ESTIMATING DAY-USE VISITATION OF PUBLIC PARKS

by

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ABSTRACT

One aspect of rational park planning involves determining what kind of opportunities people want and where they want them. That is, for each design or locational alternative the planner would like to know the inherent benefits to be derived relative to other investments under consideration. Since the primary benefit of a park is reflected in the number of visitors, the planner must estimate the use of a proposed site in advance of its construction. This thesis is directed towards meeting these needs by further developing methods which can determine the visitor implications of various locational and design possibilities.

One means of improving estimates of the expected visitation of a proposed park involves the development of statistical models which yield estimates of use based upon observed travel patterns of users at existing sites. Using the number of visits as the dependent variable, a regression model was developed using explanatory variables that were specific to population centers and parks in the Lower Mainland Region of British Columbia.

The resulting model provides a fairly close prediction of the actual attendance at those parks under consideration. It seems reasonable, therefore, that the final estimating equation could be used with some confidence in predicting attendance to a new or proposed site.

ACKNOWLEDGEMENTS

I am deeply grateful to professors Jack Knetsch and Turgut Var who have, to my great profit, provided both constructive criticism and patience as my advisors over the past two years while at the same time spurring me on in the development of ideas.

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Many writers, including Butler (1959) and Romney (1945), have emphasized the role that outdoor recreation plays in a physically and emotionally healthy person. According to this view, one needs to participate in some outdoor activities to get away from the tensions of job and urban living. Although this view is becoming rather widely held, it is not new. More than a century ago J.S. Mill (1970) wrote:

> It is not good for man to be kept perforce at all times in the presence of his species. A world from which solitude is extirpated, is a very poor ideal. Solitude in the sense of being often alone, is essential to any depth of meditation or of character; and solitude in the presence of natural beauty and grandeur, is the cradle of thoughts and aspirations which are not only good for the individual, but which society could ill do without (p.115).

Regardless of how one views need for outdoor recreation, there is no question that many people demand it. Millions of Canadians spend portions of their available time and income to enjoy outdoor recreation which is one of the fastest growing activities in Canada. This trend may be traced through many indicators: the increased construction of commercial recreation facilities, the rising sales of fishing tackle, skis, outboard motors, mobile homes, and above all, the rising number of visits to National and Provincial Parks. The trends in park attendance are shown in Figure 1.

As frequently suggested (Kraus 1971, Clawson 1963, Knetsch and Davis 1966, Landsberg et. al. 1963), social trends such as increasing availability of leisure time, higher incomes, a growing population, shifting age structures, and considerably more mobility will continue to influence the demand for outdoor recreation.

An Examination of Trends

> Thus for the first time since his creation, man will be faced with his real, his permanent problem - how to occupy the leisure which science and compound interest will have won for him, to live wisely and agreeably and well (p.445).

FIGURE 1

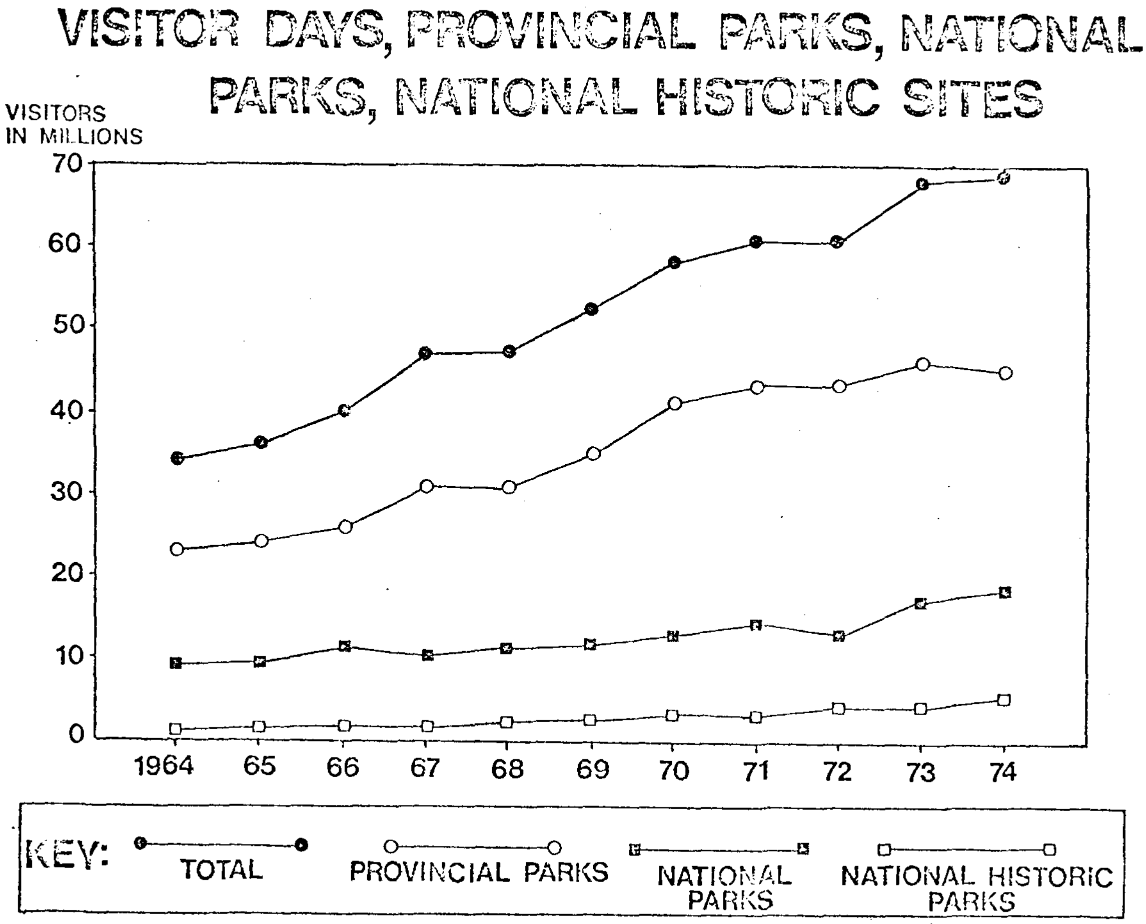


TABLE I

ESTIMATED VISITS TO CANADIAN PUBLIC PARKS (1964, 1974)

(Thousands)

Year	Provincial Parks	National Parks	National Historic Sites	Total
1964	23,590	9,170	1,445	34,205
1974	45,977	18,290	5,185	69,452

Source: Federal/Provincial Parks Conference, 1976, Park and Recreation Futures in Canada, Victoria, p.62.

The above passage was written by J.M. Keynes (1930). Our economic system has long held out one rather striking promise - the eventual opportunity for a great deal more leisure. Free time will be abundant. One way that the amount of leisure hours can be increased is by a reduction in the average number of hours worked each week. A review of contemporary literature indicates what some authors predict as to the timing and extent of future reductions in the work week (Table II).

TABLE II

ESTIMATES OF THE FUTURE WORK WEEK

(Hours)

	1970/74	1975/79	1980/84	1985/89	1990/99	2000/05
Clawson _et_. _al_. (1956)	--	--				28
O.R.R.R.C. (1962)	--	36				32
Nat. Comm. on Tech. (1967)	34	30	25	22		
Kahn _et_. _al_. (1967)	--	--				30
Laplante (1969)	--			35		
Dyke (1970)*	--	34	28		26	24
D'Amore & Assoc. (1974)	--	--		35		
Shafer, Moeller, and Getty (1974)	--	--	32			

*White Collar Workers Only

Clearly, the experts do not agree on either the magnitude or timing of the promised reduction in the work week. To this point in time each predicted reduction has proven to be an overestimate. According to Statistics Canada (1974), the work week has stabilized at approximately 40 hours. However, there have been some recent developments that tend to offer more leisure hours. In particular, a four day week involving the same number of weekly hours of work is becoming more popular. Another recent innovation has been the "flex hours" system, giving workers increased freedom in choosing their daily hours of work. In the post war years, we witnessed a growth in paid vacations and a trend towards longer durations of such, together with a general lengthening of retirement periods. Each of these trends has contributed to increasing the availability of leisure hours. Some groups in the population are getting a lot more leisure time and many people are getting more of it.

According to Statistics Canada (1976), per capita disposable income has increased about 8.7% over the last decade. This rate of increase has varied from prosperity to recession, and is often masked by inflation. Yet, there have been remarkable gains in real per capita income in the past few decades. As incomes in general rise, the proportion which is spent on necessities declines. Persons with higher incomes are able to spend their wages on other than the necessities of living. As incomes rise, people can spend more on outdoor recreation experiences.

With this new affluence, more and more people will be able to afford activities which heretofore have been prohibitively expensive. Activities which require a substantial outlay of money are, over time, becoming more popular.

Recreational equipment, facilities, and activities are becoming more and more sophisticated. Increased incomes together with technology have created many new activities and reshaped the character of old ones. Witness the growth of snowmobiling, water skiing, gliding; also the use of recreational vehicles, acqualungs, telephoto lenses, and ski lifts.

Providing opportunities to participate in these technological activities often requires many new facilities and modifications in park infrastructures. Campgrounds specially designed for big camping vehicles require not only modified parking spurs, but also water, electrical, and sewage hookups. Tent campers are now substantially outnumbered in Canadian parks by families with vacation trailers, truck-mounted camper units, and other mobile homes. According to Parks Branch records, only 34 percent of the visitors to British Columbia Provincial Parks in 1975 used tent accomodation.

Visitors seem increasingly soft; life in camp is often little different than home. Requests to park authorities for hot water, laundry facilities, showers, electricity, and flush toilets are becoming more emphatic. The increasing numbers of park users together with a changing pattern of preferences is accompanied by a need to harden heavily used areas. Paved parking lots, complex water systems, flush toilets, and other costly improvements are often needed to assure visitor satisfaction, safety, adequate sanitation, and protection of the site itself.

Of all the socio-economic factors affecting participation in outdoor recreational pursuits, age has the sharpest influence. As might be expected the older people get, the less they engage in the majority of outdoor activities. For Canada, this has a special significance. The high birth rate of the 1950's which came to be known as the "baby boom" has profound implications for the subsequent course of outdoor recreation. Equally profound though, are the implications of the precipitous drop in the birth rate which began in the 1960's. A by-product of these trends, of course, is the resulting nature of the age distribution. We can expect older groups to constitute a larger proportion of the Canadian population in the future.

To the extent that population growth alters the composition of consumer demands, it is likely also to influence investments of various kinds in outdoor recreational facilities. The consumption patterns of children are clearly quite different from those of adults and the implications for investments in recreational facilities are also quite different. Specifically, future investments in outdoor recreational facilities might be expected to reflect middle-aged tastes, particularly the tastes of people born in the period of the great "baby boom".

Planning For the Future

When we look ahead to the future it is not unusual to start by glancing at the past to see where the trends are likely to lead. Over the last decade as this is written, the combined effect of both an increasing supply of facilities and a rising demand for recreational opportunities have led to an overall increase in outdoor recreational activity of about 7.1 percent annually. This means a doubling in attendance every 10 years. What can these historic trends tell us about the future? Literally, not much and as Clawson (1959) put it:

> Simple extension of trend lines, which under some circumstances is sound economic procedure, in this instance, give answers that are nonsensical...clearly, this won't do; our careful calculations have only led down the same blind

> alley that sometimes tempts playful statisticians to prove by trend lines that some fast-growing town will in a certain number of years have more people than the whole state, and in a certain number of added years, than the entire country (p. 9).

Or, as Boulding (1973) once said:

> Anyone who believes exponential growth can go on forever is either a madman or an economist (p.3).

There are a multitude of difficulties in making projections of future demands for outdoor recreation. We can expect many unforeseeable factors to arise which alter the pace of recreational participation.

In basing estimates of future demands for outdoor recreation on historic trends in use, we must understand that the past rapid growth in outdoor recreational activity was possible only because the supply of opportunities expanded so greatly. Had facilities remained at a fixed level of supply, use would not have increased as it did. We cannot expect future use to increase at the same rate as in the past unless more areas, larger acreages, and more facilities are provided.

To the degree that increased opportunities are not provided, we can expect the existing sites to be used to a greater capacity. In particular, with a given level of land, water and facilities dedicated to recreational pursuits and a growing number of people placing demands on these facilities, we can expect that congestion will result. Congestion is likely to cause a decline in the personal recreation experience and might well reduce the number of recreational outings that any individual would demand in its absence.

Projecting Participation

The projection of past attendance can give us some idea of the direction outdoor recreational activity is going, but it does not inform us as to the relative growth and future magnitude of participation in various activities. Two studies, that of the Bureau of Management Consulting (1976) and Cicchetti et. al. (1969), have attempted to answer these questions.

The Bureau of Management Consulting Study involved projecting the growth in the number of participants ten years of age and older in twelve selected activities. Using multiple regression analysis, a linear relationship was determined between peoples' socio-economic characteristics and the Canadian national participation rate. The model was based on the assumption that each socio-economic group maintains the same rate of participation over time and future participation estimates were based upon projected changes in the socio-economic variables. It is quite unlikely, however, that participation rates will grow in step with only socio-economic factors.

Participation data obtained from population surveys are measures of consumption, which is dependent on the demands of that population as well as the supply of opportunities that they enjoy. As Knetsch (1974) suggests:

> ...the rate of participation for most activities... seem more likely to vary with the supply of opportunities available to people in different areas than with differences in population characteristics that give rise to differences in demand...The point is that observation of what occurs will not alone permit judgement of relative demands (p.19).

Using participation rates as an indicator of demands can lead to providing more of the same kind of facilities in the areas which already are well supplied. Moreover, if people do not participate in an activity because they lack opportunities significant recreation demands are never brought to light.

TABLE III

REASONS FOR NOT PARTICIPATING IN AN ACTIVITY

	That One Would Like To Participate In	As Many Days As One Would Like
Lack of Time	29%	58%
Lack of Supply or Crowdedness or Distance From House	22%	18%
Lack of Money	12%	12%
Lack of Skill, Age, Health, Fear	19%	5%
Lack of Equipment	10%	---
Other	8%	7%
	100%	100%

Source: Cicchetti et. al. The Demand and Supply of Outdoor Recreation Rutgers University, New Jersey, 1969, p.69,70.

Casual observation of Table III reveals the importance of supply related variables in relation to recreational participation. However, studies which relate participation to supply variables are relatively rare in outdoor recreational research literature.

One that has achieved some degree of success, however, is a study conducted at Rutgers University (Cicchetti et. al., 1969) which involved an analysis of 24 outdoor activities. In this study, variables representing the quality and quantity of recreational facilities were analyzed together with socio-economic factors to explain participation levels.

Having determined the relationship between participation in a certain activity and the associated explanatory variables, it is possible to make projections of future demands. These estimates can be made from projections of future populations and their expected socio-economic characteristics together with some assumptions about the supply of opportunities. In the Rutgers study, the derived relationships were used to show the relative effects of two different future supply scenarios on recreational demands.

The Problem

We have seen that extrapolating past trends in recreation may lead to highly unlikely estimates. We have also reviewed some attempts to estimate future participation in various activities which can indicate some idea of where we are headed in regard to future participation rates. There still remains, however, a fundamental weakness in these approaches. Specifically, any government which has allocated funds to the development of additional outdoor recreational facilities cannot determine by these methods what kind of opportunities people want and where they want them. Additionally, in the design of new parks or expanded versions of existing facilities the planner is interested in ascertaining the visitor implications of each of several alternate design possibilities. That is, the planner would like to know for each design version how a park would "stack up" against other parks. Rational park planning requires that these questions be answered.

It is not unusual for planners to rely on visitation data from similar existing sites in order to estimate how many people can be expected to use a proposed site, if and when the facility becomes a reality. But, even though a similar existing facility draws 20,000 visits per year, the new park will not necessarily draw the same number of visitors. Casual observation of existing Provincial Parks in British Columbia reveals that no park is identical to another. Even if the natural and man-made features are the same, the location of a park with respect to highways and population centres always remains unique. Therefore, it is important to analyze the underlying factors that affect park visitation levels.

One means of improving estimates of expected use of a park involves the development of models which yield estimates of use based upon observed travel patterns of users at existing sites. Several researchers have attempted to construct models which use as dependent variables various measures of park visitation and as independent variables various influencing factors (eg., Cesario, Goldstone, and Knetsch (1969, Cheung (1972), Grubb and Goodwin (1968), Brown and Hansen (1974)).

Independent variables which are specific to population centers and to parks are, of course, generally considered to be extremely relevant. But, due to the virtually unlimited number of possible combinations of variables which can be hypothesized to characterize population center and park effects on outdoor recreation visitation, the selection of particular variables to include in the models is an extremely subjective procedure.

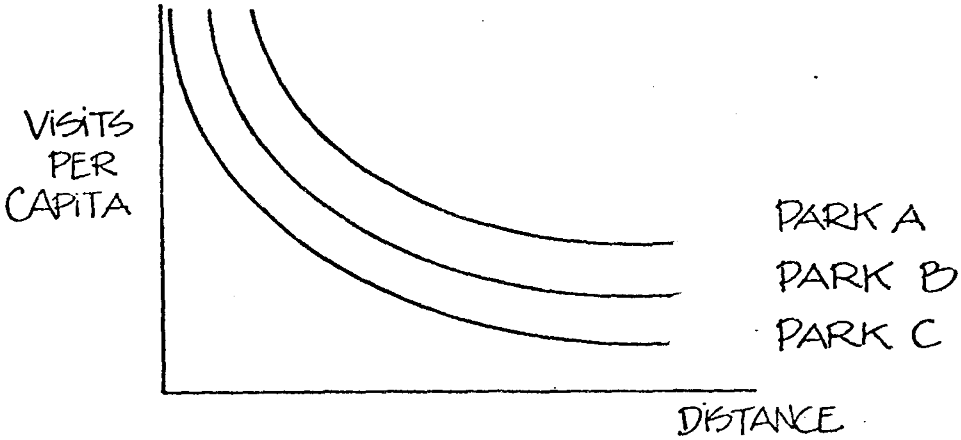
This thesis is directed towards further developing methods which indicate the visitor implications of various locational and design possibilities. More specifically, this thesis is directed towards establishing measures of recreational attractiveness and developing a day-use visitation model related to the provision of Provincial Parks in the Lower Mainland Region of British Columbia. A critical need exists to have a far more complete understanding and measurement of recreational demands in the Lower Mainland to guide investment and policy choices and to forecast recreational use of the area as it relates to alternative development proposals.

Following a brief presentation of different visitation models in chapter 2, a survey of the literature concerning attractivity indices is given in chapter 3. Chapter 4 deals with the specific methodology used in this study to derive attractivity indices. Next, in chapter 5, this methodology is used to establish the relative attractiveness of eight Provincial Parks in the Lower Mainland Region. In chapter 6, a day-use visitation model is developed.

CHAPTER 2 - PREDICTION MODELS

A user's choice among competing parks is dependent upon the influences of both attractiveness and distance. Parks with an equal attractiveness but at different distances from a population center can be expected to attract visitors in some inverse relation to their distance. Parks with an unequal attractiveness but equidistant from a population center, should attract visitors in some positive relation to their relative attractiveness. In other words, at equal distances, more attractive parks will draw more visits from a population center than less attractive sites.

FIGURE 2
HIERARCHY OF DISTANCE - DECAY CURVES



Attraction implies a drawing power - one that is often made up of not only man-made features such as picnic tables and swimming beaches, but also the natural qualities of a site such as scenery and the natural environment. Total attractiveness of a site can be a function of one or the other, but usually it is a complex combination of both.

The level of day use activity at any given site originating from a specific population center is dependent upon the size and socio-economic characteristics of the resident population together with both the drawing power of site attractiveness and the friction of distance. The generalized day use outdoor recreational model is given by the following expression:

$$V_{ij} = f(D_{ij}, P_i, A_j)$$

where:

V_{ij} = the number of visits from origin i to site j during some specific time period

D_{ij} = variable to account for the distance between origin i and site j

P_i = characteristics of origin i, such as the size and socio-economic characteristics of the population

A_j = attractiveness of site j.

The parameters of this function can be estimated from observed behaviour in the form of trip data from existing parks.

A number of different functional forms can be used to establish the working relationships among these variables. One of the more commom choices is a simple additive model, such as:

$$V_{ij} = a + bD_{ij} + cA_j + dP_i$$

with the variables defined as above and a, b, c, and d are the parameters to be estimated. This particular functional form has the virtue of simplicity but it does not allow for any interacting effects among the variables.

A basic methodological approach to the problem of outdoor recreation planning is the use of physical analog models which attempt to illustrate an analogy between real social systems and a physical system.

One of the most popular physical models is the gravity model which is an analogy to Newton's Law of Gravity. In general, the gravity model expresses trip volume between a population center and a park as a function of population size, the friction of distance, and the drawing power (attractiveness) of the park. In order to develop the concept of a gravity model, it is necessary to adopt a probability point-of-view. In particular, for any individual, we would expect that the percentage of his total trips to any given day use recreation area would equal the ratio Aj/A, which is the recreational attractiveness of park j divided by the total attractiveness of the alternative recreational opportunities available to him.

For the present, it is necessary to assume that no travel and time costs are involved, that is, the friction of distance is zero. This assumption will, however, be relaxed later under considerations of the effects of distance.

A further assumption of population homogeneity allows us to postulate that the number of trips undertaken by any individual equals the average number of trips for the entire population. Designating this average by the letter k, we find that the absolute number of trips that a resident of the study area makes to park j is kA_j/A. This reasoning applies to the total population (P_i) residing in a certain population center. Therefore, the theoretical trip volume from origin i to park j (I_{ij}) is:

$$I_{ij} = kP_iA_j/A \qquad (1)$$

The next step is to determine the effect distance will have on attendance at any park. First, actual data on day-use visits originating in the study area must be obtained. Let V_{ij} represent the actual number of visits to park j that originated from city i. The ratio of actual to expected trip volumes (V_{ij}/I_{ij}) when related to the distance between the origin and park (D_{ij}) under consideration should be greater than one when the distance is short and less than one when the distance is great. When the ratio of actual to expected trips is plotted on a graph for every park and origin together with the intervening distance the resulting distribution of points which emerge is hyperbolic. This curve is of the general form $Y = a/x^b$. Substituting the variables:

$$V_{ij}/I_{ij} = c/D_{ij}^{\ b}. \qquad (2)$$

is obtained.

A hyperbolic relationship results because the theoretical trip estimates (I_{ij}) are based upon an average distance between origins and destinations. But, all parks are not situated at the same distance from population centers. At a short distance, the theoretical number of visits will be underestimated whereas at further distances, the theoretical use is over estimated. In other words, at close proximities the ratio V_{ij}/I_{ij} will be greater than one, and at longer distances, be less than one.

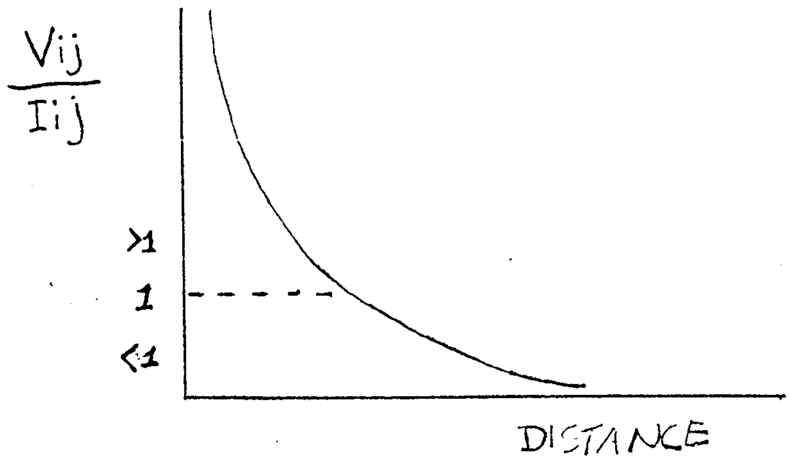
Using logarithms, the data suggests a straight-line relationship between the log of the ratio of actual to expected trips and the log of distance.

The equation of the line is:

$$\log V_{ij}/I_{ij} = a - b \log D_{ij} \qquad (3)$$

FIGURE 3

RELATION BETWEEN DISTANCE AND THE RATIO OF ACTUAL TO EXPECTED PERSON TRIPS



In this equation, a is the intercept with the log V_{ij}/I_{ij} axis, and b is the slope of the line. Removing logs from the equation and letting c equal the antilog of a, equation 2 can be solved. Substituting equation 1 for I_{ij} and letting the constants ck/A =G, the following relationship is obtained:

$$V_{ij} = G\, A_j P_i / D_{ij}^{\,b} \qquad (4)$$

This relationship may be taken to represent the level of use of any particular park from any given population center.

A popular alernative functional form used to estimate expected visitation is a multiplicative one. This particular form has the desirable property of taking into account interactions among the independent variables. Such an equation may be written:

$$V_{ij} = a\, D_{ij}^{\,b} A_J^{\,c} P_i^{\,d}$$

which reduces, for purposes of parameter estimation to:

$$\log V_{ij} = \log a + b \log D_{ij} + c \log A_j + d \log P_i .$$

Both addition and multiplication regression models were considered for use in the present study. A variation of the former was chosen even though the latter might incorporate some desirable properties. The decision to use an additive model was based upon the inherent bias associated with the estimates of use derived from the multiplicative model. In particular, the sum of the antilogs of the derived V_{ij}'s are less than the total of the observed V_{ij}'s because, as Edwards (1962) points out: the mean of the logs of any pair of numbers lies below thelog of the mean of the numbers.

Since interaction among the variables is likely to be important, the following combinations of independent variables has been chosen in favour of other alternatives:

$$V_{ij} = a + b\ P_i/D_{ij} + c\ A_j/D_{ij}$$

In terms of the recreational behaviour being examined in this study, it is fairly evident that the locational aspects of recreational opportunities plays a particularly significant role in determining visits. Interactions with this factor are likely to be important. The variables chosen for use in this study reflect this importance.

The parameters of this function can be estimated from observed behaviour in the form of trip data from existing parks. This expression can then be used for estimating or forecasting expected use of a new site or an existing one where major changes are under consideration.

Before the parameters of this function may be chosen to explain day use recreational behaviour, total visitation, origin, population, distance, and attractiveness data must first be obtained.

Total visitation data concerning use can be obtained from the Provincial Parks Branch. Origin information, which is required to delineate travel patterns of users was not available at the time this study was undertaken. To meet this need, direct interviews with users at eight lower mainland parks under consideration in this study was carried out during the summer of 1975.

Although distance information can be taken directly from most maps and population data is available from each municipal government, attractiveness indices are not so easily measured. The following chapters will deal with finding such information.

Data concerning total attendance, visitor origins, populations, and distances between parks and population centers is presented in Appendix D.

CHAPTER THREE - SURVEY OF THE LITERATURE REGARDING ATTRACTIVENESS

The rapidly growing demand for outdoor recreation has been accompanied by a parallel increase in outdoor recreation research. The studies to date, although becoming more refined to a sophisticated level still contain certain weaknesses. One of the basic problems that remains to be solved is how to measure the inherent attractiveness of different recreational areas. Even the most casual observation shows that some areas are more attractive than others. Differences among parks, however, are not easily measured.

Studies that attempt to measure the attractiveness of recreational sites are relatively rare in the literature of outdoor recreation research. Several studies (Brown and Hansen (1974), Knetsch, Brown, and Hansen (1975), and Grubb and Goodwin (1968)) of the recreational use of water reservoirs have used the size of the reservoir measured in acres to account for the variation in attractiveness of the individual reservoirs. Since the facilities provided at each site are similar, size is used as a proxy for attractiveness.

Cesario (1969) suggested the possibility of developing attractiveness indices by plotting a family of curves relating per capita visits to a park with distance. At a given distance, parks that draw more visits per capita are more attractive than those which draw less. The result is a family of distance-decay curves. Relative attractiveness ratios are assigned to parks based on the average distance between their distance-decay curves. Attractiveness indices are derived by normalizing the derived attractiveness ratios for each park. Although this procedure provides a good measure of relative attractiveness, it cannot say what is being measured. The question arises of which factors account for the different measures of attractiveness and how these differences can be measured on an individual basis. Cesario's later research, however, attempts to answer this question.

Earlier, Clawson and Knetsch (1963) suggested the possibility of developing rating scales to measure the attractiveness of different outdoor recreational areas. These measures could be based on not only quantitative, but also subjective judgements. They anticipated a substantial difficulty, however, in the aggregation of these ratings on individual site qualities into a combined score of recreational attractiveness.

A partial solution to this problem was presented in a study by Cesario and Knetsch (1976). In this effort attractiveness was defined as some composite function of the quality, quantity, and type of facilities offered. This approach used for deriving a measure of attractiveness involved the evaluation of the following function:

$$A_j = \Sigma U_i(Z_i)q_i(Z_i)a_i$$

where:

A_j = the attractiveness of park j.
U_i = utility of having activity Z available.
q_i = quality of the facilities for activity Z_i.
a_i = 0 if activity Z_i not offered.
1 if activity Z_i offered.

The utility of having an activity and the quality of the activity were multiplied and the sum of the products were added for all activities to establish a score of recreational attractiveness for each site. Each combination of activities as well as each individual activity has its own weight. This means that the relative weight for any combination of activities does not equal the sum of the weights for the individual activities comprising it - they could be more or less depending on the combination of activities under consideration.

In a southern Ontario parks study, Cesario (1973) used a two-stage analysis to derive measures of attractiveness for parks with similar characteristics. Initial measures of individual park attractiveness were derived using matrices of distance and visits for each park and population center under consideration. The results of the second stage of analysis are summarized on a "tree diagram" which forms sub-groupings of sites according to their characteristics. Each sub-grouping of parks establishes an average measure of attractiveness for parks with a similar combination of size, water-frontage, and camping units.

Cesario's tree methodology is, to some extent, misleading when used in conjunction with future park planning. The number of campsites provided, for example, is dependent upon the actual or expected use made of a park, which is in turn dependent upon the attractiveness of the site and its location in relation to its users. For benefit-cost analysis of new site proposals, using the number of campsites provided may overstate the benefits if too many sites are to be built or understate the benefits if not enough sites are to be established. This approach neglects the fact that attractiveness is made up of natural and man-made site qualities - not quantity!

Cheung (1972) and Knetsch and Cheung (1976), in a Saskatchewan parks study, derived a measure of attractiveness as a function of the degree of popularity of six day-use activities together with the quality of their associated facilities. A specific measure of attractiveness is defined by the following function:

$$A_j = \Sigma S_e R_m Q_m$$

where:

A_j = attractiveness of park j.
S_e = relative popularity of activity e.
R_m = relative importance of facility m.
Q_m = quality or quantity of facility m.

Participation rates were used to illustrate that not all recreational activities are equally popular. The relative importance of each outdoor recreational facility in drawing attendance to a park was derived by the use of Spearman's rank correlation between total day-use visitation at the sites considered in the study and each of the facilities. Each facility is then weighted in accordance with the popularity of the associated activity.

The quality and quantity of facilities at each park is measured on a rank score basis. However, it does not seem clear why increasing the number of existing facilities would increase the attractiveness of a site if, as Cheung claims, crowding is not a problem.

A problem of dependence among the recreational values of facilities in this study can lead to a questionable measure of attractiveness. For example, the attractiveness of a site without a swimming beach could be increased by installing showers.

It was mentioned previously that attraction is a function of not only the recreational opportunities, but also the natural qualities of a site. Most studies, however, have not evaluated the attractiveness of the natural factors of a site in deriving a measure of attractiveness. A further weakness of several studies has been the use of participation rates to evaluate the relative importance of an activity or group of activities. Since the amount of participation in any activity is directly dependent on the availability of an opportunity, it cannot be said that one activity is more important than another based on participation rates. Indeed, if the number of swimming beaches in a region were doubled, the level of water-based activity would surely increase. According to Knetsch (1974), participation data obtained from population surveys is a measure of consumption, which depends not only on the demands of that population, but also on the supply of existing opportunities that they enjoy. Direct observation of participation activity does not necessarily imply that one activity is more important than another.

Another formulation of an attractiveness index was developed by Gearing, Swart, and Var (1974) in a tourism study for the Turkish Government. They found that the touristic attractiveness of a region is represented by a function of the following type:

$$T_j = f(N_j, S_j, H_j, R_j, I_j)$$

where:

T_j = touristic attractiveness.
N_j = natural factors
S_j = social and cultural factors.
H_j = historical factors.
R_j = recreation and shopping opportunities.
I_j = accessibility and accomodation.

A set of seventeen criteria which represent the outstanding attractiveness features of a region were selected and organized into the above five groups. Then, using a procedure designed to elicit consistent judgements form a respondent, the contributions of 26 tourism experts were combined to form a set of numerical weights to establish the relative importance, one to another, of the seventeen criteria. Designating these criteria weights $w_1, w_2, w_3, \ldots, w_{17}$, the attractiveness of a region is defined by the following function:

$$T_j = \sum_{i=1}^{n} w_i x_{ij}$$

where:

T_j = attractiveness of region j.

w_i = the numberical weights of criterion i.

X_{ij} = an evaluation of region j in accordance with criterion i.

This study was followed up by Var, Beck, and Loftus (1975) in an application of this methodology to touristic regions in British Columbia. A modification of this approach was adopted in the model that is presented here in establishing measures of "day-use" attractiveness of provincial parks.

CHAPTER FOUR - METHODOLOGY

To facilitate the determination of attractiveness indices, a group of twelve criteria which define the outstanding "day-use" attractiveness features of provincial parks have been chosen with special attention being given to their independence. Direct interviews with recreational experts were carried out employing a procedure designed to draw forth consistent opinions from the respondents. Each expert's opinion was to be representative of a larger group of recreationists. The data collected during this survey has been combined to establish numerical weights to illustrate the relative importance of the twelve criteria. Further information was solicited from actual day-users as to their assessment of specific sites relative to the selected criteria. The information collected from both of these surveys was combined to establish a "score" of recreational attractiveness for specific provincial parks serving the Lower Mainland region of British Columbia with outdoor recreation opportunities on a day-use basis. This approach taken to quantify the notion of recreational attractiveness with respect to provincial parks requires the following to be determined:

1) the criteria by which day-use recreational attractiveness is judged;
2) the relative importance of these criteria, one to another, and illustrated by a set of numerical weights

Then, with these two requirements satisfied, it is necessary to:

3) employ the judgements of recreationists in making on-site evaluations in accordance with these criteria

and using these inputs:

4) compute a numerical score of day-use recreational attractiveness for each park.

Selection of Criteria

In order to satisfy the first requirement, it was necessary to define the outstanding day-use features of provincial parks. This was done in the context of the Lower Mainland region of British Columbia as a study area.

A considerable amount of thought and deliberation preceeded the selection of twelve criteria, organized into five sub-groups, to provide a basis for evaluating the attractiveness of recreational sites. It was found that the recreational attractiveness of a site is defined by a function of the following type:

$$A_j = f(R_j, H_j, C_j, E_j, I_j)$$

where:

A_j = day-use recreational attractiveness of site j.
R_j = recreational facilities.
H_j = facilities conducive to relaxation
C_j = commercial and educational facilities
E_j = environmental factors
I_j = infrastructure

These five groups represent the relevant factors which define recreational attractiveness. All of these categories relate to the natural and man-made qualities which contribute to the recreational experience. Each of these groups is made up of a set of related criterion that identify the important features within that category.

The selected criteria, according to expert opinion, appear to provide a reasonably complete set of considerations which may come into play in judging the recreational attractiveness of a site. Although the recreational experts did not participate in the actual selection of the criteria, they indicated that the chosen set represented a reasonably complete list of considerations to be used in evaluating day-use attractiveness.

Particular attention was paid to the independence of the selected criteria. This means that regardless of whether or not a site satisfies one criterion, that fact has no bearing on how well the site satisfies another of the criteria. In practice, the desire to establish a set of independent criteria is not easy to meet. For example, natural beauty may well be related to wilderness considerations. It is virtually impossible to remove all interdependence among a set of criteria that is used to judge attractiveness. Nonetheless, a reasonable approximation to this condition has been met.

The twelve criteria, organized into five sub-groupings are listed in Table IV. Each criterion is accompanied by a series of considerations that one would employ in judging that criterion.

Selection of Experts

In order to evaluate the relative importance of these criteria, one to another, opinions were solicited from a group of recreational experts.

TABLE IV

CRITERIA FOR JUDGING DAY-USE RECREATIONAL ATTRACTIVENESS

Group Heading	Criteria	Considerations
A) Recreational Facilities	a1) Water-based recreation (swimming, water-skiing)	Boat ramps, water and beach quality, water safety facilities, rafts, diving boards.
	a2) Winter Sports (snow-skiing, outdoor skating, tobagganing)	Ski-lifts, skating rinks, tobaggan slopes, quality of ski slopes.
B) Facilities Conducive to relaxation	b1) Land-oriented (hiking, nature walks, horse riding, picnic-king)	Shade,trails, picnic tables, fireplaces.
	b2) Water-oriented (fishing, canoeing)	Fishing success, suit-ability of water for activity.
C) Commercial and Educational Factors	c1) Food and shopping facilities	Souvenier shops, service stations, groceries and restaurants, necessities.
	c2) Historical	Museums, historical prominance.
	c3) Nature-oriented	Nature study, nature houses.
D) Environmental	d1) Landscaping	Lawns, site layout, flower beds, upkeep
	d2) Natural beauty	Topography, proximity to water bodies, flora and fauna, canyons, waterfalls.
	d3) Wilderness perception	Solitude, degree of natural-ness, absence of man-made structures, inspirational overtones.
E) Infrastructure	e1) Accessibility	Quality of access roads, parking.
	e2) Public Utilities	Washrooms, drinking water.

Since these people have been observing the actual behavior of recreationists, they are qualified to comment upon what recreationists find attractive. Each respondent, through his experience in dealing with recreational activity, has an opinion as to what recreationists find important. During the interview, each expert was instructed to average out his impressions gathered over time in dealing with recreationists.

Since the experts are to speak on behalf of a larger mass of recreationists, there must be a sufficient safeguard against biased results. A reasonably diverse group of experts, then, would be very much in point. Thus, 34 persons were selected to cover a broad range of interest groups, backgrounds, and viewpoints. The breakdown by vocational class is listed in Table V.

TABLE V

"RECREATIONAL EXPERT" RESPONDENTS BY VOCATION

Vocational Class	Number of Experts
Sporting Goods Salespersons	3
Academic Researchers in Recreation	6
Park Naturalists	2
District Park Superintendents	4
Park Research and Planning employees	5
Tourist Counsellors	7
City Park Administrators	4
Outdoor Recreation Coordinators	2
Historical Interpretive Officer	1
Total	34

Deriving Criteria Weights

It is important that the judgements collected from the recreational experts are rendered carefully and consistently. To provide this assurance, a procedure developed by Churchman, Ackoff, and Arnoff (1957) was employed. The method provides a basis for successive improvements in the estimates of criteria weightings. The respondent is subjected to two tests, each of which provides information concerning the importance of the criteria to him. In the first test, the expert assigns tentative values to the criteria under consideration. Next, he is presented with a series of questions about combinations of criteria which provides additional information about their values. The second set of judgements has the potential of refining the first set of judgements. A simple example can illustrate the procedure.

To illustrate the idea, suppose we have four pieces of wood of unequal length and no measuring device is available. If we want to determine the relative (not absolute) lengths of these four strips, one possible way is as follows:

Step 1 - Arrange them from longest to shortest. Designate the longest A, the next B, the next C, and the shortest D.

Step 2 - Assign a value of 100% to A and estimate a relative value for each of the shorter pieces.

For example: A = 100; B = 70; C = 40; D = 30.

Step 3 - Arrange B,C,D, end to end and compare to A. If the estimates were correct B + C + D = 140% of A. If they do not equal 140%, adjustments to the assigned values will be necessary.

Step 4 - To provide a further assurance of the reliability of these estimates, compare A to B + C. If B + C does not equal 110% of A, adjustments to the assigned values will be required.

Step 5 - Finally, we compare B to C + D. If $C + D \neq B$, then an adjustment is required.

This procedure basically involves a series of systematic checks on relative judgements by a process of successive comparison.

Results From Interviews

Each expert was interviewed following this procedure and a set of criteria weights were derived for each respondent (see Appendix B). An overall weighting of the criteria was derived by taking the average value for each criterion. These final weights together with their relative rank of recreational attractiveness are recorded in Table VI.

One might well ask how much agreement there was among the respondents and how much faith one might place in the final outcomes. That is, a single measure of the general agreement among the 34 experts is desired. Kendall (1948) has proposed a "coefficient of concordance" among rankings. This statistical measure may have values ranging from 0 to 1. A value of 1 would indicate complete agreement whereas a value of 0 would imply complete randomness. For the data used in this study, the coefficient of concordance is .51508. This figure indicates a good level of agreement. The level of agreement can, perhaps, be illustrated more effectively by applying the technique of hypothesis testing. The particular chi-square statistic for the data under consideration is 192.63907 (d.f. = 11). This indicates that there is very little chance that the extent of agreement among the experts would have occurred by chance alone. We may then use the criteria weights with a reasonable level of confidence that at least the experts agree on what recreationists find attractive. The statistical measures, however, cannot tell us whether the experts are correct.

TABLE VI

CRITERIA WEIGHTS AND CORRESPONDING RANKS

Criteria	Weight	Rank
Water-based Recreational Facilities	.184	1
Winter Sports Facilities	.139	2
Land-Oriented Facilities Conducive to Relaxation	.118	3
Water-Oriented Facilities Conducive to Relaxation	.106	4
Food and Shopping Facilities	.025	12
Historical Factors	.034	11
Nature Study	.036	10
Landscaping	.048	9
Natural Beauty	.101	5
Wilderness Perception	.081	6
Accessibility	.072	7
Public Utilities	.057	8

CHAPTER FIVE - AN APPLICATION - ESTABLISHING MEASURES OF RECREATIONAL ATTRACTIVENESS

The following discussion outlines the steps taken to establish measures of recreational attractiveness for eight Provincial parks in the Lower Mainland of British Columbia. The relative locations of these eight sites are illustrated in Figure 4.

A measure of recreational attraction reflects the relative (to other parks) ability to attract trips under identical circumstances; i.e. if it were the case that all parks were equally accessible. Attractiveness, thus, serves as a measure of drawing power and reflects the combined effect of a multitude of park characteristics on recreational trip-making.

Ratings can hardly be developed by experts alone; rather, the attitudes of users should be included. Thus, at each site a user evaluation survey was undertaken by randomly selecting twenty recreationists who were asked to evaluate each of the 12 criteria at that site in relation to other parks that they were familiar with. This evaluation was made by using a scoring system where the respondent rated the park in accordance with the criteria on a scale from 0 to 100. Since a location was judged by many users, an average opinion for each criterion was determined by taking a simple mean (see Appendix C). The score of recreational attractiveness for each site was determined by using the criteria weights derived from expert judgements together with these user evaluations. The basic measure for park attraction is expressed by a sum of the numerical values assigned on the basis of user evaluations, each multiplied by their respective weightings of recreational attractiveness. That is, total attractiveness is estimated by the following equation:

$$A_j = \sum_{m=1}^{n} a_m x_{mj}$$

where:

A_j = attractiveness of park j

a_m = numerical weight of criterion m as determined by expert opinion

x_{mj} = user evaluation of criterion m at site j.

By following this procedure each park was ranked in terms of its present

FIGURE 4.

THE LOCATION OF PARKS WHERE INTERVIEWS WERE CARRIED OUT

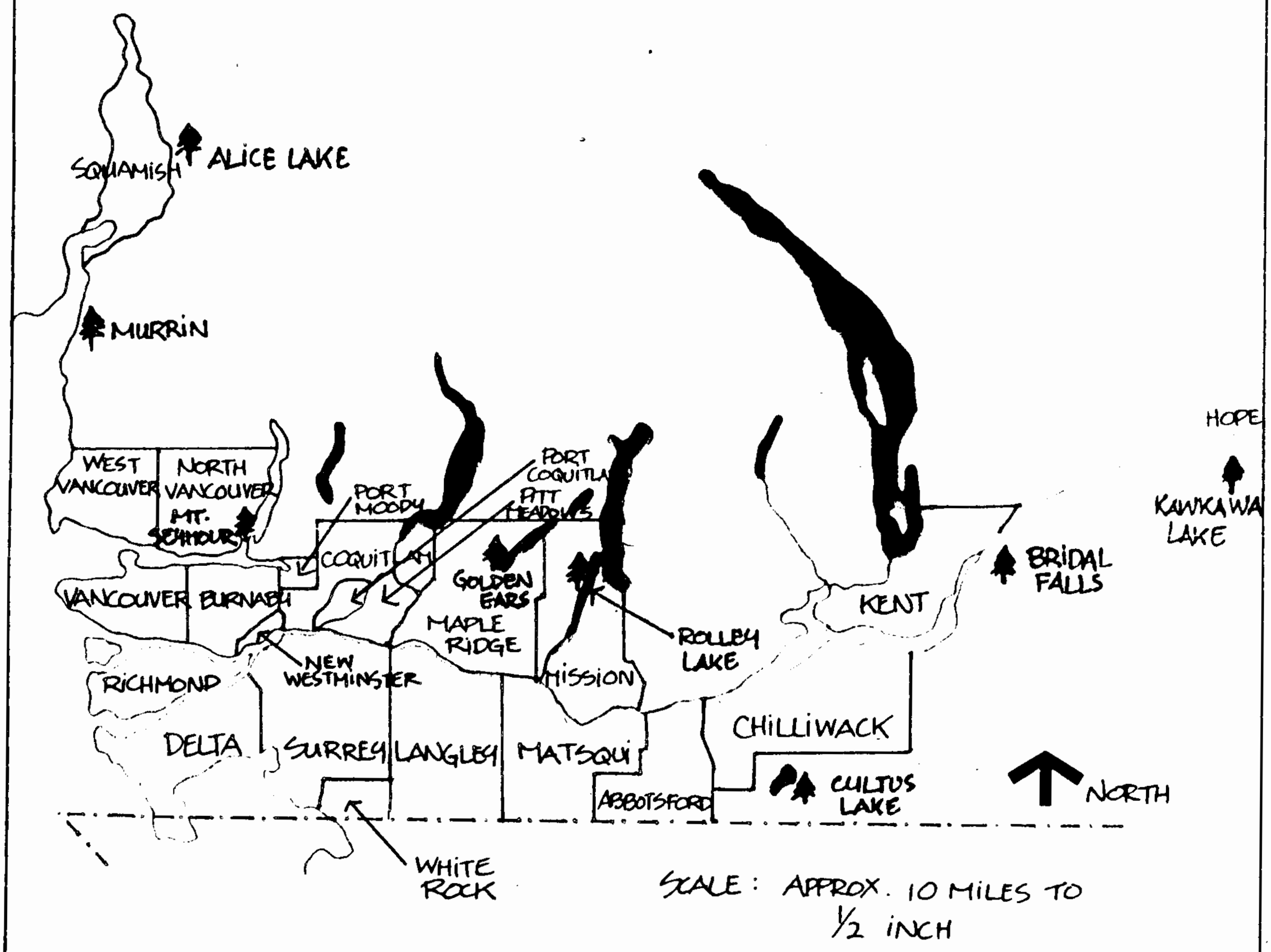


TABLE V11

LOWER MAINLAND PROVINCIAL PARK FACILITY INVENTORY (1975)

Park Name	Acres	Picnic Tables	Boat ramps	Ft. of devel-oped beach	Miles of trails
Cypress	5200				
Mt. Seymour	8669	9			13.0
Alice Lake	979	88		750	4.4
Alta Lake	2	10		100	
Birkenhead	9000	30	D	1000	.4
Garibaldi	483,989	3			14.5
Murrin	60	21		200	.2
Nairn	423				1.0
Bridal Falls	80	18			.6
Chilliwack L.	400		S		
Cultus Lake	1620	177	QD	2760	6.0
Kilby Hist.	29	6			
Sasquatch	3015	60	S	900	
Sumas Mtn.	452				2.3
Kawkawa	16	25	S	300	
Emory Cr.	37				.5
Nicolum	60	6			
Skagit	80,500				6.0
Golden Ears	137,376	179	Q	3050	34.0
Peace Arch	23	41			
Rolley L.	285	28		300	2.5
Totals	742,215	701	7	9360	85.4

*S - Single: D - Double; Q - Quadruple

Source: B.C. Parks Branch, Data Handbook, 1975, Planning Division, Victoria.

attractiveness index. This score allows a comparison to be made between any two recreational areas, and a ranking of all eight sites has been established on the basis of their respective scores. Table VIII gives the final scores of recreational attractiveness together with their respective rankings.

TABLE VIII

SCORES OF RECREATIONAL ATTRACTIVENESS

Park	Score	Rank
Alice Lake	682	1
Golden Ears	679	2
Cultus Lake	657	3
Kawkawa	552	4
Rolley Lake	527	5
Murrin	514	6
Bridal Falls	432	7
Mount Seymour (summer)	401	8

This table indicates that the most attractive sites are those which include some water-based recreation facilities. This derives from the high importance attributed to water-based recreation by the experts. Despite the fact that Mount Seymour is a popular winter recreational area, it has the lowest overall score of attractiveness. But, parks do not have the same level of attractiveness during both the winter and summer seasons. The existence of winter sports facilities does not provide a drawing power during the summer months and picnic tables are of little importance when deciding which ski slope to use. Although the established criteria can accommodate winter recreational attractiveness calculations, it would be incorrect to incorporate winter sport considerations in a measure of summer attractiveness.

CHAPTER SIX - ALL TOGETHER NOW - A DAY-USE VISITATION MODEL

Having determined attractivity indices for the parks under consideration, we are ready to proceed to the next step. Three independent variables were used in an attempt to explain the variation in the observed V_{ij}'s.

The first variable described the distribution of potential visitors about the site. In particular, this variable measures the one-way road mileage from the user origin to the park. The point of origin was taken to be the population centroid of the area. It is expected that as distance to a particular site increased, the rate of visitation would decline.

A second explanatory variable was the attractiveness of each site as determined earlier. It is believed that more attractive sites would draw higher visitation at a given distance than less attractive parks.

A third variable measures the population size of a given urban center. As population size increases, the amount of use originating from the city is expected to increase.

The origins of visitors were grouped into 19 areas based upon municipal and district boundaries. The number of observations varied from six at Bridal Falls to 15 at Golden Ears. In all, a total of 69 observations of visitor origins and park destinations were used in the analysis of the visitation patterns for the seven parks*. That is, there were 69 pairings of origins and destination (V_{ij}) used in this analysis. The functional form used to derive the parameters of visitor behavior is written:

$$V_{ij} = a + b\,A_j/D_{ij} + c\,P_i/D_{ij}$$

Since the application of this analysis included only those who were day users that lived within the study area, out-of-region use is subtracted from the total visitation made to each park. The percentage and number of out-of-region users is given in Appendix D.

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*Unfortunately, Kawkawa Lake has not been included in the following analysis because day use attendance was not collected by the Parks Branch during 1975.

Although this equation has the virtue of additive simplicity, it does allow for interaction effects among the variables. From what is known about the travel behaviour of recreationists we might expect that the importance of the effects of park attractiveness depends on how close the park is to population centers. Also, the strong dependence of day-use activity on the proximity of population centers is important. In this regard, normalizing population estimates and attractivity indices by distance makes intuitive sense.

To estimate the coefficients of the model described above, multiple regression techniques using the Massager (1973) computer program, were applied to the sample data. The equation obtained was as follows:

$$V_{ij} = 244.3.22 + 440.90\ A_j/D_{ij} + .903\ P_i/D_{ij}$$

$$(.78) \qquad (4.11) \qquad (1.69)$$

The t-values for each explanatory variable are given in parentheses below. The coefficient of determination (R^2) is .238 indicating that about 24% of the total variation among the observations can be explained by the estimation.

Although the explanatory variables indicate some degree of significance, there is obviously something very important missing from this formulation. This missing element was found in the residual differences between the observed and calculated V_{ij}'s. A considerable underestimate in day-use attendance predictions occurred for each calculated V_{ij} at Cultus Lake Provincial Park.

Obviously, the calculated attractivity index for Cultus Lake has been underestimated. However, interviews at this park were carried out in exactly the same fashion as those at each of the other sites under consideration.

Comparing this site to each of the others under consideration reveals one important differentiating aspect of this park. Indeed, within the immediate vicinity of Cultus Lake one can rent boats, horses, and bicycles, play golf, tennis and roller skate, ride go carts, and eat at commercial establishments. Each of the other parks are essentially isolated from all these complimentary recreational opportunities provided by private interests. When the criteria representing outstanding attractive features of parks were originally delineated, complimentary recreational opportunities were not included.

In order to account for this missing element, a binary variable (dummy) has been used where the value is 1 for Cultus Lake and 0 for all other sites. The estimating equation is thereby written:

$$V_{ij} = -5018.25 + 482.58\, A_i/D_{ij} + 1.50\, P_i/D_{ij} + 33{,}433.26\ (1,0)$$
$$(-2.84) \qquad (8.46) \qquad (5.23) \qquad (3.03)$$

The reported t-values (in parentheses) are all significant at the 99% level with 64 degrees of freedom. The co-efficient of determination (R^2) is .789 indicating that about 80% of the total variation among the observations can be explained by this estimation. With 3 and 65 degrees of freedom, the calculated F-value is 8.1. This figure easily meets the 4.1 critical value required at the 99% significance level.

Using this formulation results in a much better fit. However, the most attractive parks have underestimated attendance and the least attractive parks have overpredicted visitation.

Linear regression requires a linear relationship between the dependent and independent variables. This simply means that on a graph, the relationship can be represented by a straight line, or its equivalent in more than two dimensions. Even when this is not the case, the situation can sometimes be corrected by appropriately transforming (i.e. taking logarithms, squaring, etc.) one or more of the variables so that the relationship between the transformed variables is approximately linear. Several transformations of the attractiveness variable were made to try to compensate for non-linearities. Table IX indicates the effects of raising A_j to various powers.

The final estimating equation, as determined through multiple regression, is written:

$$V_{ij} = -4724.14 + .00000206\, A_j^4/D_{ij} + 1.93\, P_i/D_{ij} + 30{,}570.68\ (0,1)$$
$$(-4.439) \qquad (15.749) \qquad (10.126) \qquad (16.988)$$

The reported t-values are all significant at the 99% level. The coefficient of determination is .908 which indicates that in the neighborhood

TABLE IX

A COMPARISON OF THE EFFECTS OF DIFFERENT FORMS OF THE ATTRACTIVENESS FACTOR

Variable	Standard Error	R^2	Increase in R^2	t-value
A_j/D_{ij}	57.017	.789	-	8.46
A_j^2/D_{ij}	.073	.865	.076	12.16
A_j^3/D_{ij}	.001	.898	.033	14.77
A_j^4/D_{ij}	.000	.908	.010	15.75
A_j^5/D_{ij}	-	-	-	-

of 91% of the total variation among the observations can be explained by this equation.

The prediction capability of the formulation is the primary test of how well the equation can be expected to predict attendance for a new facility. It is, therefore, of considerable interest to compare the total actual number of visitors with the calculated totals. These totals which are the V_{ij}'s summed over all origins for each single park are compared to actual day-visits for trips originating within the study area in Table X.

TABLE X

ACTUAL AND PREDICTED VISITS DURING THE SUMMER OF 1975

	Actual	Predicted	% Difference
Alice Lake	119,248	95,959	-19.5
Golden Ears	242,624	258,257	+ 6.4
Cultus Lake	398,953	398,952	-
Rolley Lake	76,881	74,027	- 3.7
Murrin	48,362	56,453	+16.7
Bridal Falls	6,106	16,688	+173.3
Mount Seymour	99,907	91,745	- 8.2
Totals	992,081	992,081	-

Although there are some variations in the percentage differences between actual and predicted park visitation, high (low) levels of predicted use corresponds to high (low) levels of actual visitation. A correlation coefficient of .995 indicates that there is a very high degree of linear dependence between the actual and predicted visits for each park under consideration.

Since the level of out-of-region use is approximately 14% over the entire study area, total visitation including visitors from other areas might be derived by multiplying the estimated ΣV_j by: $(1 + .14)$.

CHAPTER SEVEN - CONCLUSIONS

The model provides a fairly close prediction of the total attendance for the seven parks in the sample for day-visits originating within the study area. It seems reasonable that the final estimator could be used with some confidence in predicting attendance at a new or poposed site of similar nature in this same region.

Further improvements in the precision of the equation can be made, perhaps, by using travel time to formulate the variable used to account for spatial separation between parks and population centers.

Additionally, the use data collected by the Parks Branch is not without inherent weaknesses. Specifically, at Bridal Falls day-visit counts are used in favour of traffic counters. This procedure simply involved counting the number of vehicles in the parking lot at some time during the day and multiplying by 3. It is expected that this kind of procedure drastically underestimates use.

Also, traffic counters are not without problems - people leave the park and return, boat trailers are counted as vehicles, and park employees entering the area are counted as recreationists. All of these factors tend to overestimate use. Progress, however, will only come through further efforts. A major weakness is that far more data and analysis is required before a fully adequate explanation can be offered for the patterns of use that occur.

Relevant variables, forms of equations, and models need to be tested if results are to be improved. As more analysis is done in regard to outdoor recreational planning we can expect it to have a beneficial impact.

It is hoped that the results of this study will provide the planner with some of the tools he requires. Although this study does not directly supply policy and planning solutions, it can provide an important input to making better decisions. That is, decisions to allocate or refuse funds for public recreation are made by political processes, but provision of facts may aid those processes. Finally, the approach can become an attitude and a method - the alternative is frequently rule of thumb or intuition. These are not too helpful in our changing times.

Because socio-economic characteristics and the supply of day-use opportunities vary over different regions, the criteria weights and the derived estimating equation should not be applied outside the Lower Mainland region of British Columbia.

For further applications of this methodology, it should not be forgotten that the methods presented in this paper rely heavily upon expert opinions. Therefore, selection of experts and agreements on the criteria used for evaluation should be carefully determined and applied.

APPENDIX A

Glen Nuttall
Department of Economics and Commerce
Simon Fraser University
Burnaby, B.C. V5A 1S6

Park ____________________

Date ____________________

OUTDOOR RECREATION SURVEY

We are conducting a survey of the users of various recreation areas. Only one person in a party should complete the questionnaire.

Thanks for your help!

1. Where do the people in your group live?

   city ________________________ no. of persons _______

   city ________________________ no. of persons _______

   city ________________________ no. of persons _______

2. Is your visit to this park (please check the one that applies)

   a) an outing of one day or less from your home?
   b) a trip from your home during which you spend one or more nights here?
   c) one stop on a longer vacation trip?
   d) none of the above

3. Have you or do you intend to visit another park on this day?
   If so, which park? ______________________

4. How long will your visit to this park be? ________hours or _____days.

5. What improvements would you like to see in services or facilities at this park?

   ____

   ____

6. What activities did or will the members of your party participate in at this park on this trip? (please check all that apply)

   ____1. camping
   ____2. fishing
   ____3. hiking
   ____4. picnicking
   ____5. swimming
   ____6. boating
   ____7. sightseeing
   ____8. other (please specify) ___________

APPENDIX B

Normalized And Average Scores of Experts

SUBJ.	A1	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2
01	.229	.286	.135	.168	.003	.011	.016	.020	.007	.034	.048	.043
02	.077	.096	.101	.071	.016	.033	.054	.207	.259	.052	.017	.017
03	.137	.082	.139	.111	.018	.022	.022	.049	.195	.068	.087	.009
04	.233	.119	.147	.103	.005	.016	.015	.071	.119	.060	.082	.025
05	.181	.036	.256	.179	.017	.015	.012	.031	.104	.083	.043	.043
06	.135	.108	.173	.125	.080	.048	.024	.053	.088	.071	.043	.048
07	.120	.171	.161	.161	.022	.036	.072	.031	.102	.061	.054	.011
08	.097	.194	.202	.121	.015	.038	.076	.034	.102	.061	.054	.011
09	.321	.064	.110	.044	.026	.026	.026	.051	.051	.051	.144	.087
10	.231	.185	.086	.123	.022	.036	.025	.075	.083	.050	.044	.039
11	.189	.211	.147	.133	.012	.005	.024	.007	.037	.075	.094	.066
12	.342	.171	.045	.036	.003	.008	.016	.054	.081	.135	.050	.048
13	.271	.244	.101	.081	.009	.005	.013	.007	.012	.012	.121	.121
14	.260	.208	.125	.125	.010	.031	.052	.041	.082	.033	.018	.013
15	.244	.196	.099	.141	.041	.022	.017	.032	.080	.048	.040	.040
16	.250	.250	.080	.086	.017	.017	.034	.017	.057	.040	.107	.075
17	.250	.250	.042	.033	.015	.019	.015	.029	.076	.095	.109	.066
18	.250	.250	.090	.090	.033	.013	.013	.040	.040	.080	.050	.050
19	.101	.051	.152	.152	.025	.042	.084	.051	.121	.071	.076	.076
20	.127	.102	.129	.129	.048	.043	.048	.060	.143	.083	.043	.043
21	.152	.091	.114	.102	[illegible]	.061	.049	.047	.106	.118	.068	.068
22	.179	.107	.105	.101	.019	.021	.017	.027	.045	.014	.157	.157
23	.038	.038	.023	.015	.045	.226	.113	.066	.154	.038	.107	.085
24	.108	.076	.102	.082	.068	.051	.055	.055	.068	.061	.132	.132
25	.374	.150	.084	.059	.011	.013	.018	.012	.030	.006	.140	.098
26	.114	.103	.082	.136	.072	.043	.055	.036	.055	.095	.109	.065
27	.096	.077	.249	.199	.004	.022	.043	.051	.082	.143	.020	.014
28	.202	.121	.097	.161	.027	.067	.067	.013	.129	.052	.038	.027
29	.098	.059	.139	.111	.018	.022	.022	.063	.162	.087	.122	.097
30	.080	.024	.117	.070	.040	.024	.020	.027	.219	.274	.052	.052
31	.073	.073	.093	.093	.027	.008	.014	.098	.146	.244	.068	.054
32	.294	.147	.155	.109	.026	.033	.029	.065	.059	.052	.014	.015
33	.229	.327	.093	.056	.010	.006	.021	.012	.117	.094	.021	.016
34	.179	.054	.044	.089	.015	.050	.035	.094	.168	.151	.050	.050
AVG.	.164	.139	.118	.106	.025	.034	.036	.048	.101	.081	.072	.057

```
COEF OF CONCORDANCE =        0.51508
CHI-SQUARED STATISITIC =    192.63907
PROB OF EXCEEDING CHI-SQUARED =          0.00000
KENDALL S =        84603.500
ERROR PARAMETER =        0
```

APPENDIX C

HOW EACH SITE SCORED RELATIVE TO THE CHOSEN CRITERIA

Criteria	Mt. Seymour	Bridal Falls	Golden Ears	Kawkawa Lake	Cultus Lake	Alice Lake	Murrin	Rolley Lake
a_1	0	0	84.5	65.5	81.0	81.5	63.5	56.1
a_2	------------------- Not Applicable -------------------							
b_1	74.4	77.5	92.5	68.0	88.5	82.5	68.8	68.3
b_2	0	0	67.1	62.2	76.1	77.0	55.3	61.9
c_1	84.2	63.0	5.5	59.0	69.0	54.0	32.4	13.9
c_2	------------------- Not Applicable -------------------							
c_3	76.4	0	48.5	0	0	78.5	0	0
d_1	40.7	86.7	78.4	67.5	83.0	82.0	65.9	62.5
d_2	77.7	95.0	94.5	84.5	89.0	88.5	74.7	87.2
d_3	72.8	83.3	87.2	63.0	77.9	81.0	50.6	90.0
e_1	83.0	95.0	95.0	86.0	93.0	91.5	85.9	75.9
e_2	84.1	89.2	91.0	70.0	80.0	89.5	68.1	49.4

APPENDIX D

POPULATION (Pi) 1975

Port Coquitlam	25,000
Surrey	119,100
Vancouver	400,000
Abbotsford	9,500
Chilliwack and Kent	35,026
North Vancouver	104,342
Pitt Meadows	3,562
Coquitlam and Port Moody	103,000
Langley	43,695
Delta	66,382
Maple Ridge	30,000
Mission	15,000
Richmond	80,000
White Rock	13,000
New Westminster	45,000
Matsqui	32,500
West Vancouver	39,150
Squamish	10,000
Burnaby	133,000

Source: Trade and Commerce Magazine, April 1976

APPENDIX D

DAY-VISITS - JUNE, JULY, AUGUST, 1975

Park	Day-Visits	% in Region	Adjusted Day Visits
Alice Lake	167,956	71%	119,248
Golden Ears	266,629	91	242,624
Cultus Lake	419,948	95	398,953
Rolley Lake	80,084	96	76,881
Murrin	53,144	91	48,362
Bridal Falls	10,176	60	6,106
Mount Seymour	158,584	63	99,907
	1,156,512	86%	992,081

Source: B.C. Parks Branch, Data Handbook, Victoria, 1975.

Proportion of in region use derived from direct interviews at each site.

APPENDIX D

% Vij

	Golden Ears	Cultus Lake	Bridal Falls	Murrin	Alice Lake	Rolley Lake	Mount Seymour
Port Coquitlam	12	8.5			4	5	4
Surrey	5	8.5				7	3
Vancouver	13	11	5	42	24	13	21
Abbotsford		10	6			3	
Chilliwack & Kent		19	74	2.5			
North Vancouver	4		3	12	12	5	32
Pitt Meadows	7					2	
Coquitlam & Port Moody	13			1		12	6
Langley	3		6			5	
Delta	3	7			3	3	2
Maple Ridge	16	8				16	
Mission	3					16	
Richmond	1				4		1
White Rock	7	7					
New Westminster	2					6	6
Matsqui	1	8					
West Vancouver				2.5		1	4
Squamish				31	44		
Burnaby	10	13	6	9	9	6	21
TOTAL	100%	100%	100%	100%	100%	100%	100%
Sample size	512	150	260	176	192	268	178

Source: Direct interviews undertaken at each site during the summer of 1975.

APPENDIX D

Vij

	Golden Ears	Cultus Lake	Bridal Falls	Murrin	Alice Lake	Rolley Lake	Mount Seymour
Port Coquitlam	29,115	33,911			4,770	3,844	3,996
Surrey	12,131	33,911				5,382	2,997
Vancouver	31,541	43,885	305	20,312	28,620	9,994	20,981
Abbotsford		39,895	366			2,306	
Chilliwack & Kent		75,801	4,518	1,209			
North Vancouver	9,705		183	5,803	14,310	3,844	31,971
Pitt Meadows	16,984					1,538	
Coquitlam & Port Moody	31,541			484		9,226	5,994
Langley	7,279		366			3,844	
Delta	7,279	27,927			3,577	2,306	1,998
Maple Ridge	38,820	31,916				12,301	
Mission	7,279					12,301	
Richmond	2,426				4,770		999
White Rock	16,984	17,927					
New Westminster	4,852					4,613	5,994
Matsqui	2,426	31,916					
West Vancouver				1,209		769	3,996
Squamish				14,992	52,470		
Burnaby	24,262	51,864	366	4,353	10,732	4,613	20,981
TOTAL	242,624	398,953	6,106	48,362	119,249	76,881	99,907

APPENDIX D

Dij

	Golden Ears	Cultus Lake	Bridal Falls	Murrin	Alice Lake	Rolley Lake	Mount Seymour
Port Coquitlam	19	61			68	25	21
Surrey	31	56				37	24
Vancouver	37	74	72	34	50	43	27
Abbotsford		28	26			22	
Chilliwack & Kent		10	8	99			
North Vancouver	38		78	30	46	44	8
Pitt Meadows	15					21	
Coquitlam & Port Moody	23			51		29	17
Langley	41		44			42	
Delta	40	62			65	53	42
Maple Ridge	10	36				16	
Mission	26					14	
Richmond	48				61		38
White Rock	44	74					
New Westminster	27					33	20
Matsqui	50	37					
West Vancouver				21		53	17
Squamish				7	9		
Burnaby	25	62	60	46	55	32	15

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