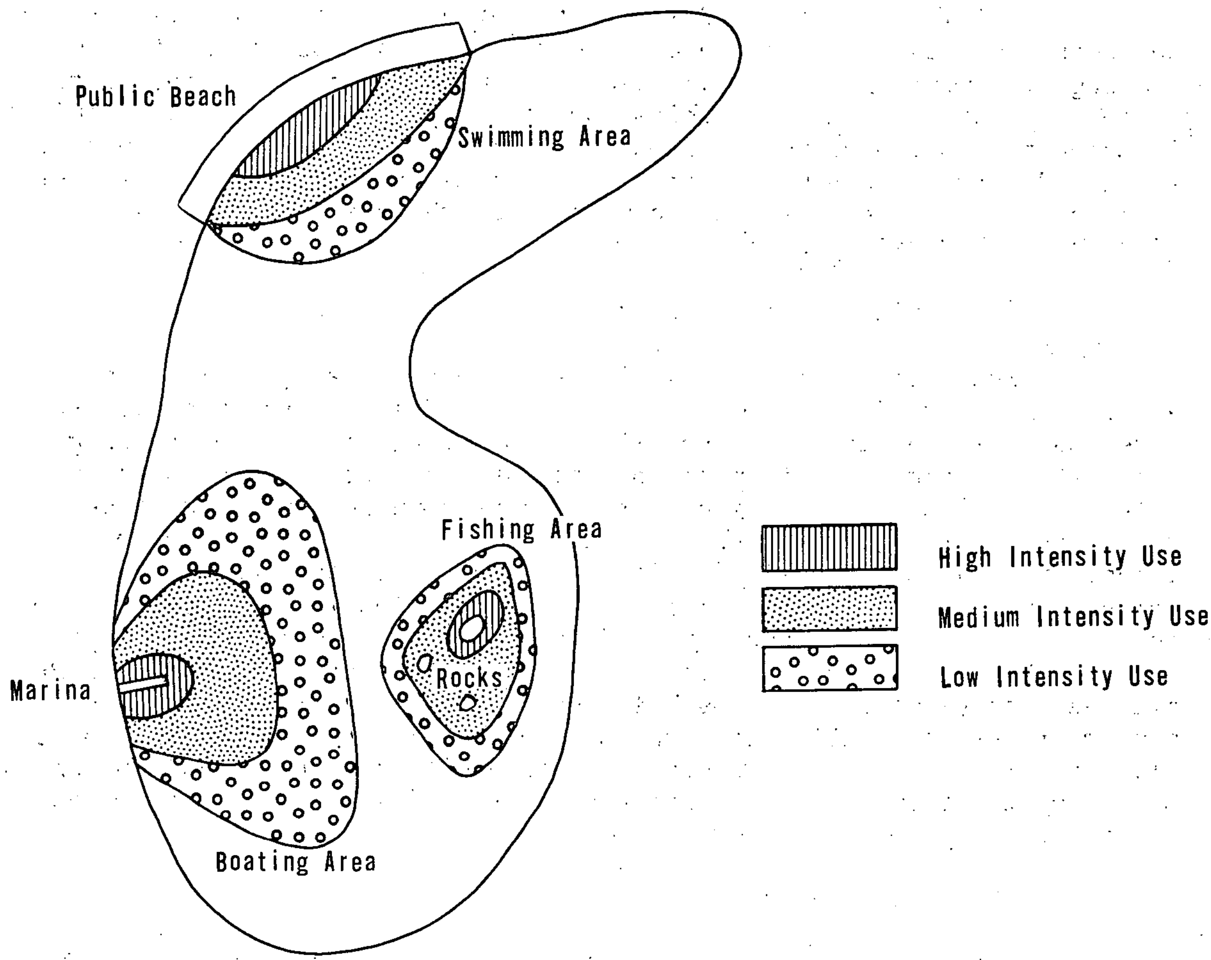

Figure 13. Hypothetical Variable Intensity of Lake Use

At least three categories of use may be apparent, either in mutual conflict or coexistence:

(i) Recreation including active use of water in boating, fishing etc. and passive aesthetic appreciation of a watery scene.

(ii) Disposal of waste from recreational facilities, and other junk.

(iii) Water supply for recreationists and the natural ecosystem.

The complexity of this problem increases as greater measuring accuracy is sought (Figure 14), but an estimate of acreage values may be derived from a weighting of each activity according to total benefits combined with the partial solution suggested for the problem of varying use intensity.

(c) Combinatory Value of Uses

Certain elements of a lake have no value unless they coexist with others. Thus, a lake is of absolutely no practical use if it is not accessible, and is of reduced value if it is not physically suited to human uses. Moreover, if useful at all, the swimming value, for example, may be reduced where no change-houses are provided, or fishing grounds may be useless where overrun by weeds or power-boats. An infinite number of combinations of each element alter the relative value of each other. This appears to be an insoluble problem although a nominal, presence-absence form of data may be useful. In this situation, valid and invalid combinations may be noted and adjustments to scores, derived from summed presence-absence data, made.

(d) Nominal Data

In recognizing some variables, quantification in nominal data form may be the only method available. Although this may be a partial solution to the previously-mentioned problem, nominal data is one of the least useful types of data for model building. To exemplify, it may be ascertained from a survey of a site whether or not certain elements such as a water course, tree cover, or accommodation exist. In these cases it is more important to the total attractivity of a site that one of these actually exists rather than *to what extent* it exists.

Some Conclusions

This chapter has attempted to distinguish two kinds of models used in assessing quantitative environmental values, 'aesthetic measure' models and 'attractivity' models. A number of problems have been outlined which effect either or both of these types. It may be concluded that in spite of the apparent difficulties of the models developed by various

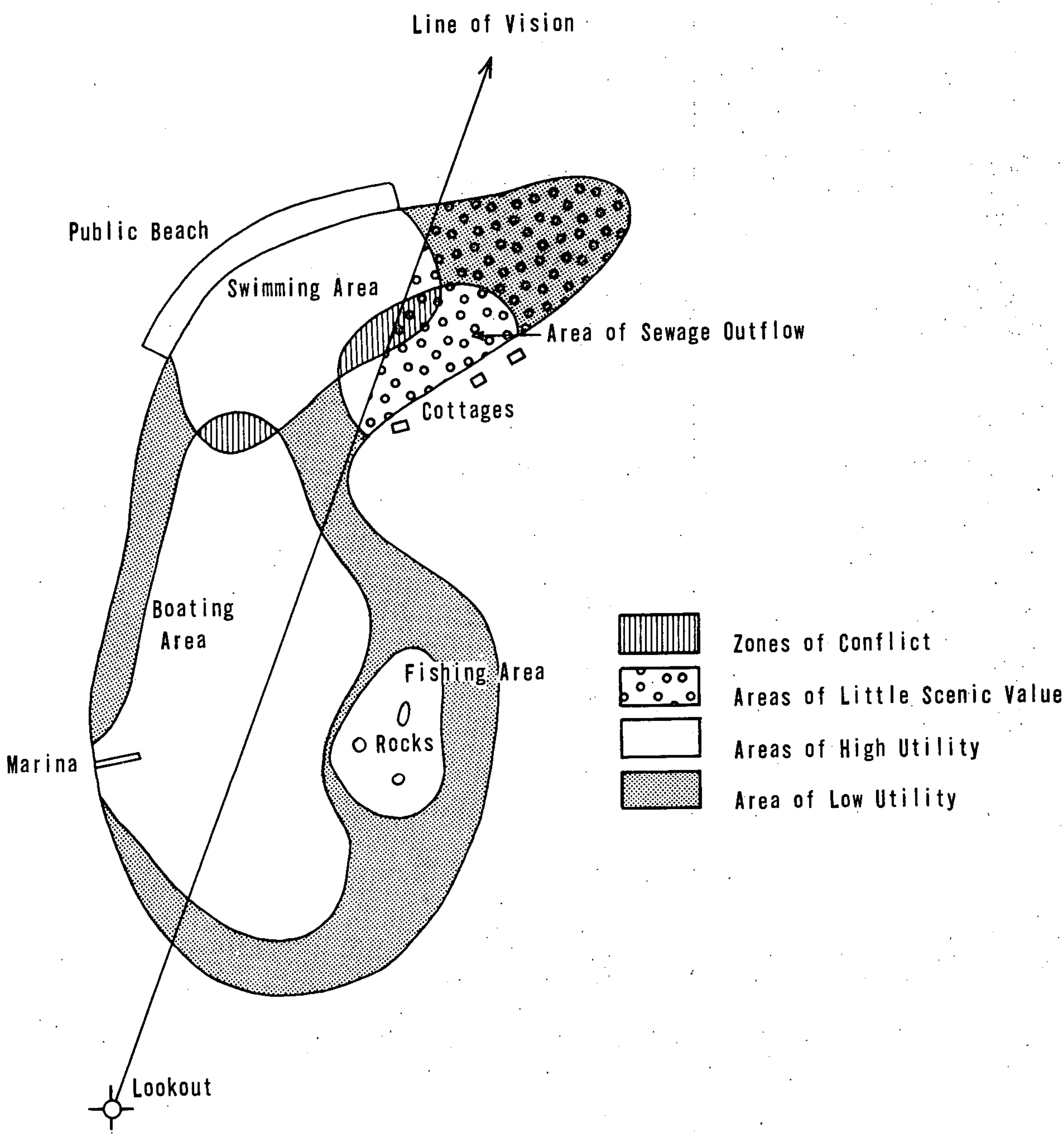

Figure 14. Hypothetical Multiple Use of Lake Area

researchers, there is considerable promise in their developed form. There remains the problem, however, of transposing these reasonably objective quantitative values into monetary terms suitable for decision-making through benefit-cost analysis or other techniques.

CHAPTER IV

CONCLUSIONS

There is little need to emphasise more than the salient points and the overall purpose of this report. To summarize, this study has been undertaken to consider the possibility of accurate assessment of the values of environmental intangibles. If values comparable with those produced for other commodities by normal market mechanics can be adduced, a large obstacle will have been removed from accurate project appraisal and benefit-cost analysis. This study has not attempted to derive new techniques, a task which seems to be as unnecessary as it is impracticable, but has concentrated on existing methods. This in itself embodies the conclusion that some currently adopted techniques possess considerable merit and may be modified for more accurate functioning.

This study falls naturally into three phases, focussing on individual contributions to the state-of-the-art:

(a) Chapter I - the historical and economic background of evaluatory techniques and their present adaptability to benefit-cost analysis.

(b) Chapter II - the classification and review of techniques for the economic evaluation of environmental intangibles.

(c) Chapter III - the classification and criticism of non-monetary evaluatory and comparative techniques.

There appears to be a dichotomy of goals among exponents of two major types of methodology. Few authors, however, explicitly acknowledge this by considering that techniques may be useful in one of two ways:

(a) to produce an absolute value for intangibles, and

(b) to produce a relative value for intangibles.

Considerable progress has been made toward the latter in spite of a lack of uniformity in methodologies adopted, since both monetary and nonmonetary methods are applicable to this. Only monetary methods are applicable, however, to the methods of absolute evaluation since non-monetary values have no meaning in the economic appraisal of each component of a project. Because recreation, and environmental intangibles in general, are a "vague utility function" and not a "clearly defined production function" (Seckler 1966, p. 494), the methods designed to produce an absolute value for intangibles have met with little success. Their value has been primarily incidental in facilitating decision-making among a choice of projects.

There is at least some agreement on the need for a uniformity of approach for the purposes of wider comparative evaluations. As Beardsley (1970, p. 4) concludes, "the need for a uniform policy determination of the appropriate use level to use in benefit calculations is obvious." Moreover, not only would standardization of techniques increase the reliability of decision-making but also consolidate such findings that exist today. Merewitz (1966, p. 639) has no doubts concerning the research which he has attempted that "such replication would yield suggestions as to the stability of certain parameters of the model and the variability of others."

Among the authors discussed, there appears to be further agreement over the most expedient methods that should be adopted. Lerner (1962, p.75) and a number of other authors accord with most of the proposals set forward in Clawson's (1959) most popular paper. However, Lerner suggests that a discriminating monopoly revenue method based on demand curves constructed according to Clawson's method would produce the most usable results. The shortcomings of the discriminating monopoly approach, which is tantamount to the collection of consumers' surplus, and of Clawson's demand curves, were discussed in Chapter II.

A particular facet of the shortcomings of the latter, however, bears greater emphasis than is accorded in available literature. Only Knetsch (1963, p. 396) emphasises that of the questions remaining to be answered "the effects of time are possibly the most important." This is also the conclusion of this report. So much literature has recently been produced on the subject of intangible benefits that the simplistic nature of the original problem has been obscured. Whether a good is negotiable on the open market or not, consumers will attribute to it a value expressed by their willingness to pay for it. It is nonsensical to argue that individuals' differential valuations invalidate such values when assigned to recreational activities, since the same is true of any market or extra-market good. The difficulty does not lie in this argument, since the amount users are willing to pay is a reasonable reflection of the economic value of the recreational good. The difficulty lies in the assessment of the amount that users are willing to pay. It has been shown that more expenses are incurred than simply cash costs, and it is a matter of conjecture whether there are other costs in addition to those dubbed 'time' costs. Because recreation is a utility and not a tangible product, capital outlays on market goods are substituted by time outlays incurred in preparation, travel and experience. It can be a much more time-consuming process than the purchase of a book or radio, and monetary costs rarely reflect the total expenditures of the purchaser. Thus, if the value of time to users can be evaluated and added to the known value of monetary expenditures, a much closer approximation to the economic value of the recreational experience will be derived. These estimates might then be used to construct demand curves similar to those of Clawson's, which could be used to describe and predict optional recreational values and demands (without the use of consumers' surplus).

There are numerous other problems, however, which cause inaccuracies in value estimates. Two important drawbacks to valuation may be noted. First, as Merewitz (1966, p. 639) observes, prediction equations describing demand in a given area for a particular recreational facility are based on existing user preferences of persons already supplied with the recreational good. They are therefore only vaguely predictive of the demand of non-users or of the increased demand of existing users. Second, surveys of users to assess local demand functions are continually hampered by the problem of differential incomes among respondents. The problem lies in the threefold effect of income upon recreational patterns:

(a) income reflects and moulds personal tastes,

(b) levels of income are inversely proportional to personal valuations of economic worth, and

(c) incomes have a direct effect on levels of monetary expenditures.

It is extremely difficult to conceptualise these effects of income on recreational benefits without a preconceived notion of to whom the benefits accrue. To discuss 'total benefits' is to incur the effects of all three personal (primary) benefits will be effected largely by ability to pay (c) while social (secondary) benefits may be effected mainly by the first two. A satisfactory stratification of samples to account for these problems has not yet been developed. Attempts mentioned in Chapter II to correct demand curves through incorporating income and other socio-economic indices into regression analyses ignore the uniqueness of incomes as a threefold determinant of recreational activities.

This study has deliberately paid only lip service to secondary benefits. The problems involved in assessing the social benefits of recreation have received almost no recognition in available literature except in the dubious method known as the Gross National Product method (e.g. Lerner 1962). There is perhaps less reason than might be supposed to encourage the evaluation of secondary benefits. Within project appraisal, aspects other than recreation which also produce secondary benefits, are rarely evaluated according to their total social value. In the same way that it may be invalid to incorporate consumers' surplus in the recreation sector of a project when no other sectors do so, it may overstate the comparative value of recreation to add secondary benefits to the primary. Moreover, secondary benefits are a very vague concept. Authors blandly discuss reduced crime rates or higher industrial productivity assuming that the demand for recreation is insatiable and there is no limit to the amount of increased productivity and other benefits which can be derived from providing more and more recreational facilities. There must, in fact, be a point of diminishing returns where, for example, productivity is reduced after a certain level of leisure activity is reached. It is unfortunately not certain where this point lies, whether it has been passed or whether it lies somewhere in the future. Indeed a state of equilibrium may now exist through a natural adjustment of each member of the society to their own leisure allotment. If this is the case, then society must judge whether total benefits accruing to society will be increased more if current users and a limited number of non-users receive more leisure time, or if a total democratisation of leisure should occur with equal leisure time and costs. The decision can only be made after a clearer conceptualisation of user and social benefits has been made, and the philosophical and political implications fully understood.

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SECTION II

Economic Evaluations

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SECTION III

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