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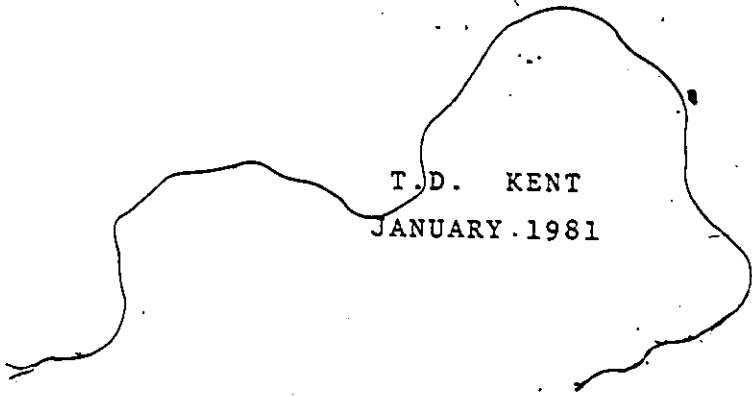
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THE UNIVERSITY OF OTTAWA

IMPLICATIONS OF THE CARRYING CAPACITY CONCEPT
AS APPLIED TO KLUANE NATIONAL PARK
YUKON TERRITORY



T.D. KENT
JANUARY 1981

A THESIS PRESENTED TO THE
SCHOOL OF GRADUATE STUDIES
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REQUIREMENTS FOR THE DEGREE OF
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PREFACE

During my career as a park planner and land use manager with an Ontario Conservation Authority, I found that the greatest portion of my work involved reacting to impacts after damage, both environmental and social had occurred.

My primary intention, when I embarked on this thesis, was to develop a universally applicable method of establishing carrying capacity for parkland, using a virtually untouched environment as my model. However, it soon became evident that when dealing with individual park users, universality does not exist. Instead, the document attempts to explain the applicability of various ideas associated with the carrying capacity concept in relation to the planning of a national park north of the 60th parallel.

Financial support for the 1979 field season was contributed by the Northern Research Group of the University of Ottawa, and the Natural Science and Engineering Research Council (operating grant A 7486, held by Dr. P.G. Johnson). Thanks are due to Rik Kristjansson for his advice, back-packing abilities, the loan of his ice axe, and his timely

instructions on Grizzly survival techniques. Dr. Peter Johnson, who directed this thesis, provided unlimited amounts of time and patience throughout as well as access to an ideal laboratory. In addition, Peter Johnson together with Andy Williams fostered and developed in me a deep appreciation for and understanding of the St. Elias Mountains over the last 8 years. Dr. Jean Paul Paquin provided invaluable assistance during the revision of some of the basic concepts contained in this thesis. The contribution of Ginette Sanchez who typed this document is also acknowledged. To all, I extend my deepest appreciation. However, without the constant encouragement, support and understanding of my wife, Monique Labrecque, this work would never have been completed.

ABSTRACT

The concept of environmental carrying capacity as it is applied to the recreation planning of wilderness areas is examined. The objectives of the document are: to examine the concept, particularly the relationship between user perception of wilderness, user satisfaction, and environmental quality; to establish a method of evaluating environmental quality and attractiveness, and; to determine the environmental carrying capacity for a selected area in the greenbelt of Kluane National Park. While logistical problems were encountered during the field season, which limited data collection, it was found that Kluane National Park is not a major attraction for wilderness users. The isolation of the Park from a large and diversified market, in addition to the characteristics of the Park user, preclude an application of standard techniques for maintaining or increasing environmental and social carrying capacities in this type of environment.

SOMMAIRE

L'investigateur a examiné le concept de capacité d'absorption de l'environnement comme il est appliqué dans la planification récréative des régions sauvages. Les objectifs de cette recherche sont: d'examiner le concept, plus particulièrement la relation entre la perception des usagers des régions sauvages, leur satisfaction et la qualité de l'environnement; d'élaborer une méthode d'évaluation de la qualité et de l'attrait de l'environnement; de déterminer la capacité d'absorption de l'environnement pour une région déterminée du parc national de Kluane.

Malgré des difficultés d'ordre temporel et la rareté des ressources humaines qui ont limité la collecte des données, l'investigateur est d'avis que le parc national de Kluane n'est pas une attraction majeure pour les usagers des régions sauvages. L'éloignement des grands bassins de population ainsi que les caractéristiques des usagers du parc font que les techniques traditionnelles utilisées pour maintenir ou augmenter les capacités d'absorption sociale et de l'environnement ne sont pas appropriées pour ce type de parc.

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CHAPTER ONE

THE PROBLEM

Since the recognition of wilderness as a recreation resource, particularly during the environmental crisis and subsequent development of an environmental ethic in the late 1960's and early 1970's, concerns have been widely expressed about the quality and the integrity of that resource.

Increases in resource oriented recreation by the year 2000 have been estimated to be in the order of four to eight times present levels (Leisure Consultants 1973). Human factors, and more specifically the level of satisfaction of users, will therefore, continue to be one of the major concerns in establishing, developing and maintaining parkland. Planners are expected to provide universally accessible opportunities for a wide variety of recreation activities, which may not be compatible. At the same time, they must insure the quality of the experience over time (Verburg 1972).

It has become evident that recreational experiences are generally decreasing in quality. This deterioration, stemming from high demand, manifested by overuse of trails

and campsites and the high density use of selected wilderness areas has resulted in increased consumption and decreased user satisfaction. Wilderness purists, who may no longer achieve their desired levels of satisfaction in wilderness recreation areas, which are easily accessible in terms of location to population centers (such as Algonquin Provincial Park), must absorb the costs of deteriorating conditions by either accepting lower levels of satisfaction, or finding new areas which meet their overall objectives, but which may, also, represent significantly higher financial costs in addition to imposing prohibitive time constraints.

Concern over such reduction in quality, both environmentally and socially, has forced planners to realize that limits to use exists and that when those limits are exceeded quality is reduced. One measure of environmental quality, including not only concerns relating to environmental quality, but user satisfaction and aesthetic considerations as well, is that of outdoor recreation carrying capacity. The concept of carrying capacity will be examined in terms of its applicability in the planning of Kluane National Park.

Objectives

The objectives of this thesis are: to examine

the concept of carrying capacity, particularly the relationship between user perception of wilderness, user satisfaction, and environmental quality; to establish a method of evaluating environmental quality and attractiveness and; as a test of its applicability in the north determine the environmental carrying capacity for a selected area in the greenbelt of Kluane National Park, Yukon Territory.

Area of Study

(1) Regional Context - Kluane National Park, established in 1972, is a wilderness area encompassing 22,000 square kilometres of the Southwest Yukon Territory. It is bounded on the west by Alaska, and on the south by Alaska and British Columbia. The major access routes from southern Canada and the United States, the Alaska and Haines Highways, lie adjacent to portions of the Park's northwestern boundaries. (Figure 1)

A small number of communities, ranging in population from 42 to 330, are located in close proximity to the Park along the Alaska Highway. The major population centre (15,000) is located at Whitehorse, approximately 160 kilometres to the east. (Figure 1a)

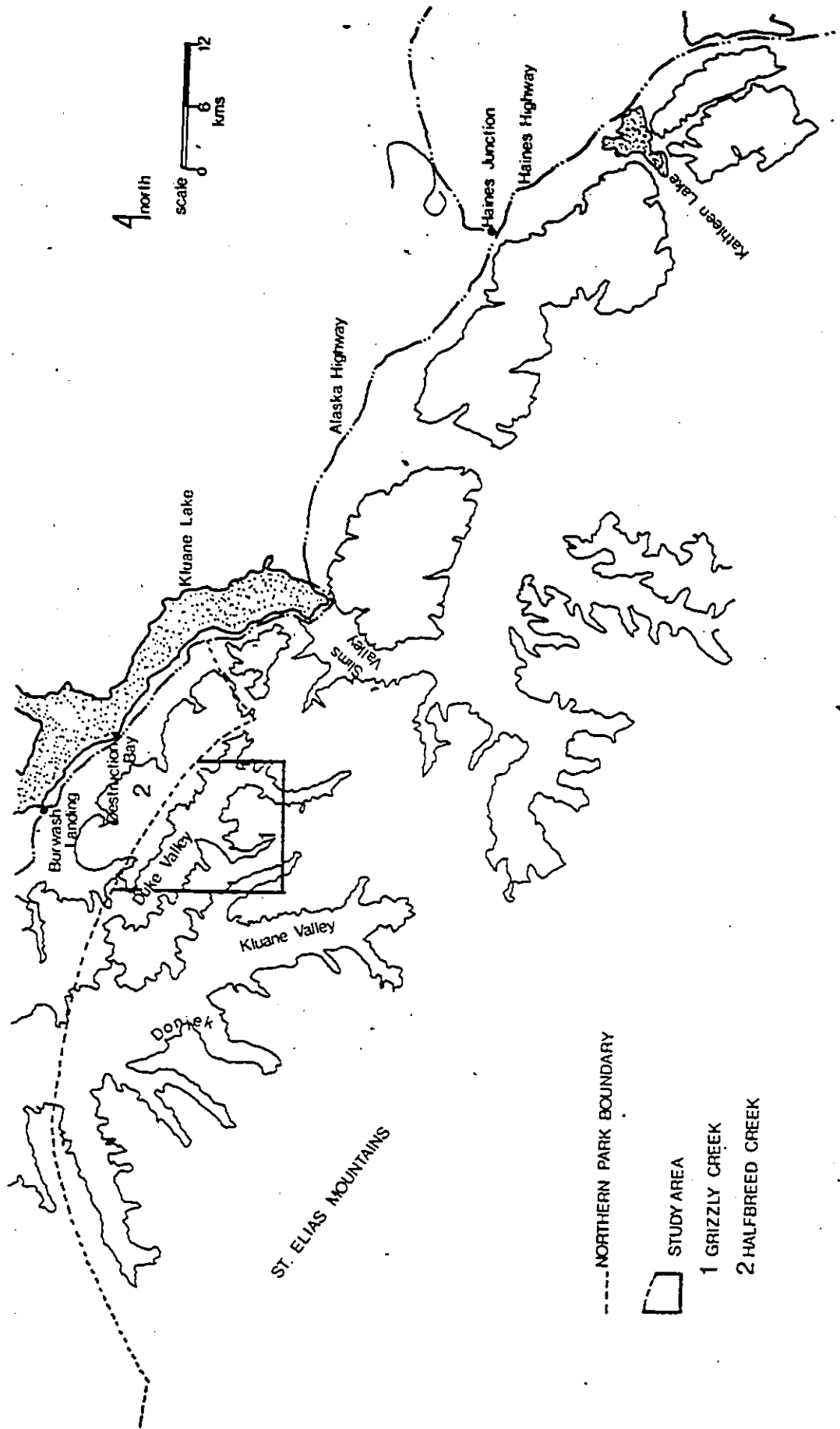
Yukon Territorial Government campgrounds along

Figure 1 Location of Study Area within Kluane National Park.

Reproduced from: Kluane National Park Planning Program, Parks Canada, Indian and Northern Affairs (1977).

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Figure 1 Location of the Study Area Kluane National Park



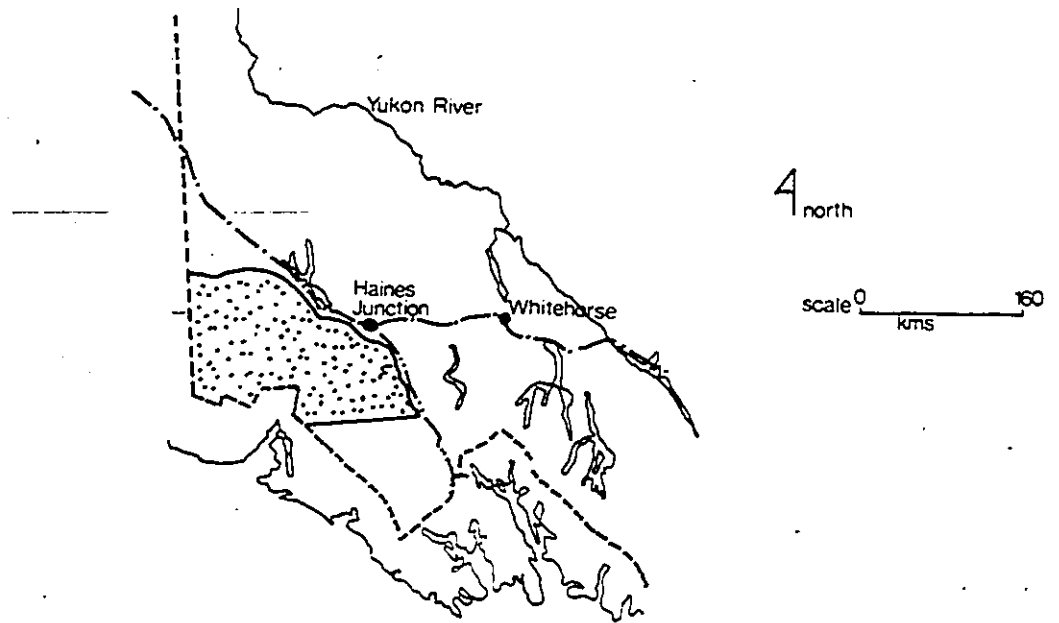
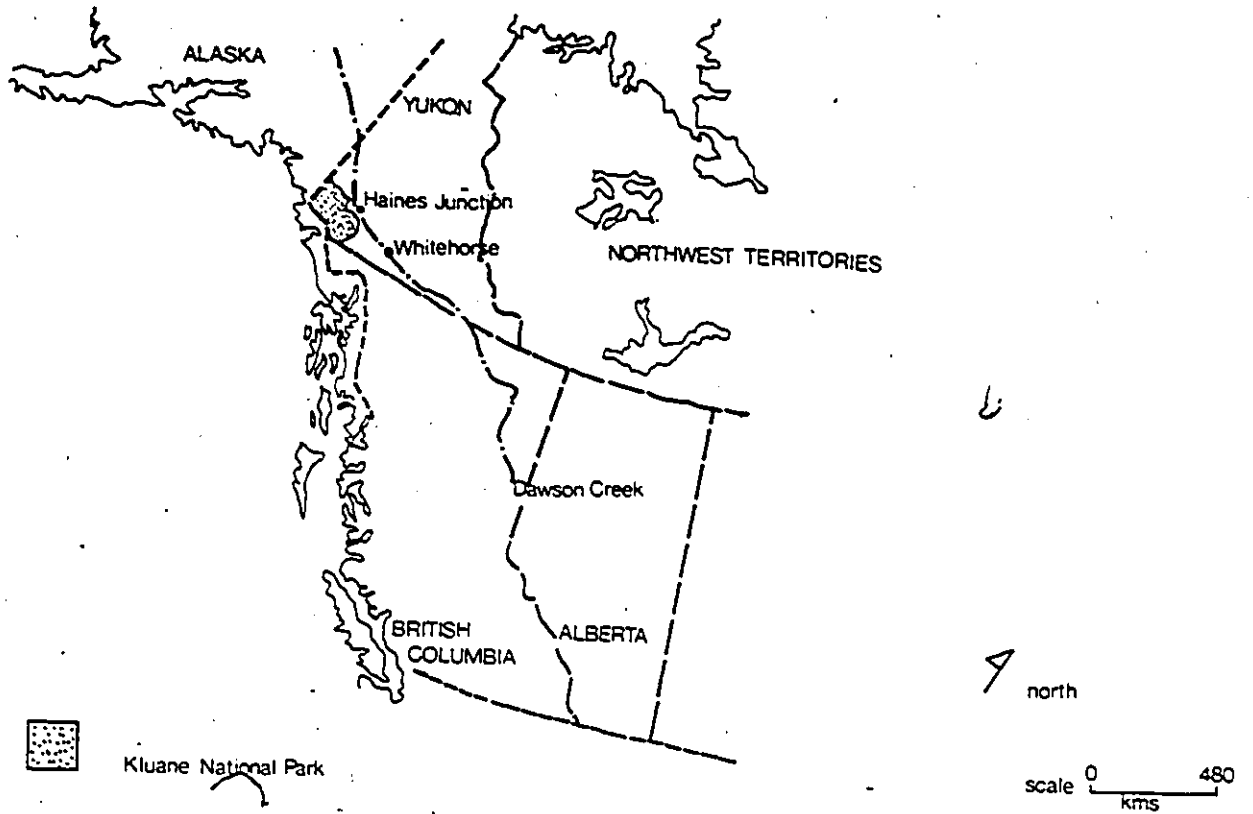


Figure 1a Regional Context

(from Parks Canada)

the Alaska Highway serve as departure points for day users of Kluane National Park. In addition, two national parks in the United States system, Mount Mckinley National Park and Glacier Bay National Monument are located in the Yukon-Alaska region. Both these facilities provide mountain wilderness and glacier resources which are comparable to those offered by Kluane National Park.

Development of intensive use areas within Kluane has been limited to Kathleen Lakes, which presently provides major facilities for camping, boating and fishing. Hiking is most popular further to the north along the Slims River Valley, the most accessible of many glaciated valleys in the Park. (Figure 1)

(2) Characteristics - The most striking feature of the park are the Icefield Ranges, the largest non-polar icefield in the world. An extensive network of glaciers flow from the icefields including the Steele, Donjek and Hubbard. In addition, Mt. Logan (5,950 metres in altitude), the highest mountain in Canada is located in the Icefields as are Mt. St. Elias, Mt. Lucania, Mt. Steele, and Mt. Wood.

Varying conditions of altitude, moisture and temperature result in a great variety of vegetation. Lower valleys and slopes ranging up to 1,100 metres form a

montane vegetation zone dominated by white spruce, a sub-alpine zone consisting primarily of tall shrubs (willows) continues to an altitude of 1,400 metres, and alpine tundra is found above that elevation.

Kluane National Park exhibits a wide variety of wildlife which has been protected by the federal government since 1943, when the Kluane Game Sanctuary was created. Important species include: grizzly bear, dall sheep, mountain goat, moose, black bear, caribou, wolverine and coyote. Approximately 180 species of birds have been identified and several unique fish species have been reported (Parks Canada 1977). Detail of the biophysical nature of Kluane National Park have been examined by various authors. Selected articles in this literature have been published in the Icefield Ranges Research Projects Results.¹

(3) Visitor Use - Presently, Kluane National Park is not being used to any great extent by visitors to the Yukon. The majority of the 330,000 people who visit the Territory annually travel in self-contained recreation vehicles and spend no more than 3 days in the Yukon (Yukon Government 1972). While Kluane National Park is readily accessible, that is to say adjacent to portions of the

¹ - Icefield Ranges Research Project Results, vol. 4
Published by the American Geographical Society and the
Arctic Institute of North American, 1974.

Alaska Highway, it appears that most tourists are limited by time constraints which preclude their visiting the Park.

Informal discussions with the staff of Parks Canada (located at the main entry points to the Park), indicated that the majority of the users of the Park's main facility, located at Kathleen Lakes, availed themselves of the camping facility as an overnight stop on their Alaska Highway trip. Other than local residents who used the Kathleen Lakes campground for weekend fishing and camping trips, the greatest portion of use was from people in-transit.

Use of the more isolated portions of the Park, which requires overnight camping in remote areas not accessible to motorized vehicles, was minimal. Apart from specialized groups of mountaineers, who were permitted access to the St. Elias Icefields, and three research parties, access to the Park interior by individual, self-funded groups was negligible.

In general terms, the majority of Park use is of an overnight, transient nature, or of a limited access, day use character, along routes of easiest access. The more remote areas of the Park are used only by a small, dedicated group of wilderness purists.

CHAPTER TWO

REVIEW OF THE LITERATURE

Recreation planning for wilderness areas has frequently been based on the aesthetic qualities of a particular area, with very little attention given to the number of users who would eventually take advantage of a particular facility. Consequently, the environmental impact on those areas has often, in the past, been ignored.

Increased leisure time, resulting in augmented numbers of users and increased resource exploitation, has contributed to the deterioration of the environmental quality of many of those areas, forcing planners to realize that use limits exist for recreational activities and for recreation areas. If these limits are exceeded, the result will be manifested by a declining level of user satisfaction and a deteriorating environment.

There is a strong attraction, therefore, to the idea of using an objective method of environmental analysis as a growth management tool. While the concept of carrying capacity addresses two major questions central to resource planning - what is the appropriate level of use for a given

recreation area, and what steps can be taken within current technological expertise to increase an areas' capacity without sacrificing quality (Lime and Stankey 1971), it is a concept replete with problems of definition and methodology. Apart from the environmental elements, the concept includes institutional and perceptual definitions, each of which has different applications and methodologies (Godschalk and Parker 1975). Institutional carrying capacity is defined by these authors as:

"...the ability of organizations in an area to guide development toward public goals. It involves the limitations imposed by government structure, budgets and personnel as well as the more general economic and cultural limits of the area on environmental decision-making."

Perceptual carrying capacity is:

"...the amount of activity or degree of change that can occur before we perceive the environment to be different than before ...and is only applicable where a high value is placed on the visual or psychological quality of the environment."

The concept of carrying capacity, applied to recreation design, has been adapted from ecological and range management disciplines. The ecological definition of the concept, "the upper level (of a population curve), beyond which no major increase can occur" indicates that the numbers of a population which can be supported (or the environ-

mental carrying capacity) is limited by certain factors over which the population has no control (Odum 1971). (Figure 2)

The most popular population growth model is the logistic curve model depicted in Figure 2. The model is based on two propositions put forth by Malthus which are explained by Richardson (1977) as:

- "a) that unrestrained populations grow in a geometrical progression,
- b) that this growth does not remain unrestrained, but eventually is stopped by the inability of the environment to support more individuals."

Contained in the second proposition is the conception of environmental carrying capacity; that is: the maximum number of individuals who can be sustained by the environment. The flattening of the logistic curve indicates the equalization of birth and death rates in the population as environmental limits are reached, resulting in a stabilization of the population (until manipulation of the environment takes place).

Briefly explained, when environmental constraints to growth of a population are low, reproduction far exceeds mortality, and each succeeding generation is larger than the preceding one. Since each generation is larger, its

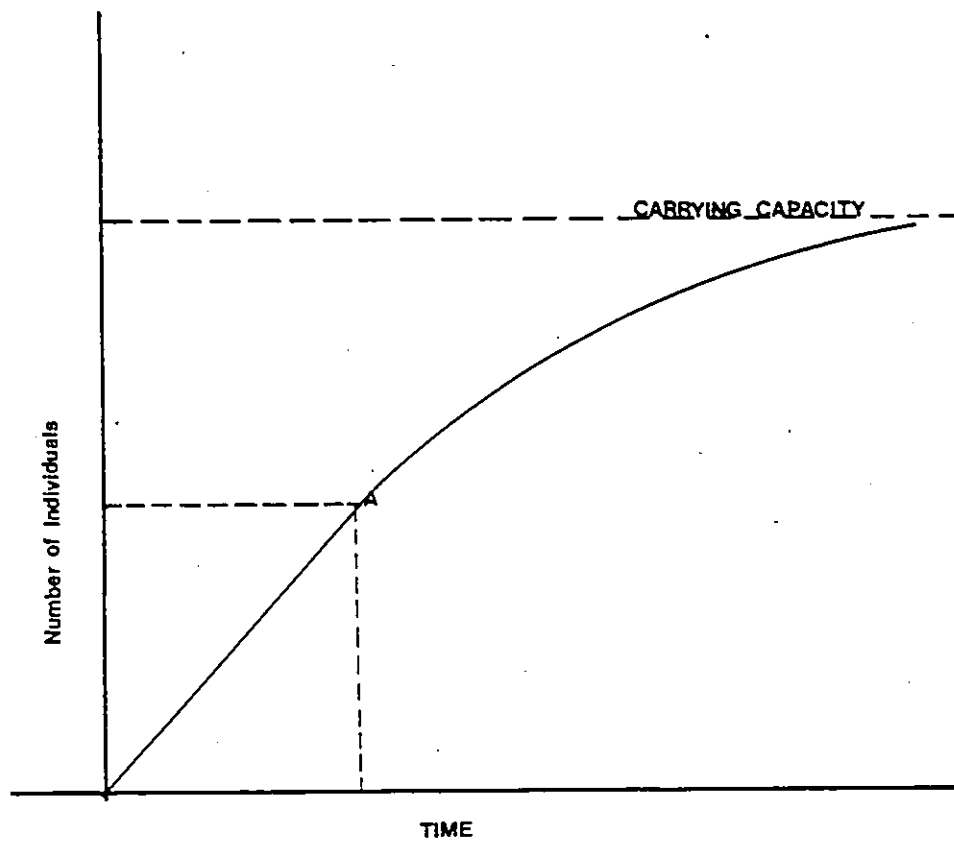


Figure 2

Logistical Population Growth (from Richardson, 1977)

A—represents the point of most rapid growth (half the carrying capacity)

rate of reproduction will be higher (represented by the steeper part of the curve). However, as the population grows, the environmental constraints become greater and the rate of mortality begins to approach the rate of reproduction. Growth of the population ceases when the two rates are equal. At that point (of equilibrium) the environmental carrying capacity has been attained.

Environmental constraints do not necessarily increase gradually with population growth. Richardson (1977) reports that "restraints may be imposed suddenly, in the manner of threshold phenomena".¹ The population will, therefore, experience declines and will not grow to meet carrying capacity in the manner suggested by the curve in Figure 2.

The range management concept of carrying capacity expanded the definition to include the amount of biota which could be sustained by a particular environment. In addition, it proposed the manipulation of carrying capacity to extend the environment. (The improvement of winter food supplies for deer through forest management is an example of manipulation of carrying capacities to extend the environment.)

Meinecke (1929) identified the need for standards

1- Threshold phenomena are considered to be catastrophic events such as drought or flood for example, which have negative effects on a population.

enabling the description of the maximum allowable use which a facility could withstand before a major change in its character or even the destruction of the system took place. This description in biophysical terms was, in essence, the first recognition of excessive use changing the nature of a park facility.

The importance of the physical or environmental limitations in the concept of carrying capacity diminished with the National Advisory Council on Regional Recreation Planning (1959) definition which explained the term as:

"the maximum use over a given period of time that a particular landscape has the ability to absorb while maintaining the primary qualities and characteristics... carrying capacity may also be the maximum human use that is compatible with the quality of the recreation experience desired by the user."

This definition, in addition to identifying the ability of the resource base to absorb certain levels of use beyond which the environment would be significantly impaired as the major criteria in the determination of carrying capacities, indicates that it would also be appropriate to define the concept in terms of the level of use that could be tolerated by individuals without a significant loss of satisfaction to the user.

A two-stage definition of the concept, incorporat-

ing both the work of Meinecke of that of the National Advisory Council on Regional Recreation Planning, was developed by Lapage (1963). Aesthetic carrying capacity was defined by Lapage as:

"... the level of development and use beyond which measurable decreases in average satisfaction occur as a direct result of gross numbers of recreationists."

The biophysical carrying capacity was defined as:

"... the level of development and use beyond which the site's capacity to provide a sustained high level of satisfaction becomes impaired due to severe damage to the natural site."

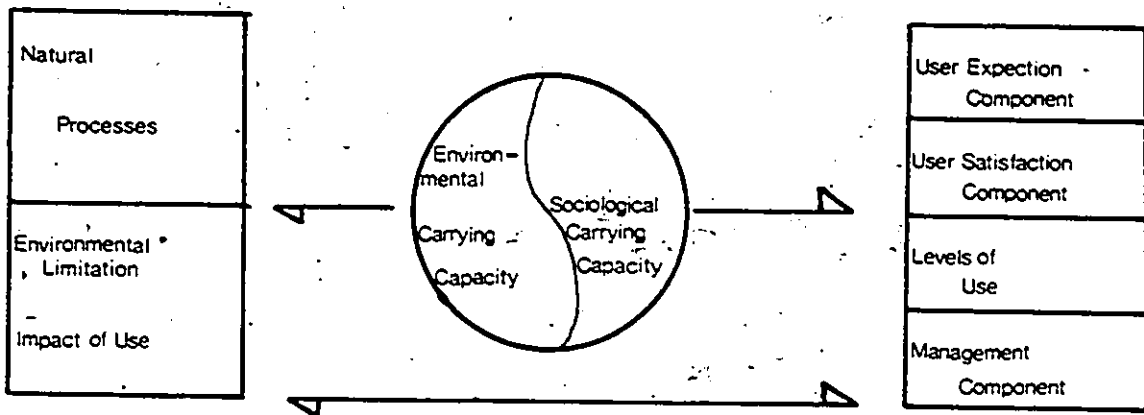
Here, clearly defined, are three distinct components in the concept of carrying capacity:

- (a) user expectations
- (b) user satisfaction
- (c) the physical limitations of the resource base.

In an article published in 1964, J.A. Wagar identified a fourth element (Figure 3) which he considered vital to the concept; that of management. Wagar indicated that:

"... in every statement of ~~carrying~~ capacity there must be, at least implicitly a statement of some management objective."

The idea that recreation was thought of primarily as an accessibility problem, rather than as a resource to be managed on a long and sustained basis, which would encourage



(From Verburg 1975)

Figure 3

Relationship of the 4 Components of Carrying Capacity

the definition of carrying capacity in terms of ecological standards and landscape characteristics, leads Wagar to believe that in spite of the vast amount of information available to the planner, the final determination of carrying capacity must rest with the park manager (Lime, Stankey, Wagar, Verburg).

Since 1964, the major emphasis in the field has concerned itself with those four components of carrying capacity and more specifically with the inter-relationships between the components. Determination of recreation use levels has become primarily a case of establishing so called physical and psychological "space standards" which satisfy both management levels and user groups. Researchers have generally considered that the level of importance of each factor, in relation to each other, is site specific, but that in a majority of cases the objectives identified by the planner for a particular site will take precedence in determining carrying capacity (Verburg, Wagar).

User Satisfaction - Quality of the Wilderness Experience

The quality of a wilderness experience is defined in the literature in terms of the user's expectations or perception of the wilderness experience, including solitude and the primitive or natural character of the area.

Factors influencing user satisfaction such as crowding, the number of encounters with other groups, noise levels, or the sighting of wildlife, become very important in establishing a carrying capacity value for a particular area. The ability of the resource base, on the other hand, to provide access to unique physical features or biological communities which may interest the user and essentially determine visitor satisfaction, must be based on the ability of the resource to withstand user-caused damage. In most instances involving wilderness park areas which are inherently fragile, it would seem reasonable to assume that the characteristics of the resource and their preservation are of prime importance in the determination of carrying capacity.

The contemporary approach to carrying capacity has been to attempt to identify the relationships between the four components. However, neither of the components is easily measured since each is, in essence, an abstraction which is heavily dependent on the other factors. Verburg (1972) describes carrying capacity in the following way:

"the concept of carrying capacity cannot be viewed otherwise than (as) an irregularly fluctuating level of dynamic equilibrium between the objectives of the manager, the ability of the site the impacts and experience of the user and a variety of external influences including technological innovations, political expediencies and physical catastrophies."

The discussion of carrying capacity becomes very nebulous and difficult when applied to determine use levels for specific recreation areas. When planners consider what type of development should take place, how many people should be accommodated by a facility, and when and for whom those areas should be developed, a consensus of opinion can very rarely be reached (Lime and Stankey 1971). The major problem is that park managers must consider a wide range of potentially conflicting uses, while at the same time insuring the integrity of the resource base.

User satisfaction and user expectation² are considered to be major components of wilderness carrying capacities. It has been established by Wagar (1964), among others that the quality of outdoor recreation depends on user satisfaction or user perception of the environment. User satisfaction is related to user expectation in that if the wilderness user can fulfill his expectations during the recreation experience, he will then indicate a generally higher level of satisfaction than if those expectations were not fulfilled. The Outdoor Recreation Resources Review Commission (1961), showed that there are many different types of groups seeking some form of outdoor recreation

2- In this thesis "user expectation" is used synonymously with "user demand". User demand is however not to be taken in the economic sense but rather it refers to what the user expects of a particular recreation experience.

and that each group has a "characteristic array of preferred activities". Carrying capacities must, therefore, reflect the user's perception of the resource base in addition to the user's effect on other recreationists.

Attitudes and Perception:

The attitudes and perceptions which individuals hold are many and varied. Thurstone and Chave (1946) define an attitude as:

"the degree of positive or negative affect associated with some psychological object (a psychological object being a person, institution, ideal...)." .

Many psychologists indicate that attitudes are composed of a combination of affects and beliefs (all of which are based on culture and previous experience) which according to Schiff (1971) causes an individual to react in a specific way to an object. The reaction or the behavioural component of the attitude is what environmental psychologists measure when investigating peoples' attitudes toward the environment.

Perception, on the other hand, is the impression that an individual has of a particular object within a set of similar objects, which may or may not affect the individual's attitude toward the set of objects. Schiff

(1971) defines social perception as:

"the impression one has of a social stimulus or set of stimuli, as that impression is modified by the perceiver's past experience in general, his previous experience with that same or similar stimuli and the individual's state at the moment he is viewing the stimulus of interest."

A person who, because of some past experience, has the impression that mountain ranges are dangerous will perceive them as such and can then be said to have a negative perception of mountain ranges.³ However, since mountain ranges form only one element of wilderness, the individual may also have a positive attitude toward wilderness in general.

The quality of outdoor recreation may depend on the user's expectations, which are based on previous recreation experience and general cultural background, more than on the physical attributes of a particular park (Wagar 1964). Carrying capacities must, therefore, reflect the user's perception of the resource base, in addition to the user effect on other recreationists.

Research by Lucas (1964), has shown that for the specific region of the Boundary Waters Canoe Area, in the Lake Superior region, wilderness canoeists indicated

³- Barkham (1973), indicates that perception of both individuals and society changes through time, thereby making the establishment of planning goals very difficult.

dissatisfaction when they encountered motor boats and when they did so, their perception of the quality of the wilderness experience was not as favourable as when they had no such encounter. The physical nature, or the quality of the environment through which they travelled had not changed. The question then arises of whether the actual physical character of the environment is important in determining the level of user satisfaction.

The planners' perception of wilderness was shown by Lucas to have changed with modifications to the park boundaries. In addition planners and users differed on three points:⁴

- (1) importance of wilderness
- (2) area of wilderness
- (3) essential wilderness qualities (Mitchell 1979).

Shafer et al (1969), have shown that the user is more favourably affected by pleasant scenes than by unpleasant ones. If assuming that a pleasant scene is one characterized by the lack of human interference, specifically the absence of planned campsites, then the requirements of a user seeking solitude and wilderness may be satisfied

4- The author does not present a detailed discussion relating to the perception of planners, since in his opinion the management goals established by planners should reflect the goals and objectives of the users of those parks.

in a variety of parks of differing physical character.

Several authors, notably Lime, Stankey, Verburg and Wagar, argue that capacity can only be judged in terms of management objectives, which must clearly indicate what type of recreation opportunities an area is to provide. The fact that a person interested in a wilderness experience will not be satisfied by camping in a high density, multiple use facility, is not an indication that the facility has exceeded its carrying capacity, but rather that the park's objectives are not consistent with those of the individual's perception of wilderness.

The Evaluation of Landscape:

The evaluation of landscape poses a difficult problem. While it is generally accepted that landscapes are a natural resource (Linton 1968, Mitchell 1979), the development of an objective approach to its evaluation has been severely limited. The description of landscape generally revolves around the concept of beauty, a term which cannot be scientifically described and which therefore, cannot be defined (Kates 1966-67).

There are three general approaches to landscape evaluation:

- (a) the consensus approach
- (b) the description of landscape
- (c) the identification of landscape preferences.

The consensus approach involves the evaluation of landscapes by an interdisciplinary team who designate the relative attractiveness of areas based on field reconnaissance and the analysis of aerial photography. Although this system has been widely used in Britain and the United States as then basis for the establishment of National Parks and Scenic Routes (Blacksell and Gilg 1975, Knudson 1976) the method suffers from a lack of objectivity, since very little measurement is undertaken (Mitchell 1979). Hence evaluations of landscape cannot be systematically defined.⁵

Landscape description entails the identification and measurement of specific landscapes in addition to the assessment of the quality of landscapes against some standard or criteria (Mitchell 1979). Litton (1972) proposed the identification of general landscape attributes based on what he called factors of recognition. The factors of recognition were defined as form, space, time and variability. Position, distance and sequence were identified as "second-

⁵- While Mitchell (1979) points out that the consensus system lacks objectivity he also indicates that it is difficult to find fault with a system on which the creation of many National Parks and Areas of Outstanding Beauty were based.

ary recognition factors" which determine the relationship between the landscape and the observer. The criteria against which Litton assessed landscape were: the unity, vividness and variety of a particular scene.

Objective description of landscapes in a quantitative fashion was proposed by Leopold (1969, 1971) in an attempt to determine the aesthetic values of areas in order "to aid in decisions regarding alternative uses of the environment" (Mitchell 1979). Three factors were considered to be applicable to the evaluation of landscape aesthetics (and the separated components of the environment):

- (a) physical features
- (b) the biological elements
- (c) the human use which was evident.

Observations were made utilizing an ordinal scale of between 1 and 5. Leopold stressed that the values did not imply evaluation but rather represented the presence or absence of features. His justification of this method is based on the premise that either a positively or negatively unique landscape is of more value to society than a common place landscape. However, Leopold was careful to point out that his measure of uniqueness is not an indication of attractiveness.

Other techniques such as those developed by Fines

(1968) and Litton (1968, 1972) base the evaluation of landscape on the preferences of individuals with environmental design experience. Scales developed in this fashion are inherently biased since as Wagar (1964) has indicated, environmental experts rarely have the same perception of wilderness (and therefore of a particular landscape) as do lay-users.

Bultena and Taves (1961), identified five different images or interpretations of wilderness among users in the Quetico-Superior region on the Ontario-Minnesota border:

- (a) wilderness as a locale for sport and play
- (b) wilderness as fascination - a summons to adventure, an opportunity to struggle with the elements
- (c) wilderness as a sanctuary
- (d) wilderness as heritage
- (e) wilderness as personal gratification.

A photo slide test for the investigation of preferences for broadly varying types of landscapes was developed by Sonnefield (1966) in an attempt to determine the influence of personality as a factor in environmental perception and behaviour. The slides were paired in such a fashion that preferences for greater or lesser relief, richer or poorer vegetation, more or less water and warmer or cooler temperatures were indicated. Results showed that

there was a tendency to prefer the home type of environment, a factor which accounted for differences between populations. On the other hand, some individuals preferred "alien" landscapes which were attractive because they differed from their home environment.

While some individuals seek a kind of communion with nature or solitude, others and possibly the majority of nature users prefer "maximum social contacts and the conveniences of home when they go camping" (Saarinen 1976). The individual's reaction to his immediate surrounding is affected by a complex series of characteristics developed through past experiences. The individual will, therefore, arrive at a campsite with preconceived expectations and value judgements concerning the importance of each aspect of the experience in relation to their overall level of satisfaction. Saarinen (1976) identifies three components of the recreation experience which will influence the users' level of satisfaction:

- (a) the specific aspects or conditions which comprise the physical environment
- (b) the activities possible or permitted
- (c) the goals sought in an experience which may vary according to value hierarchy.

Yi-Fu Tuan (1974), reports differences between

visitor and resident perception of, or attitudes towards, an environment. The basis for environmental evaluation by a tourist is aesthetic while, on the other hand, the resident has a very complex attitude towards his environment which is based on his total involvement with that environment. Tuan uses the following example to illustrate his point:

"the wilderness environment in which the colonial settlers made their living was considered as a major threat by those settlers to their survival, on the other hand, to the leisure class, the wilderness was considered as an asset."

Variation in environmental perception according to sex has been reported by Sonnefield (1966). Males prefer landscapes with rough topography, while females tend to prefer vegetated landscapes in warmer environments. This generalization is confirmed by Thorsell (1971), who found that wilderness users of three British Columbia provincial parks (including Mt. Robson Provincial Park), were, for the most part, young and middle aged adults and that of that group, young male adults were the predominate users. Gilbert et al (1972), Harry et al (1969), as well as Thorsell also found that wilderness users are generally above the national average for income, are employed in "higher status" jobs, have vast wilderness experience, having been introduced to the wilderness at an early age (before the age of 15) and are highly educated. Catton (1969) hypothesized that wild-

erness users are drawn to the wilds largely because of the intellectual puzzles presented by nature. It can then be expected that as education levels rise, more people will be moving into higher categories of society, which as indicated by Thorsell, have higher wilderness recreation tendencies.

Thorsell has also shown that the greatest portion of wilderness users are city dwellers. On the other hand, those who resided in rural environments (and employed in rural occupations) which are inherently oriented towards resource exploitation were poorly represented. Hendee (1969) suggests that because of the nature of rural occupation that is, exploitative as opposed to preservationist, the development of "wilderness ethic" in that group has been slow.

However, the definition of recreation objectives and standards, is based on the consideration of values (Lime and Stankey 1971). The identification of values is subjective by nature. From a planning point of view, the question of determining whose values carry the most weight, the management's or the public's, is a difficult question. If the public values are to be used then which public: the purist's or the "average user's"? Lime and Stankey (1971) suggest that if the needs of users and the physical characteristics of a recreation area are not jointly managed, then that area will become homogeneous, lacking diversity.

It is necessary then to determine how visitor objectives relate to management goals in order to solve the problem.

Incompatible or conflicting land use in recreation areas is a major problem encountered when attempting to maximize environmental quality. Lucas (1975) and later Greist (1976) proposed zoning based on user perception studies as a solution to these conflicts. In Lucas' 1964 study, users were asked to identify which zones of the Boundary Waters Canoe Area they thought of as wilderness. Boaters (motorized) were less bothered by the presence of roads, noise or crowding than were canoeists. Canoeists, on the other hand, defined as wilderness those areas which were the most restricted and indicated that "light logging did not seem incompatible with wilderness, (and that) remoteness was not necessary if use was light". Lucas concluded that by identifying varying user definitions or perceptions of wilderness, it would be possible to delineate areas within a park facility to provide sufficient diversity of environments, so that the differing perceptions of wilderness held by each group could be accommodated by an individual facility. Such zones, however, would have to be strictly policed in order to preserve the wilderness enjoyed or required by the more sensitive types of users.

User Impact:

It has been generally assumed that such activities as hiking and backpacking associated with wilderness use are non-consumptive uses. The basis for this argument is that individuals involved in these activities do not pick up and remove souvenirs, for example. However, Wilkes (1977) indicates, that so called non-consumptive users do indeed consume spatial, visual and recreation resources. Facilities installed, and the provision of access to those facilities occupy space and are, therefore, consumptive; the fact that large numbers of people are present in a park indicates consumption, in that large numbers consume solitude, thereby affecting the levels of satisfaction of these people seeking the quality of solitude. If solitude becomes rare enough to cause a feeling of overcrowding, then perceived space has been totally consumed.⁶ The presence of humans may not directly affect wildlife. However, it may cause migration and is, therefore, consumptive; the impacts of users on vegetation will cause trampling and is again consumptive.

6- Wilkes does not indicate that there are two dimensions of consumptive use: (a) consumption of a permanent or structural nature and (b) consumption in a transient or functional form. The construction of a building is permanently consumptive in that resources used in its construction are permanently consumed. The consumption of space by large numbers of individuals during the peak use season of a park is consumption of a transient or functional nature. After the peak use declines space becomes available once more.

Rodgers (1975) reviewed the literature and found that of all environmental impacts stemming from recreation use of parkland, regardless of activity, trampling was the foremost. Trampling results in soil compaction, erosion, changes in soil moisture and temperature regime, loss of vegetation and shifts in vegetation species, as well as in animal populations. All result in changes in the character of a park.

The variables which affect impact have been summarized by Pratt (1976) as: the type of recreational activity, the number and the distribution of users, and the biophysical character of the environment. The clearing of a nature trail will have an impact over the length of the trail. However, that impact will be considerably less than that of a campground facility which requires sewage systems, roads, parking lots and other related infrastructure.

In a study of new campsites, Lapage (1967) and Merriam et al (1973) have shown that the maximum level of compaction and denudation of an area takes place in the first two years after establishment. Thereafter, the level of compaction did not increase. Lapage has also found that loss of ground vegetation during the first year is in the order of 45% and that if heavy use is permitted to continue over a long period of time, cementation of the soil, total

loss of vegetation and erosion of the A and B horizons is likely to occur. A later study by Young (1978), shows that there are significant differences in the impact of use on campground vegetation due to unequal use distribution, and that there are therefore, major differences between impacts on individual campsites within a particular campground. Young also found that after half a season's use little change in vegetation cover occurred.

The distribution of users over time has an important effect on environmental impact (Pratt 1976). Willard and Marr (1971) have shown that while low level use of alpine tundra, even over an extended period did not significantly affect vegetation, highly concentrated use over a short period would destroy vegetation within a matter of days. Regeneration, even over the span of a decade, was improbable. Frissell and Duncan (1965) reported an 80% destruction of vegetation when use was light, a level which did not increase under heavier use conditions.⁷ (Figure 4) Increased concentration of use in any specific area will not, therefore, significantly increase the environmental impact. On the other hand, a marked increase in environmental impact would result if the concentration of users was reduced by expanding the campgrounds over a larger area (Pratt 1976).

7- Wagar (1961) has shown that while large amount of the indigenous vegetation is destroyed, it ~~is~~ replaced by more resilient species.

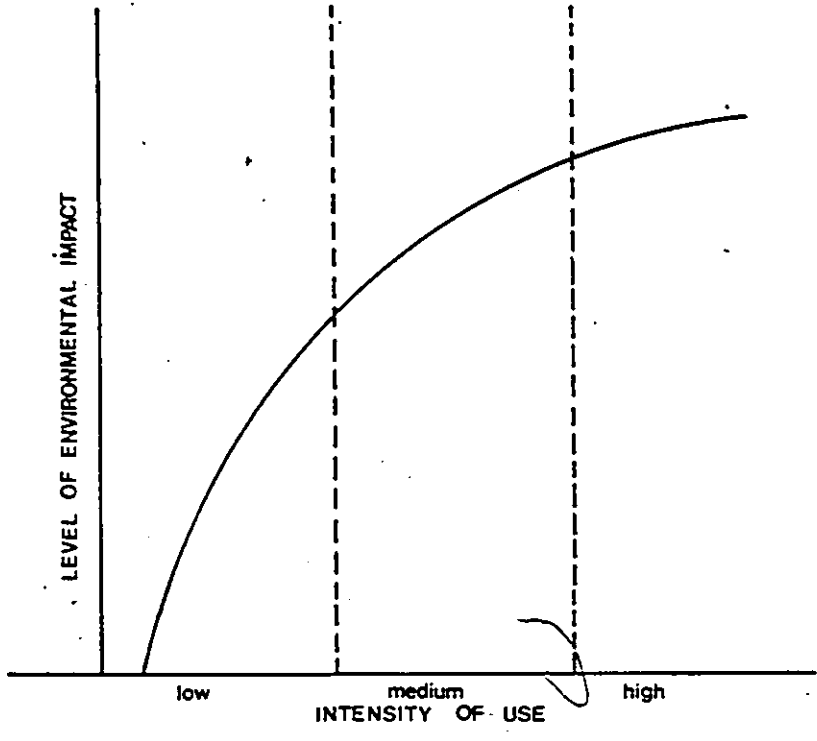


Figure 4 Environmental Impact Levels - Intensity of Use

Hendee and Stankey (1973) have identified two philosophical approaches to the management of user impacts⁸ on the environment. The first recognizes that man's use of the environment is the primary management objective and that although it is necessary to maintain the quality of the environment, the objective is superceded by the requirement of providing recreation opportunities. The opposite of this anthropocentric approach is the biocentric management concept which emphasizes the importance of maintaining environmental quality, to the point of excluding human activity. In a facility where the management objective is to maintain the environmental quality, where the accepted amount of change in the resource base would be small, the manager would have to limit use, rather than make site modifications (such as the paving of trails) which would extend the site's physical carrying capacity but which may also decrease its environmental quality.

Management goals for the establishment of carrying capacities including the reduction of conflicting uses, the reduction of people's destructive tendencies, providing increased user opportunities and increasing environmental protection, have been outlined by Wagar (1961). Management techniques used to realize these goals which have been suggested by Lime and Stankey (1971) are: site changes, user regulation, education of park users and direct

intervention through law enforcement.

While much of the literature reviewed emphasizes user satisfaction as a major component of carrying capacity, Greist (1976) argues that carrying capacity should not be based on identifying levels of satisfaction. Rather Greist proposes "risk zoning", in effect a voluntary lottery system, for recreation areas where "natural use levels are too high". The proposal is based on the precise application of the definition of capacity:

"the use level demanded by users after they consider costs."

Briefly explained, a wilderness area is divided into several zones each having differing use intensity limits. The proportion of people applying for entry permits who are admitted to a zone is inversely proportional to the levels of use restriction applied to each zone. For example, those individuals whose recreation objectives do not include solitude, will value "assured access" higher than the intensity of use and will apply for a high density zone with a greater probability of receiving a permit than the individual applying for access to a low density zone.

Adjustments in the areas set aside for limited use zones would be made to meet demand, which Greist de-

finer as the "schedule of the number of people who would apply for permits" (and not as the quantity of the "good" which would be consumed at different prices). Once these adjustments reflect demand, the total use level for the area is the area's carrying capacity.

Applications of the Carrying Capacity Concept:

Godschalk and Parker (1975), identify three ways in which environmental carrying capacity has been applied. The applications differ in the amount of environmental change which is acceptable in a particular situation. The first identifies the level of a new activity which can occur without any significant change. The environment can only accept limited pressures from new activity before changes in the ecosystem begin to occur. High value is placed on the environment and any development may be, therefore, precluded. The second deals with instances where change is acceptable, but where environmental pressures are limited to a level where environmental degradation will not be allowed to occur below a predetermined level. The third identifies the ability of the environment to accommodate a new use before that use becomes self-limiting. Massive environmental changes are permissible and the only limit of acceptable degradation is the total collapse of the resource base.

The application of the carrying capacity concept to recreation resources, in particular park planning is much more limited, primarily due to the difficulties in measuring user satisfaction.

Conclusions:

Recreation carrying capacity is a complex concept. Its complexity is a function of its 4 components:

- (a) user expectations
- (b) user satisfaction
- (c) the physical limitations of the environment
- (d) management;

each of which are complicated by problems of definition and methodology. The interrelationship between the components further complicate the practical application of the concept.

Research Objective:

Kluane National Park represents a major, isolated, undeveloped wilderness area. Although remote, the Park is accessible by road (via the Alaska and Haines Highways). Unlike Nahanni and Pangurtung National Parks in the Northwest Territories which are accessible only by air, Kluane by virtue of its greater accessibility should be able to

accommodate a greater number of wilderness users.

The research objective of this thesis is to determine whether the concept of recreation carrying capacity (developed in studies pertaining to recreation areas located relatively close to large, highly diversified markets) can be applied to the development of Kluane National Park.

CHAPTER THREE

KLUANE: RESULTS OF PREVIOUS STUDIES AND FIELD METHODOLOGY.

Throughout the first two chapters of this document, the term wilderness appears frequently. It is a term which is exceedingly difficult to define. Lucas (1964), Stankey (1971) and others have recognized that different groups of wilderness users interpret wilderness in different ways. The variation generally has been attributed to differences in perception, environmental attitudes, and modes of travel between groups.

As used in this thesis, the wilderness is defined as an area where the biophysical character has been relatively unaffected by man and where man himself is not established in a permanent fashion, so that for the most part, human impact is unnoticed. In addition, it is an area which offers outstanding opportunities for solitude, or for primitive and unconfined forms of recreation.¹

Results of Previous Studies:

Very little work has been carried out which

1- Adapted from the Wilderness Act; Public Law 88-577; Congress of the United States of America, 1964.

specifically examines the characteristics and attitudes of individuals visiting the Yukon Territory in general and little is known about those visitors using Kluane National Park in particular.

Only two studies specifically examine the characteristics and attitudes of individuals visiting the Yukon Territory and of Yukon residents:

(a) the analysis of the 1975 Yukon Exit Survey carried out by the Socio-Economic Research Division of Parks Canada in 1977

(b) Burton's 1977 examination of the outdoor recreation characteristics of Yukon residents.

A third study undertaken by Wright (1973)² examined the attitudes and perception of tourists, both in Kluane National Park and in campsites located along the Alaska Highway adjacent to the Park.

Characteristics of Yukon Travellers:

In 1977, the Socio-Economic Research Division of

2- Wright's work is in the form of an unfinished master's thesis. The validity of his findings has not been established. However as it is the only work dealing specifically with the use of Kluane National Park, the author will make reference to Wright's findings.

Parks Canada analyzed the 1975 Yukon Exit Survey in order to determine the planning implication of that document for Kluane National Park and the Dawson City Historic Sites.

Briefly explained, the Yukon Exit Survey was divided into three components; one for each method of leaving the Yukon Territory (road, rail or air). The major project effort was focused on surveying the four main road exits. A total of 4,225 visitor vehicles were counted and 1,789 useable questionnaires were obtained during the period May to September 1975. The total numbers of visitor vehicles estimated to have left the Territory during the survey period was 44,428. With an average party size of 2.68 people/vehicle the survey indicates that the 44,428 vehicles represent 118,903 individuals. The sample observations were weighted in order to obtain figures corresponding to the total population of vehicles exiting the Yukon Territory.

The results (Table 1) show that the greatest portion (88%) of tourists in the Yukon Territory consist of American families who are passing through the Territory and whose major destination is other than the Yukon. A relatively small percentage of the traffic (12%) is composed of Canadians who, in general, are sightseeing or touring. The Yukon is the main destination for the majority of Canadians travelling in the Territory.

TABLE 1*
 GENERAL CHARACTERISTICS
 OF VISITORS TO THE YUKON TERRITORY

VARIABLES		%
Origin**	American	88
	Canadian	12
Reasons for being in the Yukon	Passing through	64
	Sightseeing	20
	Wilderness recreation	15
	Kluane	1
Total visiting Kluane**	Total	54
Origin	Americans	30
	Canadians	59
Activities under- taken while in Kluane	Sightseeing	29
	Photography	23
	Camping	11
	Backpacking	3
	Other	34

Population: 44,428***
 Sample: 4,225
 Error: less than 3%
 Level of Significance: 99%

- * Figures from: Planning Implications for Kluane National Park and the Dawson City Historic Sites - An analysis of the 1975 Yukon Exit Survey. SERD - Parks Canada 1977.
- ** A discrepancy exists in number of individuals between these two totals.
- *** Estimated number of tourist vehicles which left the Yukon May - September 1975. This figure does not include Yukon residents, commercial vehicles or buses.

Reasons for being in the Yukon are varied: 64% of the auto parties surveyed indicated that they were passing through; 20% identified sightseeing as the purpose of their trip. Wilderness and outdoor activities were an attraction for only 15% of the sample, while visiting Kluane National Park was specifically cited as the purpose of the trip by only 1% of the survey sample. It is noteworthy that no Americans indicated that Kluane was their prime objective.

Thirty-four percent of the sample visited Kluane National Park. Of that group 30% were Americans and 59% were Canadians. An examination of the activities participated in while visiting Kluane indicated that sightseeing and photography were the most popular, attracting 29% and 23% of Kluane visitors respectively. Camping involved 11% of the sample, while backpacking was undertaken by only 3% of the group. On the other hand, Parks Canada (1977c) shows that 14% of Canadians and 16% of Americans indicated that they would have undertaken backpacking, if they had been offered the opportunity.

The following can be inferred from these figures:

- (a) Yukon visitors are engaged on a long trip and are, therefore, limited by time or have lengthy vacations
- (b) Yukon visitors view driving long distances as a recreational activity

(c) Yukon visitors will not, or are unable to (because of time constraints), to participate in wilderness activities.

Characteristics of Kluane Park Visitors:

In 1973, Wright carried out a survey of Yukon tourists who were camping in seven sites adjacent to Kluane National Park. At the time of the data collection exercise, in which the author participated, there was only one campground established within the boundary of the Park. That campground, located at Kathleen Lakes, in the southern sector of Kluane, is still the only such facility provided by Parks Canada. The six other campgrounds, in which interviews were conducted, were established by the Yukon Territorial Government. They are located along the Alaska Highway immediately adjacent to the Park between Haines Junction and Burwash Landing. (Figure 1)

Three hundred and forty questionnaires were answered during a three month field season (mid-May to mid-August), twenty two of which were rejected by the investigator. Wright's major objectives were:

(a) to determine an individual's feelings about the Kluane area in particular and about the Yukon in general

(b) to determine the primary reasons for undertaking the trip

(c) to determine how individuals "assess an area in terms of recreation potential and attractiveness."

Wright's sample consists of 318 individuals, 65% of whom were Americans. (Table 2) Of the total sample, 86% resided in metropolitan areas, the remainder came from rural environments. Sixty-one percent had university educations and 57% had incomes in excess of \$10,000/annum, an above average income in 1973. Only 6% of those surveyed indicated that the Yukon was their main destination, while 88% identified sightseeing as their main purpose.

The primary recreation activities of this groups were picnicing/sightseeing (88%), hiking (71%), fishing (60%) and photography (42%). These activities generally require no specialized equipment and participation is not contingent on detailed, advanced knowledge of the area.

Seventy-nine percent of the sample indicated an interest in visiting the Park, or in visiting more of the Park. Of that group, 26% were primarily attracted by the possibility of observing wildlife, 11% expressed an interest in visiting glaciers, 35% were attracted by the hiking and camping potential and 56% indicated photography as their

TABLE 2
 GENERAL CHARACTERISTICS OF KLUANE NATIONAL PARK
 VISITORS AS REPORTED BY WRIGHT.

VARIABLES		%	DEGREES OF FREEDOM	LEVEL OF SIGNIFICANCE
Origin	American	65	4	0.006
	Canadian	34	4	0.006
Residence	Metropolitan	86	8	0.06
	Rural	14	8	0.06
Education	University	61	16	0.03
Income	> \$10,000	57	12	0.000
	< 10,000	43	12	0.000
Main destination	Yukon	6	N.R.	N.R.
	Other	94	N.R.	N.R.
Activities undertaken	Sightseeing	88	N.R.	N.R.
	Hiking	71	N.R.	N.R.
	Fishing	60	N.R.	N.R.
	Photography	42	N.R.	N.R.
Visit the Park?	Yes	79	N.R.	N.R.
Main Reason	Wildlife	26	N.R.	N.R.
	Glaciers	11	N.R.	N.R.
	Hiking & Camping	35	N.R.	N.R.
	Photography	56	N.R.	N.R.

Sample: 318
 N.R.: Not reported by the author.

prime reason. Significantly, 50% of the sample indicated that they would visit the Park only if motorized access was possible. Generally, tourists to the Yukon Territory participate in a limited range of outdoor activities including tenting, nature study/sightseeing, driving for pleasure/picnicing and visiting historic parks (Burton 1977).

Knowledge of Kluane National Park and Environmental Attitudes

Wright's data showed that while 79% of the sample indicated an interest in visiting the Park, 74% of those interviewed had no prior knowledge of the facility.³ It can be assumed that because people, in general, are not aware that such a facility exists, potential visitors cannot plan to use the area and are, therefore, not prepared to do so when presented with the opportunity. The majority of Wright's sample who expressed an interest in exploring the Park, could not do so because of time constraints and lack of prior preparation resulting from a lack of advance knowledge of the facility.

In addition Wright found the following:

(a) 92% of those in the age group 15-24 would

3- Wright does not indicate the level of significance for the remaining figures and there is no indication in his work that he has tested for significance. To this extent then, his methods and findings are qualified.

visit the Park while only 61% in the group 35-44 expressed such an interest

(b) 90% of Canadians would visit the Park, compared to 72% of the Americans interviewed

(c) 82% of city dwellers expressed an interest in visiting Kluane while only 60% of people from rural environments expressed the same interest

(d) an increase in the level of education showed a corresponding increase in visitation; 88% of university graduates as opposed to 66% of high school leavers.

Wright's survey also shows that 85% of his sample indicated generally positive attitudes towards the environment and were concerned about environmental issues including the limitations of road, recreation facility, and service development, which would affect the character of the area. Wright has also shown that the most positive attitudes toward the environment are exhibited by those individuals involved in hiking and mountain climbing; those respondents also indicated that access to wilderness areas should be restricted in some way.

Burton (1977) examined the outdoor recreation patterns of Yukon residents. Burton's target survey sample of 1,711 adults (over the age of 16) was drawn from the list of the Yukon Health Care Insurance Plan and represented 10%

of the adult population of the Yukon Territory. The random sample was stratified by eleven populated Territorial regions. The final survey sample consisted of 811 responses to his questionnaire.

The study revealed that 50% of Yukon residents had not visited Kluane National Park.⁴ Of those who did, 28% wanted no further development of the Park, while 19% were in favour of more extensive development which would enhance their experience.

The study also revealed that Kluane National Park was of relatively low significance in terms of overall Yukon resident recreation activities with the exception of mountain climbing. Even at this level, however, Burton found that only 1% of his sample participated in such activities and concludes that demand for organized or restricted use of wilderness is low among Yukon residents.

Physical Environment of Kluane National Park:

While it can be safely assumed that mountainous regions are generally considered highly attractive from a recreation stand point, it is very difficult to describe the

4- Burton indicates that the data is significant at the 99% confidence level.

physical environment of Kluane National Park, or indeed any other similar facility, objectively. Description of mountainous regions lend themselves to subjective qualifiers associated with attractivity scales, environmental attitudes and individual perception of the environment, in short description of the sort found in National Geographic. It may, therefore, be more useful to describe Kluane's environment in terms of its frontier character, the challenges and the rewards it offers to wilderness users.

Thorsell (1971), Shaffer (1969) and others have shown that wilderness users in general seek the quality of solitude in their experience, and that the quality of the wilderness experience depends on the level of solitude that can be achieved, more than on the aesthetic quality of the attractiveness of the areas.

The frontier character of Kluane National Park is manifested in several ways: first, the Park is isolated, access to the interior is difficult, although the fringe area is easily reached via the Alaska Highway; second, use of the Park interior is limited,⁵ (Johnson has reported that

5- Although Parks Canada information indicated that 7,034 people visited Kluane National Park during the 1979-80 season, the data do not indicate the number of people using the Park interior in that season. During the three summers in which the author spent extended periods in the Park interior, only one other group of back country hikers was encountered.

in over a decade of extensive back country travel in Kluane he has only encountered one other group - personal communication 1980) and third and perhaps most importantly, there is very little evidence of man's impact on the environment.

Implicit in the frontier nature of Kluane National Park, is the physical challenge offered by the Park's environment. Survival in mountain regions subject to rapid climatic changes, difficult climbing and walking, is a challenge in itself and meeting the challenge has significant rewards which serve to augment levels of satisfaction.

The following photographs illustrate the Park environment.

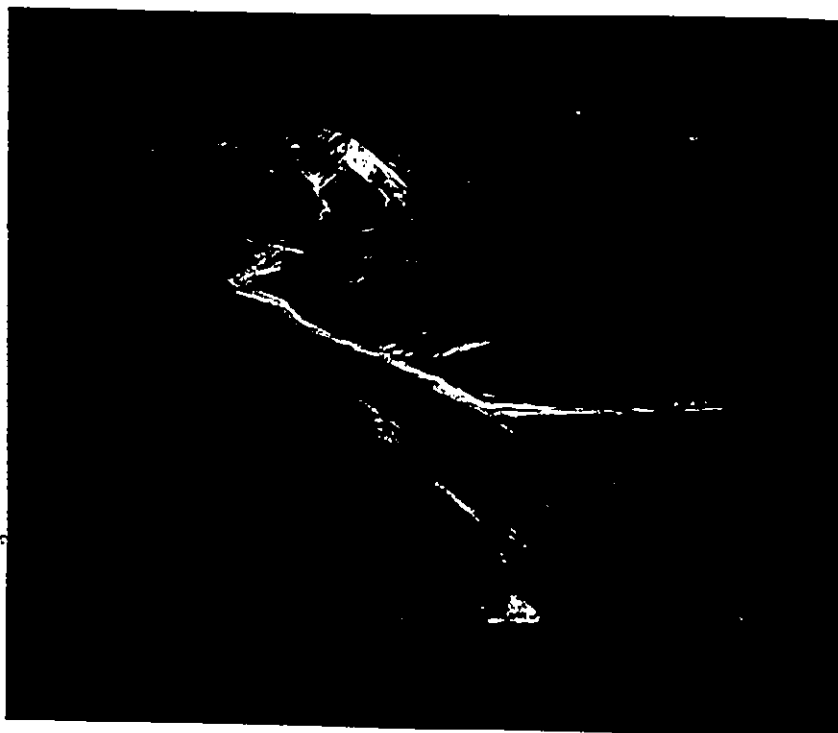


Plate 1 - Grizzly Creek - Lower end

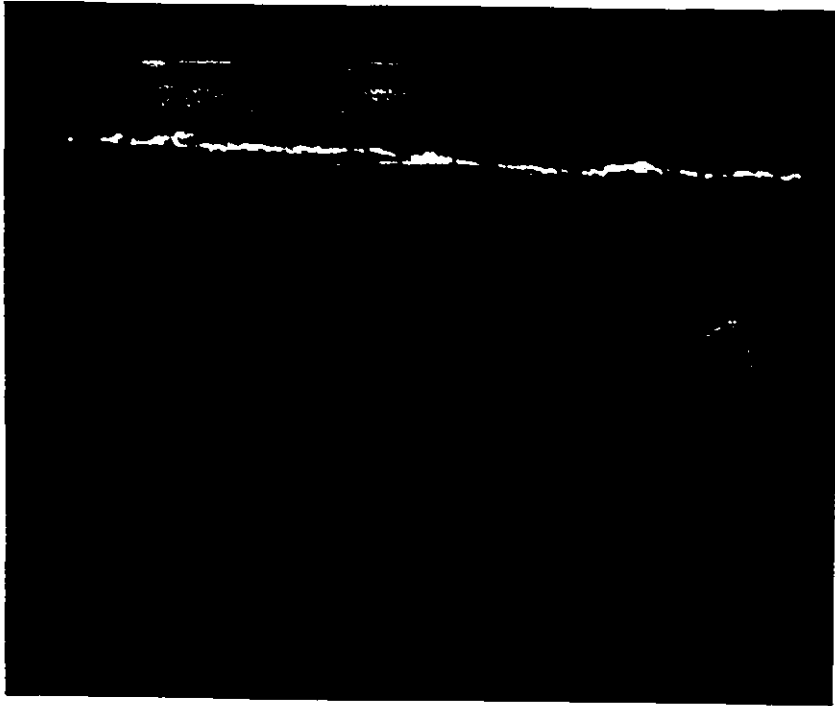


Plate 1 and 2 - Lower Grizzly Creek, Duke River
At the lower elevations represented in these photos, the opportunities are much greater than in the following plates. The levels of skill required to travel through the area are substantially less and the opportunity of observing highly diversified environments are much increased.

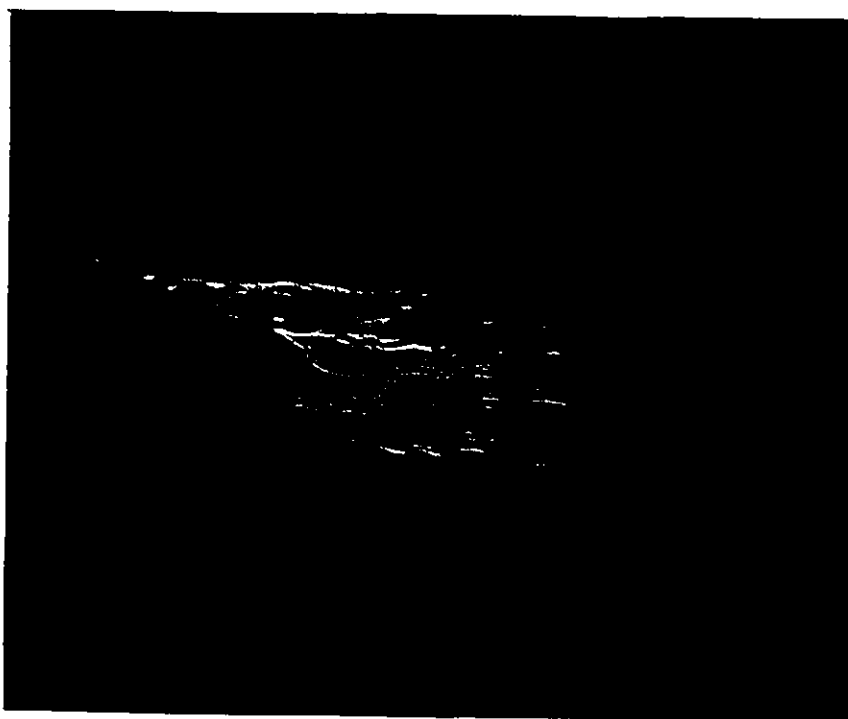


Plate 3 - St. Elias Icefields at Divide
Mt. Logan is seen in the background; glaciers can be observed flowing from the icefields. Travel through this area, although feasible, is extremely difficult, requiring both special equipment and skills. Access is, therefore, normally limited to mountaineering parties.



Plate 4 - Donjek Valley
At lower altitudes, differing environments are evident. Although access becomes easier, travel on glaciers such as the Donjek is limited to skilled individuals.

Field Methodology:

Since the environmental carrying capacity of a sensitive area can be attained before the social carrying capacity is reached, environmental carrying capacity was judged by the author to be the most important element of the concept. Accordingly the primary research thrust of this document was to determine the environmental carrying capacity of Kluane National Park. However, problems of the description of environmental capacity in general and for the description of environmental capacity of Kluane National Park in particular were encountered.

Problems of Descriptions of Sensitive Areas:

Determination of environmental sensitivity generally assumes that a major development objective has been established. For specific projects (such as the construction of a hydro electric dam for example), it is possible to evaluate subjectively and quantitatively the potential impact of particular construction phases on various environmental elements and to then manage the project to minimize those impacts.

On the other hand, objectives established for the creation and development of wilderness parks are at the best vague and very general. Parks Canada's objective for Kluane

National Park is, as stated in Park-use Statistics 1979-80:

"to protect and manage for continued public appreciation and enjoyment a natural area of Canadian significance representing the important features of the St. Elias Mountains."

This type of general objective limits the evaluation of environmental impact and sensitivity. In addition, the classification of areas as wilderness parks (especially in northern environments), implies, according to the definition of wilderness, that those areas provide un-structured recreation opportunities. That is, users are not channelled or restricted in their use of the park.

The general understanding and interpretation of the term sensitivity as it is applied to park planning is the degree to which a park can absorb impacts without a significant decline in the quality of the park. The term quality is nebulous and is taken to mean the quality of the environment, including the broad area of the quality of the environmental experience (based on perception and attitudes).

Sensitivity properly defined must be explained in terms of terrain units, and vegetation and biological communities which will have varying degrees of susceptibility to different external forces applied over time. In terms of recreation planning, any evaluation of sensitivity presumes a prior knowledge of market conditions of the area relating

to the quantity of use and user expectations. Without such prior assessments accurate statements of environmental sensitivity are not possible. Management of the environment becomes in most cases a matter of reacting to impacts after the fact.

As no accurate data have been collected concerning user potential for Kluane National Park, it is obviously difficult to evaluate environmental sensitivity. The Park can, however, be divided into two broad environmental categories:

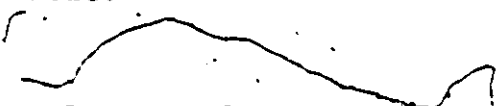
(a) the icefield ranges, which by their very nature are not sensitive to use

(b) the mountain valleys, which due largely to their relative ease of access can be said to be more sensitive than the icefields.

Given that present levels of back-country use in Kluane National Park remain constant as they have for the last decade, it may be assumed that, for the purpose of this thesis, Kluane does not represent a particularly sensitive environment. Even if the market was known, there is no information on how this environment reacts to use.

Since the environmental sensitivity of Kluane National Park cannot be accurately determined in an a-priori

fashion, it follows that the environmental carrying capacity of the area cannot be determined in a similar fashion. This fact points to a major weakness in the concept of carrying capacity, that is, the difficulty of a-priori assessments of carrying capacity. Until their weakness is resolved the applicability of the concept to the planning of northern parks remains problematic.



Present use levels of the Park preclude a-priori determination of environmental carrying capacity. It was therefore assumed that the user satisfaction component of the concept is of primary importance. Levels of user satisfaction are based on the preconceived ideas held by the user of what he expects from a wilderness experience. Previous work indicates that tourists are drawn to the Yukon, at least in part, because of wilderness. Associated with wilderness is solitude and the observation of wildlife.

In order to determine areas best suited to user expectations and, therefore, those areas most attractive to the potential user a resource survey was carried out.

The original intention was to pre-determine access routes into the Park and to survey the individual routes throughout the field season. However, logistic and manpower difficulties which only came to light in the field,

precluded such an approach. As a result, the research was limited to the area of Grizzly Creek.

Grizzly Creek and four of its tributaries in addition to Halbreed Creek and a portion of the Duke River Valley were surveyed. All of these areas are accessible from the Alaska Highway, requiring no more than 2 days of relatively easy hiking. Each valley was divided into kilometre sections beginning at the glacier, in the case of glaciated valleys, and from the headwall in unglaciated valleys. Each of the valleys with the exception of Halbreed Creek is glaciated, containing a small valley-glacier at its head. The valleys range in elevation from 1,500 - 3,000 metres and exhibit a wide variety of biotic and landscape changes.

The survey, a simple resource inventory noted the presence of geomorphological (glaciers, kettles, kames, eskers, talus slopes ...), biological (moose, grizzly, dall sheep, ground squirrels ...), and botanical (wildflowers, sensitive vegetation ...) features within each kilometre section of the valleys. The selection of features in each category represents the primary elements of the total composition of each and was largely based on the desires (user expectations) expressed by the potential visitors, and

on the author's knowledge of the Park. In addition to noting the presence of features, the likelihood of encountering wildlife species was estimated on a scale of 1 to 5; the value 1 representing a very low probability of observing a particular species while 5 represented an actual sighting.⁶

No statistical analysis of the information gathered was undertaken as no corresponding data relating to user expectations was collected during the 1979 field season. It was, however, possible to identify trends in the character of each valley. Generally physical interest, based on the number of distinct geomorphic features, declined in down valley segments, while vegetation diversity increased, as did the possibility of observing wildlife. More specifically, in each valley surveyed, with the exception of Half-breed Creek, it is possible to identify three distinct components:

(a) a pro-glacial environment at the head of the valley, devoid of vegetation (and with limited wildlife), but of high interest from a physical point of view, as the range of geomorphic features associated with a glacial environment is extensive and the features are generally very distinct

⁶ - It is recognized that because of the migratory characteristics of most species wildlife these values, or the chances of actually sighting wildlife, can vary from one season to another, or even on a daily basis. However, the relative probability of making such a sighting can still be ranked.

(b) a transition zone between the barren proglacial areas and lower segments of the valley which is generally characterized by a wide range of geomorphic features, a greater variety of vegetation types and a higher potential for the observation of a more diverse, although limited wildlife population

(c) a low valley segment which is characterized by less distinct geomorphic features, a highly diversified botanical component, and a correspondingly high potential for observing a wide variety of wildlife

Generally speaking, then, as can be expected, the survey indicates that when the presence of botanical features within a section of valley is high, the probability of wildlife sighting is correspondingly high. Since the variety of botanical features is altitude-dependent, the low sections of the valleys exhibit a greater variety of botanical species and, therefore, the probability of wildlife sightings increases. Conversely, as the altitude increases, wildlife sign diminished in number as the variety of botanical species reduces.

CHAPTER FOUR

DISCUSSION

Approaches to Management:

All of the work appearing in the literature review deals with carrying capacity studies carried out in recreation areas located in relatively close proximity to large population centres. The major planning concern, therefore, has been to satisfy the expectations of a very large and highly diversified market. The management techniques developed reflect this situation. However, Wright's work suggests that the market for Kluane National Park is both restricted and highly specialized.

Wagar (1961) in one of the most comprehensive documents dealing with carrying capacity proposed several management techniques which were intended to provide what he called "quality recreation" for increased numbers of people. Wagar's suggestions are still generally valid for the management of recreation areas serving large populations. Wagar's premise was that high use and high recreation quality were compatible provided that:

(a) conflicts between land uses were minimized through zoning

(b) opportunities for destructiveness by people using an area was dissipated

(c) the sensitivity of an area was limited

(d) there was an increase in recreational opportunity.

Wagar's work suggests that zoning would reduce conflicts in land uses by providing areas of untouched wilderness for the use of future generations and wilderness purists, while at the same time providing adequate areas for the use of "non-wilderness recreationists". The values of both groups and, therefore, their expected levels of satisfaction would not be jeopardized.

The destructiveness of the user, whether intentional or not, can be reduced through the use of engineering techniques such as "channelling movements" of people, thereby limiting the areal extent of damage and by "hardening" facilities so that they can withstand high and repeated use. Unused or previously inaccessible areas can be opened, increasing carrying capacity.

The condition of the biotic communities affects, at least in part, the enjoyment of wilderness areas. Management techniques, including fish stocking, providing winter browse and improving the resistance of vegetation all serve

to enhance the character of the wilderness and, therefore, of the quality of recreational experience. However, all of these techniques result in tangible evidence of man's presence in the wilderness environment and as such, tend to detract from the quality of wilderness as defined in Chapter III.

The creation of three new national parks in 1972, north of the 60th parallel, of which Kluane National Park was one, has added a new dimension to the traditional concepts of parkland management as identified by Wagar.

The most striking difference is the isolation of Kluane. It is not easily accessible to the large market areas which are served by southern parks. The nearest population centre, of any significance, is Vancouver over 2,400 kilometres to the south. This isolation implies very high costs both in terms of time and financial outlay to potential visitors and is, therefore, a limiting factor with regard to the volume of use and possibly the type of visitor. Until technological advances reduce the costs involved in travelling great distances and socio-economic changes increase significantly the amount of leisure time available to the average individual, the use levels of Kluane National Park cannot be expected to increase significantly.

While it is difficult to argue that the concept of the wilderness purist does not cross social class structures, Thorsell (1971) points out that wilderness users generally tend to be in the upper echelons of society, to whom financial and time limitations are not as restrictive. It can be assumed, therefore, for the purposes of this thesis, that Kluane National Park will for the foreseeable future, serve the needs of small groups of wilderness purists. It is also assumed that the wilderness purists have the same basic wilderness recreation goals: that of achieving solitude and a satisfactory recreation experience. The necessity of providing a variety of recreation opportunities and, therefore, of accommodating conflicting land uses is considerably reduced.

Burton (1977) has shown that Yukon residents consider any restrictions of their use of wilderness as detrimental to their levels of wilderness recreation satisfaction. It can be assumed that wilderness purists visiting the Yukon Territory view restriction or regulation of their wilderness activities in the same light as Yukoners. In terms of planning for user satisfaction (and carrying capacity), Wagar's concept of channeling movements and hardening facilities can only be detrimental to satisfaction levels. However, while restriction of use is generally viewed as curtailment of recreation freedom by Yukon residents some limited form

of control must be applied; this control is necessary to ensure the integrity of the environment, to protect the quality of experience and minimize conflicts in land use. The modification of the concept in such a way as to allow freedom of movement while ensuring solitude and environmental integrity is fundamental to the planning of northern parks.

Problems of Attractivity and Interpretation of Wilderness:

The question of attractivity and definitions of what is beautiful as it applies to landscapes is a subject which has been extensively discussed in the literature.

Attempts to quantify these vague terms, by way of attractivity indices have, for the most part, been inconclusive.¹ Concepts of attractiveness and of what is beautiful vary from one individual to another; what may be perceived as beautiful by one individual may not be by another due to differences in cultural backgrounds and previous experiences.

Kluane National Park, as well as all other mountainous regions are inherently attractive. Ideas of attractiveness are at least partially based on the expectations of

1- Although Ross was carried out extensive investigations in this field, much of his work involved determining levels of attractivity based on the number of return visits individuals made to local parks (within a short distance from home).

the visitors. The user's rating of the attractiveness of an area will, therefore, be higher if his expectations in terms of his recreation goals can be fulfilled. Although potential visitors have very little prior knowledge of Kluane, those who indicated that they would visit the Park have some pre-conceived notion of what they expect to see. Wright's 1973 survey indicated that potential park visitors considered encounters with wildlife and the opportunity to observe unspoiled features important in assessing the quality of their wilderness experience. The sighting of wildlife, or the possibility of sighting wildlife would, therefore, enhance their satisfaction with (and therefore the attractiveness of) that experience. User expectations, as interpreted within the context of this document to represent attractiveness; 26% of those who would visit Kluane are attracted by the wildlife potential, that is to say that they find the observation of wildlife attractive.²

Stankey (1971) has indicated, each group of wilderness user will interpret the meaning of the work in a different way. Among other things, the difference is

2- Wright (1973) showed that of his sample who indicated that they would visit Kluane, 26% were drawn by the wildlife potential, 11% were attracted by glaciers, 35% by the hiking and camping potential and 56% by the photographic potential. It is obvious that all of these interests are inter-related and that visitors will participate in more than one of the activities.

attributed to modes of travel. The hiker's impression of wilderness will be adversely affected by the sounds of a motorized vehicle travelling through the same area. On the other hand the operator of that vehicle, whose recreation goals must be substantially different from those of the hiker, may find that sound entirely acceptable within his concepts of attractivity and wilderness. Contrary to Lucas (1964), the quality of the environment in the hiker's mind has changed. Its is difficult to separate environmental quality and perception of environmental quality.

The possibility, however, of such vastly differing modes of transportation occurring within Kluane National Park is limited by the terrain. Hiking and backpacking are virtually the only feasible methods of transportation. Variation in the interpretation of attractivity and wilderness based on modes of travel can, therefore, be eliminated.

Routing:

As an alternative to the use of the carrying capacity concept, the author proposes a routing method (based on the resource inventory described in Chapter III) for the planning of Kluane National Park. Wright's work (1973) implies that the market for Kluane, while restricted is

highly specialized. Since the possibility of encountering wildlife was identified by those of Wright's sample as the most important single element which would draw them to the Park, the lower sections of the valleys can, therefore, be said to be the most attractive areas from a visitor standpoint. The uniformity observed in the valleys surveyed applies to all glaciated valleys, within the Park. The only divergence occurs in the front ranges near the Eastern Park boundary where pro-glacial environments at the head of the valley do not exist, as is the case in Halfbreed Creek.

It is not, however, feasible to limit the discussion of attractiveness to a single facet of user demand. In addition to a preconceived notion of what they expect to see in a northern environment, wilderness users expect to experience solitude. As in the case of wildlife sightings reflecting satisfaction with wilderness experience and, therefore, attractiveness, the level of solitude achieved by the wilderness purist will also have a bearing on satisfaction and attractiveness. Wilderness purists using Kluane will, because of the costs involved, attempt to minimize social contacts and maximize solitude.

The uniformity of the Park in terms of its attractiveness, based on the primary element of user expectation facilitates the direction of Park users, in that any section

of Kluane will satisfy that particular demand and will, therefore, be attractive, and contribute to a satisfactory wilderness experience. The individual characteristics of the user, and in particular, his desire to experience solitude become of primary importance.

Solitude implies levels of use. Interpretation of what constitutes an acceptable level of use varies (as do the other factors discussed), with the individual and is based primarily on background and previous experience. While an individual might find that encountering only one other party over the length of his backcountry trip ruins his feeling of solitude, another may rate solitude highly if he encounters ten groups over the same period. At present levels of use, which as indicated previously are not expected to increase significantly, solitude, at a general level, can be experienced anywhere within Kluane.

As it is assumed that all users of Kluane National Park will have the same recreation goals the major element in the planning of the facility becomes one of the amount of time available at the site. While no information is available dealing with user time constraints, it is evident from Kluane's isolated position and relative difficulty of access that in a majority of cases time available for travel through the Park is limited. The number of areas access-

ible, or the degree of penetration into the Park will, therefore, be determined accordingly.

Since user demand can be accommodated in any sector of the Park, routes can be designed on the basis of time constraints. Individuals with limited amounts of time may be directed through areas which, while meeting demands in terms of a satisfactory wilderness experience will also accommodate their time limitations. Those with unlimited amounts of time may be given a free rein of the Park.

The routing method is however based on several assumptions (regarding user satisfaction, user expectations and attractivity) which must be validated. It also requires, as does the concept of carrying capacity a prior evaluation of user satisfaction (user expectation) which makes a priori evaluation difficult.

CHAPTER FIVE

CONCLUSIONS

Research Limits:

In order to fully develop carrying capacity values for recreation areas; it is necessary to understand the characteristics of the potential users of a particular facility. However, due in part to field and logistical problems, a detailed survey of user potential for Kluane National Park was not undertaken during the 1979 field season. Any such survey should be carried out over a period of 2 or 3 years in order to establish continuity. Within the context of this thesis, such an approach would not have been feasible. In addition, it was believed given the negligible backcountry use of Kluane over the last decade, that a robust statistical analysis could not have been undertaken as the sample would have been too small.

As a result, the author has relied on data relating to user characteristics and user expectations collected by others working in similar environments. In particular Wright's 1973 information dealing with attitudes and, in part, the characteristics of Kluane Park visitors and the findings of Thorsell (1971) were used as the basis for

establishing the characteristics of wilderness users. The similarity between these two works lead to the assumption that all wilderness purists using Kluane have the same recreation goals.

It must also be emphasized that any discussion of carrying capacity, both environmental and social, is limited to a definition of the concept in terms of contemporary technological and sociological frameworks. Modification of either or both of these frameworks will result in changes in any established carrying capacity values.

Finally, it is recognized that where it is possible to establish a value for carrying capacity, that value is site specific and cannot be applied to other facilities, even those of a similar nature.

Conclusions:

It has become evident over the course of this study that the discussion of carrying capacity revolves around very complex statements of:

- (a) user expectations
- (b) user satisfaction
- (c) environmental quality
- (d) management,

each of which require subjective evaluation as well as complete understandings of user expectations and ecological relationships.

In isolated areas, such as those represented by Kluane, information necessary to develop the understandings is lacking. The author has come to the following conclusions about the concept of carrying capacity as it applies to Kluane National Park:

1 - In isolated areas, such as those represented by Kluane, the concern for environmental quality, in terms of impacts, diminish in importance. The evaluation of environmental sensitivity is a function of the amount of use. Due to its isolated position, and the difficulty of access in terms of costs and time, use levels of Kluane National Park are exceedingly low. Environmental sensitivity and, therefore, the impact of use will be negligible. Environmental quality will remain stable, the impact of the quality of the environment on user satisfaction will also remain stable. A priori determination of environmental sensitivity and, therefore, of environmental carrying capacity is not feasible;

2 - In order to develop a carrying capacity value for Kluane National Park it is imperative to understand

the potential market. At present detailed, reliable market information specifically relating to user expectations, is not available. The calculation of carrying capacity values for Kluane is, therefore, precluded, and under present levels of use, impractical;

3 - Wilderness users of Kluane have preconceived notions, developed from previous experience and their backgrounds, of what they expect from their wilderness experience. The uniformity of the park in terms of its characteristics can, therefore, provide opportunities for fulfillment of the user's recreation objectives, insuring that user satisfaction related to those objectives can be achieved anywhere within the Park;

4 - Given present use levels of Kluane, solitude can be found anywhere within the Park. The cost, both financially and in terms of time available severely limit the use of Kluane National Park. Until technological and sociological changes ease those costs, use levels cannot be expected to increase, thereby, the quality of solitude will be maintained at the same level, until those changes occur;

5 - The present levels of use have set a social

carrying capacity, for those wilderness purists who now use the facility. For those people, an increase in use, whether resulting from technological advances or sociological changes or through development, will result in a decrease in levels of satisfaction brought on by the consumption of space. Present users, who value solitude, will move to other areas in order to find the solitude they require.

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APPENDIX
GRIZZLY CREEK RESOURCE
INVENTORY: DATA

GRIZZLY CREEK
KM. DOWN VALLEY

PHYSICAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Glacier	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Moraine	1	1	1	1	1	0	0	0	1	0	0	0	0	0
Outwash	0	1	1	1	1	1	1	1	1	0	1	1	1	1
Kame	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Kettle	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Rock glacier	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Talus slope	1	1	1	0	1	1	1	1	1	1	1	1	1	1
Scree slope	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Water course	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Alluvial fans	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Periglacial	1	1	1	0	0	0	0	1	0	0	0	0	0	0
Snow pack	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Gorge	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Tributary	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Bedrock cliffs	0	0	0	0	0	0	0	0	0	0	1	0	1	1

1= present

0= absent

GRIZZLY CREEK
KM. DOWN VALLEY

BIOLOGICAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Grizzly	1	1	2	1	2	2	2	2	2	2	2	2	2	2
Dall sheep	1	1	3	2	4	5	5	5	5	5	5	5	5	5
Wolf	1	1	2	2	2	3	3	3	3	3	3	3	3	3
Fox	1	1	1	1	5	5	3	3	3	5	5	5	5	5
Moose	1	1	1	1	2	3	3	5	5	5	3	3	4	3
Coyote	1	1	1	1	2	2	2	1	3	3	3	3	3	3
Caribou	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Elk	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ground Squirrel	1	1	5	4	5	5	5	5	5	5	5	5	5	5
Marmot	1	1	1	5	5	5	3	3	3	3	3	3	3	3
Voles	1	1	5	5	3	3	3	3	3	3	3	3	3	3
Pika	1	1	5	1	1	1	1	1	1	1	1	1	1	1
Weasel	1	1	5	1	1	1	1	1	1	1	1	1	1	1

1= low probability of observation
5= high probability of observation

BOTANICAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wildflower	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rare specimen	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rare community	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrubs	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Rare specimen	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rare community	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Trees	0	0	0	0	0	0	0	0	0	0	1	1	1	1

1= present
0= absent

VOLCANO CREEK
KM. UP VALLEY

PHYSICAL	1	2	3	4	5
Glacier	0	0	0	1	1
Moraine	0	0	0	1	1
Outwash	1	1	1	1	1
Kame	0	0	0	0	0
Kettle	0	0	0	0	0
Rock glacier	0	0	0	0	0
Talus slope	1	1	1	1	1
Scree slope	0	0	0	0	0
Water course	1	1	1	1	1
Alluvial fans	1	1	0	1	0
River gorge	0	1	0	0	1
Patterned ground	0	0	0	0	1

1= present

0= absent

BIOLOGICAL	1	2	3	4	5
Grizzly	2	2	2	2	2
Dall sheep	3	3	3	4	4
Wolf	2	2	2	2	2
Fox	3	3	3	2	3
Moose	3	3	3	3	2
Coyote	2	2	2	2	2
Caribou	1	1	1	1	1
Elk	1	1	1	1	1
Ground squirrel	4	4	4	5	5
Marmot	3	2	2	2	2
Voles	3	3	3	2	2
Hawk	1	5	1	4	1

1= low propability of observation

5= high probability of observation

VOLCANO CREEK

KM. UP VALLEY

BOTANICAL	1	2	3	4	5
Wildflower	1	1	1	1	1
Rare specimen	0	0	0	0	0
Rare community	0	0	0	0	0
Shrubs	1	1	1	1	1
Rare specimen	0	0	0	0	0
Rare community	0	0	0	0	0

1= present
0= absent