Wilderness Perception Mapping

A Geographic Information Systems (GIS) Approach to the Application of Wilderness Perceptions to Protected Areas Management in New Zealand

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Abstract

Increasing demands for wilderness experiences, principally through outdoor recreation and tourism, are creating an ever greater need for careful management of natural and pristine areas in order to preserve the natural ecological processes of an area while also permitting appropriate wilderness use. This study addresses these pressures by emphasising the application of varying perceptions of wilderness within a geographic information systems (GIS) framework as an approach to balancing the ecological and experiential conditions that characterise wilderness environments.

The specific objective is to delimit the spatial extent of multiple perceptions of wilderness, held by backcountry users, as a means of improving the effectiveness of management approaches, *via* a GIS framework. A wilderness perception mapping (WPM) methodology is operationalised through two alternative approaches. The first method applies perceptions of wilderness settings, from an attitudinal scale, and maps the spatial extent of these perceptions. This is achieved through a direct overlay process using GIS. The second method utilises multivariate techniques which enable a weighted overlay process to be performed.

The initial results obtained from employing the WPM methodology are examined through the application of the two approaches to a case-study, namely North-West Nelson in the South Island of New Zealand. The end products for each approach provide new and useful information that has applicability to both management and research. After comparing the end products, the results for the first method are further analysed with respect to protected areas management. The role and implications of WPM are discussed with reference to wilderness management in North-West Nelson and in New Zealand, and to protected areas management at a broader level.

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Glossary of Abbreviations

ATNP = Abel Tasman National Park
BLM = Bureau of Land Management (USA)
BWCA = Boundary Waters Canoe Area (USA)
CGIS = Canadian Geographic Information System
CMP = Conservation Management Plan
CMS = Conservation Management Strategy
CONCOM = Council of Nature Conservation Ministers (Australia)
DoC = Department of Conservation
DoLS = Department of Lands and Survey (now DoSLI and DoC)
DoSLI = Department of Survey and Land Information
FP = Forest Park
FMC = Federated Mountain Clubs
FNP = Fiordland National Park
FUP = Facilities Use Pass
GBRMP = Great Barrier Reef Marine Park (Australia)
GCT = Group Construct Theory
GIS = Geographic (or Geographical) Information Systems
LAC = Limits of Acceptable Change
MDS = Multi-Dimensional Scaling
NCC = Nature Conservation Council
NP = National Park
NPS = National Park Service (USA)
NP&WS = National Park & Wildlife Service (Australia)
NR = Nature Reserve
NWN = North-West Nelson
NWNFP = North-West Nelson Forest Park
NWNSFP = North-West Nelson State Forest Park
NWPS = National Wilderness Preservation System (USA)
NZFS = New Zealand Forest Service

NZMS = New Zealand Map Series
NZTD = New Zealand Tourist Department
NZTP = New Zealand Tourist and Publicity Department
OPH = Organisation to Preserve the Heaphy
PC = Principal Component
PCA = Principal Component Analysis
PCT = Personal Construct Theory
PNAP = Protected Natural Areas Programme
POS = Protection Opportunity Spectrum
RARE = Roadless Area Review and Evaluation (USA)
RCC = Recreational Carrying Capacity
RF&BPS = Royal Forest & Bird Protection Society
ROPS = Recreation Operations Planning System
ROS = Recreation Opportunity Spectrum
SR = Scenic Reserve
UET = Ultimate Environmental Thresholds
USDA = United States Department of Agriculture
USDI = United States Department of the Interior
USFS = United States Forest Service
USF&WS = United States Fish & Wildlife Service
VAMP = Visitor Activity Management Process
VCM = Vegetative Cover Map
VIM = Visitor Impact Management
WAG = Wilderness Advisory Group
WPM = Wilderness Perception Mapping
WRIDS = Wildland Resources Information Data System

We take a handful of sand from the endless landscape of awareness around us and call that handful of sand the world.

Once we have the handful of sand, the world of which we are conscious, a process of discrimination goes to work on it . . . We divide the sand into parts. This and that. Here and there. Black and white. Now and then. The discrimination is the division of the conscious universe into parts.

The handful of sand looks uniform ar first, but the longer we look at it the more diverse we find it to be. Each grain of sand is different. No two are alike. Some are similar in one way, some are similar in another way, and we can form the sand into separate piles on the basis of this similarity and dissimilarity. Shades of colour in different piles—sizes in different piles—grain shapes in different piles—subtypes of grain types in different piles—grades of opacity in different piles—and so on, and on, and on. You'd think the process would come to an end somewhere, but it doesn't. It just goes on and on.

One type of understanding is concerned with the piles and the basis for sorting and interrelating them . . . Another type of understanding is directed toward the handful of sand before the sorting begins. Both are valid ways of looking at the world although irreconcilable with each other.

What has become an urgent necessity is a way of looking at the world that does violence to neither of these two kinds of understanding and unites them into one. Such an understanding will not reject sand-sorting or contemplation of unsorted sand for its own sake. Such an understanding will instead seek to direct attention to the endless landscape from which the sand is taken.

ROBERT M. PIRSIG, Zen and the Art of Motorcycle Maintenance (1974)

Mount Arthur Track, North-West Nelson Forest Park

1

Introduction

From shores fringed by golden sands beside the ocean's enchanting depths; rising through an emerald forest which abounds with life and diversity; to open upon alpine fields of minute variation and intricacy untrodden by humans; and reach the rock and ice peaks of *terra firma* before the wind's ethereal presence—the country's protected areas are a myriad of biota within a dynamic landscape. These areas harbour the remaining vestiges of New Zealand's undisturbed ecosystems, yet also provide unequalled opportunities for backcountry recreation and the enjoyment of wild nature.

The protected areas system in New Zealand comprises its ever popular National Parks, diverse Conservation Parks, and numerous reserves and stewardship areas. Administered and managed by the Department of Conservation (DoC), since 1987, this nationwide system of protected and natural environments is also termed the *conservation estate.* The mandate by which this estate is managed is twofold, namely:

- that protected areas should maintain and emphasise the indigenous and distinctive New Zealand character of our landscapes;
- while at the same time providing for human use and enjoyment.

(*Conservation Act 1987*)

These fundamental principles permeate the primary functions of protected areas management. The resource *protection* function pertains to the preservation and protection of an area's natural ecosystems, while the resource *use* function concerns itself with providing for the recreational enjoyment of these areas.

1.1 Outline of Research Problem

Increasing backcountry use, primarily through recreation and tourism, places pressure upon the management of protected areas and makes the task of adhering to the dual mandate for the conservation estate a difficult proposition. On a nationwide basis visitation levels for New Zealand's protected areas are difficult to assess (Parr 1991 pers. comm.), although some trends may be surmised by examining North American patterns, projecting regional figures in New Zealand, and scrutinising general tourist numbers in New Zealand. The backcountry recreation boom of the late 1960s and 1970s in New Zealand (Catton 1971, Mason 1975) reflected a similar rapid growth of backcountry use in United States national parks and forests during the 1950s and 1960s (Roggenbuck & Watson 1989). Thus, New Zealand backcountry use appeared to mirror United States trends, but on a smaller scale and with a temporal lag. Growth in recreational use of backcountry areas in the United States continued in the 1970s and 1980s but the rate of increase has been slowing for some time, and has recently levelled off and even declined in a number of areas (Lucas & Stankey 1989, Cordell *et al.* 1990). Such downward trends, however, are considered to be short-term (Lucas & Stankey 1989) with a recent United States survey showing either stable or growing use between 1986 and 1988 (Cordell *et al.* 1990), and indicating a possible recurring upturn. Another recent survey in the United States (Hill 1990) also suggests that use of peripheral areas has steadily increased despite apparently decreasing use of core backcountry areas.

While the lack of national visitation figures in New Zealand makes it difficult to confirm similar trends, reliable monitoring for major tracks in a number of regions shows steady visitor increases and supports a possible upturn parallel to the United States trend (DoC 1990a, 1990b). This is corroborated by national and regional tourism statistics and forecasts (New Zealand Tourist & Publicity Department (NZTP) 1989a, 1989b, 1989c, New Zealand Tourist Department (NZTD) 1990) which anticipate continuing increases in international visitors to New Zealand, and domestic visitors within New Zealand. Commensurate increases in backcountry use may be expected, especially given the large number of visitors seeking out the country's natural environments (NZTD 1990). Despite the backcountry boom, recreational use of the conservation estate in New Zealand has been relatively moderate, especially when compared with the United States. It appears, then, that New Zealand's protected areas system may well be on the threshold of being opened up, a transition which occurred in the United States' parks and forests systems with remarkable speed, and with damaging consequences. Whilst recent United States trends suggest some curtailment of such growth, the expansion of international *green tourism* oriented towards New Zealand's natural environments

(Kliskey & Kearsley 1991), coupled with uncertain visitation figures at a national level, means that the potential exists for sustained pressure on backcountry use on New Zealand.

One notable aspect of this heightened backcountry use is the rise in expectations for a particular quality of experience—a wilderness experience. Associated with feelings of aesthetic appreciation, of self-reliance, and of remoteness from the ordinary activities and works of humanity (Smith & Watson 1979), wilderness experiences represent the psychological response of individuals to unmodified natural environments. Typically, the experience may include such aspects as solitude, freedom, romance and challenge (Molloy 1983). The importance of expectations for wilderness experiences amongst backcountry users has been highlighted in the United States (Stankey & Schreyer 1987, Brown 1989) and in New Zealand (Shultis 1991). While the precise nature of the wilderness experience clearly differs from one user to another, the generic characterisation of the experience and its underlying themes are similar—enjoyment of nature, escape from civilisation, relaxation and solitude. In broad terms the object of wilderness experiences refers to *relatively unmodified natural environments*, such as protected areas. The provision of opportunities for such experiences, however, may ultimately lead to the demise of these areas in the face of continued and increasing levels of use and the burgeoning desires for wilderness experiences.

The problem which emerges for protected areas management, and one which the present study specifically addresses, is the provision of opportunities for satisfactory wilderness *experiences* while also maintaining the natural *ecological processes* of an area in an undisturbed state. New Zealand's protected areas system, by virtue of its dual mandate, is expected to accommodate both conditions, and yet achieving a balance between them is an issue of some magnitude and complexity. Thus, this study is concerned broadly with:

> ... *the need to find new ways to retain ecological integrity and also provide for wilderness use* [and experiences] *within existing constraints.*
>
> (Frome 1985 p64)

An underlying basis to the approach taken in this thesis is to concentrate on enhancing the management of visitor use and experience in protected areas, rather than of the biophysical resource itself, since such use is seen as the major perpetrator of imbalance from which the problem is manifest. The wilderness experience, however, represents a feeling ostensibly unique to those areas perceived as wilderness, and which is dependent on a person's perception of an environment (Stankey

& Schreyer 1987). As such, a *wilderness experience can be characterised as whatever one feels when in a setting that is perceived as wilderness.* The difficulty from a management perspective is then one of providing a geographic context for wilderness, a concept that is decidedly ambiguous (Nash 1967, Gardener 1978, Driver et al. 1987b).

The wilderness concept has two discernible components. The first refers to the biophysical features of the environment through which wilderness is perceived. These are essentially the objective, ecological conditions of an area which can be termed the *phenomenal* environment. The second component conceives of wilderness as a state of mind, that is, the constraints and interpretations of the human mind applied to what are otherwise quite neutral features of the physical environment. These experiential conditions are subjective and can be termed the *perceptual* environment. Wilderness can then be considered in terms of both the ecological and experiential conditions of an environment. In this thesis *wilderness is effectively defined by experience and refers to landscapes perceived as wilderness, where human beings can have wilderness experiences.* Such landscapes are likely to be those areas which have not been significantly modified by human activity, although some alteration might be acceptable to a moderate degree. There is also likely to be *"... individual variation in the perception of what is and what is not wilderness ... with each such personal conception equally valid"* (Shultis 1991 p4). The ecological conditions sought under the protection function of protected areas would, in contrast, imply a pristine state with no human impact (as far as possible). A distinction is also made between wilderness as defined above, and *those areas specifically designated as* a de jure *wilderness under a country's legislation, which are termed 'Wilderness Areas'*. Wilderness Areas may or may not encompass wilderness, and *vice versa.* Other terms such as 'natural environment', 'backcountry' and 'wildlands' are used generically to refer to relatively unmodified landscapes, commonly included in the protected areas system, from which wilderness is likely to be perceived. The management problem that has been referred to can, for convenience, be termed the *wilderness management issue* and is concerned with preserving the ecological processes of an area, undisturbed by human activity, while still providing opportunities for wilderness experiences.

The wilderness management issue may be represented by a *wilderness system* (Figure 1.1) where, in the effort to meet the fundamental principles of protected areas management, the provision of use to fulfill the attendent demands for wilderness experiences, and the protection of ecological conditions are essentially in conflict. Consequently, a balance must be sought between the interactions of the phenomenal and perceptual environments, such that the elicitation of satisfactory wilderness experiences and the maintenance of acceptable ecological conditions in protected areas are permissible. Wilderness management is thus a balancing act operating upon the wilderness system within the broader context of the *protected areas management system* (generically a natural resource management system). Any notion of wilderness management, however, appears somewhat paradoxical. On the one hand wilderness implies *freedom* from human control, while on the other management implies at least a degree of *control* by humans. Yet, it is commonly accepted that some form of management intervention is inevitable if protected areas are to be retained intact and consistent with their fundamental principles of establishment (Hendee *et al.* 1978). The above notion of wilderness management, as a balancing process of ecological conditions and experiential conditions, is quite distinct from the United States wilderness management concept that applies specifically to the management of Wilderness Areas.

The adoption of an experiential approach to wilderness that is advocated above, is complicated by the apparent multiplicity of perceptions of wilderness (Kearsley 1990) which must be accommodated in any attempt to address the issue from this perspective.

The approach to the wilderness management issue taken in this thesis advocates a greater understanding of varying, multiple perceptions of wilderness held by backcountry users through a spatial-perceptual framework, and is advanced by the application of geographic information systems (GIS). In broad terms, this research seeks to answer the call to:

> . . . *establish the nature of the knowledge held* [by users, with respect to wilderness,] *as well as to identify new models and structures to incorporate the knowledge into planning and management decisions.*
> (Stankey 1989a p249)

Thus, the basic aim of the study is :

> **to develop an appropriate methodology for mapping multiple perceptions of wilderness in order to address the wilderness management issue, and to assess its viability as a management tool.**

1.2 Outline of Thesis Structure

The thesis is organised into three distinct parts which serve to put the above aim into effect. These parts are concerned with: the analysis of the problem context; the conceptualisation of an appropriate approach to the problem; and, the application of that approach.

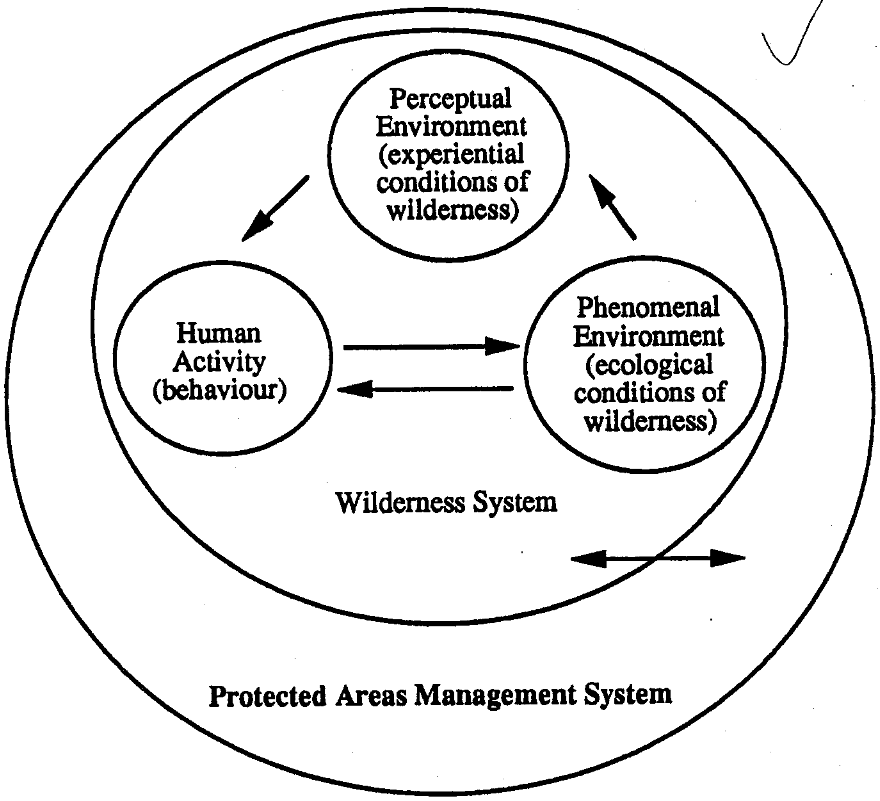


FIGURE 1.1: Conceptualisation of a Wilderness System within the Protected Areas Management System

Part I of the thesis provides a broad analysis of the problem context surrounding the wilderness management issue, and comprises four chapters. The first of these chapters (Chapter 2) begins with a discussion of the background and philosophy to wilderness preservation and management. This is followed by a critical examination of conceptual approaches towards managing wilderness conditions which have emerged in natural resource management research. Chapter 3 provides an examination of wilderness management practices, both historical and contemporary, within the context of protected area systems. This includes a brief account of the evolution of the wilderness concept and management in New Zealand, an analysis of contemporary wilderness management practices in New Zealand, and finally a comparative analysis of these practices with those of the United States, Canada and Australia. Chapter 4 examines the development of environmental perception studies in behavioural geography with an emphasis on wilderness imagery, perceptions and attitudes. The application of wilderness perceptions in natural resource management is then considered with a view to establishing the role of a perceptual approach in protected areas management. Chapter 5 examines the rationale for adopting a spatial approach to natural resource management strategies, and leads to a discussion on the role and application of GIS in protected areas management. The role of a GIS-assisted spatial approach in protected areas management is then considered. The overall perspective established by the broad analysis in Part I is problem-solving in nature.

Part II of the thesis integrates the various aspects analysed in the first part to outline explicitly the approach taken to the wilderness management issue and comprises a single chapter—Chapter 6. This chapter provides a synthesis of the elements analysed in the problem context (Chapters 2–5); this establishes the basis for the spatial-perceptual approach adopted in this research and allows the expression of the aim of the conceptual model. It then outlines the conceptualisation and development of the spatial-perceptual approach which is manifest in the resulting wilderness perception mapping (WPM) methodology. The amalgam of the various application-oriented fields of resource management, behavioural geography and geographic information systems provides an applied and interdisciplinary outlook to the problem situation.

Part III of the thesis examines the application of the methodological approaches developed in the second part, using a case-study. Chapter 7 examines the results of applying the wilderness perception mapping methodology to the case-study region—North-West Nelson. Chapter 8 then considers the application of these map results to the wilderness management issue, and the ability of WPM to address the problem. This includes the application of WPM to a scenario situation—the proposed Heaphy Track Road. The application of the conceptual approach throughout this part of the thesis recognises the interacting components of the immediate wilderness system, but also its place within a broader natural resource management framework—the protected areas system.

Chapter 9, the final chapter, summarises and integrates the process followed through the three parts of the thesis. In so doing the chapter reviews the operationalisation of wilderness perceptions, the resulting implications, and how it is further enhanced by the application of GIS. Finally, recommendations are made for the implementation of WPM, for protected areas management, and for further research.

Part I

Analysis of the Problem Context

2

Theoretical Approaches to Wilderness Management

The overall wilderness management issue is one of managing protected areas for the purposes of preserving natural ecosystems while at the same time providing for their use and experience. Since these concepts may be incompatible, wilderness management must also provide for the best balance between those conditions, according to agreed standards. The issue has already been conceptualised in Chapter 1 as requiring management input from a wider natural resource management system directed towards the wilderness system, but more particularly it involves the planning and management of those particular conditions which characterise the wilderness system, however that might be perceived. The emphasis here is on management of *conditions*, rather than simply the management of particular designated *areas*, but does not ignore the fact that the physical reality of wilderness environments is a vital factor in the system. It does, however, permit closer focus on the key instigator of imbalance in a wilderness system, the human visitor or user. This is especially so since "... *the biophysical aspect of wilderness itself often needs little in the way of management* ... " (Brown *et al.* 1987 p321) provided that natural processes can function in an undisturbed way. Rather, it is the management of the human use of wilderness environments, both compatible and non-conforming, which have given rise to the wilderness management issue.

This chapter first examines briefly the concepts and philosophy of wilderness preservation and management, and then moves on to consider a number of conceptual approaches towards managing wilderness conditions that have emerged from natural resource management research.

2.1 The Wilderness Preservation Concept

The concept of wilderness "*... designates a quality... that produces a certain mood or feeling in a given individual...* " (Nash 1982 p1)—one might add that the quality is itself culturally influenced. Thus, wilderness has its origins in cultural traditions, the historic roots of which have been the subject of considerable examination, in recent years, within the context of nature and protected areas. Glacken's seminal work *Traces on the Rhodian Shore* (1967) provides a solid benchmark on the history of environmental attitudes, while Nash (1982) and Stankey (1989b) have documented the historic roots of the wilderness idea specifically. Most recently, Oelschlaeger's (1991) work has provided a comprehensive historical account of the philosophical and political development of the wilderness idea. In New Zealand, Thom's (1987) *Heritage - The Parks of the People* provides a thorough account of the natural and human history of New Zealand's National Parks while Shultis (1991) provides an historical account of Western attitudes toward wilderness and protected areas as expressed in contemporary New Zealand. These studies collectively provide a detailed and complete examination of the evolution and development of the wilderness idea, attitudes toward wilderness, and wilderness preservation. The following section is thus intended to provide a brief review of the salient points in that evolutionary process which have important underpinnings for the rationales of wilderness management, and their expression in the various conceptual approaches which have developed.

No special cultural significance was attached to undeveloped nature at the time of pre-historic humanity—it was a world of biophysical, neutral features. However, the Biblical conception of wilderness, essentially a Judaeo-Christian portrayal, was to foster contrasting perspectives (Glacken 1967). On the one hand wilderness referred to desolate and uninhabited land, a manifestation of evil, whilst on the other it was considered a suitable arena for communion with God, a place for contemplation. These views have been identified as a possible cause for the ambivalence toward wilderness which still exists today (Stankey 1989b).

As a word, *'wilderness'* has its etymological roots in the Old English term *wild-deor-ness*, meaning the place of wild beasts (Nash 1982), and reflected the notion of uninhabited regions, beyond human control, primarily the domain of wild animals. This medieval European notion was one of a land cloaked in evil and foreboding but which would eventually be broadened with developing scientific interest in the environment *per se*.

In the wake of the scientific revolution of the Sixteenth and Seventeenth Centuries, the Romantic and primitivist traditions, and in particular the concept of *sublime* nature, led to an increasingly positive view of wilderness in sectors of Western society. This particular attitude, however, did not immediately gain acceptance in the New World of North America and later Africa and Australasia, where vast tracts of uninhabited environment were seen in puritanical eyes as a threat and a barrier to be conquered. The *frontier* was that beyond which there existed wilderness. The rise of American Romanticism in the 1800s, and the idea of wilderness as the sublime, helped to re-establish a positive view of wild nature in North America. Enhanced by the transcendentalist view of natural settings providing a mode for spiritual truth and insight, that "*... in wildness is the preservation of the world...* " (Thoreau 1906), this was the precursor for a "*... philosophical framework within which* [wilderness] *could be defined as contributing to human welfare*" (Stankey 1989 p21). The practical manifestation of this idea was the push to preserve wilderness for the public domain.

The creation of Yellowstone National Park in the United States in 1872 and other similar acts in recently colonised New World countries of the time [1], were the first conscious, formal efforts to establish protected areas. This also mirrored an attitudinal shift from the *negative* domination of uninhabited land to the *positive* preservation of remaining natural environments. While these acts of reservation assimilated an idea of wilderness preservation, the areas in question were not necessarily perceived as wilderness (Stankey 1989b). For the next 100 years these, and other, countries witnessed a continued refinement of public and political awareness toward the issue of the protection of wilderness, particularly as the total area of wild country steadily decreased to become a scarce resource. Very much later the United States Wilderness Act of 1964 accorded wild country unprecedented protection and recognition as a desirable component of the landscape. It also established a formal definition of Wilderness for that country:

> *A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain.*
>
> (US *Wilderness Act 1964*— Sec.2c)

Australia and Canada have followed suit with similar legislation at state or provincial level (e.g. the Ontario *Wilderness Areas Act 1955*, and the New South Wales *Wilderness Act 1987*). In New Zealand, the efforts of the Federated Mountain Clubs (FMC) in the 1960s and 1970s, and the establishment of the Wilderness Advisory

[1] Australia's Royal National Park set aside in 1879; Canada's Banff Hot Springs reserved in 1885 (later to become Banff National Park); and New Zealand's Mount Tongariro gifted by deed in 1887 (later to become Tongariro National Park)

Group (WAG) in 1981 led to a formal definition of *Wilderness Areas* as a further protected area category possible within National Parks, Forest Parks and Reserves. In this context Wilderness Areas in New Zealand are:

> ... *wild lands designated for their protection and managed to perpetuate their natural condition and which appear to have been affected only by the forces of nature, with any imprint of human interference substantially unnoticeable.*
>
> (WAG 1985)

This, however, has never gained common usage or familiarity in New Zealand, as its United States counterpart has, so whilst there are five designated Wilderness Areas in the New Zealand protected area system, the concept of wilderness remains a broader *state of mind* for most, rather than an explicitly defined area.

2.2 The Philosophical Rationale for Wilderness Preservation

While the changing attitudes, accounted for above, led to popular support for preserving land representing some conception of wilderness, the actual enactment of these sentiments by respective governments essentially lay in *utilitarian* ideals. Most significant was the *worthless lands* idea, which suggests that since the type of land characterised as wilderness had no apparent economic value there was no reason why such areas should not be preserved (Hall 1988a). Other motives later emerged to support the retention of wild areas in their natural state including, on the one hand, the spectacular scenery, therapeutic values, recreation and tourism offered—for utilitarian reasons—while on the other, for its intrinsic worth. Although two broad, separate preservation motivations have emerged, anthropocentric values have usually dominated the enactment of wilderness preservation.

The rise of environmentalism in recent times has been associated with two broad philosophical stances for preserving wilderness. First, there is the concept of *anthropocentricism*, which espouses instrumental values and the associated idea of conservation of an area. The second is *biocentricism* which espouses intrinsic values and the idea of preservation of an area in perpetuity.

Four key instrumental values which accompany anthropocentrism (also termed shallow environmentalism) are the *cathedral*, *laboratory*, *silo* and *gymnasium* views (Godfrey-Smith 1979). In brief, the cathedral view holds that wilderness provides refreshment for the human spirit, that is, an element of the mystical, emotional or directly religious experiences. The laboratory argument suggests that protection of wilderness provides a secure method to ensure the survival of complex biological systems for scientific inquiry which may be of value to human society. The silo argument is that the natural areas of wilderness provide a stockpile of genetic diversity which may be necessary as a back-up to the simplified biological systems of agriculture. Finally, the gymnasium view regards wilderness as useful for sport and recreational activities. Clearly, the basis of all these arguments relates to conserving wilderness for its usefulness in fulfilling *human* interests, either now or in the future.

The biocentric stance (sometimes termed deep environmentalism) maintains that wilderness, including species and natural ecosystems, have *intrinsic* worth and should be preserved for their own sake, quite apart from human interests. Such an idea ascribes to the protection of species because of moral rights inherent to them, or because of non-human value in nature (Molloy & Wilson 1986).

While both stances would appear to be in agreement over the issue of whether to preserve wilderness or not, their differences have considerable implications for the level and mode of management of such areas and, therefore, the approach taken in addressing the wilderness management issue.

2.3 The Wilderness Management Concept

Wilderness management, as an input to the system for maintaining appropriate wilderness conditions, is only possible provided that the preservation of wilderness is seen as an appropriate and accepted action, and that human intervention in natural systems, for whatever reason, is also seen as appropriate.

However, in practice, since the first efforts to preserve wilderness, some form of wilderness management has been implicit in the stewardship of protected areas. Initially, the mere act of establishing parks formally, and thereby preserving wilderness, was considered to be all that was necessary for maintaining the conditions of wilderness. However, additional management activities soon became necessary, such as caretaking functions to protect parks from poaching and vandalism. In turn, these activities also were to be considered as inadequate for appropriate management of protected areas, and the need for a more dynamic, longer-term view arose. Such a view included "*... manipulation of successional processes to obtain ... a more ideal or stable type of biota ...* " (Bratton 1985), and which recognised the importance of naturally occurring processes. As a response to the increased numbers of visitors to natural areas, especially evident in the United States in the period since the late 1940s, a more process-oriented management approach became necessary. This type of approach emphasised a hands-off attitude with less unnecessary management interference in park ecosystems. Efforts toward managing wilderness conditions, a process inherent in protected area management, have since seen a continued trend toward a greater understanding of systems and processes, that is, ecosystem management (Agee & Johnson 1988).

The paradox of any wilderness management *input* is that a wilderness environment is supposed to be void of human influence, and yet *management* implies human control. It is, however, widely accepted that the objectives of preserving wilderness—the long-term preservation of natural ecological processes and provision of wilderness experiences—are not fully met by mere designation of park areas (Hendee *et al.* 1978). Thus, sources of influence, both external and internal, that represent threats to the achievement of these objectives, require further management within the system.

Two possible alternative actions that negate the need for actual management intervention have been posed (Hendee *et al.* 1978). First, all use in protected areas could be prohibited, that is, a *lock-it-up* approach. However, this makes the objective of providing for recreational enjoyment of such areas, and therefore the elicitation of wilderness experiences, unachievable. The second action is that any kind of use, which is not expressly precluded, could be allowed to continue unhindered so that any impacts in the system would simply be accepted, that is, a *forget-about-it* approach. In particular, such an alternative allows unlimited recreational use with no management controls on the amount and impact of use. This approach violates the objective of protecting the natural ecosystems in protected areas. Thus, the need for wilderness management is generally accepted and the concern lies rather with how wilderness management should be carried out in order to achieve the objectives (Lucas 1973). Furthermore, it is apparent that the dilemma of choosing between use and preservation of wilderness which arises from the dual objectives, will be central to the underlying philosophy of a wilderness management approach.

The two broad philosophies of wilderness management, anthropocentricism and biocentricism (Hendee & Stankey 1973), are derived from the respective rationales for wilderness preservation. Wilderness management under an anthropocentric philosophy is primarily concerned with enhancing and providing opportunities for recreational and other human values. A secondary motive lies with maintaining the integrity of the natural environment, and consequently emphasises the role of management intervention directed at facilitating sustainable human use of wilderness. By contrast, the biocentric philosophy emphasises the maintenance of natural ecological processes wherein human use should not be allowed to alter this flow to any significant degree. The distinguishing feature of these philosophies is "...

the extent to which the human benefits of wilderness are seen as being dependent on the natural integrity of the wilderness setting" (Hendee *et al.* 1978 p16). This has led to a generally biocentric orientation being favoured, one where "... *management should not mold nature to suit people ... rather, it should manage human use and influences so that natural processes are not altered"* (Hendee *et al.* 1978 p21). This is uniquely important for wilderness conditions—it can be for other natural environments also—but one could argue that if wilderness is perceived as *untouched by humans*, then it is paramount. On the other hand, if wilderness experiences can be felt by some people in non-wholly-untouched environments (as is argued here, and developed in Chapter 4), then management that preserves the appearance of naturalness is sufficient for those people. Nevertheless, the approach to wilderness management must necessarily operate in a manner that does justice to both preservation and use objectives via some chosen integrating framework.

2.4 Strategies for Managing the Conditions of Wilderness

In the last 30 years a body of research has emerged which integrates aspects of biophysical and social science and uses it in the understanding and management of protected area conditions, and especially those of wilderness. A major thrust of natural area, management-oriented research has emanated from the United States Forest Service, with wilderness research emphasising management of the US Wilderness Preservation System and legally-defined Wilderness Areas (Lucas 1987a). However, the concepts developed in that work are applicable to the management of wilderness conditions in a broader sense. Specific wilderness research is also supplemented by other research, commonly in the geographical sciences which, while not specifically directed at wilderness conditions, can still be usefully applied to the issue (e.g. Rosier *et al.* 1986, Fagence 1990). The brief history of wilderness management-oriented research has been characterised by two distinct periods (Lucas 1987a), with a third period currently emerging.

The early period, between 1960 and the early 1970s, involved studies which were largely descriptive. Biophysical research concentrated on ecological processes and visitor impacts, with studies being carried out predominantly in backcountry dispersed recreation settings. Research themes included work on the impacts of recreation upon vegetation; the role of natural fire in ecosystems; and the systematic documentation of impacts. Early social research involved descriptive visitor studies on use patterns, user characteristics, attitudes and activities.

The second period, from the early 1970s to the mid-1980s, witnessed more scientifically rigorous research with a narrower focus and greater efforts to develop theories, concepts and models. During this time, biophysical research emphasised studies of campsite impacts, track conditions, and the recovery and rehabilitation of vegetation (Cole 1987), with a lesser focus on disturbance and indirect impacts of recreational use on wildlife habitat (Ream 1980). The emphasis in social research was placed heavily on sociological carrying capacity (Graefe *et al.* 1984), although there was a later shift to the acceptability of change in these areas (Stankey *et al.* 1985). Other research efforts considered the benefits and values of wilderness in both socio-psychological and economic terms (Driver *et al.* 1987a, Peterson & Randall 1984), and recreation choice behaviour and the effect of information (Stankey & McCool 1984).

The third period, since the mid-1980s, has been characterised by a shift in social science research from studies on recreational use and values of wilderness to other non-recreational use and values (Freilich 1989), such as scientific, educational and traditional subsistence-use values. Efforts in biophysical science research during this most recent period have begun to focus on basic ecological values of wilderness (Franklin 1987). In general, the research thrust has been directed by attempts to take an interdisciplinary approach to the study of wilderness problems (Roggenbuck 1990) in a more unifying and systemic manner.

The remainder of this section examines various concepts that have emerged from this body of research which have been aimed at, or are applicable to, the management of wilderness conditions. These are: recreational carrying capacity; the recreation opportunity spectrum; the visitor activity managment process; the limits of acceptable change frameworks; and, visitor impact management. Following this, two ecology-based concepts which have relevance to wilderness management are examined. A typology of management techniques which can be used within the different approaches discussed is also briefly considered.

2.4.1 Recreational Carrying Capacity

Recreational Carrying Capacity (RCC) and the idea of human use levels applied to parks and protected areas management have their origins in the notions of population and stocking levels, as developed in wildlife and range management (Dasmann 1964). This generic form of biological carrying capacity has involved establishing the ultimate limit for growth of a dependent species as constrained by various natural factors of environmental resistance (Odum 1959). The concept of recreational carrying capacity has grown from this approach in response to increasing recreational use of a finite resource, with impacts upon that resource and upon the users. Carrying capacity is thus an applied issue in recreation resource management and one primarily focused on natural settings.

Recreational carrying capacity has been defined as the "... *level of recreational use an area can withstand while providing a sustained quality of recreation*" (Wagar 1964 p3). The two components inherent in the description of the concept are the biophysical quality of the environment, and the quality of the recreation experience. As such, the research on RCC has focused on biophysical carrying capacity in recreation settings, mainly through environmental studies, and on social carrying capacity, using recreation experience research and, especially, perceptions of crowding.

Research on biophysical (or ecological) carrying capacity has concentrated on problems, and potential problems, of impacts on tracks and at campsites (Cole 1982, 1983a, 1983b, Cole & Schreiner 1981) and, to a lesser extent, on wildlife and wildlife behaviour (Ream 1980). Ecological impacts of recreation can have a number of effects on ecosystems such as vegetation loss, succession by exotic species, soil erosion and compaction, and impacts on wildlife habitat, behaviour, and population levels (Wall & Wright 1977, Edington & Edington 1986, Agee & Johnson 1988). Figure 2.1 illustrates such impacts in a model of the interaction between components of the biophysical environment and recreation, as developed by Wall & Wright. Effects such as these are representative of conditions where carrying capacity constraints may need to be imposed in order to prevent detrimental changes in wilderness quality.

Social carrying capacity research has concentrated on personal responses to environmental variables, with particular emphasis on the relationship between user satisfaction, and the number and type of encounters among users (Lucas 1964, Stankey 1971a, 1973, 1980, Stankey & McCool 1984). This approach has its basis in social science theories, particularly the principles of crowding and impact perceptions, expectancy models of behaviour, and functions of social norms (Schreyer 1984).

Two aspects of relevance to carrying capacity arising from the perception of human impacts on the environment are:

- the perceived importance of impact conditions relative to other aspects of the setting; and
- the evaluation of a given condition as being desirable or undesirable.

(Lucas 1979)

Thus, visitor perceptions of a quality recreation experience, for example a wilderness experience, will vary considerably within and between activities.

Expectancy models of behaviour suggest that people participate in recreation

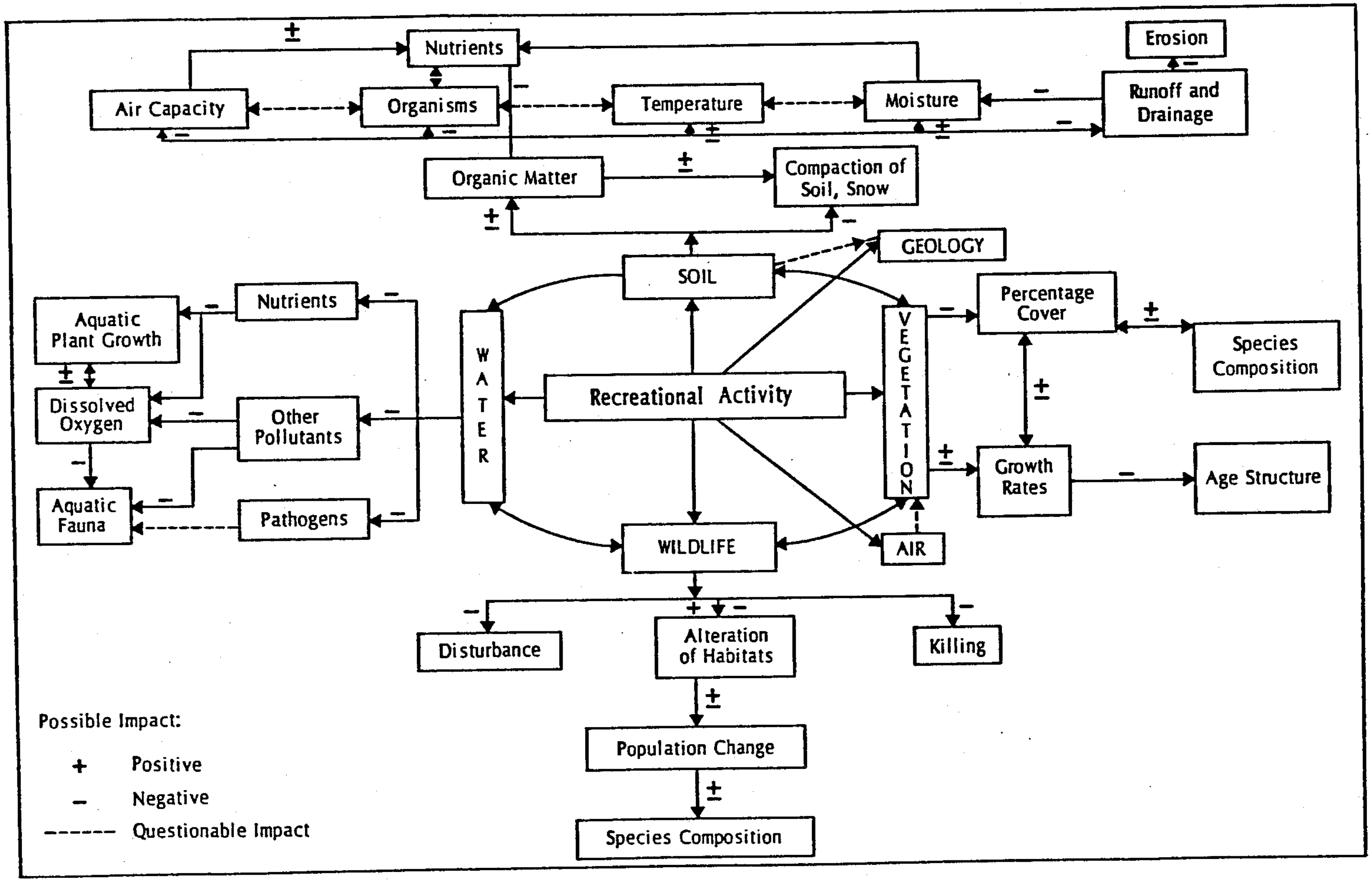


FIGURE 2.1: Recreational Impact Interrelationships (from Wall & Wright 1977 p49)

in order to satisfy certain multiple expectations (Driver & Tocher 1970). These expectations then influence the perception of a recreation experience at several levels of specificity (Schreyer & Roggenbuck 1978). The *general* expectations are broad psychological constraints, such as achievement, challenge and self-awareness, whilst *specific* expectations relate to particular components of an experience, such as the naturalness of the setting.

Social norms are the shared behavioural expectations or prescriptions of what people think ought to happen in a particular situation. In relation to carrying capacity these norms emphasise the assessment of users' perceptions of appropriate amounts of use. This leads to the notion that understanding quality in the recreation experience demands an appreciation of the goals or types of experiences sought by users (Graefe *et al.* 1984).

The focus of much of this research has been on the relevance of social science applications to recreation resource situations in the real world. One suggestion for this type of implementation has been the identification of conditions necessary for the establishment of social carrying capacity as a parallel to, and extension of, physical carrying capacity. Such a concept would require:

- a known relationship between use level, or other management parameters, and experience parameters;
- agreement among relevant groups about the type of recreation experience to be provided; and
- agreement among the relevant groups about the appropriate levels of experience parameters.

(Shelby & Heberlein 1986)

All three conditions depend somewhat on value judgements as an input to effect implementation (see Figure 2.2).

The concept of carrying capacity has had to cope not only with the need to limit and control threats to the resource but also with the need to maximise benefits by maximising use within the limitation of quality experiences. Thus far it has not been possible to obtain a single technical solution to the problem of carrying capacity. Instead, it has been necessary to provide a context in which the human values and subjective evaluations of desirable conditions can be formally recognised. Clearly, changes to phenomenal environment can be measured in a formal, scientific manner, but, equally clearly, human values will vary with the character and expectations of users, both as individuals and as groups. In the many studies that have been carried out thus far, the essential elements of carrying capacity that have been recognised are that:

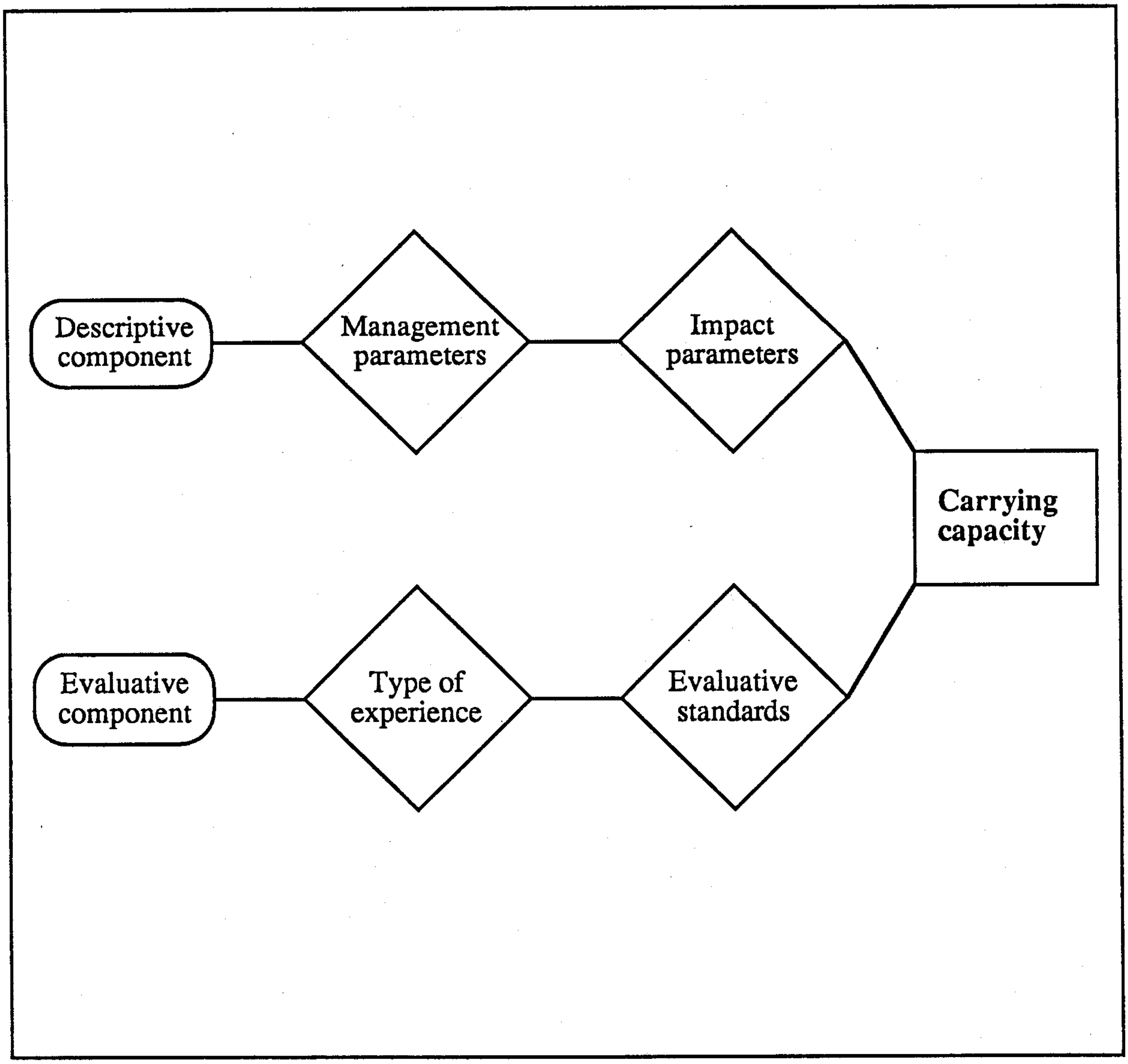


FIGURE 2.2: Recreational Carrying Capacity Model (from Shelby & Heberlein 1986 p12)

- recreationists seek satisfaction from recreation engagements and, depending upon these, encounters with other people will affect those experiences;
- the satisfaction which visitors report is a function of more than merely the use level;
- the type, frequency, and location of encounters are important intervening variables;
- clearly stated objectives are essential to identifying carrying capacities; and
- the emphasis in management needs to be placed on the desired outputs (the experiential conditions), not on inputs such as use.

Thus, in summary, recreational carrying capacity has been derived from two components, namely, biophysical and social carrying capacity. Biophysical carrying capacity concerns the changes in the physical and biological aspects of an area due to both natural and human impacts, while social carrying capacity revolves around the effects of use on user satisfaction.

Carrying Capacity in Wilderness Conditions

As a management concept, carrying capacity has been applied broadly in outdoor recreation, and has been considered to be particularly well suited to the wilderness situation in which there are particular concerns about preservation of natural resources and the provision of specific recreation opportunities (Brown *et al.* 1987). Carrying capacity in a wilderness situation has been defined as "... *the maximum degree of the highest type of recreational use which wilderness can receive, consistent with its long-term preservation*" (Sumner, in Stankey 1980 p6). As with RCC in general, decisions regarding wilderness carrying capacity require explicitly defined management objectives and standards. These, in turn, require some conception of what ecological and social conditions are appropriate for wilderness; that is, conditions of wilderness.

While it has not been possible to determine when the use becomes excessive, the broader context of carrying capacity has provided a structure for considering the multifarious aspects of wilderness use, experience and management under increasing use and resource impact pressures. One such model of a management system (Stankey 1972) has specified the type of information necessary to arrive at carrying capacity, and the kind of management response needed to ensure use and impact remain within carrying capacity (see Figure 2.3). The use parameters identified as requirements for sociological carrying capacity, while dependent on the ecological conditions, are also very much a function of the user's experience within those conditions. Thus the need for the identification and measurement of experiential conditions pertaining to wilderness is important, particularly where different levels of ecological capacity are able to support essentially uniform wilderness experiences for different users.

This style of modelling of the wilderness management system sets out a process that requires a focus on the breadth of relevant management objectives. Despite this and other efforts to formulate a process for applying the carrying capacity concept, its implementation has not so far, generally, been successful. The inability to implement a framework arises mainly from the difficulty encountered in establishing a predictable link between use levels and impact (Graefe *et al.* 1984), and has led to a shift of focus from use levels and the question of 'how much use is too much', to the notion that recreational use inevitably produces change in both social and biophysical settings (Frissell & Stankey 1972). That is, the question arises of 'what level of change can be permitted' should be answered before the essential conditions of wilderness are lost.

2.4.2 The Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) planning technique in outdoor recreation has emerged from the long-standing need to provide for a diversity of recreational tastes (Burch 1964, Lucas 1964, Shafer & Meitz 1969), particularly since a diversity of opportunity, both within and between recreation activities, has been identified (Brown & Haas 1980). ROS was proposed as a solution, first to the problem of integrating recreation into land management planning (Brown *et al.* 1978, Driver & Brown 1978), and second, to the problem of management changing recreation settings without a clear recognition of the consequences (Clark & Stankey 1979).

The ROS framework employs a behavioural definition of recreation opportunity that extends the conventional activity-opportunity definition (Driver & Tocher 1970) by incorporating the realisation that recreators seek opportunities to:

1. engage in the activity itself;
2. recreate in certain settings in which activities take place;
3. realise specific experiences, or psychological outcomes;

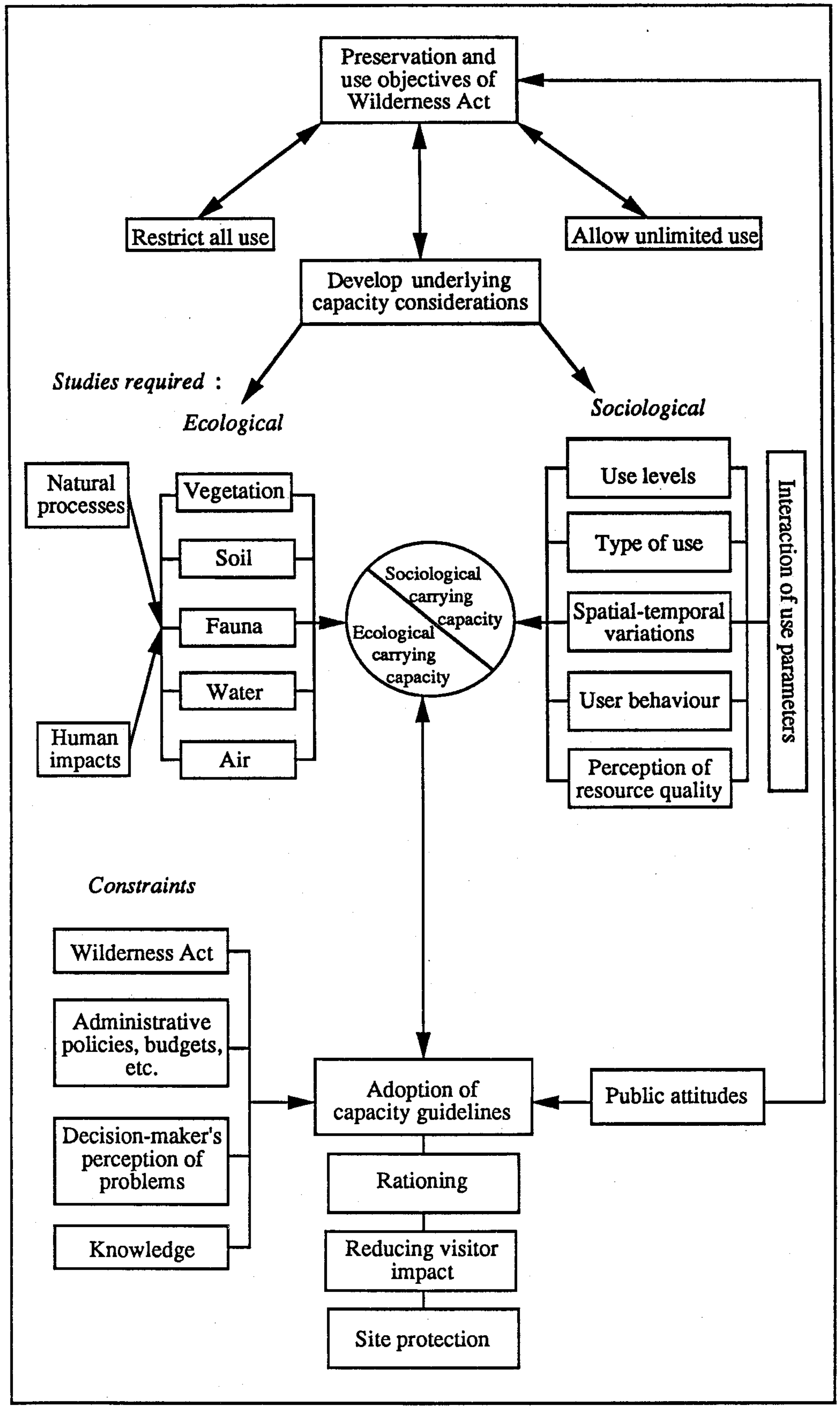


FIGURE 2.3: Carrying Capacity Model for Wilderness Management (from Stankey 1972 p99).

4. realise the ultimate benefits which flow from satisfying the experiences derived from recreation participation.

(Driver & Brown 1978)

These four levels of demand represent a hierarchy, based on the differential awareness of demand for each component, of increasing difficulty for measurement from level 1 to level 4. Using this hierarchy of needs, a *recreation opportunity* can be defined as a chance for a person to participate in a preferred activity in a specific setting in order to realise a predictable recreation experience. A realisable experience would, in this sense, connote an expectation of satisfaction. It follows from this that the management role of the ROS process is "... *to formulate various combinations of activity and setting opportunities to facilitate the widest possible achievement of desired experiences*" (Brown *et al.* 1987).

Thus, the ROS framework is based on a probabilistic view of the relationships among activities, settings and experiences whereby the provision of diversity in settings assures that a corresponding diversity of experiences will be obtained. There is, however, an inadequate theoretical basis to the linkages between these three concepts. The work of Virden & Knopf 1989 has indicated that significant relationships do exist between these variables but that systematic explanations for these relationships are not clearly apparent. The recreational settings from which the diversity in ROS emanates are defined by three broad factors:

- physical setting;
- social setting; and
- managerial setting.

(Manning 1985)

The physical setting includes features such as the vegetation or topography of an area. The social setting refers to the size and type of group involved, and to the number of other groups or individuals encountered. The management setting denotes the extent and type of controls and regimentation that exists in an area. By describing ranges of these factors, selected types of recreation opportunities can be defined which, in turn, produce a range of opportunities—the recreation opportunity spectrum—for recreational users (see Figure 2.4). The spectrum is conceived as ranging from an accessible, urbanised opportunity to a remote, natural opportunity, that is, from "... *the paved to the primeval*" (Nash 1982 p6). One arrangement of these factors (Clark & Stankey 1979) specifies four basic opportunity types: developed, semi-developed, semi-natural, and natural (see Table 2.1).

Management factors	Range of recreational opportunity setting classes			
	DEVELOPED	SEMI-DEVELOPED	SEMI-NATURAL	NATURAL
1. ACCESS				
ROADS	—	sealed		
		—	gravel or dirt	—
TRAILS	—	manicured	—	
			cross-country	—
CONVEYANCE	—	car	—	
		horse	—	—
	—	—	feet	—
2. NON-RECREATION RESOURCE	compatible on a large scale	—		
		depends on nature and extent	—	
				incompatible
3. ONSITE MANAGEMENT				
EXTENT	very extensive	—		
		moderate extent	—	
				none
OBVIOUSNESS	very obvious			
		natural-appearing	—	
				none
COMPLEXITY	very complex	—		
		—	not complex	
				none
FACILITIES	—	many facilities		
		—	occasional	
				none
4. SOCIAL INTERACTION	—	frequent		
		occasional	—	
			infrequent	—
				none
5. ACCEPTABILITY OF VISITOR IMPACT				
MAGNITUDE	—	high degree		
		—	moderate degree	—
				none
PREVALENCE	prevalent over broad areas	—		
		prevalent over small areas	—	—
				none
6. REGIMENTATION	—	regimented	—	
			not regimented	—

TABLE 2.1: Factors Defining a Range of ROS Classes (from Clark & Stankey 1979)

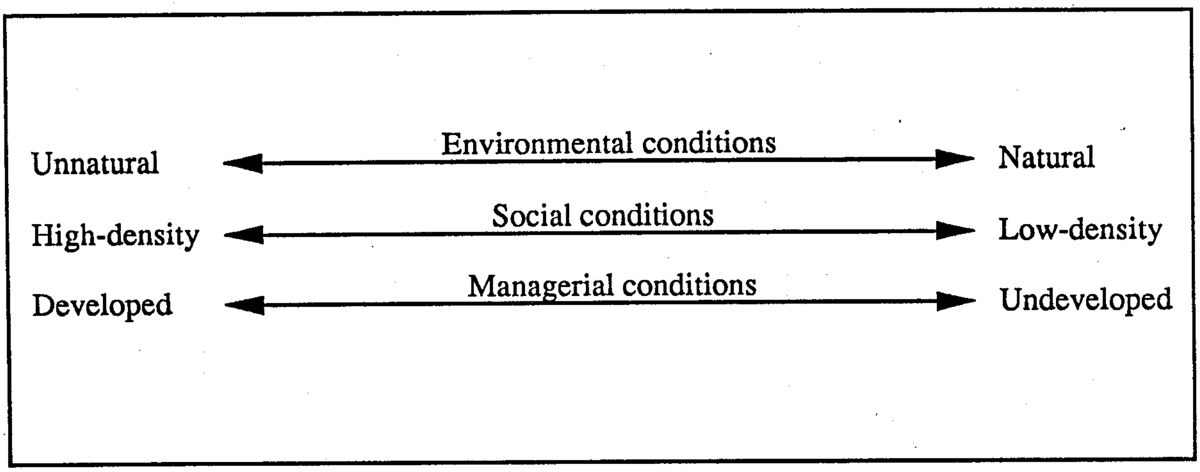


FIGURE 2.4: Relationship Between the Three Setting Factors which Describe the ROS

Broadly speaking the ROS is a conceptual framework for understanding recreation and one explicitly recognising that experiences derived from recreation are related to the settings in which they occur and that those settings are a function of the environmental, social and managerial factors considered above. By describing ranges of these factors, the ROS allows management objectives to be provided, in terms of these characteristics, at particular locations. The totality of these setting characteristics, and the experiences they allow to occur, form the opportunity spectrum. This is represented diagrammatically in the recreation opportunity model of Figure 2.5.

The ROS concept can assist management of wilderness conditions in two ways. In a general sense, the application of ROS over protected areas would characterise the extreme natural end of the spectrum as comprising *wilderness settings* and, therefore, providing wilderness experiences. The ROS framework thus considers *wilderness opportunities* as one specific component of the array of recreation opportunities possible. This also makes a distinction between designated Wilderness Areas and wilderness opportunities as different concepts. Indeed this is useful as wilderness opportunities could quite likely exist outside designated Wilderness Area boundaries. However, this notion of a wilderness opportunity rests on the assumption of the *setting-experience* relationship, a linkage in ROS for which there is little theoretical foundation. The suggestion in the ROS framework is that there are particular combinations of setting factors that realise wilderness experiences in a like manner for all recreators. This, however, is not necessarily the case when

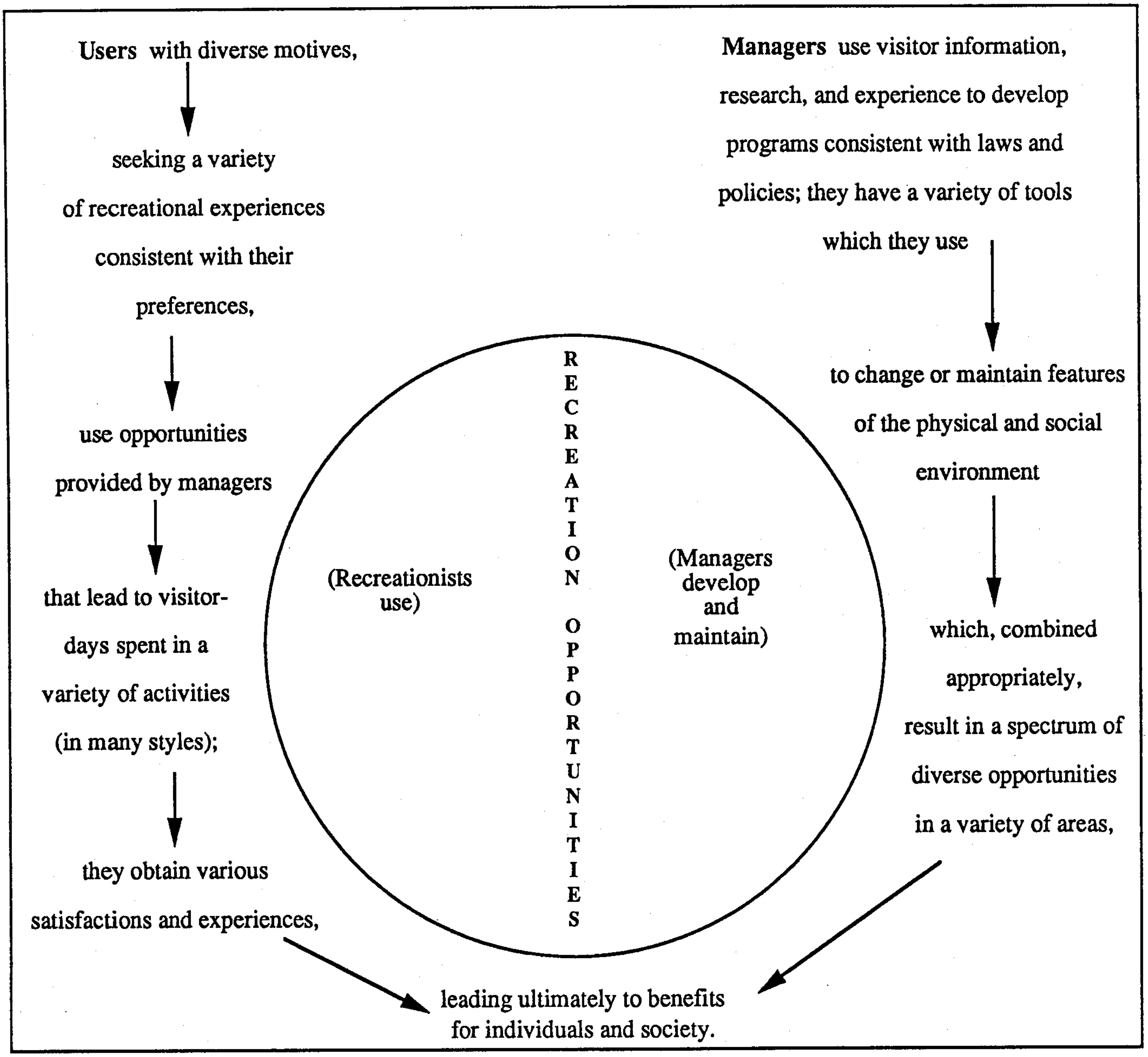


FIGURE 2.5: Recreation Opportunity Model (from Clark & Stankey 1979 p6)

wilderness, as an experience, can take place in many settings (this idea is examined further in Chapter 4).

ROS has been used in a more specific manner to indicate the types of recreation opportunity existing in designated Wilderness Areas and the types that should be prescribed. This may involve a more finely-divided spectrum for the natural end of the range.

ROS has also been applied as a wilderness opportunity spectrum (Haas & Plisco 1979). This application suggests that all aspects of wilderness management, that is, recreation, wildlife, scientific, and so on, can be prescribed after consideration of the conditions of wilderness that should be maintained (Brown *et al.* 1987). The varying conditions and uses in a designated Wilderness Area are considered to represent a spectrum of use opportunities which, given that diversity is desirable, can then be managed through a system of *wilderness opportunity zones* (Haas *et al.* 1987). The zoning defines desired conditions for different parts of the area which, for example, may comprise four zones: transition, semi-primitive, primitive and pristine (see Table 2.2). This approach to wilderness protection, obtained by developing management prescriptions for several zones has been termed a *staircase approach* (Haas *et al.* 1987). For example, those parts of an area managed under a pristine prescription would be maintained such that the quality of the resource and its use did not fall below defined pristine conditions. A similar situation would pertain to the other zones. One argument against over-reliance on a single management direction stems from the danger that the biophysical resource, and the use of it, will *bottom out* to the minimum conditions established for the entire area, as less pristine conditions expand and replace more pristine conditions. Consequently, wilderness opportunity zoning is touted as offering an effective strategy to maintain diversity and enhance protection of wilderness conditions (Haas *et al.* 1987).

The use of ROS has met with some degree of success in managing a diversity of outdoor recreation tastes. However, the application of ROS to the highly resource-dependent conditions of wilderness has largely been confounded by a need to substantiate clearly the relationship between activity, setting and experience characteristics of these conditions, and to offset the demand-driven emphasis of ROS with the biophysical assessment and monitoring of wilderness conditions. While an important foundation of ROS is the experiential characteristics of recreation, a theoretical footing to the linkage between environmental settings and wilderness experiences has not been forthcoming. However, so that settings can be specified which satisfy some users' expectations for wilderness, without necessarily requiring pristine or fragile ecosystems—and risking their damage—it is vital that settings perceived as wilderness by different users can be identified. This would effectively clarify the

Elements	Transition	Semi-primitive	Primitive	Pristine
Party size limitation (without special permit)	10	10	10	10
No camping within 100 feet of trails, streams, lakes	Yes	Yes	Yes	Yes
Percentage of groups to be contacted by rangers	90	33	25	10 or less
Camping in designated sites only	Yes	No	No	No
Campfires permitted	No	Yes	Yes	Yes
Trail maintenance standard	Level 3	Level 2	Level 1	No trails permitted
Average number of daily contacts with other groups during peak use season	20	5 - 20	0 - 5	0 - 2
Campsite condition class standard	3	3	2	2
Maximum size of campsites (square feet)	225	225	100	49

TABLE 2.2: Elements Defining Wilderness Management Zones, based on the Maroon Bells-Snowmass Interim Management Direction (from Haas *et al.* 1987)

setting-experience linkage for wilderness, and is in essence the object of this thesis. That some conditions are considered acceptable in a wilderness system, while others are not, reflects the shift of focus that has developed through the following concept, RCC, and it is from this formal basis that the limits of acceptable change approach has developed.

2.4.3 The Visitor Activity Management Process

A more market-oriented approach than ROS to the integration of user activity demands with resource opportunities, in order to identify appropriate recreation opportunities, is the Visitor Activity Management Process (VAMP). Developed in Canada for Environment Canada-Parks, VAMP is an attempt to integrate data about users and their characteristics and satisfactions with data about the natural environment of a protected area (Graham *et al.* 1987, 1988).

The basic premise of VAMP is that the process would determine in a rational way what is needed to support an agency's use function (stemming from a dual use-preservation mandate), what activities are appropriate in a protected area, and how the user might appreciate and enjoy the area (Graham *et al.* 1988). A strong emphasis is placed on the human element in protected areas management such as access, boundary definition, economic and social impacts related to visitor and traditional use, infrastructure development and regional integration. This concern with social science data attempts to identify users and their motivations in order to determine appropriate markets for protected areas. The process is essentially problem-and-issue driven with a series of structured decisions as its primary output (see Figure 2.6). Integration of this end-product with ecological data is envisaged as occurring in a broader protected areas management process.

The VAMP framework could, potentially, be applied to the management of wilderness conditions as an extension of the generic framework for a specific set of conditions. In this manner VAMP would operate in a comparable way to the use of ROS, as a WOS, for wilderness conditions. The major limitation in this is the simplistic view of recreation as an activity rather than an experience, in this case the wilderness experience. A modification of the VAMP framework to recognise the experiential conditions as a prime element in the process would seem necessary if it is to address usefully the wilderness management issue. There then arises a similar problem to that in ROS pertaining to the theoretical linkage between setting and experience.

VAMP is essentially a bureaucratic model and has yet to develop the mechanisms by which the ROS framework has been established. Nevertheless, VAMP is a comparable framework to ROS but with a marketing orientation for integrating visitor demands with resource opportunities to identify appropriate recreation opportunities. It would require considerable development in order to be applied effectively to the management of wilderness conditions.

2.4.4 The Limits of Acceptable Change Framework

The identification of carrying capacity levels and the development of opportunity spectrum zoning for wilderness conditions suggest that some conditions may be acceptable in wilderness while others may not be tolerated. The carrying capacity concept can thus be reconsidered in terms of a natural equilibrium, where use comes into balance with the biophysical environment, as a limits-to-change model (Frissell & Stankey 1972). This has been developed as a framework for wilderness

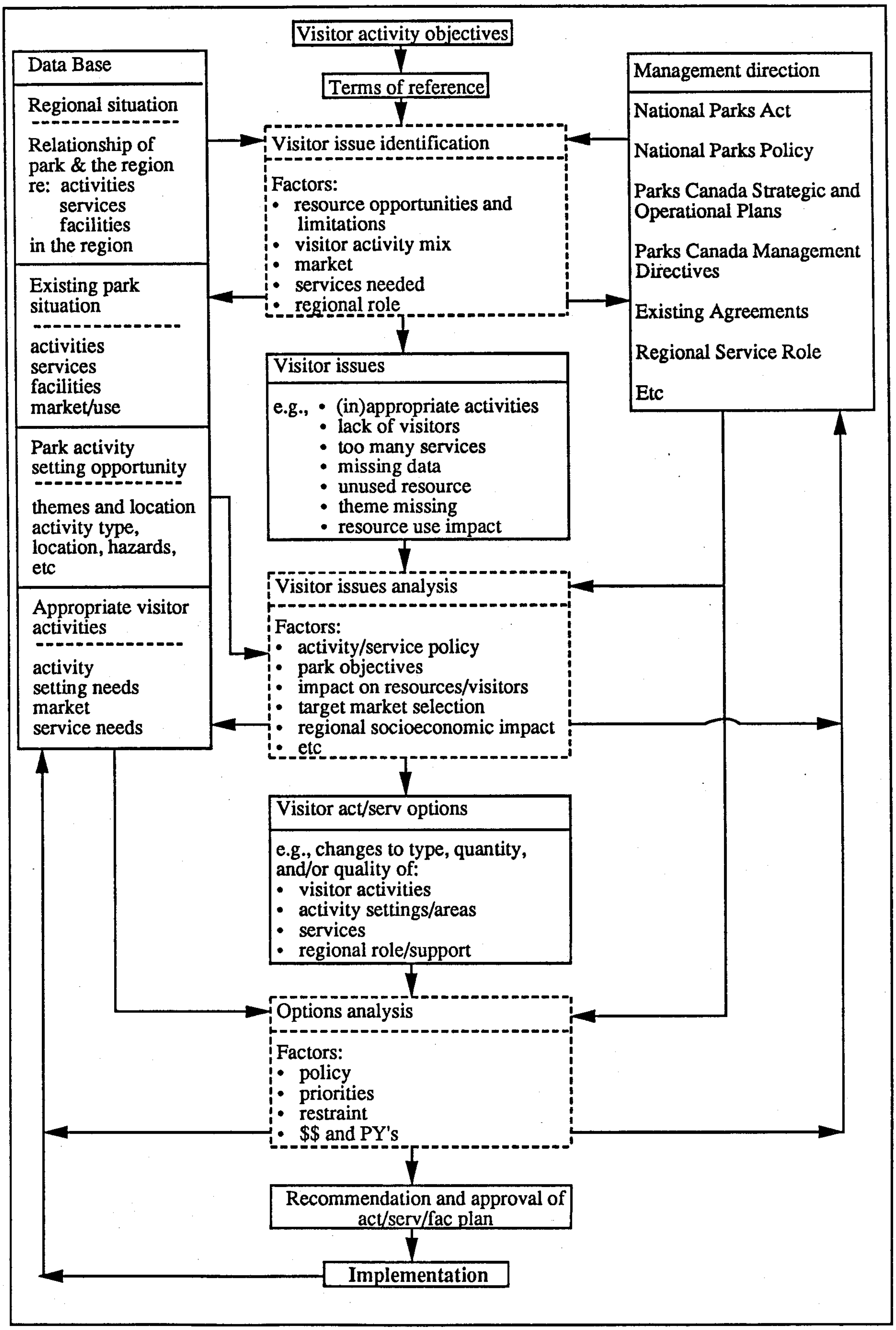


FIGURE 2.6: Model of VAMP Process (from Graham *et al.* 1988 p52)

management, known as the Limits of Acceptable Change (LAC) planning system (Stankey *et al.* 1985), with the primary emphasis being on the effects of use and the wilderness conditions desired in an area, rather than on how much use is occurring and how much an area can tolerate.

The LAC system is not an attempt to prevent human-induced change. Rather it is a means of deciding how much acceptable change may occur, and the actions needed to control it. The amount of change to be allowed is defined explicitly by means of quantitative standards, the appropriate management actions needed to prevent further change are identified, and the procedures for maintaining and evaluating management performance are established.

Given that any use produces some impact, the process requires management to identify where, and to what extent, varying degrees of change are appropriate and acceptable. Since use, and predominantly recreational use, is the primary source of change in otherwise natural conditions, LAC requires the definition of desired opportunity setting conditions and implementation of actions to maintain or achieve those conditions. ROS planning enables an inventory of environmental settings to be developed according to certain criteria which indicate the capability of various settings to provide opportunities for recreation activities and experiences. The concepts of ROS are thus extended to develop the LAC process which has further applicability for protected areas management. The crucial extension from the ROS framework is the specification of quantitative standards for physical and social indicators appropriate to each opportunity class. These are measurable aspects of previously defined indicators and effectively set out the maximum permissible change in natural conditions that will be allowed in a specific opportunity class.

Thus the LAC system establishes a procedure for deciding what biophysical and social conditions of wilderness are acceptable in a natural area as well as what actions are necessary to protect or achieve those conditions. The process consists of four major components:

1. Specification of acceptable and achievable resource and social conditions as defined by a series of measurable indicators;

2. analysis of the relationship between existing conditions and those judged acceptable;

3. identification of management actions necessary to achieve those conditions;

4. Monitoring the indicators of conditions, and evaluation of management effectiveness.

(Stankey *et al.* 1985)

The system follows general planning guidelines, includes a monitoring programme, and is an iterative procedure. The planning procedure for LAC consists of nine inter-related steps (see Figure 2.7), and provides a logical and explicit planning approach to natural area management which is particularly relevant to wilderness management by virtue of the emphasis it places on the conditions of wilderness.

The application of LAC raises a number of concerns, namely the selection of suitable biophysical and social indicators, and the development of appropriate standards (Prosser 1986). The extensive research-base on social and ecological dimensions derived from the carrying capacity concept in the United States is not necessarily available in other countries, such as New Zealand, though it may be possible to make inferences from the North American work (Stankey, in Prosser 1986). The standards actually adopted in the process are critical since they determine the future character of an area. However, any uncertainty related to the development of such standards can be ameliorated, through the later revision of standards in response to improved information which the feedback element in the process makes possible. A further concern with respect to LAC as a broader management framework has been alluded to:

> [The] *Limits of Acceptable Change framework is a logical process for problem identification and management based on a comparison of site conditions and selected standards . . . The emphasis on management of* conditions *rather than use* per se *. . . raises some questions . . . on how such management might actually take place . . . It seems inadequate to suggest that determining an area's capacity is simply a matter of observing the associated use level when conditions reach or are close to those identified as minimally acceptable . . . Existing impact conditions may have little to do with the overall density of visitors in an area. The suggestions that this approach gets around such problems as the lack of relationship between density and satisfaction offers little to quell the fears of those who see carrying capacity as an attempt to legitimise value judgements through research.*
>
> (Graefe *et al.* 1984)

Thus it is suggested that LAC fails to focus explicitly on the probable causes of unacceptable impacts as a precursor to evaluating alternative management actions.

The LAC process appears to be a rather complex process which, while forcing managers to think carefully about the purpose and process of their management, is impractical when the whole process must be followed (Krumpe 1988). In particular, steps 6–8 of the LAC model (see Figure 2.7) have been developed specifically

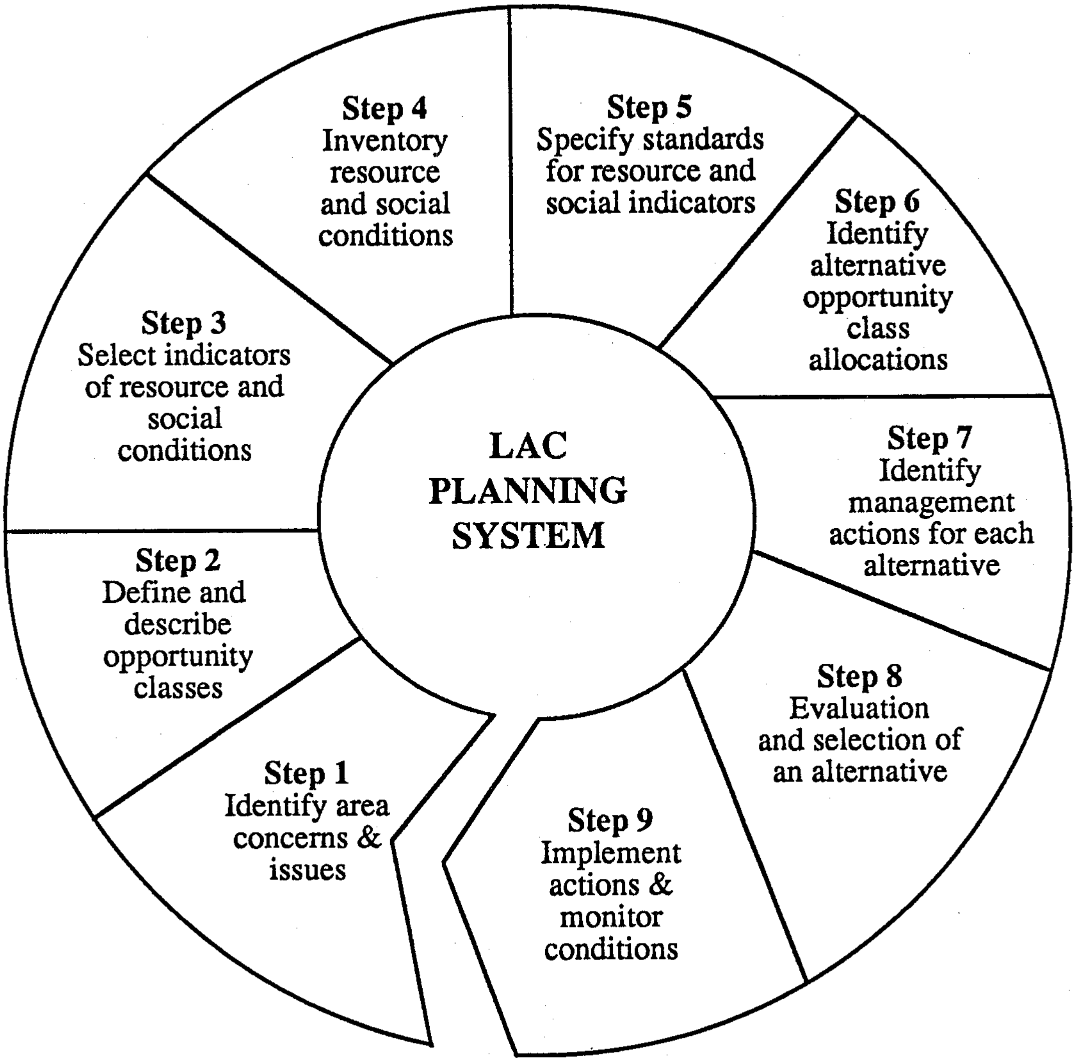


FIGURE 2.7: Representation of the LAC Planning System (from Stankey *et al.* 1985 p3)

to fit current legislative requirements in the United States, whereas in practice it may be more sensible to decide on management zones and then set standards which correspond to the objectives for each zone. Also the implementation and monitoring phases in step 9 of the model is unrealistic, given that the process requires considerable iteration in order to operate effectively in a given environment. Moreover, without an empirical basis to the selection of standards for an indicator, it will probably be more efficient to re-evaluate the indicators themselves, the data collected, the standards set, and the method of sampling. Management action could then proceed once standards have been validated through the re-evaluation step. A modified LAC process has been developed in response to these issues, and this constitutes a more pragmatic approach (Krumpe 1988, and see Figure 2.8).

At a more fundamental level, attention needs to be directed to understanding the role and importance of specific features of the recreation setting, or more particularly of the wilderness setting. This is especially important because such features are relatively undeveloped components of the LAC approach, as they are for the ROS concept. Significantly, it is the conditions of these settings which provide the focus of user behaviour and management action. The focus further implies recognisable and measurable expectations and standards of wilderness conditions which, in the work discussed above, are not adopted through a recognition of the multiple and perceptual nature of personal environmental cognition. This is considered to be a major shortfall in the LAC approach—one which this research aims to rectify.

In general terms, the LAC process is an extension of the ROS framework which reformulates the carrying capacity concept and provides a systematic framework for managing those wilderness conditions that are related to user behaviour and can be influenced by managers.

2.4.5 Visitor Impact Management

The visitor impact management (VIM) framework is an alternative decision framework for the management and reduction of visitor impacts in backcountry recreation settings (Graefe *et al.* 1986). VIM provides a sequential approach aimed at assessing and managing the impacts which threaten the quality of natural areas and experiences, and is therefore applicable to wilderness conditions. In a manner comparable to LAC, the VIM process has resulted from the failure of social carrying capacity models to accommodate the numerous factors of the users' experience and their complex inter-relationships (Stynes 1977 in Getz 1983), and the rejection of methodologies which ignore goals and objectives for resource management (Hendee *et al.* 1978).

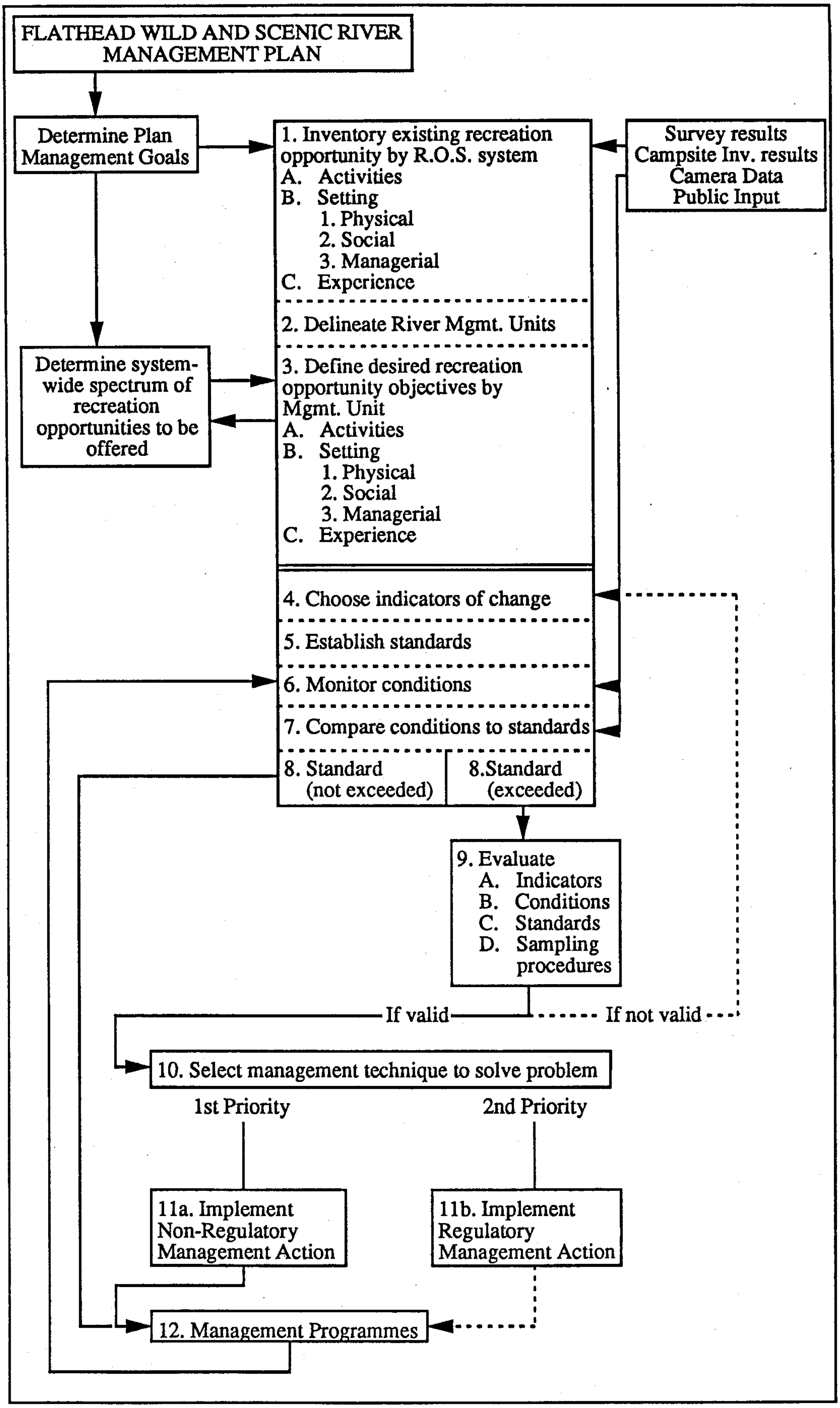


FIGURE 2.8: Modified LAC Process based on Flathead Wild and Scenic River Management Plan (from Krumpe 1988)

Recognition of these shortcomings, has led to the emergence of a systems approach which is intended to be comprehensive in scope, and relevant to recreational experiences (Getz 1983). Such an approach requires two separate components to be integrated. The first of these concerns general research aimed at describing and understanding the system, while the second is the application and evaluation of controls exerted on the system.

The *descriptive* component considers the relationships between specific elements of use and the impacts associated with these. That is, the observable characteristics of the wilderness system. These include management parameters, which can be directly implemented, and impact parameters which describe the effect on the user and the environment of management parameters. The *evaluative* component considers the relative merits of the different alternatives produced by the management parameters and is concerned with the manner in which the system should be managed. It is at this point that value judgements enter the process, with parallels to be drawn to Shelby and Heberlein's (1984) conceptualisation of the recreational carrying capacity process.

The VIM approach is notable for being built on the recognition that "... *any effective management strategy involves both scientific and evaluative (judgemental) considerations*" (Graefe & Vaske 1987). It contends with three issues which are considered inherent to managing user impacts:

- the identification of problem conditions (or unacceptable impacts upon wilderness experience);
- the determination of potential causal factors affecting the occurrence and severity of unacceptable impacts; and
- the selection of potential management strategies for ameliorating the unacceptable conditions.

(Graefe *et al.* 1986)

This approach is set out explicitly in an eight-step process (see Figure 2.9) which incorporates the use of objectives, indicators, and standards—which are also central features of the LAC framework.

Thus, the VIM framework is another management-by-objectives process resulting from the reconceptualisation of carrying capacity, in a similar vein to LAC. However, VIM focuses on the probable causes of unacceptable impacts as a prerequisite to the evaluation of alternative management objectives.

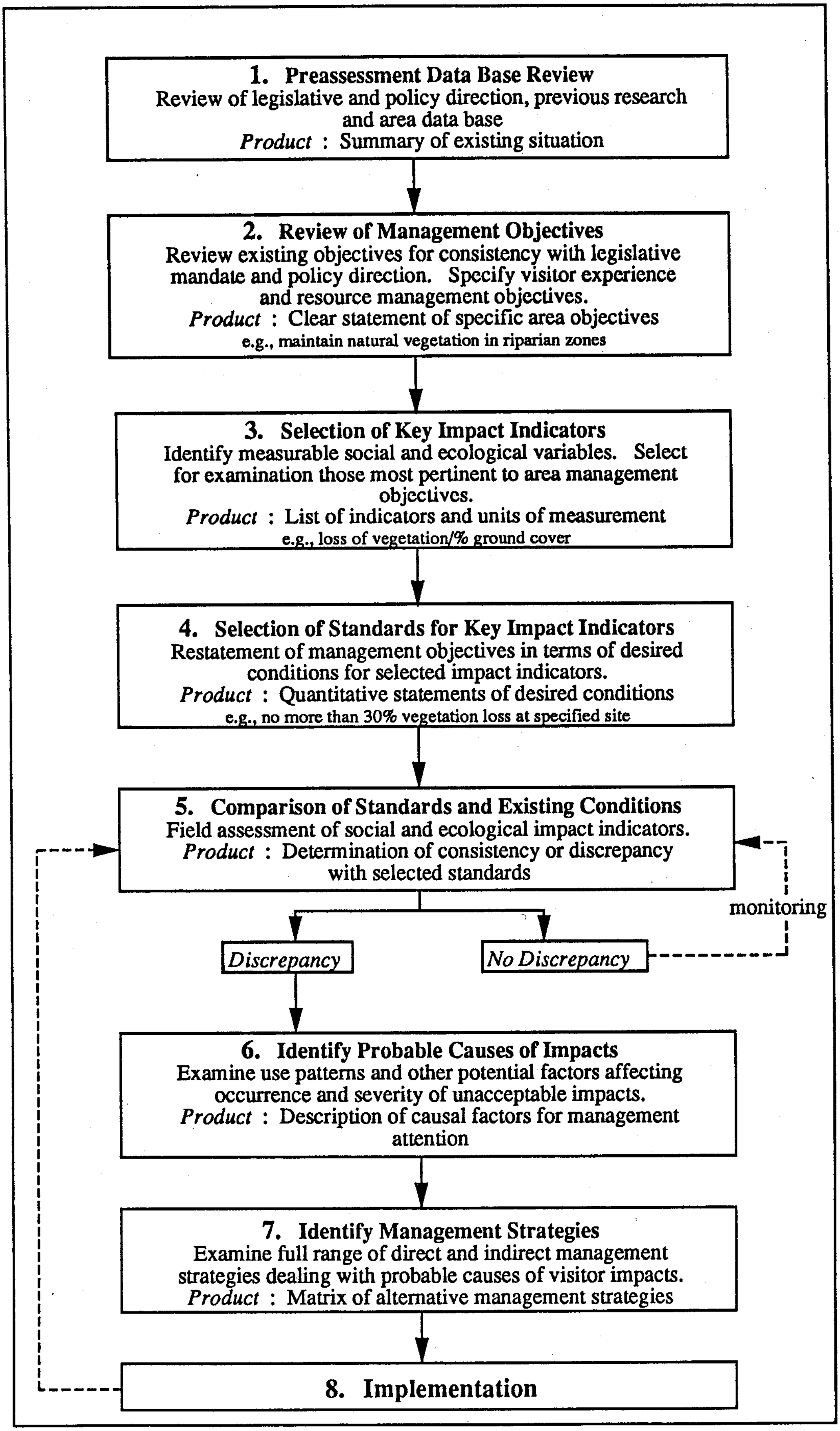


FIGURE 2.9: Representation of the VIM Planning Process (from Graefe *et al.* 1986 p434)

2.4.6 Experience-based Setting Management

The preceding approaches to the management of wilderness conditions can be collectively termed *experience-based* strategies which focus on managing use and users, natural areas, and impacts, to provide opportunities for wilderness experiences. The broad shift in emphasis that has occurred from the efforts centred on recreational carrying capacity to the development of LAC represents a consolidation of this experience-based focus.

The condition of the experience becomes of paramount importance to management and has led to yet another strategy *Experience-based setting management* (Manfredo *et al.* 1983) which implies that the psychological outcomes of user involvement in specific settings are important. With respect to wilderness conditions, it is management of resources and users which will increase the probability that wilderness experiences can be realised (Brown *et al.* 1987). The ROS and LAC processes are both consistent with experience-based management and are likely to contribute to the development of this strategy in more operational terms. However, while the condition of the experience is emphasised this must be supported by a sound understanding of the nature of the wilderness experience and the settings which for different users, leads to the experience. The identification and delimitation of such multiple conditions of the wilderness experience has been absent in the various experience-based approaches discussed above, yet is paramount to such a perspective.

The broad type of management approach considered thus far implies a primary concern with the expectations of the user, rather than a pre-determined standard of the biophysical environment. While the latter is an important element of the LAC approach, it is useful at this stage to examine more *ecologically-oriented* approaches to wilderness management.

2.4.7 Ecology-based Approaches to Wilderness Management

By contrast to experience-based approaches, approaches to managing wilderness conditions may also focus on managing use, natural areas, and impacts in order to protect undisturbed wilderness ecosystems. Thus, while the objects of management are the same, the purpose differs, reflecting a more biocentric wilderness management philosophy. Two such ecologically-based approaches have emerged which can be applied to the management of wilderness conditions namely the ecological component in planning, and ultimate environmental thresholds.

An Ecological Component in Planning

The ecological conditions of wilderness inherent in the phenomenal environment of the wilderness system are as important in the system as the experiential conditions. As such, the inclusion of ecological information in the planning process has been vital (Cain 1968), though the the manner by which such information can be assessed, organised and incorporated into the natural resource management process has evidently been confused (Caldwell 1970, Regier & Cowell 1972, Skinner 1976).

Two essential components, *ecological* and *threshold* evaluations, have been suggested for an ecological input into the planning process which provides the link necessary to mediate ecological components and resource management decisions (Dearden 1978). These components are considered within a conceptual framework for organising ecological information in natural resource management (Figure 2.10).

The ecological evaluation component involves the assessment of a natural area in terms of its relative ecological values, and in particular its value for conservation purposes. This type of evaluation lends itself to protecting areas of vital ecological concern. The basis for the approximation of ecological values has commonly involved species and habitat diversity (Regier & Cowell 1972) as well as rarity (Tubbs & Blackwood 1971). Thus, in the management system those areas of high ecological value would preferably be protected while potential use could be considered in lower value areas (Dearden 1978).

The determination of ecological thresholds is the second ecological component, and can be generalised as ecosystem resilience, that is, the ability of an ecosystem to absorb continuous stress and still persist (Dearden 1978). The specification of an ecological threshold suggests that there is a level at which the use of a natural area becomes incompatible with the protection of its inherent species diversity and rarity. The likely consequence is that the ecosystem sustains irrevocable damage. This could also possibly refer to perceivable damage that is slow to recover, although in this approach it is the capacity to recover that is of concern, rather than any evidence of temporary impact. This arises from the biocentric philosophy underpinning the approach.

In the conceptual framework (see Figure 2.10), the assessment of relative ecological value within a natural area (ecological evaluation), and a consideration of the natural ecosystem's capacity to sustain use (threshold evaluation) form the major ecological inputs. If, on the basis of these evaluations, potential or actual use is incompatible with the high ecological value determined for an area, then planning and management decisions are necessary to maintain wilderness conditions.

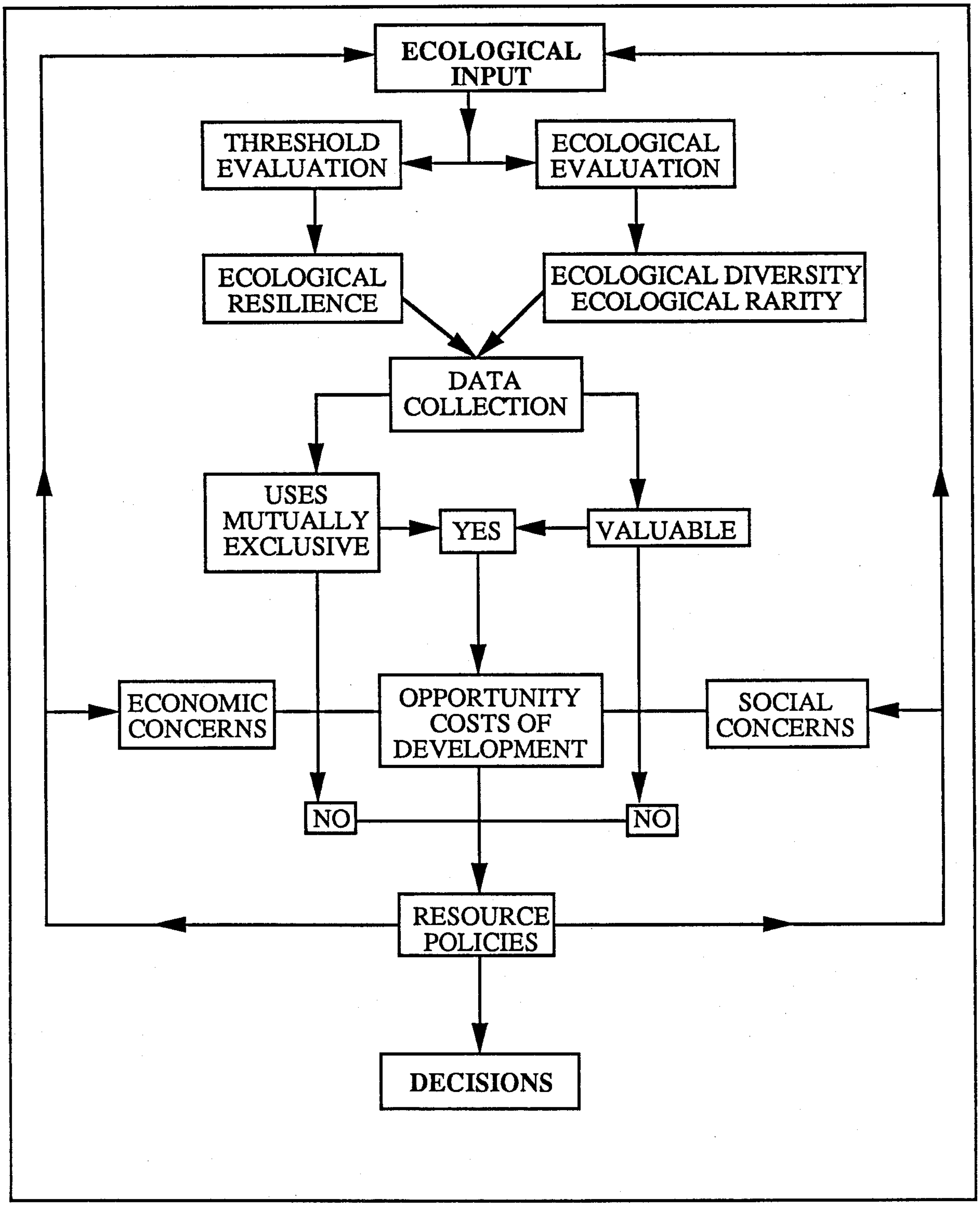


FIGURE 2.10: Conceptual Framework for the Organisation of Ecological Information for Natural Resource Management (from Dearden 1978)

Thus, this ecological component in management is essentially a conceptualisation of biophysical carrying capacity with an emphasis on ecological data.

Ultimate Environmental Thresholds

The ecological threshold component has undergone considerable development, as a means of protecting valuable ecosystems from degradation by human use (Kozlowski 1984). Known as Ultimate Environmental Thresholds (UET), the concept is based on the notion that human use in protected areas should be kept within the environmental capacity of such areas. To this end, UETs have been defined as "the stress limit beyond which a given ecosystem becomes incapable of returning to its original condition and balance" (Kozlowski 1985), and can therefore be used to determine areas from which particular types and levels of use should be excluded. With respect to wilderness conditions, the application of the UET method would determine zones of exclusion from use and as a result also from wilderness experience in order to maintain the ecological conditions of wilderness.

The environmental capacity of an area that UETs express in fact comprises three dimensions of use in the area concerned: the spatial dimension (*territorial* UET); carrying capacity (*quantitative* UET); and the seasonal constraints (*temporal* UET). These require some measure of environmental quality of the key environmental elements of the area—e.g. vegetation, fauna, geomorphic structure—and are expressed in terms of *uniqueness*, *resistance*, and *transformation* of the elements. Such measures of quality appear to relate, in part at least, to the ecological evaluation component of the previous approach. Uniqueness refers to the frequency of occurrence of a particular environmental element within a given region; resistance of a particular element to damage from human use denotes its ability to withstand the effects and to regenerate; while transformation determines how substantially a particular element has been altered from its original state (Kozlowski 1984, 1985). The analysis process for UETs thus involves the definition of exclusion zones based on uniqueness, resistance, and the definition of the relationship between exclusion zones and the existing situation (Rosier *et al.* 1986, and see Figure 2.11).

In effect, the UET approach is an elaboration of the ecological component in planning (Dearden 1978) but applied within a more explicit framework and with a more biocentric purpose. As an approach for wilderness management it would obviously concentrate heavily on the ecological conditions of wilderness, reflecting its biophysical carrying capacity characteristics, but would still require consideration within a wider process if the experiential conditions of wilderness are

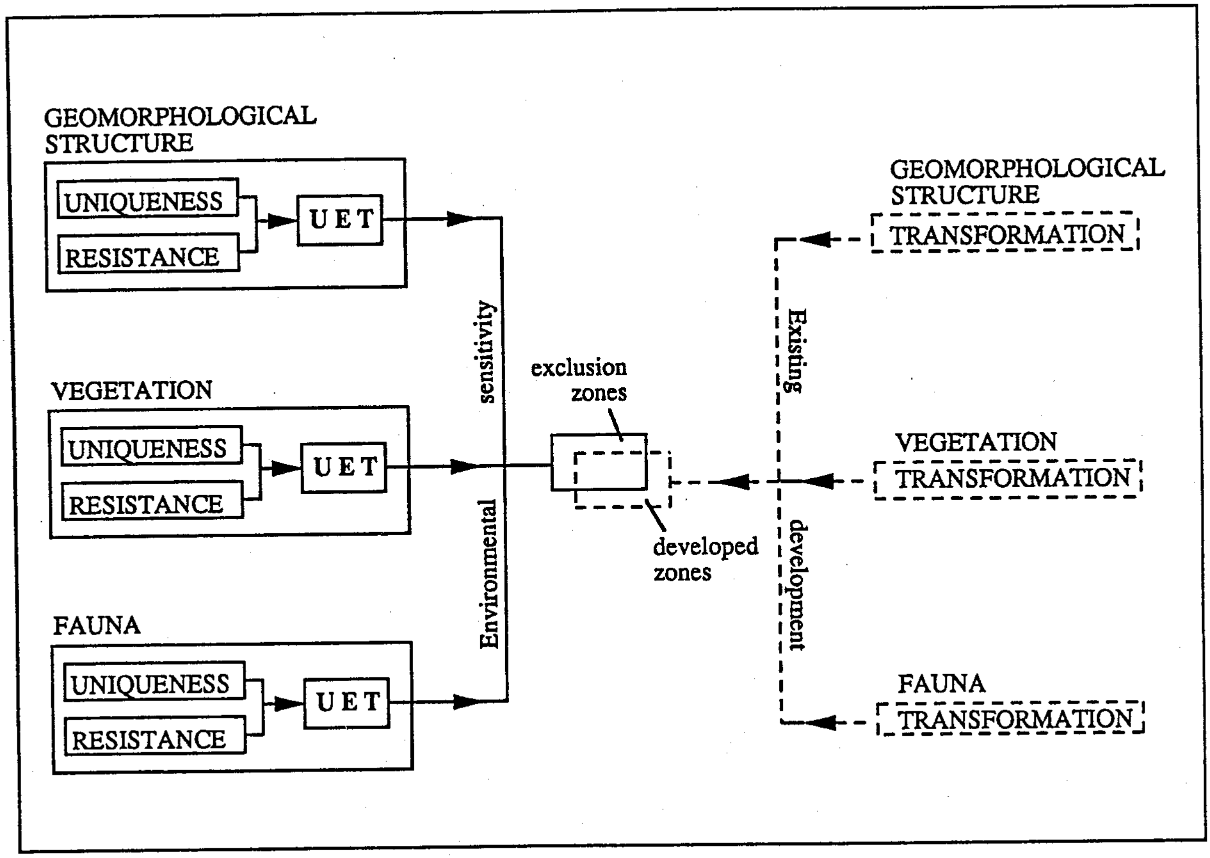


FIGURE 2.11: Analysis Process involving UET (from Rosier *et al.* 1986)

to be accommodated as well. Thus the ecology-based approaches emphasise resource protection by identifying areas from which all use should be excluded, and when combined with the identification of areas providing experiential conditions of wilderness, to some users but not others, may provide the necessary database for balancing use and preservation.

2.4.8 Techniques for Application within Wilderness Management Strategies

The focus of the discussion thus far has been on the strategic or conceptual approach to wilderness management but it is useful to examine briefly the tactics or techniques of wilderness management, since the implementation of a particular approach relies upon these factors. A plethora of techniques and methods has developed in outdoor recreation and parks management as tools with which to invoke the decisions resulting from wilderness management approaches (Lime 1976, Hendee *et al.* 1978, Manning 1979, Brown *et al.* 1987, Cole et al. 1987, Jim 1987). Such management tools "... *are the means of meeting the conditions specified by management objectives and standards*" (Brown *et al.* 1987), that result from the application of a conceptual framework for managing conditions of wilderness.

Management tools are likely to relate either to site management or to visitor management. Site management methods are directed at the consequences of visitor behaviour upon ecosystems and include aspects such as: rehabilitation of track or site conditions; hardening of site conditions; development or rationalisation of facilities; or expansion of the park area (Lime 1976, Manning 1979). The majority of techniques, however, involve the management of visitor use and/or behaviour (Hendee *et al.* 1978).

A recent typology of visitor management techniques (Jim 1989) considers a sequence of potential measures involving *soft*, *intermediate*, and *regimental* methods. Soft measures involve indirect influence or modification of use or user behaviour. These include visitor information and education efforts such as encouraging minimum-impact ethics and techniques, that is, education in an *outdoor code*, and providing interpretative material. Intermediate measures are those aimed at redistributing use, either spatially or temporally, in order to lessen impacts in over-used or vulnerable areas and so reduce user conflicts. Use may, therefore, be dispersed over a wider geographic area or alternatively encouraged away from the peak user season. Regimental measures involve direct regulation or rationing of use in an area, and are generally regarded as extreme measures. Rationing may be instituted through various systems based on reservation and permit, supply and demand (i.e. a market-based approach), *first come first served*, or by selection on merit (Hardin 1969, Stankey & Baden 1977). Of course there are limitations and shortcomings with any technique and these have been the subject of much research activity (Stankey & Baden 1977, Washburne & Cole 1983, Cole *et al.* 1987).

There is a considerable array of techniques for visitor and site management for wilderness conditions and which are vital for implementing a suitable approach to wilderness management. However, the selected techniques must be appropriate to the general management approach adopted, the conditions sought, and to the objectives set if the approach is to be effective. Thus there are effective potential techniques so that it is the development of the right strategy that requires thinking through.

2.4.9 Approaches to the Management of Wilderness Conditions

The main impetus to develop strategies for wilderness management has been provided by the outdoor recreation planning research of the United States Forest Service. The essentially experience-based approaches of RCC, ROS, LAC and VIM have developed in succession, and represent a major shift in management concern from appropriate use levels under wilderness conditions, to a concern for the limits of change in conditions acceptable for wilderness. This conceptual development has culminated in an experience-based approach to the management of wilderness conditions that incorporates ROS and LAC concepts. As such the approach rests on an explicit elucidation of the relationship between settings and experiences for wilderness conditions—a linkage which is a major shortcoming of the ROS and LAC concepts. Notwithstanding this need for further research—which this thesis should help to alleviate—the LAC framework is probably the most comprehensive approach to wilderness management to emerge, particularly given its ability to integrate biocentric and anthropocentric perspectives relatively evenly.

The two ecology-based approaches have considerable potential for application to the ecological conditions of wilderness, naturally enough, but take no account of experiential conditions. However, the inclusion of the evaluative components of the UET process in the LAC framework could prove useful. This effectively adds a heavier biocentric perspective to the experience-based approach.

All the approaches towards wilderness management that have been considered are based on, or are reformulations of, the carrying capacity concept. It further appears that some of the approaches have developed in isolation from others. The essential differences between them, therefore, arise from their underlying philosophical perspective, on the biocentric–anthropocentric continuum, and in the structuring of the framework in which they are applied. As such there is an important difference between planning for ecological conditions pertaining to wilderness, which implies no human impact as far as possible, and the experiential conditions of wilderness, which can take place in a variety of natural environments of usually low impact. Thus, ecological and experiential planning methods can be vastly different as has been highlighted above. What is necessary is a way of doing justice to both types of conditions and integrating the different management perspectives. A suitable kind of analytical framework would combine an ecological analysis, which the UET method supports, with an experiential analysis, which the LAC system establishes. However, the need for the understanding of wilderness in experiential terms, as the latter suggests, must recognise the multiple and perceptual nature of environmental cognition if it is to be effective, and therefore, if the above framework is to address successfully the wilderness management issue.

2.5 Conclusion

This chapter has examined conceptual approaches to managing conditions of wilderness and the search to achieve a balance between preservation and use in the protected areas system—the central issue of wilderness management. Perhaps more significant, the consideration of these approaches has been from the viewpoint of managing a set of conditions, ecological and experiential, rather than specifically designated areas, although in a wider sense these conditions will be found generally, though not exclusively, in the protected areas system.

The wilderness concept itself is a culturally-imbued notion which, in countries such as New Zealand, United States and Canada, is viewed contemporarily with increasing positiveness and attraction. While in the United States the concept equates rather strongly with a legislated definition and specific areas, the wilderness concept in New Zealand is more closely tied to a broader state of mind. The philosophical rationale behind a particular effort to preserve or protect natural areas—wilderness preservation—is a manifestation of the attitudes discussed above, and can be thought of as lying on a spectrum between two poles representing anthropocentric and biocentric approaches.

The notion of wilderness management, while apparently a paradox, is commonly accepted as a necessary measure if protected areas are to be maintained in a relatively undisturbed state and backcountry visitors are to be able to elicit satisfactory wilderness experiences. Thus, the real issue revolves around the actual approach taken to the wilderness management issue in maintaining an appropriate balance.

Management approaches or strategies that address, or can be applied to, the management of wilderness conditions generally fall into three broad types. Experience-based approaches, which include RCC, ROS, LAC and VIM, have specific applicability to contend with conditions of wilderness—even though their development has stemmed from a concern for those particular conditions of designated Wilderness Areas. These approaches reflect a broadly anthropocentric orientation arising from concerns for the quality of the visitor experience, although LAC does take account of biological as well as social conditions. Ecology-based approaches stem from concerns for anthropogenic impacts upon natural ecosystems and are biocentrically oriented. They do not, however, include a consideration of experiential conditions. While the UET approach can provide an important ecological component, it does not operate as a balanced strategy. A common thread in all the types of conceptual approaches that have been developed for addressing the balance between use and preservation in protected areas is the notion of carrying capacity.

The management of conditions of wilderness is a form of balancing act between ecological and experiential conditions of natural areas and, therefore, requires appropriate information on both aspects as a basis for informed management decisions. LAC has emerged as the most highly developed planning approach directed at achieving this balance and providing a framework on which both sets of conditions can be assessed. The incorporation of the UET concept with this approach would further enhance the ecological input to the framework. As has been discussed above ecological conditions of wilderness is ideally an absolute state, which could still be acceptable in a slightly modified form, whereas experiential conditions of wilderness can be found wherever users perceive it. Thus, there remains a need to improve the experiential input to the framework, that is characterised by the setting-experience relationship underlying LAC and requiring further elucidation. It is important that this shortcoming is alleviated, and clear that it requires a perceptual approach to identify differences in conditions which provide wilderness experiences for individuals. It is further apparent that a spatial context would also be useful for the geographic identification of such variation, and its subsequent operationalisation for management.

The development of a perceptual basis for addressing the wilderness management issue is considered in Chapter 4, and the further consideration of a spatial context is taken up in Chapter 5. Prior to this Chapter 3 examines the approach to wilderness management practised in New Zealand.

3

Wilderness Management in New Zealand

The previous chapter has outlined theoretical approaches, and their limitations, to the management of wilderness conditions, while forthcoming chapters develop and apply a concept which purports to enhance such approaches. However, before doing so, it is necessary to examine current management practices for wilderness conditions in order to establish the institutional and real-world context in which the proposed concept is to operate. The overall purpose of this chapter, therefore, is to examine the practice of wilderness management in New Zealand. First, the development of wilderness management in New Zealand is explored. Second, contemporary wilderness management practices in New Zealand are considered by looking at the institutional arrangements surrounding the protected area system, and the type of wilderness management that has resulted. Third, an international comparative analysis of New Zealand wilderness management practices is undertaken with respect to the United States, Canada and Australia.

3.1 Introduction

The natural resource management system which forms the wider system, in which wilderness management operates, provides a useful context in which to examine the practice of wilderness management in a real world situation. In the case of wilderness management in New Zealand the appropriate natural resource management system is the country's protected areas system which, in the main, comprises *National Parks*, *Conservation Parks*, *Reserves*, and *Stewardship Areas*.

A natural resource management system can be considered to be a human ecosystem (Micklin 1973, Machlis & Tichnell 1985) resulting from the interaction of population, social organisation, and technology in response to a set of environmental conditions (see Figure 3.1). Consequently, the concept of a natural resource management system offers a means for analysis (Miller *et al.* 1987), in which the relationship of a society to its geographic environment, and "... *the human interdependencies that develop in the action and reaction of a population to its habitat*" (Hawley 1950 p72), are of particular interest.

The major interacting components of the protected areas system are: the protected area users or visitors (population); institutional arrangements, including the appropriate planning process of the protected areas system (social organisation); and, the protected area ecosystems (environment). Within the context of these interacting variables (see Figure 3.1) it is useful to consider the practice of wilderness management.

3.2 The Emergence of Wilderness Management in New Zealand

The emergence of efforts in New Zealand to balance experiential conditions of wilderness with the maintenance of ecological conditions in natural environments is closely linked to the evolution of the wilderness concept in New Zealand, and the parallel development of natural area preservation. There have been thorough examinations of both the evolving nature of the wilderness concept in New Zealand (Hall 1988a, 1988b, Shultis 1991), and the historical roots and development of protected areas, especially National Parks (Harris 1974, Thom 1987, Shultis 1990). While this section intertwines aspects from each, it is for the purpose of highlighting influencing factors in management approaches and is not intended to be a comprehensive account of either.

3.2.1 Early Preservation of Natural Environments

The act of preserving natural environments in the United States represented the first efforts to *manage* conditions of wilderness in that country (see Chapter 1). In a similar way, the preservation of natural areas in New Zealand has marked initial, albeit implicit, wilderness management efforts. Moreover, the designation of National Parks has both contributed to establishing management of wilderness conditions, if only in a precursory fashion. The wilderness concept itself has largely been an imported idea to New Zealand, having strong parallels to the origin of the

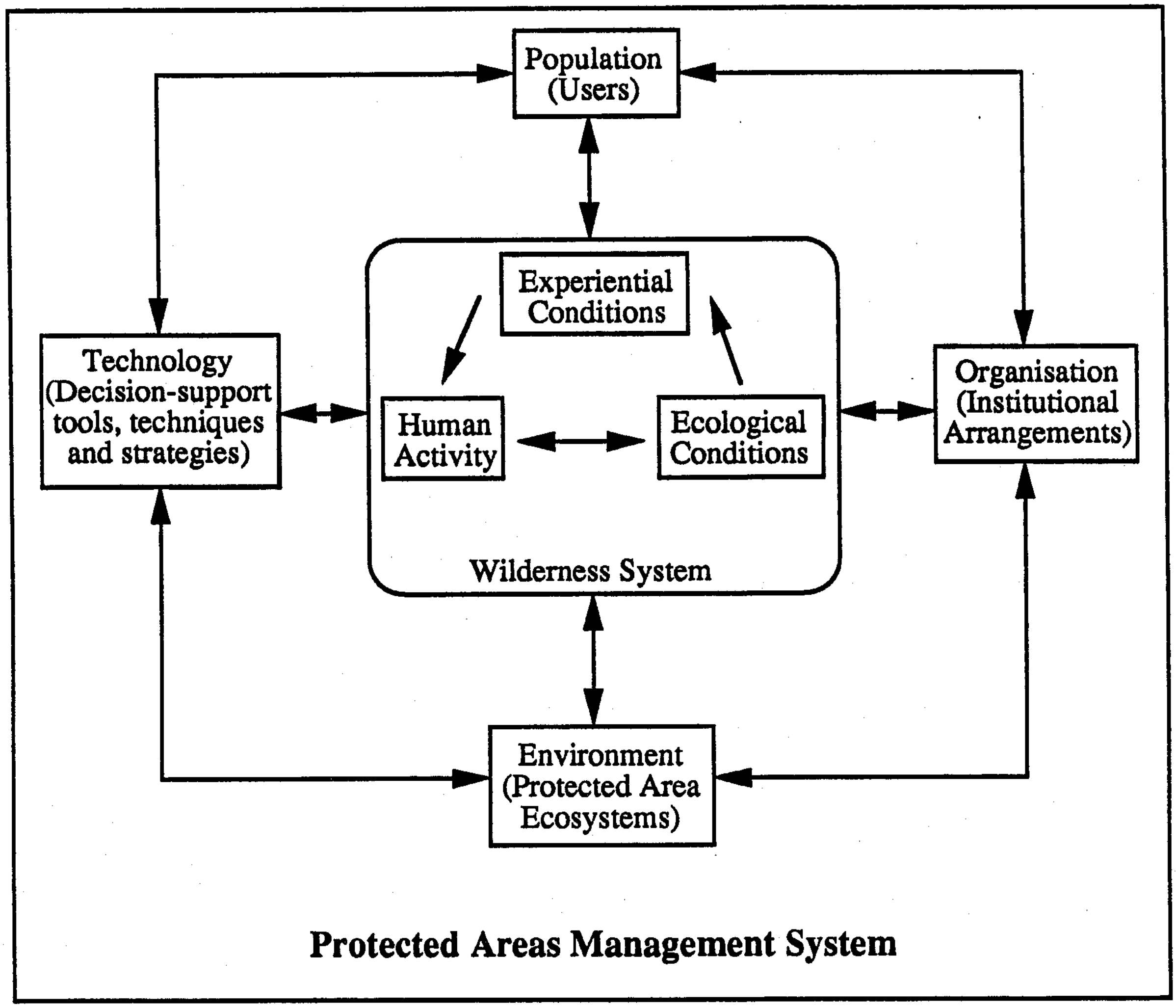


FIGURE 3.1: Protected Areas Management System as a Human Ecosystem (after Machlis & Tichnell 1985)

wilderness idea in other New World countries.

European settlers of New Zealand in the mid-1800s had their attitudes to natural environments shaped by their mother country—which was Britain in most cases. However, any pre-existing notion of a Romantic wilderness changed quickly with early pioneers' first contact with their new environment (Shultis 1991). The surrounding wilderness was seen primarily as desolate and worthless, as land that needed to be cleared for agriculture or other human use. In contrast, by the late 1880s emerging preservationist attitudes (Hall 1988b) gave the earliest expressions of a desire to preserve New Zealand's wild country. These views were realised by the designation of New Zealand's first National Park, encompassing the mountainous region of Tongariro. However, when the peaks of Tongariro were gifted to the New Zealand Government in 1887 by Te Heu Heu Tukino, chief of the Ngati Tuwharetoa tribe, the reasons appear to have been political and spiritual (Thom 1987). While this action represented the first effort in the country to preserve wilderness, the motives for the Government's designation of *Tongariro National Park* in 1894 were essentially utilitarian, namely type of landscape, otherwise worthless lands, revenue generation (principally through tourism), spectacular landscape, and public recreation (Runte 1973, Shultis 1989). In many ways this mirrored the rationale for designating the first national parks in the United States, Australia and Canada respectively.

Other areas were to be designated. These included much of Fiordland, reserved for national park purposes in 1905 and finally constituted as a national park in 1952, while in 1929 *Arthur's Pass National Park* was established. In practice, the two main proponents (and users) of natural areas were the climbing/mountaineering and deerstalking/fishing fraternities. However, while wilderness was considered in more positive terms during this period, the dominant attitude towards national parks was that they were provided for the purposes of recreation and tourism (Hall 1988b). The perception remained of wilderness from an anthropocentric view.

A degree of protection for natural environments was, therefore, only a fortunate by-product of national park declaration. Any notion of management applied to wilderness was purely by default; that is, the result of an area's designation rather than any conscious action.

3.2.2 An Evolving Protected Areas System

Until the passage of the *National Parks Act* 1952, and the subsequent establishment of the National Parks Authority, national park planning lacked a co-ordinated and systematic approach (Thompson 1976). The 1952 *National Parks Act* brought together hitherto separately enacted and managed parks for the purpose of:

... preserving in perpetuity as National Parks, for the benefit and enjoyment of the public, areas of New Zealand that contain scenery of such distinctive quality or natural features so beautiful or unique that their preservation is in the national interest.

(*National Parks Act 1952* s.4(1))

With the creation of the National Parks Authority, administered by the Department of Lands and Survey (DoLS), came an explicit expression on the one hand for the functions of providing facilities, such as huts and tracks, thereby enhancing public enjoyment of the parks, and on the other hand for wild (introduced) animal control, thereby protecting ecological conditions of the park.

As was the case with the United States and Canadian national parks legislation, which it emulated, New Zealand's first national parks Act portrayed a strong recreational perspective (Hall 1988b). This anthropocentric perspective carried through to wilderness, to which New Zealand's national parks were equated:

The ... conception of a national park is that of a wilderness area set apart for preservation in as near as possible its natural state, but made available for and accessible to the general public, who are allowed and encouraged to visit the reserve. In such an area the recreation and enjoyment of the public is a main purpose, but at the same time the natural scenery, flora and fauna are interfered with as little as possible. Such a reserve should contain scenery of distinctive quality, or some natural features so extraordinary or unique as to be of national interest and importance, and as a rule it should be extensive in area.

(Cooper 1944, in Thompson 1976 p11)

National Parks were commonly conceived as wilderness, a popular perception at the present time (Kearsley 1985a), while both represented recreational rather than ecological values. The 1952 Act (succeeded by the *National Parks Act 1980*) did, however, make allowance for Wilderness Areas to be set apart as a distinct status of protected area[1]. Consequently, legal recognition of the wilderness concept in New Zealand was initiated, with the first Wilderness Area established in 1955.

The *Reserves and Domains Act 1953* (later repealed by the *Reserves Act 1977*) brought the country's various scenic and amenity reserves into a commonly co-ordinated reserves system in a similar manner to the national parks system under its parent Act. The *Reserves and Domains Act* also made allowance for Wilderness

[1] see Appendix A for the definition of a Wilderness Area under this and subsequent legislation.

Areas (see Appendix A), although no such areas were established in the reserves system during its currency.

A degree of protection for ecological values was more obviously provided in the protected areas provisions of the *Wildlife Act 1953*. A current statute, this Act also contributes to the protected areas system by providing for sanctuaries, refuges and management reserves to protect native and introduced wildlife populations and their habitats. It also made allowance for their management, under the responsibility of the Department of Internal Affairs' Wildlife Service. With respect to these protected areas, the Act provides a preservation mandate but, understandably, does not express any provision for the public use of such areas, as contained in the *National Parks Act*—although, conceivably, it could.

A further component of the country's evolving protected areas was its State Forests. Administered by the New Zealand Forest Service (NZFS) under the 1949 *Forest Act*, State Forests were intended to aid the prevention of uncontrolled depletion of native forest resources and the preservation of forested high country as water and soil conservation areas. While the provision of recreation was not a specific function of the NZFS, the 1949 Act did recognise recreational use in State Forests.

During the 1950s and early 1960s the evolving protected areas systems of parks, forests and reserves underwent a more co-ordinated approach to their management, the result of changing attitudes and legislative changes. These areas were, however, maintained with relatively low levels of manpower and intervention (Roche 1979). An emerging legal recognition of Wilderness Areas was also prominent.

3.2.3 Backcountry Boom and Outdoor Recreation Planning

A broadening public awareness of the environment during the 1960s, precipitated by the campaign to save Lake Manapouri from hydro-electric development, coupled with the backcountry recreation boom of the 1960s and 1970s (Catton 1971, Mason 1975), resulted in the first conscious awareness of pressures on natural areas, the necessity to establish new park areas, and a need to manage existing uses. The management of protected areas consequently received serious consideration with the DoLS (responsible for National Parks), and the NZFS (responsible for State Forests, both exotic and indigenous), adopting more directed approaches to outdoor recreation planning, an example of which, was the recreation operations planning system (ROPS). Another significant development which helped mould efforts during this period was the strengthening of the outdoor movement in New Zealand, which centred around the Federated Mountain Clubs (FMC).

In 1965 an amendment to the *Forest Act* provided for the constitution of *Forest Parks* by the NZFS expressly for recreation, and for soil and water conservation purposes. These were essentially native forests, invariably in the high country, for which production values from logging were uneconomic, yet which provided suitable areas for public recreation. The changing view of the NZFS to recognise the recreational values of State Forests as comparable in importance to production values (Burrell 1981), gave a greater importance to the Forest Parks system, cementing their role as complementary to the National Parks and Reserves systems. Provision for Wilderness Areas in State Forests followed with a 1976 amendment to the *Forest Act* (see Appendix A) which established a definition very similar to the *National Parks Act* and the *Reserves and Domains Act.* In fact, much of the Forest Park system provided conditions of wilderness to the same, or an even greater, extent than National Parks and Reserves. The relative lack of development also contributed to wilderness conditions in Forest Parks, but equally their lesser popularity meant a diminished awareness of potential for wilderness in such areas.

Despite the clear recognition of Wilderness Areas in legislation the FMC was particularly active in promulgating attempts to define more explicitly the wilderness concept. While the various Acts discussed above had made allowance for the creation of wilderness areas within parks and forests, the FMC felt that the wilderness concept itself required greater clarification (Burrell 1981), and sought to assimilate broad, individual concepts of wilderness into their 'mountain recreation' wilderness. The following conclusions from an FMC Wilderness sub-committee typified these intentions:

> *There is a general and wide-spread desire on the part of trampers and climbers to have some large undeveloped areas in New Zealand set aside as wilderness areas. The primary motivation appears to be the desire to maintain areas wherein trampers and climbers must be entirely dependent on their own resources, preferably for days on end.*
>
> *The desire is laudable and understandable. It is natural that we should wish to leave for future generations areas which, if no longer completely unexplored, are at least unhutted, untracked and unbridged.*
>
> *This motivation behind mountaineering proponents of wilderness areas can be considered to some degree a selfish one, but as is evident when the problem is analysed, wilderness means different things to different people. Other sections of the community have their own wilderness needs and it is only right that these as well as the mountaineers' needs should be met.*
>
> *Some 'mountaineers' wilderness areas are justifiable and desirable, but they should be few in number and as far as possible not at the expense of the wider recreational needs of the public.*

> *The purpose of creating wilderness areas is not explicitly stated in the National Parks or Reserves and Domains Acts. It would appear that the predominant aim is nature protection, i.e. wilderness for plants rather than wilderness for people. In this case the Act does not specifically cater for the wilderness need of mountaineers. Any type of wilderness area should be kept "in a state of nature" which means the preservation of all indigenous plants and animals in the same ecological balance as occurred before the advent of man. Without such preservation, the wilderness value to humans would be drastically reduced, if not entirely lost. It is suggested that the purpose of wilderness should not be nature protection as such—for this there are other types of special areas, national parks and state forests...*
>
> (Burrell 1981 p101)

This view of wilderness, and initiatives to preserve areas as wilderness for, as well as from, recreational use, were voiced repeatedly throughout the 1970s (Molloy 1972, 1976, 1978, 1979), and had considerable influence upon NZFS and DoLS efforts.

The apparent need for separate ecological recognition in protected areas was addressed in the *Reserves Act 1977* (replacing the *Reserves and Domains Act 1953*). This was intended to provide legislation which would ensure the preservation, protection, and management of reserves in times of increasing land use pressure and, at the same time, provide an assurance of their availability for public use where appropriate. A range of reserve types with differing purposes and emphases were established (see Table 3.1). The *Reserves Act* introduced a scientific/ecological basis for protected area identification and management, giving particular emphasis to:

1. the preservation and management of areas possessing recreation opportunities or potential, wildlife, indigenous flora or fauna, environmental and landscape amenity, or other features of special interest and value —natural, scenic, historical, cultural, archaeological, biological, geological, scientific, educational or community;
2. ensuring as far as possible the survival of all indigenous flora and fauna, and the preservation of representative ecosystems;
3. ensuring the provision of public access to, and promoting the preservation of the natural character of, coastal environments.

(*Reserves Acts 1977* s.3)

Thus, the *Reserves Act 1977* provides a clear rationale for establishing and maintaining a national system of protected natural areas. By also providing *for the benefit and enjoyment of the public* in, and *access for the public* to, such areas, it provides a similar mandate on preservation and use to the *National Parks Act.* As with its predecessor the *Reserves Act 1977* (Section 47) made provision for areas to be set aside as a Wilderness Area. To date *Tasman Wilderness Area*, encompassing a part of *Gouland Downs Scenic Reserve*, is the only Wilderness Area to have been established in the reserves system.

Recreation Reserves provide areas for recreation, sporting activities and physical welfare with an emphasis on the retention of open spaces and on outdoor recreation activities.

Historic Reserves protect and preserve places, objects and features of historic, archaeological, cultural or educational interest.

Scenic Reserves protect and preserve areas possessing qualities of scenic interest, beauty, or natural landscapes and features of public interest.

Nature Reserves protect and preserve indigenous flora, fauna, or natural features of rarity, scientific interest or public interest.

Scientific Reserves protect and preserve ecological associations, plant or animal communities, types of soil, or geomorphological phenomena for scientific study, research and education.

TABLE 3.1: Reserve Types established under the *Reserves Act 1977*

The *National Parks Act* 1952 was replaced in 1980. The reformed *National Parks Act 1980* was primarily intended for:

> *. . . preserving in perpetuity as national parks, for their intrinsic worth and for the benefit, use and enjoyment of the public, areas of New Zealand that contain scenery of such distinctive quality, ecological systems, or natural features so beautiful, or scientifically important that their preservation is in the national interest.*
>
> (*National Parks Act 1980* s.4(1))

This legislative change enabled a focus on the protection of ecological values in the establishment and management of national parks, and for an amended system of policy formulation and management planning to be implemented. The *National Parks Act 1980* retained provisions (s.14) from the former Act relating to Wilderness Areas essentially unchanged (see Appendix A). An important change in emphasis from the 1952 Act that the 1980 Act stresses, as highlighted in the above excerpt, is the preservation of national parks *for their intrinsic worth* not only *for the benefit, use, and enjoyment of the public*. While the concept that national parks have intrinsic value is not recognised in most overseas legislation and is potentially a controversial value, Shultis (1991 p182) has commented that "*... up to the present, it seems to have had little impact upon the ... management of these areas*". However, the Act did give effect to both preservation of natural areas and their recreational use, from which preservation and use of wilderness conditions is legitimised. Further, neither appears to take precedence over the other, making decisions on priorities between the two rather difficult.

The most significant changes resulting from the 1980 Act saw the system of a national parks authority and separate park boards for each national park replaced by a national parks and reserves authority and a structure of regional boards. The authority and the various boards gained the oversight for all parks and reserves on a regional basis, but in the process shed actual management responsibility for these areas to DoLS. These changes have seen a more comprehensive management approach to parks and reserves (Thom 1987).

Efforts which were specifically linked to the management of wilderness conditions, especially the experiential conditions, remained within the domain of those designating Wilderness Areas within National Parks and Forest Parks for a recreational, and therefore experiential, rationale. In this context, wilderness management *per se* encompassed those actions necessary to adhere to the formally defined criteria of wilderness. Despite this, the public perception of national parks in New Zealand generally was as wilderness (Kearsley 1983a), suggesting that a much broader view of conditions pertinent to wilderness was necessary than those provided by Wilderness Areas alone.

The continuing lobbying of the FMC, culminating with their Wilderness Conference in 1981, urged still further attention to be placed on wilderness recreation (Molloy 1983). Following the conference, the Government appointed a Wilderness Advisory Group (WAG) which subsequently formulated New Zealand's *Wilderness Policy* (WAG 1985) within which wilderness is formally defined along the lines of the FMC concept (see Appendix B). The major variation in the Policy from the definitions stated in the various statutes was that foot tracks were not allowed to be constructed in Wilderness Areas under the WAG definition, and where facilities such as huts, tracks and bridges existed they were to be either removed or no longer maintained (WAG 1985). This Wilderness Policy was adopted by both NZFS and

DoLS for Wilderness Areas within their respective jurisdictions and so management of wilderness conditions tended to relate exclusively to the maintenance of the specifications set out in the Policy.

3.2.4 Conservation Management

As part of a major government restructuring of agencies involved in environmental administration (Cocklin 1989, Cahn & Cahn 1989), the creation of the Department of Conservation (DoC) in 1987 brought the responsibilities for protected areas together under a single government department with a mandate to act as an advocate of conservation and protection of the natural environment. In essence, DoC took over, *inter alia*, the protected area functions and responsibilities formerly carried out by the DoLS (national parks and reserves), the NZFS (forest parks and reserves), and Wildlife Service protection of natural environment and scientific/ecological, aesthetic, historic and recreational values. The *Conservation Act* 1987 establishes the Department of Conservation with responsibility for the above protected areas, and provides for the conservation of natural resources held by DoC which are not covered by other enactments. Conservation of these resources is defined as:

> *... their preservation and protection ... for the purpose of maintaining their intrinsic values, by providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.*
>
> (*Conservation Act 1987* s.2)

Thus, where conservation values are not compromised, recreation and tourism are to be encouraged. As a result, recreational use attains a secondary purpose for protected areas with preservation taking priority. This is highlighted in the provisions for conservation parks, which are managed "*... so that their natural and historic resources are protected, and, where not inconsistent with this, to facilitate public recreation and enjoyment*" (*Conservation Act 1987* s.19). As with previous statutes the *Conservation Act* makes provision (ss.18 and 20) for declaring any conservation land to be held for the purpose of a Wilderness Area, primarily for wilderness experiences (see Appendix A). While the definition of a Wilderness Area is very similar to previous statutory provisions, an additional provision which applies to Wilderness Areas under the *Conservation Act* is that "*... its indigenous natural resources shall be preserved...*" (*Conservation Act 1987* subs.20(i)(a)), so that the preservation of a state of nature is primarily, but not exclusively, for wilderness experiences. The general mode of protected area development engendered by the Act, i.e. conservation above other uses, explicitly aids the preservation of conditions from which wilderness experiences might be elicited—it could also potentially exclude recreational use and experience of such areas altogether.

The functions of DoC, in respect of the protected areas system, include the management of such areas for conservation purposes, advocacy of conservation values, and fostering their use for recreation and tourism (*Conservation Act 1987* s.6). In undertaking these functions DoC uses a three-tier organisational structure within which a national Head Office handles policy development matters; fourteen regional conservancies co-ordinate conservation management tasks and specialist activities; and the various field centres in each conservancy handle operational activities (see Figure 3.2). This structure seeks to decentralise management functions from national to regional level where necessary and desirable.

With respect to protected areas, policy development is formulated through three key Head Office divisions: resource protection (including estate protection and protected species), resource use (including recreation), and advocacy. A similar demarcation is reflected in conservancies with conservation management functions generally organised through protection, use and advocacy function sections. However, field centre operations tend to cross these functional divisions in order to implement all operations, as cohesively as possible, for particular areas. Management of wilderness conditions, while not an explicit function, is encompassed by the resource protection and use components of policy formation and conservation management. However, the distinction that is made above with respect to the management of resource use and protection has important implications for the way DoC approaches wilderness management.

Management planning functions of DoC with respect to its protected areas have been amended and enhanced by the *Conservation Law Reform Act 1990*. While this Act does not alter the protected area system *per se*, it does change the conservation management planning of the system—instituting a system of conservation management strategies and plans in each conservancy. In conjunction with DoC the New Zealand Conservation Authority and Conservation Boards possess advisory functions in respect to the protected area system. The Authority's functions subsume those formerly administered by the National Parks and Reserves Authority, the Nature Conservation Council, and the New Zealand Walkways Commission, and relate principally to the oversight of the administration and management of the entire conservation estate. This includes the approval of statements of general policy and of management plans and strategies (*Conservation Act 1987* s.6B). At the regional level Conservation Boards, replacing National Parks and Reserves Boards, perform similar functions in respect of the protected areas system.

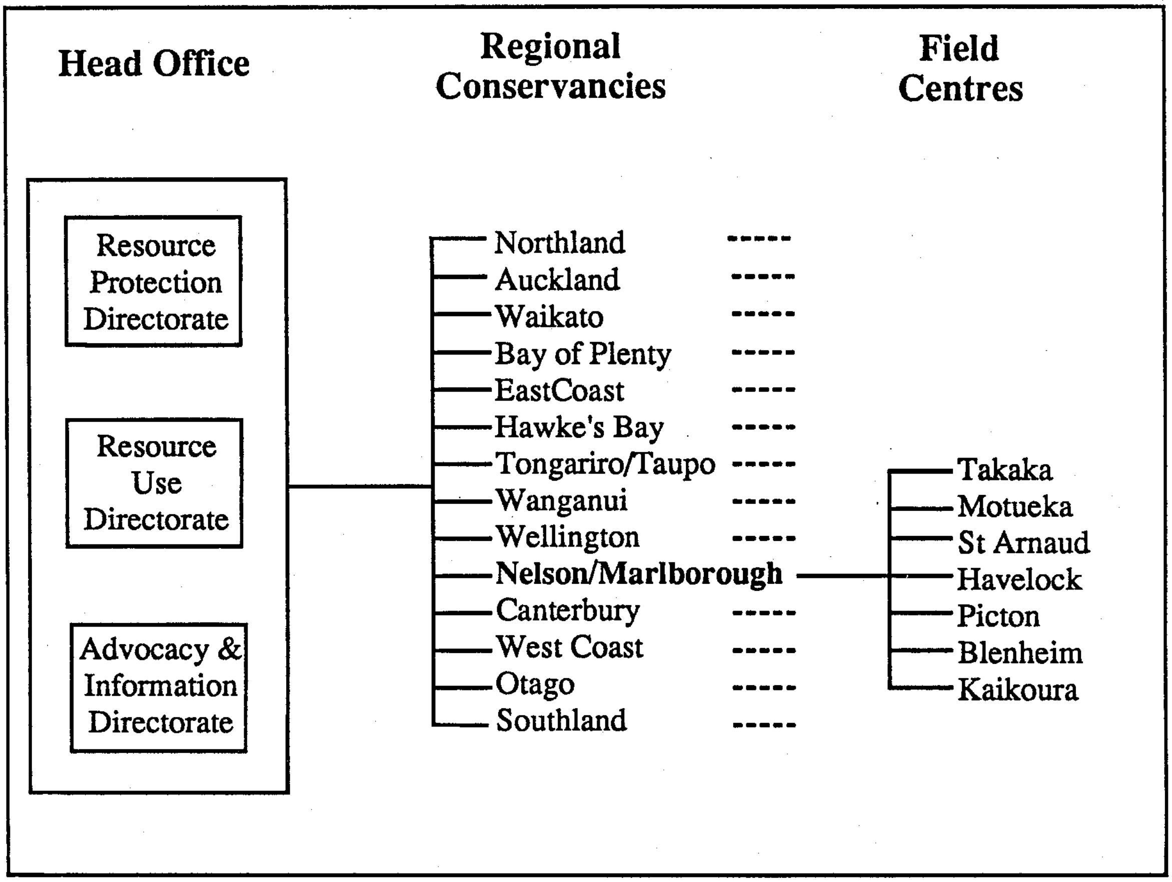


FIGURE 3.2: Management Structure of DoC (as at January 1992)

3.2.5 A Protected Areas System Mandate

The current protected areas statutes (*Wildlife Act 1953*, *Reserves Act 1977*, *National Parks Act 1980*, *Conservation Act 1987*, *Conservation Law Reform Act 1990*) collectively form the basis of a general body of enactment—the New Zealand protected areas legislation—which constitutes the articulation of a societal mandate for the protected areas system. The principles which emerge from this amalgam are as follow:

- protected areas may be established for their intrinsic worth as well as, or even *more than*, for public benefit and enjoyment;
- *in toto*, protected areas should convey the essence of the New Zealand natural landscapes, emphasising indigenous, distinctive and representative environments, and maintaining natural and cultural diversity;
- protected areas are retained in the *public estate*, which Government has a key role in protecting as a national conservation estate;
- protected areas are held in trust for present and future generations;
- protected areas legislation and administration should have regard to the principles of the *Treaty of Waitangi* [2];
- in addition to legislative protection, effective management of protected areas is essential.

(DoC 1988a)

The paradoxical intention of maintaining natural ecosystems, species and landscapes characteristic of New Zealand, while still providing for the public use and enjoyment of these natural areas, is reflected in these principles and their underlying statutes. Within this common set of principles underpinning the protected areas system there is an adequate basis on which an approach to the management of *wilderness* conditions can be established irrespective of the designation of Wilderness Areas. However, the more explicit, and narrower, expression of wilderness conditions provided in the legislation seems to dominate management practice. As highlighted throughout the preceding sections the *Reserves Act 1977* (and its predecessor), the *National Parks Act 1980* (and its predecessor), and the *Conservation Act 1987* (and the former *Forests Act 1949*) all contain (or contained) provisions for setting apart Wilderness Areas in a state of nature for wilderness experiences (refer to Appendix A). The provisions of these statutes all include the following controls:

- no buildings or apparatus can be erected;
- no animals or vehicles can be taken or used;

[2] The *Treaty of Waitangi*, signed in 1840, creates a partnership *of rights* between the indigenous Maori people, the tangata whenua, and the New Zealand Government. In respect of the management of protected areas of New Zealand, management and decision-making should actively include Maori perspectives, while traditional and customary uses of protected areas ought to be accommodated.

- no roads or tracks can be constructed.

These make the definitions exclusionary, and serve to particularise wilderness in what is considered by some to be elitist (Stankey 1971b). Wilderness Areas as established in the legislation effectively operate as another overlay onto existing protected areas—national parks, reserves, or conservation areas—whereby the emphasis of wilderness protection is towards pristine recreational and cultural concepts. Thus, Wilderness is differentiated in the legislation as a protected area category within an environment that already has protected area status. Interestingly, between the first statutory definition of Wilderness in the *National Parks Act 1952*, and the most recent in the *Conservation Act 1987* there has been very little modification. The major exception to this has been the *Wilderness Policy* 1983 which marked a significant move to a definition based on more general qualities rather than on specific, exclusionary criteria. The key departure in this definition from previous (and later) definitions was the exclusion of foot tracks—a criterion vehemently supported by the FMC (Molloy 1983). It is, nevertheless, a strongly anthropocentric-oriented document, linked closely to the FMC view of wilderness. This is also the view of wilderness that has pervaded protected areas management.

In a similar manner to its former agencies (NZFS and DoLS) DoC has adopted the WAG Policy as departmental policy. Yet, while conservation management and planning efforts have brought a greater emphasis on the ecological and intrinsic values of protected areas, *wilderness management* itself has tended to remain locked into a *designate and leave it alone* attitude associated with formal Wilderness Areas. Notwithstanding this formalisation of Wilderness Areas, the concept of wilderness *in the vernacular* still remains broad and varied, so that while five Wilderness Areas have been formally designated and numerous others proposed (see Table 3.2), *de facto* wilderness still effectively exists throughout the protected areas system. Thus from a management perspective the management of experiential conditions must look beyond Wilderness Area boundaries to a broader possible range of wilderness environments.

While the setting aside of Wilderness Areas is, in itself, useful from a conservation perspective, the definitions described above as the basis for designation are only one view of what wilderness might be. This particular view of wilderness appears to occupy "*... an extreme pole on a scale of what constitutes wilderness for various individuals and groups of people*" (Kearsley 1990 p133). Moreover, such a view makes for more constrained approaches to any attempt to balance the provision of wilderness experiences on conservation estate, while at the same time, protecting that resource. Ecological protection occurs in these areas only by virtue of their size and the minimal human imprint. The wilderness policy currently adopted

NAME	PROTECTED AREA	AREA (ha)
	Designated Wilderness Areas	
Raukumara	Raukumara FP	21,000
Tasman	North-west Nelson FP & Gouland Downs SR	87,000
Hooker-Landsborough	Westland NP	44,000
Glaisnock	Fiordland NP	125,000
Pembroke	Fiordland NP	18,000
	Under Investigation by DoC as Wilderness Areas	
Paparoa	Paparoa NP Victoria FP	36,000
Adams	Westland NP	54,000
	Re-designated as Remote Experience Zone	
Te Tatau-pounamu	Tongariro NP	6,500
Hauhangatahi	Tongariro NP	8,500
Otehake	Arthur's Pass NP	12,000
	Proposed as Wilderness Areas by FMC	
Ruakitiri	Urewera NP	18,000
Ikawhenua	Urewera NP	7,000
Kaimanawa-Kaweka	Kaimanawa FP & Kaweka FP	47,000
Callery	Westland NP	10,000
Balfour	Westland NP	4,000
Olivine	Mt Aspiring NP	55,000
Garvies	-	43,000
Preservation-Waitutu	Fiordland NP & Waitutu FP	182,000
Pegasus	Stewart Is. NR	63,000

TABLE 3.2: Status of Wilderness Areas in New Zealand (as at January 1992)

for the New Zealand protected areas system "... *continues the tradition of perceiving wilderness in terms of a* [purist] *recreation experience, rather than the intrinsic qualities of wilderness that give rise to the experience...* " (Hall 1988b p44) in its broader sense.

3.3 Wilderness Management Practice in New Zealand

The set of environmental conditions to which the protected areas system responds are protected area ecosystems—New Zealand's conservation estate—within which there exist particular ecological conditions giving rise to wilderness experiences (see Figure 3.1). The first component of this wider system, the population, comprises users of, and visitors to, the conservation estate. This includes those who seek and elicit wilderness experiences (particular experiential conditions of the protected areas). The second component, the social organisation of the protected areas system, refers to the particular institutional arrangements (legislation and administrative structure) which give effect to the management of the system's environment and population—these have been outlined in the previous section. The third component is the technology utilised within the management system, which includes the strategies, techniques, decision support tools, and practices applied to the environment and population components within the social organisation. This section examines the policy and planning processes from which management of wilderness conditions within the protected areas system must operate, and the actual approaches applied within this context.

3.3.1 Policy Formulation

The administrative structure pertinent to the protected areas system provides the mechanism through which appropriate policy may be formulated. Such public policy is concerned with the organisation of purposive action intended to fulfil some societal value (Heclo 1972). In this case the societal values pertain to the protected areas system and in particular those articulated through the protected areas legislation. Subsequently, planning and management involves the choice of actions designed to achieve the purpose dictated by those values. Policy efforts in respect of managing wilderness conditions are centred on the WAG Wilderness Policy through which wilderness management is treated as the maintenance of a particular, narrowly defined, protected area status.

Policies such as these are implemented through conservation management strategies (CMSs), which also establish objectives for the integrated management of natural resources (*Conservation Act 1987* s.17D), prepared by conservancies in consultation with conservation boards. In turn a CMS is implemented through conservation management plans (CMPs) which establish detailed objectives for the integrated management of natural resources within particular protected areas (*Conservation Act*1987 s.17E). This management planning sequence provides a basis to the planning process within which the practice of wilderness management occurs.

3.3.2 The Planning Process Supporting Wilderness Management

Planning is the decision-making process directed toward fulfilling the purposes expressed through the social organisation of the system. The planning process that DoC follows in its management of the protected area system operates predominantly at conservancy level with head office policy and guidelines establishing the purpose that directs the process. Then, field centres implement the operational consequences of the process that give rise to the desired outputs. The overall planning process can be conceptualised in terms of distinctive sub-processes that broadly fill the various planning efforts in which the agency is involved. Thus, the planning process which DoC follows in its management of the protected areas system contains elements of strategic planning, management planning, corporate planning and operational planning, comprising the various planning sub-processes (Figure 3.3).

The strategic planning element of the process concerns itself with the longer term outlook necessary to achieve certain goals. The two strategic sub-processes are the conservation management strategy (CMS) and any separate functional strategies.

A CMS attempts to establish objectives for directing conservation management and, in particular, the integrated management of protected areas. The CMS process draws together relevant information in setting long-term goals. Part of this information source may derive from separate functional strategies, where they exist. Separate functional strategies do exist in some situations, as is the case in a number of conservancies which have strategic recreation planning processes in place. Recreation strategies provide a process for identifying recreation priorities which form a major part of resource use on protected areas. A consistent process for strategic recreation planning adopted by DoC (DoC 1990c) singles out ROS as a central planning tool in the process, and has been implemented in a number of conservancies. While such a strategy is useful it remains complementary to the broader CMS process which integrates the wider conservation priorities that apply to the protected areas system.

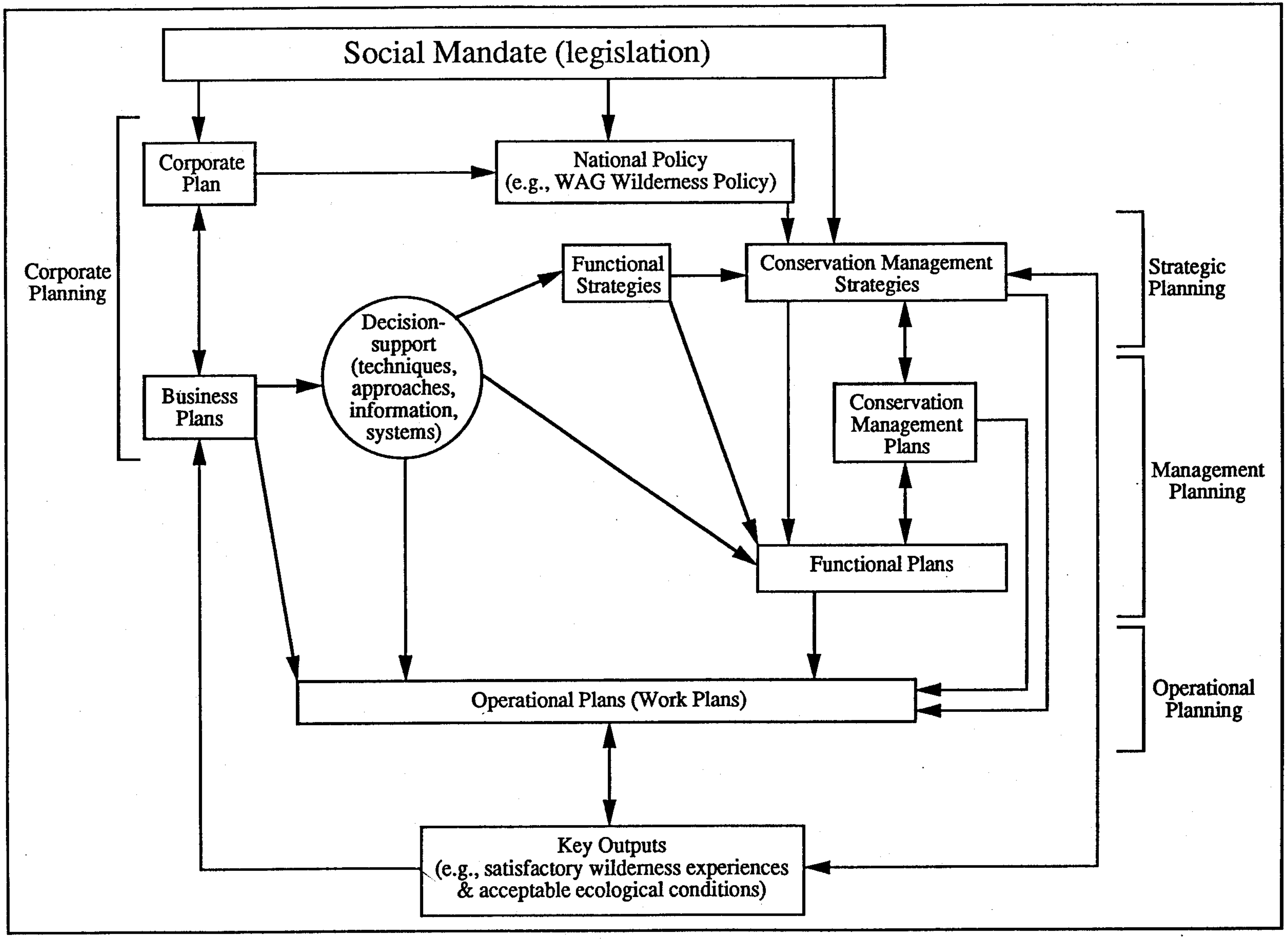


FIGURE 3.3: Planning Processes and Functions in DoC Protected Areas Management

Other feasible functional strategies, such as a protection planning process, have not been formulated to date. Appropriate planning tools on which this process might be based are in use already. An example is the protected natural areas programme (PNAP) (Park & Kelly 1986) which, in conjunction with other nature conservation evaluation techniques (O'Connor *et al.* 1990), could provide a protection-oriented equivalent of ROS; that is, a protection opportunity spectrum (POS). This would result in a spectrum of opportunities ranging from high to low in terms of an area's propensity for ecological preservation.

Whether separate functional strategies exist or not, the role they serve in identifying priorities for recreational use, ecosystem protection, or whatever, must be incorporated into a CMS. That is, a CMS may involve the integration of explicit use and protection strategies, *inter alia,* or else combine these functions implicitly as a single strategy. The former approach has the advantage of allowing a clearer focus on separate elements in the first instance, which can then be balanced against one another in the overall CMS where it would be possible for trade-offs to be made with respect to the different conservation functions (Kliskey 1988). These trade-offs can be represented in a simple matrix denoting the outputs of the ROS and POS concepts (see Table 3.3). This helps clarify the various management options for intervention (Devlin 1991 pers. comm.). The latter approach, however, attempts to contend with the multiplicity of conservation components in a single, and presumably complex, process.

It is at this level of strategic planning that it would be appropriate to address the specific issue of wilderness management. Under a use (or recreation) strategy the experiential conditions of wilderness could be specified while the ecological conditions of wilderness would be considered in a protection strategy. The CMS process would set the appropriate priorities within which the overall conditions of wilderness are balanced, and which are then applied to particular protected areas in management planning.

The management planning element of the process leads to the preparation of management plans for National Parks, and to CMPs for any other protected areas. Consequently, such plans cover discrete conservation areas involving a wide range of functions, serving a variety of objectives and resolving protection, recreation and other use demands. The resolution of conflicting protection and use objectives for a particular part of the protected areas system could be included in this. Separate functional plans could also be prepared in specific areas of responsibility through the management planning process. For example, recreation operational plans provide a strategic plan for dealing with recreation use as guided by relevant conservation management plans. Written on specific aspects and activities, these plans assist the implementation of a CMS at an operational level. Operational planning

Opportunities for: -		Protection (based on POS)	
		High	Low
Use (based on ROS)	High	**1** Conflict between protection & use requires management to attain a balance	**2** Management favours enhancement of resource use
	Low	**3** Management favours maintenance of resource protection	**4** Management intervention unnecessary

TABLE 3.3: Trade-off Matrix for Use and Protection of Conservation Estate showing Options Available for Management Intervention

takes the priorities, recommendations and guidelines from the previous strategic and management planning components. It then establishes working plans at field centre level, which direct the actual field operations in producing the ultimate outputs from the overall planning process for the protected areas system. Any efforts to manage the conditions of wilderness under the present system would be tied to resource use and protection considerations in the CMS process and the preparation of conservation management and functional plans.

Contributing to, and enhancing, the overall management process is the application of decision-support tools. Specific techniques and approaches have already been considered, for example, ROS and PNAP. Probably the greatest potential for decision-support is likely to come from the implementation of a geographically-referenced system, that is, GIS, for protected areas management (McEwen 1990a, Harrison 1991a). Although GIS has not been implemented by DoC, it has been the subject of recent consideration (McEwen 1990b, Harrison 1991b). Given the range of management functions DoC has with regard to protected areas, a framework by which these aspects can be integrated spatially would be invaluable and powerful in decision-making.

3.3.3 Wilderness Management Approaches

The practice of wilderness management in New Zealand is currently characterised by two main approaches. The first treats wilderness purely as a protected area and so attempts to maintain the characteristics of those areas under the Wilderness Policy definition by which it was designated in the first place. The second recognises wilderness as one extreme on the recreation opportunity spectrum. Yet both approaches envisage wilderness from a recreational experience perspective, rather than in terms of the intrinsic qualities of wilderness that give rise to that experience, thereby reflecting New Zealand's wilderness policy, and the FMC legacy contained therein.

A relatively long-standing treatment of wilderness management, attributable to the management era of NZFS and DoLS prior to DoC's establishment, has been in terms of wilderness as a protected area overlay. This effectively considered the mere act of preservation as an adequate management intervention. Thus, the act of designating part of a protected area as wilderness is considered to fulfil, to a large degree, any need to manage conditions of wilderness. However, some action would be necessary in maintaining an area's status, predominantly aerial access control, wild animal control and keeping a check on facility development. This would suggest a reactive approach to management. There has also been a trend in some areas, e.g. *Mount Aspiring National Park* (DoC 1990d) and *Mount Richmond Forest Park* (DoC 1990b), towards returning areas to wilderness by zoning them as such, and then removing, or no longer maintaining, facilities. This, it is hoped, will allow areas to revert to more pristine conditions—approaching those of wilderness.

While the implementation of the Wilderness Policy through designation of Wilderness Areas has afforded a small number of areas an additional protected status, it has also fostered an attitude that, in itself, designation constitutes management of wilderness conditions. There remain vast tracts of *de facto* wilderness covered by this approach, which are effectively *unmanaged*, and therefore at risk. This type of approach also fails to cater fully for non-purist recreationists who, nevertheless, seek a legitimate wilderness experience but are unable to, or have no wish to, enter Wilderness Areas. There is an apparent lack of understanding as to what constitutes wilderness and can provide satisfactory wilderness experiences. In coping with the problem of increasing user numbers and the wilderness management issue (see Chapter 1) this type of understanding becomes especially important.

More recently wilderness management has been considered as part of resource use management of the conservation estate. In particular the wilderness experience is viewed as the natural, undeveloped end of the recreation opportunity spectrum.

Here, the ROS planning tool accounts for a wide range of recreation experiences of which wilderness is simply a part. This provides for diverse opportunities but does not account for wilderness experiences perceived in a range of different opportunity settings. ROS also fails to incorporate ecological conditions of wilderness in the process, although this can be ameliorated somewhat by incorporating LAC within the process. In fact, the LAC concept has been evaluated for introduction as a resource planning technique by DoC (Tyson 1989), and a recreational capability planning system based on this has been proposed for the conservation estate (DoC 1989). However, to date, the implementation and operationalisation of this system to assist wilderness management has not eventuated. Rather, it has been shelved (Taylor 1991 pers. comm.). In any case, the potential to address wilderness management using these approaches is confounded by the theoretical limitations outlined in Chapter 2.

In broad terms, there is a need for the closer integration of resource use and protection functions in protected areas management. The recently invoked CMS process may provide the necessary forum to achieve this integration, and so allow explicit consideration of use and protection priorities at a common level. Implementation of a LAC concept to enhance ROS would also assist this situation by introducing a biophysical component. A further medium for improving the management of wilderness conditions is the utilisation of GIS which provides a common spatial framework with which to integrate use and protection information.

However, it may be that a more fundamental view is needed and that the policy underlying the management and planning approaches ought to be carefully reconsidered giving due recognition to the ecological dimensions of wilderness.

3.4 Wilderness Management Practices—A Comparative Analysis

The appraisal of New Zealand wilderness management *vis-à-vis* a number of other countries can provide a broader perspective on the issue of managing the conditions of wilderness. Culturally the wilderness concept is quite disparate and difficult to compare across different societies (Hendee *et al.* 1978, Eidsvik 1986). However, some distinct parallels and similarities have been identified between New Zealand, United States, Canada and Australia with respect to the evolution of the wilderness concept (Hall 1988a), the establishment of national parks (Shultis 1989), and development of a preservation ethic and wilderness protection (Hall 1988b).

The common British colonial origins of these countries, as either New World or Antipodean colonies, have bred similarities in environmental attitudes and national development (Shultis 1989), and thus is reflected in the near simultaneous establishment of their first *national parks* in the 1870s and 1880s, and comparable rationales behind the creation of these parks. Today, all four countries are developed urbanised societies whose systems for protected areas have much in common. Similarly, the issue of managing conditions of wilderness and backcountry recreational pressures reflect useful parallels in those countries (Hendee *et al.* 1978) Thus, the United States, Canada and Australia provide appropriate examples of wilderness management within their respective protected areas systems, for comparison with New Zealand. While other countries, for example South Africa, Kenya, Spain or USSR (pre-1991), would offer a contrasting perspective, the nature of the wilderness experience and the management of wilderness conditions in such countries are sufficiently disparate that any comparison is difficult.

3.4.1 United States

The United States protected areas system reflects a complexity comparable to the country's size. It comprises national forests, a national park system, and a national wildlife refuge system, as well as separate state park systems—an overall system that has evolved since the creation of *Yellowstone National Park* in 1872.

Some sixty federal statutes provide a legislative base for the conservation and management of different components of the protected area system (16 US Code Service). In broad terms, the National Park Service (NPS) of the US Department of the Interior (USDI) promotes and regulates recreational use of the National Parks; the Forest Service of the US Department of Agriculture (USDA) administers multiple-use management of the National Forests; the Fish and Wildlife Service of the USDI have responsibility for protection and conservation of species and their habitats; and, the Bureau of Land Management administer other potential protected areas on federal land. Overlaying this, the National Wilderness Preservation System (NWPS) established by the *Wilderness Act* 1964, includes wilderness areas *"... devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use"*. This system of preserving the wilderness character of particular areas operates within, and is supplementary to, the natural resource management systems from which respective areas have been designated. Thus, areas included in the NWPS continue to be managed by the particular agency (NPS, USFS, USF&WS or BLM) which administered that area prior to inclusion in the system.

All formally designated federal wilderness areas are managed under the general terms of the Wilderness Act. This is a tacit acceptance that leaves the wilderness concept in the United States explicitly expressed as *de jure* wilderness. The management of wilderness conditions is thus closely linked to managing the designated areas of the NWPS. Important differences in wilderness management have been suggested as a function of the particular agency exercising administrative control over an area (Fish & Bury 1981, Allin 1987, Harrington & Roberts 1988). Those differences relate to the historical origins and core values of the agencies themselves. The USFS approach to wilderness management is characterised as a single-use notion in which recreational and preservation mandates tend to be grouped as a single interest (Culhane 1981). They are exercised with reluctance—managers preferring not to respond with regulation (Allin 1987). By contrast, the NPS has tended toward a more biocentric approach to wilderness area management (Foresta 1984) which it exercises with relative eagerness, aggressively applying a variety of regulatory strategies (Allin 1987).

As a result, wilderness management approaches are not applied consistently within the NWPS. However, both the USFS and BLM have adopted the ROS system for inventorying, planning and managing the recreational resources under their control (Lichtkoppler & Clonts 1990), while the USFS is enhancing its use of ROS in wilderness management by implementing LAC.

The practice of managing wilderness conditions in the United States is dominated by the legislative consequences of the 1964 Wilderness Act. Wilderness management is, therefore, almost exclusively an activity concerned with the administration of *de jure* wilderness. Furthermore, the execution of this prerogative depends on the agency having jurisdiction over a particular Wilderness Area in the NWPS. The *Wilderness Act 1964*, in contrast to New Zealand's 1983 *Wilderness Policy*, is very powerful—only Senate can revoke the designation of an area in the NWPS. However, while the New Zealand *Wilderness Policy* disallows foot tracks in Wilderness Areas, the United States *Wilderness Act* retains this facility in its definition of a Wilderness Area. Compared with New Zealand, many United States Wilderness Areas are heavily used. While the NWPS enjoys considerable popularity (comparable at least to that of New Zealand's National Parks) there is little awareness of the New Zealand system of Wilderness Areas (Shultis 1991). The upshot is that conditions of wilderness, especially isolation and solitude, can be very difficult to achieve in the American system, and so management practices are highly regimented to try and attain such conditions (Devlin 1991 pers .comm.).

3.4.2 Canada

The protected areas system in Canada encompasses both national and provincial park systems, as well as a number of national wildlife areas. Protected area management operates at both federal and provincial levels. The federal government's role arises primarily from an interest in the environment and, in particular, national parks. The federal parks agency, Environment Canada-Parks, derives responsibility from the *National Parks Act 1930* for the preservation of parks in an unimpaired condition while also maintaining and facilitating recreational use. This Act also provides for the establishment of wilderness zones within National Parks.

Thus, by contrast, no federal wilderness statute or policy exists but rather *wilderness* operates as a zoning class in the national park system (Downie 1984), and therefore exists as a management overlay. This contrasts with the *wilderness overlay* in New Zealand which is an additional protected status category. Environment Canada-Parks' Policy (Parks Canada 1979) acknowledges zoning as a resource-based approach in which both the need for protection and the capability of areas to support different forms of use, are the bases upon which zones are identified. The wilderness zone is characterised as a natural area where facility development is minimal, where recreational opportunities are dispersed and which rely solely on appreciation of the natural resources of the area with non-motorised access. In broader terms, this policy still seeks to manage the conditions of wilderness.

The need to consider both visitor use and resource protection, as expressed in Environment Canada-Parks' policy, has been implemented through the use of the VAMP approach which attempts to integrate data about users and their characteristics with data about the natural environment of the park. This is seen as a rational attempt to determine what is needed to support Environment Canada-Parks' use portion of its mandate. Subsequently, this is integrated with a biophysical input, resulting from a parallel Natural Resources Management Process, in an overall Park Management Planning Process. This represents a similar planning approach to the New Zealand system of integrating separate functional strategies for resource use and protection through the CMS process. While the management philosophy of Environment Canada-Parks is both experiential and ecological, it is inherently more ecologically-oriented than management philosophy in New Zealand. This is particularly so considering the system of representative natural regions used as a basis for selecting new national parks (Foresta 1985)—this process is similar to the PNAP used in New Zealand, but operates on a more extensive scale and with greater influence.

Outside the National Parks system the federal government has relatively little involvement in wilderness management when compared to the responsibilities of provincial governments. The provincial systems of parks and related reserves are complementary to, and even subordinate, the federal protected areas. In contrast to federal government, a number of provinces, notably Ontario and Alberta, have separate wilderness area Acts—although these have been weak, with developmental activities occurring when seen as necessary (Sewell & Dumbrell 1987). In British Columbia a variety of Acts, notably the *Parks Act*, *Forest Act*, and *Environment and*

Land-use Act, provide provincial control to over 90% of its land-base and, therefore, also responsibility for wilderness management. There are various policies on wilderness in the province but no overall set of guidelines for designation or management. The lack of consistency in policy on wilderness management has made the resolution of wilderness issues difficult. At provincial level generally, parks are either managed for recreational purposes, or for more ecological purposes as wilderness parks. Decisions on both aspects reflect the importance of alternative land uses in provincial, rather than federal, terms. Therefore, federal initiatives require considerable consultation with provinces.

Canadian practices for managing the conditions of wilderness relate to the zoning of federal national parks in which conditions of wilderness, both ecological and experiential, are accommodated. In provincial park systems, separately established wilderness parks generally fulfil ecological purposes for the overall system. This provides some degree of balance in conditions of wilderness but it is tempered by provincial dictate.

3.4.3 Australia

The national parks and related reserves which comprise the Australian protected areas system exist predominantly in state park systems, with the Federal (or Commonwealth) national park system being a recent development. All Australian states have separate national park legislation by which a park system and an appropriate administrative agency are established especially for that state. For example, the *Tasmanian National Parks and Wildlife Act 1970* establishes a system of national parks and other reserves with respect to the conservation and protection of fauna and flora. Its National Park and Wildlife Service (NP&WS) is responsible for the management and maintenance of these areas for the purposes of public recreation, preservation of fauna and flora, and protection of scenic beauty. Australian states, like Canadian provinces, are primarily responsible for resources and environmental management. As such, decisions tend to reflect state priorities in respect of land and resource use. Unique natural areas which may generate benefits for the country as a whole, tend to be used for other purposes under this state system—federal *national* parks being underprovided (Armstrong 1977).

The extent to which conditions of wilderness are managed within the overall protected areas system varies considerably from state to state, although in most instances some recognition of wilderness is given. The state of New South Wales has a separate *Wilderness Act* (1987) providing for the identification, protection and management of Wilderness Areas. These areas conform to anthropocentric ideals, but again this differs considerably in definitional terms from state to state.

Furthermore, few policies directed specifically at wilderness preservation exist.

It is only recently that a federal level of park areas and administration has been created in Australia. The Australian NP&WS, established under the *National Park and Wildlife Conservation Act 1975*, is essentially an advisory agency on national nature conservation and wildlife policies, working closely with state agencies. As a result a federally administered national park system has been instituted with the notable inclusions of *Kakadu* and *Uluru* (Ayers Rock) *National Parks* in the Northern Territory. The management of wilderness conditions within this federal system is provided for by adopting the explicit classification of wilderness zones. However, much of the federal efforts concerning conditions of wilderness have emanated from the Australian Heritage Commission's introduction of a National Wilderness Inventory programme aimed at providing wilderness resource information. These efforts focus on the survey and evaluation of areas of *wilderness quality* (Lesslie 1991). Particular management regimes suitable for application to the product of this phase have yet to be implemented, although ROS has received attention in some states.

An additional, and separately legislated, component of the protected areas system in Australia is the *Great Barrier Reef Marine Park* (GBRMP) that is administered solely by the GBRMP Authority. The main strategy used in the management of the Park is zoning, by which potentially conflicting activities are separated while allowing reasonable uses, in strictly ecological rather than experiential terms, and ensuring long-term conservation of the reef's ecosystem. However, the UET approach has also been applied to a particular part of the park as a means of resolving use and preservation (Rosier *et al.* 1986), and therefore implicitly tackles conditions of wilderness in a localised manner.

The practice of managing conditions of wilderness in Australia is relatively poorly developed, reflecting the variation inherent in different state park systems and their management as well as the belated establishment of federal administration of protected areas. Accordingly, management efforts to date have predominantly dealt with the identification and preservation of 'wilderness' areas that must obviously precede any efforts for the management of conditions therein.

3.4.4 Comparative Summary

In the United States, the management of wilderness conditions is equated almost exclusively with the management of areas comprising its NWPS. Differences thus arise in management rationales that are related to the origins and core values of the different agencies involved in administering the NWPS. These result in approaches being, on the one hand, regulatory and biocentric, while on the other, more anthropocentric with a greater reluctance to regiment users. The application of ROS has become widespread while its enhancement using the LAC process is gradually evolving.

The management of wilderness conditions in Canada utilises a parks zoning mechanism and the VAMP framework, in a similar vein to ROS, within the federal parks system. Although a *wilderness* zone does exist, it is a natural experience zone, and a broader interpretation of managing ecological and experiential conditions occurs through the application of the complete preservation-use continuum. At the provincial level, management of the park system varies between provinces. In some cases, separate wilderness parks have been created for ecological purposes while parks or recreation areas generally fulfil experiential purposes.

The predominance of state park systems in Australia, and subsequent state parochialism in land use decisions, has had a major influence on the management of wilderness conditions in this country—more so than in the Canadian provinces—which reflects a relative immaturity in the development of its national parks system compared with the United States, Canada and New Zealand (Eidsvik 1989). The recent establishment of a Commonwealth parks administration and protected areas system does, however, aid this development and make provision for wilderness zoning. Nevertheless, the legislation (NP&WC Act 1975) appears to include several clauses maintaining options for resource utilisation, particularly mining and explicitly with respect to *Kakadu National Park.* The current state of wilderness management in Australia emphases the identification of suitable areas for preservation, instituted by a National Wilderness Inventory program, with subsequent management approaches in respect of conditions of wilderness yet to eventuate. Provisional application of the UET approach has occurred on parts of the Great Barrier Reef effectively representing initial management efforts.

By virtue of its relatively small size, the New Zealand protected areas system is comparatively cohesive, and managed under the auspices of a single central government department (since 1987), in contrast to the multi-organisation approach that has evolved in the United States. The absence of provincial legislature has probably made a considerable difference to wilderness management efforts. The management of protected areas and approaches to wilderness management would undoubtedly be significantly different if regional governments rather than a national government had management and decision-making responsibilities, as is the case in Australia and Canada. Nevertheless, there are some regional differences in management approaches but these are more the result of differences in interpretation of policy and of management personnel, since common policy and guidelines exist.

A strong anthropocentric perspective has flavoured policy and approaches to management of wilderness conditions in the past in New Zealand. However, this is changing, and the New Zealand management experience is becoming akin to that of Canada in terms of a greater ecological influence on the ecological/experiential balance in protected area management. In response, appropriate New Zealand policy should reflect this need. A much stronger wilderness area system, *vis-à-vis* the United States NWPS, might ameliorate the apparently *ad hoc* nature of New Zealand's current system. However, an alternative is to reconsider wilderness management and to balance conditions of wilderness rather than emphasise the management of particular designated areas.

3.5 Conclusion

While the designation of Wilderness Areas, in itself, is very useful from a conservation perspective in New Zealand, the exclusive and labelled type of wilderness that is engendered by this tends to be elitist and restrictive in the provision of wilderness experiences within the conservation estate. Consequently, the provision of wilderness experiences becomes equated with tightly defined Wilderness Areas (reflecting the FMC perspective) when public and backcountry user concepts of wilderness are much broader than this. Wilderness management would perhaps be better accommodated through a particular management regime that views wilderness in these broader terms, rather than being tied to formal Wilderness Areas. This would conceivably allow the provision of opportunities for wilderness experiences to focus on a wider set of conditions than is currently the case. Not only would some opportunities be realisable in considerably less fragile and pristine conditions than Wilderness Areas, but a greater number and range of recreationists could be catered for. The objective would be to accommodate recreational users in the least pristine and fragile ecological conditions possible while still providing a satisfactory wilderness experience. Thus by recognising that wilderness experiences are related to widely differing settings, in some cases quite developed conditions and rarely in the extreme conditions represented by Wilderness Areas, it may be possible to reduce more readily recreational impacts upon fragile ecosystems, yet still satisfy increasing demands for wilderness experiences.

The findings from examining wilderness management practices in New Zealand parallel the shortcomings in theoretical approaches to the wilderness management issue, identified in Chapter 2, and support the development of a perceptual approach to the wilderness management. However, in order to develop such an approach it is necessary to establish the theoretical underpinnings of perception research and their applicability to resource management. This is undertaken in the next chapter.

4

Wilderness Perceptions: An Application to Wilderness Management

The previous chapter highlighted the need for wilderness management in New Zealand to focus on managing conditions of wilderness, rather than simply maintaining designated areas of wilderness. Planning frameworks which are suitable for supporting a management regime, discussed in Chapter 2, are either being implemented in New Zealand, or are being considered for implementation. However, there are still certain shortcomings with even the most appropriate frameworks (e.g. ROS and LAC), notably the linkage between experience and setting, particularly in the context of wilderness. Both the need to focus on managing conditions of wilderness in practice, and the need to improve the experiential input to theoretical approaches for wilderness management, are dependent upon an understanding of the nature of perceptual environments which constitute wilderness. The purpose of this chapter is to establish the foundation for a perceptual approach to wilderness management.

First, the development of environmental perception studies in behavioural geography is examined and provides a broad interdisciplinary context for the study of perceptions. This leads to the development of a theoretical model for understanding the perception of wilderness, and as the basis for key concepts which are used in the approach of this thesis to wilderness management. The contribution of perception studies to natural resource management is examined from which the application of perceptions to wilderness management has first been suggested. The state of research on wilderness imagery, attitudes and perceptions is reviewed—as a central body of research from which this work has emerged. In particular, research on New Zealand imagery and perceptions of wilderness is examined—this provides the perceptual concept on which the approach taken in this thesis is explicitly based. Finally, the application of wilderness perceptions to natural resource management is discussed, and includes a consideration of the justification for using perceptions as a planning criterion and their associated problems—including their spatial delimitation.

4.1 Environmental Perceptions and Behavioural Geography

The study of environmental perceptions has become an integral component of behavioural geography and has been dealt with in various reviews over the last decade or so (Bunting & Guelke 1979, Saarinen & Sell 1980, 1981, Gold & Goodey 1983, 1984, Goodey & Gold 1985, Garling & Golledge 1989, Golledge & Timmermans 1990, Timmermans & Golledge 1990, Aitken 1991). The extent and advanced nature of work in this field is such that perceptual and behavioural geography has been termed a mature subfield of geography (Aitken *et al.* 1989). In particular, Golledge & Timmermans (1990) have summarised the key elements in the emergence and development of this important subfield as:

- a search for models of humanity which were alternatives to the economically and spatially rational beings of normative location theory;
- a search to redefine environments, other than objective physical reality, as the milieu in which human decision-making and action took place;
- an emphasis on procedural rather than structural explanations of human activity and the physical environment;
- an interest in exploring the spatial dimensions of psychological, social and other theories of human decision-making and behaviour;
- a shift in emphasis from aggregate populations to the disaggregate scale of individuals and small groups;
- a need to develop new data sources other than the generalised aggregate statistics of government departments;

- a search for methods to aid in explaining latent structure in data, and which could handle data sets that were less robust than the traditional interval and ratio data sets; and

- a desire to merge geographic research into the broadening stream of inter-disciplinary investigation into theory building and problem solving.

A central concern of the subfield, and indeed of geography broadly, is the human-environment relationship, of which the study of perception provides a deeper understanding (Wood 1970). Since perception can be considered as basic to all human activity (Bartley 1958), its study provides a useful avenue to inter-disciplinary research. Conversely, the study of environmental perceptions in geography has been moulded by inter-disciplinary studies in fields such as psychology and sociology.

4.2 Theoretical Developments

The early work on perceptions originated in psychology. It was based on the notion that a person's knowledge of the world was derived from the five senses and the various stimuli acting upon the senses (Bartley 1958). Lewin's (1932) concept of topological space or *psychological lifespace* was an early attempt to deal with the structure of cognitive space. Further impetus arising from philosophical concerns about the nature of reality led to greater appreciation of the perceptual approach to human-environment studies in the behavioural sciences, notably in sociology (Firey 1945), geography (Wright 1947), and psychology (Tolman 1948).

The work of Firey, in studying three different urban locational processes, enabled the identification of certain symbols as especially important ecological variables (Firey 1945). This focus on symbolism has since been incorporated into geographic research (Saarinen 1969, Tuan 1974). Tolman's research on cognitive maps established the notion of a spatial mental mapping process derived from all of the sensory sources which influence behaviour (Tolman 1948). This work has subsequently found its way into various geographic studies of mental maps (Downs & Stea 1973, Gould & White 1974). Thus the sociological and psychological studies of Firey and Tolman respectively, kindled a broader and better awareness of perceptual images. In geography, the importance of images of the environment has also emanated from Wright's work on the fundamental place of the imagination in the practice of geography (Wright 1947). He promulgated *geosophy*, a concept arising from a concern for the human awareness terrestrial space, as the study of the nature of geographic knowledge which:

> *... covers the geographical ideas, both true and false, of all manner of people ... and for this reason it necessarily has to do in large degree with subjective conceptions.*
>
> (Wright 1947 p83)

The role of the imagination was further advanced with Lowenthal's work in which he developed Wright's ideas through a structured consideration of the "*... relation between the world outside and the picture in our heads*" (Lowenthal 1961 p241). In essence, this suggests that the central interest of the discipline lies with spatial knowledge and ideas concerning humanity and its milieu. This fusion of inter-disciplinary ideas is promoted as the basis for perceptual approaches to understanding environmental behaviour (Moore & Golledge 1976), thereby advancing an approach in geography that "*... explicitly considers man's* [sic] *view of his* [sic] *environment*" (Wood 1970 p130).

The consideration of environmental perceptions in a geographical framework, as precipitated by Sauer (1941), was continued by Wright (1947)and Kirk (1951) and emphasised that people behave in the real world not merely on the basis of objective knowledge, but also in terms of their subjective images of it. The framework suggested by Kirk is characterised by the important distinction between the phenomenal environment, mainly comprising physical reality, and the behavioural environment, within which phenomenal facts are structured and so acquire values in a cultural context. Thus, the:

> *... phenomenal environment is refracted through the filters of culture and the lens of personal experience and imagination to produce the behavioural environment in which occurs individual behaviour.*
>
> (Lowenthal 1961 p260)

The crystallisation of a perceptual approach to the comprehension of environmental behaviour is credited to the work of Boulding (1956) and Lynch (1960). Boulding's work, *The Image*, established a theoretical foundation for the juncture between environment and humanity through perceived reality. He further argued that an understanding of such an image was necessary if the relationship between environment and overt behaviour was to be understood. That is, the nature and extent of the image could be inferred from actual behaviour. Following on from, and closely linked to, this work Lynch's (1960) empirical examination of environmental image was the first recorded attempt at applying images in a problem-solving manner by emphasising the relevance of perception ideas and studies in various applied contexts.

In clarifying these concepts, and adapting Kirk's (1951) idea of the relationship between the behavioural and phenomenal environments, Downs (1970) provided a succinct schema for environmental perceptions (see Figure 4.1). This model views humans as decision-makers whose behaviour is a function of their image of the real world. Perception and image then form the intervening components between the world and the decision to act in it. The real world, as a source of information, is received by the individual, filtered through a system of perceptual receptors, and modified by the individual's value system to create an image. Decisions and behaviour are then based on this image, and are subject to further adjustment through a continual feedback process. A central notion of this model is that the world as perceived by the individual is a mere representational model of external reality. Thus, the Downs' model encapsulates the various relationships associated with views of environmental perception which are central to the notion of images.

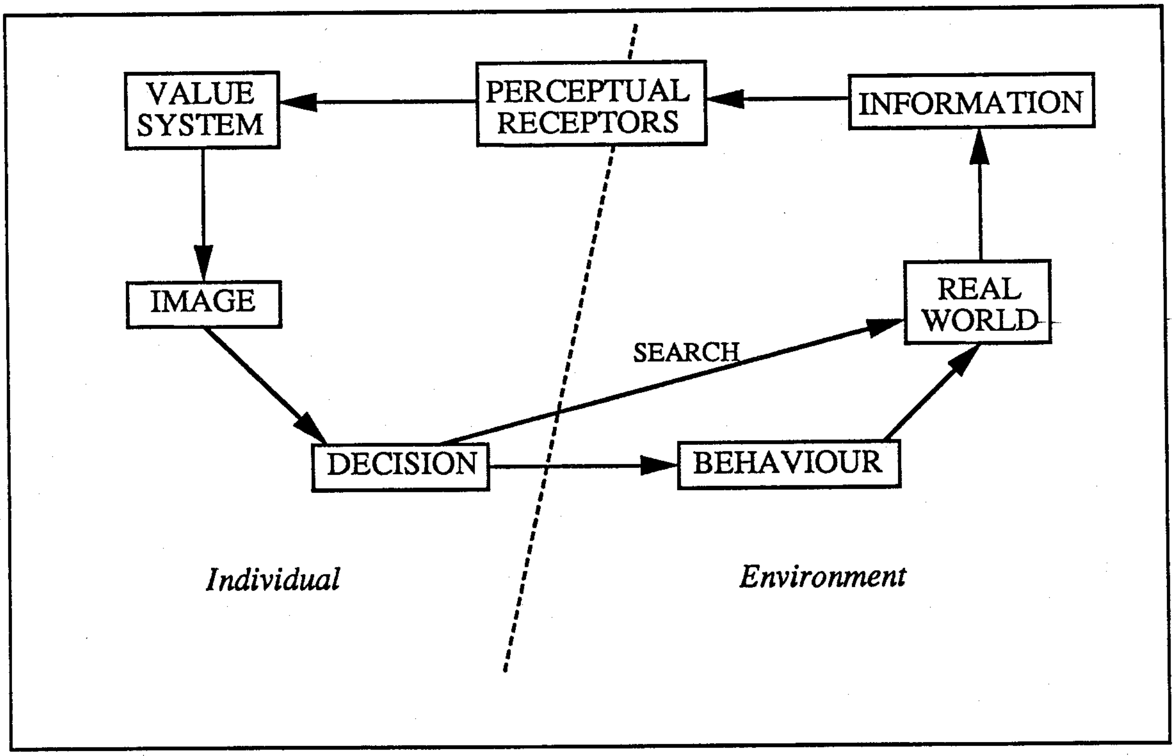


FIGURE 4.1: Conceptual Schema for Environmental Perception (from Downs 1970)

The theory of attitude is of particular relevance to this model, and to environmental perceptions generally. The key assumption, that knowledge of a person's image of an environment allows prediction of their spatial behaviour in respect of that environment, can also be made with respect to attitudes and behaviour (Downs 1970). Thus, quite distinct similarities can be drawn between perceptual and attitudinal concepts. However, it has been contended that the relationship between attitude and behaviour is mediated by other factors (Fishbein 1967). More specifically, beliefs and behavioural intentions are viewed as determinants of attitude. Indeed, they should be considered as independent factors, providing an indication of an individual's attitude (Figure 4.2). The distinction between beliefs in the *existence* of an object, and beliefs about the *nature* of the object is viewed as particularly relevant to the concept of image or perceived reality. Fishbein (1967) has formalised this distinction in a multi-component view of attitudes comprising:

Affect feelings toward the environment

Cognition beliefs about the environment

Behaviour actions with respect to the environment

These attitude components are, therefore, viewed as intervening and interacting factors between environment and behaviour.

That attitudes alone constitute a sufficient basis for determining behaviour is not readily accepted by all researchers. Ajzen and Fishbein's (1980) theory of reasoned action suggests that the range of intervening factors should be further expanded. In turn, Desbarat (1983) criticises the apparently narrow focus of the multi-component view of attitude on the fundamental linkages between environmental perception and behaviour. Instead she proposes a reconceptualisation of these linkages based on the theory of reasoned action. This theory incorporates structural, social and institutional constraints on behaviour which emphasise an individual's attitudes toward *behaviour* rather than attitude solely toward *objects*. Thus, attitudinal theories which accommodate the relationships between individual's attitudes, perceptions and behaviour have important ramifications for the application of environmental perceptions in the human-environment arena.

Golledge and Stimson (1987) have advanced a paradigm for enhancing *behavioural human-spatial settings* which includes the broad set of attitudinal, perceptual and behavioural factors, and their functional relationships, and which also elaborates on Downs' (1970) schema. The intervening process or filtering mechanisms, through which humans perceive their environment and act in it are particularly important in the paradigm. Golledge and Stimson (1987) develop a model of this human-environment behavioural interface (see Figure 4.3) within which individuals form an image of the environment. This model represents an enhanced

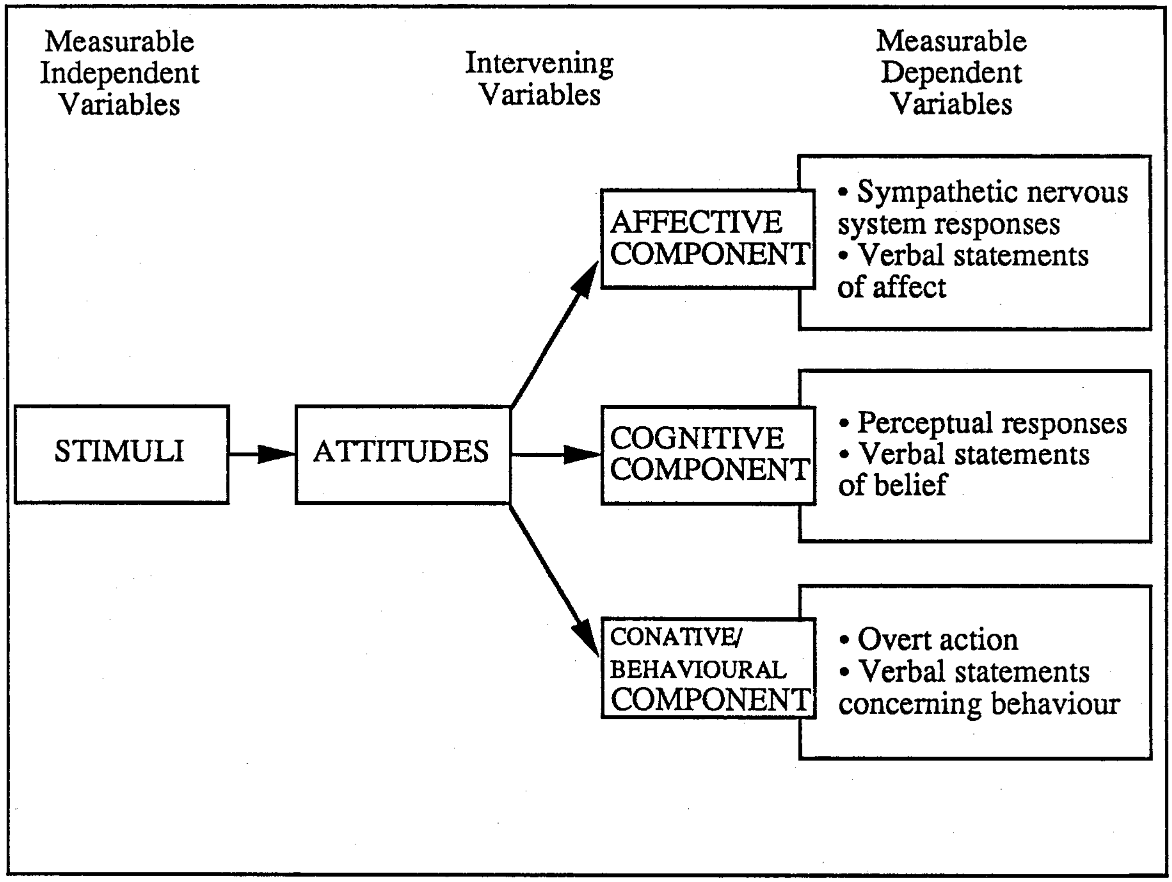


FIGURE 4.2: Relationship between the Three Components of Attitude (from Golledge & Stimson 1987 p50)

behavioural approach to the relationship between human and environment within which peoples' perceptions of, and attitudes to, the environment are accommodated. Consequently, it is in this context that perception studies and their application in natural resource management are considered.

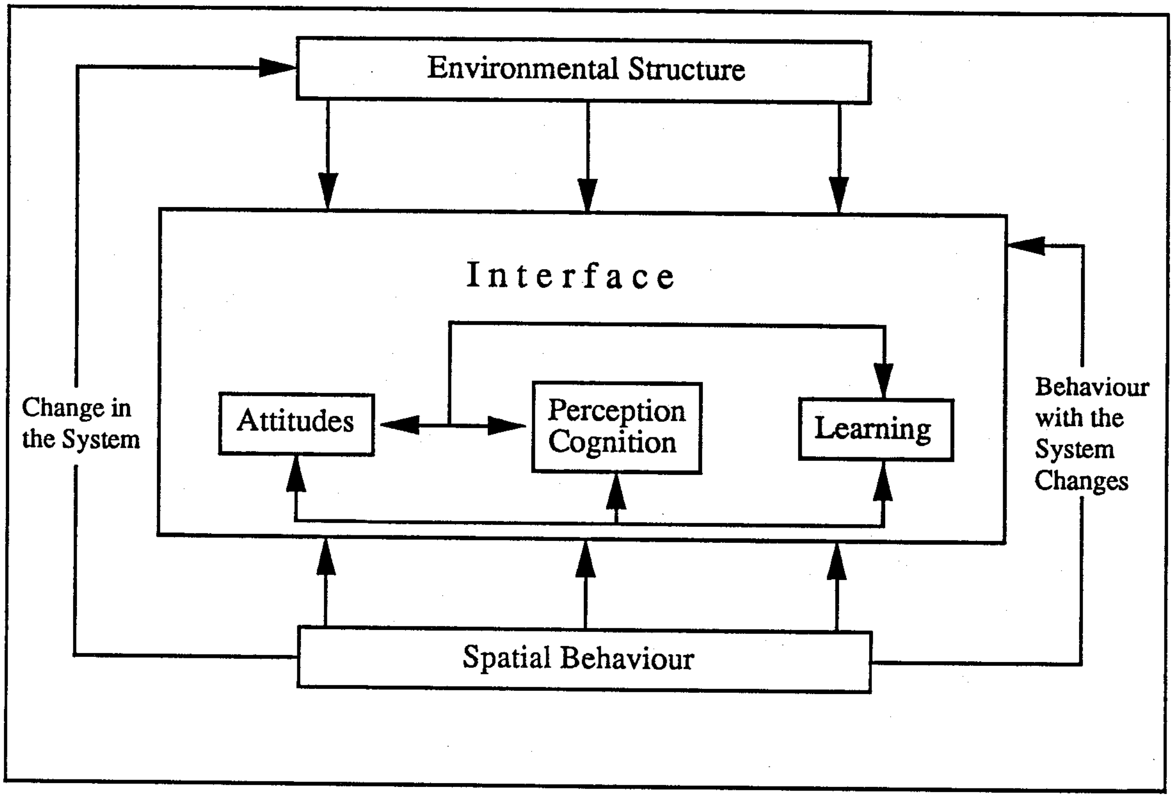


FIGURE 4.3: Model of the Human-environment Interface (from Golledge & Stimson 1987 p11)

4.3 Environmental Perception Studies and Natural Resource Management

The evolving theoretical models of the human-environment relationship discussed above, have provided a mould for the understanding of environmental perceptions. Specifically, this has precipitated various perception studies which have enhanced the contribution of the study of environmental perceptions to resource management. Particular areas of interest are perception studies of mental mapping, hazards, landscape evaluation, and of specific environments of concern to resource management. All of these consider some aspect of the behavioural environment and, in some way, exemplify the various parts of the Golledge and Stimson model.

4.3.1 Mental Mapping Studies

The mental map concept, essentially derived from Tolman's (1948) work, has been a prominent theme in behavioural and perception geography with Downs & Stea (1973) and Gould & White (1974) responsible for major contributions. Mental mapping concentrates on space or place preferences, stressing the notion of a person's subjective image of a geographical area. A specific example of mental mapping with respect to wilderness is Lucas' (1964) work in the Boundary Water Canoe Area (BWCA) which attempted to determine geographic space manifestations of wilderness by canoeists and motor-boaters respectively. This was a pioneering study of wilderness perceptions and provides an important basis for this thesis (it is dealt with further in Section 4.6).

4.3.2 Hazard Studies

Pursuit of the theme of hazard perception has generated considerable research and is of particular significance to resource management. White's (1945) early study of peoples' perceptions of water resources has been followed by major works by Kates (1962) on flood hazards, Saarinen (1966) on drought hazard, and Burton & Kates (1964) on perceptions of natural hazards in resource management. A key focus of this work has been the examination of subjective images of hazard-prone inhabitants in relation to a more objective reality, based on the physical sciences (Bunting & Guelke 1979). The findings suggest that past experiences, and frequency of occurrence, do lead to greater awareness. Moreover, they suggest that this occurs where resource use is directly linked to the hazard. Kearsley (1989) examines the relationship between hazard and resource commenting that natural hazards are the *second face* of the relationship between humans and phenomenal environments. In the same way that positively-viewed resources are constructs of the human mind, e.g. wilderness, so too are the negative resources, or hazards. The two are inextricably bound to our perceptions of their relative utility. Thus, the nature of people's environmental experiences are considered to be influencing factors, in their perceptions of the real world and upon their behaviour.

4.3.3 Landscape Studies

A wealth of studies on both the subjective and objective nature of landscape has arisen, strongly rooted in the human-environment tradition. The more subjective landscape *preference* studies consider various aspects of perceptions and images of landscapes (Lowenthal & Prince 1964, 1965, Lowenthal 1968, Tuan 1974, Zube *et al.*,1975, Appleton 1975), while the landscape *description* studies concentrate on evaluating landscape in terms of scenic quality from a more objective basis (Fines 1968, Linton 1968, Leopold 1969, Litton 1972). Recent work has considered both descriptive studies, in terms of their effectiveness in land use planning (Moss & Nickling 1980), and subjective studies, in relation to the aesthetic experience of surface phenomena (Tuan 1989) . Other researchers (Zube *et al.* 1982) have proposed a relational view that admits to the presence of both object and subject, and consequently integrates the two approaches. In a recent review Dearden & Sadler (1989) suggest that the approaches which have evolved in landscape evaluation should not be viewed as mutually exclusive, but rather as complementary. Thus, the extent to which environmental perceptions are actually adopted is dependent on the purpose and circumstance of an evaluation, and thereby reflects the multifarious aspects of the human-environment relationship.

4.3.4 Recreation-related Studies

Yet another specific field which has attracted attention in terms of perception research has been the study of recreational and related experiences. This has produced studies of perceptions and preferences of, and attitudes to, backcountry settings and other similar aspects. Various components of environmental quality upon which recreational activities impinge have been studied, including wildlife (Shaw & Zube 1980), national parks (Bultena & Field 1980), recreation areas (Frissell *et al.* 1980, Schroeder 1981), and wilderness (Stankey 1980, Zube 1980). The approach to these studies is commonly from an applied perspective and with a concern for environmental problem-solving and planning.

Some specific efforts have been directed at solving the problem of determining wilderness perceptions. According to Lucas (1964), the concept of resources as cultural perceptions has been essential in the study of wilderness. Lucas (1970) then proceeded to consider the identity and structure of geographic space perceptions of wilderness, suggesting that the identification of the spatial extent of such areas is dependent upon an individual's behavioural intentions. This work has generated a substantial body of research which has concentrated on wilderness images and perceptions, and will be dealt with in more detail in the Section 4.4. However, as a line of research it has important implications for managing protected areas.

4.3.5 Conclusion

The various perception studies, reflecting the different foci on the human-environment model, hold some value for resource management and planning, and in general, these arise from a growing concern for environmental quality. Mental mapping studies are of considerable relevance to urban planning and design, as are those landscape studies which seek to consider fully the built environment. Evaluative landscape studies also possess significance for planning in more diverse environments, notably in natural and scenic areas. Perception studies of hazards are particularly useful in regional planning situations and have been applied practically to resource management schemes. In summary, most of these studies imply that the world we imagine is more real than the world that *is*, and this is pivotal to wilderness as a human construct. Each of these areas of study contributes to the understanding of wilderness perceptions in natural resource management and leads to the final focus, on recreation-related studies, and in particular on wilderness—the research focus that is integral in this thesis.

4.4 Wilderness Images, Attitudes and Perceptions

The wilderness system is a representation of specific conditions of the human-environment relationship in the cognitive-behavioural mould. It is a system in which there exist particular phenomenal conditions, specific manifestations of those conditions as a behavioural environment, and therefore particular perceptual conditions. Thus, the wilderness system parallels the Golledge & Stimson (1987) model for a particular set of environmental conditions. Those phenomenal conditions which are not directly perceived as wilderness and, likewise, those perceptual conditions not formally equated to wilderness, are nevertheless important in a broader management sense. It is primarily for this reason that the wilderness system is conceived of as a subsystem of the wider, protected area management system.

The central concern in adopting a behavioural approach to the wilderness management issue lies with applying a knowledge of perceptions, namely that associated with wilderness as a perceptual construct, to the issue. The study of how people perceive environments, stemming from the landscape evaluation tradition, has been applied to research on wilderness perceptions (J.Taylor 1990). In reality, four separate research paradigms reflected in perception research can be subdivided, into those concentrating on the *understanding* of human-environment interactions, and those which focus on the *application* of perceptions (Figure 4.4).

In reviewing these paradigms the cognitive approach is characterised as the investigation of the meaning of environment to people, and has been epitomised by

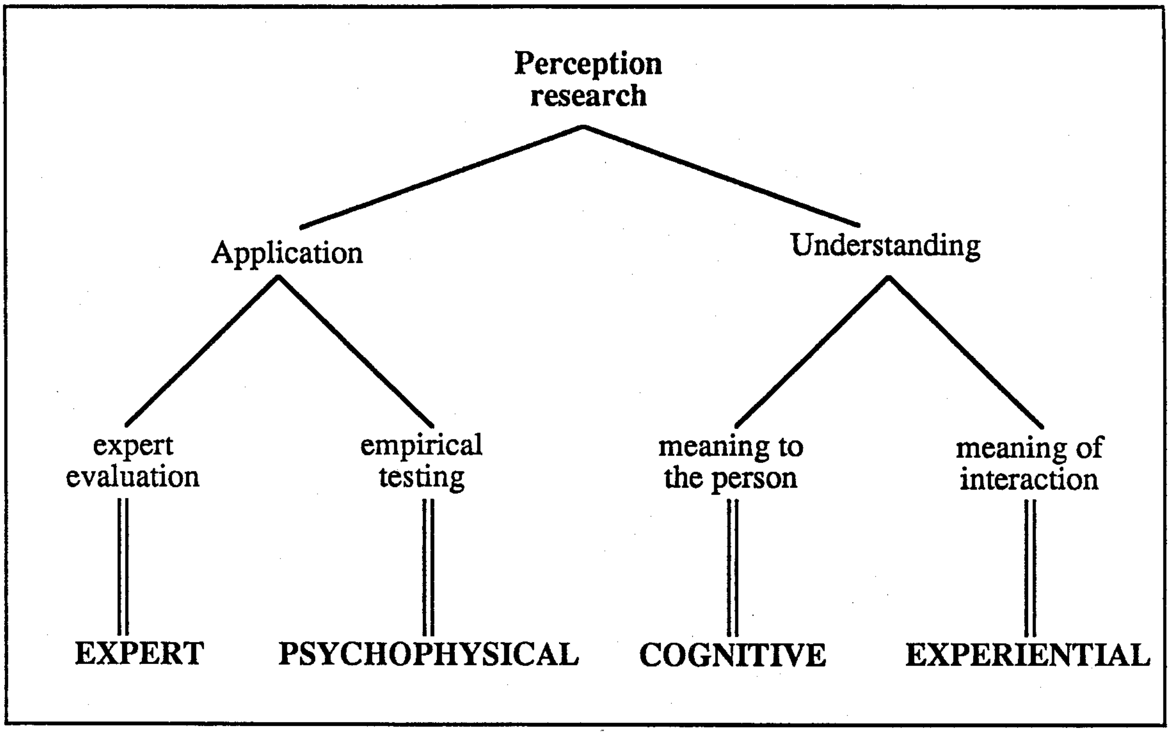


FIGURE 4.4: Paradigms in Perception Research (from J.Taylor 1990)

Appleton's (1975) *prospect and refuge* theory which examined these apparently innate motives for seeking particular environments. The experiential approach focuses on the nature of the human-environment interaction, and has been dealt with by Daniel & Vining (1983). The expert approach is essentially the evaluative study of landscape quality and, as such, is characterised by the landscape evaluation studies reviewed earlier. Finally, the psychophysical approach has dealt with the empirical testing of human responses to environments, suggesting that different perceptions of an environment's quality result from its consideration as an external stimulus (Gibson 1977).

Research into human experience and perception of recreation environments, most notably of wilderness conditions, has been almost exclusively psychophysical in nature (J.Taylor 1990). While studies such as Peterson (1974) have utilised the psychophysical approach in considering the quality of a wilderness environment, it would seem useful here to consider the reciprocal view, that is, to identify or define the environmental conditions evaluated or perceived as wilderness. By identifying those perceptions of environmental conditions which generate perceptual constructs of wilderness, it is possible to elucidate more clearly the human-environment relationship in terms of wilderness conditions. In fact, the behavioural response of individuals to these environments can be considered by examining the nature of wilderness experiences and users' perceptions of those environments.

4.4.1 The Experience of Wilderness

An individual's perception of the environment is derived essentially from a subjective experience (Stankey & Schreyer 1987) but one tempered by cultural and social factors. A wilderness experience is a state of mind which is unique, ostensibly at least, to natural environments. The Shafer & Mietz (1969) study noted that aesthetic and emotional experiences were particularly important to backcountry users in Montana, while Swan (1977) highlights the psychological significance of the wilderness experience. The common characteristics which emerge from these studies refer to: solitude, freedom, naturalness, aesthetic appreciation, spiritual values and mystical dimensions of the wilderness experience (Hendee *et al.* 1978). A further characteristic is denoted by the heightened awareness or enhanced perception of the environment which users experience (Scott 1974). Contemporary elements that are evident in stated motives for seeking wilderness experiences are, most notably: solitude, escape, nature appreciation and social interaction (Stankey & Schreyer 1987). Despite the existence of such common themes, it has also been suggested that there are numerous different ways in which the same environment can be experienced, this depending primarily on an individual's perspective (Knopf 1983). Merriam & Amon's (1968) analysis of backcountry users' concepts of the wilderness experience indicated three distinct views held by backcountry users in Montana. Thus, there is no single thing which can be construed as fully incorporating the wilderness experience (Stankey & Schreyer 1987), and certainly not in terms of any objective criteria.

In practice, wilderness experiences are sought by individuals for differing, but nevertheless related, purposes. This suggests that certain attributes of the phenomenal environment are central to wilderness experiences. A parallel conception for the broader domain of recreation experiences has already led to the development of inventory tools for identifying recreation opportunities as the basis to ROS (Buist & Hoots 1982).

The majority of research which examines those attributes of environments which induce wilderness experiences, emanating predominantly from the United States (Allen 1979, Haas 1979, Manfredo 1979, Feingold 1979), has dwelt on the attributes of designated Wilderness Areas which, owing to their legal status and widespread awareness, are assumed to be *wilderness environments*. Therefore,the experiences obtained when enjoying recreation in such environments are further assumed to be wilderness experiences *per se*. Manfredo's (1979) work identified three wilderness experience groups: a high risk/achievement group; a low risk/social interaction group; and, a norm group. The distinction is based on a series of psychological outcomes (security, autonomy, achievement, leadership and risk taking) which were linked to certain physical resource, social and managerial attributes in three Wyoming wilderness areas. Comparable studies of Colorado wilderness areas (Haas 1979, Brown & Haas 1980) distinguished five experience groups for which the primary discriminating attributes were: the vegetation; attractive topography; water related attributes; and, large wildlife attributes. Hence, wilderness recreation experiences were defined in terms of the psychological outcomes actually sought by recreational users of Wilderness Areas. Yet, while the results from these studies shed some light on the motives and environmental attributes leading to certain recreation experiences in particular protected areas, they do not fully explore wilderness experiences *per se*. However, a useful approach would be to examine the attributes of natural environments that are perceived as providing a wilderness setting from which wilderness experiences are derived.

The experience of wilderness is based on the personal feelings which people take with them into the phenomenal environments that comprise objective reality. The experience and image of wilderness induced in an individual are influenced by values, emotions, social and cultural influences, beliefs and past experiences (Stankey & Schreyer 1987). Collectively, these subjective images are a strong influencing factor on what a person considers wilderness to comprise, and what is actually experienced when interacting in such a behavioural environment. Accordingly, a wilderness experience is largely dependent on, and conditioned by, a person's perception of an environment and what is perceived as the object of a wilderness experience.

4.4.2 The Perception of Wilderness

Wilderness environments do exist as an objective physical reality—a phenomenal environment—but the realisation of that reality as *wilderness* is a function of personal perception. The identification of those wilderness perceptions becomes of paramount importance, assisted by the trends that have emerged in studies exploring the nature of the wilderness image, and then defining the components of wilderness perceptions.

Early studies highlight the intangible nature of wilderness images (Stone &

Taves 1958) and, specifically, identify five different types of images held by back-country users (Bultena & Taves 1961):

- a locale for recreation;
- a place of fascination;
- sanctuary;
- heritage;
- personal gratification.

Lucas (1964) has attempted to explain such differences in wilderness perception, noting first, that variation in such perceptions was associated with several factors, but in different ways for different types of recreationists, and second, that perception of wilderness is influenced by *intended* behaviour. Lucas suggests that by bearing in mind the different user definitions of wilderness, it may be possible to zone park areas in order to provide a diversity of areas deemed suitable for differing types of experience. Hendee (1969) further considered differences in users' abilities to discriminate among environments, focussing particularly on rural-urban differences between users. A broad notion which emerges from these studies suggests that wilderness has different meanings for different people, reflected in imagery and in perceptual variations of wilderness.

Wilderness Purism

The idea that wilderness conveys different images to different individuals was extended by Hendee *et al.* (1968) in the construction of a wilderness attitude (or wildernism) scale. The development of this theoretical framework reflects a variation in perceptions ranging from wilderness purists (wildernists) to non-purists (urbanists) in which the following elements appeared to differentiate those disparate groups:

- tranquility
- solitude
- alpine meadows
- absence of human-made features
- native forest

- natural lakes
- bushline vegetation
- vast areas and enormous vistas
- rugged topography
- native wild animals

(Hendee *et al.* 1968 p25)

In other words, a wildernist found more appeal in these particular features. Conversely, a wildernist was more averse to:

- camps for organisations
- gravel roads
- private cottages
- commercialisation
- powerboating
- developed campsite

(Hendee *et al.* 1968 p25)

The attitude scale itself reflected a uni-dimensional concept of wildernism from which seven factors were distinguished:

1. Spartanism.
2. Anti-artifactualism.
3. Primevalism.
4. Humility.
5. Outdoorsmanship.
6. Aversion to social interaction.
7. Escapism.

(Hendee *et al.* 1968 p31)

Heberlein (1973), however, points to the methodological error of assuming that wildernism is a uni-dimensional concept, and considers that it is in fact a multi-dimensional construct. Heberlein's re-analysis of Hendee *et al's* (1968) data demonstrated that the shorter, uni-dimensional, and conceptually more integrated, artifactualism scale—a scale associated with the degree of development of facilities—accounted for the majority (77%) of variance in wilderness perceptions.

In continuing this work on wilderness scales, Stankey (1972, 1973) accepts that such attitude scales tap a multi-dimensional domain, but he interprets the purism scale as being uni-dimensional from an intuitive point of view mainly in order to provide an additive index of purism. Stankey's *wilderness purism* scale (see Table 4.1), based on the United States legislative definition of wilderness, incorporated three basic characteristics: a natural ecosystem; minimal human development; and, primitiveness of human activity, which are represented by ten items and four other potential qualities of wilderness environments. These are: solitude; evidence of others; remoteness; and size. This resulted in four purism groups, themselves representative of variation in perceptions, ranging from strong purist to non-purist. Thus, the more purist users' perceptions of wilderness were in accordance with the legislative definition and should, Stankey suggests, be the focus of management intentions. This would appear to have certain elitist implications and focuses use on only one pole of the perceived wilderness scale.

More recently, Schreyer & Roggenbuck (1980) have applied the wilderness purism scale, distinguishing three purism groups (high, medium and low) and lending tacit support to the Stankey methodology as applied to the wilderness construct. In broad terms, the wilderness purism scale allows attitudes toward physical and social aspects of wilderness settings to be measured, and also permits the subsequent elucidation of perceptions of these settings.

Wilderness Impact and Carrying Capacity Perception

An additional factor, which holds considerable importance to the perception of wilderness settings, is the perception of carrying capacity and other anthropogenic impacts in natural environments. Stankey's (1971c) work dealt with factors related to a carrying capacity perception of users, thereby focussing on the impact of encounters with other people in wilderness environments. Users' perceptions of wilderness carrying capacity were related to the level of use, type of use, the location of an encounter (i.e. trailhead or interior), and the behaviour of other users. Martin *et al.* (1989) have confirmed that perceptual zoning of natural environments, as measured by the acceptability of impacts in different parts of an area, can occur and with significant distinctions being drawn between the interior and periphery of

1. Absence of manmade features, except trails.
2. Lakes behind small manmade dams.
3. Gravel roads.
4. Private cabins.
5. Stocking the area with kinds of game animals that were not native to the area.
6. Developed campsites with plank tables, cement fireplaces with metal grates, and outhouses.
7. Lots of camping equipment to make camping easy and comfortable.
8. Stocking the area with kinds of fish that were not native to the area.
9. No motorised travel by visitors.
10. Forests, flowers, and wildlife much the same as before the pioneers.
11. Solitude (not seeing many other people except those in your own party).
12. Covers a large area.
13. Remote from towns or cities.
14. Little evidence of other visitors before you.

TABLE 4.1: United States Wilderness Purism Scale Items (from Stankey 1973 p10)

an area. According to Stankey (1971c), the role of these perceptions in establishing carrying capacity was fundamental. He then argued a case for incorporating attitudes of users, particularly those approaching the strongly purist end of the purism scale, as an indicator of capacity.

Frissell & Stankey (1972) had already developed this idea further in considering the role of user perception when setting limits of acceptable change, advocating that user definitions of acceptability be recognised as an important constraint on management decisions. However, they point out various difficulties with accommodating the range of user attitudes toward the constitution of wilderness *per se* and a *desirable* wilderness experience. First, whose definition of acceptable change is to be used (perhaps the strong purist!), and where (everywhere or just some places)? Second, the evolution of culturally imbued perceptions makes human definitions of acceptability realistic only at a single point in time.

Kearsley (1981) extends the investigation of the perceptual component of capacity in wilderness environments by examining the perception of impacts upon environment and behaviour, emphasising that since those conditions which constitute wilderness are defined in terms of human perceptions, the human impacts in any such environment must be similarly constructed. Kearsley also makes the primary distinction between *real* and *perceived* impacts. Real impacts occur when the interaction of human and physical environment generates change, while perceived impacts include those real impacts that are actually seen to have taken place. Perceived impacts may further be considered as either acceptable or adverse which is, essentially, a function of users' attitudinal structures. This has been conceptualised in a model of impact perception (see Figure 4.5), one which derives management recommendations from a knowledge of perceived impacts on the basis of individual and aggregate perceptions.

The perception which an individual has of a wilderness environment has been described as a schema (Moore,1989)—an idealised cognitive representation of what a wilderness environment is like—which is constructed from past experiences and social processes. Moore develops this concept of cognitive schemata by suggesting a framework to explain how users actually determine whether particular social encounters in a natural environment are appropriate or inappropriate in wilderness. His results suggest that social encounters are an important factor in an individual's perception of wilderness and that such attributes can be incorporated into a management system such as LAC. These particular attributes effectively act as cues by which users perceive wilderness and interpret their own experiences in that setting.

The critical role of cognitive processes in defining the wilderness percept has also been explained by Beaulieu (1984). In a study of the components of users' wildland images he showed that, while physical components of an environment were important, aspects of the psychological experience were considered most important. Recent work by J.Taylor (1990) implies that cognitive responses to wild environments can provide information for determining what constitutes wilderness for a user, and this corroborates earlier work identifying the importance of subjective responses to wilderness environments.

4.4.3 Summary

Efforts to explore recreationists' perceptions of wilderness demonstrate that the subjective nature of cognition and experience do shape the perception of what wilderness might be. Although considerable variation arises in what people actually consider wilderness to be, there is some broad consistency in the physical

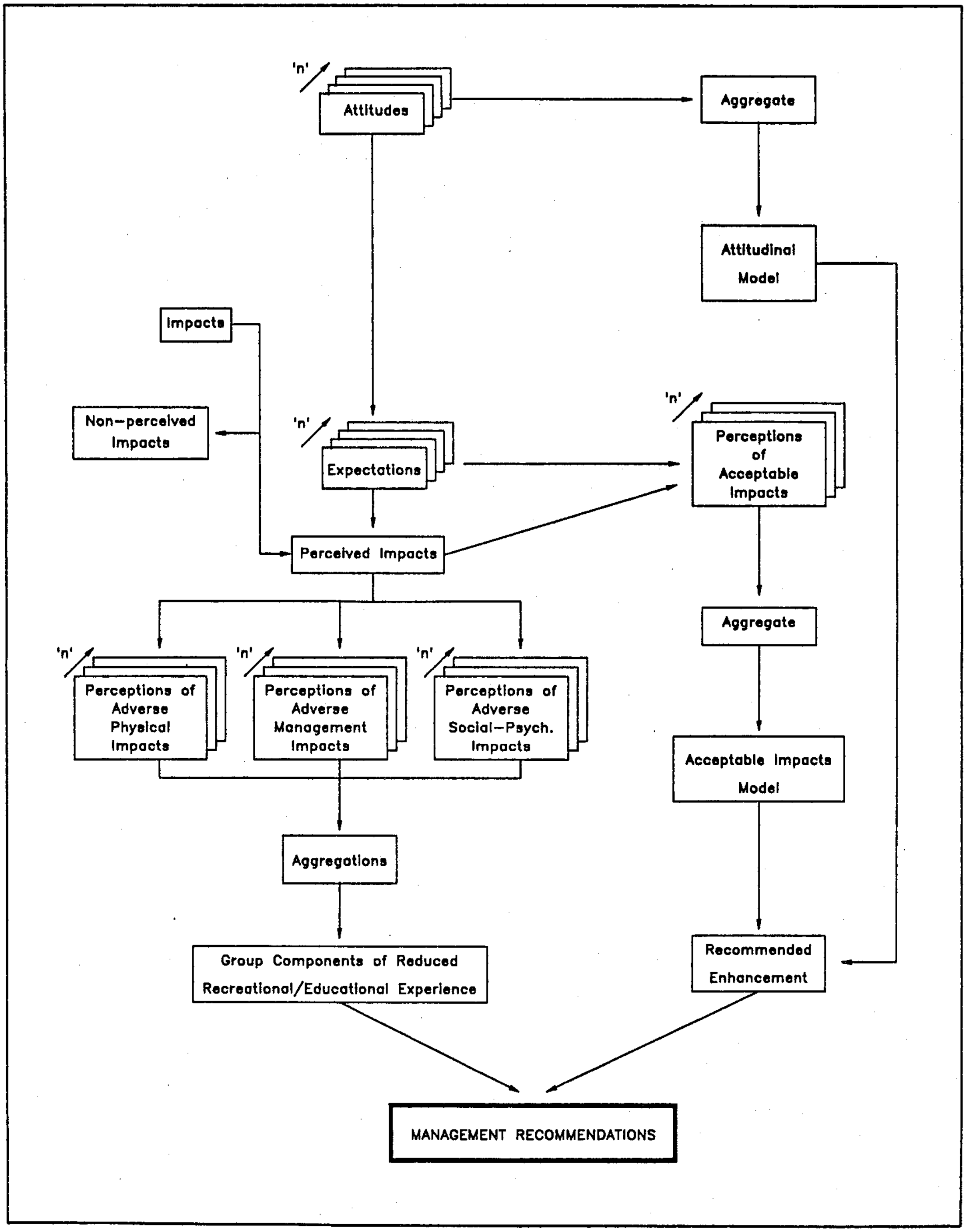


FIGURE 4.5: Model of the Perception of Recreational Impacts (from Kearsley 1990 p133)

and psychological elements that constitute these types of environments. Moreover, whilst wilderness has no universal and agreed physical reality, personal cognition acts to indicate where it occurs such that different social groups have different wilderness perceptions. In this context Stankey & Schreyer (1987) note that such wilderness settings as perceived by an individual do not actually *give* the person a wilderness experience, but rather function as a medium for eliciting such perceptions. Thus, the setting is seen as a place where a wilderness experience appropriately occurs.

4.5 Wilderness Perception in New Zealand

Research on environmental perceptions of protected areas in New Zealand has tended to mirror overseas efforts, especially those of the United States. New Zealand research has been stimulated by NZFS efforts in the mid-1970s and DoL&S work in the early 1980s, both of which were a response to increasing problems concerning over-use of protected areas. However, the primary source of perceptual research has been graduate theses.

Devlin's (1976) study of visitors to Tongariro National Park included a consideration of wilderness attitudes and motivations of respondents, thereby demonstrating comparable results to Hendee *et al's* (1968) study in the United States regarding wildernism factors. In a parallel study of visitors to Arthurs Pass National Park, Simmons (1980) noted that overall perceptions of the Park operated subjectively at both individual and group levels. Cessford's (1987) study of recreationists in the Fiordland/Mt.Aspiring area also included an analysis of user perceptions, focussing on the conflict/crowding perceptions of different activity groups.

While not examining images or perceptions of wilderness explicitly, these studies nevertheless made useful contributions to an understanding of protected area user perceptions within the context of comprehensive surveys in particular areas. However, recognising that user behaviour and its management are dependent upon how the particular environment is perceived (Kearsley,1985b), there is a real need for the explicit elucidation of wilderness perceptions. In response to this hiatus a programme of research has been implemented expressly aimed at fostering an understanding of wilderness imagery in New Zealand and its application to protected area management (Wilson 1979, Kearsley 1983a, 1983b, 1985a, Shultis & Kearsley 1987, Kliskey 1989, Kearsley 1990, Kliskey & Kearsley 1991, Shultis 1991).

Wilson (1979) noted a distinct difference in wilderness imagery and perception

"The world we imagine is more real than the world that is, & this is pivotal to wilderness as a human construct" (Pg 88) between the committed outdoor recreationists and the general public (who exhibited a much broader range of imagery). The more active recreationists tended to be *hard line purists* equating wilderness with pristine environments which contained no evidence of human impact, no matter how slight. However, the general public believed that the presence of facilities (i.e. huts, tracks and footbridges) were still consistent with a wilderness experience—though they set clear limits as to what was acceptable, e.g. rejecting motorised access. Thus:

> ... *the highly active* [appear to] *require wilderness without any human contact* [whereas] *the less involved public believe they can satisfy their desires for a wilderness experience in places that have been in part developed.*
>
> (Kearsley 1985a p135)

This idea has been confirmed in a study of Fiordland National Park (FNP) (Kearsley 1982) which showed that while FNP was generally "... *associated with wilderness in the minds of almost all its visitors* ... " (Shultis & Kearsley 1989 p174), their perceptions of acceptable development and appropriate facilities varied from group to group, reflecting the extent of artifactualism consistent with their images of wilderness (see Table 4.2). Thus, the more pristine-oriented *trampers* did not feel they were in true wilderness as long as facilities existed, while the other groups were "... *quite willing to accept them as part of the wilderness that they perceive*" (Kearsley 1985a p136).

The extension of this work via a substantial study of wilderness throughout New Zealand (Shultis & Kearsley 1987, Shultis 1991) has enabled the elicitation of images of wilderness from the general public, but particularly from users of natural areas in New Zealand (Table 4.3). The principal elements of wilderness perceptions which have emerged are:

- aspects of forest and vegetation (i.e. naturalness);
- solitude;
- absence of human impact (i.e. artifactualism); and,
- isolation or remoteness.

Ignoring the minor differences, images of wilderness characteristic of the general public appear similar to those of backcountry users (Shultis 1991).

A comparison of backcountry users' images of natural environments generally and those perceived as wilderness (Table 4.4), revealed that wilderness was considered to:

USERS(trampers) n = 324	MOTORISTS n = 303	PUBLIC(holiday makers) n = 545
	Positive(most liked)	
Signposts	Signposts	Signposts
Long distance tracks	Toilets	Nature Walks
Nature walks	Nature Walks	Toilets
Information displays	Information displays	Information displays
Toilets	Long distance tracks	Long distance tracks
	Neutral	
Helicopter flights	Through roads	Fireplaces
Fireplaces	Fireplaces	Tables
Picnic tables	Picnic tables	Aeroplane flights
Aeroplane flights	Aeroplane flights	Safari trips
	Safari trips	
	Negative(least liked)	
Jet boats	Jet boats	Circular roadways
Safari trips	Circular roadways	
Hunting	Rail tours	Through roads
Circular roadways	Hunting	Hunting
Through roads		Rail tours
Rail tours		

TABLE 4.2: Attitudes toward the Provision of Facilities in Fiordland National Park—rank ordered (from Kearsley 1990 p137)

- have less facilities;
- be more remote;
- have less human impact; and,
- provide fewer encounters with other people;

than natural environments. Attitudes to the concept of wilderness, determined by using a wilderness purism scale (Table 4.5), showed that facility-related items, i.e. tracks, huts, bridges and road access, were seen as the most desirable by both the

IMAGE	PER CENT
Bush and native forest	29
Peace and solitude	25
No evidence of human impact	22
Trees and natural vegetation	19
Isolated and remote	16
Animals and birds	15
Scenic and natural beauty	12
Rivers, streams and water	12
Mountains and hills	10
In an original condition	8
Birds and birdsong	8

TABLE 4.3: Images of Wilderness held by Backcountry Users—strongest principal elements declared (after Kearsley 1990)

general public and, to a lesser extent, the backcountry users, in what each group perceived wilderness to be. The development-related items, e.g. hydro-electric generation, mining and logging, were seen as undesirable by both samples, though a greater degree of adverse comment was voiced by the backcountry users. Experiential items, e.g. solitude, remoteness, large size, and no human impacts, were perceived as desirable by both groups in their consideration of a true wilderness setting. Again greater support for this aspect was expressed by backcountry users. Thus, while there appears to be a degree of similarity in the elements which constitute the perception of wilderness between the groups, there are also significant differences in the precise composition of those images. Overall, "... *the notion of a broad wilderness consensus, but with a detailed variation of personal perception*" (Kliskey & Kearsley 1991 p6) is confirmed.

Multiple Perceptions of Wilderness

It has been shown that images of wilderness vary from group to group with the possibility of wilderness experiences being satisfied at several levels of facility development. Therefore, pristine wilderness susceptible to even moderate use may in fact be necessary for only a few users. By contrast, less remote backcountry which is sprinkled with huts, tracks and bridges is wholly adequate for the wilderness experiences of many potential users. However, the highly purist, formal physical definition of wilderness that exists within New Zealand's protected areas legislation and practice is rather narrow. This could attract visitors seeking a wilderness

DIFFERENCE	FIRST SECOND	THIRD	CUMULATIVE	
Less Facilities	35	37	23	95
More Remote	18	12	10	40
Less Impact	13	12	11	36
Less People	10	12	19	41
No Difference	5	na[a]	na	na
More Rugged	3	5	9	17
No Exploitation	3	4	2	9
Other	13	18	26	
TOTAL	100%	100%	100%	

TABLE 4.4: Perceived Differences between Natural Environment and Wilderness Areas (from Shultis 1991 p311)

[a]Those who indicated there were no differences between the two areas would not provide additional answers: na = not applicable.

experience—particularly to those areas labelled 'wilderness'—when they may well have been satisfied, in terms of their own particular perceptions, by a much wider range of natural environments. Consequently, Kearsley (1985a) has proposed a typology of natural environment zones, which treat wilderness in much broader terms, as a solution to this particular problem:

Sanctuary areas where no one but scientific observers may enter.

Primeval areas which correspond to the pristine wilderness that the purists desire, and where no sign of man (sic) is allowed.

Remote experience areas that are provided with minimal facilities.

Natural areas which have an easy road access, and are laid out with nature walks, camp sites, toilets and barbeques.

(Kearsley 1985 p136)

The *wilderness* label is not attached to any particular zone in this typology, but each zone contains selected attributes of wilderness environments at least partially dependent on the view of the user concerned. In that sense, the formal legislated definition is only one view of wilderness and one which lies at the puristic end of a scale of wilderness constructs for various individuals and groups of people.

Kliskey & Kearsley (1991 p7) argue that defining wilderness in rigid terms might be self-defeating, and because "*. . . there appear to be a variety of acceptable*

SCALE ITEM	BACKCOUNTRY SAMPLE	PUBLIC SAMPLE	LEVEL OF SIGNIFICANCE
Maintained Huts	2.0	1.9	–
Maintained Tracks	2.1	1.8	0.0006
Bridges/Walkwires	2.2	2.0	0.03
Road Access	2.5	2.3	0.03
Hunting	3.0	3.3	0.002
Developed Campsites	3.3	2.7	0.0001
Solitude	3.8	3.7	–
Stocking Exotics	3.9	3.6	0.01
Remoteness	4.0	3.7	0.0002
Large Size	4.1	3.8	0.0001
Motorised Travel	4.2	3.7	0.0001
Hydro Development	4.3	3.8	0.0001
No Human Impact	4.4	4.2	0.001
Commercial Recreation	4.7	2.6	0.0001
Commercial Mining	4.7	4.4	0.0001
TOTAL MEAN	56.4	51.6	0.0001

TABLE 4.5: Wilderness Purism Mean Item Scores[a] (from Shultis 1991 p241)

[a]The mean score ranges from 1(strongly desirable) to 3(neutral) to 5(strongly undesirable), except for the four experiential attributes (solitude, remoteness, large size, and no human impact), which are scored in the reverse direction due to negative wording.

wilderness states based upon individual perception, a variety of wildernesses *could be defined*". It is this multiplicity of wilderness perceptions that makes it possible to accommodate wilderness in a variety of levels of environmental development, thereby providing a range of satisfactory experiences, and so reducing pressure on fragile ecosystems.

The body of research on wilderness imagery in New Zealand demonstrates that while there are "*... differences of degree, and shades of interpretation among different groups...* " (Kearsley 1990 p135) attracted to natural environments, broad patterns of consistency do exist with respect to their perception and imagery of wilderness. It further suggests that there are four important elements of contemporary wilderness imagery:

- artifactualism;
- remoteness;

- solitude; and,
- naturalness.

To a large extent, these elements reflect general patterns of perception that have emerged in North America. Nevertheless, there are important individual and group variations in perception which suggest that since "*... wilderness is a state of mind, as much as a phenomenon of place...*" (Kearsley 1990 p136), there are many environmental contexts considered acceptable as wilderness. Thus, the multiple wilderness perception concept suggests that there exists a range of perceptions of where wilderness might be found, providing multiple satisfactory wilderness experiences with a commensurately lessened risk of irreversible environmental damage.

4.6 Wilderness Perceptions in Natural Resource Management

So far this chapter has established a theoretical footing for wilderness perceptions as the basis for a perceptual approach to wilderness management. The remaining section will examine the link between perceptual research and resource management in order to highlight a number of points which are vital to the application of the suggested perceptual approach in a management context.

The contribution of perception studies to natural resource management has been highlighted by White (1984). This work focused on the value to resource managers of including a consideration of human experiences of a locality. A prerequisite to such a focus was an understanding of how the environment is filtered perceptually. Vallentyne (1984) draws attention to the importance of images, or perceptions of reality, and calls for an increased appreciation of this knowledge in resource management. This request has been answered by Albrecht & Thompson (1988) who assign the application of perceptual measures a central place in social impact assessment practice. In considering the role of attitudes and perceptions in environmental management, Heberlein points to the usefulness of such information to those who "*... manage natural resources and who must make decisions about the natural environment*" (Heberlein 1989 p55). In particular, he notes three types of useful information that perception and attitude studies can provide:

- goal-setting information necessary to set standards;
- evaluative information about what people feel; and,
- behavioural information about what people might do.

The protection of natural areas and management of wilderness experiences is an especially important case in point whereby the role of perceptions is crucial.

The justification for using perceptions as a planning criterion in addressing the wilderness management issue also relates to the conceptualisation of the wilderness system from a behavioural stance. The behavioural approach stresses the importance of the perceptual environment and has culminated in the Golledge & Stimson (1987) model of the human-environment relationship. Thus, knowledge of perceptual environments of wilderness is deemed as a critical element in wilderness management and supports the application of wilderness perceptions. Until recently, protected area management has been bereft of such knowledge. This is highlighted by the absence from *"... overall planning frameworks of a systematic and integrative process of addressing ... how to include an understanding of the needs of people and the relationship of those needs to national parks"* (Nilsen, in Graham & Payne 1990 p125). Furthermore, Rueggeberg notes that *"... linkages between scientific and ... users' environmental knowledge to support parks management has been limited"* (Rueggeberg, in Graham & Payne 1990 p125). Stankey (1989c) attempts to ameliorate this shortcoming by seeking the knowledge of the non-manager as a way of *linking parks to people* and calls for the systematic identification and use of the substantive knowledge held by users, amongst others, in managing park resources. Such knowledge is suggested as a synthesising platform for the central elements in the designation and stewardship of a protected area system—policy, planning, management and research (Burch 1988). It underlies the pretext by which perceptual information can be employed as a planning criterion.

Two basic assumptions are attributable to the application of environmental perceptions. First, that identifiable environmental images exist, and these can be extrapolated and quantified accurately. Second, that there is a relationship between perceptions, images and behaviour. Both assumptions are crucial to the application of perceptions in an environmental management context and, while they have been variously questioned, are generally agreed upon (Johnson 1983, Kearsley 1983b). Nevertheless, a number of problems arise when environmental perceptions are applied as a planning mechanism to real-world situations. These relate broadly to the operationalisation, i.e. measurement, identification and implementation of perceptions.

4.6.1 Operationalisation

In order to operationalise perceptions, some form of measurement is necessary and this is commonly accomplished through attitudinal devices, such as questionnaires.

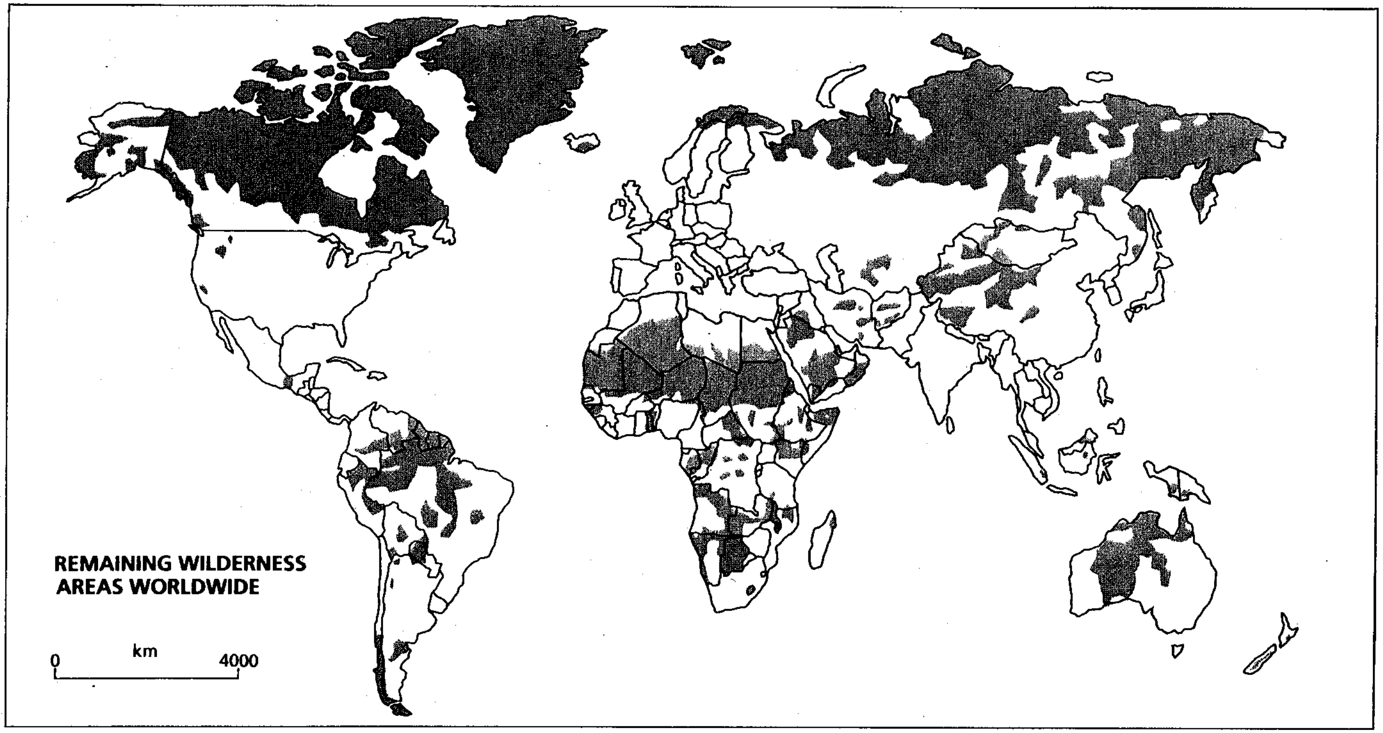
While the elicitation of perceptions through attitudinal surveys is valid (Kearsley 1985b), there are measurement problems associated with such devices (Albrecht & Thompson 1988) which focus attention on the validity, reliability, and scalability of the measurement indicators used. Thus far, the elicitation of wilderness perceptions has been steeped in work of an attitudinal nature, with the wilderness purism scale attracting particular attention regarding attitudes and perceptions of wilderness. Such methodological problems associated with the use of the purism scale have been addressed by Stankey (1973) and Heberlein (1973).

4.6.2 Identification

Having elicited perceptual images through attitudinal surveys, the task is then to identify time and place to which they apply. This identification process is imperative if perceptions are to be fully implemented in a planning process and lead to the notion of spatial delimitation of perceptions.

Approaches to the spatial identification of wilderness conditions have commonly involved objective inventories of undeveloped areas in a natural state. On a global scale, McCloskey & Spalding (1989, 1990) have undertaken a reconnaissance inventory of the amount of wilderness remaining in the world where *wilderness* is taken to be *land without permanent human settlements or roads* and which is *not regularly cultivated or heavily and continuously grazed* (see Map 4.1). This methodology identifies wilderness as a singularly defined state rather than perceived wilderness or ecological aspects of such. While this does not identify experiential conditions of wilderness, it does provide a useful overview for the identification and preservation of potential protected areas and parks. Thus, in determining *"... how much of the land surface of the planet is still predominantly influenced by the forces of nature..."* (McCloskey & Spalding 1990 p14), the inventory provides a broad-brush basis for reserving areas for protection. As a reconnaissance-level inventory, McCloskey & Spalding suggest that it offers a point of departure for more refined inventories in various parts of the world.

Inventories of a more detailed nature have been implemented by the USFS in their Roadless Area Review and Evaluation projects—RARE I & II (USDA 1973, 1978)—aimed at identifying tracts of *de facto* Wilderness Area in their land holdings as a basis for designation as protected areas. More recently surveys of *wilderness quality* in Australia (Preece & Lesslie 1987, Lesslie *et al.* 1988a) have attempted to identify *"... the extent to which land is remote from and undisturbed by the influence of modern technological society"* (CONCOM 1986). In contrast to previous Australian studies, which made use of a single fixed set of identification criteria (Helman *et al.* 1976, Russel *et al.* 1979, Feller *et al.* 1979, Kirkpatrick &



MAP 4.1: Reconnaissance Inventory of Remaining Wilderness Areas Worldwide (from McCloskey & Spalding 1989 p223)

Haney 1980, Hawes & Heatley 1985), this work applies a wilderness continuum concept (Lesslie & Taylor 1985) which conceives of *wilderness quality* in a relative rather than an absolute manner (see Figure 4.6). While this approach has much value in supporting a methodology for identifying objectively undeveloped areas for protection (see Map 4.2), its reference to neither experiential nor ecological conditions makes its claim of recognising *the true nature of wilderness* (if indeed such a thing exists) difficult to substantiate.

These objective inventories are, therefore, useful in supporting global, national and regional policies for the preservation of new protected areas. However, as a means of managing the conditions of wilderness they are deficient, failing to be included within an appropriate management strategy, such as LAC, which integrates biophysical and social data. More significantly, such objective inventories do not provide perceptual information relating to wilderness, which would elucidate the experiential conditions pertinent to the issue.

The initial attempt to identify areas perceived as wilderness is Lucas' (1964) BWCA study, already referred to above. This pioneering work sought to identify geographic space manifestations of wilderness for different recreational activity groups—*albeit* in a crude manner. Thus, the proportion of visitors perceiving a given place as wilderness was determined by aggregating individual responses to a mental mapping exercise (see Map 4.3). However, a more conceptually robust approach is necessary if perceptions are to be incorporated into a planning process and to support the management of wilderness conditions.

As an exploratory concept, Lucas' mental map approach has initiated the idea of a spatial approach to wilderness perception. Such an approach is further enhanced when considered within the context of spatially-supported planning strategies for resolving potential conflicts in environmentally sensitive areas (Fagence 1990). Thus, a spatial approach is of potential value, not only for the task of delimiting perceptions of wilderness, but in the overall planning strategy within which such perceptual information is applied.

4.6.3 Implementation

The implementation of perceptual information in a planning process should not be interpreted deterministically as a *decision-making* mechanism, but rather in a *decision-support* role. Similarly, the elicitation and incorporation of perceptions in planning should not be construed as an alternative to active public participation. This, in itself, is a separate element of any planning process.

In summary, there is adequate justification for applying perceptual information in natural resource management. This is especially pertinent to wilderness

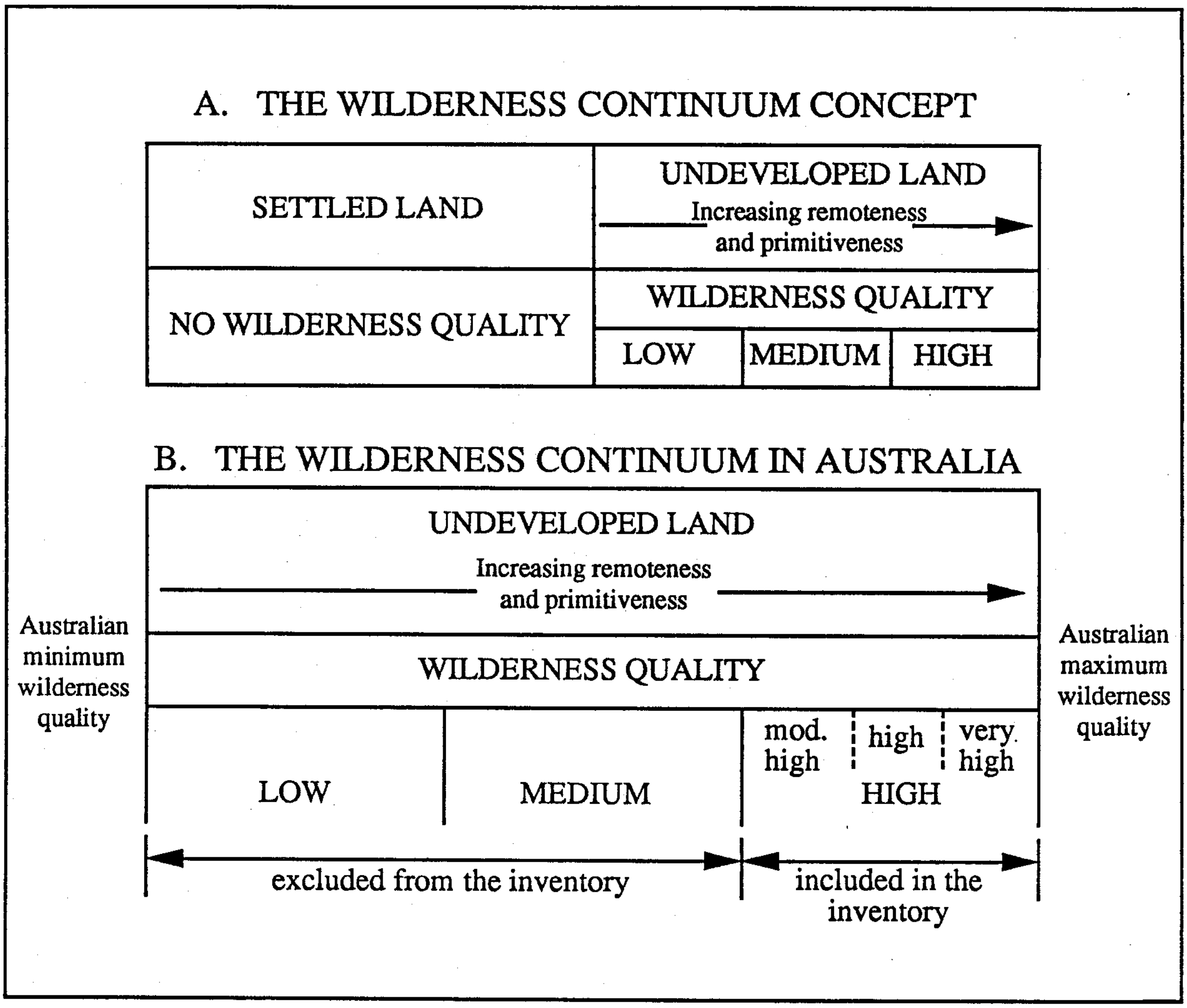
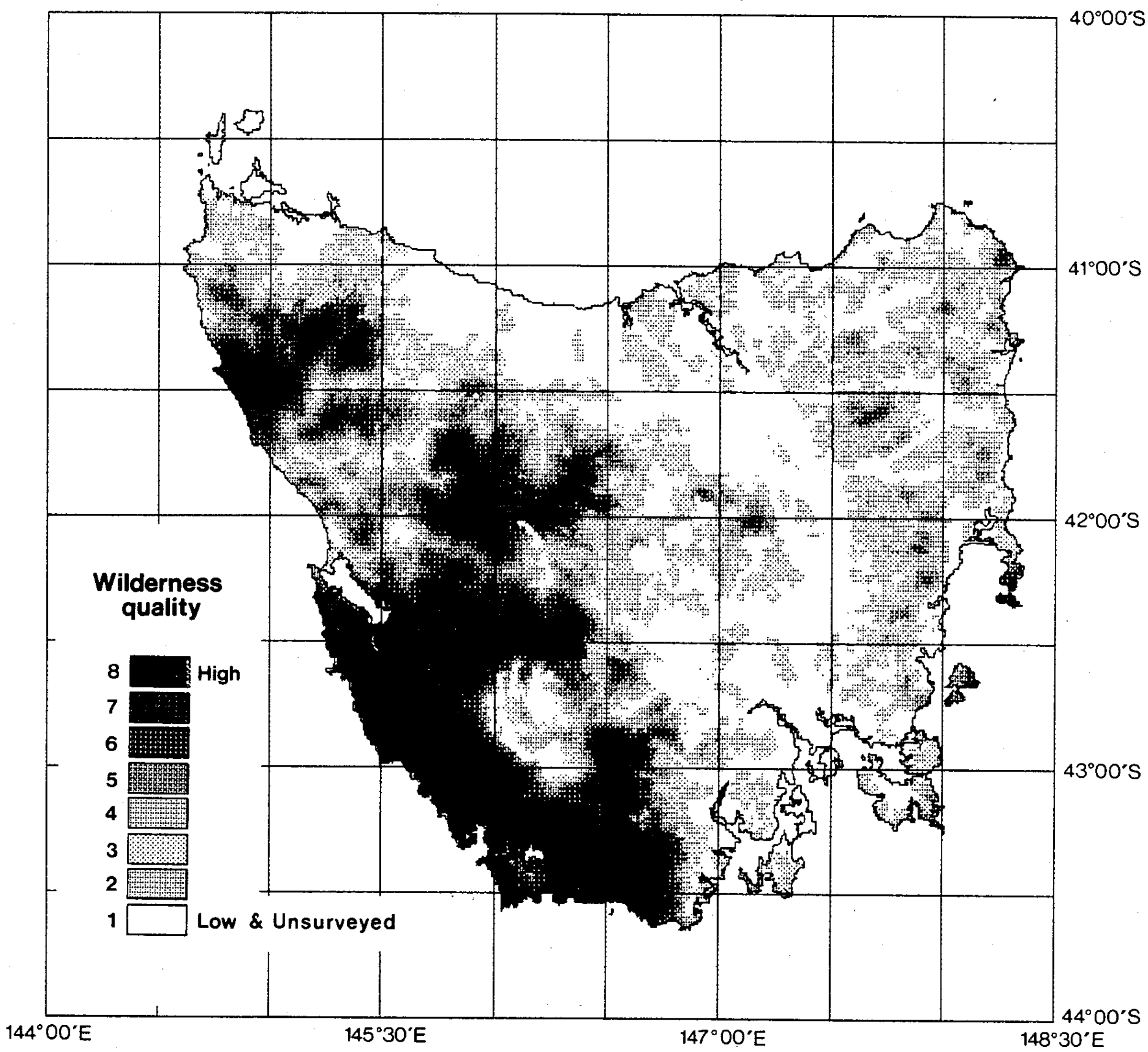
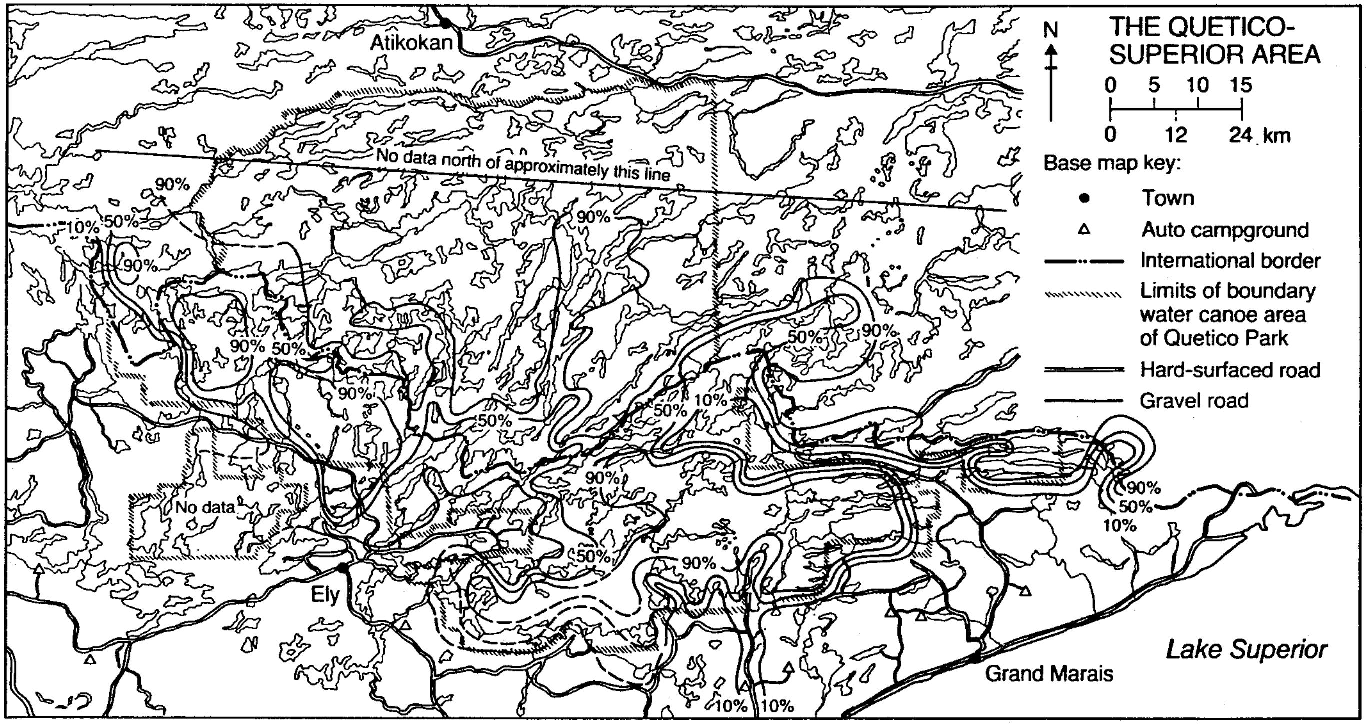


FIGURE 4.6: Representation of the Wilderness Continuum Concept and its Application to Australian Wilderness Inventories (from Lesslie & Taylor 1985 p310)



MAP 4.2: Wilderness Quality in Tasmania derived from an Assessment of Wilderness Quality using the Wilderness Continuum Concept (from Lesslie 1991 p37)



MAP 4.3: The Area considered Wilderness by Four Major Types of Users in the Boundary Waters Canoe Area (from Lucas 1964)

perceptions for protected area management. Underlying assumptions of applying perceptions in this manner relate to the identifiability of environmental images and their relationship to behaviour. Here, a crucial item that requires further examination is the application of a spatial framework to support, first, the delimitation of perceptions, and second, a management strategy for protected areas in which this information is applied. The rapidly developing field of Geographic Information Systems (GIS) and its associated technology provide an exceedingly useful tool which has potential for facilitating such a framework. This is assessed in the next chapter.

4.7 Conclusion

The behavioural approach to the human-environment relationship, in the form of the Golledge & Stimson model, establishes an appropriate approach through which the management of wilderness conditions can be focussed. Broad yet useful contributions of environmental perception studies to resource management have emerged from this model, and especially to the matter of managing conditions of wilderness.

Wilderness perception research has displayed considerable variation in establishing individual constructs of wilderness, and yet a broad consensus emerges on the basic physical and socio-psychological elements. In New Zealand, perception research has highlighted four principal elements of wilderness imagery—artifactualism, remoteness, solitude and naturalness. The variations in imagery that are evident have given rise to the *multiple perceptions of wilderness concept*. This is important for the support it lends to the determination of different levels of wilderness perception. Consequently, the multiple wilderness perception concept has substantial potential for a perceptual approach to the wilderness management issue.

The application of a perceptual approach to natural resource management requires an awareness of the fundamental justification and assumptions associated with using perceptions, and the consideration of problems arising from their implementation. Of paramount importance, with reference to management of wilderness conditions, is the spatial determination of perceptions. Coupled with the idea of a spatial approach to an overall management strategy in which this information is applied, there arises a need to consider the application of GIS to the wilderness management issue. This is dealt with in Chapter 5.

5

The Role of GIS as a Planning Tool in Wilderness Management

An important aspect of any approach to natural resource management lies with the ability to represent spatially those resources and elements of the environment which are relevant to the decision context. The previous chapter highlighted the value of perceptual knowledge and the need to delimit perceptual environments spatially. In the case of the wilderness management issue, this concerns the spatial delimitation of wilderness perceptions. The adoption of a spatial framework for management strategies provides a mechanism for the *spatial conceptualisation of solutions* (Fagence 1990). A basic rationale for applying a spatial perspective to management strategies can be readily derived from the overall function of planning, namely that of providing information in a form that is communicable and applicable to decision-making. Geographic Information Systems (GIS) provide a suitable interface for such a spatial approach and one which establishes the necessary analytical and decision-support tools. Thus, this chapter first examines the role of GIS as an appropriate decision-support tool for natural resource management—the broad field of application within which wilderness management is considered. Second, the application of GIS to protected area management is considered, and finally, the role of GIS in managing wilderness conditions and assisting in the resolution of the wilderness management issue is examined.

5.1 GIS as an Appropriate Tool for Natural Resource Management

5.1.1 A Recapitulation on the Management Process

In order to justify the application of GIS to natural resource management problems, such as the wilderness management issue, it is useful to describe briefly the broad context in which information for the support of decision-making is used. In a generic sense this context embraces the broad set of "... *managerial decisions and actions that determine the long-run performance of an organisation...* " (Koteen 1989), and involves the interaction of several functions—programme design, planning, organising, budgeting, staffing, controlling, and evaluating.

Within the overall management framework the *planning* function provides the structured process within which decision-making and problem-solving occur. The *strategic* planning process in particular has been characterised as a suitable framework for dealing with issues pertaining to outdoor recreation and tourism in a natural resource management arena (Innes 1988, Kliskey 1988) and has "... *gained a reputation among public sector organisations ... as an innovative planning process*" (Seasons 1989 p19). It is also a process being used in conservation management in New Zealand (Willets 1991, also see Chapter 3).

Strategic planning is effectively "... *a disciplined effort to produce fundamental decisions shaping the nature and direction of an organisation...* " (Olsen & Eadie, in Bryson & Roering 1987 p9), within the bounds of its social mandate. A planning process supporting this effort has been presented by Bryson & Roering (1987) and is shown in Figure 5.1. The strategic planning process is not unlike other planning models (Seasons 1989, Gertler 1991), and corresponds to a general systems model as described by Churchman (1968). However, it is primarily concerned with problem-solving, the linkages with the organisation's operating environment, and information needs (Ansoff *et al.* 1976). While the scope of the management process is wider than this, the focus on the strategic planning process provides a useful structure to consider the role of information and decision-support in natural resource management

5.1.2 The Role of Information in Planning

The strategic process portrayed in Figure 5.1 serves to highlight the importance of information in planning and problem-solving. In each stage of the process, information is a crucial ingredient for effective operation within the system (Hoogsteden

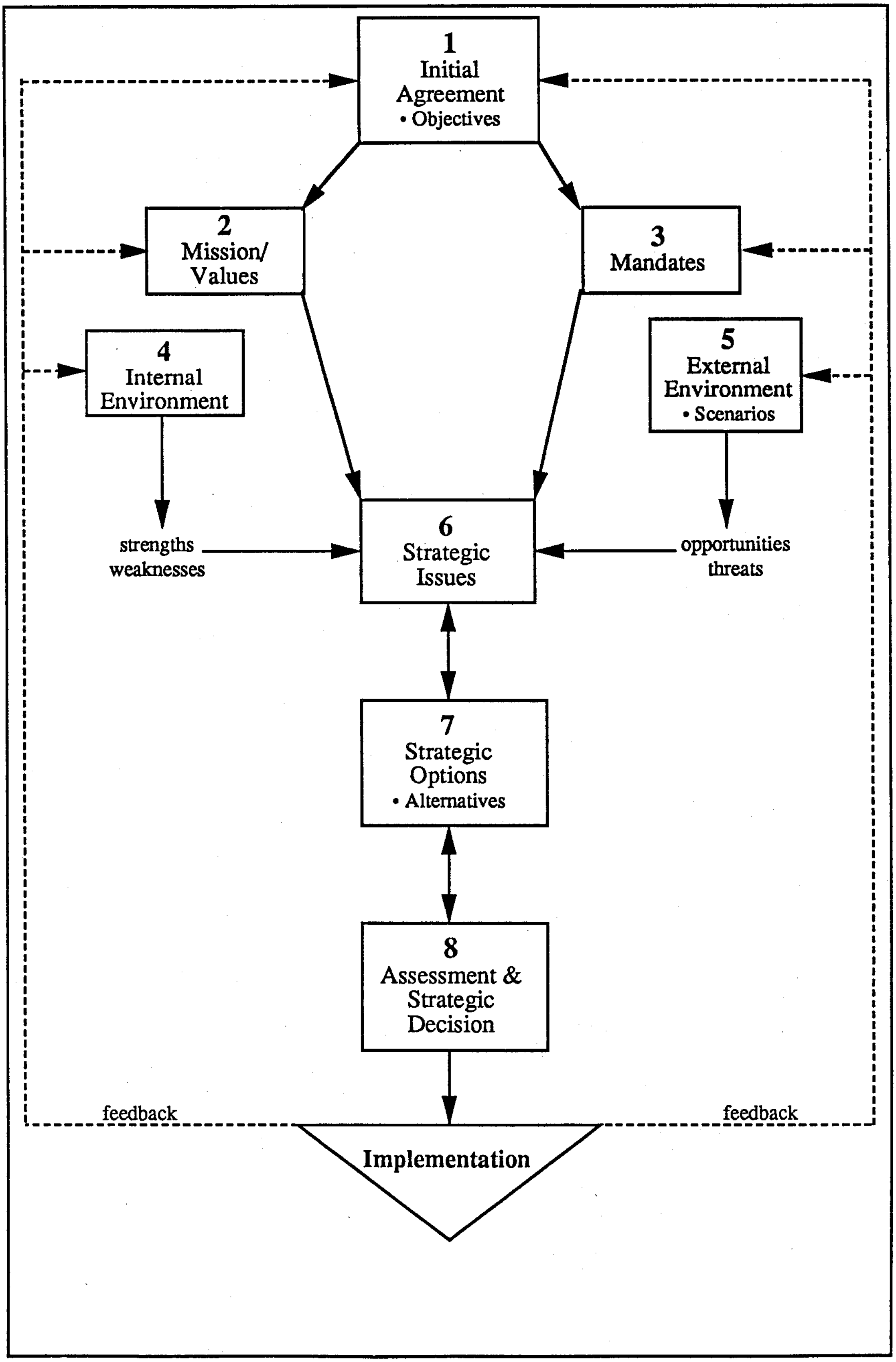


FIGURE 5.1: Strategic Planning Process (from Bryson & Roering 1987)

1988). This is especially true of stages 4 and 5, where resource information is vital in establishing an understanding of the external and internal environments, and in stages 6 to 8, where manipulation of that information is necessary for various analyses, evaluations and assessments. Thus, the successful outcome of decision-making and problem-solving within the planning process is dependent on the input of information and its subsequent manipulation and handling. In this context information acts to reduce uncertainty and enhance decision-making (Faibisoff & Ely 1976).

In natural resource management information of a *spatial* nature, rather than information *per se*, is of particular value to decision-making. When applied to a management strategy, spatial information provides a geographically-referenced basis for analysing relevant resource information. Geographic-referencing itself allows information and subsequent decisions to be interpreted with respect to the *ground* in real world situations, while graphical representation aids the communication of these ideas to those responsible for implementing decisions. Consequently, the implications of policies and management decisions can be expressed geographically. This furnishes the formal statements of objectives with geographic precision and, for example, shows *where* a particular development might be located physically as well as its linkages to other features. It also permits consideration of a regional balance with respect to particular features and, subsequently, portrays the relative importance of such features. That is, the framework establishes a disciplined spatial configuration of relevant information. Importantly, a spatial framework can act to impose structure on an otherwise unstructured configuration of resource inventories, providing a form of geographical classification. Therefore, the application of spatial information and a subsequent spatial view of decisions and solutions is seen as necessary, even essential, for effective problem-solving in natural resource management.

5.1.3 Evolution of Spatial Applications in Resource Management

In providing the basis for a spatial perspective, evolving spatial information applications have provided increasingly useful decision-support in natural resource management. This development has reflected the broad evolution of *thematic* mapping and culminated in the burgeoning use of GIS as a decision-support tool.

The *map* originated as a sketch to communicate a sense of place (Wilford 1981), and is further described as a basic form of communication with special utility for encoding and transmitting human knowledge of the environment. *Topographic* maps are intended to be general purpose tools, forming a base map for environmental study, whereas purpose-specific or *thematic* maps contain information about a single subject or theme, often drawn over the topographic base (Wilford 1981). The definition of attributes for a given geographic area, the characteristic of thematic mapping, has led to the idea of recording different layers of data on a series of maps with a similar underlying base. Developments in the assessment and understanding of natural resources have prompted the development of thematic maps and their usefulness as a source of information for exploitation and management (Burrough 1986). The integration of cartographic techniques, social science theory and environmental responsibility, during the Nineteenth Century gave support to more comprehensive thematic mapping projects. Examples of this were the Railway Atlas of 1838, which overlaid different map attributes at a given locality for transport route planning, and the Snow Map of 1854 which represented specific attributes in a geographic manner for health planning.

The first aim of many early spatial data-collecting studies was to compile an *inventory*; that is, to observe, classify and record. Resource inventory and the modelling of physical processes combined with the need for improved urban planning in the Twentieth Century encouraged greater interest in geographic information processing as a decision-making tool (Kraemer 1969). Thematic maps were of increasing importance, not only for presenting the results of a study, but also as analytical tools. However, until computers facilitated the analysis and display of data, the basis of thematic mapping remained the hand-drawn map. The use of mapped data for resource assessment, land evaluation and planning during the 1960s saw the emergence of integrated resource surveys, that is, mapping in terms of the total interaction of the attributes under study (Hopkins 1977). There were, however, problems of information generality with integrated surveys and difficulties in isolating specific aspects of information. However, in an innovative breakthrough, single-attribute resource maps were combined by McHarg (1969) to give an integrated overview through the use of transparent map overlays.

During the late 1960s and early 1970s the development of digital computers, the advance of spatial analysis through the quantitative revolution, and increased awareness of the environment and its finite resources, acted as a catalyst for the development of GIS as a decision support tool. The advent of computerised cartography allowed the development of computer-generated thematic maps through mapping programs, such as SYMAP, and the spatial and logical analysis of mapped data through computerised map overlays (Fisher 1978). The Canadian Geographic Information System (CGIS), designed to store digitised map data and land-based attributes, was one of the first systems capable of creating new information layers and generating graphic output to support the decision-making process (Tomlinson 1976). Computerised land-use suitability mapping has been developed from such

GIS to obtain the optimum location for a variety of developmental actions given a particular set of goals and various other criteria. The technique, which is applied to natural and human processes, analyses the interactions among location factors, development actions and environmental effects (Lyle & Stutz 1983), using GIS as the key tool for analysis. Developments in computer mapping and analysis, automated data capture, data analysis and presentation have been characterised as an attempt to produce a set of tools for the collection, storage, retrieval, transformation and display of spatial data from the real world for a particular set of purposes. It is such a comprehensive set of tools which constitutes GIS (Burrough 1986).

The evolution of spatial information applications in natural resource management has had its roots in the history of thematic maps and, in particular, in the development of resource studies using thematic maps. The evolution of thematic maps into a true analytical tool increased the awareness of geographic information processing, and the impact of computers on such analyses has led to the development of GIS as decision-support tools. Inherent in this development, a primary goal of GIS has been to take raw data and transform it, through overlaying and other analytical operations, into new information which can support the decision-making process (Parent & Church 1987).

5.1.4 Functionality in Spatial Information Applications

The underlying rationale for initiating spatial information applications in natural resource management is attributable to the communication aspect of a typical planning process. The communication of ideas by graphical means, such as diagrams, maps and plans, has been the subject of considerable attention, mainly through the cartographic process, with specific efforts focussing on the cartographic communication process (Robinson & Petchenik 1976, Keates 1982). As Balodis (1986) suggests, one:

> ... *cannot make a spatial decision without appropriate information. Statistics, computer-generated models, scientific or technical reports more often than not, are cumbersome and meaningless to a legislator or a decision maker, whereas a "good" map like a well-written narrative, should supply the readily understandable spatial information essential to the process of decision making.*
>
> (Balodis 1986 p215)

In this planning role, Taafe (1970) identifies four useful characteristics which maps possess; they:

1. are highly efficient for certain types of data storage;

2. permit a variety of multidimensional measurement;

3. may be used to transform surface characteristics in the plane; and,

4. may be used for testing hypotheses on spatial organisation.

(Taafe 1970 p38)

While such features have contributed to the functionality of maps in natural resource management, there are also severe limitations attached to the traditional hard-copy map which restrict its ability to support the planning process. Notable shortcomings in this role include: the rigidity of a fixed scale; inflexibility with respect to map edges and the detail provided; constraints imposed by the static nature of maps; and difficulties with updating information. Thus, the availability of a means for cost-effective and immediate spatial analysis, capable of supporting management applications, has been lacking.

A dynamic spatial tool that extends the cartographic process to provide an analytical capability in the context of a planning process has arisen only relatively recently. With the advent of computer cartography and computer-assisted mapping, the use of digital maps has provided greater spatial information support for resource management. Advances have included better data management and storage (electronic map filing) and more rapid mapping capabilities (electronic drafting). Despite these advances, Cowen & Shirley (1991) warn that such improvements should not be mistaken for better decision-making tools, noting that:

> *... an atlas, even in electronic form, is not capable of providing the planner with the ability to evaluate alternatives, to deal with land use conflicts or even to handle simple routing or politically sensitive districting functions.*
>
> (Cowen & Shirley 1991 p300)

The central point at issue here is the need for more sophisticated means of analysis, whereas computer mapping systems have placed *"... far more emphasis on efficient data input and retrieval"* (Goodchild 1987 p334). Thus, a geoprocessing system which is to support decision-making processes must provide geographical information analysis capabilities. This would usefully include the following:

- graphic overlay—to produce a variety of maps;
- topological overlay—to integrate two or more files to generate site suitability models and other forms of locational analysis;

- address geocoding—to assign automatically a coordinate point or district to an address;
- polygonisation—to form new districts from the set of existing maps;
- relational matching—the ability to relate two entities for functional purposes.

(Cowen & Shirley 1991 p300)

GIS now provides such a set of tools, uniquely permitting the overlay and integration of different forms of geographical entities.

The *integrating* capability of GIS is an especially important element with regard to planning, enabling the linkage of diverse types of information drawn from a variety of sources. This is an improvement from previous traditional and computer mapping systems for a number of reasons:

- a broader range of operations can be performed on integrated information than on disparate sets of data;
- by linking data sets together, spatial consistency is imposed on them—this adds value to existing data, making them a more effective commodity;
- through the integration of data which were previously the domain of individual disciplinary specialists, an interdisciplinary perspective to geographical problem-solving is encouraged;
- use of an apparently seamless information environment provides more effective and convenient analyses.

(Shepherd 1991 p337)

A key element of information integration within GIS is the linkage of non-spatial (or attribute data) to spatial (or locational data) describing real world features. In a context of natural resource management, this allows a far richer set of questions to be posed, and a considerably broader range of problems to be solved than would be possible in computer mapping systems which handle only spatial data, or in conventional information systems which involve only attribute data. The value of the linkage between spatial and attribute information within GIS include the following:

- users can interrogate geographical features displayed on a computer map and retrieve associated attribute information, either for display or for further analysis;

- maps can be constructed by querying or analysing attribute information in the database;
- new sets of information can be generated by performing spatial operations (such as overlaying) on the integrated database;
- different items of attribute data can be associated with one another through a shared locational code.

(Shepherd 1991 p339)

Therefore, it is the *analytical* potential provided by this integrating capability that establishes GIS as a highly useful planning tool. At minimum, the application of GIS should enable the resource manager to conduct exploratory spatial analysis (Openshaw 1991) while, in an optimal setting, GIS offers the possibility of supporting a sophisticated decision-support system (Cowen & Shirley 1991).

A comparison of the functionality afforded by different spatial information systems (see Table 5.1) highlights the relative value of GIS in supporting planning and resource management. All three systems provide a high level of information presentation in *communication*. The computerisation of maps, giving rise to computer cartography and GIS, has provided those systems with improved functionality for the collection and storage of data to support the planning process (*inventory*); and for monitoring changes resulting from plan implementation or other sources, and identifying sources of conflict (*monitoring*). The integrative ability of GIS provides that system alone with the enhanced capability for generating and testing alternatives, modelling various scenarios, and determining the coincidence of potentially contributing factors (*analysis*). Thus GIS provides planners with a flexible, dynamic problem-solving environment that can enhance natural resource management.

5.1.5 The Role of GIS in Natural Resource Management

The utility of the problem-solving environment, which GIS can establish in natural resource management applications, is related to the functionality of GIS itself. While the functionality of GIS has been examined in some detail (Burrough 1986, Maguire & Raper 1990, Maguire & Dangermond 1991) it can be classified broadly as all the processes of data collection and input; storage and retrieval; manipulation; analysis; and output operations. An examination of the importance of each function with respect to several application areas (including natural resource management) highlights the significance of GIS functionality, especially the manipulative and analytical capabilities, in natural resource management (Table 5.2).

Ability of different spatial information systems to provide functionality for planning (ranging from high - low)		Spatial Information Systems		
		Traditional Maps	Computer Cartography	GIS
Functionality of planning	Communication	High	High	High
	Inventory	Moderate	High	High
	Monitoring	Low	Moderate	High
	Modelling/ Analysis	Low	Low	High

TABLE 5.1: Ability of Different Spatial Information Systems to provide Functionality for Planning

These capabilities enhance the problem-solving environment in two ways. First, the problem can be examined in order to increase the level of understanding and to refine the definition. Second, the generation and evaluation of alternative solutions enables the planner to investigate potential trade-offs between conflicting factors and to identify unanticipated impacts resulting from solutions (Densham 1991). This is characterised in terms of the role GIS plays in the planning process by Figure 5.2 The first part of the diagram shows the basic operation of a GIS, while the latter portrays the application of GIS to the planning process as described above. Thus, the use of GIS is likely to be more effective when applied within a structured problem-solving environment. In broad terms this effectiveness means:

- accomplishing existing tasks more efficiently;
- accommodating a higher volume of existing tasks;
- facilitating the development of new tasks and applications.

(Calkins 1991)

Despite the utility of GIS as a decision-support tool for natural resource management, there are some limitations associated with the application of GIS.

Relationship between GIS functionality and selected applications (ranging from high - low significance)		Selected Applications of GIS		
		Land Information Maintenance	Natural Resource Management	Map Production
Functionality of GIS	Input	High	Moderate	High
	Storage & Retrieval	High	Low	Low
	Manipulation	Moderate	High	Moderate
	Analysis	Low	High	Low
	Output	Low	Moderate	High

TABLE 5.2: Relationship between GIS Functionality and Selected Applications, including Natural Resource Management (after Maguire & Dangermond 1991)

At a technical level the use of GIS functions has required an awareness of the problems associated with using overlay mapping in GIS for planning (Bailey 1988),

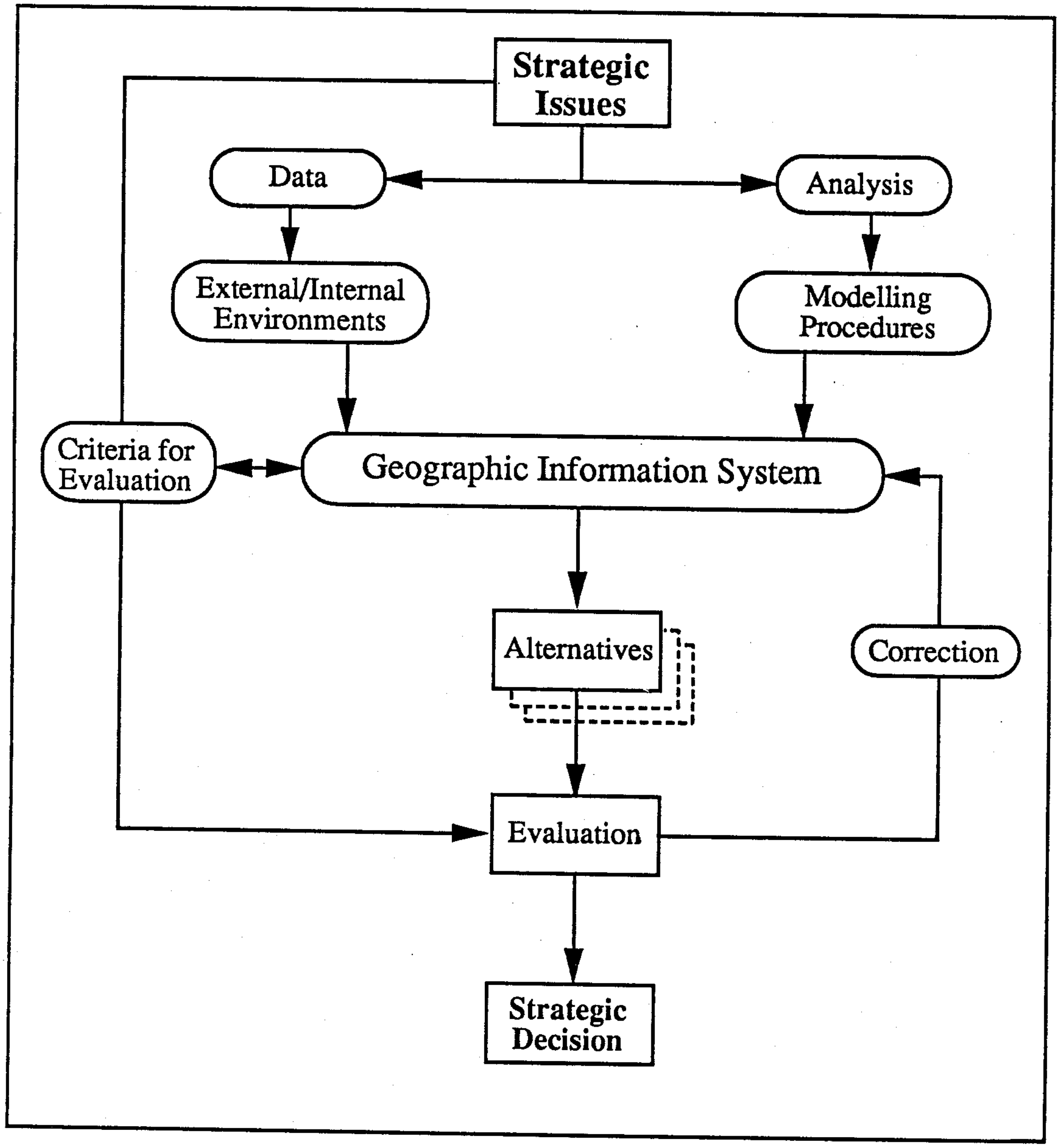


FIGURE 5.2: The Role of GIS in the Strategic Planning Process (after de Meijere & van de Putte 1987)

particularly the need to take account of error modelling in overlaid categorical maps (Veregin 1989, Chrisman 1989). Since GIS is not scale-dependent, the overlay of spatial information that has been derived from markedly disparate scales (e.g. 1:10,000 and 1:500,000), can introduce substantial errors. A simple example arises when a stretch of coastline derived from 1:50,000 topographic mapping is overlaid with the equivalent coastline derived from 1:500,000 relief mapping—the lack of coincidence can be alarming—and any analysis resulting from this type of integration may lead to fallacious conclusions. Similarly, it can be dangerous to apply information, which was originally derived at a particular scale, at a more detailed level. That is, at a scale beyond that which the original scale can realistically support.

In addition to the technical problems related to scale-independence and overlay error, there is a range of social constraints which are likely to affect the use of GIS in natural resource management. These relate principally to personnel training, to legal aspects surrounding information ownership, the interface between user and technology, and to economic factors (Cowen & Shirley 1991). The most significant constraints GIS poses for an organisation, whether natural resource management-oriented or otherwise, are the large financial and time costs associated with their introduction and on-going use. The 1 to 10 to 100 relationship between hardware, software, and data costs respectively, is commonly overlooked—data collection, input and updating can be particularly costly, requiring intensive labour use and incurring high overheads.

In summary, GIS provides the functionality capable of supporting a highly useful, dynamic and flexible problem-solving environment which holds considerable potential for natural resource management applications. Nevertheless, care must be taken to avoid potential pitfalls when using this type of decision-support system.

5.2 The Application of GIS to Protected Areas Management

Geographic Information Systems have emerged as a particularly useful decision-support tool for protected areas management. To this end, there has been considerable work in the development of integrated geographic databases using GIS for regional natural resource inventories (e.g. Dangermond *et al.* 1982) which can assist management approaches to protected areas systems. GIS have also been applied to the resource assessment, planning and management needs of national parks and forests with the express purpose of permitting more rational decision-making and planning (Dangermond 1980).

The application of GIS to protected areas has been a response to efforts to adopt spatial approaches for parks management planning processes (Davis 1980, Nyguist 1987, Wherry *et al.* 1988, Welch 1990, Gauthier 1990, McKay & Kaminski 1991). Furthermore, these efforts have not been limited to terrestrial environments and include wetland planning (Marshall & Blackman 1990) and marine protected areas (Davis & Davis 1989, Bacon & Wong 1990). Some approaches to particular protected areas have been augmented by specific applications of GIS to modelling landscape preferences (Steinitz 1990), historical and cultural resources (Parker & Johnson 1987), and outdoor recreation policy (Gobster *et al.* 1987). The burgeoning use of GIS technology for managing, planning and monitoring protected areas highlights the functionality GIS are able to provide as a decision support and planning tool, and includes: resource inventory and monitoring (Ahlstrand 1991, Chang 1991, McKay & Kaminski 1991, Pearsall 1991, Riebau *et al.* 1991); impact and change detection (Carroll *et al.* 1991, Patterson & Dawson 1991, Tanimoto & Wright 1991); data integration (Campbell 1991, Gribb 1991, O'Doherty *et al.* 1991, Parker *et al.* 1991, Puky 1991, Reynales 1991); resource evaluation and assessment (Beal & Reynolds 1991, Johnson *et al.* 1991); modelling (Adams 1991, d'Oleivre 1991, Lafargue 1991); mapping and communication tasks (Nepstad 1991, Rogers 1991); and general support for decision-making and problem-solving (Hall & Knoerl 1991, Liu *et al.* 1991). While many of these applications emphasise a particular use or function they do not do so exclusively, but usually incorporate a range of functionality depending on the specific problem at hand.

In conservation management, the application of GIS has also assisted the analysis of species *richness* relative to existing nature reserves for the purpose of protecting future biological diversity (Scott *et al.* 1987, Davis *et al.* 1991). The monitoring functionality of GIS has also been applied to biodiversity assessment (Adam 1991, Beckwitt & Beckwitt 1991), as well as to the evaluation of significant ecosystems and rare species (Hamilton & Flaxman 1991), for global and regional conservation. Other ecological applications involve GIS approaches to ecological land classification (Davis & Dozier 1990), vegetation distributions (Klock 1988, Moore *et al.* 1991), quantitative analysis of ecotones (Johnston & Bonde 1989), wildlife distributions (Walker 1990), and habitat evaluation and modelling (Tomlin *et al.* 1980, Donovan *et al.* 1987, Johnson *et al.* 1991). This work has obvious value in protected area management and can, for example, be applied to trans-boundary problems for wildlife management in national parks (Schreier pers. comm. 1991).

As a decision-support tool for natural resource management, and in particular for the management and planning of natural areas, GIS allow the generation and manipulation of spatial data for decision-making and the efficient use of maps for policy analysis. While GIS are merely a tool and do not replace the decision-making process itself, they do possess the potential to assist the resource manager in the application of proper judgement to protected area management problems in a structured and systematic manner.

5.3 The Role and Potential of GIS in Managing Conditions of Wilderness

Geographic information systems have become accepted as an important decision support tool in natural resource management and especially for protected areas planning. In addressing the wilderness management issue specifically, it is evident that, here too, GIS has an important role to play.

Efforts have been made by researchers and managers to apply GIS to two of the theoretical approaches for managing conditions of wilderness (see Chapter 2), and thereby to establish a spatial framework for the particular approach. For example, Gobster *et al.* (1987) adopt a GIS approach for modelling outdoor recreation policy alternatives based on ROS. This is aimed at providing a high degree of flexibility in the analysis of alternative policy decisions. However, the approach is only as effective as the underlying concept (ROS). Consequently, this deals solely with land allocation alternatives based on recreation opportunities. In extending the ability of this concept to deal with conditions of wilderness, the information needs associated with the LAC process have been met by the application of GIS (Mercer 1986). The use of GIS was also seen as providing a spatial framework within which the analysis of biological and physical data, by opportunity classes, could be carried out, location-specific data could be incorporated, and the data could be made readily available, easily updated, and stored in a consistent format. More recently, the Wildland Resources Information Data System (WRIDS) has been implemented as a monitoring tool to support LAC guidelines (Riebau *et al.* 1991). This has concentrated primarily on physical and ecological conditions of Wilderness Areas but has included recreation opportunities. The computer-based method of evaluation for the wilderness continuum concept (Lesslie *et al.* 1988b, Lesslie 1991) has been more closely related to the delimitation of wilderness. However, this is subject to the same limitations as its manual counterpart (see Chapter 4). While GIS is able to enhance the data handling and analysis capabilities of these various approaches, it will ultimately provide a solution only as useful as the original concept that has been applied.

Other approaches, such as UET which provides an ecological component, could be integrated into the LAC process as a result of the spatial framework that GIS provides. Although GIS-based approaches to the ROS and LAC concepts have only been used provisionally, the potential for invoking an appropriate planning approach to managing the conditions of wilderness, through such a framework, is of much value. In fact, the information requirements of all of the approaches detailed in Chapter 2 could be applied through GIS, and subsequently used for further analysis to support decision-making. While enabling social, biophysical and ecological components to be expressed and integrated spatially for management purposes, GIS has a similar potential to invoke a spatial perspective for perceptual information pertaining to wilderness. All that is required is a suitable conceptual framework.

5.4 Conclusion

The rationale for adopting spatial information to support management strategies is derived from functional attributes of the planning process which, in turn, are enhanced by invoking a spatial framework. The technological manifestation of such geographic information concepts as GIS, provide the requisite analytical and decision-support tools for supporting a suitable spatial framework in natural resource management. The application of the decision-support capabilities of GIS in natural resource management have been particularly useful, especially so in protected areas management where their use is becoming more widespread. GIS is seen as having an important role in providing a spatial problem-solving environment for an approach to the management of wilderness conditions. Moreover, GIS harbours the potential for the spatial delimitation of perceptual environments, and its integration into the planning process.

Part II

Conceptualisation of a Spatial-perceptual Methodology

6

The Wilderness Perception Mapping Methodology

This chapter draws together the elements that have been considered in Part I and sets out an approach to the wilderness management issue. First, the research problem is reiterated and the various elements which comprise the problem analysis are synthesised. This allows a suitable methodology to be conceptualised. Secondly, two methods are developed which operationalise the methodology. Method 1 is a relatively intuitive spatial-perceptual approach, while the alternative, Method 2, is a more sophisticated approach that incorporates multivariate analysis techniques.

6.1 Reiteration of the Research Problem

The management of wilderness conditions has been characterised by the need to balance experiential and ecological conditions of a wilderness system. In a broad sense this refers to the dilemma of providing for both use and preservation in protected areas.

A number of management approaches directed toward this issue have emerged, chiefly from outdoor recreation research, and have been outlined in Chapter 2. The common theme underlying these approaches, whether experience- or ecology-based, is their foundation on, or reformulation of, the carrying capacity concept. A premise of all approaches, and of this study, is that management focuses on the key instigator of imbalance in the system, that is, human use of protected areas, rather than management of an area *per se*. The LAC framework has shown the greatest potential in addressing the wilderness management issue, a claim which is strengthened by integrating an ecological component such as, for example, the UET approach. There still remains, however, the need to improve the experiential input to the framework, and it is from this shortcoming that a perceptual approach is suggested.

In New Zealand, the practice of wilderness management has been heavily influenced by the formal definition of designated Wilderness Areas, in largely anthropocentric, and especially purist, terms (see Chapter 3). Within the broader context of the protected areas system this view has been limiting and resulted in reactive management of particular areas, rather than of conditions of wilderness. Despite the implementation of the ROS planning tool and consideration of the LAC framework, a comparison with other countries suggests that New Zealand wilderness management be reconsidered in terms of a management regime that focuses on the conditions of wilderness. This enhances the view that a more fundamental change is necessary at the policy level with due recognition of wilderness conditions.

In response to the shortcomings of both theoretical and practical approaches to the wilderness management issue, a perceptual approach has been suggested (Chapter 4). By conceiving of the wilderness system as behavioural in nature, this approach promotes the application of knowledge of users' perceptions of wilderness as a means of improving the effectiveness of existing conceptual frameworks, such as LAC. The basis of a perceptual approach is the multiple wilderness perception concept that has emerged from New Zealand research on wilderness imagery. Whilst this concept is of much value as a theoretical notion, its management effectiveness would be enhanced considerably if it could be operationalised. This leads to a further issue, that of spatially determining perceptions. The rationale for adopting a geographically-referenced spatial approach to management strategies has been considered in Chapter 5. Consequently, GIS is seen to have a crucial role in establishing a spatial framework for a perceptual approach to the management of wilderness conditions. Thus, GIS provides the requisite analytical capability for the spatial delimitation of wilderness perceptions, and, further, functions as a decision-support mechanism for applying this information to the issue.

On the basis of the analysis of the problem situation in Part I and the above synthesis of these components, the remainder of the research is concerned with a conceptual approach to:

> **delimiting the spatial extent of multiple perceptions of wilderness, as a means of improving the ability of existing management approaches to contend with balancing conditions of wilderness in protected areas.**

This will result in the spatial expression of multiple perceptions of wilderness which can be integrated into an appropriate planning process for natural areas, with the question of *whose wilderness is where* translated into objective and multiply mappable terms. To achieve this, two alternative methods are proposed. The first, Method 1, is a four-stage approach based on simple contingency table analyses of the wilderness purism scale as a uni-dimensional scale, and the uniform overlay of its resulting spatial items. This assumes a straight-forward additive overlay of items. The second, Method 2, is a five-stage approach utilising more sophisticated, multi-variate analysis techniques which probe multi-dimensional aspects of the wilderness scale. In this method the overlay of spatial items incorporates weightings to account for the relative importance of different items. The two alternatives are detailed in the remainder of this chapter.

6.2 Method 1—A Spatial-perceptual Approach

The identification of geographical variation in wilderness perceptions involves translating a relatively abstract concept into more concrete spatial terms. If personal perceptions are to be turned into something approaching direct measurement then the wilderness concept has to be defined in terms of certain quantifiable properties. While it is difficult to consider a direct measure of holistic wilderness perceptions, one strategy lies with the placing of individuals or groups on some *scale* of wilderness, thereby establishing a surrogate means of measurement. In saying this, it is recognised that much of the meaning of wilderness may well lie in the realm of sentiment and emotion. Rather, the intention is to record the varying physical environments where these emotions are aroused in the belief that many environments fulfil this purpose, depending upon whom it is that experiences them.

While personal perceptions of wilderness vary across individuals, there is still a broad area of consensus which include remoteness, artifactualism, naturalness, and solitude. With these concepts, it is possible to move towards operationalising the initial abstract concept. However, in order to measure each of these properties they themselves have to be defined since none of them has a precise meaning in common usage. Once each of the major properties has been defined and suitable spatial variables identified, the required data set can be specified. A schematic representation of the operationalisation of this concept is shown in Figure 6.1. This schema describes the general process of *translation* as one of taking variations in perceptions of wilderness and by, listing the general properties, effectively defining each perception level. The spatial criteria for each property are formulated and a wilderness perception map is constructed from these.

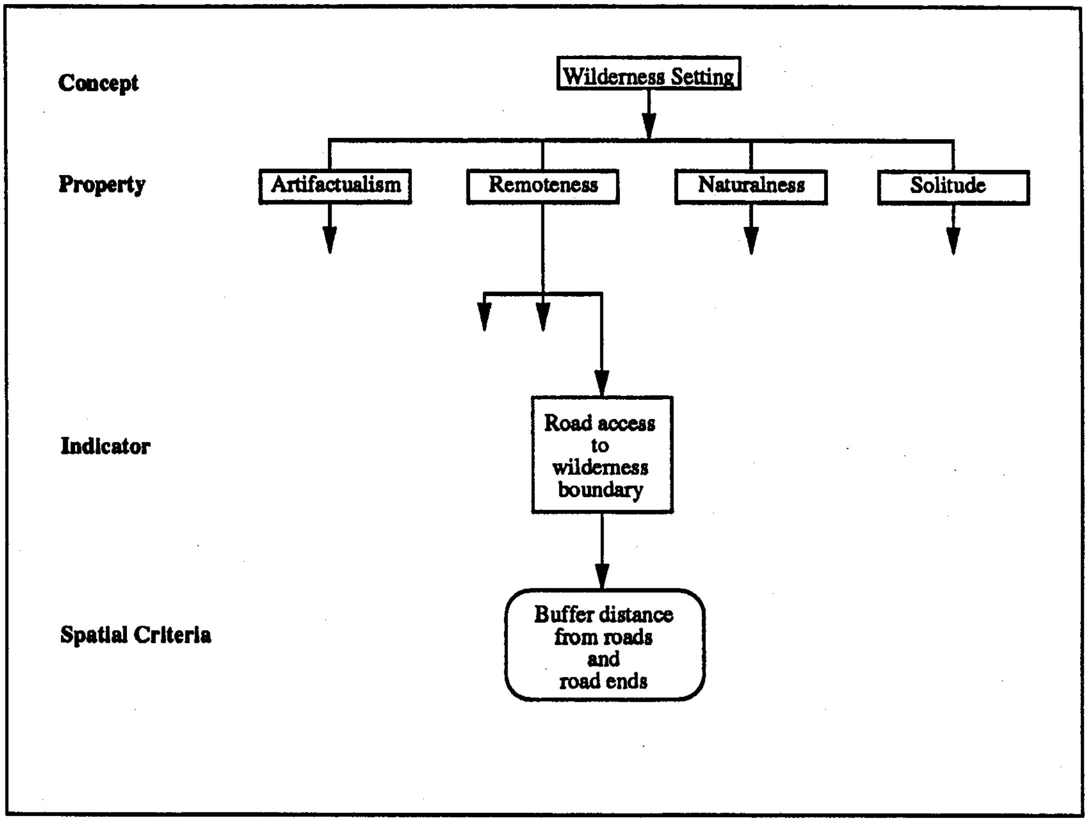


FIGURE 6.1: Schema for the operationalisation of wilderness as an abstract concept (after Smith 1975)

The process of wilderness perception mapping is operationalised through a four-stage methodology which:

- distinguishes varying *levels* of wilderness perception;
- applies backcountry users' perceptions of wilderness settings as elicited through an attitudinal scale;
- translates the attitudinal data into spatial indicators; and,
- maps the spatial extent of these perceptions using geographic information systems.

This methodological approach was first proposed by the author (Kliskey 1989) and is now described in detail (see Figure 6.2).

6.2.1 Classification of Perception Levels

The ability to identify different groups of users, whose perceptions of what constitutes a wilderness setting clearly vary between the groups, is an explicit premise arising from the *multiple perceptions of wilderness* concept. In this particular study, these different *levels of perception* have been based on backcountry users, rather than the general public. While some value would be gained by including a general public sample, whose latent demand makes them potential users, the management of wilderness conditions is primarily concerned with managing actual use and user-impact on protected areas. Thus, the analysis is essentially concerned with user perceptions. Nevertheless, in principle, the process could be applied to the broader largely non-user, public.

The classification of perception levels was based primarily on a wilderness purism scale. Such purism scales are, in general, attitudinal scales, usually Likert or *summative* scales, which are obtained by adding together the response scores of its various constituent items measuring the same attitude (McIver & Carmines 1981). Thus, Likert scaling utilises a set of items, composed of similar numbers of favourable and unfavourable statements concerning the attitude object. In this case, the respondents' conceptions of a wilderness setting, is scored by the respondents in terms of their own degree of agreement or disagreement. The specific responses to items are then summed such that people with the most favourable attitudes obtain high scores while those with least favourable attitudes display low scores. So, for example, referring to the purism scale set out in Table 4.5, a respondent noting all 16 scale items as highly desirable on a five-point scale (highly desirable to highly undesirable), would receive a score of 1 for each item and a total purism score of 16. This represents the lowest possible score (which could range from 16 to 80) and indicates an extreme attitude toward wilderness, i.e. a non-purist attitude. Since the purpose of this is to scale respondents, and not attitude items, the Likert procedure is essentially *subject-centred* (Torgerson 1958). Thus, in Likert scaling *"... all systematic variation in the responses to the stimuli is attributable to differences among the respondents"* (McIver & Carmines 1981 p23).

The wilderness purism scale was first used to identify a hierarchy of wilderness users utilising as a basis the underlying values that govern their attitudes toward wilderness (Hendee *et al.* 1968). Subsequently, this has been used to provide a mechanism that accommodates the variation of user definitions of wilderness

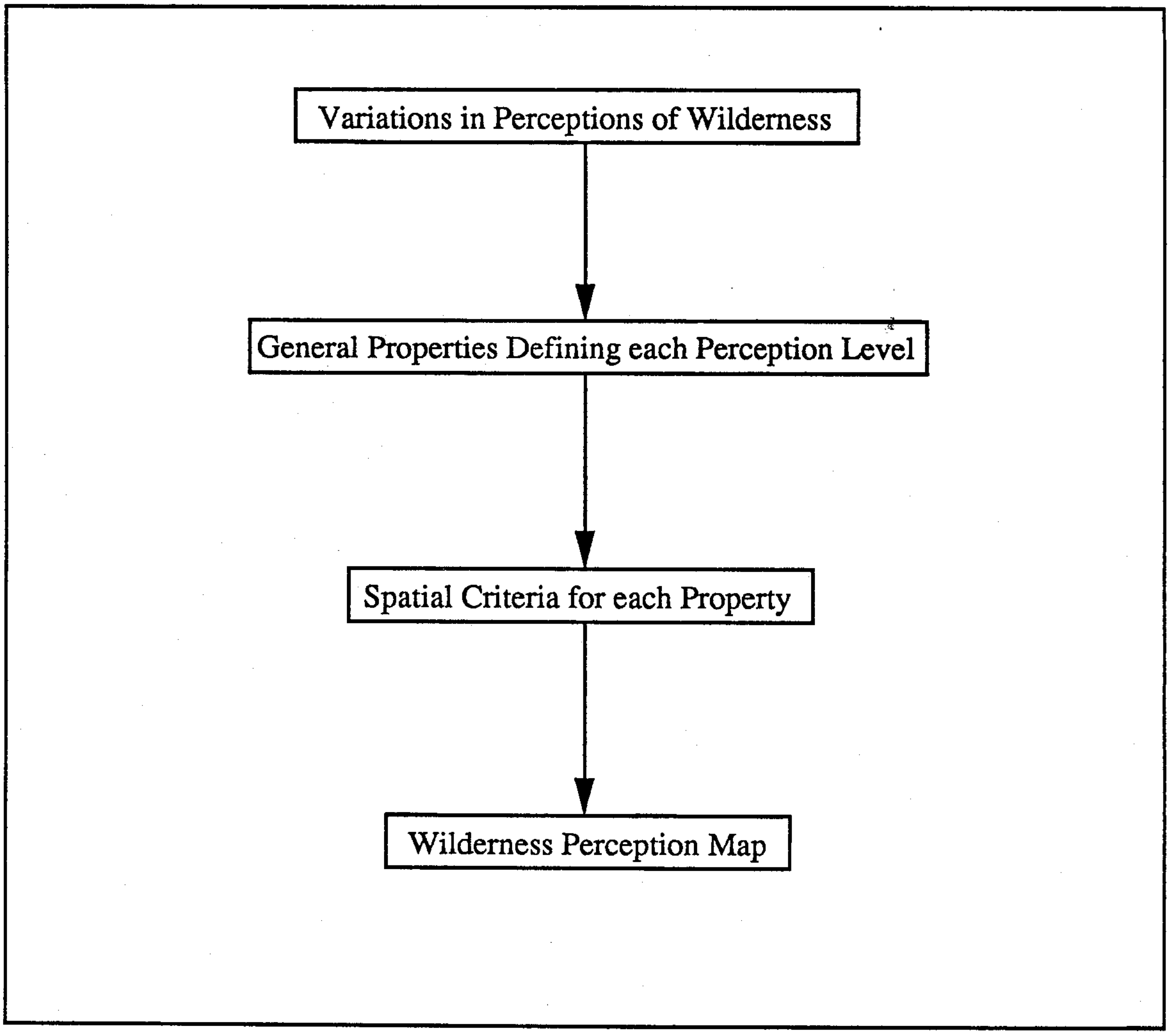


FIGURE 6.2: General Process for method 1

(Stankey 1973), and also to examine the influence that social definitions of recreation areas have upon user perception of, and behaviour in, those environments (Schreyer & Roggenbuck 1980). Whereas these studies have been related to US Forest Service or National Park Service research, a more recent New Zealand study (Shultis 1991) has modified one of the US purism scales (Stankey 1973) to provide a wilderness purism scale which is appropriate to New Zealand and which forms the basis of this stage of the methodology.

The wilderness purism scale, as a uni-dimensional scale, provides an eminently useful method for eliciting perceptions of wilderness settings, as well as providing a conceptual basis for WPM. It is, however, worthwhile to consider briefly other techniques that may have value in eliciting perceptions of wilderness. Should better instruments be developed, they would not invalidate the process developed here using the wilderness purism scale, but they could well lead to somewhat different input criteria.

Personal construct theory (PCT) (Kelly 1955) has been developed to provide an understanding of individual psychological functioning in certain segments of the environment based on the postulate that *"... a person's processes are psychologically channelled by the ways in which they anticipate events"* (Bannister & Mair 1968). While PCT does not afford a suitable means of elicitation when applied to groups of individuals, since the large number of constructs involved in aggregated images of a large population preclude an overall appreciation, its development as group construct theory (GCT) (Wheeler 1981), provides a means for examining the dimensions about which a group of individuals organise their experience; for example, a wilderness experience. GCT is not, however, designed to reveal preferential aspects of aggregate images associated with specific segments of the environment.

Scherl (1988, 1989) has applied the repertory grid technique of eliciting personal constructs in order to construct the major properties or domains that individuals use to interpret a structured wilderness experience. There is, therefore, likely to be some merit in using a personal construct technique, though it would be difficult to apply to wilderness settings compared to the experience itself. Certainly any differentiating *items* that result could be applied spatially as has been done for the purism scale items. A particular disadvantage of using PCT *'a-vis*purism scale would be the use of a surrogate for the experience (i.e. photographs) instead of personal interview in the field.

A more indirect method of eliciting image concepts uses multi-dimensional scaling (MDS) techniques based on multiple comparisons (Kruskal & Wish 1978). Here, data are collected from individuals who evaluate similarity or dissimilarity among pairs of alternatives. The similarity measures yield a set of independent dimensions that represent the structural relationships among the alternatives. This would be more difficult to apply to the wilderness construct, especially from a spatial perspective.

While the repertory grid technique, and, to a lesser extent, MDS represent possible alternatives for eliciting perceptions of wilderness, the application of the purism scale is a sufficiently well founded and robust structure to confirm its use in this study. Needless to say there is scope for further research (beyond this study) in the exploration of alternative methods of eliciting perceptions, and the incorporation of such techniques in WPM.

The wilderness purism scale actually adopted in this study measures backcountry user attitudes towards the desirability of various activity, facility and experiential items in what respondents considered to be a wilderness setting. The 16 items included on the scale (Table 6.1) recognise the variation which is inherent in wilderness perceptions. Specifically, the construction of items on the purism scale reflects the essential elements of the NZ Wilderness Policy (Wilderness Advisory Group 1985) because, in a comparable manner to the purism scale based on the US Wilderness Act (Stankey 1973), "*... that legislation served as a constraint, as well as a guide to, management of wilderness,*[and therefore] *attitudes should be defined in the context of* [such legislation]" (Stankey & Schreyer 1986 p260).

The Questionnaire Survey

The attitudinal questionnaire from which the wilderness purism scale originated, as well as other perceptual data used in the study, was Shultis' (1991) New Zealand backcountry user survey. That research involved the elicitation of perceptions and images of wilderness in an effort to obtain individuals', and New Zealand society's, conceptions of the wilderness resource. It further considered the extent to which different types of natural areas could fulfil the users' requirement for a wilderness experience.

A sample of backcountry users (N=233) was surveyed, *in situ*, from 17 protected areas (national parks, conservation parks, and stewardship areas) throughout New Zealand (see Appendix C), and comprised New Zealand residents who had had at least one overnight stay in the protected area. Shultis' survey sampling utilised personal interview methods predominantly, and involved both *waiting* (usually at a backcountry hut) and *roaming* techniques although in some cases a *mail-back* technique was used. The response rate for the survey as a whole was high, at 85%. A summary of the data elements of Shultis' work is contained in Appendix C.

Specific parts of the Shultis questionnaire, notably the wilderness purism scale, Please refer to the following list of items which might possibly be found in wilderness areas. Indicate how desirable you feel each item is in what you consider to be a wilderness setting.

	strongly desirable	desirable	neutral	undesir-able	strongly undesirable
a) developed campsites					
b) stocking of species not originally native to NZ					
c) road access to the wilderness boundary					
d) commercial recreation (e.g. guided tours)					
e) maintained tracks					
f) bridges/walkwires over rivers or streams					
g) hunting					
h) logging					
i) motorised travel by visitors (use of powered vehicles, boats, etc.)					
j) maintained huts, shelters					
k) hydro-electric development (e.g. dams, powerlines)					
l) commercial mining					
m) solitude (not seeing many other groups of people)					
n) remote from cities or towns					
o) free from evidence of obvious human impact					
p) big enough to take at least two days to walk across					

TABLE 6.1: The Wilderness Purism Scale used in New Zealand (from Shultis 1991)

have been used in this study in order to provide the empirical basis for the elicitation of perceptions. Apart from the raw questionnaire data, the analysis of that data set and its subsequent incorporation within the methodology are original.

The Application of the Wilderness Purism Scale

The wilderness purism scale, by measuring the extent or purism of a person's perception of a wilderness setting, makes possible the classification of users according to their level of purism—ranging from strong purist to non-purist. The items on this scale then serve as initial indicators for the delineation of wilderness images and can be related to each purism class.

The respondents indicated the desirability of an item, in the context of what they considered to be a wilderness setting, on a five-point scale, which ranged from strongly desirable to strongly undesirable. A numeric value between one and five was assigned to the respective response and a total purism score aggregated for each respondent. This summation gave a possible range for purism scores ranging between 16 and 80. These scores provide an indication of users' puristic attitudes toward wilderness with the higher scores representing the more puristic attitude, and therewith their perception of a wilderness setting also.

Classification of backcountry users was based on a four-group segmentation of purism scores. The four backcountry user-groups (comparable to Stankey's (1973) division of purism) are given in Table 6.2. Thus the *strong purists* and *moderate purists* represent two groups with higher scores, the *neutralists* are a group whose scores are centred around the midpoint of the scale, and the *non-purists* comprise a group at the low end of the purism scale. Whilst the classification might be seen as arbitrary, the importance of the groupings actually lies in the *variation* or *gradient* of perceptions they portray. It is also significant that users themselves, so often depicted as a single uniform, often purist, group, can be differentiated in this way. Thus, the purism scale represents a gradient of perception levels based on backcountry-users' personal concepts of what constitutes a wilderness setting.

PERCEPTION LEVEL	PURISM CLASS	PURISM SCORE	PER CENT OF SAMPLE
1	Non-purist	16–45	11
2	Neutralist	46–55	37
3	Moderate purist	56–65	34
4	Strong purist	66–80	18

TABLE 6.2: Classification of Perception Levels based on Purism

The four purism groups reflect levels of perception, or perceptual typologies, which are developed further in the next stage. However, it is useful at this point to examine briefly the demographic profiles of these purism-based perception levels. Contingency table analyses of respondents' purism groups and each of the demographic details elicited from respondents, produced four significant relationships. These are shown in Table 6.3, and provide a general characterisation of these perceptual user groups. The significant characteristics were related to the sex (P<0.03), age (P<0.04), education level (P<0.05) and dwelling locale (P<0.01) of a respondent.

DEMOGRAPHIC VARIABLE	LEVEL OF SIGNIFICANCE
Dwelling locale	0.01
Sex	0.03
Age	0.04
Education level	0.05
Occupation	0.18
Marital status	0.77

TABLE 6.3: Significant Relationships between Purism Groups and Demographic Variables

The overall backcountry sample was characterised as relatively young (approximately 75% of sample was younger than 45), more predominantly male (60%), highly educated (over 60% of sample had tertiary experience or qualifications), and more predominantly from city locations (64%). Across the four purism groups several trends were notable. Thus, as purism strengthens, the age composition moves from a bi-polar situation of younger and older to an increasingly centralised situation of younger–middle age, and then levels out somewhat in the strongest purism group but still with the centre of gravity in the younger–middle age. While males seemed to dominate overall, there was a broad trend of increasing female representation across the first three perception levels which then dropped back somewhat in level 4. There was an overall trend of increasing education level, from school certificate only to graduate qualifications, with increasing purism. The locality of respondents' dwelling place in terms of rural-urban differences was the most significant demographic relationship. Overall, city dwellers tended to predominate but increasingly so with stronger purism.

Respondents in the non-purist group, representing perception level 1, were characterised as 18–24 or 45–54 years of age, predominantly male (88%), less well educated (50% reaching school certificate level with 30% having tertiary qualifications), and with no particular pattern in locality of settlement.

Respondents in the neutralist group, representing perception level 2, were broadly 18–44 years of age but most predominantly 25–34, approximately $\frac{2}{3}$ male and $\frac{1}{3}$ female, displayed no particular pattern in educational attainment, and contained more city dwellers (55%) with correspondingly smaller numbers from small towns or rural areas.

Respondents in the moderate purist group, representing perception level 3, were characterised as 25–34 years of age, equally male and female, predominantly better educated and generally city dwellers.

Respondents in the strong-purist group, representing perception level 4, displayed no particular age structure (all age cohorts being represented in the group), were also approximately $\frac{2}{3}$ male and $\frac{1}{3}$ female, even more well educated and more predominantly city dwellers.

These characterisations provide broad demographic profiles of the four perception groups. The key differentiating features, however, are the perceptual typographies developed in the next stage of the methodology.

6.2.2 Identification of Indicators Defining Key Properties

The different perception levels of the wilderness concept can be defined in terms of key properties. The elicitation of images of wilderness settings from backcountry users in New Zealand (Shultis & Kearsley 1987, Kearsley 1991) has shown that four principal elements or properties of wilderness perception are held:

- absence of human impact (i.e. artifactualism);
- aspects of forest and vegetation (i.e. naturalness);
- isolation or remoteness; and,
- solitude.

These properties also reflect the more general patterns of perception that have emerged in North America (Hendee *et al.* 1968, Heberlein 1973, Stankey 1972, 1973, Hammitt 1982) and allow a closer determination of spatial variation in perceptions of wilderness.

Artifactualism

The Hendee *et al.* (1968) analysis of wildernism first indicated that the perception of wilderness was strongly based on a rejection of permanent human presence in the natural environment, a situation termed *anti-artifactualism*. Thus, the more purist users rejected the presence of facilities and artifacts in wilderness. In the re-analysis of this work Heberlein's multivariate analysis (1973) showed that artifactualism accounted for the predominant perceptual factor of wilderness, noting that 77% of variance in the wildernism scale was attributable to artifactualism.

The inventory work of Lesslie & Taylor (1985) utilised an indicator termed *aesthetic primitiveness* which reflected the *"... disturbance of otherwise natural settings due to the evidence of permanent human presence in the landscape ..."* based on evidence of permanent structures. Lesslie & Taylor recognise the importance of an artifactual component in their *wilderness quality* evaluation, although their rationale for so doing was not based on empirical evidence and the work was not an attempt to identify perceptions of wilderness.

In solid empirical terms, Shultis & Kearsley's (1987) study showed that 22% of respondents (N = 845) rated an artifactual element, i.e. *no evidence of human impact*, as the strongest image of wilderness (see Table 4.3). The earlier work of Wilson (1979) also supports this, using an adjectival selection. The analysis of Shultis' backcountry user data-set reveals that artifactualism (*no evidence of impact* and *no facilities*) was rated by 41% of respondents (N = 233) as one of their three strongest images of wilderness (Table 6.4). By comparison, Shultis' general public sample, while indicating that artifactualism was, too, a strong image, noted this to a somewhat lesser extent, with only 26% rating an artifactual item as one of their three strongest images of wilderness.

Naturalness

Hendee et al's (1968) study indicates that perceptual differentiation of wilderness is also related to experiencing undisturbed natural environments—known as *naturalness* or primevalism. Put another way, people who rejected this element were not attracted to primeval scenes. It was noted that naturalness had some conceptual resemblance to artifactualism, in that a rejection of human dominance over nature is implicit in a preference for primeval scenes. However, the two elements were considered separately.

The work of Lesslie & Taylor (1985) also refers to a naturalness component, termed *biophysical naturalness*, which is defined as the *"... biophysical disturbance of natural ecosystems due to the influences of settled people"*. While not defined on a perceptual footing, this is inferred as an objective and biocentric meaning. Yet in their application of this concept, no reference is made to ecological principles. S.Taylor (1990) appears to recognise this shortcoming when referring to

IMAGE (adjectival response comprising the image)	PER CENT OF SAMPLE RESPONDING BACKCOUNTRY (PUBLIC)
Naturalness (bush/native forest/trees/ vegetation/nature)	63 (60)
Artifactualism (no huts/no tracks/no facilities/ no evidence of impact)	41 (26)
Remoteness (isolated/remote)	30 (16)
Solitude (peace/solitude/tranquility)	12 (25)

TABLE 6.4: Four Most Frequent Responses noted as One of Three Strongest Images of Wilderness

natural ecosystems in biocentric terms, and in particular to disturbances of ecosystems. Thus *ecosystem disturbance* was denoted as "*... a physical or biological (including human) agent (i.e. a cause) that creates a perturbation (i.e. an effect manifested as a detectable change) in the vegetation structure and dominant plant species composition of the ecosystem*". In reality, such changes are of two kinds—succession and fragmentation.

The latter definition by Taylor is dissociated from perceived naturalness and yet fits into models of impact perception (i.e Kearsley 1990). As such, all ecosystem disturbances equate to *real* impacts in Kearsley's model, whilst *perceived* impacts refer only to those ecosystem disturbances which are seen to have taken place. Thus, naturalness is recognised in this work as a perceptual concept and seeks to avoid much of the prevalent confusion between biocentric and anthropocentric notions of naturalness (S.Taylor 1990). This is not intended to imply that ecosystem disturbance is of no interest unless it is a perceived impact—it must still be considered within the wider protected areas management system—but rather that it is not an element in the identification of wilderness perceptions *per se*.

Shultis & Kearsley's (1987) study indicates that 29% of respondents rated the naturalness component *bush and native forest* as the strongest image of wilderness whilst 19% considered its counterpart *trees and natural vegetation* as the strongest image (see Table 4.3). The analysis of Shultis' backcountry user data-set reveals that naturalness descriptors (*bush/scrub/native forest, trees/ vegetation/forest* and *nature*) was rated by 63% of respondents as one of their three strongest images of wilderness (Table 6.4). By comparison Shultis' general public sample also indicated naturalness was a particulary strong image of wilderness, with a similar proportion (60%) indicating this. The first two items comprising naturalness appeared to distinguish between those perceiving naturalness in general arboreal terms in contrast to those who perceived the element in stricter, native (or indigenous) terms.

Remoteness

A further factor identified by the Hendee et al (1968) study that differentiates users on the basis of their perceptions is *remoteness* and isolation from cities or civilisation—also referred to as escapism. Thus, the more purist users were likely to be increasingly averse to involvement with *modern, impersonal, human aggregations* or any evidence of such items.

Hay (1974) comments on the importance of *remoteness* to the wilderness experience on the basis of personal observation. Lesslie & Taylor (1985) also note its importance, similarly without an empirical basis, to their evaluation of wilderness quality. That is, they conceive of remoteness as a function of proximity to settled land, and of accessibility to an area for settled people. They further draw a distinction between remoteness from *settlement* (i.e. points of permanent human occupation or settled land) and remoteness from *access* (i.e. vehicular access routes).

Shultis & Kearsley's (1987) study indicates that 16% of respondents rated a remoteness component, such as *isolated and remote*, as the strongest image of wilderness (see Table 4.3). The analysis of Shultis' backcountry-user data-set reveals that remoteness, denoted by images such as *isolated/deserted/remote*, was rated by 30% of respondents as one of their three strongest images of wilderness (Table 6.4). By comparison, only 16% of Shultis' general public sample gave remoteness as a strong image, suggesting it is somewhat stronger for the backcountry sample.

Solitude

Aversion to social interaction has been noted by Hendee et al (1968) as a further factor distinguishing users' perceptions of wilderness on the basis of puristic attitude. *Solitude* was also associated with the remoteness factor by suggesting that there is further conceptual resemblance between elements and then highlighting the cohesion of these elements in the overall wilderness concept. Thus, while different elements of wilderness can be analysed they must ultimately be considered together. Stankey (1973) also identified solitude and particularly "... *not seeing* *many other parties besides one's own*" as a discerning item of wilderness perception.

Wilderness solitude has since been the subject of considerable research (Hammitt 1982, Hammitt & Brown 1984, Hammitt & Madden, 1989, Patterson & Hammitt 1990, Hammitt & Patterson 1991). Use of a wilderness privacy scale has identified five cognitive dimensions of wilderness solitude (Hammitt 1982, Hammitt & Madden 1989), whereby a natural environment imparts aspects of solitude or privacy; these are:

natural environment & tranquillity: being in a natural environment and removed from human-made intrusions and offering a sense of tranquillity and peacefulness;

cognitive freedom: freedom of choice in terms of both the information which users must process and the behaviour demanded of them. This has two dimensions in respect to wilderness; namely:

- individual cognitive freedom which operates at an individual level and is based on individualistic personal discretion;
- social cognitive freedom which operates at a social level and related specifically to others or small groups;

intimacy: intimacy afforded by a small group of friends, the privacy from other groups and freedom to limit one's attention and degree of interaction with others;

individualism: individual freedom from the expectations and obligations of society.

This suggests that wilderness solitude is a more complex psychological concept than simply being alone or being with just a few other people, and that, from a theoretical perspective, it is more than an acceptable number of visitor encounters on the track or at a hut. Hammitt & Brown (1984) derived five factors in an analysis of functions of privacy or solitude which individuals seek during wilderness experiences:

emotional release: releasing of physical tension from everyday life and social roles;

personal autonomy: development of independence, individuality, and self-evaluation;

reflective thought: the need to regroup, recover, evaluate, and to reflect upon past thoughts, experiences, and events;

personal distance: being alone or in an environmental situation where a desired degree of mental and psychological distance can be maintained;

intimacy: a private environmental situation that fosters cognitive freedom and thought processes.

Collectively, these factors suggest that different groups or *levels* of users could be analysed as to their preferences for certain types and functions of solitude, and further, that it may be possible to manage natural areas for different dimensions and functions of privacy. An important criterion that has been considered for distinguishing such levels is the number of backcountry encounters (i.e. other groups of people met during a backcountry trip) which is found to be acceptable or unacceptable to a user. However, Patterson & Hammitt's (1990) study of backcountry-user encounter norms found that there were significant inconsistencies between the actual encounter norms reported and their relationship to wilderness solitude such that, among other things, some users do not have a clear conception of what a tolerable number of encounters is. Further, it appears that only certain types of users seeking particular experiences have backcountry encounter norms. Nevertheless, in broad terms it is a generally accepted norm that a *large* number of encounters is inappropriate in wilderness settings.

Wilderness solitude research also suggests that the solitude element infers aspects of the remoteness and naturalness elements which further highlight the conceptual interlinkages between the properties of wilderness.

Shultis & Kearsley's (1987) study indicates that 25% of respondents rated a solitude component, such as *peace and solitude*, as the strongest image of wilderness (see Table 4.3). The analysis of Shultis' backcountry user data-set reveals that solitude, denoted by images such as *peace/solitude/tranquility/freedom*, was rated by 12% of respondents as one of their three strongest images of wilderness (Table 6.4). By comparison, solitude is much more frequently noted by Shultis' general public sample (25% of respondents) as a strong image.

Defining the Key Properties of Wilderness

The key elements of backcountry users' wilderness imagery—artifactualism, naturalness, remoteness and solitude—thus form the basis for identifying and differentiating perceptions of wilderness settings. The items on the purism scale act as *locational* images of wilderness. That is, each item is a spatial feature distinguishing what is, or is not, perceived in a wilderness setting. Therefore, these items were used as indicators of a wilderness setting forming the basis for denoting each of the properties identified above (Table 6.5). These indicators then become the focus for translation as criteria with which to define the four key properties of perceived wilderness. So, for example, the artifactualism property of wilderness imagery is given by scale items representing artifactual features, such as developed campsites and hydro-electric development.

GENERAL PROPERTY OF WILDERNESS	INDICATOR FROM PURISM SCALE
Artifactualism	developed campsites
	maintained tracks
	bridges/walkwires
	maintained huts/shelters
	hydro-electric development
	logging
	commercial mining
	little human impact
Remoteness	road access
	maintained tracks
	motorised travel
	remoteness
Naturalness	stocking exotics
	large size
Solitude	commercial recreation
	solitude

TABLE 6.5: Indicators from Purism Scale used to Denote General Properties of Wilderness

Each indicator, and with it each key property, is related to each of the four purism groups so that the variation in levels of perception can be determined. The principal point of interest was the differences between purism groups, highlighting how desirable or undesirable each purism item was in those respondents' perception of a wilderness setting. Thus, it is possible to determine which items are desirable for each purism level and how these items differ between groups. Contingency table analyses of respondents' purism group and their Likert value response to an item (for each scale item) produced statistically significant results for all items (Table 6.6). This corroborates the apparent relationship between perception levels and the acceptability of an item in what is perceived as wilderness, and supports the use of these indicators for differentiating and determining variation in perception levels. Thus, each of the four perception levels displays a degree of inter-group difference, based on the 16 scale items, and suggests that each purism group displays strong internal cohesion. While some groups may not show a great degree of difference based on one or two items, taken as a whole, the purism scale is able to discriminate attitudinal differences amongst the four groups.

PURISM ITEM[a]	PERCEPTUAL LEVEL			
	1	2	3	4
1. developed campsites	√	√	×	×
2. stocking exotics	–	–	×	×
3. road access	√	√	√	×
4. commercial recreation	√	–	×	×
5. maintained tracks	√	√	√	×
6. bridges/walkwires	√	√	√	×
7. hunting	√	√	–	×
8. logging	×	×	×	×
9. motorised travel	–	×	×	×
10. maintained huts/shelters	√	√	√	×
11. hydro-electric development	–	×	×	×
12. commercial mining	×	×	×	×
13. solitude	×	√	√	√
14. remoteness	√	√	√	√
15. little human impact	√	√	√	√
16. large size	√	√	√	√

TABLE 6.6: Contingency Table Results for Perceptual Levels and the Likert Response for each Purism Scale Item

[a]All results are significant at the P<0.001 level.
'√' = item acceptable in perceived wilderness setting.
'–' = item neutral in perceived wilderness setting.
'×' = item unacceptable in perceived wilderness setting.

The process for translating these multiple-perception levels of wilderness is conceptualised in the schema shown in Figure 6.4. In this methodology there are four perception levels, reflecting each of the four purism classes classified in Stage 1 of the methodology. Each level is defined in terms of the four general properties of wilderness and differentiated on the basis of the respective scale items defining the particular property (see Table 6.5 and Table 6.6). The differentiation of each wilderness property requires more detailed consideration.

Artifactualism The artifactual property of wilderness was denoted most markedly by the experiential item expressing an *absence of evidence related to obvious human impact* (Item 15). Referring to Table 6.6 it is seen that this item is acceptable to all purism groups. A closer examination of individual group responses showed considerable variation in the extent of this acceptability, ranging from 58% of non-purists to 97% of strong-purists. This is further highlighted by the variation in desirability between purism groups for the facility- and activity-oriented items denoting artifactualism.

Developed campsites (Item 1) were acceptable to non-purists (80% of the group) and neutralists (55% of the group), while the item was clearly unacceptable to moderate purists (60% of the group) and highly unacceptable to strong purists (90% of the group). *Maintained tracks* (Item 5), however, were generally acceptable to the first three groups (96%, 95% and 81% of each group respectively) yet unacceptable only to the strong purist group (60% of the group). Similarly *bridges/walkwires* (Item 6) and *maintained huts/shelters* (Item 10) were acceptable to groups 1–3 but unacceptable to group 4.

The activity-oriented items denoting artifactualism (*logging* (Item 8), *hydro-electric development* (Item 11), and *commercial mining* (Item 12)), whilst portraying an activity also infer certain physical artifacts. All four purism groups predominantly displayed unacceptability toward these items, particularly groups 2–4 with more than 80% of each group responding to *undesirable*, and to a greater extent with increasing purism. The non-purist group, however, responded to a considerably lesser extent with only 50–60% of this group indicating *undesirable* for Items 8 and 12, while there were mixed feelings with respect to Item 11 to which equal numbers responded to *desirable*, *neutral* or *undesirable*.

In general, the facility-related items denoting artifactualism were found to be acceptable to the less purist groups whilst increasingly unacceptable to the stronger purist groups (especially group 4). The activity-related items were unacceptable to all groups, moreso the stronger purist groups, but with some degree of uncertainty by the non-purist group. The experiential item denoting artifactualism was acceptable to all purism groups and increasingly so with strengthening purism, reflecting the variation displayed by the respective facility and activity related items.

Remoteness The experiential *item* of remoteness (Item 14), which directly denotes the wilderness *property* of remoteness, was found to be acceptable to all purism groups and increasingly so by the stronger purist groups, with 54% of non-purists expressing undesirability ranging through to 93% of strong purists.

The other access-oriented, items that denote wilderness were variously acceptable or unacceptable by the purism groups reflecting this variation. *Road access to the wilderness boundary* (Item 3) and *maintained tracks* (Item 5) were acceptable to groups 1–3 but unacceptable to group 4, the strong purists. A further item related to access but also to activity, *motorised travel by visitors* (Item 9), was predominantly unacceptable to groups 2–4 (72%, 94% and 100% respectively). Again the non-purist group displayed some degree of uncertainty with 24% of this group responding to *neutral*, 36% to *desirable* and the greatest number (40%) to *undesirable*.

Overall, while the experiential expression of remoteness was acceptable to all purism groups, this was with a trend of increasing acceptability by the stronger purism groups. This variation was also displayed by distinguishable differences in acceptability of access-related items to each group, with the less purist groups sometimes finding means of access acceptable but the strong purist group recording consistent disapproval of these items.

Naturalness A major discerning factor in naturalness was the distinction made in wilderness imagery between *native bush or forest* and *vegetation and trees generally* (Table 4.3). These were both particularly strong, though separate, images of wilderness and showed a significant relationship ($P<0.04$) with the respondent's Likert value for Item 2, *stocking exotics*. While this item referred to faunal species, on the basis of the above relationship, it could be likened to vegetative species as well. Thus, those who found exotic species unacceptable were more likely to hold an image of wilderness, in naturalness terms, which was based on indigenous vegetation. By contrast those finding exotic species acceptable were more likely to hold a broader image in terms of general vegetation and forest.

There were also significant relationships between vegetation imagery and Likert response to *stocking exotics* for each purism class ($P<0.04$), suggesting that the stronger purists perceived wilderness in terms of native vegetation whereas weaker purists' perceptions were founded in terms of trees and forest generally. This item actually displayed a uniform gradient of increasing unacceptability from non-purists (40% of group) to strong purists (92% of group), confirming the above set of relationships.

The experiential item *large size* (Item 15), while not a direct indicator of naturalness, can be construed as reflecting this particular property of wilderness. There was a similarly significant relationship between vegetation imagery and Likert response to this item as there was for Item 2, confirming the use of large size as a general indicator of naturalness. All four purism groups found Item 15 acceptable in what they perceived a wilderness setting to comprise, and to an increasing extent with stronger purism.

Thus, a major basis for denoting naturalness lies with vegetation, with the key perceptual distinctions made between native and exotic species, and between forest and non-forest environments. The extent of this differentiation is related to purism with stronger purists more likely to perceive wilderness in terms of indigenous vegetation. This may, in part, reflect where the attitudinal studies were done (i.e. predominantly forested areas), and raises the question of how these perceptual differences relate to such areas as high country grassland—perhaps there is a need for a whole new set of indicators to be developed for such areas.

Solitude The principal indicator of the wilderness property solitude was the experiential item *not seeing many other people* (Item 13), also referred to as *solitude*. This was found to be acceptable to groups 2–4, and to a greater extent with increasing purism (56% of neutralists, 78% of moderate purists, and 95% of strong purists). The non-purist group displayed a degree of uncertainty with 28% responding to *undesirable*, 40% to *neutral*, and the remaining 32% to *desirable* of the item in perceived wilderness. There is thus a distinct gradient in reaction to solitude across purism groups.

The other item that assists in denoting solitude is Item 4, *commercial recreation (guided tours)*. Not only does it infer the presence of other people, but it does so in a particular manner because of the organised way in which that presence occurs. Non-purists found commercial recreation quite acceptable, neutralists were neutral toward the item, while the two stronger purist groups found the item increasingly unacceptable. Again this represented a distinct perceptual gradient.

While *commercial recreation* provides an item that allows obvious translation in physical terms, that is, routes or areas where guided tours operate, the major indicator of the property (solitude) is Item 13. However, there is no direct means of identifying the solitude item, and a surrogate measure becomes necessary. From the earlier discussion on solitude, *encounter norms* emerge as the most suitable direct measure of solitude although this too is fraught with difficulties in translation. The most notable of these arises with inconsistencies between reported encounter norms and wilderness solitude itself. To obviate this, an acceptable encounter level was determined by considering the relationship between the number of other people encountered on their trip and their reaction to this number, i.e. was it too many?

This was elicited in the backcountry survey by first asking respondents the number of other people seen on the trip in which they were engaged, and then asking the respondent what their reaction to that number of people was (i.e. *too many, about right, too few*).

There was a significant relationship ($P<0.03$) between a respondent's purism group and reaction to the number of people actually encountered, suggesting that the stronger purists were more likely to find encounters, with any number of other people, unacceptable. The relationship between the reaction to the number of people encountered by a respondent, and the Likert response to the solitude item on the purism scale was highly significant ($P<0.004$). This suggests further that the more unacceptable encounters were to an individual, the greater the desirability for the solitude item in the perceptions of wilderness.

These trends led to the determination of an actual number of encounters found acceptable. There was a highly significant relationship ($P<0.002$) between the number of other people actually encountered by a respondent and reaction to this number of encounters, suggesting broadly that the greater the number of encounters the more unacceptable this was likely to have been. Exploring this further there was a series of significant relationships ($P<0.04$–$P<0.004$) between numbers encountered and the reaction to this number, for each purism group. Thus, the more purist the respondent the more likely the number of other people encountered is deemed unacceptable, and the more likely this response is toward a lesser number of encounters. Thus, it is possible to deduce a theoretical number of encounters found acceptable or unacceptable to each purism group (see Table 6.7).

ENCOUNTERS [a]	PERCEPTUAL LEVEL			
	1	2	3	4
on tracks	–	>10	>5	>0
in huts	–	>20	>10	>0
at campsites	–	>20	>10	>0

TABLE 6.7: Number of Encounters (per day) found Unacceptable for Perceptual Levels

[a] All results are significant at the $P<0.05$ level. Figures given are number of people per day

Solitude is thus identified using the *encounters* surrogate which has displayed a gradient in numbers of encounters found to be acceptable across the four purism groups.

Differentiation of Perception Levels The variation in attitudinal response to the 16 purism scale items allows perceptions of wilderness to be defined for each purism group. The differentiations for each group are made with respect to the four key properties of wilderness imagery. Thus, profiles of each purism group can be constructed as follows:

1. Non-purist (Perception level 1).

    - accept developed campsites
    - accept road access
    - accept commercial recreation
    - accept maintained tracks
    - accept bridges/walkwires
    - accept hunting
    - accept maintained huts/shelters
    - accept some remoteness
    - accept little human impact
    - accept large size
    - reject logging
    - reject commercial mining
    - reject solitude

2. Neutralist (Perception level 2).

    - accept developed campsites
    - accept road access
    - accept maintained tracks
    - accept bridges/walkwires
    - accept hunting
    - accept maintained huts/shelters
    - accept solitude
    - accept some remoteness
    - accept little human impact
    - accept large size

- reject motorised travel
- reject logging
- reject hydro-electric development
- reject commercial mining

3. Moderate Purist (Perception level 3).
    - accept some road access
    - accept maintained tracks
    - accept bridges/walkwires
    - accept maintained huts/shelters
    - accept solitude
    - accept remoteness
    - accept little human impact
    - accept large size
    - reject developed campsites
    - reject exotic species
    - reject commercial recreation
    - reject motorised travel
    - reject logging
    - reject hydro-electric development
    - reject commercial mining
4. Strong Purist (Perception level 4).
    - accept solitude
    - accept remoteness
    - accept little human impact
    - accept large size
    - reject developed campsites
    - reject exotic species
    - reject road access
    - reject commercial recreation

- reject maintained tracks
- reject bridges/walkwires
- reject hunting
- reject motorised travel
- reject maintained huts/shelters
- reject logging
- reject hydro-electric development
- reject commercial mining

This, in effect, defines four levels of perception (related to each purism group) which can now further be defined in spatial terms.

6.2.3 Development of Spatial Criteria for Indicators and Properties of Wilderness

The third stage of the approach is concerned with the critical linkage between perceptual data and spatial data. Thus, each indicator of a general property defining wilderness perceptions was to be expressed in spatial terms, for each level of perception, to allow incorporation within a GIS environment. The nature of an indicator for a particular perception level—that is whether an item is a component of a wilderness setting for that purism group—was established from contingency table analyses (Table 6.6). The spatial extent for that indicator was then determined by delineating the physical area influenced by that feature.

In general, the degree or amount of influence was considered to be represented by a buffer zone around the geographic manifestation of the item, the buffer distance itself reflecting a linear scale which increases according to the extent of desirability or undesirability for the item. The minimum distance necessary to buffer a geographic feature (e.g. a hut or track) adequately, is taken to be 1 km. This is a reasonable assumption that takes account of the need to exclude the presence of an unacceptable feature in terms of sight, sound and smell, and is based on average New Zealand backcountry conditions (commonly forested). A buffer distance anything less than this, e.g. 500 m, is unlikely to provide sufficient exclusion. In some cases 1 km may not be adequate. However, taking a 1 km buffer as the starting point, it is possible progressively to increase the distance across purism groups, in recognition of increasing undesirability for an item. The hydro-electric development item, for example, displays a perceptual gradient whereby hydro-development is acceptable to perception level 1, but is progressively undesirable across perception levels 2–4. Thus, the buffer distance for level 2 is 1 km (the minimum necessary), and increases successively for levels 3 and 4. The relative increase in buffer distances across perception levels that has been adopted is a linear increase, which reflects the broad perceptual gradients (i.e. desirable, neutral, undesirable, highly undesirable). Thus, in the hydro-electric development example, the buffer distance for level 3 is 2 km and for level 4 is 3 km. While these are reasonable assumptions, made on the basis of perceptual differences (between groups), the distances actually used may ultimately require field testing.

The items subsequently included or excluded from the *spatial-perceptual* definition of a perception level, and the distance gradients across perception levels for each item are shown in Table 6.8. These buffer distances are critical in operationalising wilderness perceptions in a spatial manner. This being the case, should any adjustment be necessary, e.g. a greater minimum buffer distance than 1 km or a different relative increase across perception levels, then GIS functionality allows this to be accommodated, and any updating performed, with relative ease. The spatial-perceptual definitions of each wilderness property are now considered in more detail.

Artifactualism

The indicators for artifactualism are denoted by exclusion zones buffering those items, notably structures, which are unacceptable to a purism group's perception of wilderness (Table 6.8). For example, *maintained tracks* and *huts* are included in the delimitation of wilderness for perception levels 1–3 but excluded from that for level 4, using a 1km buffer. Likewise, *logging sites* and *mines* are excluded from all four perception levels but with buffer distances of 1km, 1km, 2km and 3km respectively—a linear distance gradient reflecting the perceptual variation for these items across perception levels.

Remoteness

The indicators for remoteness are expressed as buffer zones around unacceptable items, generally means of access, for each level of perception. Thus, *maintained tracks* (also an artifactual item) as an acceptable feature of a wilderness setting as perceived by the non-purist, neutralist and moderate purist groups is included in the definition for perception levels 1–3. As an unacceptable feature for strong purists the item is excluded, using a 1km buffer zone, from the wilderness perceptions of perception level 4.

Feature to be Buffered	Perceptual Level 1	2	3	4
Artifactualism				
campsites	–	–	1 km	2 km
maintained tracks	–	–	–	1 km
huts/shelters	–	–	–	1 km
logging sites/roads	1 km	1 km	2 km	3 km
hydro-development	–	1 km	2 km	3 km
mining sites	1 km	1 km	2 km	3 km
Remoteness				
roads				
sealed	1 km	1 km	2 km	3 km
metaled	–	1 km	2 km	3 km
4WD	–	–	1 km	2 km
foot tracks	–	–	–	1 km
airfields				
aerodromes	1 km	1 km	2 km	3 km
airstrips	–	1 km	2 km	2 km
Naturalness				
vegetative cover				
urban/crop/pasture	1 km	1 km	1 km	2 km
exotic scrub	–	1 km	1 km	2 km
exotic forest	–	–	1 km	2 km
Solitude				
tracks with unacceptable use levels[a]	–	1 km	1 km	1 km
huts with unacceptable use levels	–	1 km	1 km	1 km
campsites with unacceptable use levels	–	1 km	1 km	1 km

TABLE 6.8: Buffer Distances for Exclusion Zones of Undesirable Features (based on purism items)

[a]The use levels applicable here are those given for each perceptual level in Table 6.7

The variation in perceptions expressed towards *motorised travel* and *road access*, while the *remoteness* item itself is consistently acceptable, is accounted for by a gradient in unacceptable road-types across perception levels. Perception level 1 is thus denoted by unacceptability, and thus exclusion, of tar-sealed roads (1km buffer), level 2 has the additional exclusion of metalled roads (1km buffer), level 3 has the further exclusion of four-wheel drive roads (1km buffer) but 2km buffers for the previous two road-types, while level 4 comprises the exclusion of all roads, but with 3km, 3km and 2km buffers respectively.

Airstrips, as a geographic manifestation of *motorised travel*, are treated in a like manner to roads.

Naturalness

The key vegetational indicator of naturalness alluded to in the previous stage is reflected in a gradient of unacceptable vegetation types or classes, which can then be identified, buffered if necessary, and excluded as appropriate from a purism group's perception of wilderness. Perception level 1 is thus denoted by the exclusion of urban and primary production vegetation (i.e. permanently modified landscapes including exotic pasture and cropland) that includes a 1km buffer zone, level 2 has the additional exclusion of exotic scrub (1km buffer), level 3 has the further exclusion of exotic forest (1km buffer), while level 4 comprises the exclusion of all of these vegetational types but with a 2km buffer zone.

The additional indicator of wilderness related to naturalness—large size—was denoted by a gradient of increasing minimum size to which an area should conform to. The derivation of the minimum area for each perception level was based on the minimum contiguous area, commensurate with the other wilderness properties pertaining to a perception level, likely to provide a satisfactory degree of exclusion and vastness. An area of 1 km^2 was taken as the minimum necessary. As with the minimum buffer distance that was selected, this area is a reasonable assumption based on typical New Zealand conditions but may ultimately require field testing. Reflecting the perceptual gradient across perception levels for this particular item, the relative increase was 10-fold. rather than the linear increase in the case of buffer distances. Thus areas of 1 km^2, 10 km^2, 100 km^2 and 1,000 km^2 were applied respectively to perception levels 1–4.

Solitude

The encounter surrogate for solitude was denoted by excluding appropriate features, or segments of features, for which the actual use levels (determined from

DoC track counter figures) exceeded that set as acceptable by a perceptual indicator. Thus, perception level 1 involves no solitude component since there was no maximum number of encounters determined as unacceptable. Perception level 2 is denoted by the exclusion (a 1km buffer) of all tracks or track segments for which use level exceeds 10 people per day, and huts and campsites for which use levels exceed 20 people per day. Level 3 is similarly denoted by excluding tracks for which use levels exceed 5 people per day, and huts and campsites for which use levels exceed 10 people per day, while level 4 is denoted by exclusion of all use-oriented features since any encounters at all were found to be unacceptable, and also because these features were noted as unacceptable under the artifactual property described earlier.

Combining Indicators for each Perception Level

In broad terms, artifactualism is represented spatially by buffer zones surrounding the artifactual structures appropriate to each item and therefore indicating the presence of that structure. Remoteness was represented by buffer zones surrounding access routes, and naturalness by areas of the appropriate vegetation types and size. Solitude was based on hut and track use-levels whereby the number of encounters experienced by a user reflects the experience of solitude inherent in a wilderness experience. The schema for denoting and combining these criteria is given in Figure 6.3 while Figure 6.4 shows how these are invoked for multiple perception levels. The spatial-perceptual indicators applied to this schema for each perception level are detailed in Table 6.8.

6.2.4 Mapping Spatial Extent of Perceptions

The final stage of the approach involves the use of GIS technology, in this case the ARC/INFO system, to map wilderness perceptions for a specific defined area, which in this study is the North-West Nelson Ecological Region. The use of GIS in this stage of the methodology involves two principal functional aspects of GIS.

First, the data storage and management capabilities of GIS allow a geographic database to be constructed for the study area. The spatial data elements required of this database in order to apply the spatial indicators for each perception level are given in Table 6.9. This table shows the necessary geographic features required to represent spatially each wilderness property, the type of geographic entity denoting the feature in a coverage (i.e. point, line, polygon), and some of the key attributes associated with a feature.

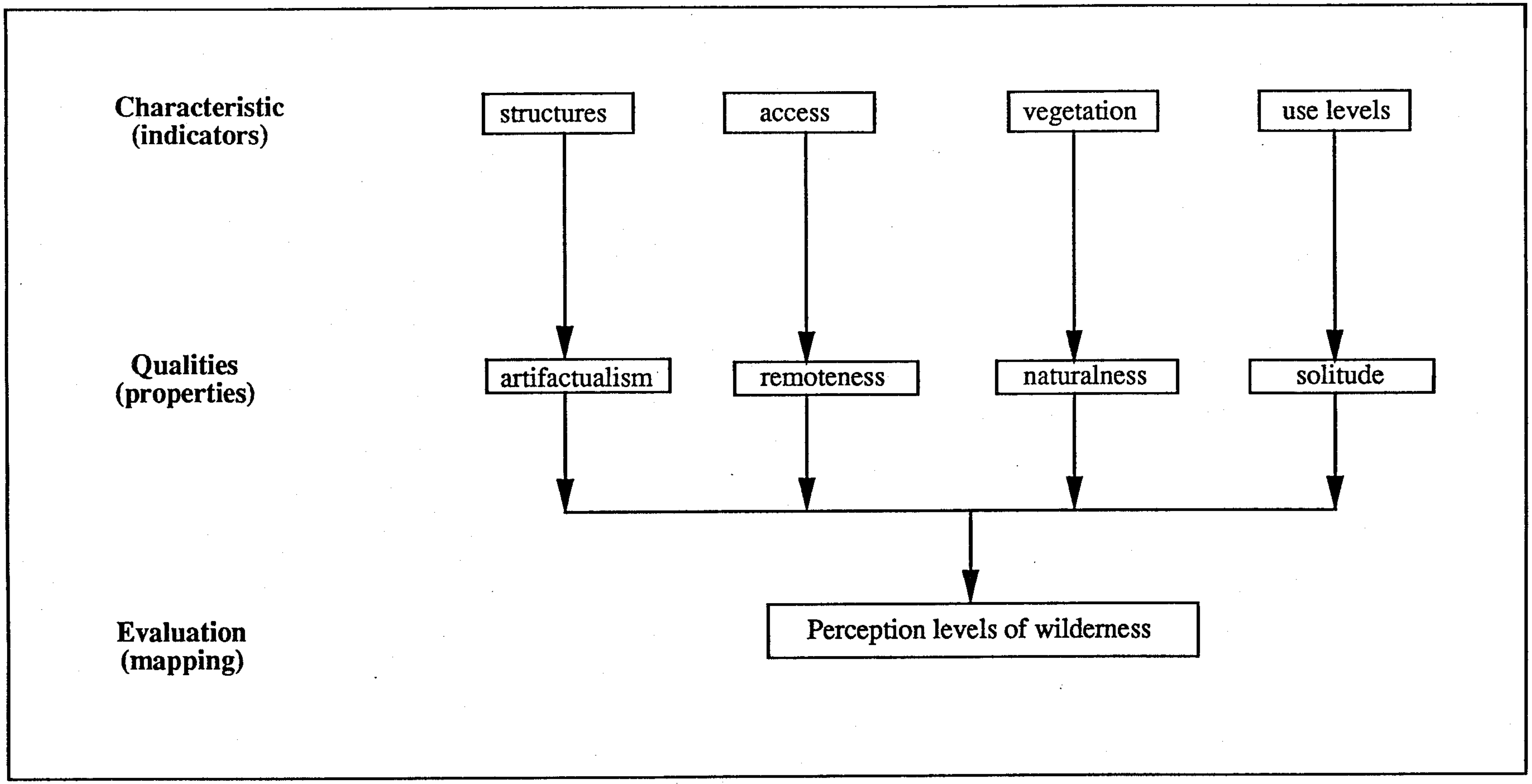


FIGURE 6.3: Schema for Perception Mapping as an Evaluation Procedure (after Burrough 1986)

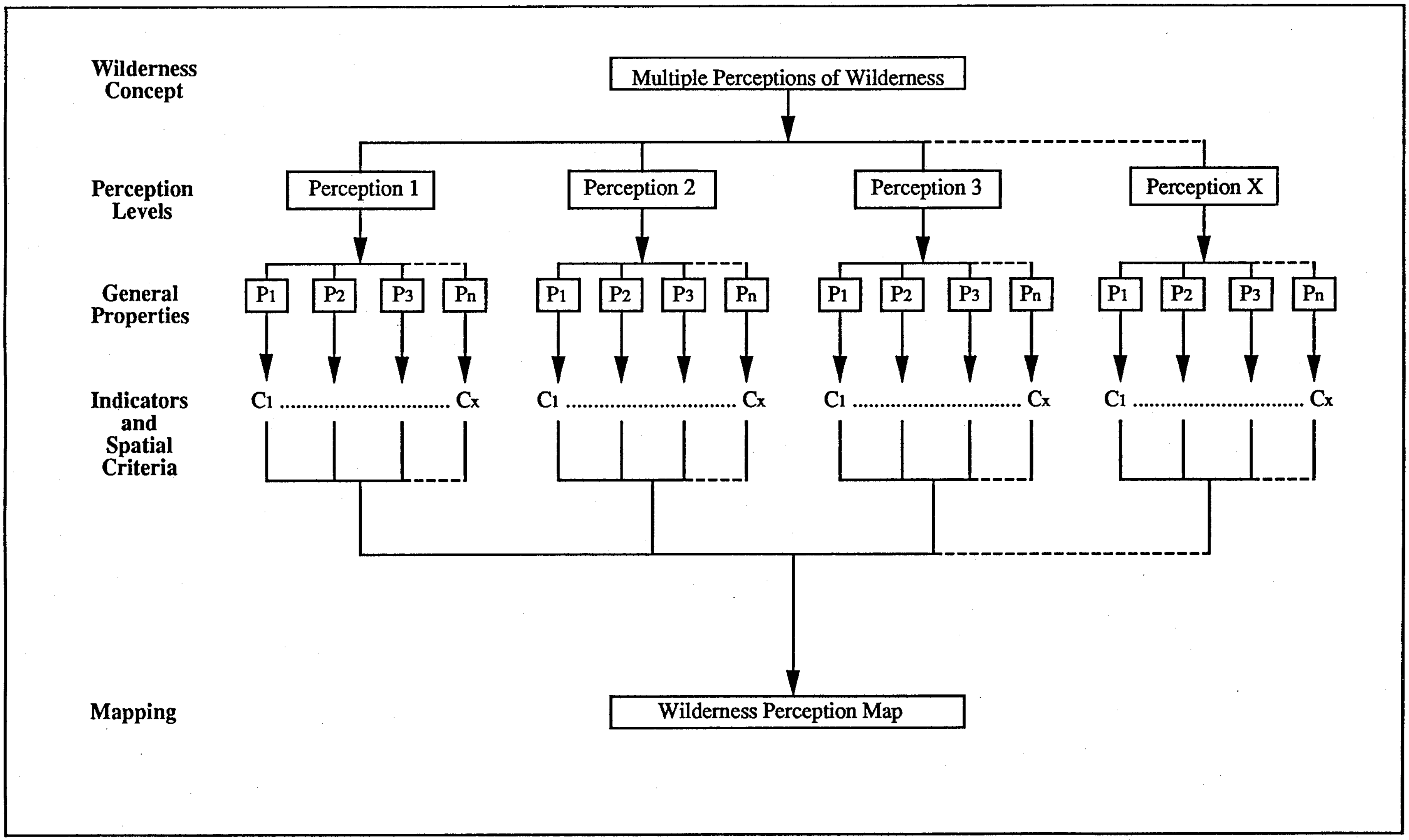


FIGURE 6.4: Schema for the Translation of Multiple Perceptions of Wilderness

FEATURE[a]	ENTITY[b]	ATTRIBUTE[c]
	Artifactual features	
mines	point	
lighthouses	point	
trigs	point	
masts	point	
huts	point	
dams	point	
campsites	point	
logging sites	point	
drains	arc	
powerlines	arc	
	Remoteness features	
roads	arc	road type
tracks	arc	track type
airfields	point	airfield type
	Naturalness features	
vegetative cover	polygon	cover class
	Solitude features	
track	arc	track use
hut	point	hut use
campsites	point	campsite use

TABLE 6.9: Spatial Database Components for Wilderness Perception Mapping

[a]Each FEATURE is the geographic representation of an indicator derived from the purism scale items
[b]ENTITY refers to the geometric entity which a feature is expressed as in the database. Thus points, arcs and polygons refer to points, lines and areas respectively
[c]ATTRIBUTES are non-spatial data attached to spatial data

Second, the manipulation and analysis functions of GIS are utilised to perform the spatial overlay procedures necessary to implement the steps outlined in Figure 6.3 and Figure 6.4 Essentially, this performs a type of suitability analysis (McHarg 1969, Steinitz *et al.* 1976, Lyle & Stutz 1983), but applied from a perceptual basis (see Figure 6.3). The result is a compilation of the spatial extent of perceived wilderness settings for each purism group. The key spatial analytic functions invoked by the GIS in this stage are as follows:

Proximity analysis: distances between or around geographic features are calculated. Commands of this type in the ARC/INFO system are:

- buffer
- near
- pointdistance

Boundary operations: new coverages are created based on coordinate boundaries, primarily for data management. ARC/INFO commands:

- append
- clip
- erase
- mapjoin
- split
- update

Logical operations: new coverages are created based on attribute values, primarily for geographic analysis. ARC/INFO commands:

- dissolve
- eliminate
- reselect

Spatial overlays: new data relationships are created using feature locations to join attribute tables together, essentially for geographic analysis. ARC/INFO commands:

- identity
- intersect
- union.

The use of this suite of functions, notably the last, has required an awareness of the problems associated with using overlay mapping in GIS for planning, as was alluded to in Chapter 5. While technical solutions have been proposed, such as error modelling, this type of problem has been minimised by adopting base map data at a consistent scale (i.e. 1:250,000).

The application of the spatial criteria (Table 6.8) to the database components (Table 6.9) using the GIS functionality described above then produces a map output—wilderness perception mapping (WPM).

6.2.5 The Overall Method

The four stages of this approach thus provide a methodology for determining the geographic extent of multiple perceptions of wilderness. The methodology, which applies wilderness perceptions assisted by geographic information systems, conforms to the general process of translation as outlined in Figure 6.2.

This process has conceived of wilderness perceptions in multiple terms where the differentiation of perception levels has been based on attitudinally-derived purism groups. The wilderness concept itself is structured along several key properties, based on elicitation of users' strongest images of wilderness, which allow the perceptual construct to be considered as comprising a number of parts. Having analysed these constituent parts in perceptual and spatial terms, the construct is reconstituted in a spatial expression. Thus, the methodology is, *in toto*, a robust structure.

6.3 Method 2—An Alternative Multivariate Approach

The development of a more sophisticated approach to the methodological process for WPM has centred on multivariate analysis of the wilderness purism scale, following Heberlein's (1973) work, an approach to which the scale lends itself. The five stages to this alternative approach are as follows:

1. Identify dimensions of wilderness purism
2. Classify users
3. Establish spatial criteria for each item of a component
4. Establish weightings for overlay procedure
5. Weighted overlay using GIS

In effect this approach follows the initial methodology but with the application of multivariate statistical techniques and the added stage of establishing weightings for the overlay procedure (see Figure 6.5).

6.3.1 Identification of Dimensions of Wilderness Purism

A principal component analysis (PCA) was carried out on the 16 items in the purism scale in order to obtain a smaller number of uncorrelated *dimensions*. The initial components resulting from the PCA were then subjected to a varimax rotation (an orthogonal method) to find new, but nevertheless uncorrelated, components that could be more easily interpreted (Manly 1986). This resulted in four principal components being retained accounting for 56% of the total variance in the scale. While this is not desperately high, given the number of original variables, the sample size and the qualitative nature of the data, it is, nevertheless, reasonable for preliminary analysis. The rotated eigenvectors, and the corresponding eigenvalues, are shown in Table 6.10.

The first component (PC 1), accounting for the most variation, had high positive loadings for Item 1 (developed campsites), Item 3 (road access), Item 4 (commercial recreation), Item 5 (maintained tracks), Item 6 (bridges/walkwires) and Item 10 (maintained huts/shelters). Therefore, the component emphasises that the greatest variation in the data is between the provision of facilities and amenities at one extreme, and the lack of facilities at the other.

The second component (PC 2) had high positive loadings for Item 8 (logging), Item 9 (motorised travel), Item 11 (hydro-electric development) and Item 12 (commercial mining) and a negative loading on Item 14 (remoteness). This component emphasises a polarity of the aversion to developmental activity and propensity for remoteness at one extreme, and its inverse at the other.

The third component (PC 3) had high positive loadings for Item 13 (solitude), Item 14 (remoteness), Item 15 (little human impact) and Item 16 (large size), and therefore represents an emphasis on the experiential items of wilderness rather than any specific activity.

The final component (PC 4) had high positive loadings on Item 2 (stocking exotic species) and Item 7 (hunting) and a negative loading on Item 16 (large size). It represents an emphasis on the activity and subject of hunting but not within too large an area. Thus, at one extreme hunting is rejected and large size preferred, while at the other extreme the reverse holds.

Thus, four dimensions of wilderness perceptions emerge from the PCA of wilderness purism that relate to a *facility-oriented* component, an *anti-developmental activity* component, an *experiential* component and a *hunting* component.

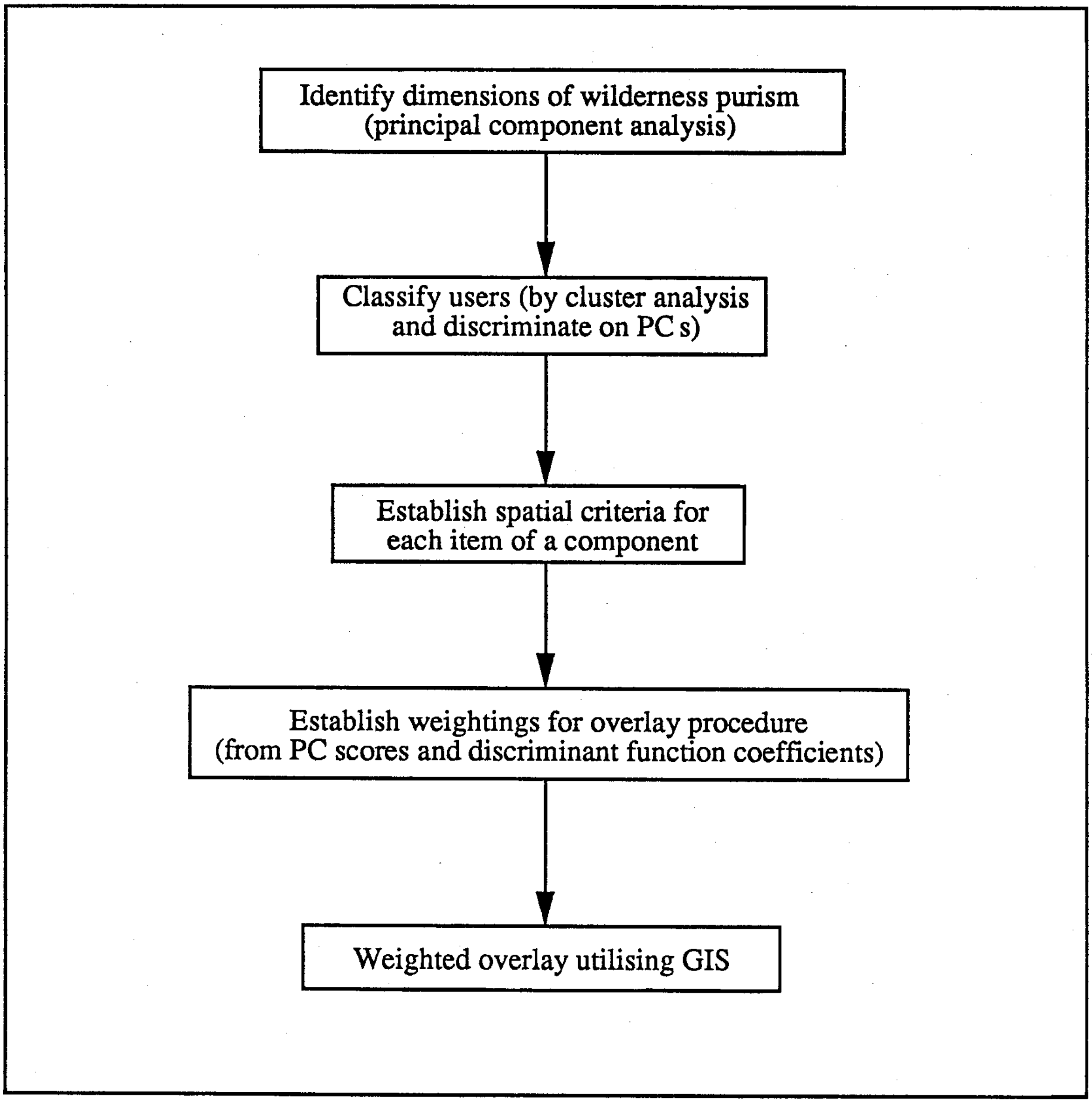


FIGURE 6.5: General Process for Method 2

PURISM ITEM	PRINCIPAL COMPONENT			
	1	2	3	4
1. developed campsites	0.450	0.319	0.286	0.018
2. stocking exotics	0.213	0.193	-0.011	0.661
3. road access	0.545	0.081	0.135	0.156
4. commercial recreation	0.516	0.302	0.113	0.155
5. maintained tracks	0.887	0.034	-0.034	-0.020
6. bridges/walkwires	0.833	-0.002	0.054	-0.020
7. hunting	-0.025	0.107	0.064	0.826
8. logging	0.012	0.756	0.190	0.047
9. motorised travel	0.227	0.632	0.155	0.011
10. maintained huts/ shelters	0.808	0.124	-0.018	0.011
11. hydro-electric development	0.113	0.725	0.024	0.102
12. commercial mining	0.079	0.724	-0.014	0.188
13. solitude	0.194	0.203	0.066	-0.079
14. remoteness	0.087	-0.142	0.757	0.124
15. little human impact	-0.052	0.155	0.679	0.239
16. large size	0.044	0.198	0.612	-0.312
VARIANCE EXPLAINED BY EACH COMPONENT	3.067 (19%)	2.410 (15%)	2.024 (13%)	1.393 (9%)
TOTAL VARIANCE	8.893 (56%)			

TABLE 6.10: Eigenvector from Principal Component Analysis of Wilderness Purism Scale

Respondents' scores on the four components are then used to classify individuals in terms of these dimensions.

6.3.2 Classification of Users

The classification of backcountry users, in terms of the four dimensions identified from the purism scale, was carried out using cluster analysis (Lorr 1983, Romesburg 1984, Manly 1986). Thus individuals, each with PC scores for the four components, were grouped into *similar* classes using Wards Method (an agglomerative technique) which clearly defined four clusters (Jolliffe 1986). The identification of clusters is summarised in Table 6.11 and Table 6.12. The four clusters respectively comprise 16%, 24%, 43% and 17% of the survey sample.

No. OF CLUSTERS	CLUSTERS JOINED	FREQ. OF CLUSTER	CCC[a]	PSUEDO[b] F	PSUEDO[c] t^2
1	CL2 CL3	230	0.00	–	36.26
2	CL7 CL4	135	-4.89	42.26	38.23
3	CL8 CL6	95	-7.08	44.48	39.60
4	CL5 CL17	98	-9.84	48.51	39.76
5	CL9 CL30	67	-9.55	47.60	35.46
6	CL10 CL28	39	-9.01	45.50	23.21
7	CL31 CL14	37	-8.30	44.43	13.78
8	CL12 CL11	56	-8.21	44.25	12.68
9	CL15 CL19	61	-7.51	44.04	18.32
10	CL13 CL22	33	-6.52	44.63	12.79

TABLE 6.11: Cluster Analysis of Respondents' PCA Scores for the Purism Scale using Ward's Method

[a]CCC is the cubic clustering criterion

[b]The psuedo F statistic measures the separation among all clusters at the current level

[c]The psuedo t^2 statistic measures the separation between the two clusters most recently joined

The four cluster groups were characterised in terms of the four principal components by performing discriminant analysis on the cluster groups with respect to their principal component scores thus producing discriminating functions for each cluster group (Table 6.13).

CLUSTER	CLUSTER No.	FREQUENCY OF CLUSTER	PER CENT OF SAMPLE
1	CL7	37	16
2	CL8	56	24
3	CL4	98	43
4	CL6	39	17
TOTAL		230	100%

TABLE 6.12: Four Cluster Groups indicated by Ward's Method

For the first cluster group, PC 1 was a very strong negative discriminant, suggesting that this group was particularly averse to facilities. PC 2 was a moderate discriminant indicating an aversion to development; the third component, also moderately discriminating, indicated some emphasis on experiential aspects; while PC 4 was deemed a moderately negative discriminant suggesting an aversion to hunting by the group. Overall, cluster group 1 was characterised by its strong aversion to facilities, and so labelled *anti-artifactualists*.

PC 1 displayed a moderately positive discriminant effect for Cluster Group 2, indicating a propensity toward facilities by this group. The cluster group produced a particularly strong discriminant effect in PC 2 suggesting a strong aversion to developmental activities by the group, while PCs 3 and 4 were both rather weak indicating relatively little emphasis on experiential aspects or hunting. In the light of the group's strong aversion to developmental activities it was labelled *anti-developmentalists.*

Cluster Group 3 was more difficult to characterise clearly. PC 1 was a moderate discriminant indicating a tendency to prefer facilities, PC 2 was a somewhat stronger discriminant suggesting a reasonable aversion to development, PC 3 was a rather weak discriminant indicating little emphasis on experiential items, while the fourth PC was moderately weak suggesting little emphasis on hunting also. Overall, there were no especially dominant characteristics and the group was labelled *general users* with no strong allegiance to a particular view.

PRINCIPAL	CLUSTER GROUP			
COMPONENT	1	2	3	4
1	-4.30	0.76	0.69	1.93
2	0.72	2.02	1.57	1.54
3	0.64	0.54	0.21	1.38
4	1.30	0.32	0.49	3.08

TABLE 6.13: Linear Discriminant Function of the Four Cluster Groups on the basis of Respondents' PCA Scores

The fourth cluster was characterised by moderate discriminants for PCs 1, 2 and 3 suggesting a propensity for facilities, an aversion to development, and some emphasis on experiential aspects. However, PC 4 was especially strong in indicating a clear preference for hunting. This group was labelled the *hunters*, and may well have revealed a genuine group in Shultis' backcountry sample.

Further analyses of the cluster groups, with respect to demographic variables, produced only two additional significant relationships. These were for education level ($P<0.04$) and dwelling locale ($P<0.03$).

Cluster group 1 respondents, the anti-artifactualists, were predominantly 45–54 years of age or to a lesser extent 25–34 years age of age, and predominantly city dwellers.

Cluster group 2 respondents, the anti-developmentalists, were either 25–34 or 45–54 years of age, and generally, though to a lesser extent, city dwellers.

Cluster group 3 respondents, the general users, were predominantly 45–54 years age of age but with sizable proportions of people aged 25–34 or 55–64 years of age, and predominantly city dwellers.

Cluster group 4, the hunters, were generally 45–54 years of age or younger (i.e. either 25–34 or 35–44 years of age), and rather heterogeneous in terms of their dwelling locality.

The cluster groups showed a significant association with the purism groups that were determined in the initial methodological approach. Thus, Cluster group 1 was composed totally of strong or moderate purists (62% and 38% respectively); Cluster group 2 was predominantly neutralist (71%) with a lesser composition of non-purists (21%); Cluster group 3 predominantly moderate purist (53%) with a secondary grouping of neutralists (31%); while Cluster group 4 predominantly neutralist (44%) with secondary groupings of non-purists (26%) and moderate purists (28%). .

6.3.3 Establishment of Spatial Criteria

Each cluster group can be identified through a certain combination of the wilderness purism components. Spatial criteria for each item defining a principal component were broadly defined in the same way as were the items for the initial methodology. However, the difference was that values were assigned to each exclusion buffer so that weightings could subsequently be applied. Attribute values of 1 or 0 were in most cases used to represent the presence or absence of a particular condition. Thus, a value of 1 was assigned to buffer zones representing the presence of maintained huts or shelters while a value of 0 was assigned to exclusion areas representing the absence of those item. For some items, such as remoteness, intermediate values between 0 and 1 were considered necessary in order to represent a corresponding gradation of distances from features denoting access. In the case of the four experiential items on the purism scale the gradient of experiential attributes was denoted by incorporating the range of perceptual properties displayed by the purism groups in the initial methodology. Thus, the scores 0 to 4 for variable 14 (remoteness) correspond to the remoteness extent (given by REM1–REM4 respectively) for each of the purism groups identified in the initial approach. The attribute values assigned to the 16 items are shown in Table 6.14. In the overlay process, therefore, attributes can be summed appropriately to generate a score that represents suitability of an area, in this case, as a perceived wilderness setting. However, the summation of such values for each dimension, and subsequently for each cluster group, implies that each item has equal importance. By applying weighting factors or loadings that reflect their importance it is possible to generate a more sophisticated suitability model. The schema for this procedure is shown in Figure 6.6.

Purism Item	Attribute Score Assigned to Variable 0	1
1. developed campsites	no campsites	1 km buffer zone around campsites
2. stocking exotics	low or no species distributions	areas containing mod. or high species distributions
3. road access	<1 km or >5 km from roads	1–5 km buffer strip from roads
4. commercial recreation	no commercial recreation activity	1 km buffer around comm. recreation sites & routes
5. maintained tracks	no tracks	1 km buffer around tracks
6. bridges /walkwires	no bridged tracks	1 km buffer around benched or bridged tracks
7. hunting	non-hunting areas	hunting areas
8. logging	non-logging areas	1 km buffer around exotic forestry & logging sites
9. motorised travel	no motorised access	1 km buffer around all roads & airfields
10. maintained huts/shelters	no huts	1 km buffer around huts
11. hydro-electric development	no hydro-development	1 km buffer around dams, penstocks & powerlines
12. commercial mining	no mines	1 km buffer around mining sites

	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1
13. solitude[a]	–	SOL 1	SOL 2	SOL 3	SOL 4
14. remoteness[a]	–	REM 1	REM 2	REM 3	REM 4
15. little human impact[a]	–	ART 1	ART 2	ART 3	ART 4
16. large size[b]	–	1 km^2	10 km^2	100 km^2	1,000 km^2

TABLE 6.14: Attribute Scores assigned to Spatial Variable for each Purism Item

[a]The spatial variables used for these three purism items refer to the solitude, remoteness and artifactualism properties respectively for the four purism groups identified in method 1. Thus, SOL 1 refers to the solitude component for purism group 1 (the non-purists), etc.

[b]minimum size for contiguous area perceived as wilderness.

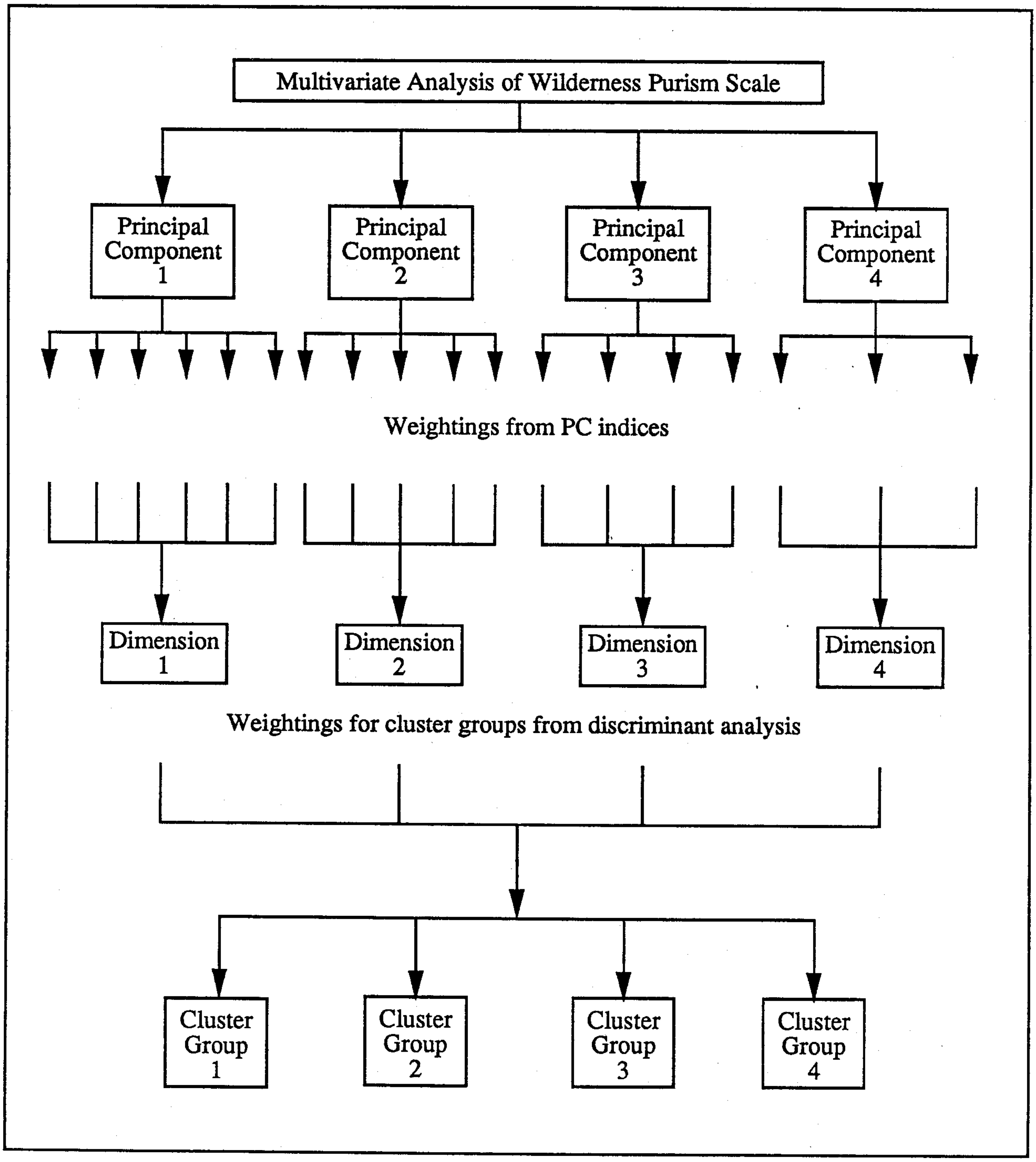


FIGURE 6.6: Schema for Multi-variate Perception Mapping of Wilderness

6.3.4 Establishment of Weightings

Weightings were necessary for the suitability analysis associated with the overlay of purism items comprising each dimension, and further with the overlay of dimensions comprising each cluster group's perception of wilderness.

The weighting for the items which contribute to the dimensions of wilderness purism were derived directly from their PC scores (see Table 6.15) since these form a set of indices which reflect the loading of each item with respect to one another, for a particular dimension. The weightings themselves are shown in Table 6.16.

PURISM ITEM	PRINCIPAL COMPONENT			
	1	2	3	4
1. developed campsites	0.12	0.08	0.09	-0.04
2. stocking exotics	0.04	-0.02	-0.04	0.48
3. road access	0.18	-0.06	0.04	0.09
4. commercial recreation	0.15	0.06	0.00	0.06
5. maintained tracks	0.32	-0.07	0.07	-0.05
6. bridges/walkwires	0.30	-0.09	-0.01	-0.04
7. hunting	-0.05	-0.07	0.03	0.62
8. logging	-0.09	0.36	0.01	-0.07
9. motorised travel	0.01	0.28	0.01	-0.09
10. maintained huts/shelters	0.28	-0.02	-0.07	-0.03
11. hydro-electric develop.	-0.04	0.34	-0.09	-0.03
12. commercial mining	-0.05	0.34	-0.10	0.03
13. solitude	0.02	0.01	0.32	-0.09
14. remoteness	0.00	-0.20	0.43	0.12
15. little human impact	-0.08	-0.04	0.36	0.17
16. large size	-0.03	0.06	0.30	-0.26

TABLE 6.15: Standardised Scoring Coefficients for Principal Components

The weightings for each dimension, as they comprise the four cluster groups, were derived from discriminant analysis (Klecka 1980, Manly 1986). While the primary aim of such discriminant analysis is to assign individuals (i.e. respondents) to a known number of groups (i.e. cluster groups) on the basis of a given number of variables (i.e. components of wilderness purism), a by-product of this function is that the discriminant coefficients reflect the loading of each component with respect to the others for each cluster group. The weightings used for the cluster groups are shown in Table 6.17.

PURISM ITEM(Item No.)	WEIGHTING
1. Facility-oriented component	
Developed campsites (1)	1.2
Road access (3)	1.8
Commercial recreation (4)	1.5
Maintained tracks (5)	3.2
Bridges/walkwires (6)	3.0
Maintained huts/shelters (10)	1.8
2. Anti-development component	
Logging (8)	3.6
Motorised travel (9)	2.8
Hydro-electric development (11)	3.4
Commercial mining (12)	3.4
Remoteness (14)	-2.0
3. Experiential component	
Solitude (13)	3.2
Remoteness (14)	4.3
Little human impact (15)	3.6
Large size (16)	3.0
4. Hunting component	
Stocking exotics (2)	4.8
Hunting (7)	6.2
Large size (16)	-2.6

TABLE 6.16: Weightings of Purism Items for each Principal Component from PCA Scoring Coefficients

It should be noted that the theoretical validity of applying discriminant function analysis in this particular way is unproven (Niven 1991, pers. comm.). Simple analyses (i.e. distribution histograms) of each component with respect to each cluster group agree with the discriminant function and suggest that it may be a valid indicator of the relative weighting of components within each cluster group; that is, it reflects differences between groups. However, this is dependent upon the discriminant coefficients being uncorrelated and independent—currently an unsubstantiated possibility. The widespread application of this alternative approach must be treated with some circumspection at the present time.

Putting the statistical robustness aside, the four components indicate trends in perceptions of wilderness, each independent of another, that are identifiable in

PRINCIPAL COMPONENTS	WEIGHTING
Cluster 1	
(Anti-artifactualists)	
PC 1 (Facility-oriented)	-4.3
PC 2 (Anti-developmental)	0.7
PC 3 (Experiential)	0.6
PC 4 (Hunting)	-1.3
Cluster 2	
(Anti-developmentalists)	
PC 1 (Facility-oriented)	0.7
PC 2 (Anti-developmental)	-2.0
PC 3 (Experiential)	0.5
PC 4 (Hunting)	0.3
Cluster 3	
(General users)	
PC 1 (Facility-oriented)	0.7
PC 2 (Anti-developmental)	1.6
PC 3 (Experiential)	0.2
PC 4 (Hunting)	0.5
Cluster 4	
(Hunters)	
PC 1 (Facility-oriented)	1.9
PC 2 (Anti-developmental)	1.5
PC 3 (Experiential)	1.4
PC 4 (Hunting)	3.1

TABLE 6.17: Weightings of Principal Components for each Cluster Group from Discriminant Function Coefficients

terms of purism scale items whose contribution to the dimension is indicated by PC scores. However, a cluster group's perception is not totally related to a single component such that the discriminant function coefficients indicate the contribution of each component to a particular group. Thus, given four map coverages, one for each component which is derived from its constituent scale items, it is possible to combine these in different ways to produce four coverages representing each cluster group's perception of the relative suitability of an area as a wilderness setting.

6.3.5 The Weighted Overlay Process

The final stage in the multivariate approach involves the application of GIS to perform the necessary spatial overlays. This involves the overlay first of items comprising each principal component and, secondly, of these components as they comprise the spatial extent of cluster groups' perceptions of wilderness. The tabular analysis of the attribute values for each map coverage is associated with the spatial overlay, by applying the appropriate weightings from the previous stage, to perform the suitability analysis. This type of weighted multiple-map overlay procedure has been detailed in applications of GIS to site analysis for physical planning (Mutunayagam & Bahrami 1987). The specific process that this follows for the multivariate approach is outlined in Figure 6.6.

6.3.6 The Overall Approach

The five-stage multivariate approach as outlined provides an alternative consideration of WPM through the application of a suite of multivariate statistical techniques (i.e. PCA, cluster and discriminant analyses). These enable the identification of multiple dimensions of wilderness perception and the classification of backcountry users on that basis. As with Method 1 the alternative approach appears to be a robust methodological approach.

6.4 Summary

The task of identifying geographic variations in wilderness perceptions has required extensive development of a methodological approach to operationalise wilderness perception mapping. The first method has involved an intuitive four-stage approach (Figure 6.2) which is based on the analysis of wilderness imagery in terms of the wilderness purism scale. A second method has been suggested as an alternative to the first, and is based on multivariate analysis techniques. This five stage approach incorporates weighted overlaying and is outlined in Figure 6.5.

Notwithstanding the structural robustness and the conceptual clarity of the two approaches to operationalising the WPM methodology, there are several important methodological points requiring consideration. The classification of perception levels in Method 1, while based on an accepted mode used previously (Stankey 1973, Shultis 1991) and also of much intuitive appeal (given its straight-forward grouping of purism scores), is nevertheless rather simplistic. Despite the apparent effectiveness of this first analysis, the multivariate approach applies a more sophisticated classifactory technique. While the latter is particularly rigorous the result of the former is simpler to conceptualise in terms of the actual users concerned. The (spatial) overlay of individual spatial components in Method 1 assumes an equal weighting of each indicator with respect to the others. This also assumes additive properties of the spatial indicators used and ignores any interaction between indicators which may either heighten or dampen the total effect. Method 2 provides a weighted overlay that takes account of the relative importance of each component. However, the unsubstantiated use of the discriminant function analysis in this alternative approach is a major caveat. This is especially so given the importance of the weightings derived from this technique in the final outcome.

The two methods represent quite different ways of operationalising WPM, with Method 1 an intuitive uni-dimensional approach, while Method 2 is a more sophisticated multi-dimensional approach. Ultimately, it is the results obtained by following each method which will provide a means of comparison between the two. Thus the ability of the WPM methodology to fulfil the objective set out at the beginning of this chapter will be examined through the results of applying the two approaches to a case-study, in the next chapter, an exercise which will also indicate to what extent the two methods produce similar end-products.

Part III

Application of Wilderness Perception Mapping

7

Initial Results of Applying Wilderness Perception Mapping

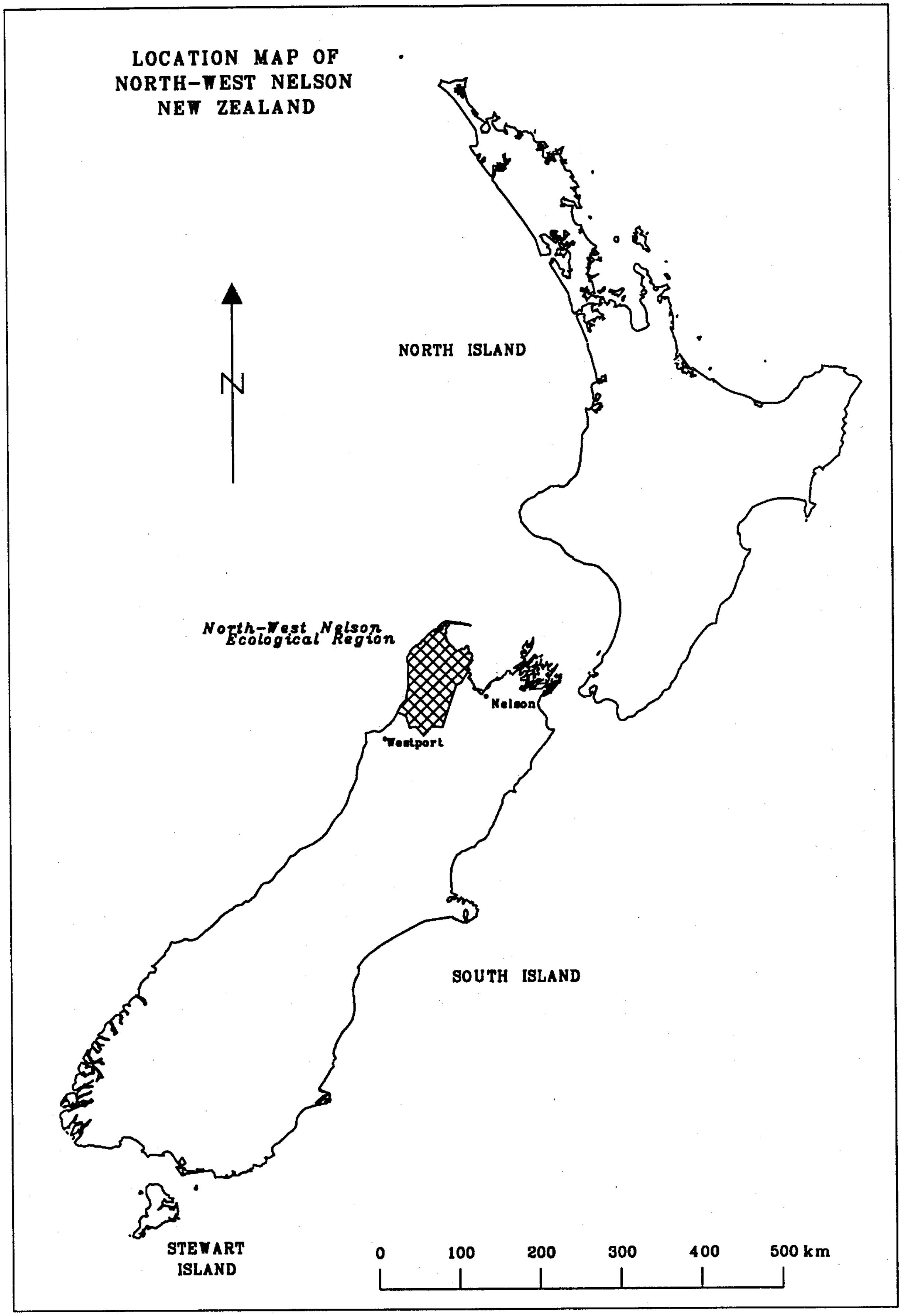
In this chapter a case study is carried out to assess the feasibility of the WPM methodology, and in particular the two methods that were developed in Chapter 6. Specifically, this involves testing the perception mapping approaches for wilderness and the GIS analysis that is a necessary component of these approaches. The next chapter will then use the information derived from this analysis, in an appropriate management framework, to consider the application of WPM to protected areas management. The case study is based on the North-West Nelson Ecological region of New Zealand (see Map 7.1).

7.1 North-West Nelson Ecological Region—a case-study description

The choice of North-West Nelson as a study area was made after an assessment of several potential areas (including the Paparoas, the Catlins, and northern and southern portions of Fiordland [1]) in terms of the following derived characteristics:

- topographic diversity;
- heterogeneity of resource use (including recreational);
- variation in the protected area status of the region;

[1]These areas can be located on the Map contained in Appendix C.


LOCATION MAP OF
NORTH-WEST NELSON
NEW ZEALAND
N
NORTH ISLAND
North-West Nelson
Ecological Region
Nelson
Westport
SOUTH ISLAND
STEWART
ISLAND
0
100
200
300
400
500 km

MAP 7.1:

- existence of a gazetted or proposed Wilderness Area;
- variety of protected area and conservation issues;
- availability of suitable map data.

When set against these criteria North-West Nelson was considered to be the most suitable area within the South Island of New Zealand.

An ecological region is considered to provide a logical, natural and useful *unit of analysis*. New Zealand has previously been subdivided in a variety of ways mainly for administrative purposes; for instance:

- local and regional authorities;
- health, education or other public service provision;
- forest or conservation land management.

The boundaries of these regions are frequently determined by physical features, e.g. rivers, although the resulting administrative regions themselves seldom reflected natural or ecological integrity (Simpson *et al.* 1988). By contrast, a framework of ecological districts and regions defines geographical areas which have a recognisably distinct pattern of characteristic natural ecosystems. In that context, the New Zealand Ecological Regions and Districts framework is a refinement, at a national scale, of the *biogeographic province* as devised by Dasmann (1972). Thus, an ecological district is defined as:

> ... *a local part of New Zealand where the topographical, geological, climatic, soil and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities.*
>
> (Park & Dingwall 1983)

As a unit for analysis the ecological region framework provides:

- a focus on characteristic features of the area;
- an understanding of the landscape by defining limits to surroundings and giving structure to amorphous diversity;
- an ecological perspective by identifying inter-relationships among physical and cultural features; and,

- a structure for integrating those human activities dependent on the natural resources of an area.

An aggregation of adjacent ecological districts with closely related characteristics together form an ecological region with its own broad ecological character. The North-West Nelson Ecological Region consists of nine ecological districts: West Whanganui, Wakamarama, Golden Bay, Totaranui, Heaphy, Wangapeka, Arthur, Karamea and Matiri (see Appendix D for details).

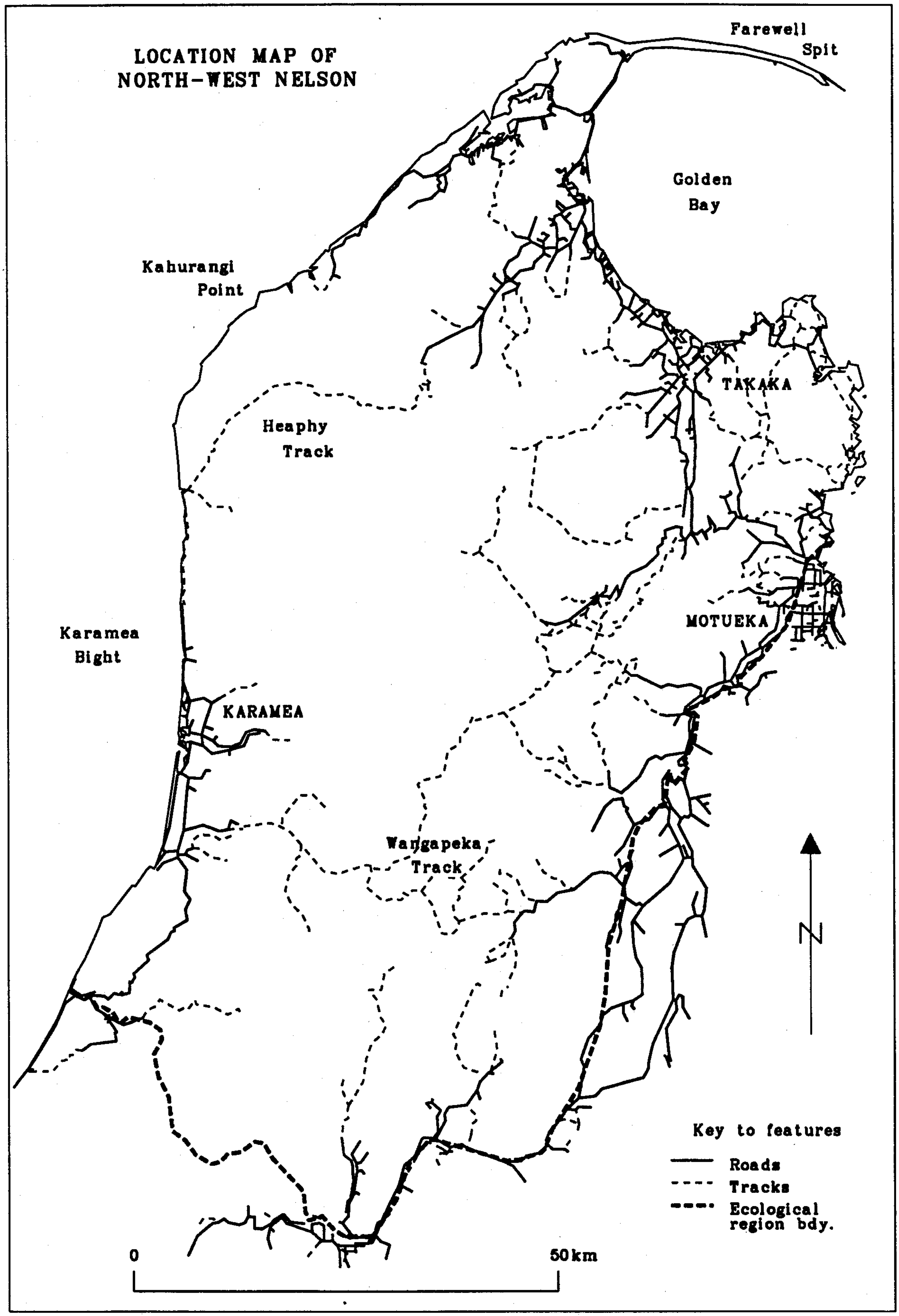
Stretching a distance of approximately 80 km from Karamea Bight and Kahurangi Point in the west across to Motueka Valley and Tasman Bay in the east; and approximately 120 km from Golden Bay and Farewell Spit in the north to its southern boundary at the Buller and Mokihinui Rivers; the North-West Nelson Ecological Region encompasses a gross area of approximately 730,000 ha (see Map 7.2). This represents a wide range both topographically—rising from sea level to a maximum of about 1,800 m—and climatically. The region comprises the main mountain ranges of the north-western South Island, most prominently the steep rugged peaks of the Tasman Mountains and the Arthur Range; interspersed with gently rolling to flat elevated plateaus, notably the peneplain remnants of Gouland, Mackay and Gunner Downs and the Arthur Tablelands; and the alluvial river plains of the Takaka, Aorere and Karamea rivers[2].

7.1.1 The Ecological Character of the Region

A number of general resource studies on the region's conservation estate (Host 1967, Jane 1989a, 1989b, Hutchings In press) have highlighted the broad diversity of the region's ecology and biota.

Geologically, North-West Nelson formations span a considerable age with much complexity. These include some of the oldest known exposed rocks of unfossiliferous pre-Cambrian through to very recent formations. The oldest fossiliferous rocks are Cambrian, such as those located in Cobb Valley, which display the ancient fossil trilobites—a primitive invertebrate that lived some 540 million years ago. Younger marble deposits, such as at Mount Owen, have been responsible for the formation of many of the region's higher mountains but are also significant for the areas of glaciated karst they contain. The cave and karst systems of Mount Arthur, Mount Owen and Oparara are internationally renowned for the sub-fossil remains which they hold and for their caving potential. A more recent formation is the remnant

[2]These geographic features and those subsequently referred to in this chapter can be located on the Terrainmap contained in the back-pocket of the thesis; a list of features and grid references are contained in Appendix E to assist their location.


LOCATION MAP OF NORTH-WEST NELSON
Farewell Spit
Golden Bay
Kahurangi Point
TAKAKA
Heaphy Track
MOTUEKA
Karamea Bight
KARAMEA
Wangapeka Track
N
Key to features
Roads
Tracks
Ecological region bdy.
0
50km

MAP 7.2:

hard quartzite base of the peneplains that were created by the erosion of softer marine sediments. The most recent formations in the region are the river-deposited gravel and sands of the terraces and flood plains, and the prominent sequence of sand deposition that has created the long seaward arc of Farewell Spit. Detailed geological studies of the region include those of Hunter (1977) and Scadden & Braithwaite (1980).

The range of soils in the region reflect its geological diversity, with areas of high fertility associated with marbles and limestones, toxic soils on serpentines which support a specialised flora, and especially the occurrence of low fertility soils on granites. More detailed studies of the pedology in the region have been carried out by Bell (1973a) and Heine *et al.* (1987).

The region's large botanic diversity is indicative of its climatic and geological variation, with a significant proportion (86%) of the region's vegetative cover in indigenous forest and scrub. The forests themselves are extremely variable, with considerable diversity in forest types, distribution of flora, and patterns of association—especially in the coastal areas. Podocarp or beech-podocarp forests predominate in the western coastal areas, the Aorere valley and the Wakamarama Ranges, while Red, Silver and Mountain beech forest associations generally cover the steep, high-altitude country with scattered rimu and other podocarps on lower hill slopes. Apart from the native forest-cover, the remaining vegetation contains a mixture of smaller, often locally occurring, plant associations, including alpine herbfields and lowland pakihi scrub associations but also exotic forest and pasture. The region contains approximately half of New Zealand's 2270 indigenous plant species, with a similar proportion of alpine species present, and a high number of endemic species—approximately 50, including 18 rare species (Given 1981, 1987). While the region contains relatively few adventive species, introduced plants are a major problem in some areas, such as gorse in the Aorere and Taitapu areas which has spread to relatively pristine areas such as the Gouland Downs (Jane 1989). Specific studies in the region have concentrated on forest systems (Hayward 1979, 1980, Hawes 1987) and subalpine or alpine vegetation (Bell 1973b, Druce *et al.* 1987, Williams 1987, 1991).

The region's wildlife is characterised by its introduced mammals, marine mammals, avifauna, invertebrates and molluscs. Deer, goats, opossums, pigs and hares have all been liberated in, or have spread into, the region and have subsequently been the focus of various animal control operations; they nevertheless remain a problem. A number of well-established fur seal breeding colonies exist along the Heaphy/Kahurangi/Wharariki coast, with recent surveys indicating 120–150 seal pups present. The region's size, migratory location and diversity of habitat is reflected in its importance to a wide range of bird species. Approximately 100 species have been recorded along the coast, especially at Farewell Spit, and about 70 species in the region's interior, 15 of which are introduced species. Thus, the area is notable as an important refuge for sea, wading and wetland birds as well as forest birds—it contains important habitat for the great spotted kiwi—and alpine birds. The region is a centre for a wide diversity of invertebrates which also display a high level of endemism. Notable among the endemics is a species of giant weta. Mollusca draw particular attention in North-West Nelson where many of the *Powelliphanta* genus of large carnivorous land snails are confined. Wildlife studies in the region have largely been general (Walker 1987) but some have concentrated on the introduced mammals and birdlife of forest systems (Hayward 1983, Hawes *et al.* 1986, Hawes 1987) and on the *Powelliphanta* (Climo 1978, Walker 1982).

It is clear that North-West Nelson is a region of particularly high ecological value, containing important and diverse ecosystems, habitat sequences and biota.

7.1.2 The Anthropogenic Character of the Region

Historic studies of the region (Allan 1965, Newport 1962, 1971, 1978) and general resource studies (Host 1967, Jane 1989a, 1989b) relate the richness of human influence in the region both in the past and at the present time.

Earliest known Maori occupation in the region has been dated to the early 14th century, with remnants of Maori settlements being found along the Motueka River and Abel Tasman coastline, in Golden Bay, around West Whanganui and Kahurangi, and at Karamea—all of which are on or near the coast (see Plates 7.1 & 7.2). The region's west coast was part of the greenstone route system by which Maori travelled between the North Island, Nelson, Golden Bay, and the West Coast. A lesser used inland route linked the Heaphy River to the Aorere valley over Gouland Downs, a route now followed closely by the Heaphy Track. During the late 18th Century and early 19th Century tribal warfare displaced many of the Maoris to such an extent that the area was only lightly populated when European settlement began.

Apart from the early visits by explorers such as Abel Tasman and Dumont D'Urville, the first European arrivals came with sealers who exploited the region's west coast during the late 18th and early 19th Century. Following the establishment of the Nelson settlement the region's coast attracted settlement in the 1850s, especially Motueka, Riwaka, Motupipi and Collingwood. The major valleys of the Motueka, Takaka and Aorere rivers were soon farmed. Inland, James Mackay began exploring the Aorere valley in 1856 for suitable grazing country, while Thomas Salisbury explored the Tablelands and Cobb valley in 1863. Both areas were subsequently grazed, with lowland areas of forest cleared for farming. Today pastoral activity is confined to the areas of Motueka, Takaka, Aorere, West Whanganui and

PLATE 7.1: Abel Tasman Coastline near Marahau
NZMS 262-9 (503021)→ NE

PLATE 7.2: Whanganui Inlet
NZMS 262-9 (469066)→ E

Karamea, though a number of grazing licences still exist on conservation estate.

Gold was discovered in the north of the region at Aorere in 1856, bringing with it a sizeable gold rush to Golden Bay, while to the south gold was also discovered in the Baton and Wangapeka rivers. Both these goldfields, Collingwood and Rolling River, remain today as historic sites while limited mining activity still occurs on the periphery of the region—a number of mining and prospecting licences are held on conservation estate.

With grazing and mining reaching toward the region's interior, several access tracks were formed. The Heaphy Track (constructed between 1882–1892), the Leslie–Karamea Track (constructed in 1893–1894) and the Wangapeka Track (constructed between 1895–1899) provided mining routes to the west coast, while the Flora Track (constructed between 1870–1878) provided a stock route onto the Tablelands and the Cobb valley (see Plates 7.3 & 7.4). These routes all remain today as major recreational hiking tracks (see Map 7.3).

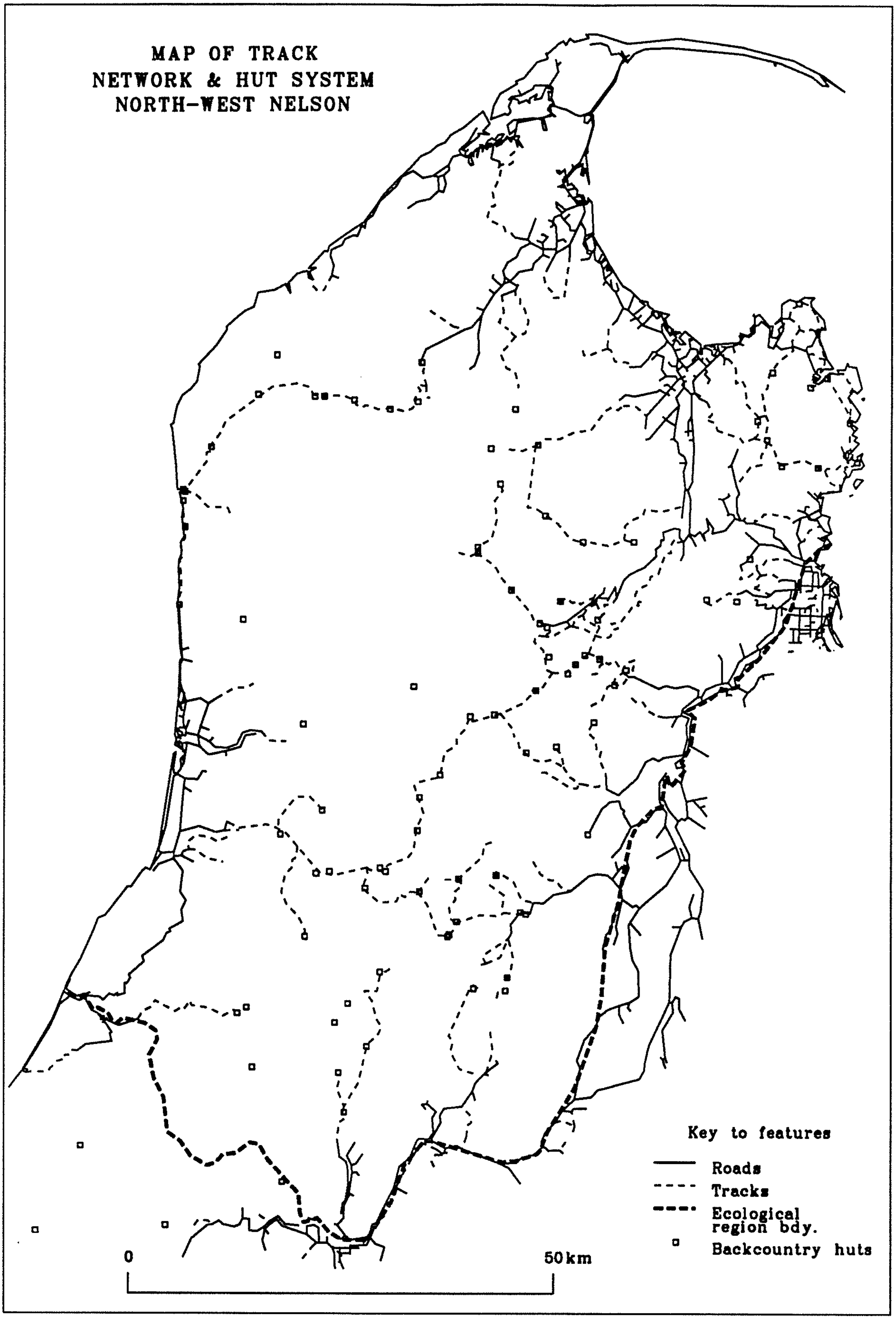
Logging in the region began in the late 19th Century although the most intense clearances occurred from the 1920s onwards, predominantly along the Motueka river, around Collingwood, at the Taitapu estates, and at Karamea. Today logging is restricted to those exotic plantations whose establishment followed earlier clearances of native forest. Other major human influences in the region relate to vegetation destroyed by fires associated with early mining and farming, and to the impacts of introduced wildlife—a problem that has supported hunting activity in the region, and is today recognised through control and eradication measures.

The region has steadily become a popular secondary tourist destination since the 1960s and also supports an increasing recreation demand. Golden Bay receives high use in the summer by holiday-makers from the cities of Nelson and Christchurch who are attracted to the beaches and campgrounds while the region's interior provides excellent backcountry recreation opportunities including tramping, caving, hunting and fishing. Much of the backcountry recreation use occurs on conservation estate which is endowed with over 700 km of walks, tracks and routes, of which 10% receive high use, 55% receive moderate use and 35% have low use (DoC 1990d). The track network is supported by a backcountry hut system that provides users with basic overnight accommodation (see Map 7.3 and Plates 7.5 & 7.6).

The region is one of important anthropocentric values, in both historic and contemporary contexts, and especially with respect to use of its natural resources.

PLATE 7.3: Tablelands and track
NZMS 262-9 (481003)→ SW

PLATE 7.4: View of Pike's Peak from Bigg's Tops near Wangapeka Saddle
NZMS 262-9 (462977)→ N


MAP OF TRACK
NETWORK & HUT SYSTEM
NORTH-WEST NELSON
Key to features
Roads
Tracks
Ecological region bdy.
Backcountry huts
0
50km

MAP 7.3:

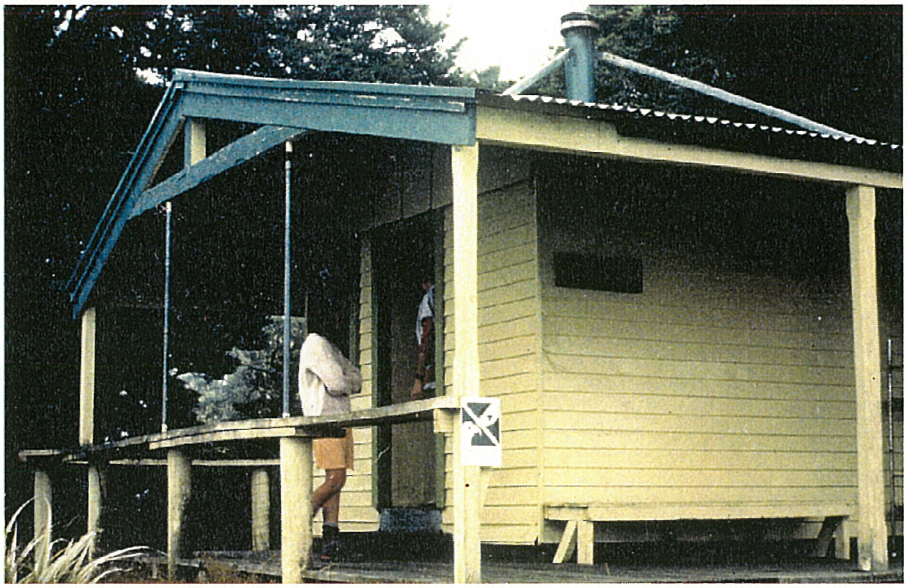


PLATE 7.5: Mount Arthur Hut
NZMS 262-9 (486001)→ NE

PLATE 7.6: Visitors on Mount Arthur Ridge
NZMS 262-9 (485999)→ NW

7.1.3 The Region's Protected Areas System

Efforts to maintain a balance between interacting ecological and anthropogenic factors have seen a number of major protection efforts being made in the natural resource management of the region.

In fact, most land with indigenous forest has been in Crown tenure since its acquisition by purchase from local Maoris in 1863, although it was not until 1917 that the first gazettals of State Forest were made. This action was followed in 1920 by transfer of major parts of the forested interior—essentially low timber-production forest—to State Forest with the passing of the *Forest Act 1922*, while the mountain tops remained as Crown land. The formation of North-West Nelson State Forest Park in 1965 encompassed much of this State Forest although it was not formally gazetted as a Forest Park until 1970. Further additions to the Forest Park have included the Taitapu Estate between 1982–1985. This Park's status was amended to a Conservation Park with its transferral to DoC in 1987, although it is still referred to as North West Nelson Forest Park (NWNFP). The Park is currently the subject of consideration as a National Park—under section 8 of the *National Parks Act 1980*—which could also include the stewardship areas of the Mokihinui, Matiri and Owen forests (formerly State Forests).

In 1938, land on Farewell Spit was set aside as a flora and fauna reserve while the adjoining tidal flats were set aside for the protection of wildlife. This status was amended in 1980 when the whole Spit became a nature reserve and since then has been further designated as one of two wetlands in New Zealand of international importance. In 1942 part of the Abel Tasman coastline was gazetted as a National Park, taking in State Forest, scenic reserve and Crown land, for preservation and the public enjoyment of the area. Further additions of coastline and inland ranges have been made since then to form Abel Tasman National Park (ATNP) as it currently exists. Other protected areas in the region have been gazetted as scenic reserves, such as the Gouland Downs.

The creation of DoC in 1987 meant that all of these protected areas came within the scope of DoC's responsibilities. Thus, the region's protected areas system of national parks, conservation parks, reserves and stewardship areas now comprise a common conservation estate under the management of a single agency (see Map 7.4). In fact, 84% of the region is conservation estate made up of NWNFP (56% of the region), ATNP (3% of the region), a number of sizeable stewardship areas (22% of the region), and an assortment of scenic and nature reserves (35 reserve units comprising 3% of the region) which includes Farewell Spit Nature Reserve. Table 7.1 provides a summary of the protected area categories which comprise the conservation estate. Numerous backcountry hiking tracks are contained within this estate including Abel Tasman Coastal Track, Heaphy Track and Wangapeka Track, to name the most popular trio. *In toto*, this protected areas system of North-West Nelson represents an especially unique and diverse natural environment—indicative of an area that is currently proposed as a World Heritage Area (Hutchings, in press).

PROTECTED AREA CATEGORY	AREA (ha)	PER CENT OF REGION
National Park (ATNP)	22,500	3
Conservation Park (NWNFP)	409,900	56
Reserves	17,900	3
Stewardship Areas	160,600	22
SUB-TOTAL	610,900	84
Non-Estate	119,100	16
TOTAL	730,000	100

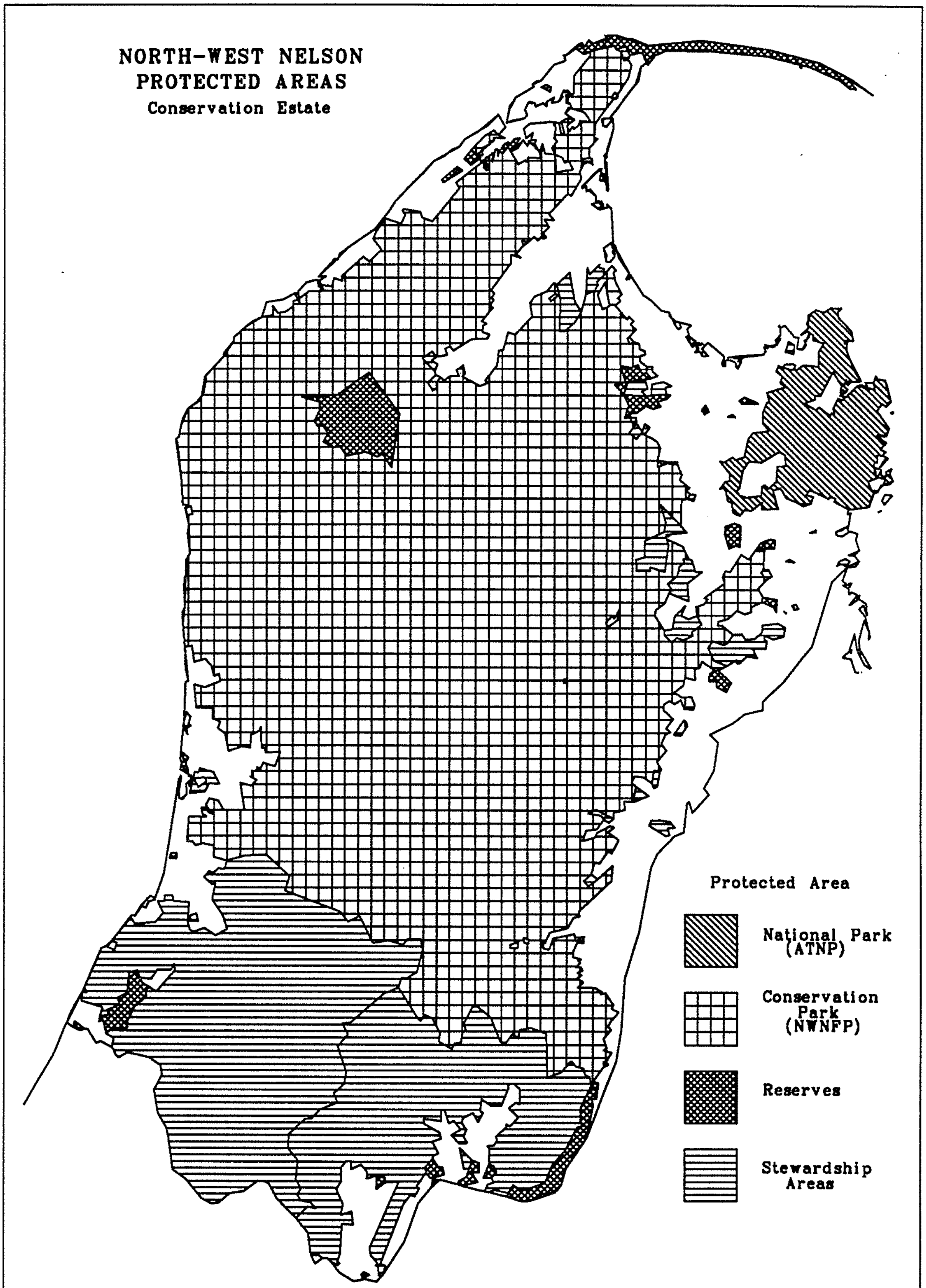
TABLE 7.1: Areas of Protected Area Categories in North-West Nelson

The administration and management of the region's protected area system falls under the auspices of two DoC conservancies, i.e. Nelson/Marlborough and West Coast, which have strategic planning responsibilities for the estate. In effect, however, the Nelson/Marlborough conservancy has *de facto* responsibility for the West Coast portion of the region as well—West Coast conservancy's interests tending to be centred further south around Franz Josef. Operational planning for the region emanates from three field centres at Motueka, Takaka and Karamea. The objectives and policies which govern the management of the use and protection of the region's conservation estate are set out in management plans for specific units of the protected areas system, the major plans being:

- Abel Tasman National Park Management Plan 1986;
- North-West Nelson Forest Park Management Plan 1991;
- Farewell Spit Nature Reserve and Puponga Farm Park Management Plan 1991.

The Nelson Conservation Board has duly constituted advisory functions in the administration of these protected areas.

Protected area management in North-West Nelson thus falls almost entirely within the institutional arrangements and structures of DoC and, therefore, under its broad preservation and use mandate.


NORTH-WEST NELSON
PROTECTED AREAS
Conservation Estate
Protected Area
National Park (ATNP)
Conservation Park (NWNFP)
Reserves
Stewardship Areas
0
10
20
30
40
50km

MAP 7.4:

7.1.4 Summary

The north-western corner of the South Island of New Zealand contains an aggregation of topographical, geological, climatic, biological and cultural features with closely related characteristics. Together these form the North-West Nelson Ecological Region with its own broad ecological character. The region is composed mainly of ancient rocks, forming mountains drained by numerous rivers which form narrow valleys and coastal terraces. The ecological diversity within North-West Nelson is reflected in a range of plant communities and wildlife habitat sequences, from coastal, warm temperate vegetation, through temperate forest and mountain scrub, to open alpine herbfields. The region has a rich human history of coastal Maori settlements, goldmining, sawmilling and dairy farming, and with the major river valleys today combining mixed farming and forestry. However, the major part of the region is natural backcountry of indigenous beech forests and subalpine grasslands which in essence contribute to a diverse and unique conservation estate.

7.2 The Geographic Database for WPM in North-West Nelson

In order to perform the mapping component of WPM, the development of a geographic database was a crucial step—in this case for the geographic extent of North-West Nelson. The geographic database was primarily developed from the 1:250,000 Terrainmap series covering the region, and additional data from the Vegetation Cover mapping for the region—both of these sources were in digital form (from DOSLI and DSIR respectively). The data elements extracted from these data sets are shown in Table 7.2. The database was also supplemented by manual digitisation of map data from Topomaps, Parkmaps and Trackmaps as necessary (see Table 7.3 for the published maps used). Compilation of the database and subsequent spatial analysis was performed using the ARC/INFO system. A considerable amount of time and effort went into creating the database, in excess of 1200 hrs, even with basic digital data to work from. This highlights the high data costs attached to the use of GIS in resource management applications, as was noted in Chapter 5, and is a point which should be considered very carefully by intending users. It is a point that should not be ignored by researchers either.

The components of the spatial database that was developed are shown in Table 7.4. Each component is represented by a map *coverage* (a GIS data layer) containing the geographic feature, as a geographic entity, and attributes associated with the feature. The database was broadly organised by perceptual components. Thus,

DATA LAYER	MAP FEATURE
Terrainmap Digital Database	
(1) hydrography	coastline
	canal
	pond
	lake
(3) utilities	powerline
(4) transport	airport
	road
	track
(6) structures	building
	mast
	mine
Vegetation Digital Database	
vegetative cover	cover class

TABLE 7.2: Data Layers and Features utilised from Existing Digital Databases

it comprises artifactual features with coverages denoting structures (STX), remoteness features with coverages denoting access (AXS), naturalness features with the coverage NTL, and solitude features with coverages denoting encounters (ENC). Several coverages were also created containing various management boundaries considered as useful in the case study analysis.

7.2.1 Artifactual Features

The structures or features of human impact, generally point or line entities, were predominantly derived from the structures layer of the Infomap topographic database (coverages STX1–STX7) while hydro-electric sites (STX8), campsites (STX9) and logging sites (STX10) were manually digitised. Attribute data for these coverages commonly included an identifying name.

7.2.2 Remoteness Features

The access-related features, also either point or line entities, were derived from the transport layer of the topographic database (AXS1–AXS3) and updated by manual digitisation. Attribute data appended to roads (AXS1) included road type (i.e. national highway, provincial highway, local highway, urban road, forestry road) and surface (i.e. sealed or metalled), and for tracks (AXS2) this included track type

MAP SHEET No.	NAME
Topomaps (Infomap 260) 1:50,000	
L25	Kahurangi
L26	Heaphy
L27	Karamea
L28	Mokihinui
M/N24	Farewell Spit
M25	Collingwood
M26	Cobb
M27	Mount Arthur
M28	Wangapeka
M29	Murchison
N25	Tarakohe
N26	Takaka
N27	Moutere
N28	Golden Downs
Terrainmaps (Infomap 262) 1:250,000	
9	Nelson
10	Grey
11	Kaikoura
Trackmaps & Parkmaps	
245	Heaphy Track
318	Wangapeka Track
273-7	Abel Tasman National Park
274-13	North-West Nelson Forest Park
Ecological Regions/Districts	
242-3	Upper South Island

TABLE 7.3: Published Map Sheets used to construct Database

COVERAGE	FEATURE	ENTITY
	Artifactual features	
STX1	mines	point
STX2	lighthouses	point
STX3	trigs	point
STX4	masts	point
STX5	huts	point
STX6	dams	point
STX7	campsites	point
STX8	logging sites	point
STX9	drains	arc
STX10	powerlines	arc
	Remoteness features	
AXS1	roads	arc
AXS2	tracks	arc
AXS3	airfields	point
	Naturalness features	
NTL1	vegetative cover	polygon
	Solitude features	
ENC1	track	arc
ENC2	hut	point
ENC3	campsites	point
	Management boundaries	
ECO	ecological district	polygon
PNA	protected area	polygon
DOC	DoC conservancy	polygon
ROS	recreation opportunity	polygon

TABLE 7.4: Spatial Database Components for North-West Nelson

(i.e. vehicular or foot) and track category (i.e. 4WD, walkway, benched track, unmaintained track and marked route—a classification developed and used by DoC Nelson).

7.2.3 Naturalness Features

The naturalness feature (NTL1), a polygon entity, was derived from the Vegetative Cover Mapping (VCM) of New Zealand, specifically the vegetative cover class data that originated from 1:250,000 field sheets compiled from the New Zealand Land Resource Inventory (Newsome, 1987). The 47 vegetative cover classes provided from this mapping gave a far greater level of distinction than was necessary given the relatively straight-forward perceptual distinctions identified in Chapter 6. Thus, the classification was simplified to provide 18 classes which retained the broad distinction between indigenous and exotic species, and among general vegetative types (i.e. cropland, grassland, scrub, forest etc.). The original and redefined classificatory systems are outlined in Table 7.5. The VCM for North-West Nelson thus required attribute data manipulation in order to redefine vegetative polygons in terms of the new classification, and spatial manipulation to dissolve and create polygons in terms of this reclassification.

7.2.4 Solitude Features

Encounter features denoting solitude were derived by attributing data to appropriate point and line entities (i.e. tracks, huts and campsites). Thus, the attribute data related to the use levels of these features and were determined from fieldwork and DoC visitor monitoring in the study area. Where possible, track counter figures obtained from the mechanical counter system were used. These have been trialled and tested in NWNFP (Clough,1987), and also used widely in Abel Tasman NP. Track counter figures were determined from 18 locations and augmented from figures in trail-head intentions books to provide track use numbers (see Table 7.6) , while hut usage was determined on the basis of hut use books (see Table 7.7). Where such monitoring did not exist, and in the case of campsites, estimates were obtained from field staff (see Table 7.8). In applying these use figures a temporal distinction was made between the peak-season (November–March) and the off-season (April–October) because of the marked differences in use levels. Subsequently, it will be possible to determine any differences between the two use-seasons for perception levels.

ORIGINAL VEGETATIVE COVER CLASS[a]	REDEFINED VEGETATIVE COVER GROUP	GENERAL DESCRIPTION
C1–C2	C	cropland
G1–G2	G2	pasture
G3–G6	G1	tussockland
GS1–GS5	GS1	indigenous grassland-scrub
GS6–GS8	GS2	exotic grassland-scrub
S1–S4	S1	indigenous scrub
S4	S2	exotic scrub
GF1–GF4	GF2	exotic grassland-forest
GF5–GF6	GF1	indigenous grassland-forest
FS1–FS7	FS1	indigenous forest-scrub
FS8	FS2	exotic forest-scrub
F1–F8	F1	indigenous forest
F9	F2	exotic forest
M1–M4	A,W,D,H	alpine areas, wetland, duneland & heathland
M5	U	Urban areas

TABLE 7.5: Reclassification of Vegetative Cover Class

[a]The vegetative cover class is that developed by Newsome (1987)

7.2.5 Management boundaries

Those coverages that delineated management boundaries were specifically of the ecological region and districts (ECO), protected area units (PNA), DoC conservancy boundary (DOC) and recreation opportunity units (ROS). The ECO coverage was digitised manually from ecological boundaries transferred onto the appropriate topographic features on the Infomap 262 sheets at 1:250,000, from NZMS 242 Sheet 3 (McEwen 1987) at 1:500,000. This process avoided digitising from particularly coarse boundary lines on the NZMS 242 series and introducing overlay error when combining coverages based on different map scales. The PNA coverage was manually digitised from conservation estate maps at a 1:250,000 scale which were obtained from DoC for the Nelson/Marlborough and West Coast conservancies, as

TRACK or TRACK SECTION	PARK	PEAK-SEASON USE (people per day)	OFF-SEASON USE (people per day)
Heaphy	NWNFP	13	5
Wangapeka	NWNFP	6	4
Upper Cobb	NWNFP	4	2
Tableland	NWNFP	5	4
Blue Creek	NWNFP	4	2
Kaituna	NWNFP	1	–
Pupu Springs	Pupu Reserve	41	17
Pupu walkway	NWNFP	14	5
Wharawharangi	ATNP	37	10
Anapai	ATNP	37	30
Goat Bay	ATNP	78	45
Skinner Point	ATNP	73	43
Holyoak	ATNP	6	2
Tinlines	ATNP	93	28
Tonga Bay	ATNP	81	13
Falls River	ATNP	47	10
Torrent Bay	ATNP	53	11
Stillwell Bay	ATNP	93	28

TABLE 7.6: Track Use Figures for North-West Nelson

was the administrative boundary between the two conservancies for the DOC coverage. The ROS coverage was digitised manually from the Nelson/Marlborough conservancy's recreation opportunity inventory that the author completed during field work in the area, and that also fulfilled an integral part of that conservancy's recreation strategy (Kliskey 1991). The inventory sheets were mapped as 1:50,000 overlays on the Infomap 260 sheets in order that once each overlay sheet was digitised, all were edge-matched, map-joined and dissolved to create a single generalised coverage for the study region.

The database components were field checked and verified by ground inspection, by the use of local map sources and aerial photographs, and from confirmation with DoC field staff in the region. On the basis of these checks the database was updated or amended. However, the database and, therefore, the result of applying it within the WPM methodology, will reflect the various map sources utilised and any inadequacies inherent in those sources.

HUT	PARK	PEAK-SEASON USE (people per night)	OFF-SEASON USE (people per night)
Bark Bay	ATNP	40	14
Anchorage	ATNP	33	12
Torrent Bay	ATNP	9	3
Awaroa	ATNP	22	8
Whariwharangi	ATNP	13	5
Mt Arthur	NWNFP	4	1
Stone	NWNFP	3	1
Salisbury	NWNFP	11	4
Crow	NWNFP	3	11
Helicopter	NWNFP	3	1
Perry Saddle	NWNFP	11	4
Leslie Clearing	NWNFP	3	1
Trilobite	NWNFP	6	2
Saxon	NWNFP	7	2
Brown	NWNFP	7	2
Karamea Bend	NWNFP	4	1
Fenella	NWNFP	7	2
Flora	NWNFP	4	1
Kings	NWNFP	6	2
Venus	NWNFP	2	–
Gouland Downs	NWNFP	2	–

TABLE 7.7: Hut Use Figures for North-West Nelson

7.3 The Application of Method 1 for WPM

In applying the WPM methodology to the case-study for Method 1, the first three stages of the method (see Figure 6.2) were followed explicitly. This yielded the four purism groups, general properties for each perception level, item indicators for each property and spatial criteria for each indicator. The case-study was then utilised in stage four by applying these criteria to geographic variables for the region.

The spatial variables for a perception level (i.e. AXS1–3, STX1–10, ENC1–3 and NTL1) were then manipulated using logical operations (e.g. the RESELECT command) and buffering as appropriate for a particular purism group. These were then overlaid to produce four map coverages (ARTx, REMx, NATx & SOLx) representing each of the four general properties of wilderness perceptions. These four coverages were subsequently overlaid to provide a coverage denoting the spatial

CAMPSITE	PARK	PEAK-SEASON USE (people per night)	OFF-SEASON USE (people per night)
Totaranui	ATNP	132	47
Anchorage	ATNP	44	16
Bark Bay	ATNP	38	13
Appletree Bay	ATNP	7	2
Mosquito Bay	ATNP	4	2
Te Pukatea	ATNP	7	2
Akerston Bay	ATNP	2	–
Mutton Cove	ATNP	4	2
Tonga Quarry	ATNP	4	2
Torrent Bay	ATNP	4	2
Anapai	ATNP	2	–
Stillwell Bay	ATNP	2	–
Watering Cove	ATNP	2	–
Observation Point	ATNP	2	–
Tonga Beach	ATNP	7	2
Whariwharangi	ATNP	7	2
Awaroa	ATNP	4	2
Waharakeke	ATNP	2	–
Tinline	ATNP	4	2

TABLE 7.8: Campsite Use Figures for North-West Nelson

extent of wilderness perceptions for that purism class. The overlay produced a coverage for which each property is consistent with a particular perception level. The criterion used in overlaying was a binary value indicating that an area is either *inside* or *outside* the perceptual definition of a purism item for a purism group. The schema for this procedure is outlined in Figure 7.1. Thus, the spatial overlay of ART2, REM2, NAT2 and SOL2 produces a compilation displaying the spatial extent of perceived wilderness settings for perception level 2, that is, the neutralist group. The resultant map coverages (PUR1, PUR2, PUR3 & PUR4) for each of the four perception levels were then successively overlaid to produce a composite map coverage (PUR0) of all four levels of wilderness perception. The graphic result for each of these coverages and the result of spatial overlaying is shown in Maps 7.5–7.27, which will be discussed in detail shortly. These individual and aggregate coverages thus represent the desired products of multiple wilderness perception mapping. The spatial extent of multiple user perceptions of a wilderness setting are considered individually for each perception level and then in aggregate form.

7.3.1 Perception Level 1

The perception properties (artifactualism, remoteness and naturalness) for perception level 1 are represented spatially in Maps 7.5–7.7 which show coverages ART1, REM1 and NAT1 respectively. Thus, ART1 (Map 7.5) shows 1 km buffer zones around commercial mines and logging sites—the artifactual features which are excluded from the perceptual map of a wilderness setting for this level of perception. Map 7.6 shows the 1 km exclusion zone around all sealed roads which comprise REM1 representing remoteness, while Map 7.7 shows vegetative cover class areas of urban, pasture and cropland classes. There is no solitude component for perception level 1 since there was no apparent maximum encounter norm appropriate to this level of perception.

The combined result of overlaying these three coverages produces the coverage PUR1 (Map 7.8) which shows the spatial extent of perceived wilderness settings. It should be noted that on the maps representing coverages of each wilderness property (i.e. ART, REM, NAT and SOL) the shaded zones denote those areas that *do not* conform to wilderness in respect of the appropriate properties. On the maps resulting from the overlay of these coverages (i.e. PUR) the shading has been reversed, so that the shaded zones denote those areas that *do* conform to wilderness for the aggregated properties.

Of some note in the wilderness perception map for this perception level are the farmed areas of Karamea, Aorere Valley, Takaka valley and Motueka valley which fall outside this group's perceptions of wilderness. The extent of these wilderness perceptions is particularly high with 79% of the region perceived as wilderness setting (see Table 7.9). In terms of conservation estate 79% of the region is perceived as wilderness and is also of protected area status, which represents 89% of the total area perceived as wilderness in the region. With reference to individual protected areas, 99% of ATNP is perceived as wilderness, by this group, 98% of NWNFP, 80% of reserve areas and 97% of Stewardship areas. There was a highly significant relationship ($P<0.001$) between areas perceived as wilderness and protected area status.

7.3.2 Perception Level 2

The perceptual elements which comprise the spatial perceptions of wilderness for perception level 2 are shown in Maps 7.9–7.12. Thus, ART2 (Map 7.9) excludes non-commercial mining sites and areas of hydro-electric development in addition to

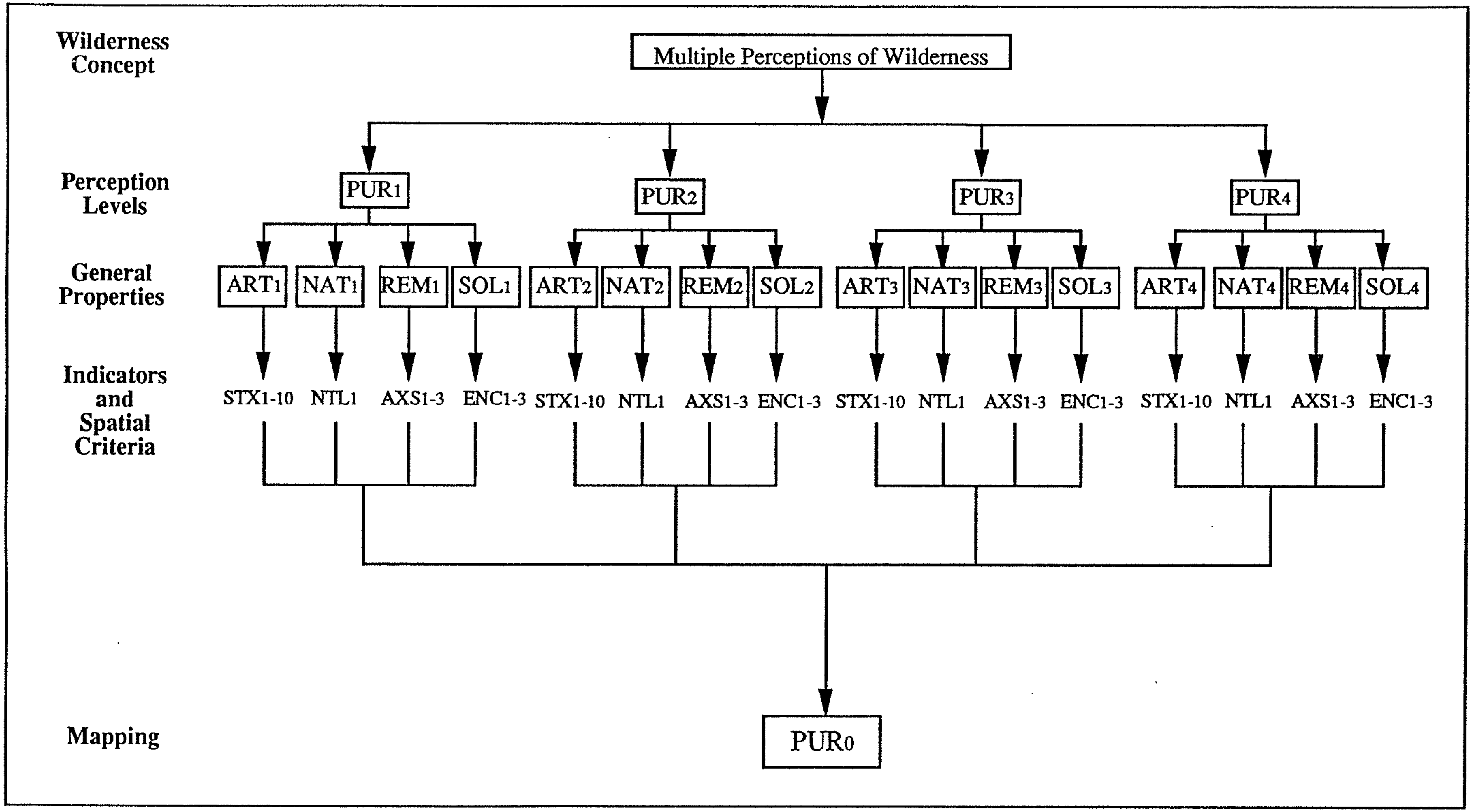
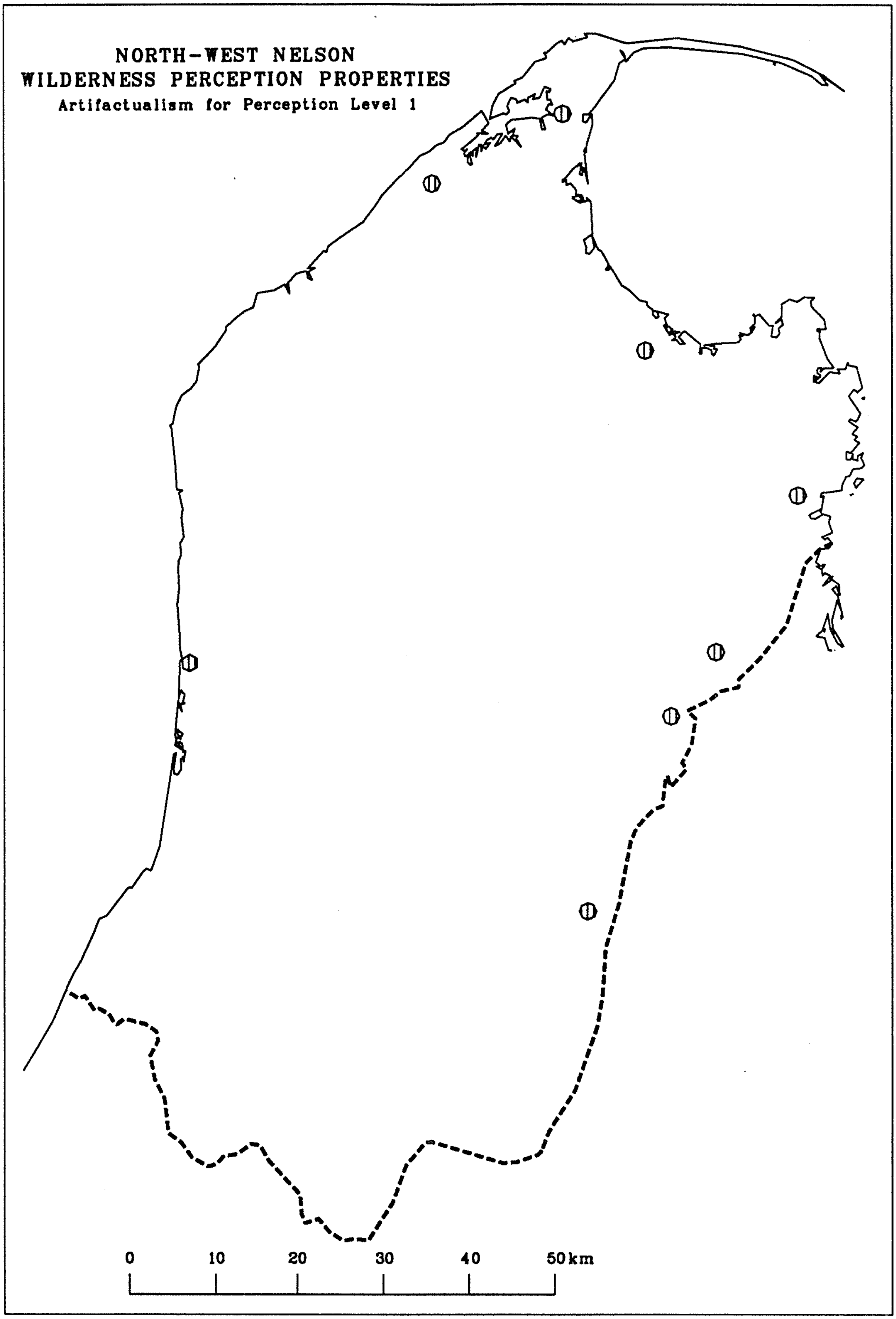
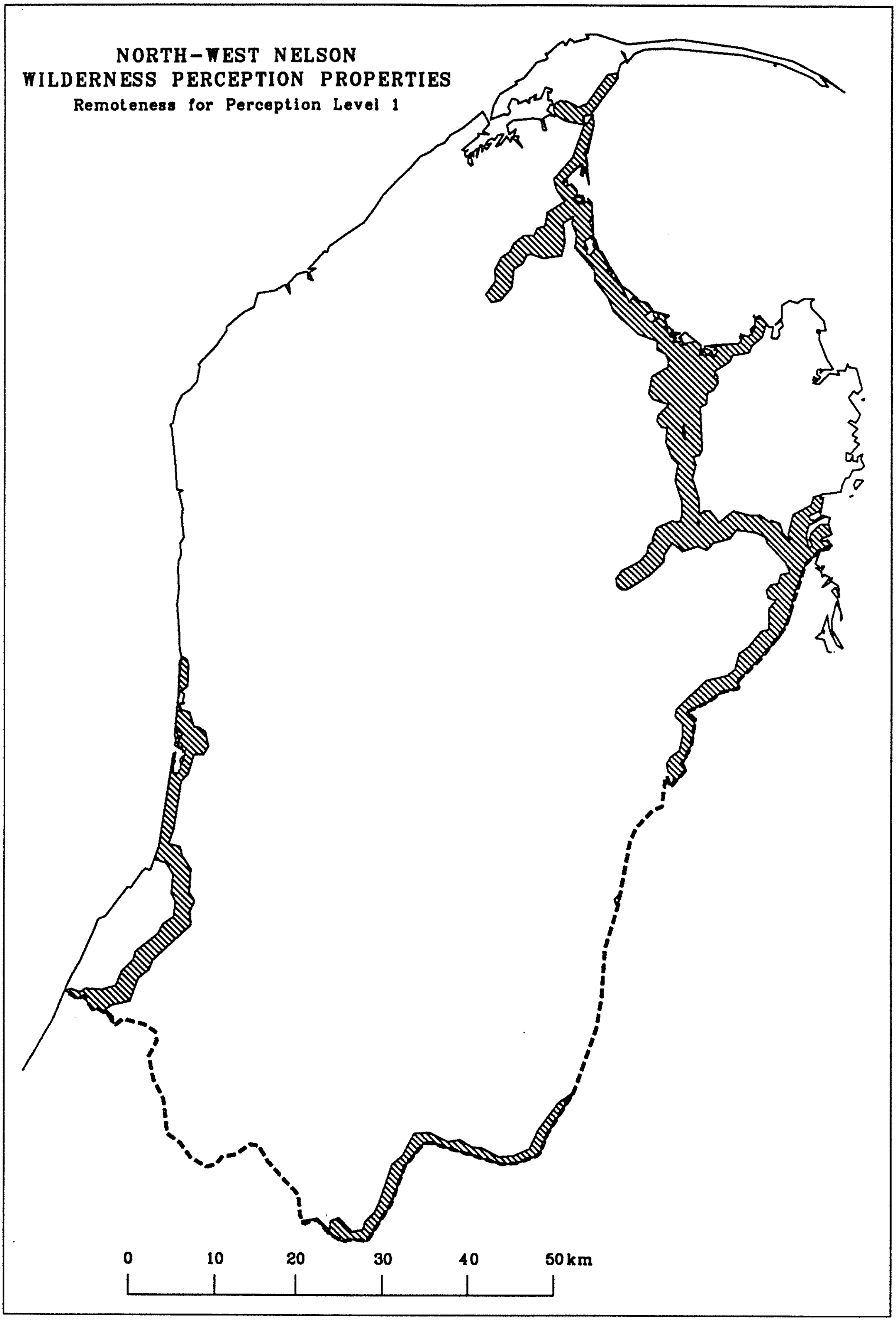


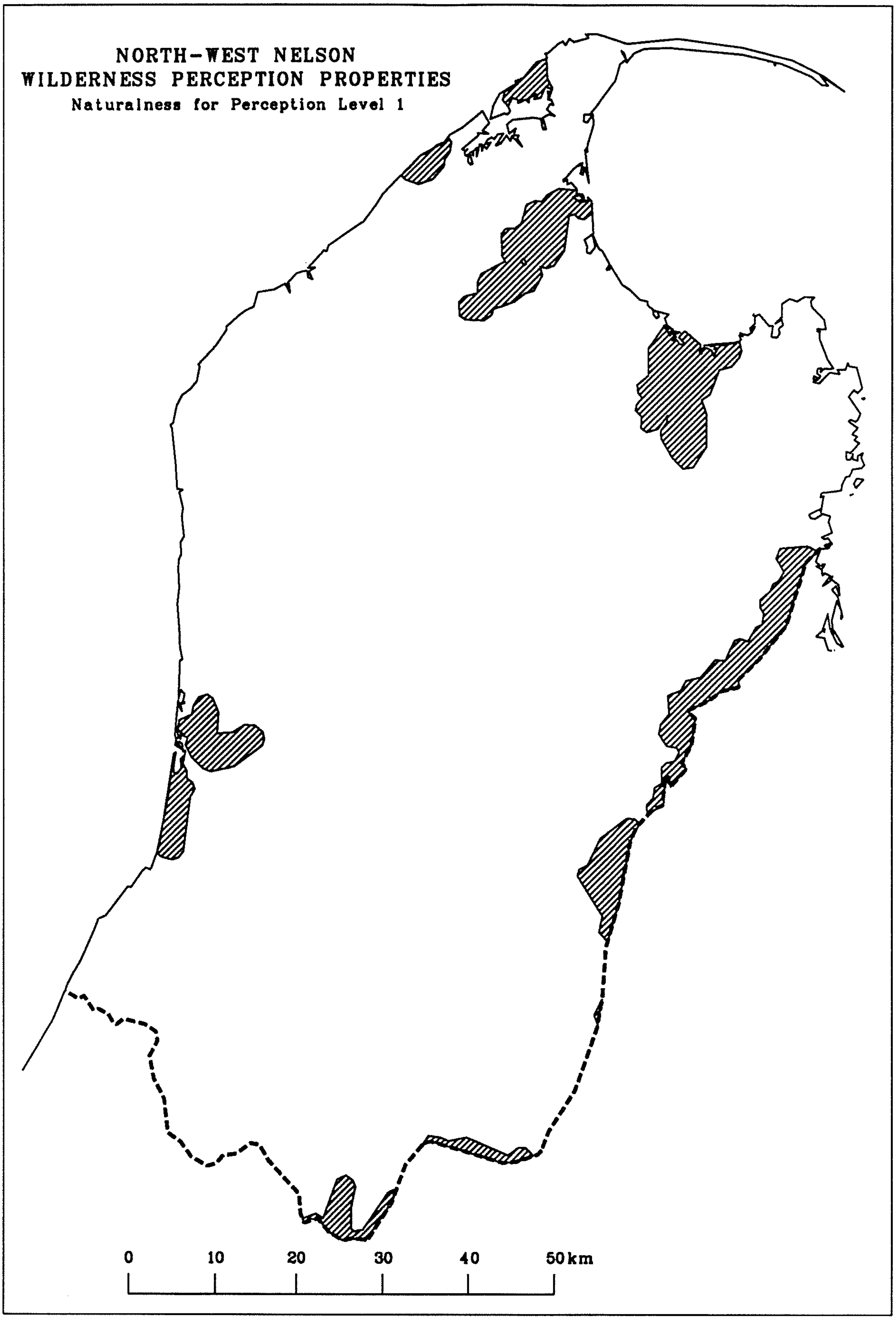
FIGURE 7.1: Schema for the Translation of Multiple Perceptions of Wilderness in the Case Study


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Artifactualism for Perception Level 1
0
10
20
30
40
50km

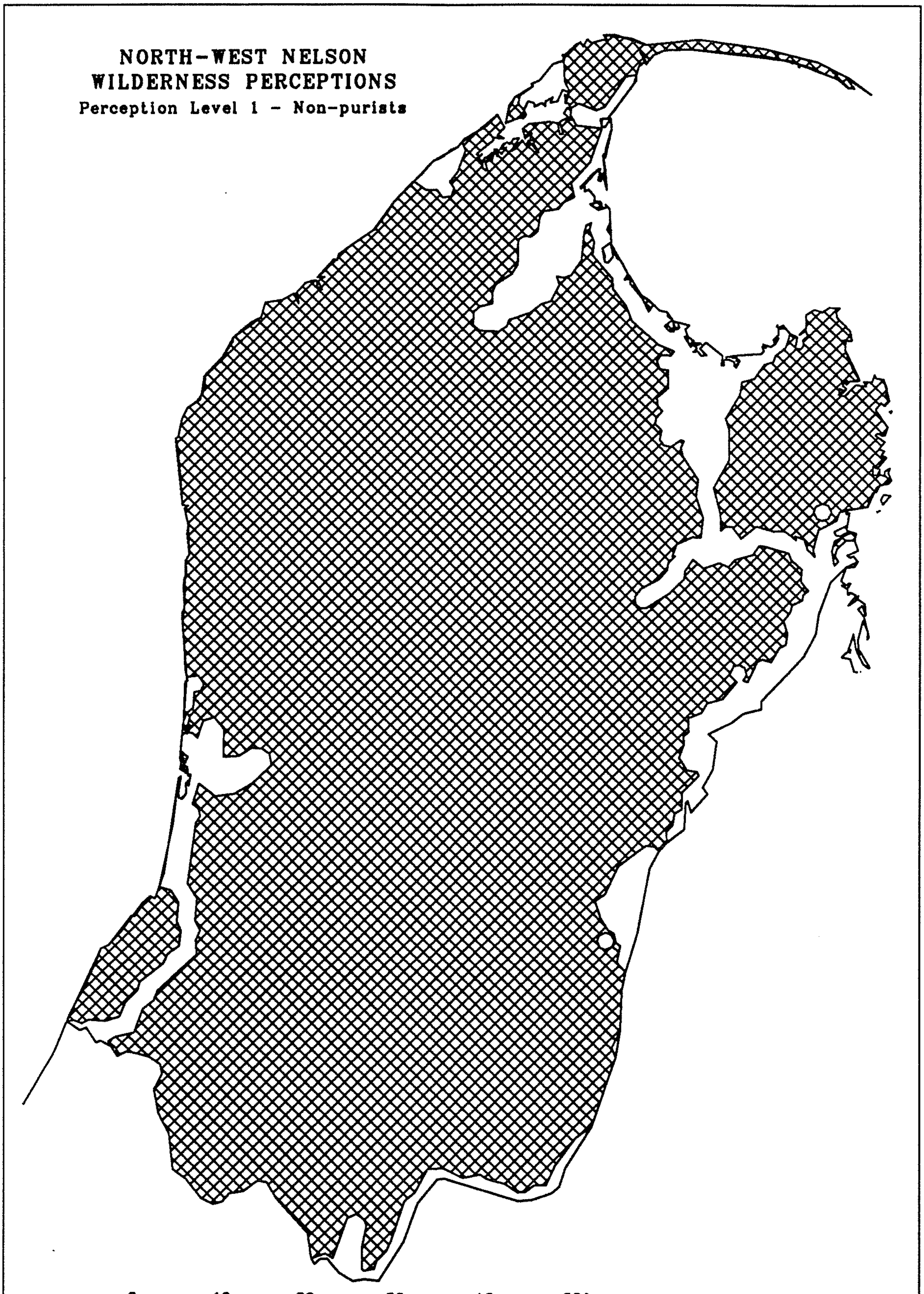
MAP 7.5:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Remoteness for Perception Level 1
0
10
20
30
40
50km

MAP 7.6:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Naturalness for Perception Level 1
0
10
20
30
40
50km

MAP 7.7:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Perception Level 1 - Non-purists
0
10
20
30
40
50km

MAP 7.8:

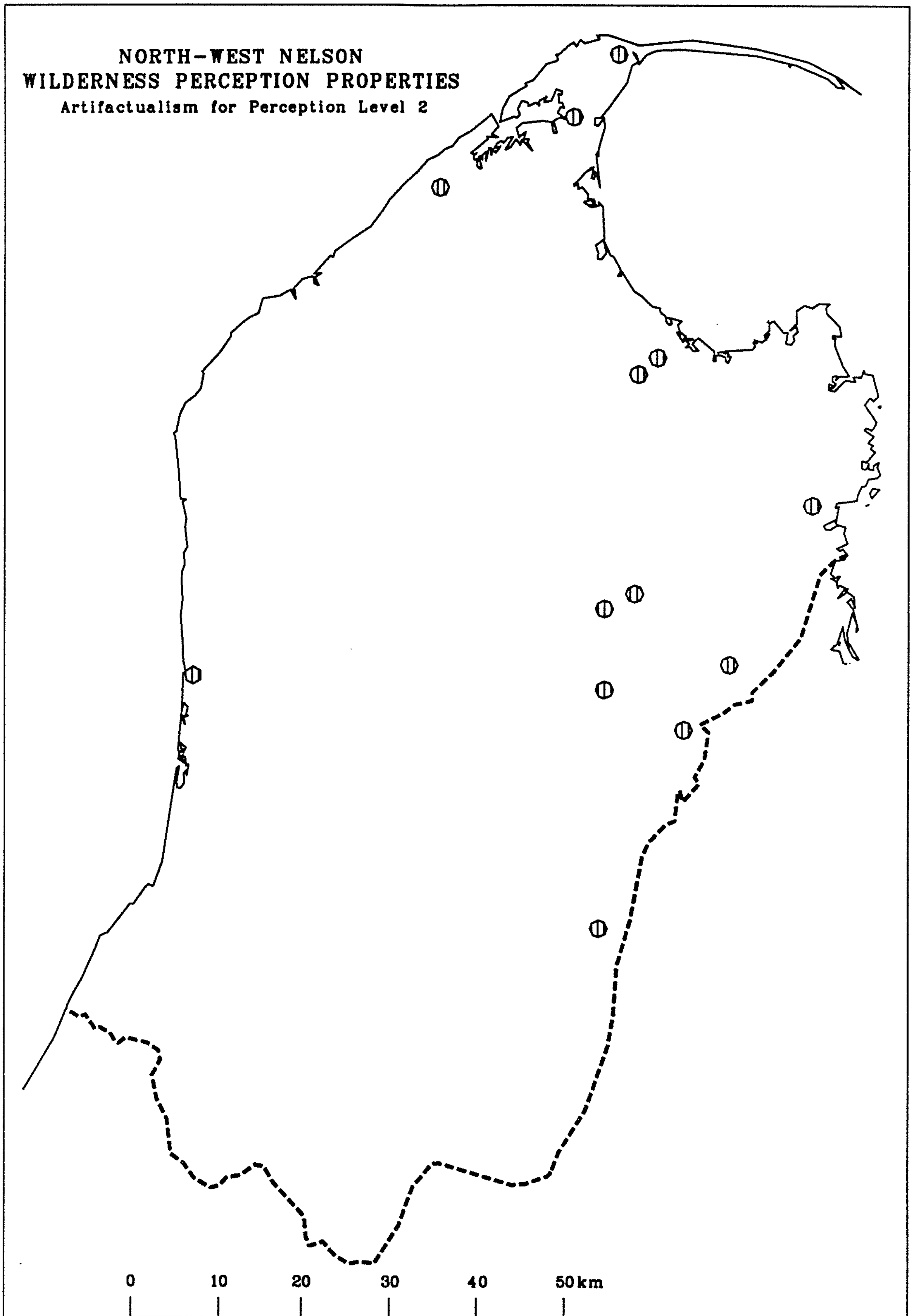
	PERCEPTION LEVEL 1	2	3	4
% of the region that is perceived as wilderness	89	77	65	47
% of the region that is perceived as wilderness and also in DoC estate	79	73	64	47
% of the area perceived as wilderness that is in DoC estate	89	95	98	99

TABLE 7.9: Percentages of Region Perceived as Wilderness by Perception Level

those excluded in ART1. The remoteness element (Map 7.10 representing REM2) extends the exclusion of access features to metalled roads and to airstrips, while naturalness (Map 7.11) additionally excludes a number of other vegetative classes (see Table 6.8). A solitude element (Map 7.12) is also apparent for perception level 2 that excludes tracks and huts that have use levels, for the peak season, exceeding the group's encounter norms.

Map 7.13 shows coverage PUR2, the wilderness perception map that results from overlaying these four elements. Notable areas that are excluded from perceived wilderness for this level of perception include the access routes into NWNFP up the Cobb valley and Flora Road, and into the Matiri and Owen valleys. Also excluded are areas surrounding the higher-use walking tracks of the Abel Tasman Coastal Track and the Heaphy Track. That area perceived as wilderness by the neutralist group represents 77% of the region, of which 95% is in the protected areas system. Thus, 73% of the region is perceived as wilderness and is also conservation estate. The 65% of ATNP that is perceived as wilderness is solely the inland part of the park, while a slightly smaller proportion (53%) of reserve areas is perceived as wilderness. Significantly ($P<0.001$) greater proportions of the other two categories are perceived as wilderness—92% of the forest park and 94% of stewardship areas.

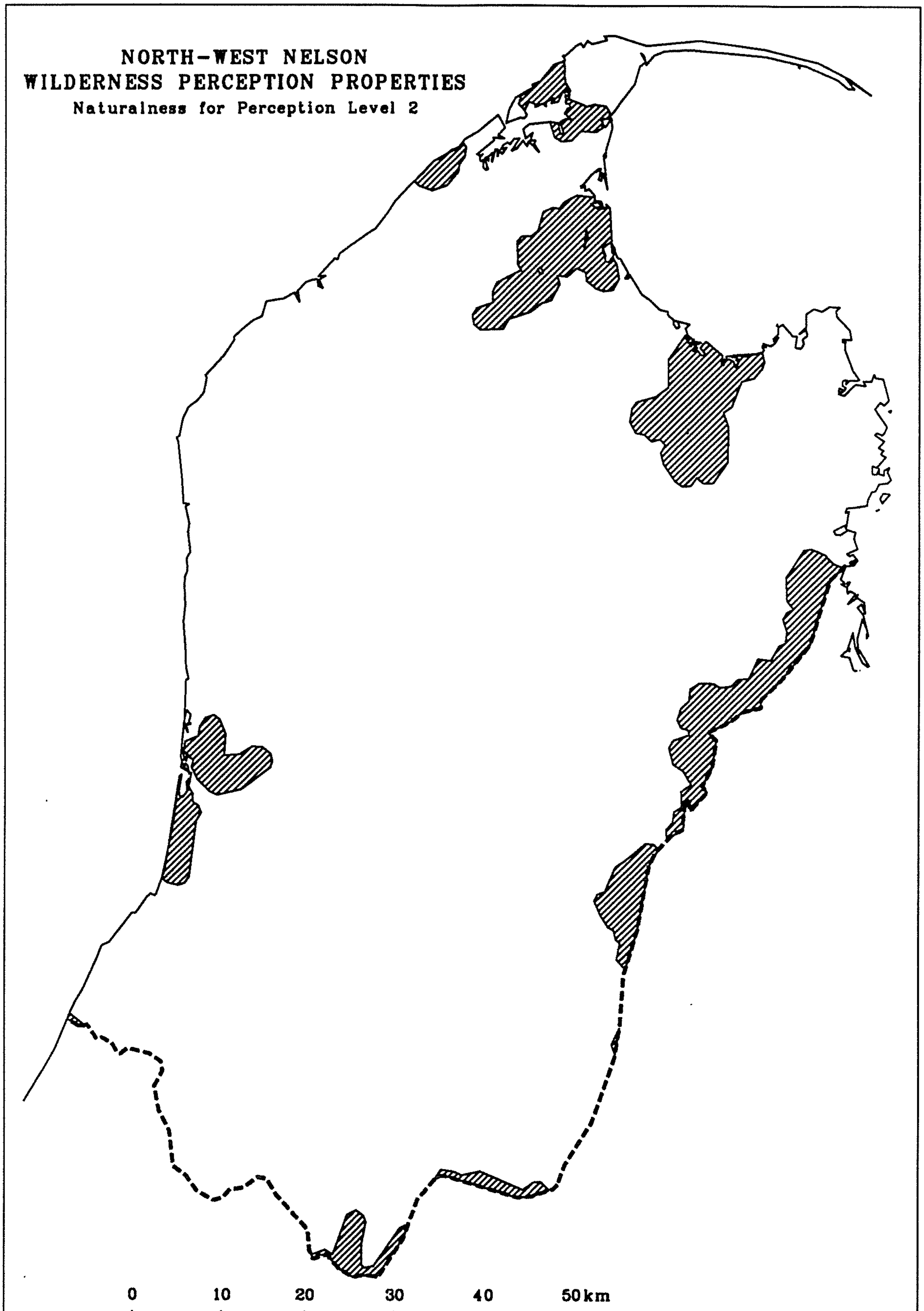
Differences in perceived wilderness due to seasonal differences in use levels have been examined by mapping wilderness perceptions based on off-season usage compared to peak-season usage which has been used so far. The lesser numbers using some tracks and huts in the off-season influence the solitude element and therefore the spatial extent of perceived wilderness. Map 7.14 shows wilderness perception mapping for perception level 2 based on off-season use. This represents 79% of the region, a difference of 2% of the region in comparison to peak-season


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Artifactualism for Perception Level 2
0
10
20
30
40
50km

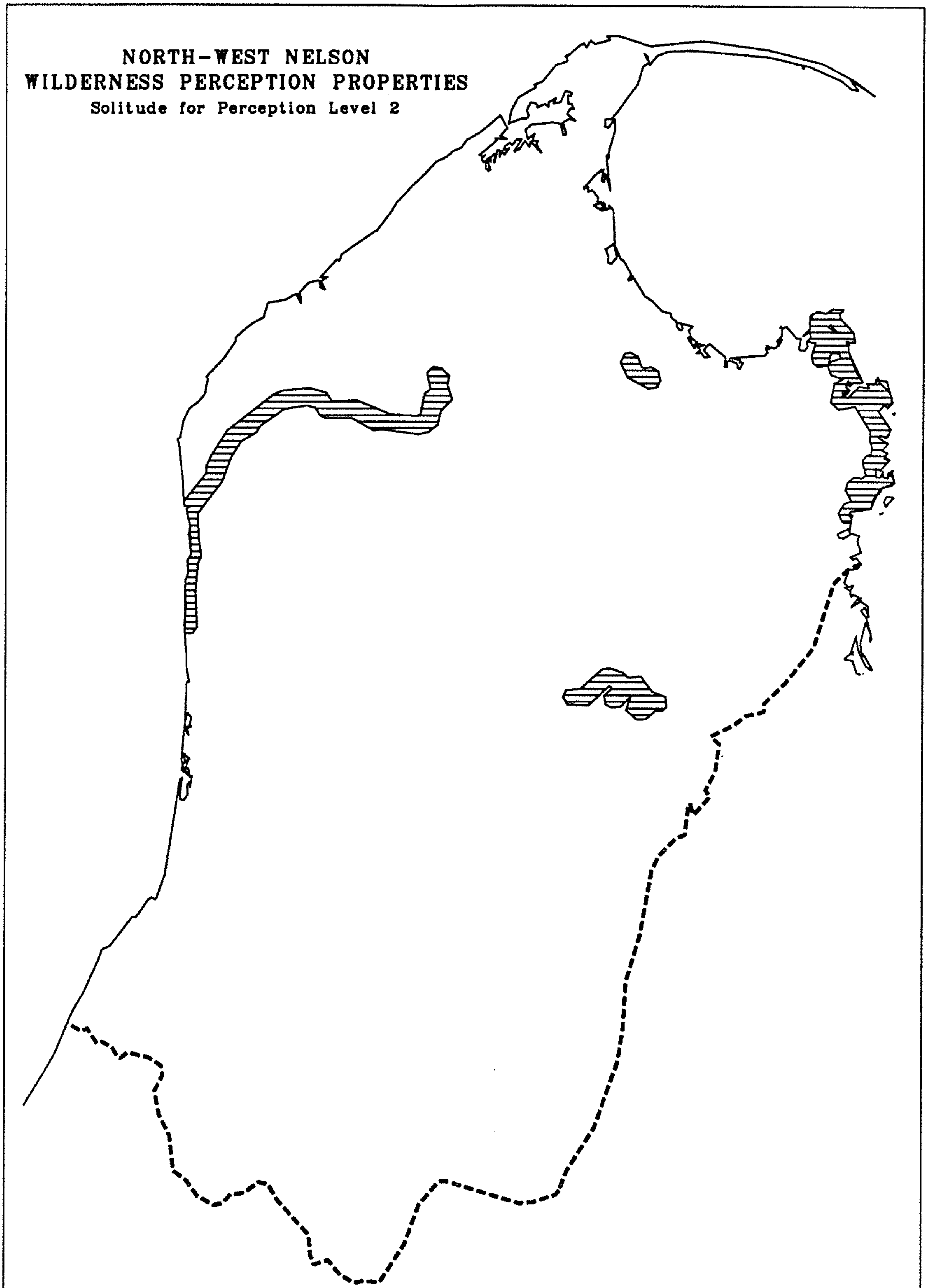
MAP 7.9:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Remoteness for Perception Level 2
0
10
20
30
40
50km

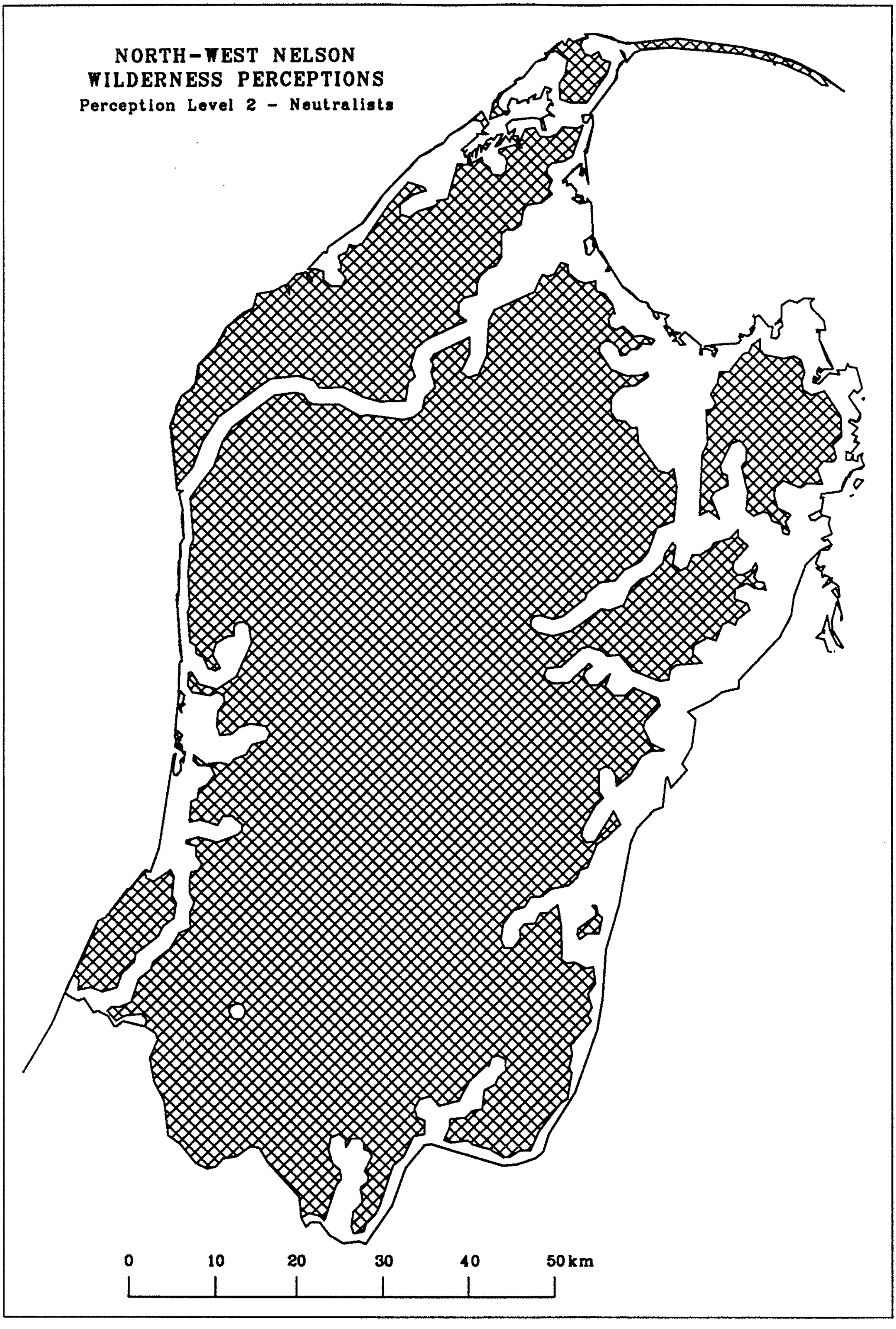
MAP 7.10:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Naturalness for Perception Level 2
0
10
20
30
40
50km

MAP 7.11:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Solitude for Perception Level 2
0
10
20
30
40
50km

MAP 7.12:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Perception Level 2 - Neutralists
0
10
20
30
40
50km

MAP 7.13:

use. The areas perceived as wilderness during the off-season, but not the peak-season, for this group are shown in Map 7.15. The notable differences are the Heaphy Track, the Flora-Tablelands tracks, the Pupu walkway and parts of the Abel Tasman Coastal walk.

7.3.3 Perception Level 3

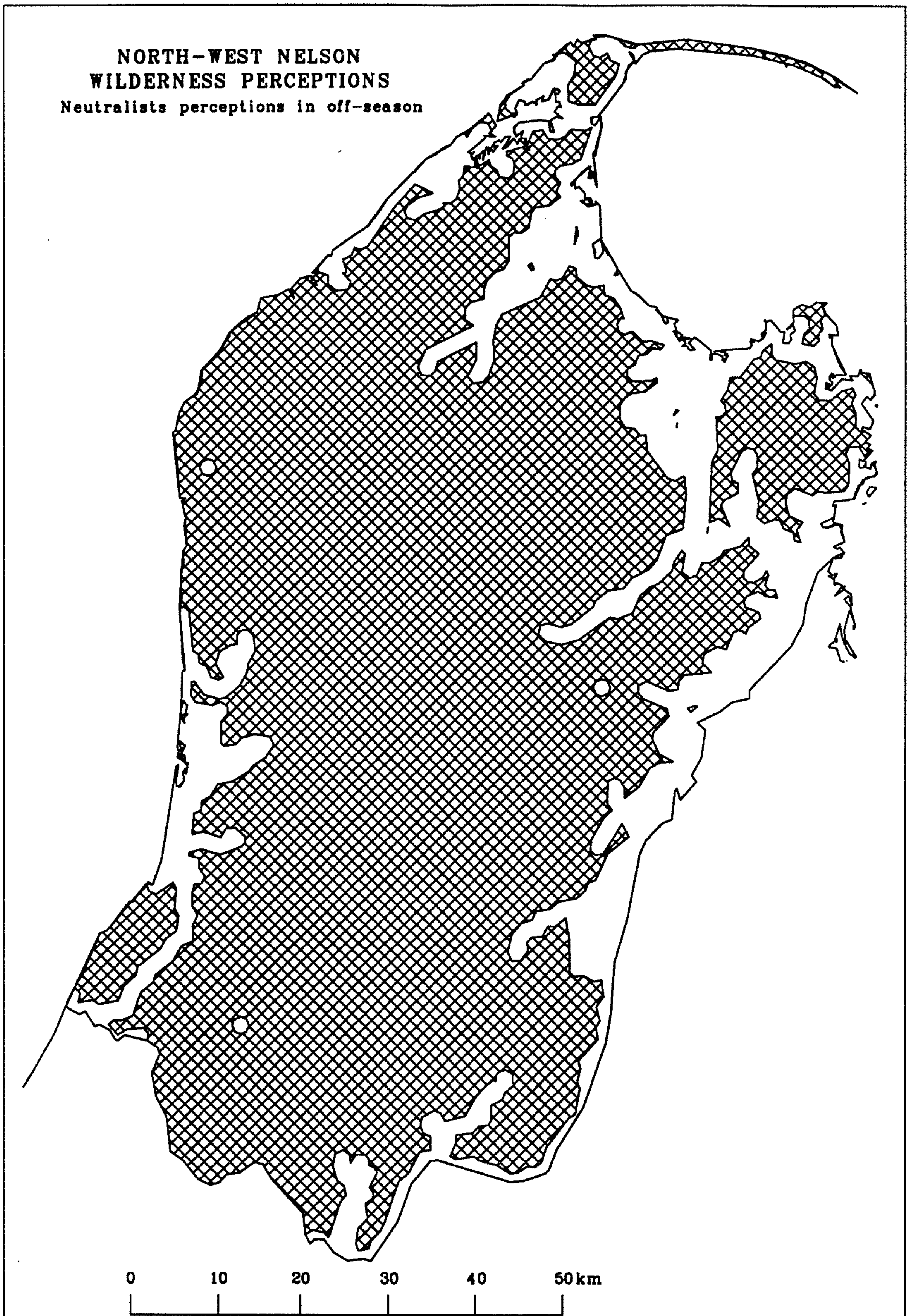
Map coverages for the perceptual elements pertaining to perception level 3 are shown in Maps 7.16–7.19. Artifactualism (Map 7.16) is denoted by greater buffer zones around features, remoteness (Map 7.17) by the additional exclusion of four wheel drive roads, naturalness (Map 7.18) means the additional exclusion of exotic forestry while the lower encounter norm for solitude (Map 7.19) results in further track areas being excluded.

The spatial extent of moderate purist perceptions of wilderness that results from the combination of these elements is shown in Map 7.20. Comprising 65% of the region, perceived wilderness for this perception level is contained in three major areas: to the north of the Heaphy Track, between the Heaphy and Wangapeka Tracks, and to the south of Wangapeka Track. Only interior pockets of Abel Tasman NP (representing 26% of the park) are perceived as wilderness, with 36% of reserve areas containing perceived wilderness. Again significantly greater parts of NWNFP and the stewardship areas are perceived as wilderness (81% and 84% respectively). Thus, 98% of the area perceived as wilderness by moderate purists is contained in the protected areas system, representing 64% of the region.

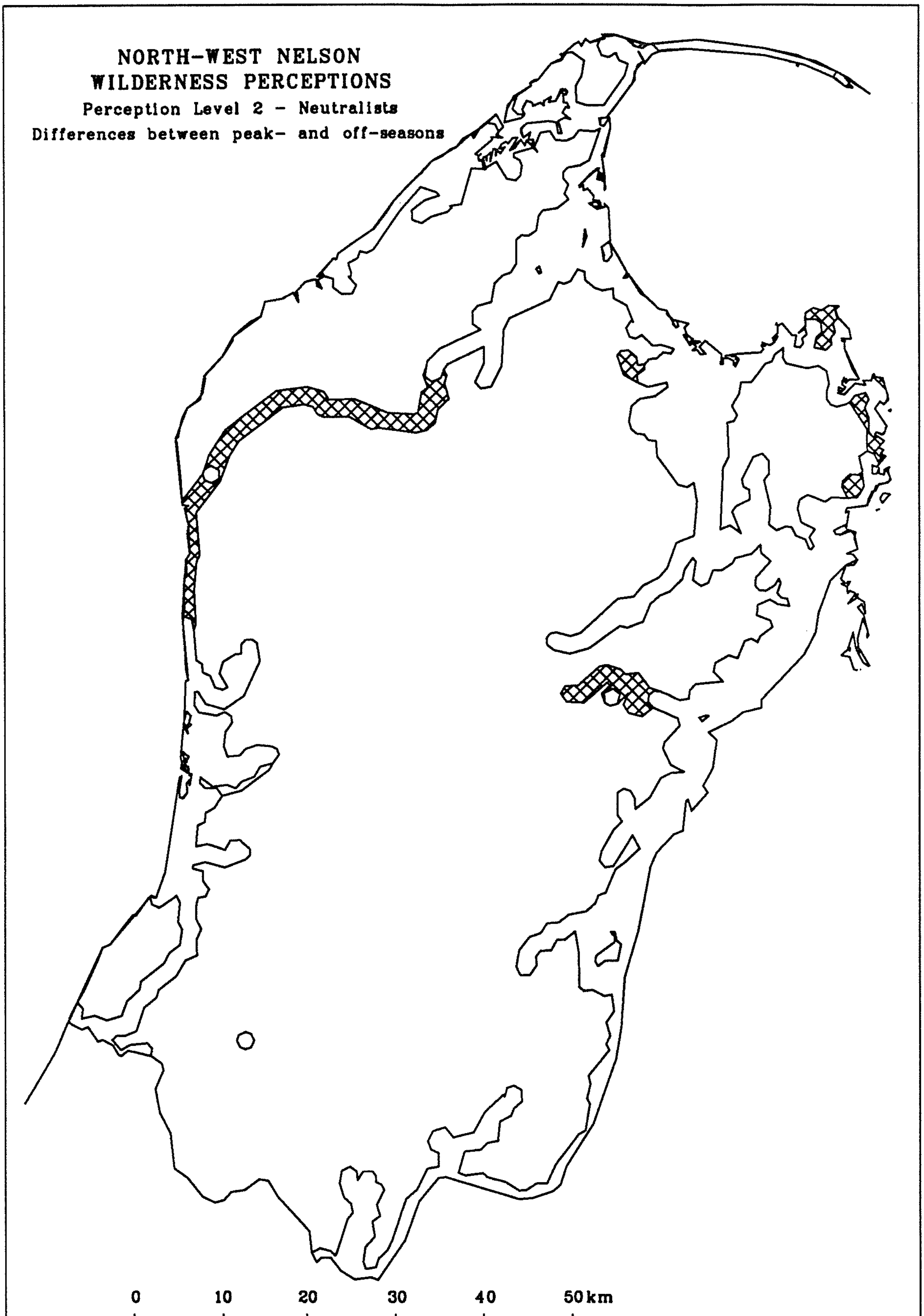
Perceived wilderness for this same level, but based on off-season usage, is shown in Map 7.21. This represents 69% of the region, a difference between peak-season and off-season perceptions of 4% of the region. The notable differences in seasonally-perceived wilderness areas (see Map 7.22) are the Heaphy, Wangapeka and Inland Abel Tasman Tracks, and some of the Mt. Arthur–Tablelands network.

7.3.4 Perception Level 4

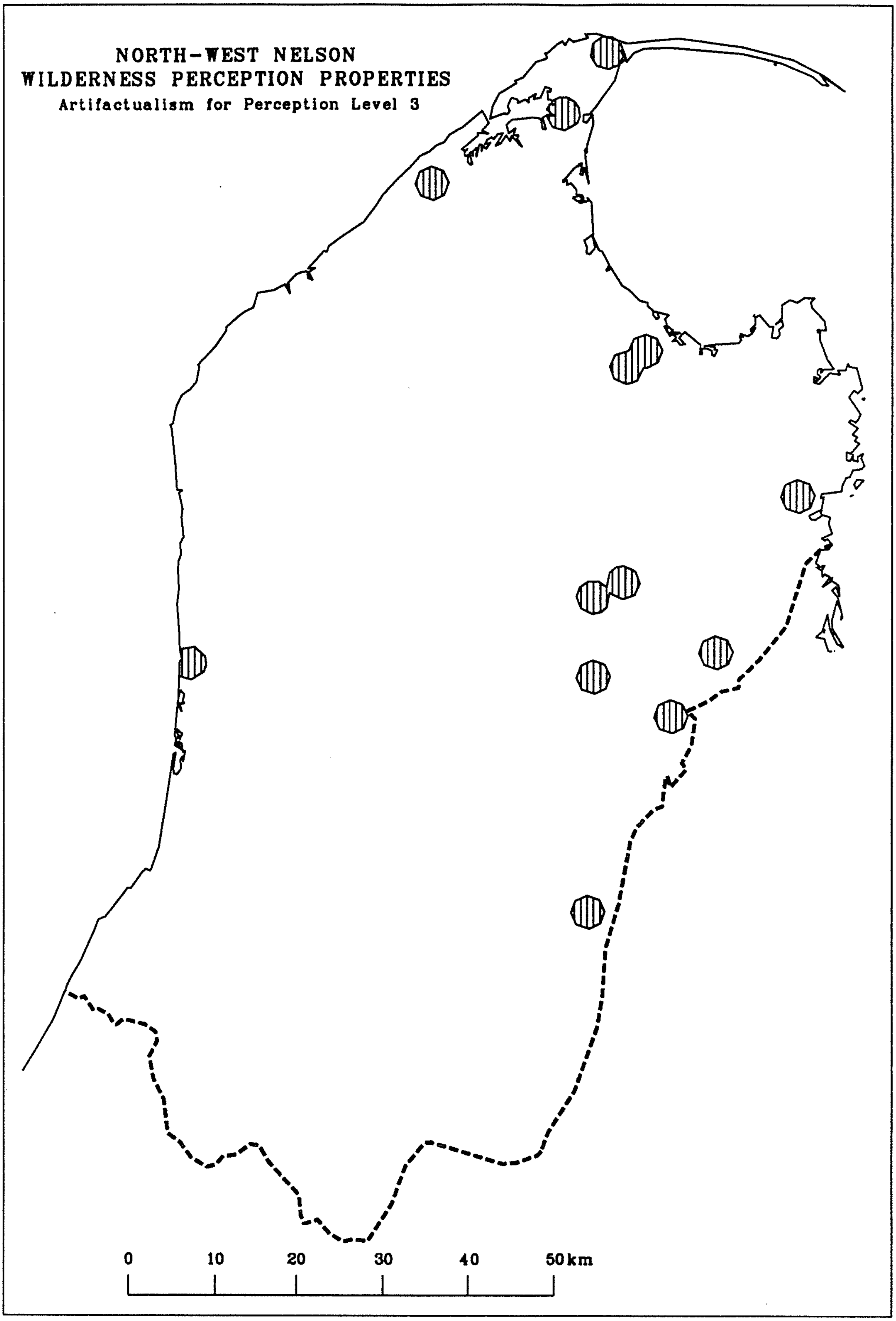
The artifactualism coverage for perception level 4 (Map 7.23) shows the peppering of huts excluded from perceived wilderness. Remoteness (Map 7.24) is denoted by greater exclusion zones which also excludes all foot tracks, while naturalness (Map 7.25) retains only areas covered in indigenous vegetation. There is no separate solitude element for this level since all huts, tracks and campsites where use invariably occurs have been excluded through the remoteness and artifactual elements.


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Neutralists perceptions in off-season
0
10
20
30
40
50km

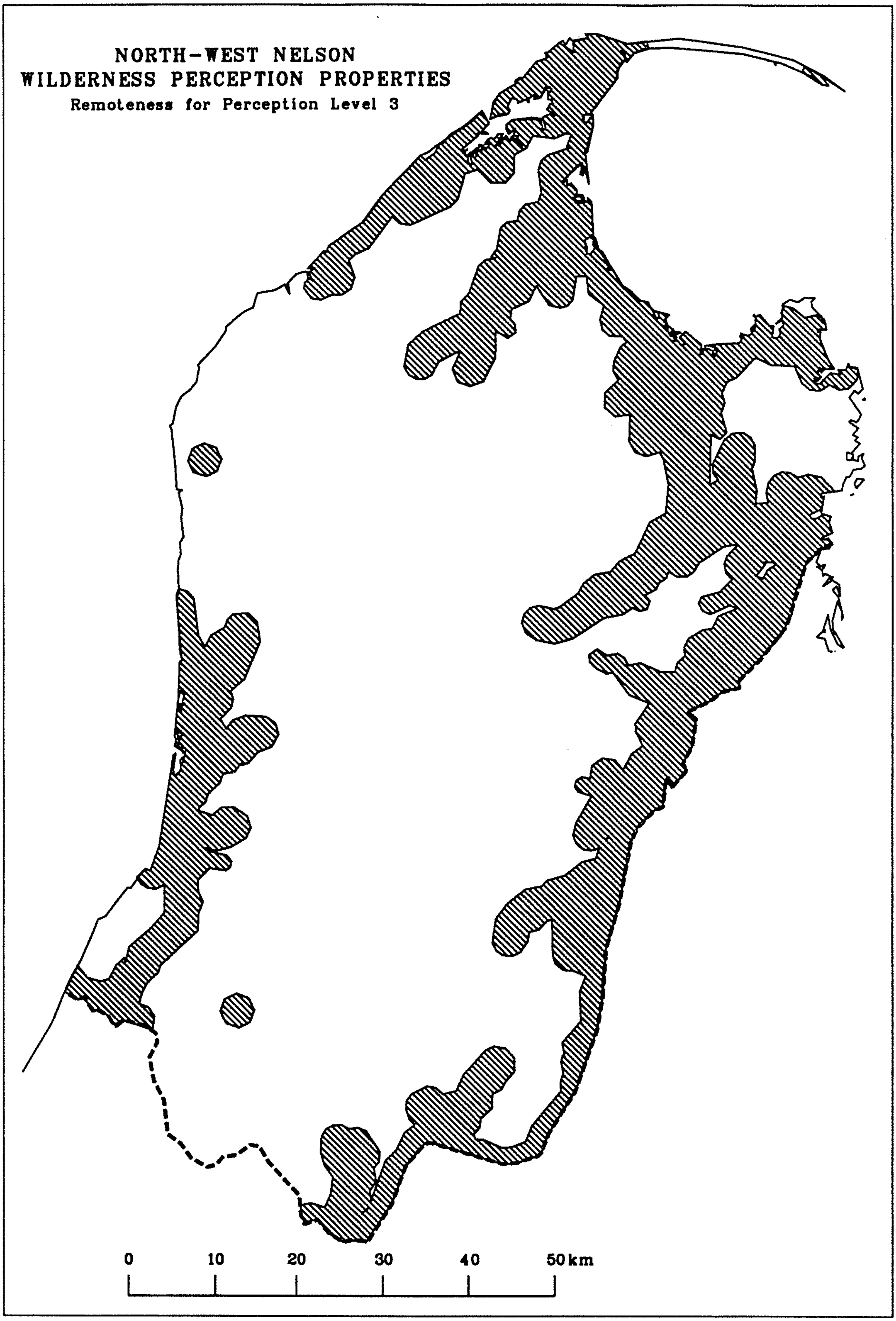
MAP 7.14:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Perception Level 2 - Neutralists
Differences between peak- and off-seasons
0
10
20
30
40
50km

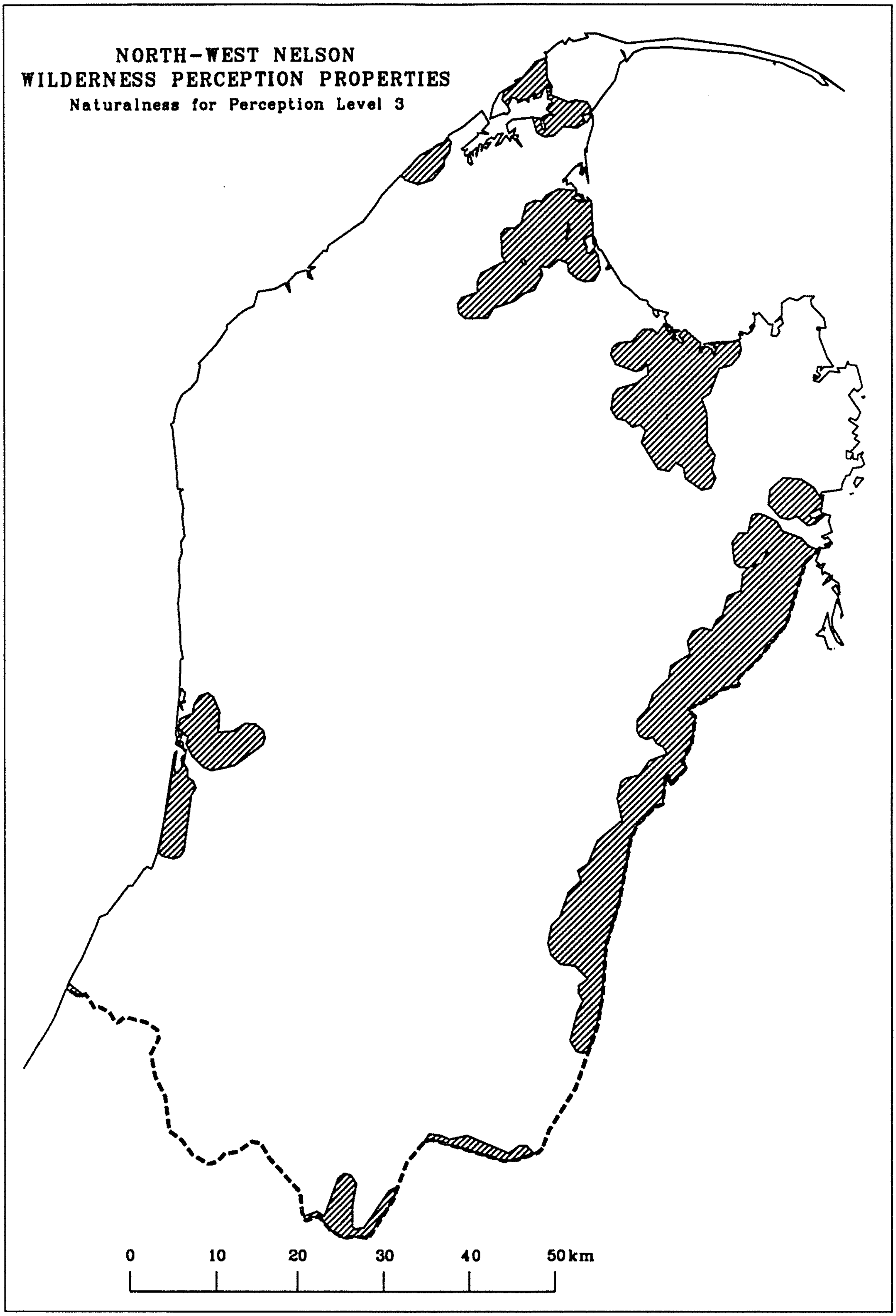
MAP 7.15:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Artifactualism for Perception Level 3
0
10
20
30
40
50km

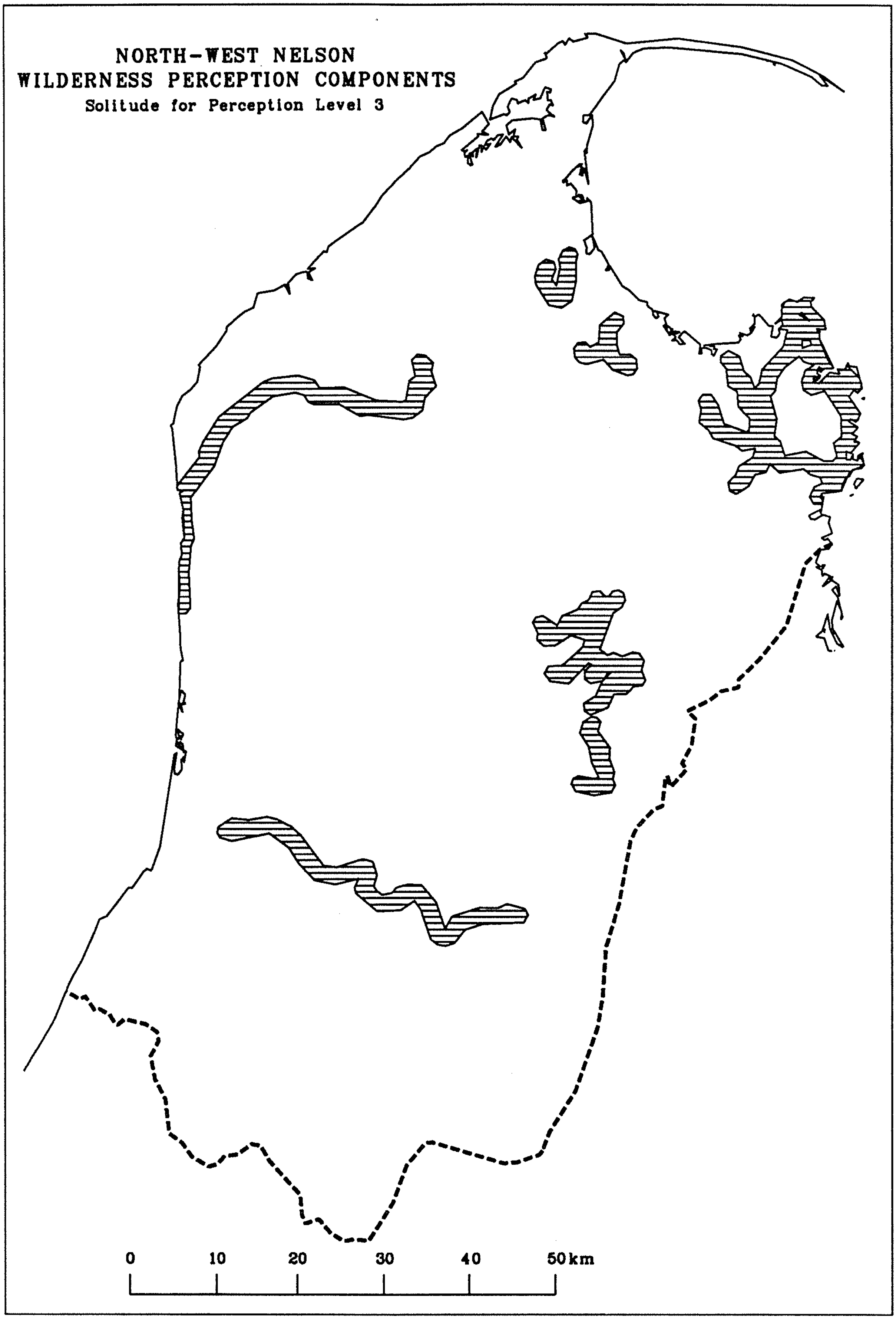
MAP 7.16:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Remoteness for Perception Level 3
0
10
20
30
40
50km

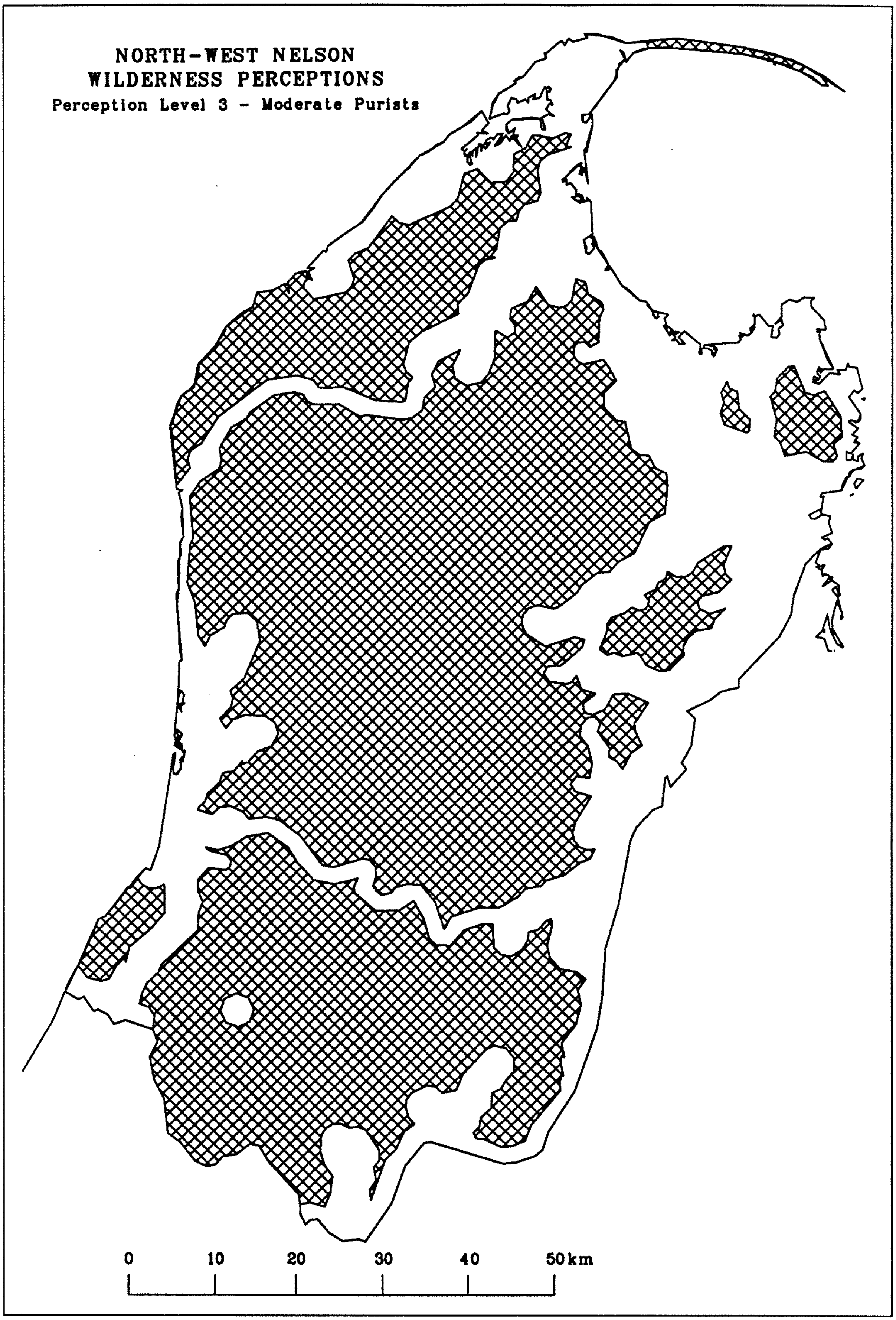
MAP 7.17:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Naturalness for Perception Level 3
0
10
20
30
40
50km

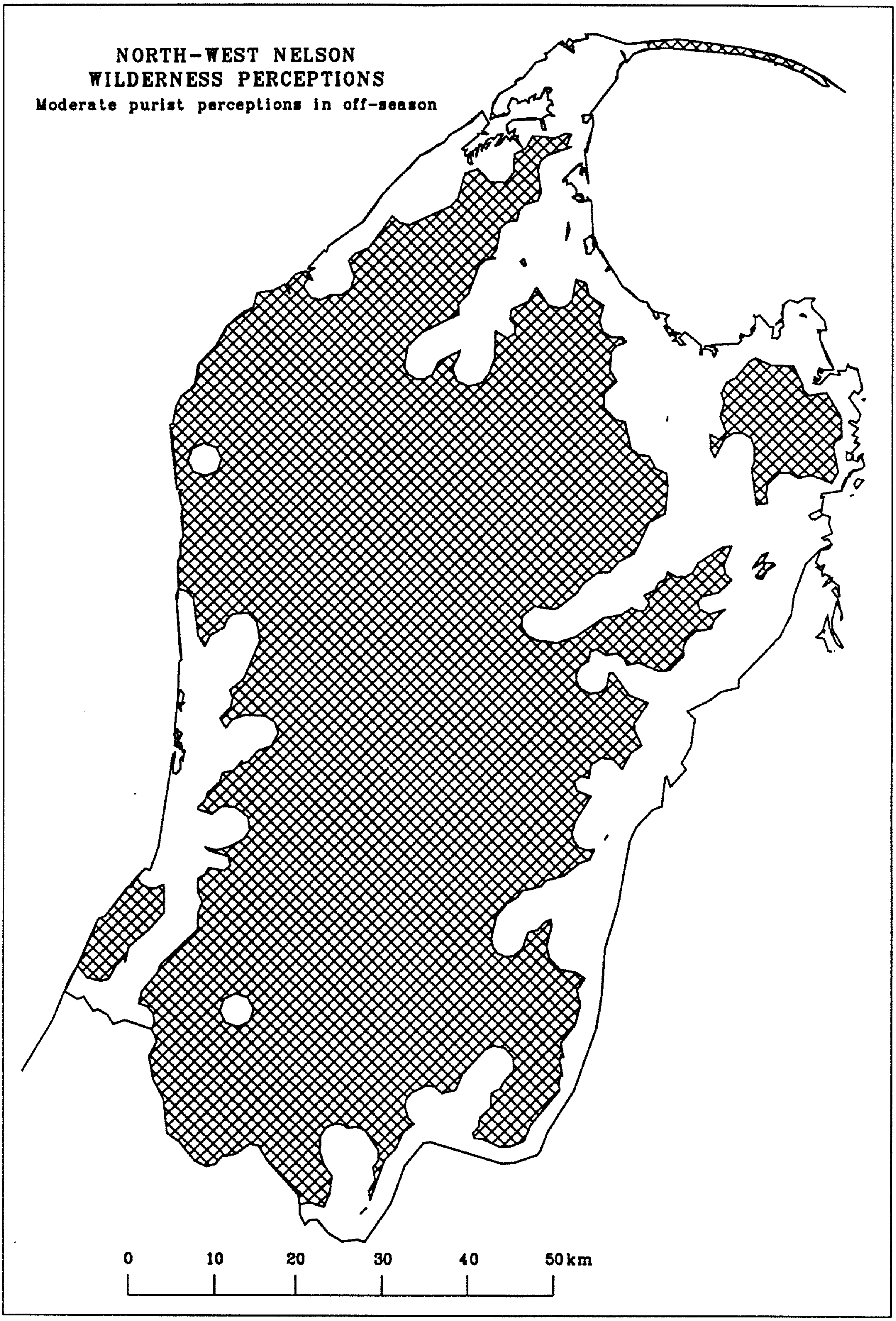
MAP 7.18:


NORTH-WEST NELSON
WILDERNESS PERCEPTION COMPONENTS
Solitude for Perception Level 3
0
10
20
30
40
50km

MAP 7.19:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Perception Level 3 - Moderate Purists
0
10
20
30
40
50km

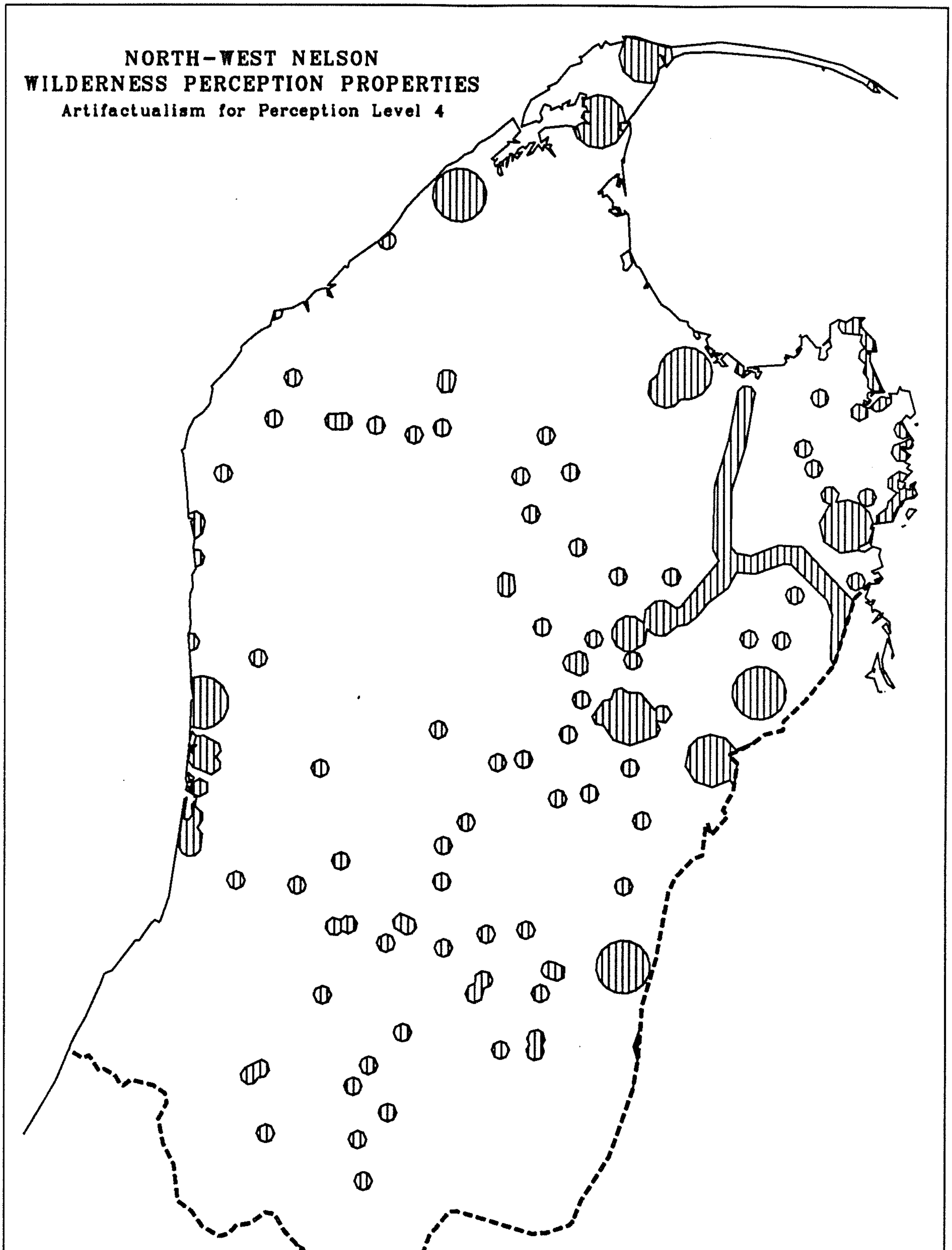
MAP 7.20:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Moderate purist perceptions in off-season
0
10
20
30
40
50km

MAP 7.21:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Perception Level 3 - Moderate Purists
Differences between peak- and off-seasons
0
10
20
30
40
50km

MAP 7.22:

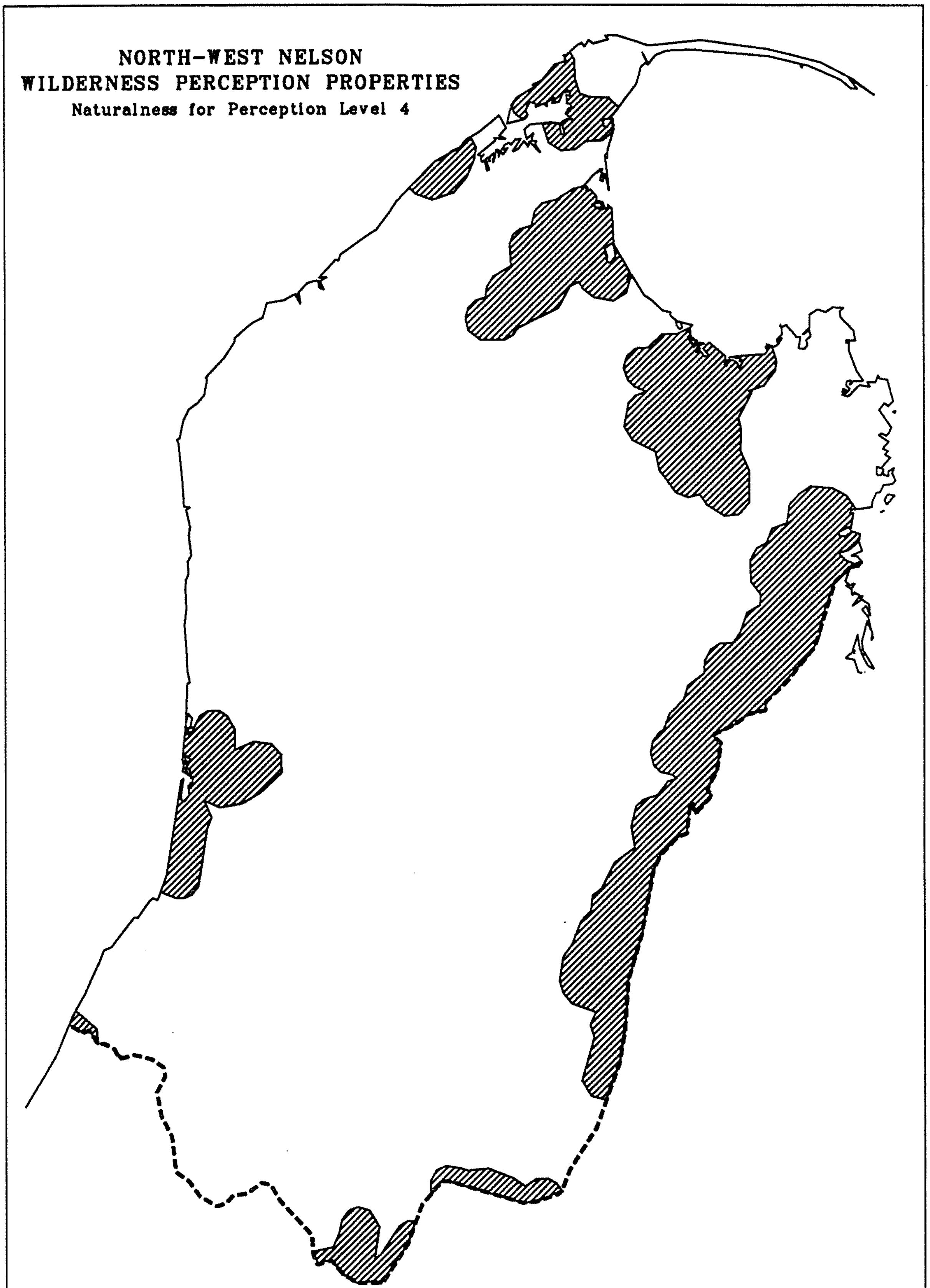


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Artifactualism for Perception Level 4
0
10
20
30
40
50km

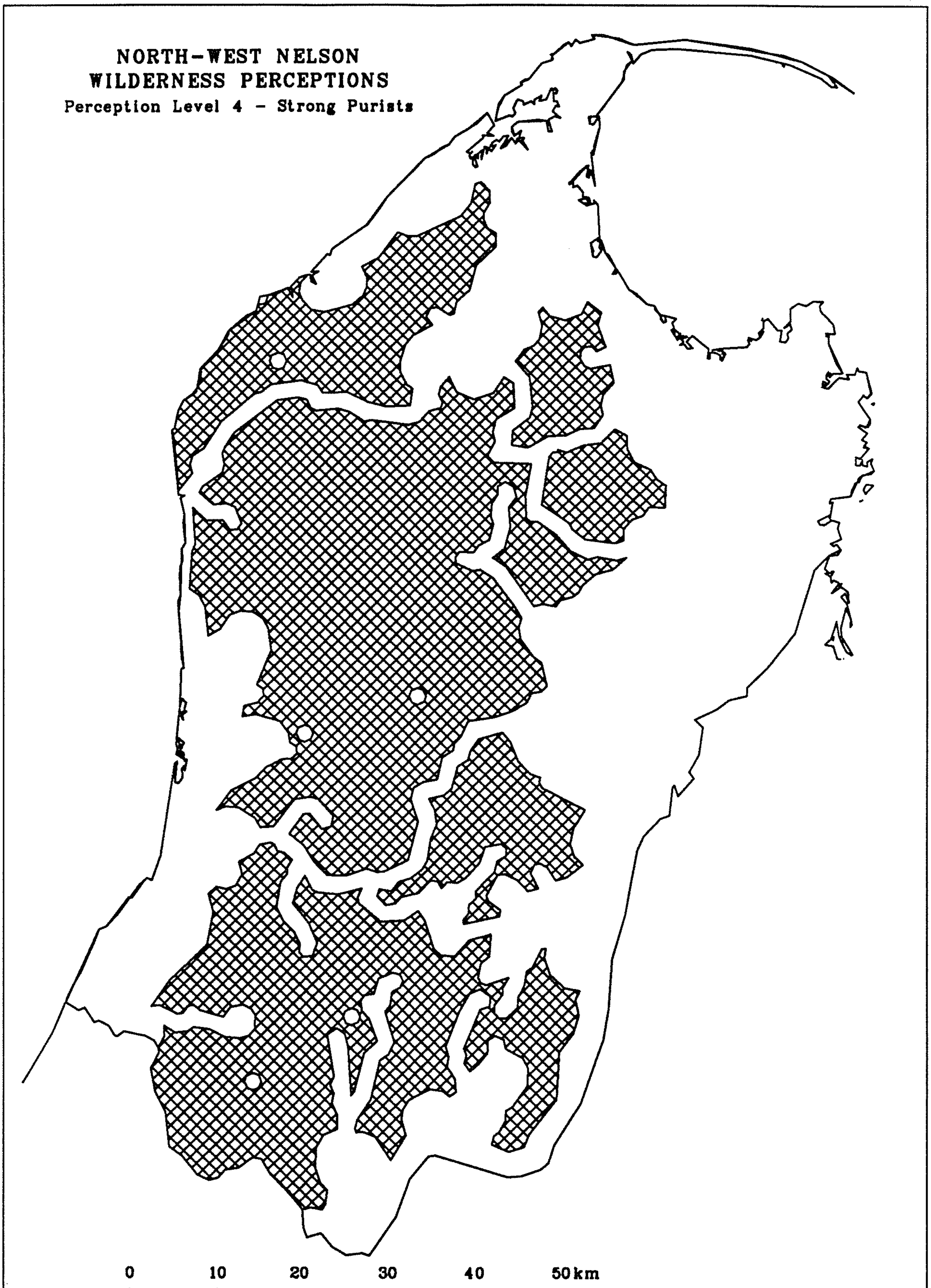
MAP 7.23:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Remoteness for Perception Level 4
0
10
20
30
40
50km

MAP 7.24:


NORTH-WEST NELSON
WILDERNESS PERCEPTION PROPERTIES
Naturalness for Perception Level 4
0
10
20
30
40
50km

MAP 7.25:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Perception Level 4 - Strong Purists
0
10
20
30
40
50km

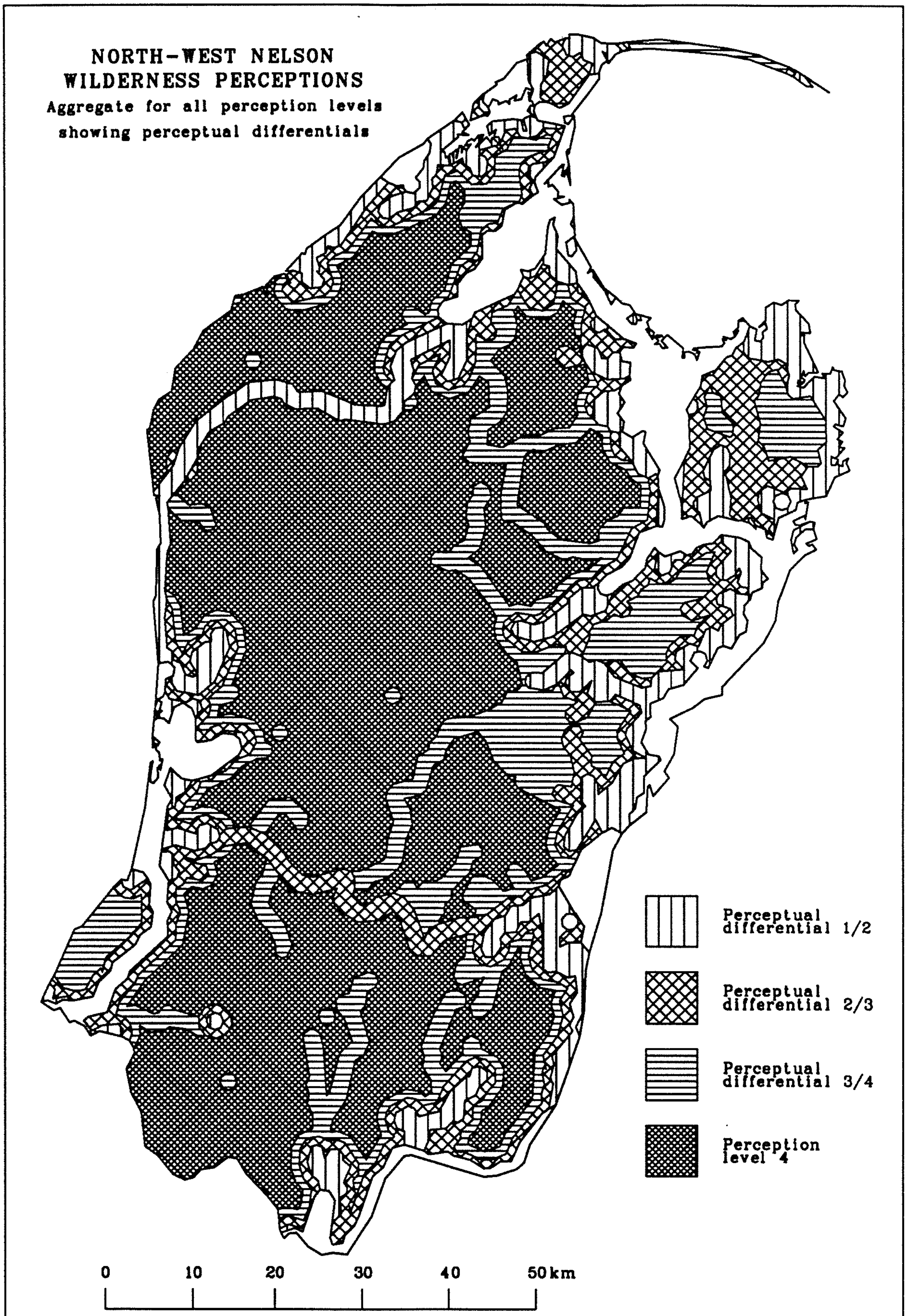
MAP 7.26:

The combined wilderness perception map (Map 7.26) reveals 47% of the region is perceived as wilderness by strong purists. The exclusion of the complete track network and all huts, including those not on the track system, appear obvious from the intrusion of those linear and point features in the major areas of perceived wilderness. These areas perceived as wilderness are almost totally (99%+) within the region's protected areas system. Of this, no part of ATNP is perceived as wilderness, while 24% of reserve areas and 61% of both stewardship areas and NWNFP are perceived as wilderness by strong purists.

7.3.5 Aggregate Perceptions

The composite map coverage obtained by spatially overlaying the wilderness perception maps for the four perception levels (Maps 7.8, 7.13, 7.20 and 7.26) produces a multiple wilderness perception map (Map 7.27) representing aggregated levels of perceived wilderness. A particularly interesting feature of the WPM is the *nested* nature of successive perception levels, and is largely the result of the buffer distances adopted (see Chapter 6). Thus, the spatial extent of neutralist perceptions (perception level 2) generally lie within that of the non-purists (level 1), while level 3 perceptions lie within that of the level 1 and 2 perceptions, and similarly level 4 is nested within perception levels 1, 2 and 3.

This nesting effect provides differentials between each perception level, which represent areas perceived as wilderness by one group but not another. Thus, the difference in area perceived as wilderness by level 1 and level 2 amounts to 12% of the region. Representing settings perceived as wilderness by non-purists but not neutralists or the stronger purist groups, these areas typically include the more popular and maintained tracks and access points to the conservation estate. Such settings are the Abel Tasman Coastal Track, the Heaphy Track, the Cobb Reservoir road and its side walks, the road and track to the Flora Saddle, the Canaan road into the Inland Abel Tasman Track, and the Rolling River road end of the Wangapeka Track, to name the most obvious differentials. The difference between perception level 2 (which includes the first differential) and level 3 perceptions comprises a further 12% of the region. The settings perceived as wilderness by neutralists and non-purists but not moderate purists are characterised by moderate-use tracks such as the Wangapeka Track and the Abel Tasman Inland Track, and peripheral areas to the higher use tracks and access points. Finally, the difference between level 3 (which includes levels 1 and 2) and level 4 perceptions, representing settings perceived as wilderness by moderate (and weaker) purists but not strong purists constitutes 18% of the region. These settings include the lower-use tracks such as the Upper Cobb, Anatoki and Waingaro Tracks; the Tablelands and Leslie–Karamea tracks;


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Aggregate for all perception levels
showing perceptual differentials
Perceptual differential 1/2
Perceptual differential 2/3
Perceptual differential 3/4
Perception level 4
0
10
20
30
40
50 km

MAP 7.27:

the Matiri, Mokihinui and Owen valley tracks; and the smaller untracked sections of the ATNP and NWNFP. Overall there is a total difference of 42% (i.e. 47%–89%) of the region between the broadest (level 1) and narrowest (level 4) perceptions of wilderness settings.

The perceptual differentials showed a highly significant association ($P<0.001$) with the protected area categories in the region. Thus, 52% of the level 1/2 differential was in conservation estate, 76% of the level 2/3 differential, while 96% of the level 3/4 differential was in the region's protected areas system. The trend indicates that the more purist a differential is, the more likely the area is to be in a protected area. The breakdown for each differential in terms of separate protected area categories is shown in Table 7.10.

	PROTECTED AREA CATEGORY[a]	PERCEPTUAL DIFFERENTIAL 1/2	2/3	3/4
% of the differential that is in DoC estate	NP	9	10	5
	CP	33	47	65
	R	5	3	2
	SA	5	16	25
	TOTAL	52	76	96
% of the region that comprises each differential		12	12	18
% of the region that comprises the total differentials			42	

TABLE 7.10: Percentages of Region comprising Perceptual Differentials

[a]NP = National Park, CP = Conservation Park, R = Reserve & SA = Stewardship Area.

7.3.6 Summary of WPM Results for Method 1

The set of maps that have emerged from the application of the initial WPM methodology to the NWN case-study epitomises the sequence of conceptual development and GIS analysis leading to the overall MWPM. Thus, individual purism items constitute the spatial expression of the four key wilderness elements which are subsequently conjoined to allow the spatial extent of wilderness to be delimited for each purism group. The differentials highlighted in the MWPM are particularly significant in regard to providing new and useful information for addressing the wilderness management issue, and are considered in the next chapter.

The initial WPM is an exclusionary model, based on whether an area falls *inside* or *outside* the given set of criteria. Once combined, the new data relationships were used to identify settings conforming to the perceptions of a purism class. Subsequently all purism items assume equal importance. While relatively simplistic, the initial WPM invokes considerable credence when interpreted from the North-West Nelson case-study, and provides valuable perceptual information for wilderness management.

7.4 The Application of Method 2 for WPM

In applying the multivariate approach to the study area the first four stages of the alternative methodology (see Figure 6.5) are followed explicitly. This produces four principal components of wilderness purism, four cluster groupings of users, and appropriate spatial criteria and weightings for these (as detailed in Chapter 6). The weighted overlay of stage 5 of the methodology utilises the NWN database, through GIS analysis, to produce coverages for each of the 16 items (or spatial variables) that relate to the principal components (Maps 7.28–7.43), the four spatial components derived from overlaying these variables (Maps 7.44–7.47), and the spatial extent for each cluster grouping's perceptions derived from overlaying these components (Maps 7.48–7.51). These coverages represent the result of the multivariate approach to wilderness perception mapping. These test-mapping results are now considered for each of the three sets of map coverages produced.

7.4.1 The Spatial Variables

The 16 spatial variables, corresponding to the respective purism scale items, are shown in Maps 7.28–7.43. Attribute scores were assigned to each variable according to those derived in Table 6.14.

The six variables identifying the facility-oriented component (variables 1,3,4,5,6 and 10) generally portray zones of inclusion or exclusion of particular facilities. Thus, variable 1 is represented by 1 km buffer zones around all developed campsites in the region (Map 7.28) with an attribute score of *1* assigned to these zones, while a score of *0* is assigned to the outside zones. Road access to wilderness (variable 3) is portrayed by a buffer strip between 1 and 5 km from all roads (Map 7.30); that is assigned an attribute score of *1* while outside it is given a *0*. Map 7.31 shows variable 4 which depicts a 1 km buffer zone around routes serviced by commercial recreation guides and outfitters—again a score of *1* is applied to the *inside* polygons. This coverage identifies the guided trekking on the Heaphy and Wangapeka

Tracks, the boat service operating along the Abel Tasman Coastal Walk, the fishing operators who service the Leslie and Karamea Rivers, and the Farewell Spit Safari Tour that operates along the length of the Spit. Variable 5 (maintained tracks) is shown as 2 km buffer zones along tracks selected from the track classification attributes which equate to walkways and maintained tracks. These are shown in Map 7.32 while Map 7.33 similarly buffers routes which have bridge or walkwire crossings (variable 6) according to the *track type* attribute which identifies whether a track is benched and bridged or not. Finally, contributing to the facility-oriented component is variable 10 (maintained huts) that is denoted by 1 km buffer zones surrounding backcountry huts (Map 7.37) which have been assigned an attribute score of *1*.

The anti-development component (PC 2) is distinguished by four major variables. Thus, variable 8 (logging) is depicted by 2 km buffer zones around three logging features—logging sites (STX10), exotic forest vegetation (NTL1) and forestry roads (AXS1)—which collectively portray logging activity (Map 7.35). Map 7.36 illustrates motorised travel (variable 9) by 2 km buffer zones, Map 7.38 depicts hydro-electric development (variable 11) by 2 km buffer zones around dam sites and 1 km buffers along high tension powerlines, while commercial mining (variable 12), normally given by 2 km buffer zones around commercial mines, shows no exclusion zones since no commercial mining sites are present in the region.

The experiential component comprises the four variables (variables 13–16), which are derived from the experiential items. Each of these reflects the range of distinction apparent in the respective elements determined in the initial method. Thus, solitude (variable 13) is portrayed by the overlay of solitude coverages for the four purism groups (SOL1–SOL4), shown in Map 7.40, the resulting solitude differentials indicating a successively stronger presence of that item in an area. Remoteness (variable 14) is similarly depicted by the overlay of remoteness coverages (REM1–REM4) shown in Map 7.41, while *little human impact* (variable 15) is given by the appropriate artifactualism coverages (ART1–ART4) shown in Map 7.42. Finally, variable 16 (large size) is delimited by a gradient of increasing size (see Table 6.14) for contiguous areas of similar score for the previous three experiential variables.

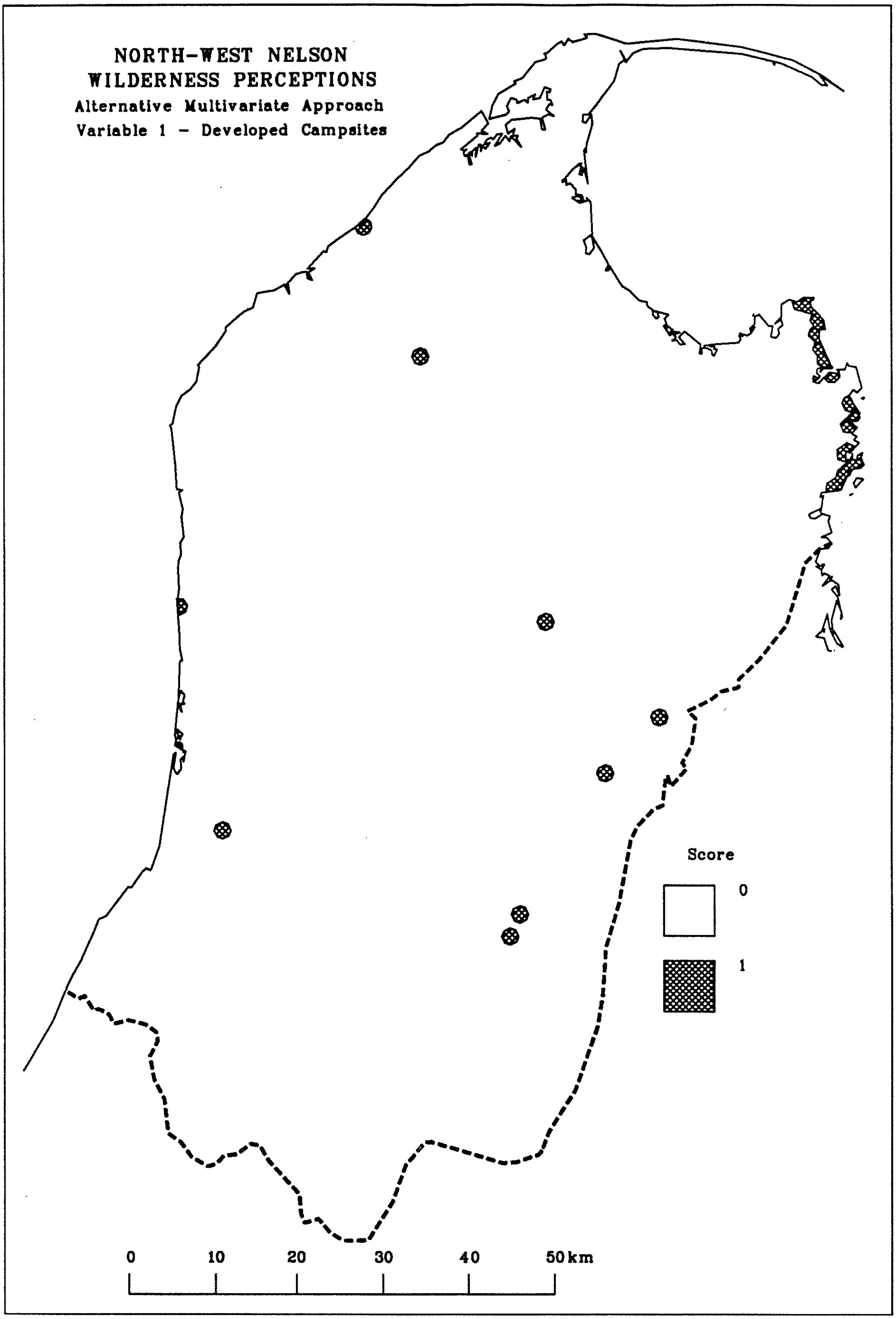
The hunting component is composed chiefly from variables 2 and 7. Thus, variable 2 representing exotic species identifies all areas with moderate or high ungulate (deer, goat or pig) distributions (Map 7.29) and are assigned an attribute score of *1* while outside these areas, where distributions are either low or nil, a score of *0* is assigned. The hunting activity variable (variable 7) identifies all areas in which hunting is encouraged (i.e. National Parks, Forest Parks, Stewardship Areas and in particular the NWNFP Recreational Hunting Area) or permitted (based on the issue of hunting permits in the region), and which are shown on Map 7.34.

7.4.2 The Spatial Principal Components

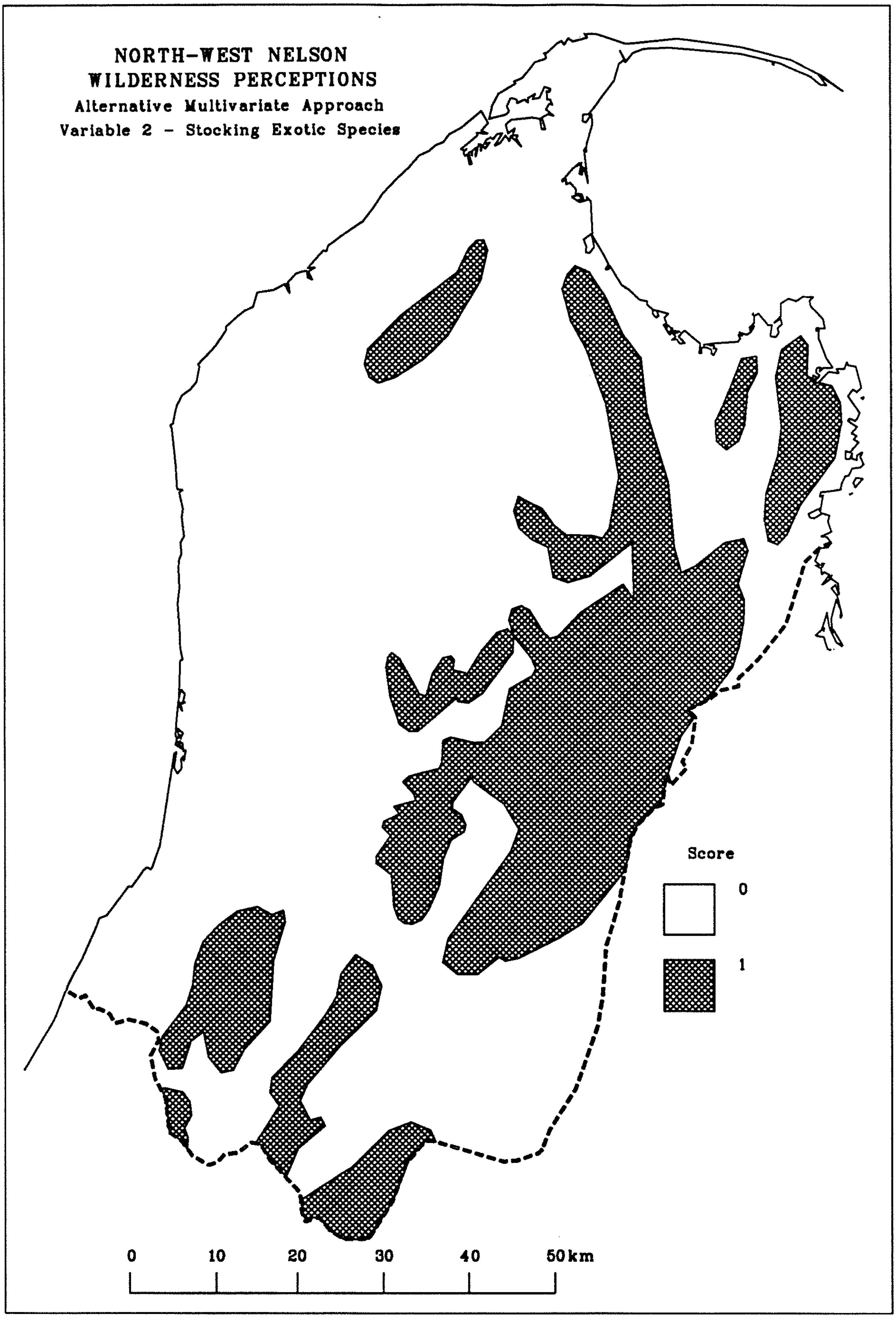
The four principal components or dimensions of perception were represented spatially by overlaying the constituent variables (see Table 6.15) for each component, and these are illustrated by Maps 7.44–7.47. The tabular analysis associated with these spatial overlays applied the PC weightings (see Table 6.15) to the attribute score for each variable, and then aggregated the weighted scores for all areas of a component's map coverage. The aggregated scores were then normalised, in this case on a scale of 1–4, to place the scores for each of the four components on consistent terms. The spatial representation of these analyses, shown in Maps 7.44–7.47, show the rating (from low, through moderate low and moderate high, to high) of an area in terms of that component. A low rating represents a normalised score of *1*, a moderate low rating a score of *2* and so on for the 1–4 scale.

The first component, emphasising provision of facilities in wilderness settings, is delimited in Map 7.44 and shows the relative ratings of areas in the region according to the provision of the six facility items. Thus, the areas with a high rating denote the coincidence of several items. Areas such as this commonly occur along the popular and highly developed tracks of the Heaphy, Wangapeka and Coastal Abel Tasman, where items such as maintained tracks, developed campsites, bridges/walkwires, and commercial recreation all coincide. These areas of a high facility-oriented rating account for 2% of the region. Similarly, moderate high ratings comprise 7% of the region, moderate low ratings 15%, while low ratings occur over the majority (76%) of the region. There are, therefore, relatively few areas in the region consistent with a high facility-oriented component.

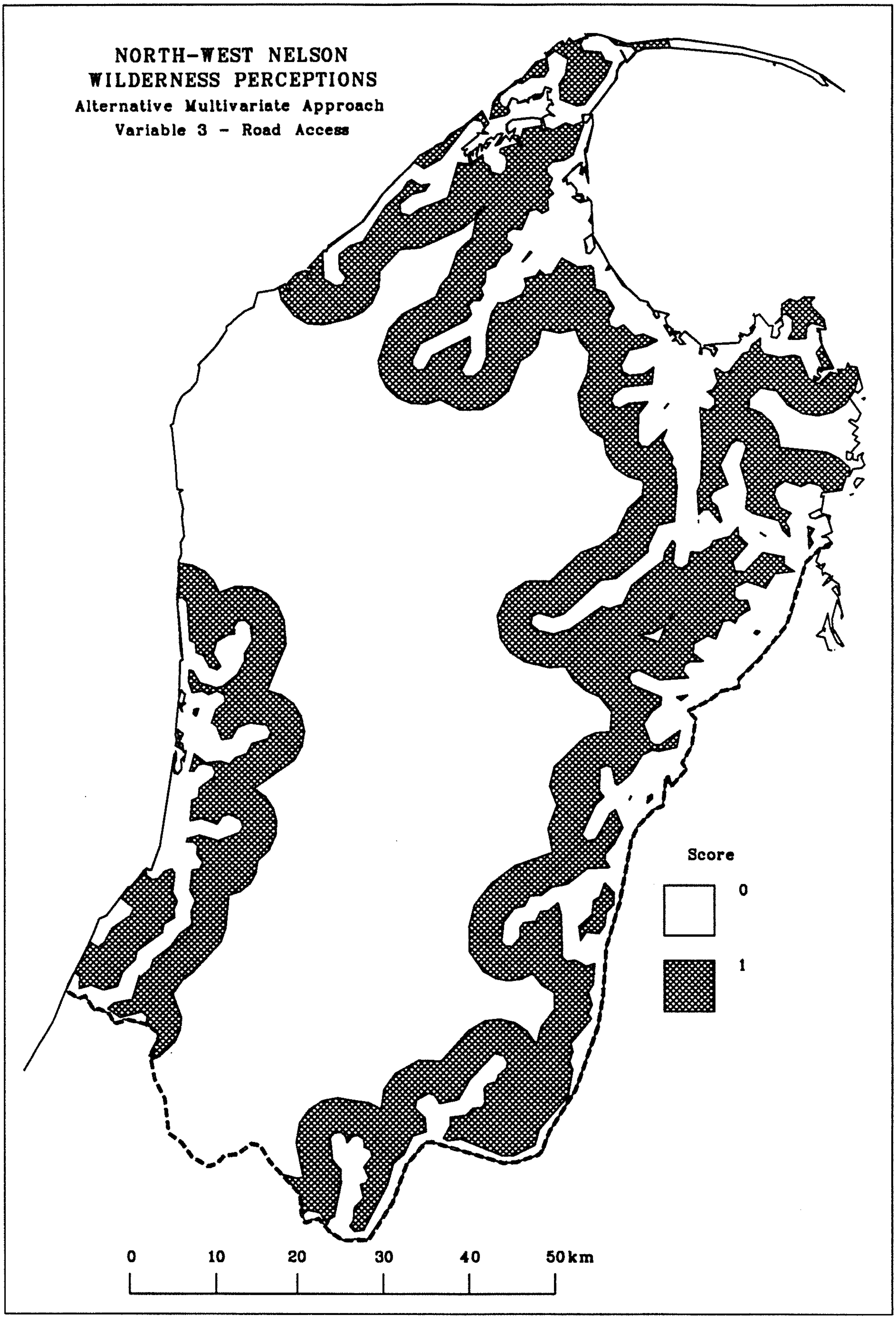
Perceptual component 2, emphasising an aversion to development, shows the relative ratings for the region according to the lack of developmental activities (Map 7.45). For this component those areas with a high rating indicate the apparent absence of any of the *offending* activities while a low rating signals the coincidence of several such items. A low rating occurs only in the vicinity of Pupu Springs, where the coincidence of hydro-electric development (Pupu powerhouse), production forestry and logging, and motorised travel are present. This accounts for less than 1% of the region. Slightly less-developed areas with a moderate low rating, such as the Upper Takaka valley and the production forestry along the lower Motueka valley, comprise 10% of the region. Moderate high ratings, that characterise the relatively undeveloped valleys of the Aorere, Matiri and Owen, constitute 12% of the region while the bulk of the region (78%) was rated high on the basis of the five variables.


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 1 - Developed Campsites
Score
0
1
0
10
20
30
40
50km

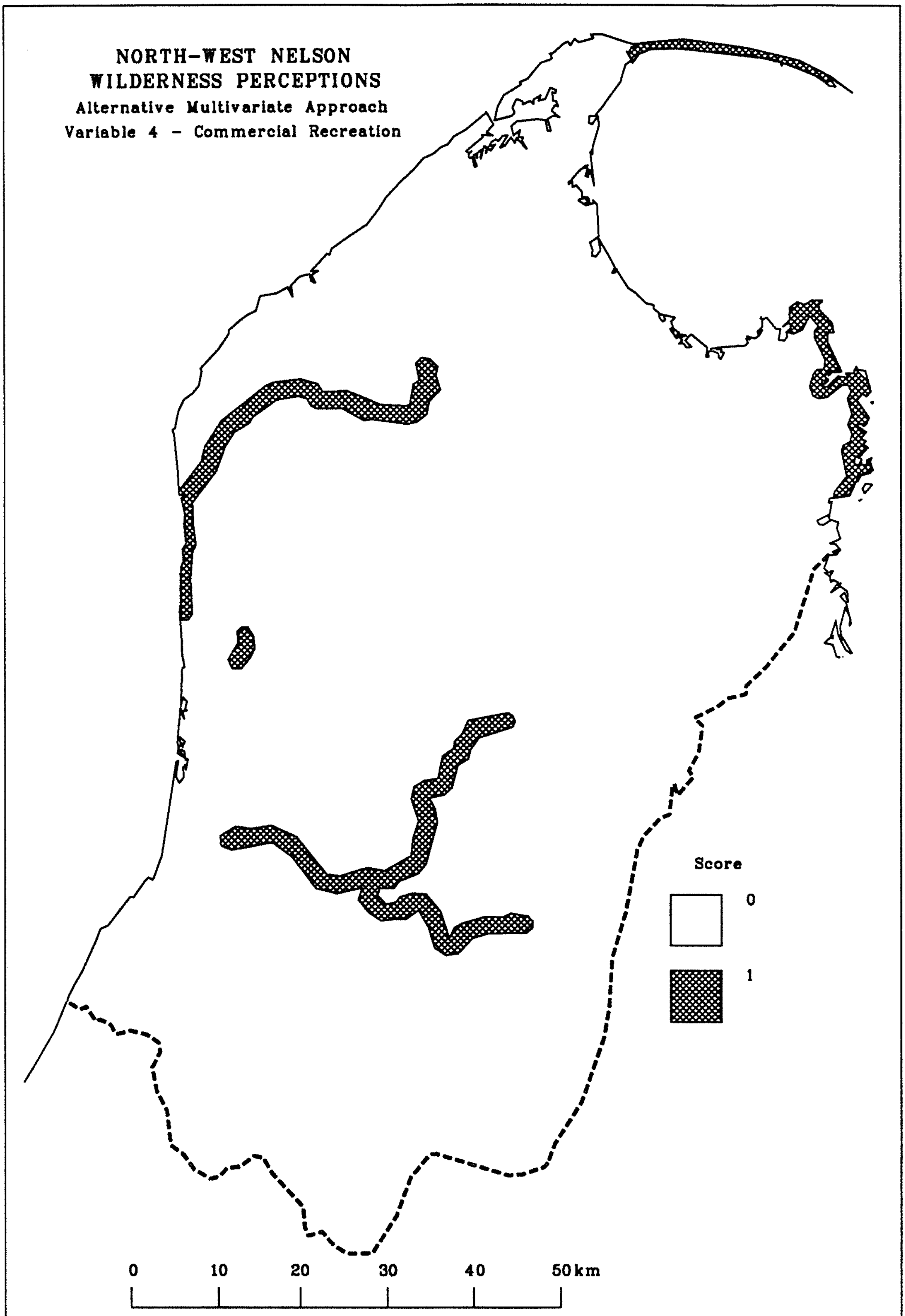
MAP 7.28:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 2 - Stocking Exotic Species
Score
0
1
0
10
20
30
40
50km

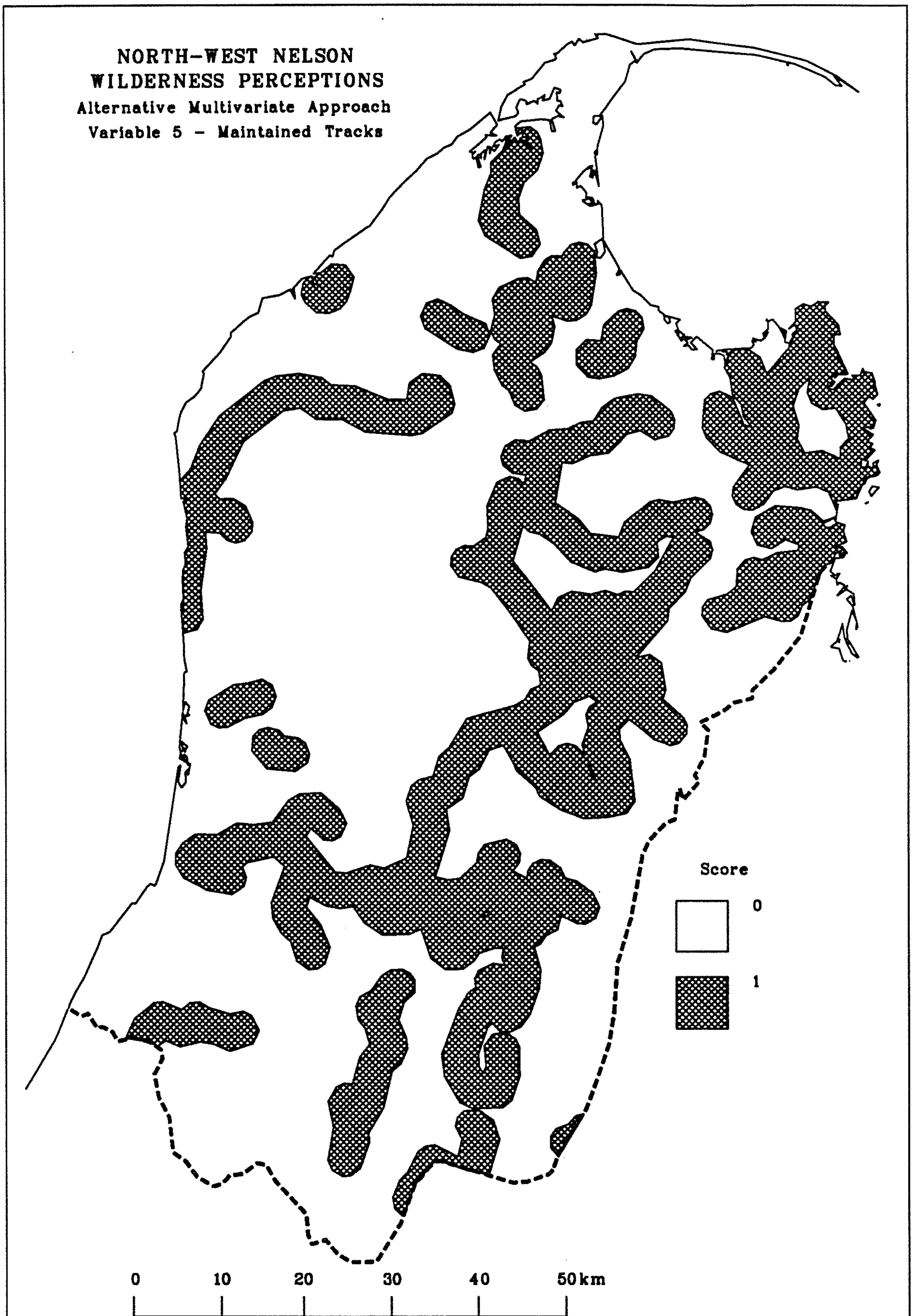
MAP 7.29:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 3 - Road Access
Score
0
1
0
10
20
30
40
50km

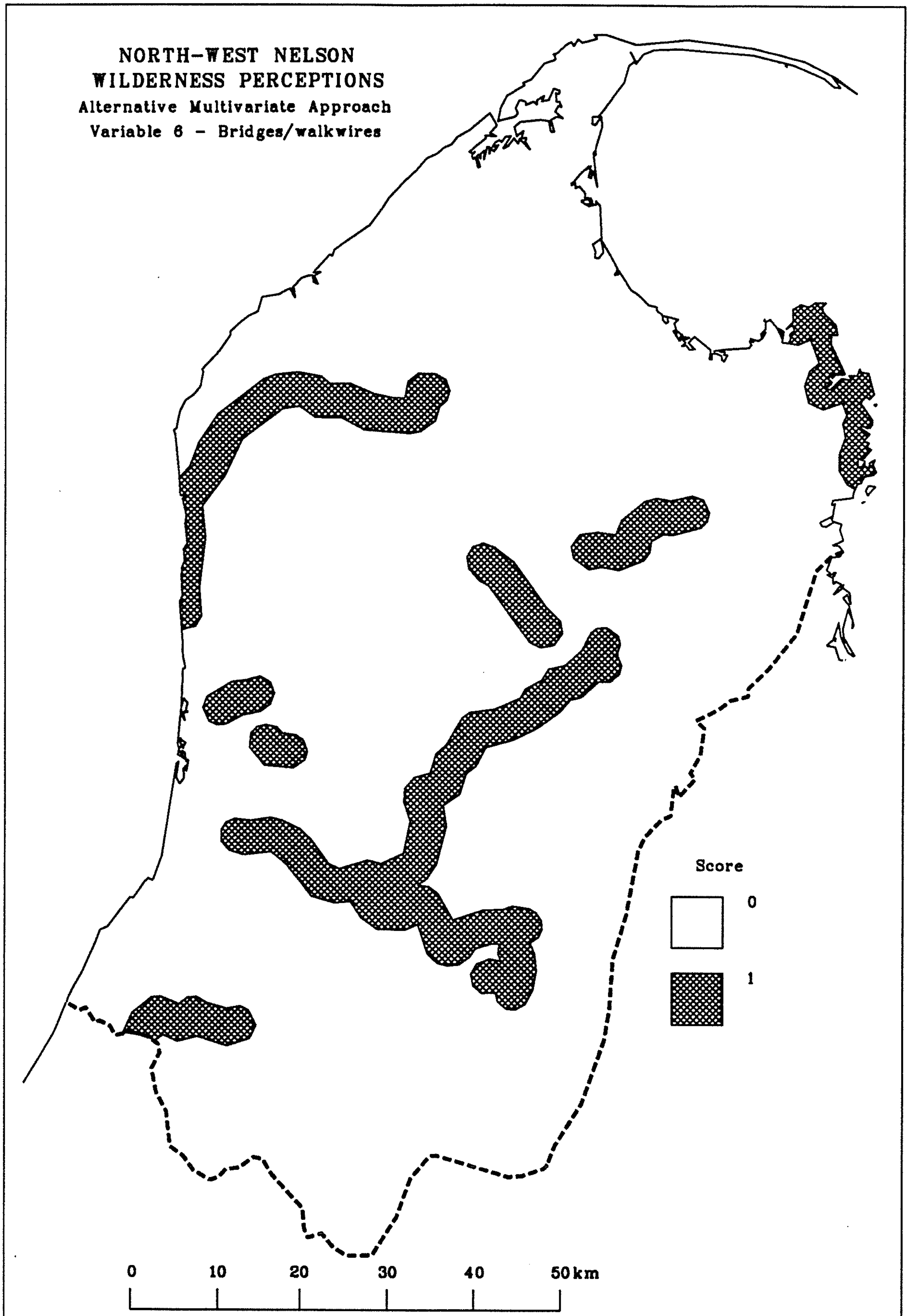
MAP 7.30:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 4 - Commercial Recreation
Score
0
1
0
10
20
30
40
50km

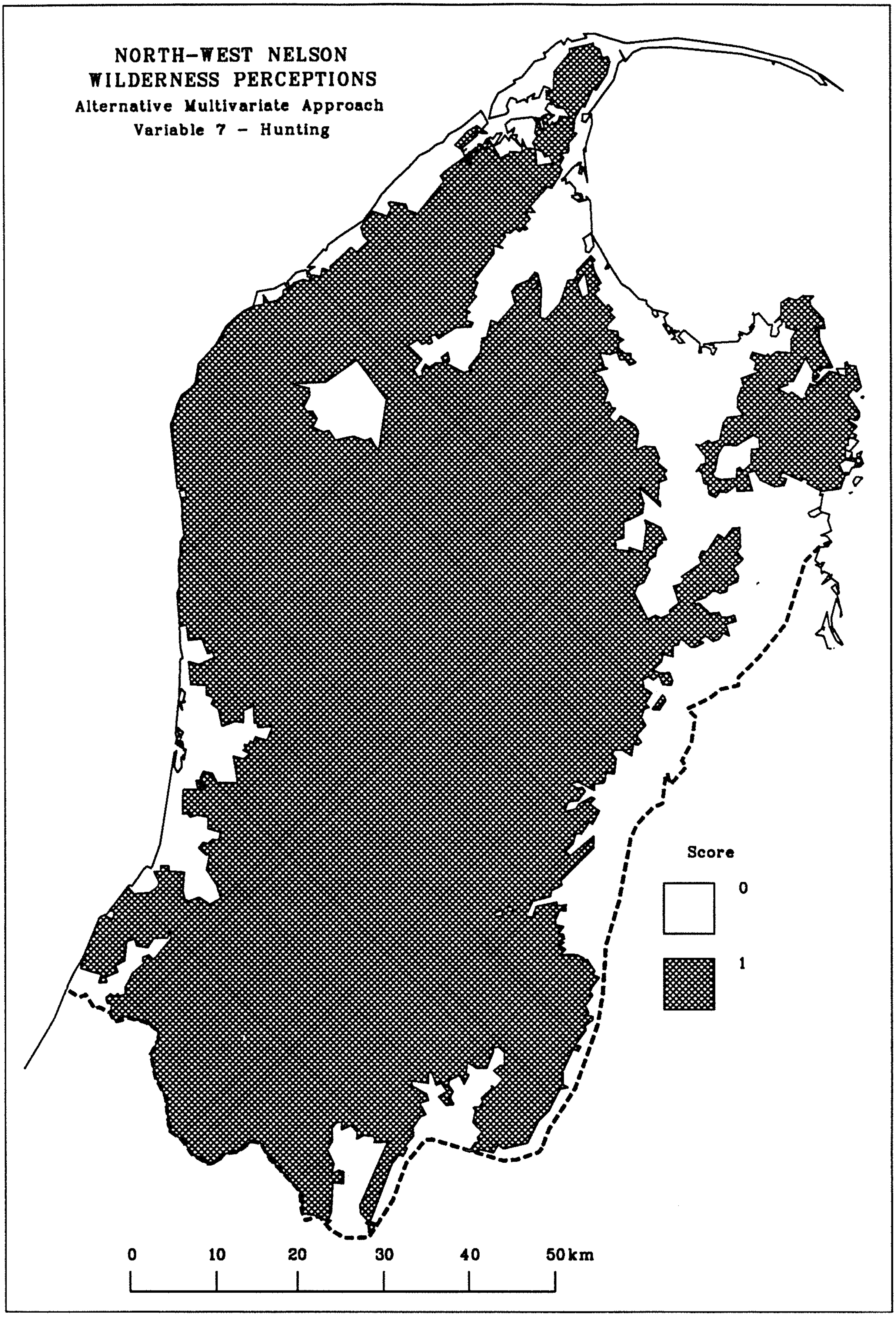
MAP 7.31:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 5 - Maintained Tracks
Score
0
1
0
10
20
30
40
50km

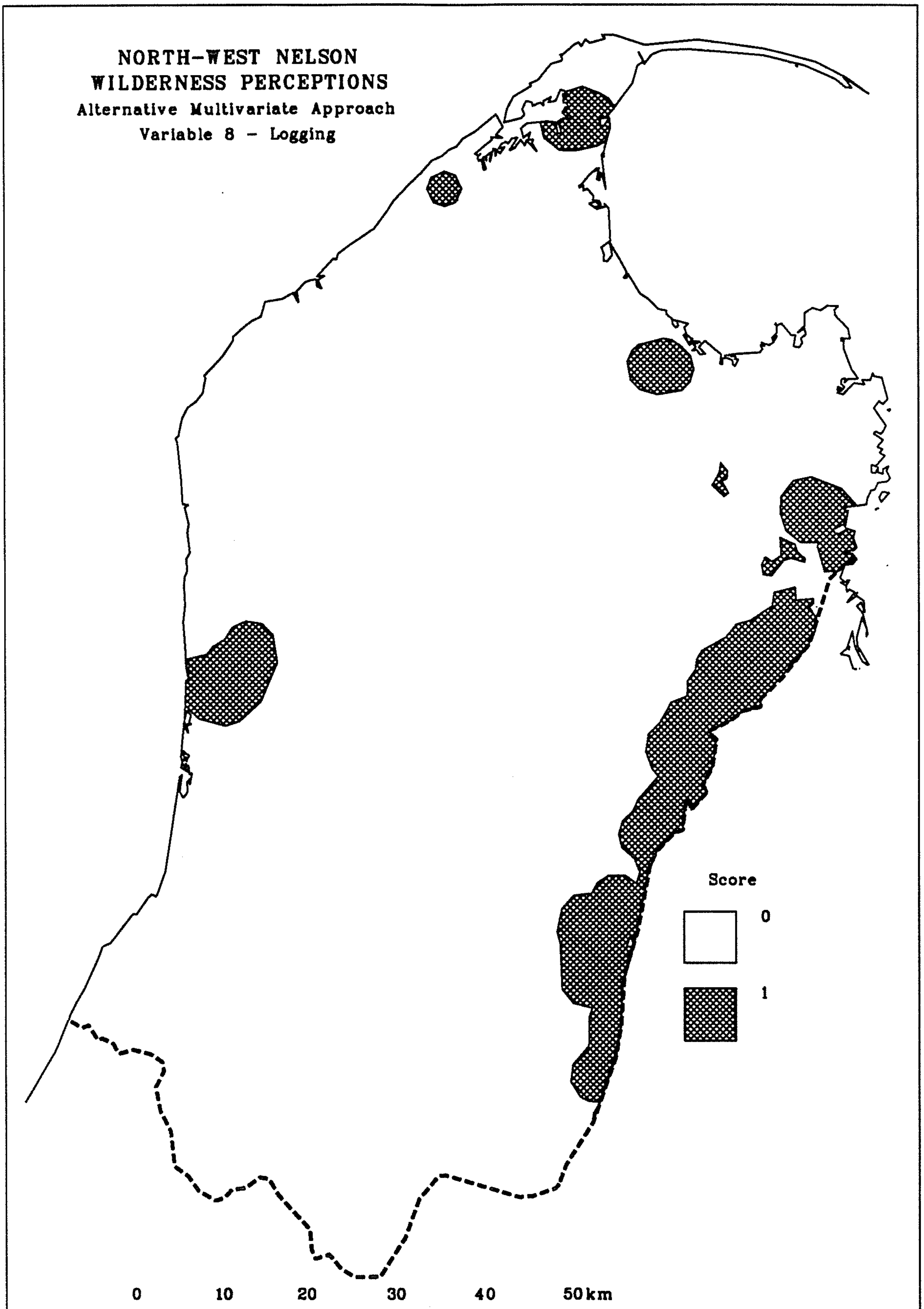
MAP 7.32:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 6 - Bridges/walkwires
Score
0
1
0
10
20
30
40
50 km

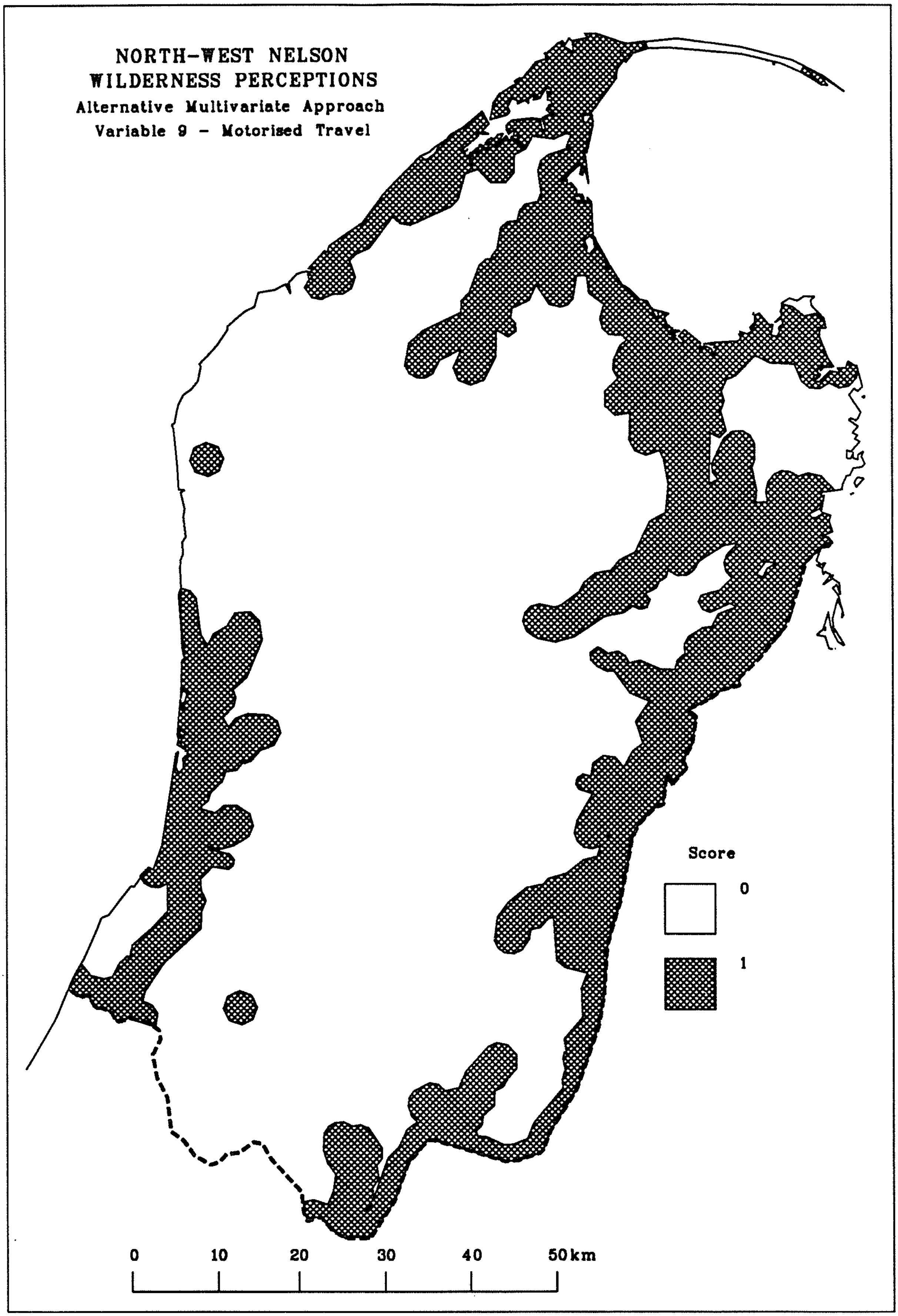
MAP 7.33:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 7 - Hunting
Score
0
1
0
10
20
30
40
50km

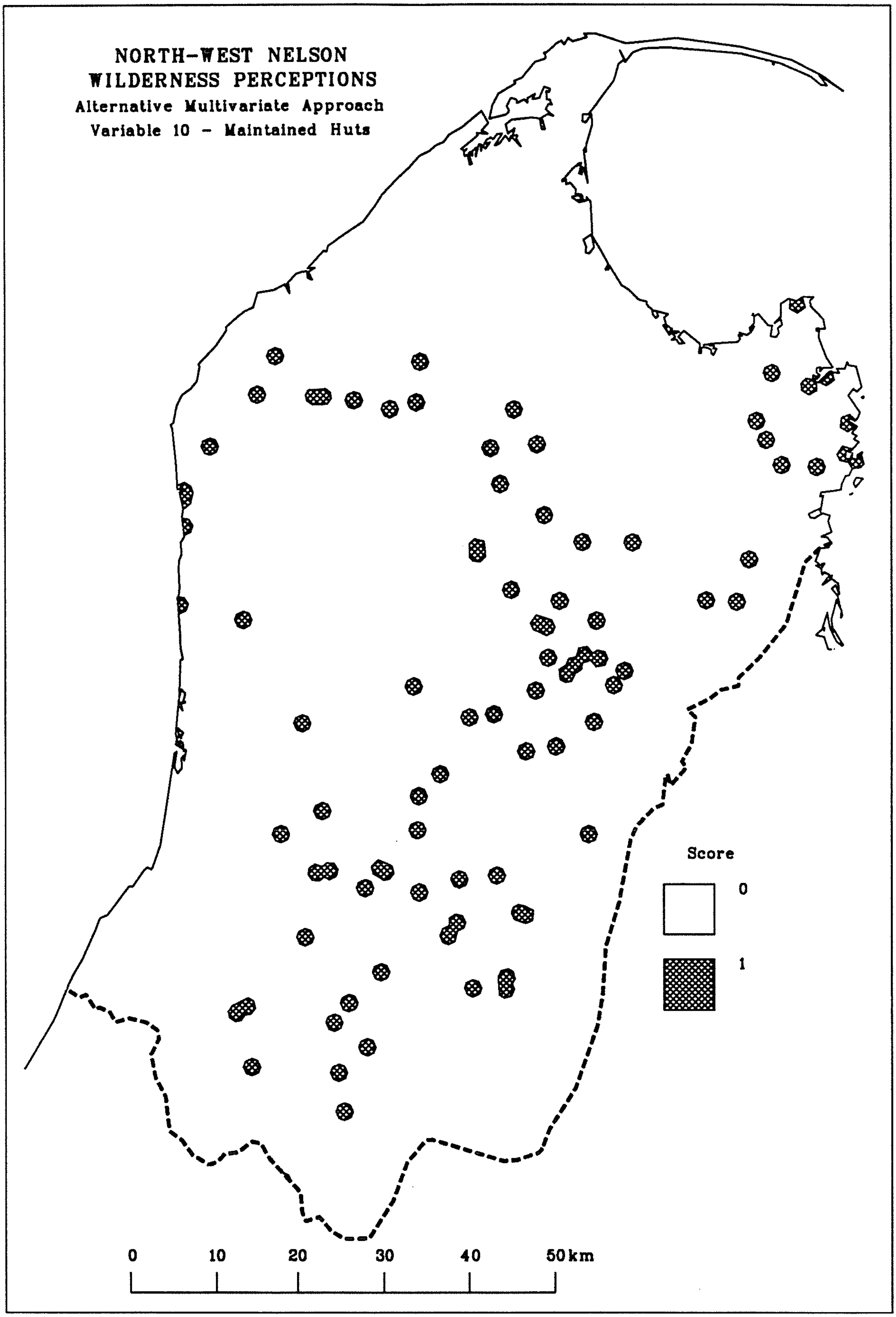
MAP 7.34:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 8 - Logging
Score
0
1
0
10
20
30
40
50 km

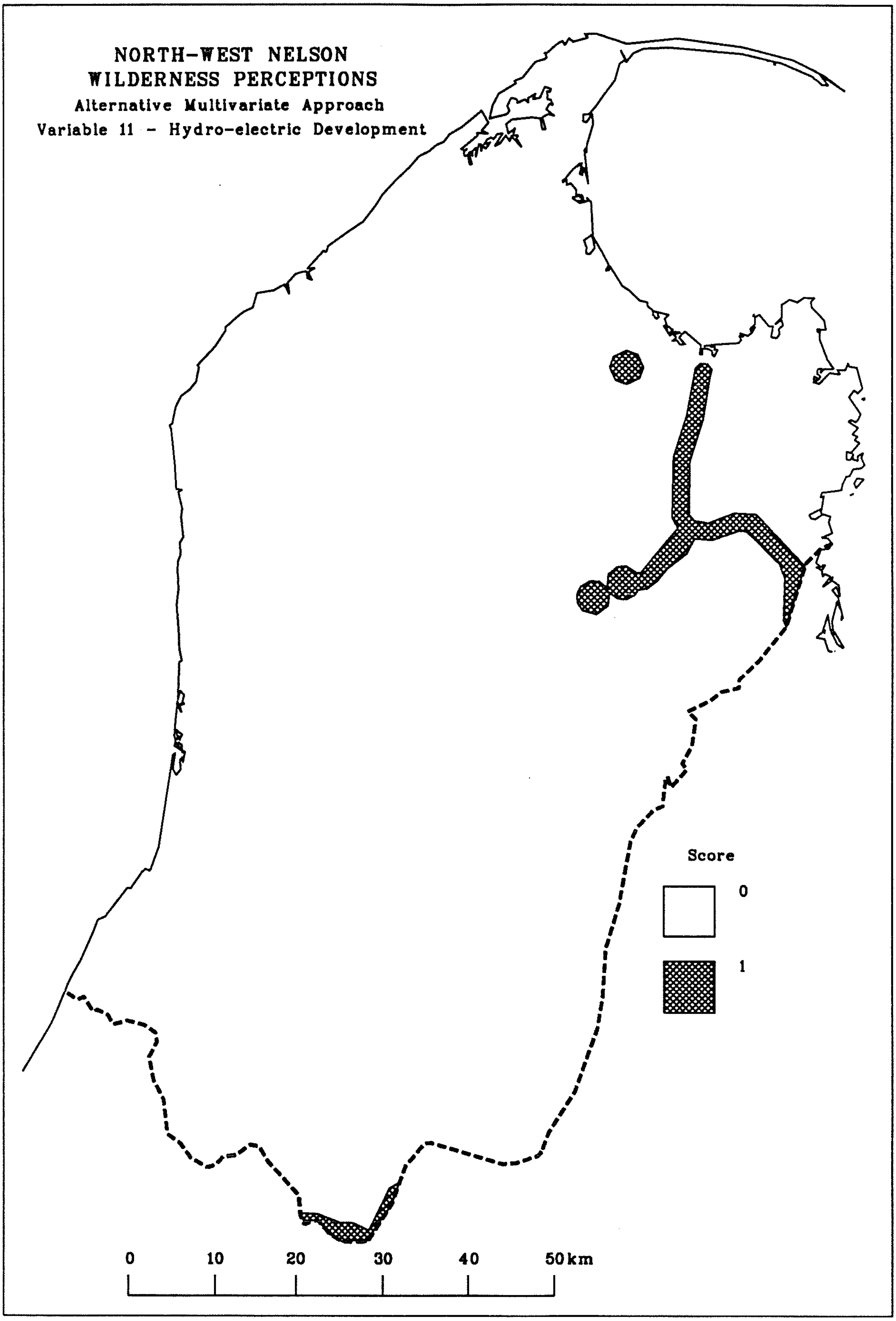
MAP 7.35:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 9 - Motorised Travel
Score
0
1
0
10
20
30
40
50km

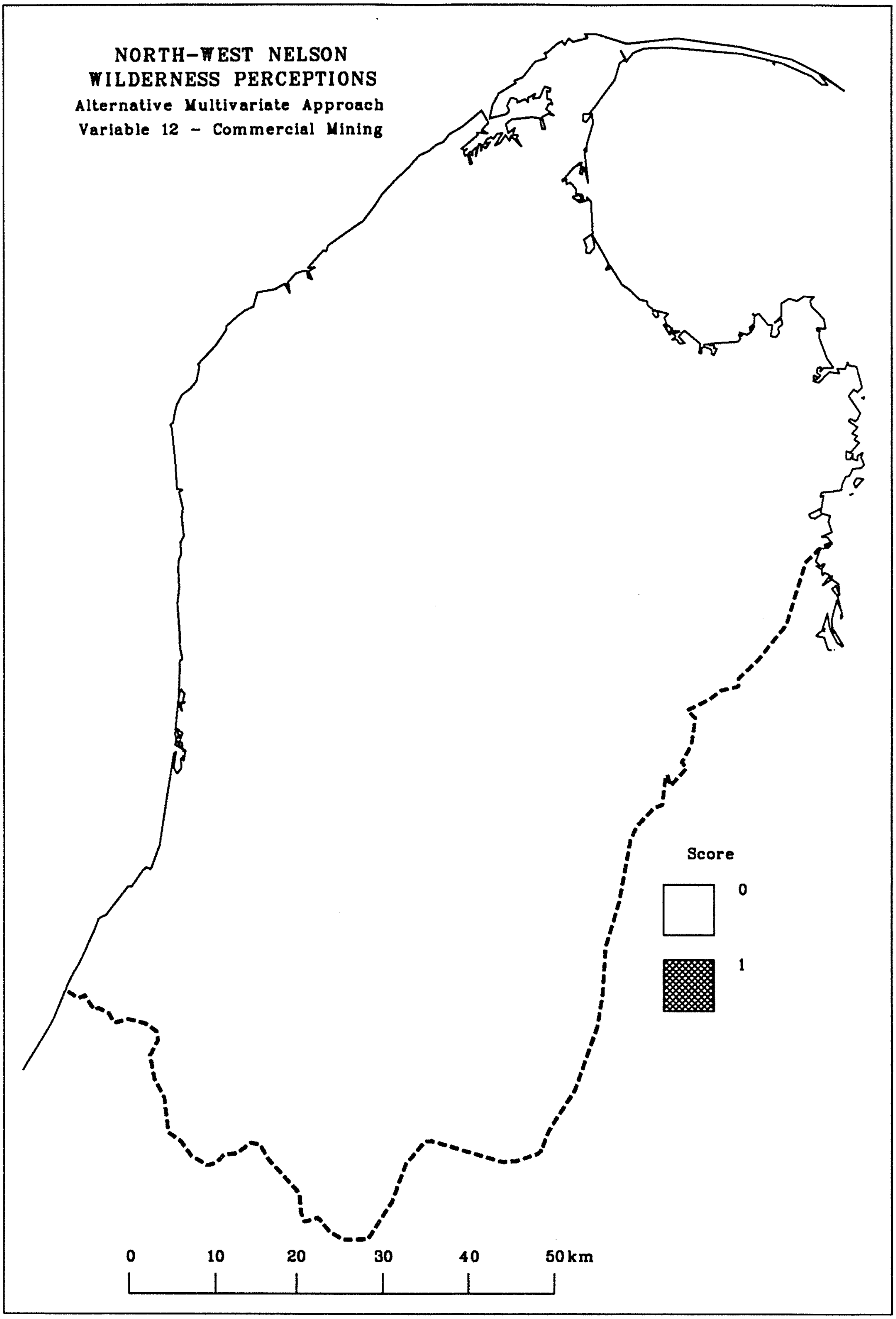
MAP 7.36:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 10 - Maintained Huts
Score
0
1
0
10
20
30
40
50 km

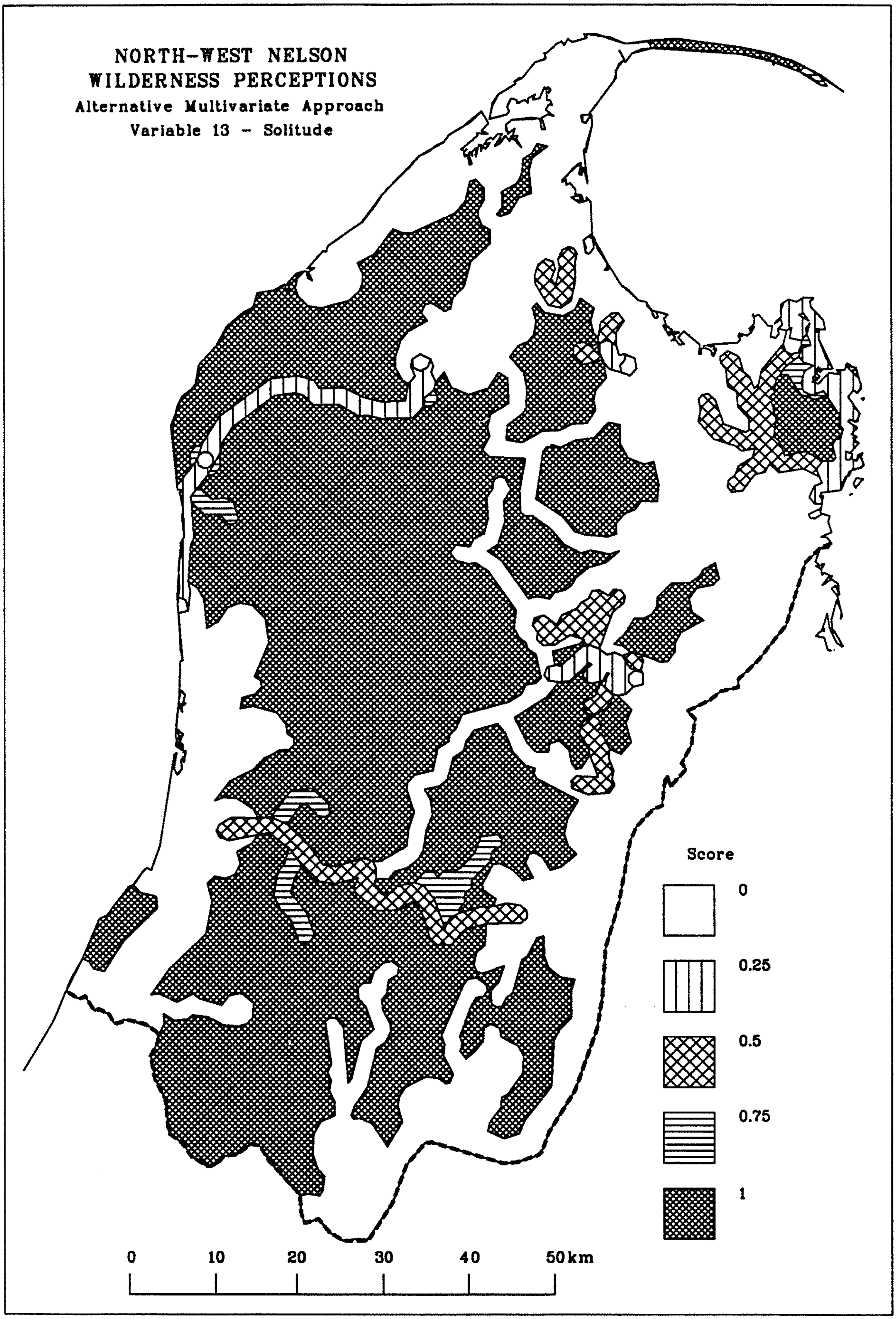
MAP 7.37:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 11 - Hydro-electric Development
Score
0
1
0
10
20
30
40
50km

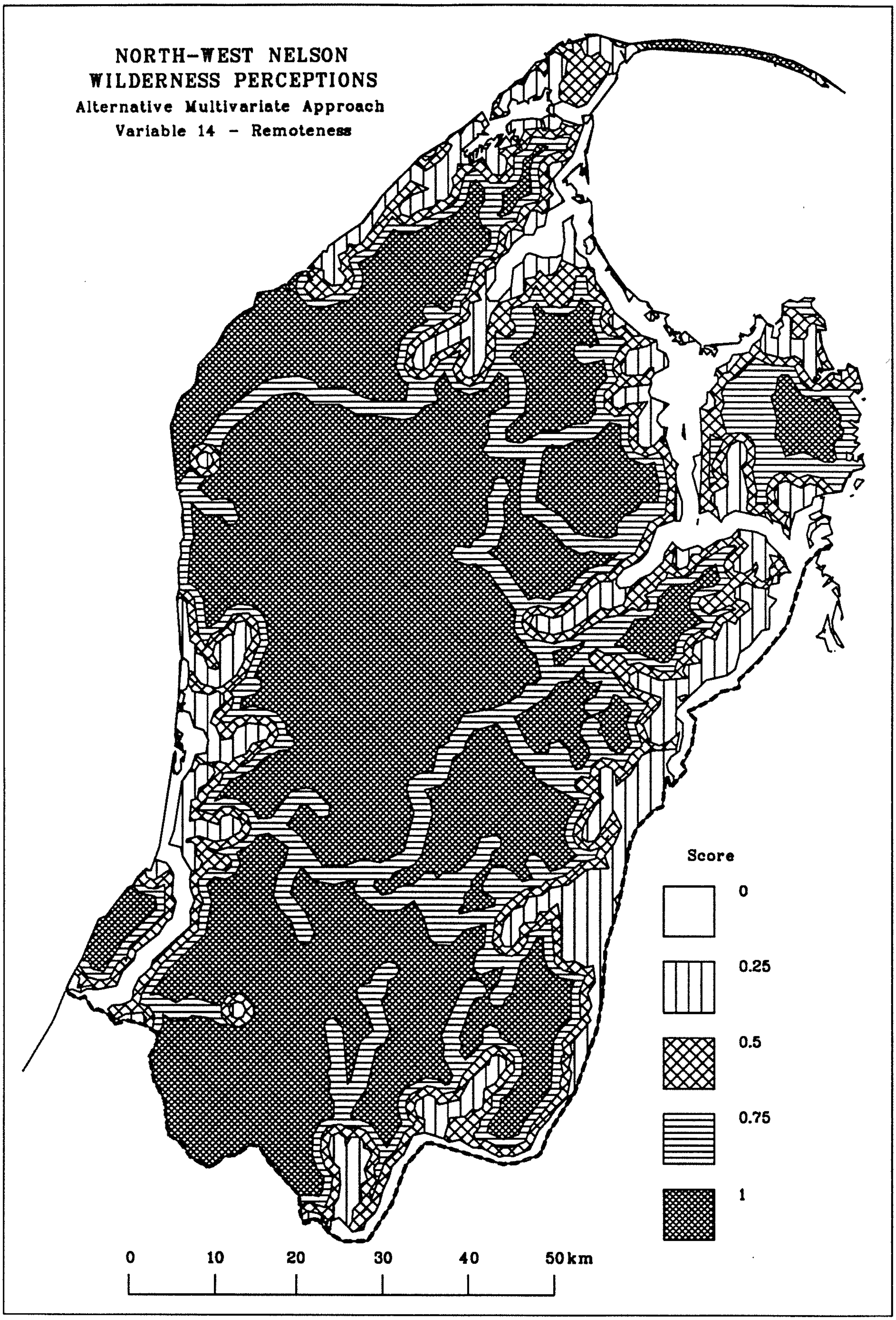
MAP 7.38:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 12 - Commercial Mining
Score
0
1
0
10
20
30
40
50km

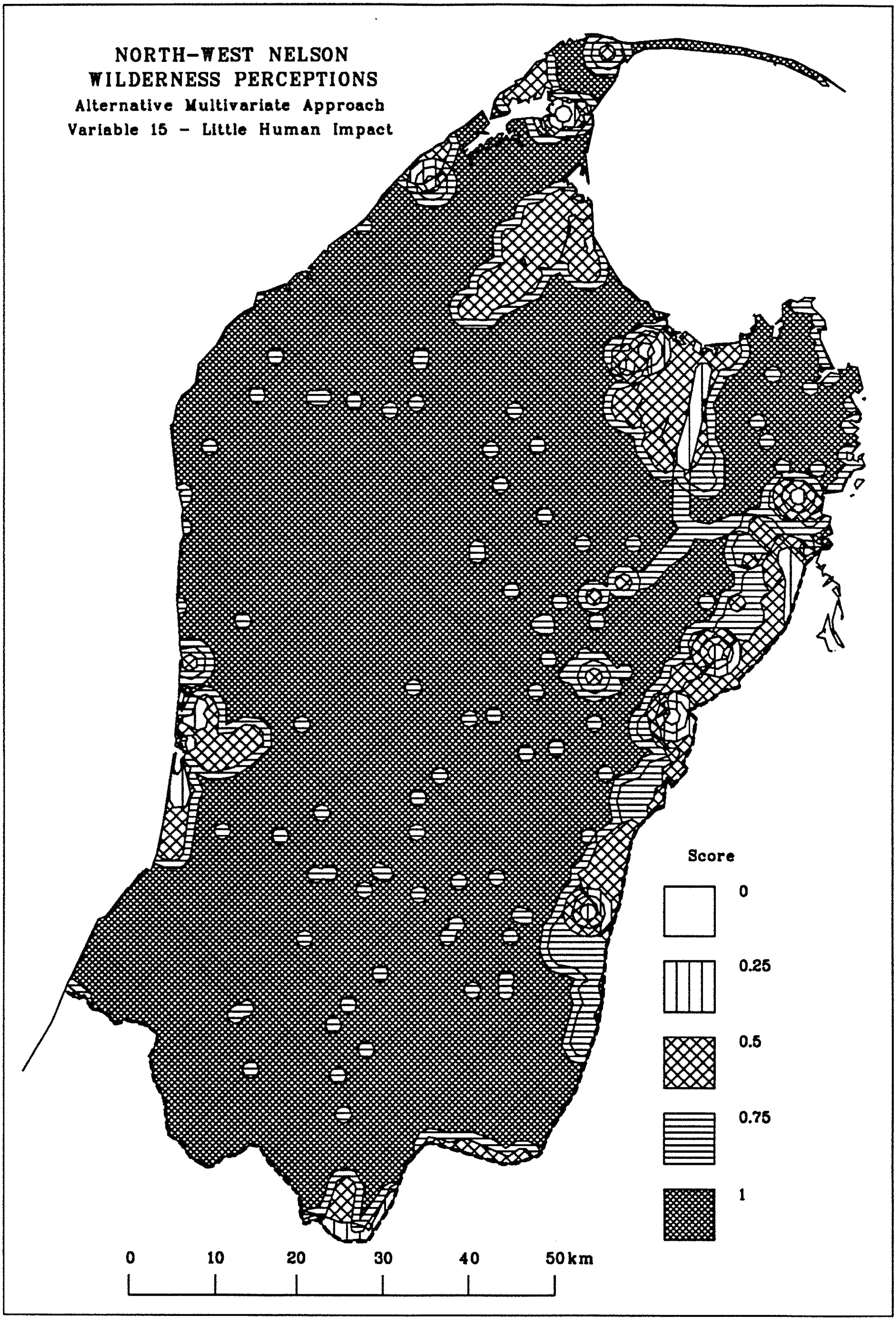
MAP 7.39:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 13 - Solitude
Score
0
0.25
0.5
0.75
1
0
10
20
30
40
50km

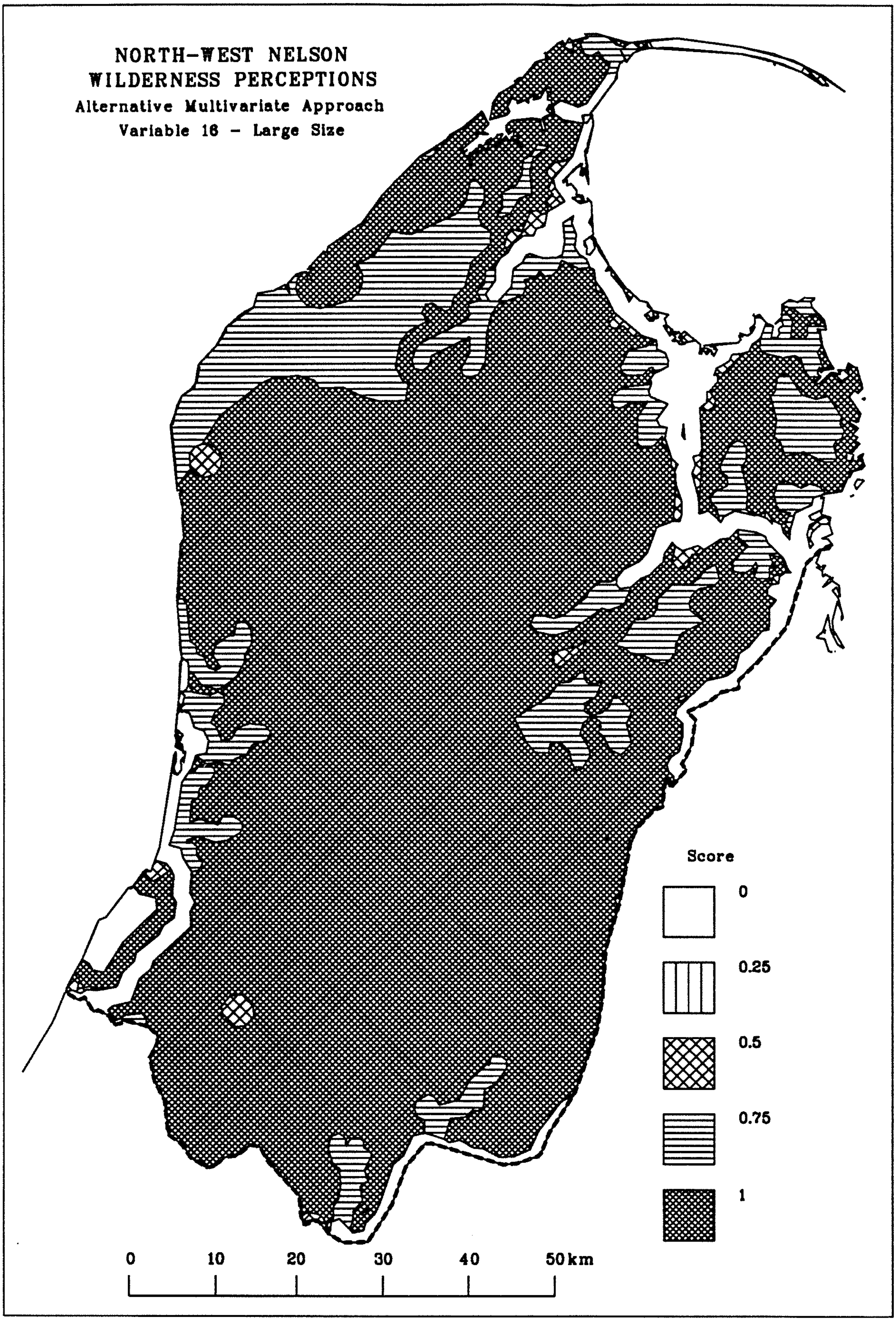
MAP 7.40:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 14 - Remoteness
Score
0
0.25
0.5
0.75
1
0
10
20
30
40
50km

MAP 7.41:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 15 - Little Human Impact
Score
0
0.25
0.5
0.75
1
0
10
20
30
40
50km

MAP 7.42:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Variable 16 - Large Size
Score
0
0.25
0.5
0.75
1
0
10
20
30
40
50km

MAP 7.43:

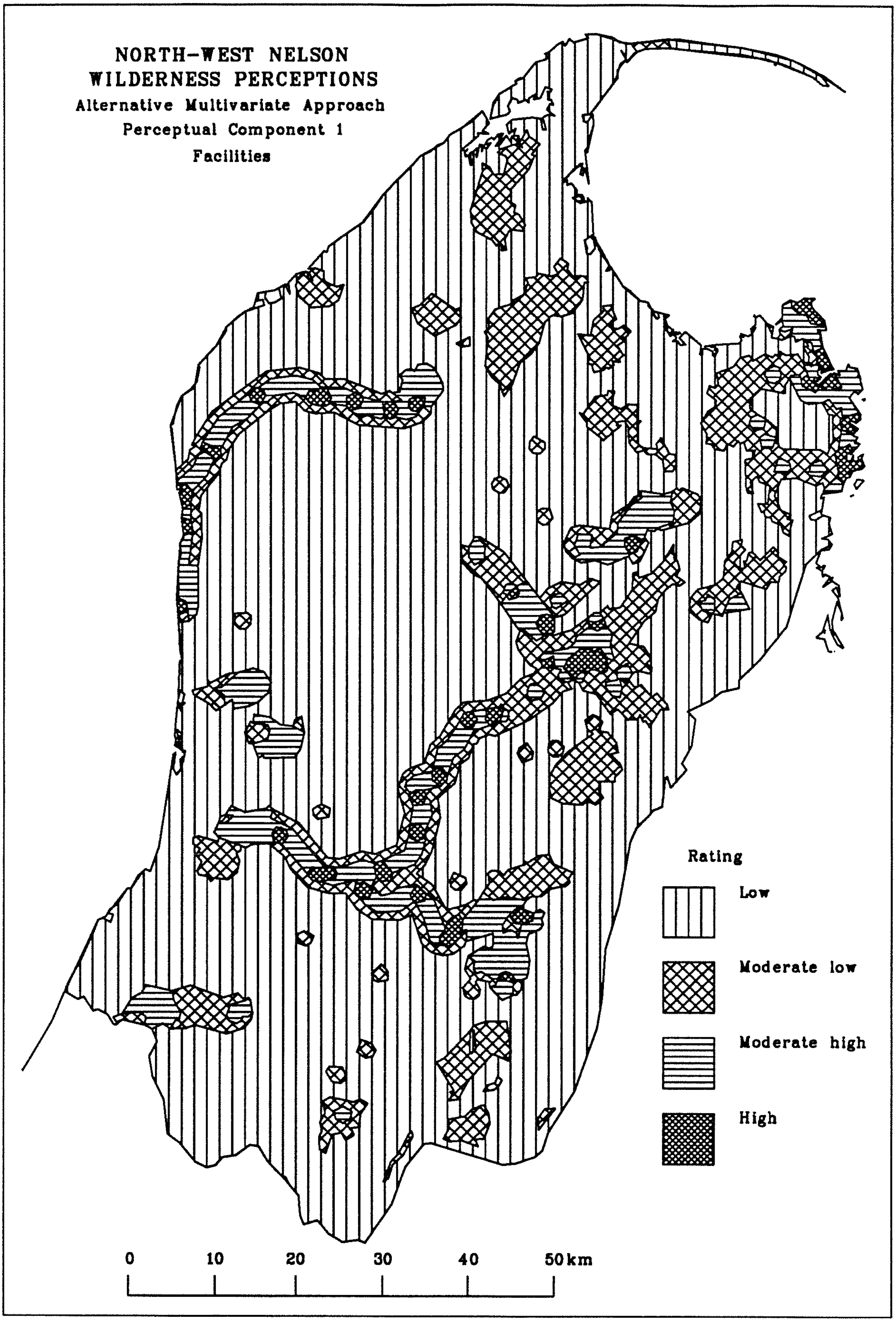
The experiential component (principal component 3), portrayed in Map 7.46, shows the relative ratings of areas in the region based on aspects of wilderness experience elicited. Areas with a high rating denote coincidence of high scoring experiential items and appear to include much of the region (80%) where solitude, remoteness, artifactualism and large size are relatively *strong*. The remaining lower ratings apply to successively smaller parts of the region with 15% rated moderately high, 5% moderately low and less than 1% as low. Not surprisingly, these lower ratings occur along the settled valleys of the region while the vast high rating area invariably occurs within the protected areas system.

The final component (principal component 4), is shown in Map 7.47 and denotes the region's ratings consistent with the relative propensity for hunting. Areas receiving a high rating indicate coincidence of moderate or high ungulate distributions and also where hunting commonly occurs or is permitted. Such areas account for 21% of the region and broadly occur along a south-west to north-east swath that takes in the Matiri, Arthur and Pikiruna ranges within the region's Forest Park and National Park. Moderate high ratings account for less than 1% of the region while moderate low ratings comprise much of the remaining Forest Park and National Park areas, and constitute 63% of the region. The remaining 16% of the region received a low rating and this area is characterised by the settled valleys devoid of forest.

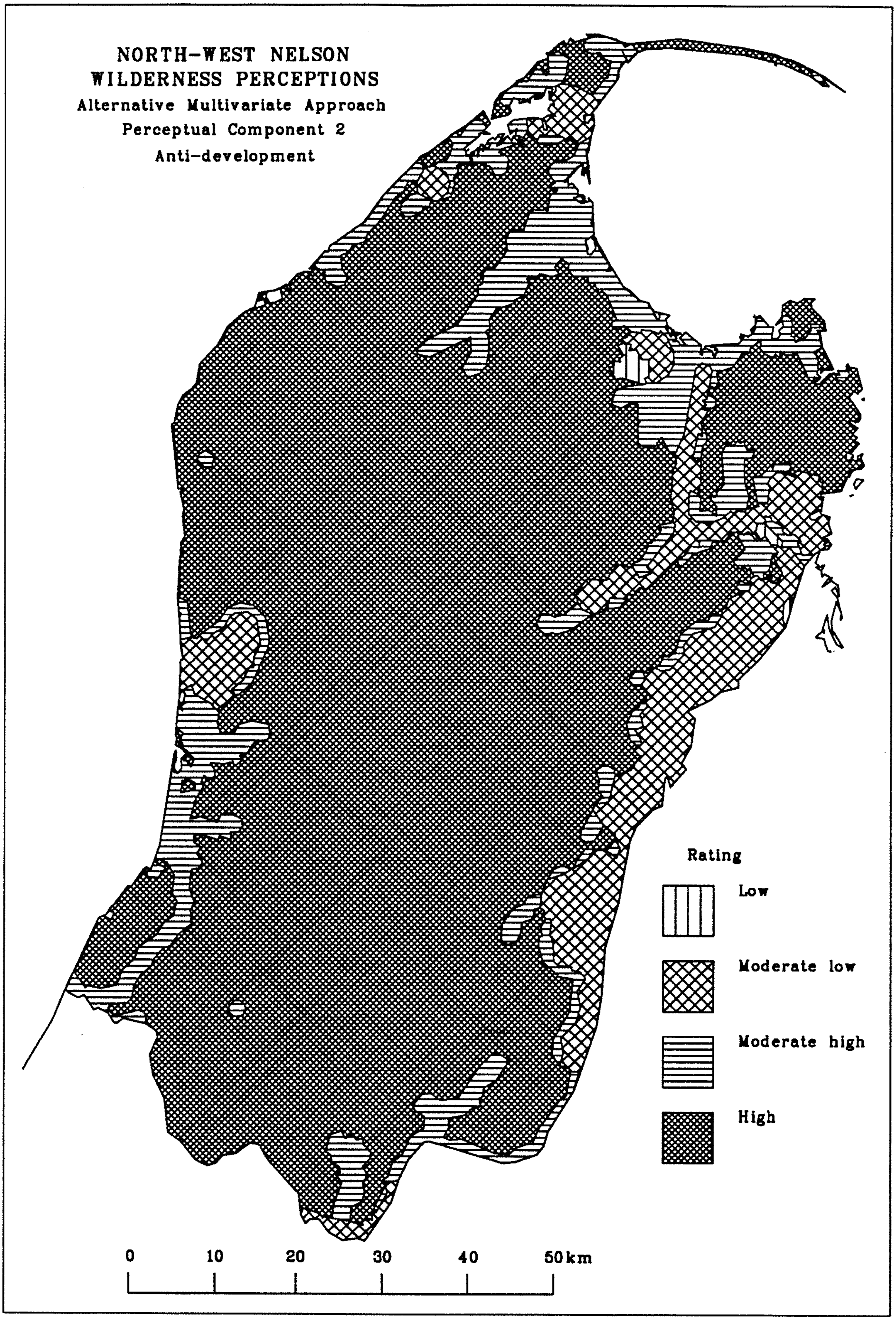
7.4.3 The Spatial Extent of Cluster Groups' Perceptions

The four cluster groups' perceptions of wilderness were represented spatially by overlaying the four constituent spatial components characterised in the previous section. The emphasis of a particular component in determining a cluster group's perception map was incorporated by applying the discriminant weightings (see Table 6.13) to the components' normalised attribute score. Each weighted score was then aggregated for a cluster and normalised—again using a 1–4 scale for consistency. The scoring for PC 1 was reversed for this procedure so that in all four components a high score represented a stronger wilderness characteristic. As was the case with the four spatial components, the spatial extent of cluster groups' perceptions, as shown in Maps 7.48–7.51, identifies areas in terms of a relative rating, ranging from low to high (reflecting respective normalised scores of 1–4), for that cluster group. The rating indicates the relative suitability of an area as a wilderness setting for a particular cluster group. Thus, in terms of wilderness perceptions a high score implies that the area is more likely to be considered wilderness.

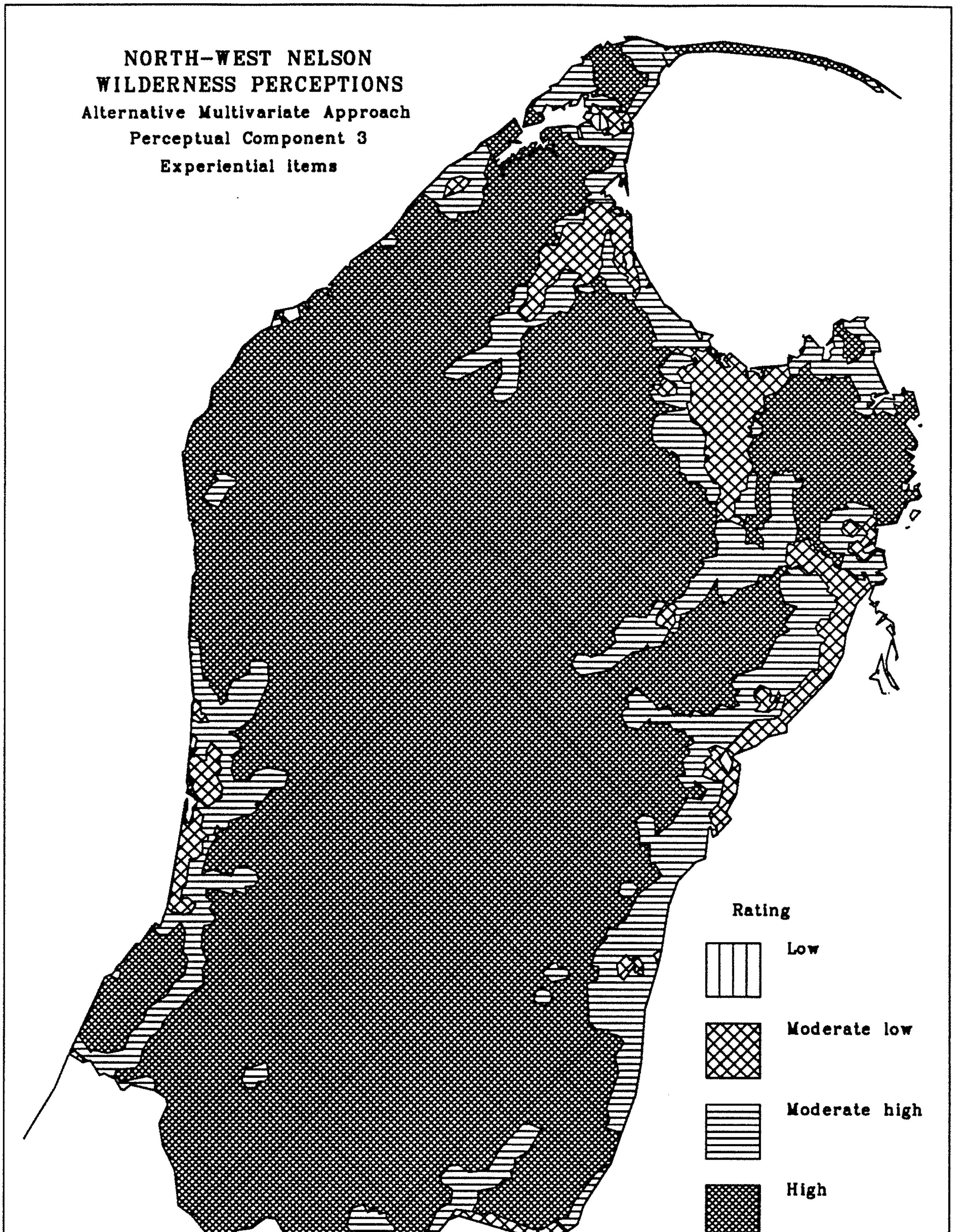
The spatial extent of perceptions for cluster group 1, the anti-artifactualists, is shown in Map 7.48. The low rating areas, accounting for 31% of the region, are


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptual Component 1
Facilities
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50 km

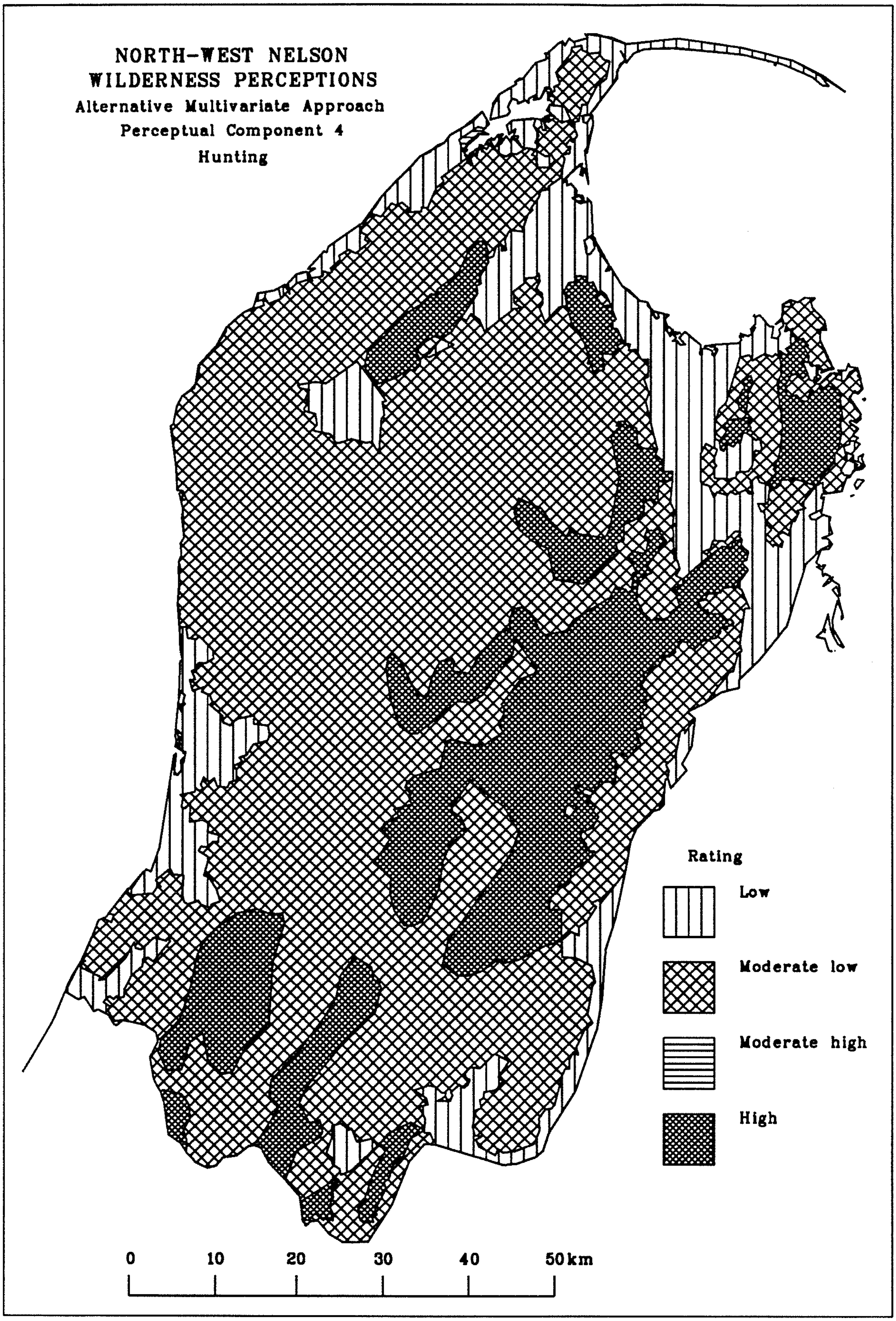
MAP 7.44:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptual Component 2
Anti-development
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50km

MAP 7.45:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptual Component 3
Experiential items
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50km

MAP 7.46:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptual Component 4
Hunting
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50km

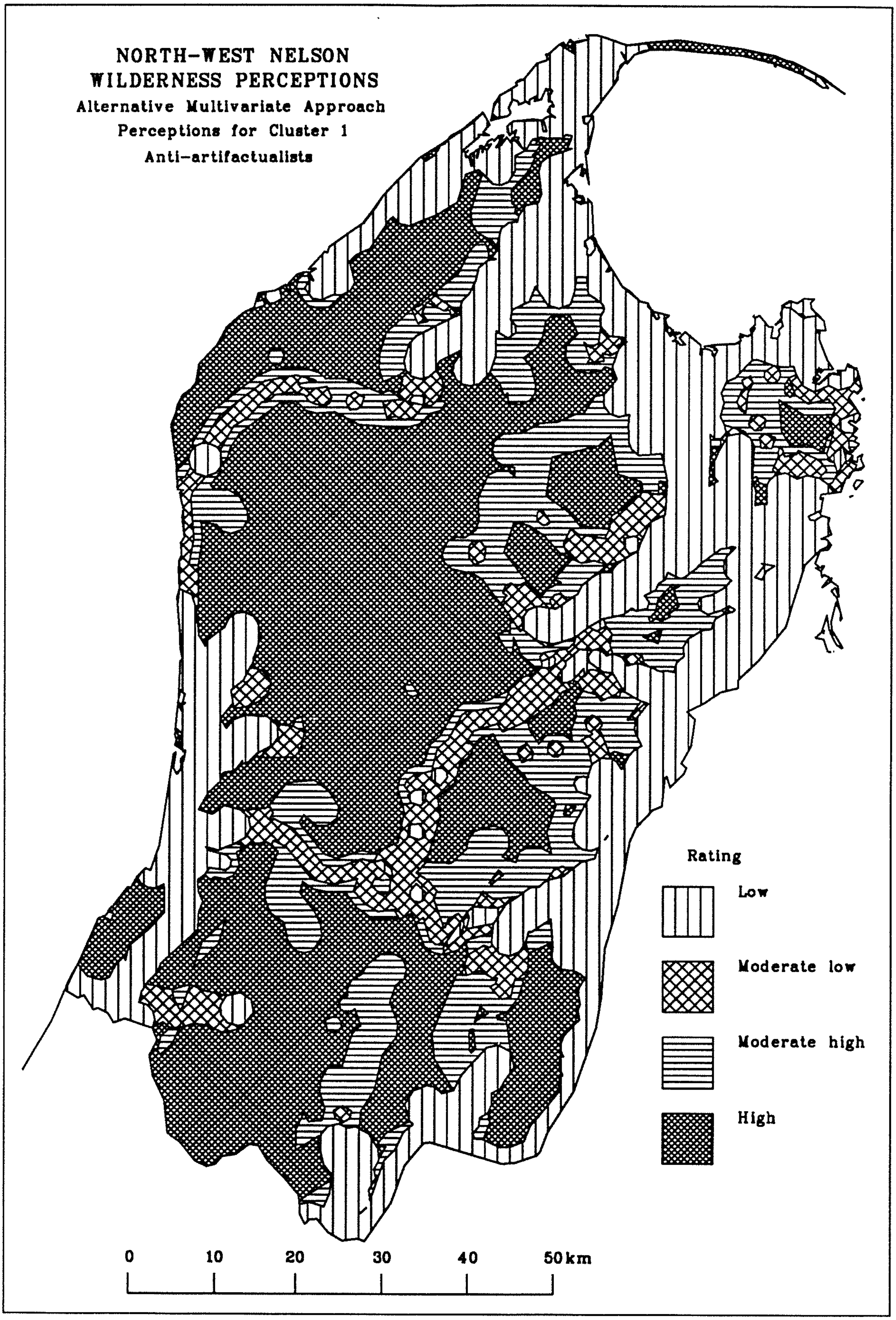
MAP 7.47:

the most adverse in terms of developmental activity and occur along the settled and primary production valleys. Moderate low rating areas generally occur in the backcountry areas where there is particularly good provision of facilities, and which are, therefore, areas of aversion for anti-artifactualists. These account for 8% of the region. The areas that receive a moderate high rating are the lesser-developed tracks, making up 18% of the region, while 43% of the region was of a high rating, and basically equates to those backcountry areas where no development or provision of facilities has occurred.

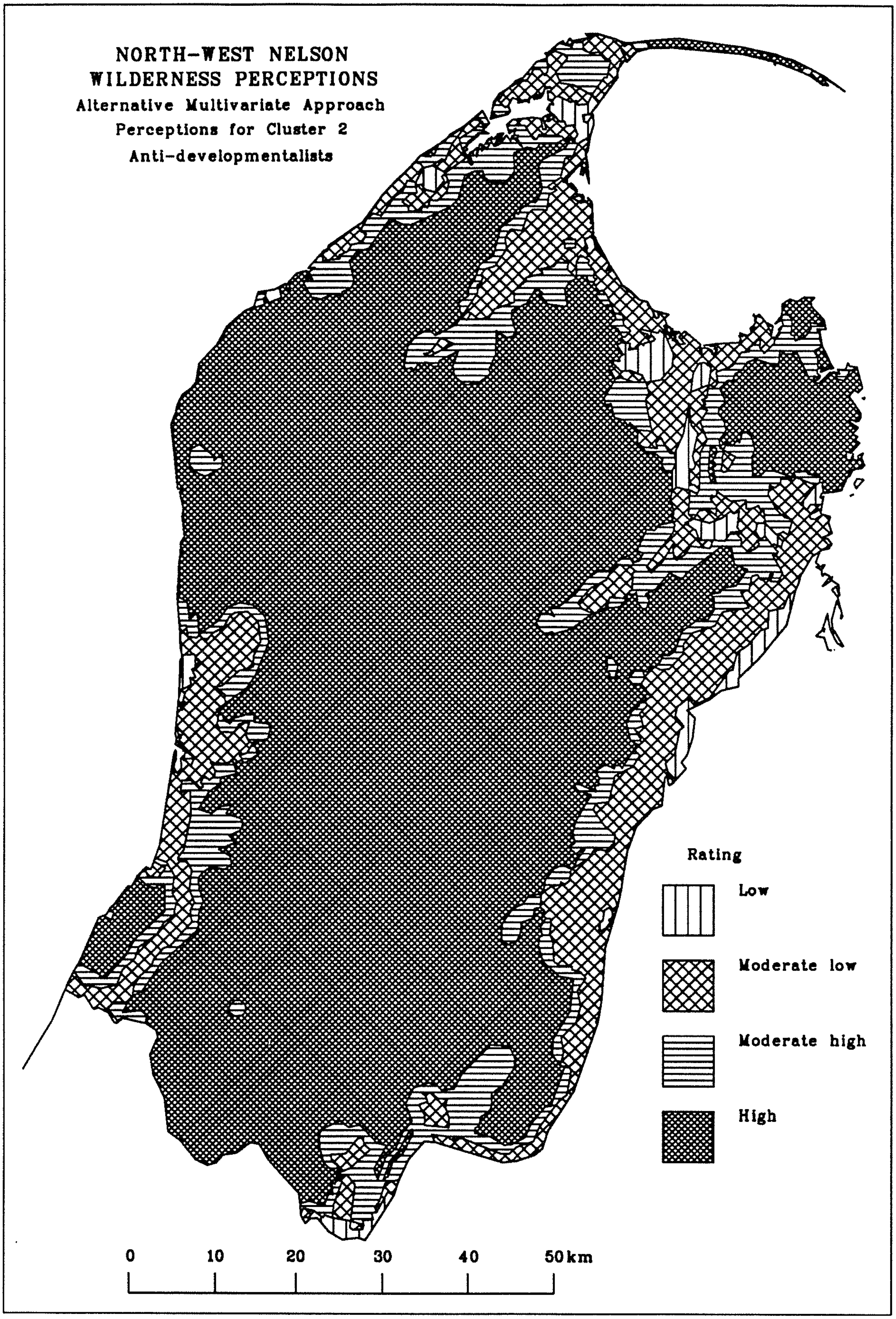
The perceptions of cluster group 2, the anti-developmentalists, displayed strong conformity with the region's protected areas system (Map 7.49). Thus, the predominantly high rating for 71% of the region invariably occurs within the protected areas system where developmental activities are relatively low-key or non-existent. The areas of moderate high rating, comprising 13% of the region, occur along the park margins and the upper, less developed, ends of the settled valleys (i.e. Upper Takaka, Owen and Matiri). Those areas with a moderate low rating, accounting for 14% of the region, cover most of the settled valleys where developmental activities commonly occur, while the low rating areas, comprising 2% of the region, refer to pockets of intensive development that occur in the Takaka and Motueka valleys, and the production forestry near Pakawau.

The spatial perceptions of the *general users* (Cluster group 3) are shown in Map 7.50. The low rating areas (3% of the region) broadly coincide with the low rating areas for Cluster group 2. This suggests that these areas are highlighting a similar aversion to development for group 3 as existed for group 2. The moderate low rating areas (16% of the region) also appear to reflect the anti-development component, broadly including the same reasonably developed valleys as was the case for group 2. However, the high rating areas, comprising 34% of the region seem to show less aversion to facilities, broadly occurring along the backcountry track and hut system. The moderate high rating areas, which constitute the greater proportion of the region (47%), appear to reflect both the aversion to development and the propensity for facilities, falling into a *no-man's land* between the areas solely characterising one of the two components.

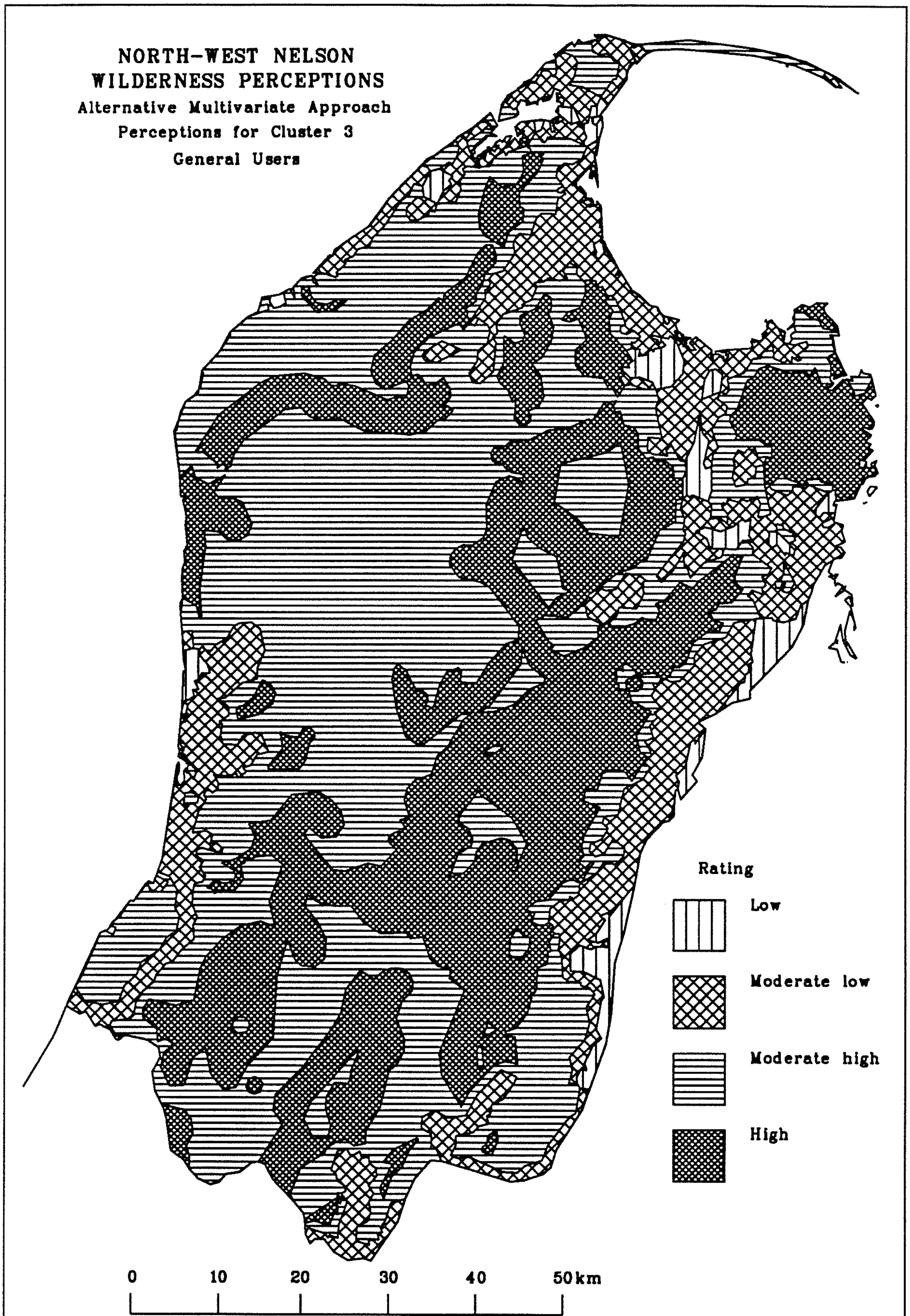
The suitability of the region as a wilderness setting for the *hunters* (Cluster group 4) is delimited in Map 7.51. This clearly shows the influence of perceptual component 4 (hunting) upon suitability with high rating areas (21% of the region) relating to those high rating areas for component 4, while areas with a moderate high rating (56% of the region), a moderate low rating (14% of the region), and a low rating (9% of the region) also strongly reflect the respective ratings for this component.


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptions for Cluster 1
Anti-artifactualists
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50km

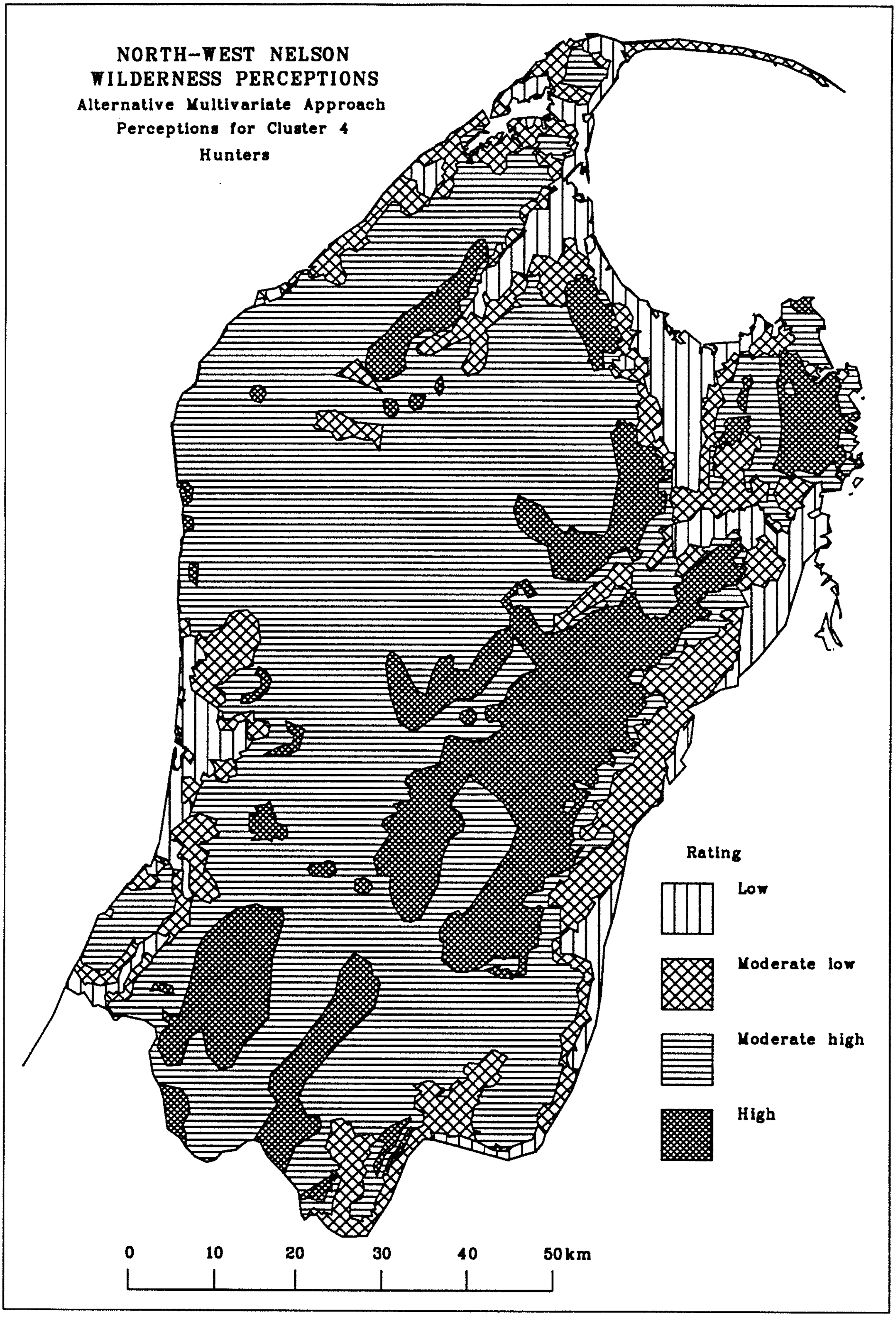
MAP 7.48:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptions for Cluster 2
Anti-developmentalists
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50km

MAP 7.49:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptions for Cluster 3
General Users
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50km

MAP 7.50:


NORTH-WEST NELSON
WILDERNESS PERCEPTIONS
Alternative Multivariate Approach
Perceptions for Cluster 4
Hunters
Rating
Low
Moderate low
Moderate high
High
0
10
20
30
40
50km

MAP 7.51:

7.4.4 Summary of WPM Results for Method 2

As with the first approach, the results of the multivariate approach are best summarised in terms of the set of maps produced in the application of the methodology to North-West Nelson. This reflects the 16 spatial variables derived from the purism scale, their overlay and weighting to produce spatial expressions of the four principal components, which elucidate dimensions of wilderness perception. These components are, in turn, variously aggregated to establish expressions of the four cluster groups with regard to perceived suitability of the region as wilderness settings.

These results are essentially a form of suitability mapping, commonly applied to physical land use planning (Lyle & Stutz 1983). This utilises multiple-map overlay and weighting techniques of the type developed for urban design and landscape architecture (Mutunayagam & Bahrami 1987). In the current work, suitability mapping has been applied to wilderness perceptions with the weighting assignment and comparative rating process determined from the multivariate analysis of the wilderness purism scale. This can be likened to the form of multi-criteria evaluation advocated by Carver (1991) in response to limitations of simple overlay analyses. The necessity to apply weightings and ratings across the whole region has meant that the final polygon overlay has been treated as a crude *grid*, that is, each polygon receives attribute scores in the way each grid cell would if data were represented in raster mode.

The final perception maps for each cluster group yield results which both identify and elucidate the spatial variation of wilderness perceptions between groups. However, the credibility of these rests to a marked degree with the weighting process and, therefore, on the ability of the tabular analysis to preserve meaning from the original attitude. While these multivariate results have not been subject to any form of ground-truth verification, they do present a cogent representation of perceived wilderness for the groups characterised by each cluster.

7.5 A Comparison of the Results for the Two WPM Methods

The results of WPM for North-West Nelson have been generated by applying two distinct methods—a relatively straight-forward, somewhat intuitive approach, and a more sophisticated and rather more rigorous multivariate approach. Both of these provide a sequence of map outputs. Briefly, the results of Method 1 display the nested composition and variation of each purism group's spatially delimited wilderness perceptions, based on their respective attitudes to the desirability or otherwise of purism items in a wilderness setting. These results reveal which areas fulfil the set of wilderness setting criteria, and which areas do not. Method 2 results depict the relative suitability of an area as wilderness for each cluster group based on the principal components that define the groups. These multivariate results determine how each unit (or polygon) rates according to the constituent dimensions of purism. Both approaches achieve a useful result and can provide a basis for understanding the spatial distribution of wilderness perceptions.

A comparison of the final results from both methods provides a crucial test of the applicability of each. In the first instance, a visual comparison between the results of Method 1 (Map 7.27) and those of Method 2 (Maps 7.48–7.51) suggests that there are reasonable similarities. The high rating areas for Cluster 1 (see Map 7.48) generally coincide with the level 4 perception differential for Method 1 (see Map 7.27). The high rating areas for Cluster 2 appear to coincide with this perception differential but also with the level 3/4 differential. For Cluster 3 the high rating areas appear more coincident with the level 3/4 differential, while the level 4 differential generally equates with moderately-rated areas. The high ratings pertinent to Cluster 4 are rather mixed, coinciding with the range of perception levels 2–4.

Utilising the analytical capability of GIS, spatial overlays between the perception differentials derived in Method 1 (Map 7.27) and each of the cluster group's suitability ratings (Maps 7.48–7.51) confirm the similarities between the results of the two methods. These overlays enable the measure of association between each cluster group's rating and the purism differentials to be computed. In each of the four cases, significant relationships were found ($P<0.001$). The similarity is to be expected and, in part at least, reflects the effect of artifactualism as a major element in Method 1 and the assumptions made about the experiential items used in Method 2. The ratings of Cluster group 1, the anti-artifactualists, displayed the greatest significance revealing that 88% of high rating areas were also coincident with the level 4 perceptions. The moderately high rating areas for this cluster were equally found in perception level 4 and the level 3/4 differential. For Cluster 2, 66% of high rating areas and 25% of moderately high rating areas were coincident with perception level 4, while 50% of moderately high rating areas matched the level 3/4 differential. The relationship was slightly reversed for Cluster 3 where 40% of the high rating areas coincided with both perception level 4 and perceptual differential 3/4, while 70% of moderately high rating areas matched perception level 4. Cluster 4 displayed a somewhat different, though nevertheless significant, relationship in which 45% of high rating areas matched level 4 and 65% of moderately high rating areas coincided with level 4. This suggests that hunters have rather different perceptions to the other groups, a feature that may reflect different *motives* for being in an area, e.g. to hunt game, than those for the other groups.

In broad terms, there is considerable similarity in the results of the two approaches with respective areas of suitability for cluster groups, as determined in Method 2, reflected in the perceptual differentials, as identified in Method 1. Whilst some degree of similarity can be accounted for by the underlying assumptions of each method, as dicussed above, the level of similarity is too striking to result completely from that—it must also reflect some degree of genuine methodological equivalence. A closer examination does reveal some differences, notably a more subtle distinction between areas and groups of users in the results of Method 2. It has been suggested above that this variation may reflect differing motives for visiting an area. Thus, while Method 1 refers to an approach based upon users' images according to a pre-determined scale, Method 2 by contrast, tends to highlight an underlying variation in the scale that reflects motivations.

Given similar conclusions for the two different methods, the viability of using either will be influenced by both theoretical and pragmatic considerations. Several methodological points in respect of the two methods were examined in Chapter 6, highlighting theoretical strengths and weaknesses of each. Briefly, Method 1 uses a simplistic additive overlay procedure whereas Method 2 applies a more rigorous weighted overlay. The classification stages of each method can also be characterised in this way. On these grounds, Method 2 is a stronger formal approach following a more rigorous path. However, the statistical sophistication of the latter, while of some benefit to the approach itself, can also pose problems. Notably, the four principal components account for a relatively low total variance, while the application of the discriminant function to these components lacks somewhat in statistical underpinning. However, it can be counter-argued that much of multivariate work is not *statistical* so much as it is a process of mechanical manipulation. Ultimately, if the results are useful to management, then *that* is a valid criterion of viability.

The map result must be interpreted and incorporated within a management process which, especially for user data, is not necessarily improved by highly sophisticated results. In pragmatic terms, since both methods yield similar results, it is reasonable to expect the simpler and more familiar, i.e. Method 1, to be preferred by many users. The relative sophistication of multivariate techniques means that the ability of managers to apply readily such an approach, i.e. Method 2, is doubtful, particularly at a local or regional level. This is heightened by the inclusion of GIS as an integral part of each method. While the use of GIS in implementing each approach contributes considerable functionality, it is not without its own technical complexities and requires a reasonable level of training. However, the use of any method in practice is situation-dependent. Thus, in many circumstances, the standard, familiar approach (Method 1) would be followed but in those cases where a more subtle degree of information is necessary to circumvent what might be seen as the simplistic nature of that approach, the more rigorous approach (Method 2) could be applied.

Both approaches for operationalising WPM appear useful and display considerable similarity. Either method would enable an analysis of management implementation of a WPM methodology. However, Method 1 has the most potential as a pragmatic tool that is applicable to management. Equally, Method 2 displays more potential as a sophisticated theoretical approach that can be applied, as a research tool, in parallel with the management application. This would provide a feedback mechanism between research and management allowing the management application to be improved on the basis of theoretical developments. Thus, while both methods produce useful results, Method 1 will be used in the next chapter as the basis for examining the application and implications of WPM in a real world situation—the North-West Nelson region.

8

The Application of WPM to Wilderness Management

As demonstrated in the previous chapter, the test-mapping produced by applying the initial WPM methodology in itself provides an interesting outcome, with the generation of new information. However, the ultimate value of this information lies in its ability to permit enhancement of management approaches toward balancing conditions of wilderness. This chapter, therefore, analyses the utility of wilderness perception mapping for the North-West Nelson (NWN) case-study in terms of its applicability in addressing the wilderness management issue.

The case-study approach to the analysis of the management issue allows:

- attention to be focused on the sequence of decisions that occurs over time;
- account to be taken of features that are unique to the particular real world situation being studied;
- account to be taken of features which reflect more general aspects of the situation.

(Masser 1981)

The following analysis will both examine the specific case-study, and attempt to evaluate the WPM approach itself.

This chapter first considers the management of wilderness conditions in NWN, and secondly uses this as a basis to examine WPM as an allocative mechanism, in respect to ROS and related planning frameworks, and also as a predictive modelling tool. Finally, the role of WPM as a wilderness management tool in NWN, and in

New Zealand generally, are considered. This includes a broader examination of its significance in the wider realm of protected areas management.

8.1 Management of Wilderness Conditions in North-West Nelson

NWN is largely protected area, of one form or another, which tends to shape the nature of management activities in the region. One particular issue is wilderness management, an issue that concerns the balance between preservation (ecological conditions) and use (experiential conditions).

The previous chapter has discussed briefly the ecological character of NWN Ecological Region as an entity and has also indicated the unique and unifying features of its constituent ecological districts. NWN's temperate natural environment comprises rainforest, tussock and mountain lands which are significant as one of the world's few remaining undisturbed natural areas in the temperate zone (Hutching, in press). Despite this positive aspect, biodiversity in New Zealand as a whole has actually been considerably reduced, and although extensive tracts of beech forest do remain in the South Island of New Zealand, the vast lowland forests of kahikatea, rimu, matai and totara have declined substantially. In NWN, biodiversity has been largely retained such that, in terms of both the actual range and extent of ecosystems as well as their relatively undisturbed state, the region represents pristine ecological conditions which are exceptional.

The region also reflects an exceptional state of experiential conditions of wilderness. While pre-European notions of the experience afforded by the region are difficult to ascertain for lack of evidential and cultural records, early European writings do provide what might be considered a contemporary perspective. In the *Nelson Colonist*, November 15, 1898, Jonathon Brough describes an account of his experiences while engaged on the construction of the pack-track in the Upper Wangapeka valley and over the Wangapeka Saddle to the head of the Karamea River:

> *... anyone who wants to get away from the bother of monthly bills, the jarring and screeching sounds of civilisation, and the hurry and bustle of city life; anyone who wishes to spend a few weeks or months amidst remote and desolate mountain solitudes where the only living things are the free and native denizens of the forest, can scarcely do better than make a journey to the locality I have in mind ... The vegetation is varied and full of interest; in one place you pass many chains through lovely Prince of Wales ferns (the famed* todea superba*), they grow like*

> *short tree ferns but their soft green fronds resemble ostrich plumes, but are to my mind far more beautiful. Nearer the saddle the nei nei grows at an elevation of something like 4000 ft, it is a small growing tree between the young lancewood and the cabbage tree in appearance, the wood being hard and beautifully marked . . . to the wilderness. . .*
>
> (Brough 1898)

Such sentiment is not so far removed from that which still imbues present day visitors to the region. The following excerpt is taken from a forthcoming publication on the proposal for a North-West World Heritage Area in New Zealand:

> *The irrepressible pipit was the only thing moving that day, apart from the rushing black clouds, the mountain beech and red tussocks rippling in the wind, and the snow driving across the frozen landscape . . . I had often seen pipits before, but never so close. Along with the kea, they had always epitomised for me the solitude of wilderness country, their high-pitched haunting song speaking of wide open spaces.*
>
> *This one seemed to be aware of our presence . . . but hunger was driving its actions more than fear. To guard against the near zero temperatures, the pipit had fluffed up its feathers. In a twinkling the bird was gone and we never saw it again during our stay . . . However, the image of its brief appearance lingered in my mind. I was reminded of the times I had come across other wild birds at close quarters—a plump kereru, a curious robin, a darting fantail—and of the delight with which I greeted them on our long tramp. Their trusting behaviour is a source of wonder, especially after humans have so drastically altered their environment.*
>
> *And then I thought about the road which had been destined to slice through the heart of this magnificent North-West Nelson wilderness, an area of plant and animal diversity matched by few others. A road which, linking a few thousand people, would have distanced people who travelled along it from the environment surrounding them.*
>
> (Hutching, in press)

For the numerous visitors to the region the natural environment of NWN provide varying and individual, but nevertheless important, experiential conditions of wilderness.

Current estimates of conservation estate use in the region indicate that approximately 150,000 people per annum use road accessed recreation facilities, over

100,000 utilise backcountry tracks, whilst 100,000 stay overnight in hut or at campsite facilities (DoC 1990d). Individual routes which attract particularly high usage are the Abel Tasman Coastal Track with 24,000 users per annum (not including considerable day use), the Heaphy Track with 4,000 users per annum and the Wangapeka Track with 1,500 users per annum. With the New Zealand Tourism Department (NZTD) forecasts for 1989–1994 anticipating a 20% increase in visitor numbers (domestic and international projections combined) to the Nelson region generally (NZTD 1990), this is likely to mean a significant increase in users of the conservation estate in NWN. A variety of sources, such as the NZTD, have identified the large number of visitors who seek out the natural areas comprising the conservation estate which *"... are perceived by many as being in a state of wilderness, and are sought for the special values that visitors believe a wilderness experience confers"* (Kearsley 1990 p127).

Increasing demand for wilderness experiences are inextricably linked to the ecological conditions of wilderness, with the result that the very things attracting backcountry users and rendering experiential conditions are then put under a threat of over-use and decline. Consequently, ecological conditions of wilderness run the risk of disturbance (whether actual or perceived) while experiential conditions are affected by the perceived impacts of such disturbances. Out of this arises the issue of wilderness management and with it the perceived need to balance the conditions of wilderness through management intervention.

Management efforts to contend with conflicting sets of conditions in NWN have centred initially on the setting aside of special areas for particular purposes within the protected areas system and, more recently, on strategic planning.

8.1.1 The Designation of Special Areas

In broad terms, designating or the specific setting aside of special areas within the protected areas system for a particular purpose reflects a specialisation of the idea of preserving natural environments generally. Thus, by the simple act of assigning an additional status upon an area the intention, and hope, is to ensure that the underlying rationale for bestowing such a designation is appropriate. In the case of efforts aimed at protecting experiential conditions of wilderness, the focus has been on the formal designation of Wilderness Areas under the WAG policy. Similarly, efforts intended to deal with ecological conditions of wilderness have focussed on the designation of suitable Ecological Areas. These measures have not usually been carried out jointly or even as part of an overall strategy. Therefore, it is not appropriate to see the actions as a coherent response to the need to balance wilderness use and preservation. It is nevertheless useful to examine each of these approaches as a partial response to the wilderness management issue.

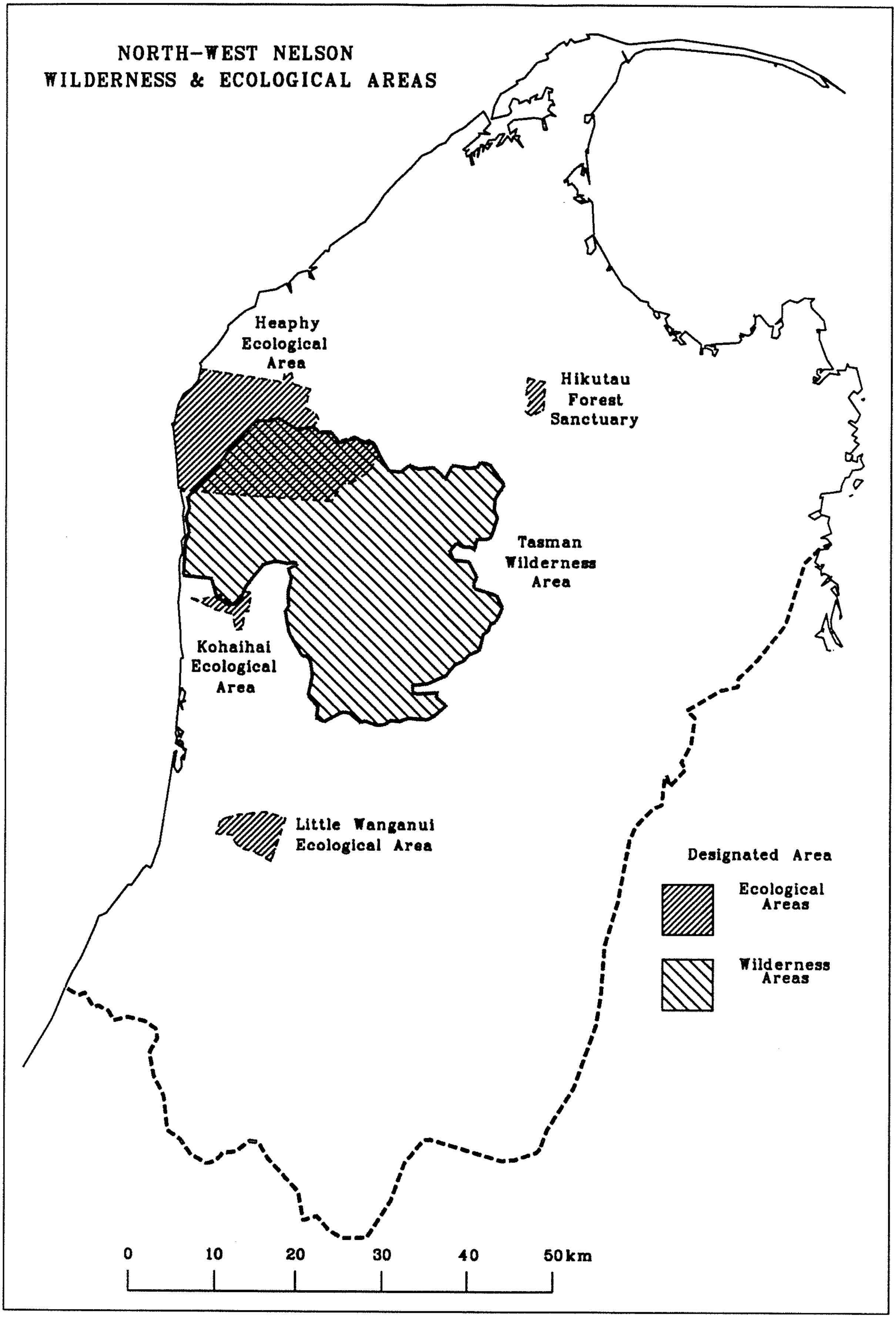
Wilderness Areas

The idea of a *wilderness*, or undeveloped area, within the region was first discussed at the inaugural meeting in 1966 of the NWNSFP Advisory Committee which, in the following year, agreed that 20,000ha of wildland in NWNSFP be maintained in a state of wilderness. In 1975 an enlarged area of 59,000 ha was zoned for management as wilderness, that is:

> *... an area whose character is determined by purely natural processes, which is large enough and so situated as to be unaffected except in minor ways by what takes place around it. Access to and within would be by foot only.*
>
> (NZFS 1975 p116)

Management activities concentrated on restricting any developmental work in the wilderness zone. In the 1970s, growing interest by both public groups, notably the FMC, and the NZFS in retaining areas in the State Forest System as wilderness focussed predominantly on a Tasman/Karamea proposal of approximately 75,000 ha in NWNFP (Burrell 1981). In 1978 the Nelson Conservancy of the NZFS finalised a proposal to gazette an enlarged area of 83,000 ha as a Wilderness Area under Section 63E of the *Forests Act 1949*. However, a decision concerning gazettal was deferred for five years because of clearly divided public opinion arising from submissions to the proposal. The NZFS subsequently undertook a more thorough assessment of the Tasman Wilderness Area proposal, issuing an evaluation and proposal document in 1983 (NZFS 1983), which led to Government approval in 1985 for the gazettal of an 83,000 ha Wilderness Area under the Wilderness Policy (WAG 1985). The Tasman Wilderness Area was finally gazetted in 1988 (Gazette 3 Nov 1988 No.184 p4339) comprising approximately 87,000 ha of Conservation Park, and enclosing the extensive tract of mountain country of the Tasman Mountains and the Ugly, Beautiful, Roaring Lion and Kakapo river catchments. The Wilderness Area accounts for 12% of the study region (see Map 8.1).

Under the current management plan for NWNFP (DoC 1991) the Tasman Wilderness Area is managed according to departmental Wilderness Policy, which has been adopted directly from the WAG Wilderness Policy (see Appendix B). Efforts to adhere to this have resulted in management concentrating on three factors seen as diluting the strict concept of pristine wilderness (Jane 1990 pers. comm.). These are the control of introduced wild animals, helicopter overflights, and commercial concessions operating on the periphery of the Wilderness Area. In broad terms, the


NORTH-WEST NELSON
WILDERNESS & ECOLOGICAL AREAS
Heaphy Ecological Area
Hikutau Forest Sanctuary
Tasman Wilderness Area
Kohaihai Ecological Area
Little Wanganui Ecological Area
Designated Area
Ecological Areas
Wilderness Areas
0
10
20
30
40
50km

MAP 8.1:

management of Tasman Wilderness Area has been characterised by a *designate-and-leave-it-alone* approach which has concentrated mainly on maintaining experiential conditions of wilderness that conform to a very purist perspective. Unfortunately, this may have contributed to a management psyche that has been unable to appreciate experiential conditions of wilderness in other areas of the region outside the designated Wilderness Area. In turn this has meant rather constrained efforts to contend fully with the wilderness management issue in the past. This situation has, however, been recognised in more recent management efforts.

Ecological Areas

Other areas have also been set aside specially to protect ecological conditions of wilderness within the region. Provision was made in 1975 for zoning an area of 850 ha in the vicinity of Boulder Lake as forest sanctuary, that is:

> ... *an area set aside for preserving in their natural state the indigenous flora and fauna for scientific and like purposes. Human interference would be controlled by permit for entry.*
>
> (NZFS 1975 p116)

Thus, in real terms, the management activities with respect to ecological conditions have also been broadly exclusionary in nature.

More recently the Protected Natural Area Programme (PNAP) has provided a mechanism for establishing ecologically representative reserves. However, the PNAP in NWN has received a relatively low priority mainly due to the general protected area status which much of the region already enjoys in contrast to other regions in the country (Myers 1984). Nevertheless attempts have been made to describe, assess and subsequently protect representative areas within the region (Park & Walls 1978, Jelinek 1980, Wardle & Buxton 1986). Thus far the preservation program has resulted in the protection of over 30,000 ha (5% of the region), comprising three Ecological Areas and a Forest Sanctuary (see Map 8.1). The Heaphy Ecological Area (29,100 ha) protects the most complete sequence of lowland forest types in the region, extending from Karamea Bluffs along the coast to Kahurangi Point, and inland from the coast to an altitude of approximately 1,500 m. The Kohaihai Ecological Area (485 ha) contains the unique Honeycomb Hill cave system and ecologically significant rimu forest types. The Little Wanganui Ecological Area (3,100 ha) supports a sequence of terrace formations ranging from tall beech associations to stunted semi-pakihi associations. The small but important Hikutau Forest Sanctuary (850 ha) protects the rare *Pittosporum dallii.*

Management of these special, set-aside areas has revolved around the prevention of activities or effects considered likely to jeopardise ecological conditions, notably *"... where representative ecosystems are identified the level of tracking and facilities will be kept to a minimum"* (DoC 1990) and also to be consistent with departmental Ecological Area Policy (see Appendix D). This has spawned efforts to identify the causal factors which might threaten any site, species or association mainly as a key tool for management intervention. However, the focus here has been rather limiting with a tendency to concentrate on specific sites or species rather than a more integrated but overall ecological perspective.

Wilderness management efforts acting through the designation of special area—Wilderness and Ecological Areas—do provide a mechanism for protecting or enhancing certain conditions of wilderness. It does so, however, in an uncoordinated fashion without taking concomitant account of wilderness conditions. This management approach, seeking to preserve particular conditions of wilderness by designation of certain areas, tends to be fragmentary, *ad hoc* and uncohesive with respect to the region as a whole. While of some benefit to conservation management generally, the setting aside of special areas is not a concerted approach for balancing conditions of wilderness.

8.1.2 Strategic Planning Efforts

Current wilderness management practice in NWN by DoC involves two broad conservation management functions, namely protection and use—functions which are now being tackled progressively in a strategic manner (see Chapter 3).

The protection function in NWN has not been expressed in strategic terms as such since there is no detailed protection strategy in place. While elements of ecological management which relate to the wilderness management issue are appear they are invariably *ad hoc* in nature. This shortcoming may be addressed by the implementation of a CMS process (see Chapter 3) in the near future. However, the use function *has* been expressed strategically and thus provides a stronger means of addressing the important issues.

The use function, as it relates to the management of wilderness conditions, is manifested in the Nelson/Marlborough Conservancy interim recreation strategy (DoC 1990d), which attempts to anticipate environmental and social impacts of recreational use, and to provide the highest quality of recreational experiences possible given the resources (natural and financial) which are available. The explicit issue that is recognised here is the management of *"... recreational use pressures to maximise the quality of the experience, balanced against retention of the site's conservation values, on a sustainable basis"* (DoC 1990d p40), and thus appears to be a generic articulation of the wilderness management issue. In confronting this issue, the interim strategy recognises this as being a problem of carrying capacity, both from social and ecological viewpoints, and recommends the adoption of procedures to monitor and quantify carrying capacity.

The major recreational pressure in the region, for which the assessment of carrying capacity is considered paramount, is on the Abel Tasman coastline and walking track. In fact, it is thought that carrying capacity has already been reached or even exceeded along this popular coastal walk. This has prompted harsh control techniques, notably the Facilities Use Pass (FUP) system and concerted use-monitoring efforts.

The interim strategy stresses a need to consider carrying capacity type procedures, such as LAC. While not adopting LAC specifically, the strategy does strongly recommend the ROS tool as a partial measure and one that can at least assess the spectrum of opportunities available. The use and adoption of ROS in the region and the recreation opportunity data it provides are now examined.

Recreation Opportunity Spectrum

The inclusion of ROS as an information input for the future management of recreation in the Nelson/Marlborough Conservancy was one of five high priority recommendations of the conservancy's interim recreation strategy (DoC 1990d). In the summer of 1990/91 the author was contracted to DoC Nelson to inventory recreation opportunities within the conservancy so as to provide a conservancy overview of recreation opportunity patterns (Kliskey 1991). In a dual-purpose operation this was also seen as an important data collection phase for the case-study analysis of this research.

The theoretical principles underpinning the ROS technique have been outlined in Chapter 2 and are those to which the Nelson work conformed. The inventory implemented the national standard classification procedures for ROS in New Zealand (DoC 1990d) which had been adapted to the specific needs of the conservancy. The spectrum, ranging from an Urban opportunity at one end to a Wilderness opportunity at the other, is detailed in Appendix F.

The inventory results for the Nelson/Marlborough Conservancy highlighted the predominance of opportunities at the natural end of the spectrum, Backcountry, Remote and Wilderness opportunities together accounting for 66% of the total recreation opportunity in the conservancy. Department of Conservation's control of recreation opportunities was particularly high with 43% of recreation opportunities contained within the conservation estate, and the majority of these occurred toward the natural end of the spectrum. In fact, 99% of the conservancy estate lies within the natural half of the spectrum. The responsibility which DoC has for these opportunities is particularly significant with 65% of the Backcountry, Remote and Wilderness opportunities occurring in the conservancy within DoC jurisdiction. Thus DoC has a crucial role in the conservancy in managing the natural end of the spectrum (Kliskey 1991).

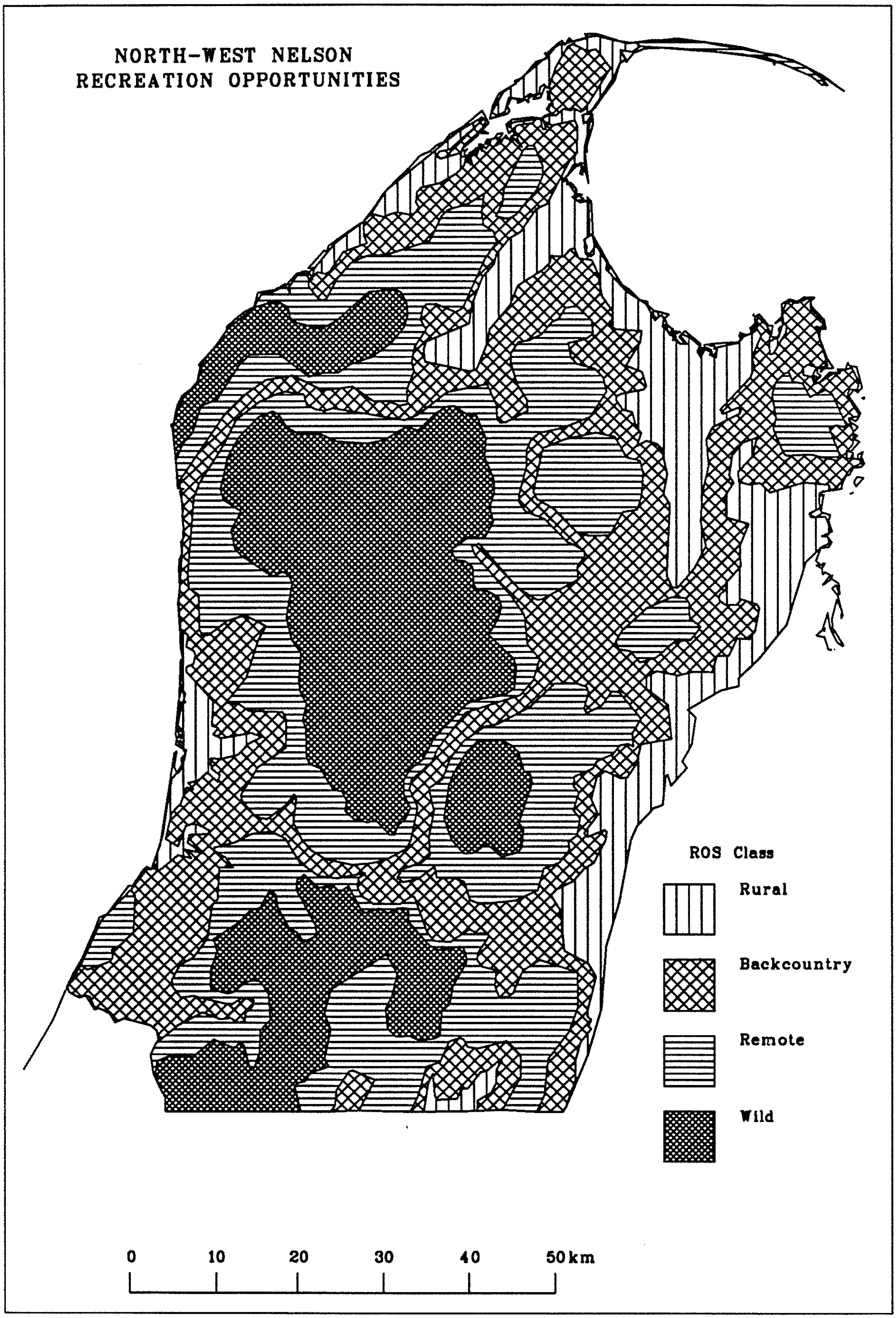
The ROS results, specific to the NWN Ecological Region, are shown on Map 8.2 and Table 8.1. Thus, Rural opportunities comprise 14% of the region, Backcountry opportunities 30%, Remote opportunities 30%, and Wilderness opportunities 26% of the entire region. The natural end of the spectrum appears to dominate with the latter three opportunities totalling 86% of total opportunities in the region. Of this total, 82% occurs in DoC estate, and this is almost entirely (99%) in the natural half of the spectrum. Thus, 1% of recreation opportunities are Rural opportunities, 30% are Backcountry, 37% Remote and 32% are Wilderness opportunities. North-West Nelson is, therefore, more heavily endowed toward the extreme natural end of the spectrum than Nelson/Marlborough conservancy, and is a region in which DoC has a particularly important responsibility for these opportunities. Thus, DoC is responsible for only 7% of Rural opportunities in the region yet has responsibility for 84% of Backcountry opportunities, 99% of Remote opportunities and complete responsibility (100%) for Wilderness opportunities in the region.

	RECREATION OPPORTUNITY[a]			
	Ru	Bc	Re	Wi
% of the region that comprises each RO[b]	14	30	30	26
% of DoC estate that comprises each RO	1	30	37	32
% of each RO in the region that is managed by DoC	7	84	99	100
% of the Tasman WA that comprises each RO	–	1	10	89

TABLE 8.1: ROS Inventory results for North-West Nelson Ecological Region

[a]Ru = Rural, Bc = Backcountry, Re = Remote & Wi = Wilderness
[b]RO = recreation opportunity

In the interpretation of the ROS inventory, the extreme natural end of the spectrum, as characterised by the Wilderness opportunity, is commonly associated with wilderness settings exclusively and with it the elicitation of wilderness experiences


NORTH-WEST NELSON
RECREATION OPPORTUNITIES
ROS Class
Rural
Backcountry
Remote
Wild
0
10
20
30
40
50 km

MAP 8.2:

as well. The examination of Wilderness opportunities in NWN highlights four such locales for this recreation opportunity (see Map 8.2). These are:

- the northern strip extending from the Heaphy/Kahurangi coastline inland to the Wakamarama ranges (this comprises 9% of the region'qs total Wilderness opportunity);
- the major core of Wilderness opportunity encompassing the central mountains of NWN (accounting for 59% of total Wilderness opportunity);
- the smaller area on the western flanks of the southern Arthur Range taking in the Crow and Little Crow catchments (6% of Wilderness opportunity in the region);
- the sizeable area encompassing the interior of the Matiri and Mokihinui Forests (25% of the region's Wilderness opportunity).

Fitting mainly into the second of these locations, the Tasman Wilderness Area largely comprises Wilderness opportunity (89%), although 10% is Remote opportunity and a further 1% Backcountry opportunity. However, the Tasman Wilderness Area accounts for only 43% of total Wilderness opportunity in the region. Thus, extensive areas of Wilderness opportunity exist outside the designated Wilderness Area, as do other relatively natural opportunities which may nevertheless provide wilderness experiences to some users.

In managing the experiential conditions of wilderness, DoC explicitly accepts responsibility for providing the Wilderness component of ROS. The interim recreation strategy, however, also accepts that each recreationist may have differing interpretations of what wilderness is. Having stated this, the strategy document then reverts to the purist concept whereby *"... the latter end of this continuum is the more usually accepted description*[of wilderness] *by New Zealand standards... "* and this is subsequently adopted by the conservancy (DoC 1990). The central issue which emerges is one where the need is *"... to deliberately retain areas for wilderness experience given increasing recreational use pressure which potentially erodes wilderness quality"* (DoC 1990d p42).

Two major points arise from this application of ROS to wilderness management. First, it is only a partial process although one which requires that standards are set and biophysical monitoring incorporated (these are central components of the LAC framework). Second, this interpretation of experiential conditions of wilderness with respect to the Wilderness opportunity founders on the conceptual weakness in the experience-setting relationship of ROS (see Chapter 2), particularly the wilderness setting-experience relationship.

8.1.3 Assessment of Wilderness Management Practices in NWN

Since early recognition of recreational pressures on the protected area system in the 1970s, the management of wilderness conditions has relied on setting aside special areas—Wilderness and Ecological Areas—as an additional overlay on the existing protected area status. While this action has provided additional protection for certain areas which are indicative of experiential or ecological conditions of wilderness, it has not allowed an integrated approach for balancing these conditions.

More recently, strategic planning efforts have enabled a longer-term and conservancy-wide approach to be taken towards carrying capacity and wilderness management issues. In particular, the conservancy recreation strategy has adopted the ROS as an inventory tool in order to define settings for recreation opportunities and also to determine the type and amount of recreation opportunity supply. This application of ROS, however, lacks a necessary monitoring component that could be provided by incorporating the LAC system with its emphasis on biophysical evaluation and monitoring of opportunity classes. It also suffers from the lack of conceptual clarity surrounding the experience–setting relationship inherent in the definition of a recreation opportunity. It is hoped this deficiency will be reduced by adopting WPM, at least with respect to the wilderness experience.

These efforts, emanating from the use component of conservation management in NWN, have lacked the underpinning of a structured protection strategy in attempting to address the wilderness management issue. The implementation of a CMS approach in the near future has the potential to provide a mechanism for integrating protection and use functions more coherently, and therefore enhancing the ability to balance ecological and experiential conditions of wilderness.

8.1.4 WPM as an Allocative Mechanism

The most direct application of WPM, in an attempt to enhance management approaches toward balancing conditions of wilderness, lies in the use of the perceptual differentials between perception levels (see Chapter 7). These differentials, which represent areas perceived as wilderness by one group but not another, provide a possible allocative mechanism for identifying *"... a variety of levels of environmental development, providing a range of satisfactory experiences, and thereby reducing pressure on a fragile and limited resource"* (Kearsley 1990 p137). That is, by virtue of different groups of people having their wilderness experiences accommodated under a range of settings, use in backcountry areas can be dispersed and directed appropriately in order to reduce damage upon ecological processes.

One mode of allocation using these multiple forms of wilderness is the operationalisation of the natural environment zoning proposed by Kearsley (1983b) in which a series of zones was suggested (see Chapter 4), as an alternative to the designation of labelled Wilderness Areas. In this case, the zoning would conform to the multiple perceptions (i.e. perception levels) that have been identified as where wilderness might be found. Thus, primeval areas which correspond to pristine wilderness desired by strong purists would be denoted by the level 4 perception map, remote experience areas that are provided with minimal facilities would comprise the level 3/4 differential, while different grades of natural areas which have easy road access and a high level of facilities would be denoted by the level 1/2 and 2/3 differentials.

However, rather than simply using the differentials for zoning they could be applied more effectively through a perceptually-based management regime, as advocated in Chapters 2 and 3, which focuses on the experiential conditions of a zone and not merely its labelling. This allows management of experiential conditions to be invoked spatially, as suggested in Chapter 4, an approach which clearly recognises perceptual differences in wilderness.

Allocation can be considered temporally as well as spatially and by examining perceptual differences between, for example, peak and off seasons for the same perception levels, it becomes possible to identify areas which thereby confer a wilderness experience at a certain time of year. Thus, referring to Maps 7.15 and 7.22, it is seen that parts of the Abel Tasman Track, the Heaphy and Wangapeka Tracks, and parts of the Tablelands area provide a perceived wilderness setting in the off-season but not in the peak-season for perception levels 2 and 3. This provides a means of establishing a management regime which allows dispersal of use in a temporal sense, as well as in a spatial sense. This supports DoC Nelson's current efforts to encourage some use of the Abel Tasman Coastal Track in the shoulder months, that is, between the middle of the peak- and the off-seasons, and away from the heavy-use peak-season.

The application of WPM differentials as an allocative mechanism is able to support a management regime which allows dispersal of use, and impacts, through perceptual distinctions. However, this is contrary to current DoC management of Wilderness Areas since it suggests people experience wilderness in different sorts of places and that these varying levels of environmental conditions can be managed to provide multiple satisfactory wilderness experiences. The thrust of this approach, therefore, is wilderness management as a *regime* rather than mere conferral of an additional protected area status. This is supported by the incorporation of user information as a technique for changing use distributions, both spatially and temporally (Brown *et al.* 1987, Lucas & Stankey 1989).

Two crucial limitations arise from this approach to the management of wilderness conditions. First, WPM differentials do not account for ecological conditions of wilderness, only for the experiential conditions, so that there is still a need to incorporate ecological monitoring of the form supported by LAC and enhanced by the UET approach. However, because the experiences of visitors provide a useful monitoring system themselves, it would be prudent to build the ecological component into the WPM approach and avoid a separate ecological monitoring system, that may entail collection of redundant information. Second, while the approach provides clarity for wilderness as a particular experience domain and the management of appropriate settings, ultimately it must be placed back in context with other experience domains as sought in the protected areas system. This then allows the management of recreation use for a range of satisfactory experiences, and not only for varying wilderness experiences. For this reason, it is useful to examine the applicability of WPM to enhance the ROS system which its advocates suggest account for the range of recreation opportunities.

8.2 Enhancement of ROS by WPM

A more realistic approach to wilderness management using WPM other than its direct application as an allocative mechanism is to use WPM to enhance the ROS system. This allows management of wilderness conditions within the context of the full domain of experiences sought, and also serves to strengthen the setting–experience relationship of ROS.

In the NWN case, the ROS inventory mapping (Map 8.2) was digitised and overlaid with the aggregate WPM (Map 7.27), and the significance of spatial association between an ROS class and WPM differential determined. Using chi-square analysis a highly significant association ($P<0.001$) was obtained between the WPM and ROS mapping, which verifies the ROS inventory.

The analysis of the ROS inventory in terms of WPM differentials shows that the further the opportunity class for an area lies toward the natural end of the spectrum, the more puristic is its perceptual differential (Table 8.2).

Rural opportunities were predominantly (56%) not perceived as wilderness although 33% of such opportunities were perceived as wilderness by non-purists only (perceptual differential 1). Backcountry opportunities were evenly related to perceptual differentials 1/2, 2/3 and 3/4, with 24%, 33% and 29% respectively conforming to this opportunity. For the Remote opportunity 30% of the opportunity related to perceptual differential 3/4 and 66% to differential 4, while the Wilderness opportunity was exclusively (99%) related to perceptual level 4.

PERCEPTUAL DIFFERENTIAL	RECREATION OPPORTUNITY[a] Ru	Bc	Re	Wi
Non-wilderness	56%	–	–	–
Diff 1/2	33%	24%	–	–
Diff 2/3	11%	33%	–	–
Diff 3/4	–	29%	30%	<1%
Level 4	–	–	66%	>99%
TOTAL	100%	100%	100%	100%

TABLE 8.2: ROS Inventory Results in terms of Wilderness Perception Differentials

[a]Ru = Rural, Bc = Backcountry, Re = Remote & Wi = Wilderness

Thus, ROS opportunities can be characterised in terms of the extent to which the setting is perceived as wilderness. The Rural opportunity is only partially perceived as wilderness by the non-purist group. The Backcountry opportunity is totally perceived as wilderness by non-purists, predominantly by neutralists while only partially by moderate purists. The Remote opportunity is totally perceived as wilderness by non-purists and neutralists, predominantly by moderate purists, while only partially perceived as wilderness by strong purists. Finally, the Wilderness opportunity is perceived as wilderness by all purism groups including strong purists. It appears, therefore, that wilderness experiences can be explicitly related to different opportunity settings for different groups of recreationists, and subsequently used to enhance the hitherto simplistic setting-experience relationship for recreation opportunities and, in particular, the experience domain of wilderness.

The complementary analysis of WPM differentials in terms of the ROS inventory similarly shows an increasingly more natural opportunity class for an area as its perceptual differential becomes more puristic (Table 8.3). Those areas that were not perceived as wilderness by any purism group predominantly (78%) provided a Rural opportunity with 22% of these areas providing a Backcountry opportunity. Perceptual differential 1/2 predominantly (60%) provided a Backcountry opportunity with smaller components (12% and 8% respectively) of Rural and Remote opportunities. The third perceptual differential, representing all purism groups except the strong purists, provided even proportions of Backcountry and Remote opportunities. Finally perceptual differential 4 (which is the same as perception level 4), in which strong purists also perceive the area as wilderness, provided both Remote and Wilderness opportunities in relatively even proportions. Thus, WPM can be interpreted and applied within the broader context of experiential domains that the ROS inventory provides.

RECREATION OOPPORTUNITY	PERCEPTUAL DIFFERENTIAL				
	0	1/2	2/3	3/4	4
Ru	78%	39%	12%	–	–
Bc	22%	60%	80%	47%	4%
Re	–	1%	8%	50%	42%
Wi	–	–	–	3%	54
TOTAL	100%	100%	100%	100%	100%

TABLE 8.3: Wilderness Perception Mapping Differentials in terms of ROS

The consideration of WPM results with respect to the ROS inventory in NWN, provide a verification of ROS and clarify the setting-experience relationship inherent in the ROS concept. This conceptual clarity applies specifically to wilderness as one experience domain. The consideration of WPM in terms of ROS, however, then allows the mapping of perceived wilderness settings and the identification of areas providing satisfactory wilderness experiences in the context of other experience domains. This not only enhances the ROS concept but also the LAC framework of which ROS is an integral component. The ability of these approaches to balance conditions of wilderness is enhanced by their extension on a perceptual basis, and even moreso in the case of LAC where a biophysical basis is also apparent.

8.3 Predictive Modelling using WPM—the Heaphy Scenario

The two modes of application for which WPM has been considered thus far in respect to wilderness management have concentrated on the conditions of an area, in this case NWN, at the present time. That is, the experiential and ecological conditions of wilderness as determined by existing use and processes. However, there is considerable potential for considering the outcome that proposed policy or development changes would have on the region in terms of wilderness perceptions. As a predictive modelling tool, and using GIS, WPM would enable the impact of recreational or non-recreational land use activities on perceptions of wilderness to be modelled. It would then be possible to examine the effects of a particular scenario on each perception level as to what is perceived as wilderness.

In NWN the Heaphy controversy (the debate over the proposal to construct a road linkage between Karamea and Collingwood) provides a very useful scenario that is symptomatic of a typical environmental conflict—whether to construct or not—and one which closely parallels other roading issues related to natural areas in New Zealand, such as the Greenstone and Hollyford/Jackson's Bay proposals in Fiordland.

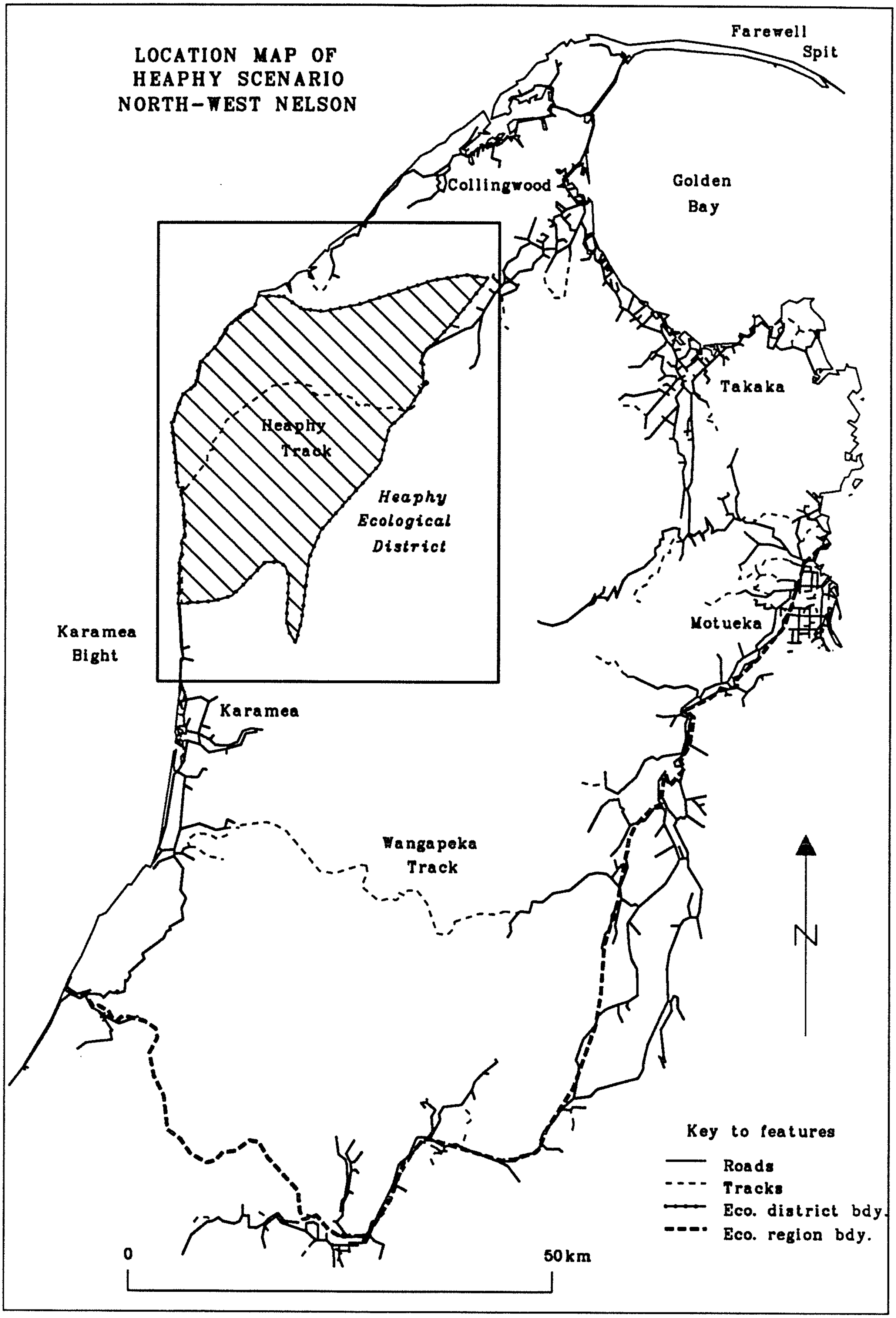
8.3.1 Background to the Heaphy Controversy

The Heaphy controversy arose during the early 1970s following a proposal to build a road along part of the Heaphy Track. The locality which is the subject of the controversy is shown on Maps 8.3 & 8.4.

The Heaphy Track, one of New Zealand's more popular tramping tracks, is a relatively easy 78 km walk linking the Aorere valley in Golden Bay with Karamea on the region's west coast. The northern track-end lies at the junction of the Brown and Aorere Rivers, not far from Collingwood. From here the track rises through podocarp and beech forest to its highest point on Perry Saddle then across the rolling tussock of Gouland Downs, down the Heaphy River and along the warm temperate forested coastline to the southern track-end at the Kohaihai River (see Plates 8.1–8.6).

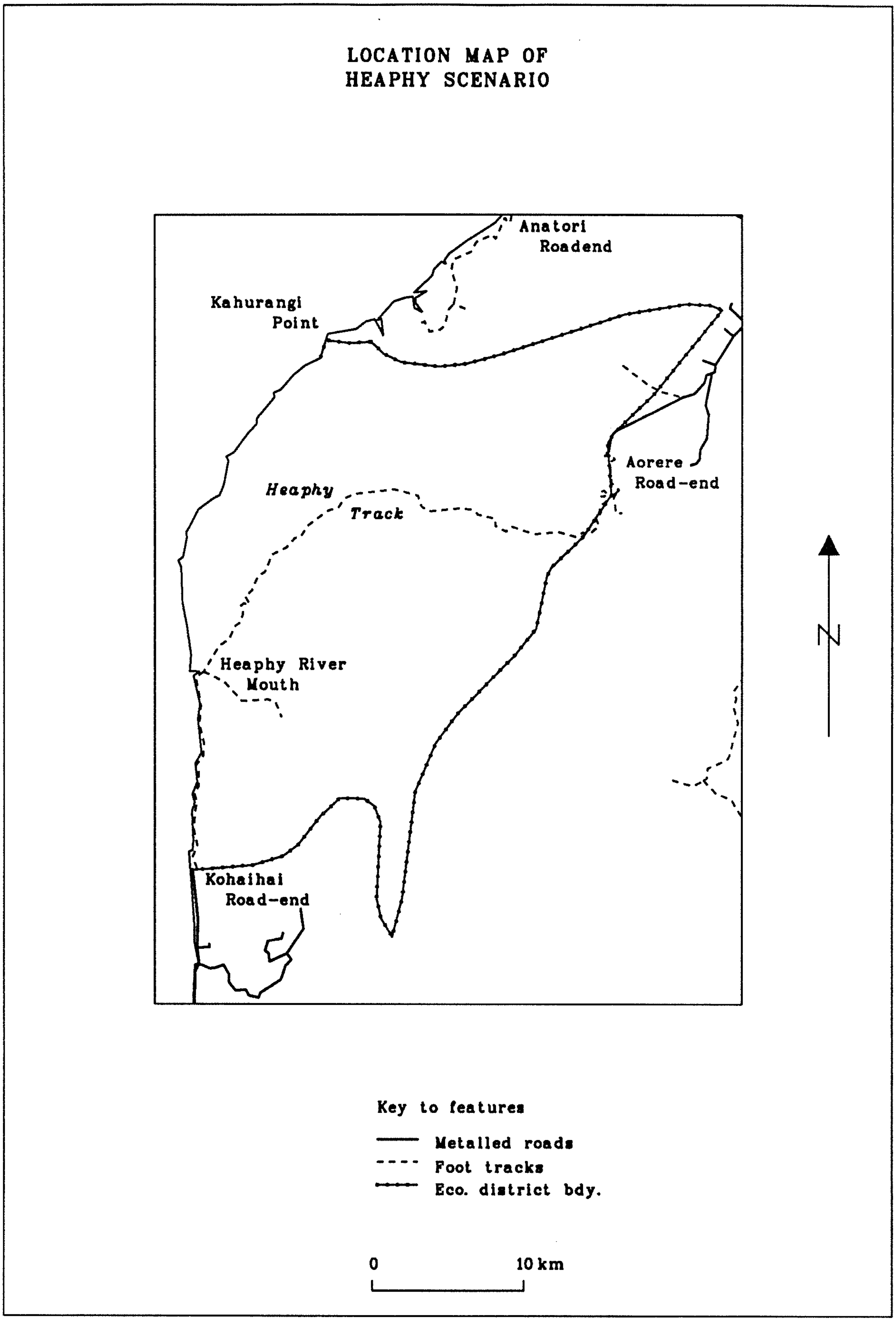
In 1846, Charles Heaphy, after whom the track is named, along with Thomas Brunner, were the first Europeans to cross what is now the coastal section of the track, accompanied by two Maori guides. The inland section of the track's route remained uncrossed by Europeans until two gold diggers traversed the route in 1857 following James Mackay and John Clark's explorations in the area in 1856. Mackay returned in 1862 to cut a rough saddle track from the upper Aorere to the mouth of the Heaphy. A bridle track was later surveyed and constructed along this route between 1882 and 1900. Whilst initially receiving fairly heavy usage for both grazing and prospecting, the route fell into disuse with the exception of occasional recreational passage on foot or horseback. It was not until the establishment of NWNFP in 1965, when the track came under the control of the NZFS that the it was cleared and progressively upgraded for recreational use. With control having now passed to DoC, the track and its use falls within the jurisdiction of the Heaphy Track Recreational Strategy Plan (DoC 1988b). An increasingly popular tramping route, the track currently attracts over 4000 overnight users per annum, which ranks it alongside New Zealand's most renowned routes—the Milford and Routeburn Tracks.

Controversy first arose in 1907 when the Buller County Council advocated the opening of a vehicle road by the route, the *Heaphy Track Road*. This has been a perennial *promise* in Golden Bay and Karamea by successive governments and politicians. The proposal resurfaced most recently in 1970 when the Golden Bay and Buller County Councils, along with regional tourism interests, mooted the idea



LOCATION MAP OF
HEAPHY SCENARIO
NORTH-WEST NELSON
Farewell
Spit
Collingwood
Golden
Bay
Takaka
Heaphy
Track
Heaphy
Ecological
District
Karamea
Bight
Motueka
Karamea
Wangapeka
Track
N
Key to features
Roads
Tracks
Eco. district bdy.
Eco. region bdy.
0
50km

MAP 8.3:



LOCATION MAP OF
HEAPHY SCENARIO
Anatori
Roadend
Kahurangi
Point
Aorere
Road-end
Heaphy
Track
Heaphy River
Mouth
Kohaihai
Road-end
N
Key to features
Metalled roads
Foot tracks
Eco. district bdy.
0
10 km

MAP 8.4:

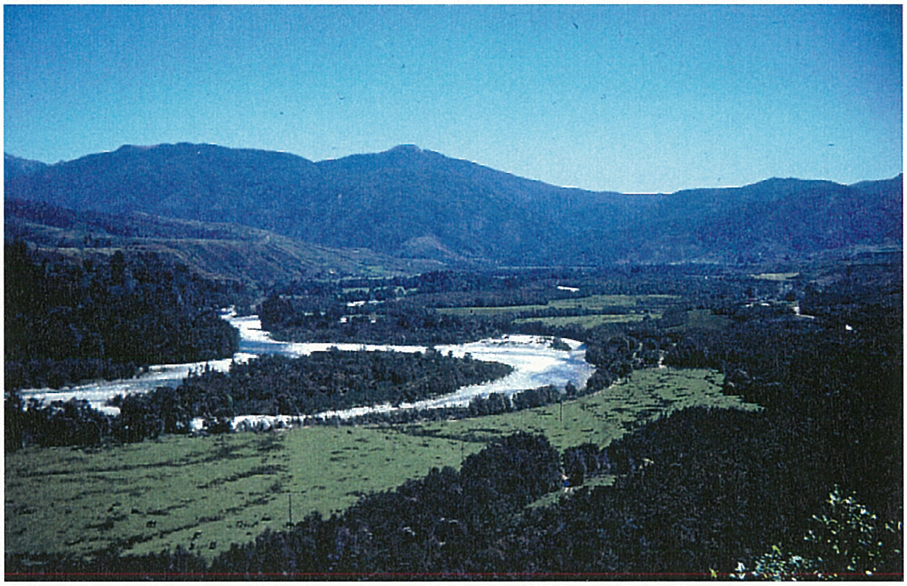


PLATE 8.1: Upper Aorere Valley looking toward Perry Saddle
NZMS 262-9 (468043)→ SW

PLATE 8.2: The tussock-covered Gouland Downs
NZMS 262-9 (456034)→ SE

PLATE 8.3: Bridge-crossing on the Heaphy River near the Lewis River confluence
NZMS 262-9 (439029) → NE

PLATE 8.4: Warm Temperate Forest along the Heaphy Track Coastal section
NZMS 262-9 (435015)

PLATE 8.5: The Heaphy Coastline form Kohaihai Bluff
NZMS 262-9 (435012)→ N

PLATE 8.6: Kohaihai River and Road-end
NZMS 262-9 (435011)→ S

of road construction. This led to an intensive campaign of support in 1973. The controversy came about with the equally intensive opposition that arose to the proposal. Centred on local and regional *ad hoc* committees, the Organisation to Preserve the Heaphy (OPH) also drew support from national organisations such as FMC and the Royal Forest & Bird Protection Society (RF&BPS).

Those advocating the proposal argued a need to link Karamea and Collingwood in order to:

- alleviate the relative isolation of their districts and allow trade between the two centres;
- to generate tourist traffic and provide a circular touring route in the region;
- as an alternative route in an emergency; and,
- to provide employment during road construction.

The opponents countered these suggestions contending that the linkage was unnecessary because:

- the two districts had similar farming and milling economies;
- there was a greater need for good communications with their nearest main centres;
- it would not shorten the road distance from either place to Nelson or Westport;
- while the road would generate tourism so would the existing track and its walkers; and,
- the alternative access argument was spurious since a major natural disaster would be likely to sever all links.

As well as arguing against the proposal on purely economic grounds, the opponents of the road argued for the retention of an undeveloped walking route as a recreational asset, and for *"... the wilderness quality of the surrounding NWN hinterland"* (Henson 1977).

The then Ministry of Works and Development undertook a feasibility study of road routes, concluding that a road extension of the existing road to West Whanganui and Paturau, was more feasible than a road following the entire route of the Heaphy Track. On 26 September 1973 the Minister of Works announced a decision in principle on the coastal route. The general description of the route is as follows (also see Map 8.5):

> *At the northern end, existing roading coming from Collingwood around the Whanganui Inlet goes as far as the Anatori River. From the end of the road, the route follows the coast for a few miles before turning inland and climbing up to the Mackay Downs. From there it follows the Lewis River to its confluence with the Heaphy River. From this point it follows the Heaphy Track down to the coast and along the beach to the end of the road from Karamea.*
>
> (Nature Conservation Council 1974)

The route was, however, little more than a line on a map and required detailed plans to be drawn up. The details of an inspection report by an Advisory Officer from the Nature Conservation Council (NCC) are given in Appendix H and this highlighted some of the ecological impacts of the proposal. As a result the NCC adopted a policy of opposition:

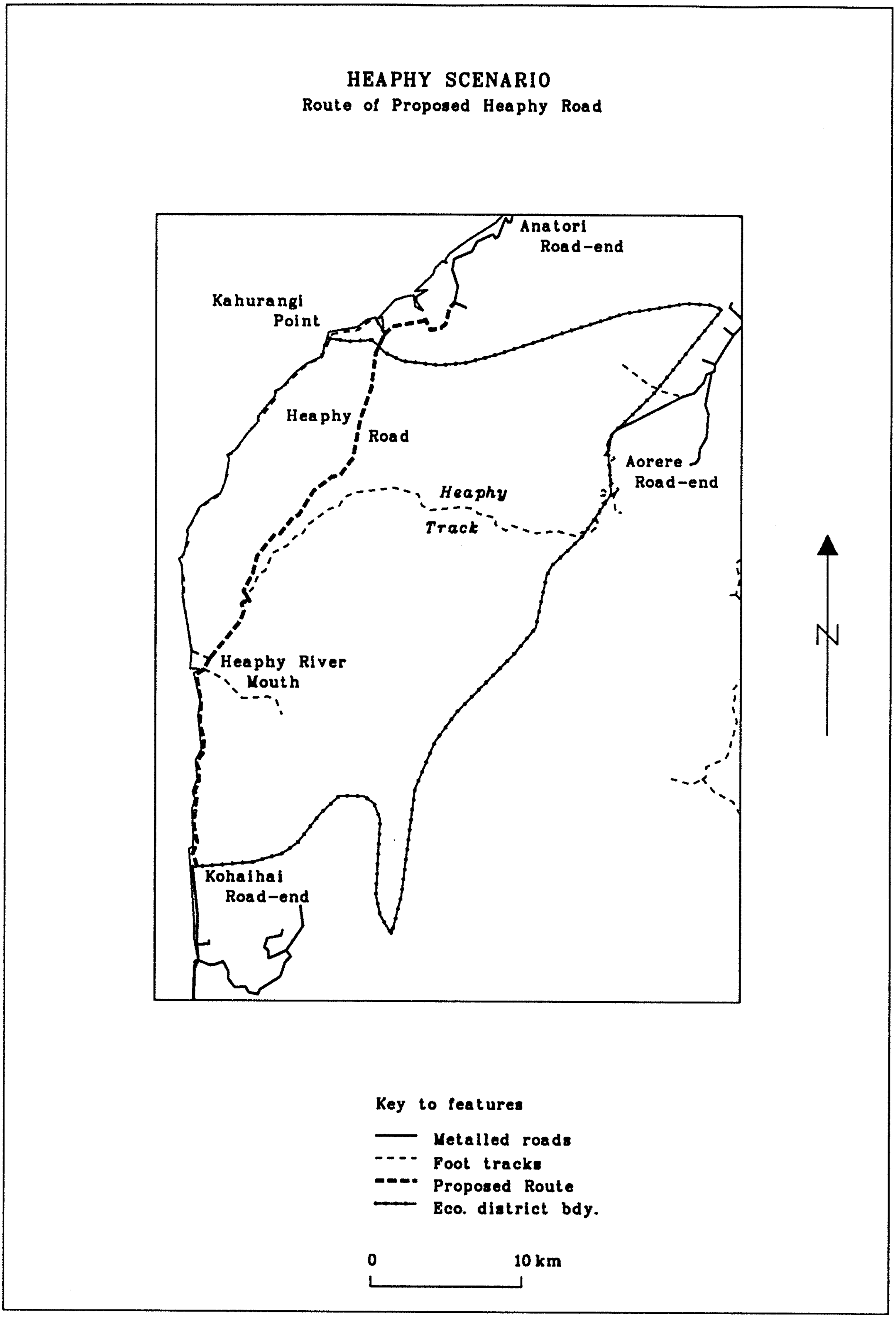
> *"... to any road going through the area, on the grounds that it is unnecessary, that its benefits are very questionable in relation to its costs and that the route as proposed would effectively destroy approximately a ten mile stretch of coastline which is almost unique in New Zealand and which forms an integral part of the Heaphy Track."*
>
> (NCC 1974)

This report, in association with a high profile campaign by OPH throughout 1973 and 1974, saw the proposal shelved by the Government. A further attempt to reactivate the road proposal in 1975 was unsuccessful.

The controversy has subsequently faded, and road linkage in the near future is unlikely, although regional parochialism and devolution of resource management responsibilities to regional governments could see the proposal emerge once again.

8.3.2 The Heaphy Controversy as a Scenario

One of the more intangible arguments for the retention of the track, and against the road proposal, revolved around the *wilderness quality* of the surrounding area and the likely detrimental effects of the proposal it. Although very much in the forefront of opponents' motives, wilderness conditions were relatively difficult to evaluate, and it was easier to argue against more tangible economic considerations. Similarly, it was difficult for advocates of the road proposal to appreciate these conditions without substantial evidence. While the NCC report provided a basis for environmental and ecological aspects of the proposal's impacts, the experiential conditions of wilderness remained in the realm of opponents' broad opinions. This


HEAPHY SCENARIO
Route of Proposed Heaphy Road
Anatori
Road-end
Kahurangi
Point
Heaphy
Road
Aorere
Road-end
Heaphy
Track
Heaphy River
Mouth
Kohaihai
Road-end
N
Key to features
Metalled roads
Foot tracks
Proposed Route
Eco. district bdy.
0
10 km

MAP 8.5:

has often been the case with the subjective nature of perceptual constructs such as wilderness, especially in the face of environmental conflict of the kind typified by the Heaphy controversy. However, WPM operationalised through GIS provides a mechanism through which perceptions of wilderness can be spatially determined and modified for a given set of changes. Therefore, the Heaphy Track Road proposal is now examined as a scenario in which the effects of a major development proposal in a natural environment can be modelled in terms of the spatial extent of perceived wilderness.

Modelling the changes for the scenario

Predictive modelling of WPM for the scenario requires that likely changes be considered with respect to the WPM methodology. Thus, the effects on each of the four general properties of wilderness must be considered.

With respect to the scenario artifactualism is likely to reflect increased human impact and more facilities in the area. Most obviously this relates to the proposed road itself but also to new walking tracks, huts and campsites which might be expected.

The remoteness property could be expected to change considerably with the area being perceived as less remote than previously. Increased access would result, not only from the proposed road itself, but from the opening up of adjacent areas through new and upgraded tracks and routes.

The solitude property is also likely to sustain considerable change, with increased access and facilities likely to change use patterns and levels and, therefore, the number of encounters likely in the area. Solitude is thus likely to decrease with the effects most obviously felt on the Heaphy Track but also with regional implications likely to flow on to the Wangapeka Track resulting from a displacement effect of use from the Heaphy Track.

Naturalness would not necessarily suffer a great deal of change apart from the obvious clearance of vegetation for the road route. There is also the possibility of later clearance adjacent to the road and interference with species succession, although these will not be included in this model.

The likely changes for these four properties broadly reflect the key differentiating factors between backcountry user's images of natural environments generally *vis-à-vis* wilderness (see Chapter 4 and Table 4.4). Thus, even before modelling the predicted WPM, significant impacts upon perceptions of the area can be expected. The changes for each property must then be incorporated in the geographic database so that WPM can be undertaken with respect to the modelled changes. The unit for analysis of the WPM of the scenario is the Heaphy Ecological District, one of the nine districts in NWN, that largely contains the proposed road linkage (see Map 8.4).

The Modified Geographic Database

The geographic database was modified to accommodate the predicted effects of the scenario on the four wilderness properties. These are reflected in changes to the geographic variables indicating each property. Thus, the access features (AXS coverages) are modified by adding appropriate road and track segments, and altering attribute values to reflect tracks and routes which have been upgraded. The encounter features (ENC coverages) are updated to reflect changes in use levels while structure features (STX coverages) and naturalness features (NTL coverages) are modified slightly to reflect the changes in these. The major changes, to access features, are shown in Map 8.5, while Map 8.4 shows the existing situation.

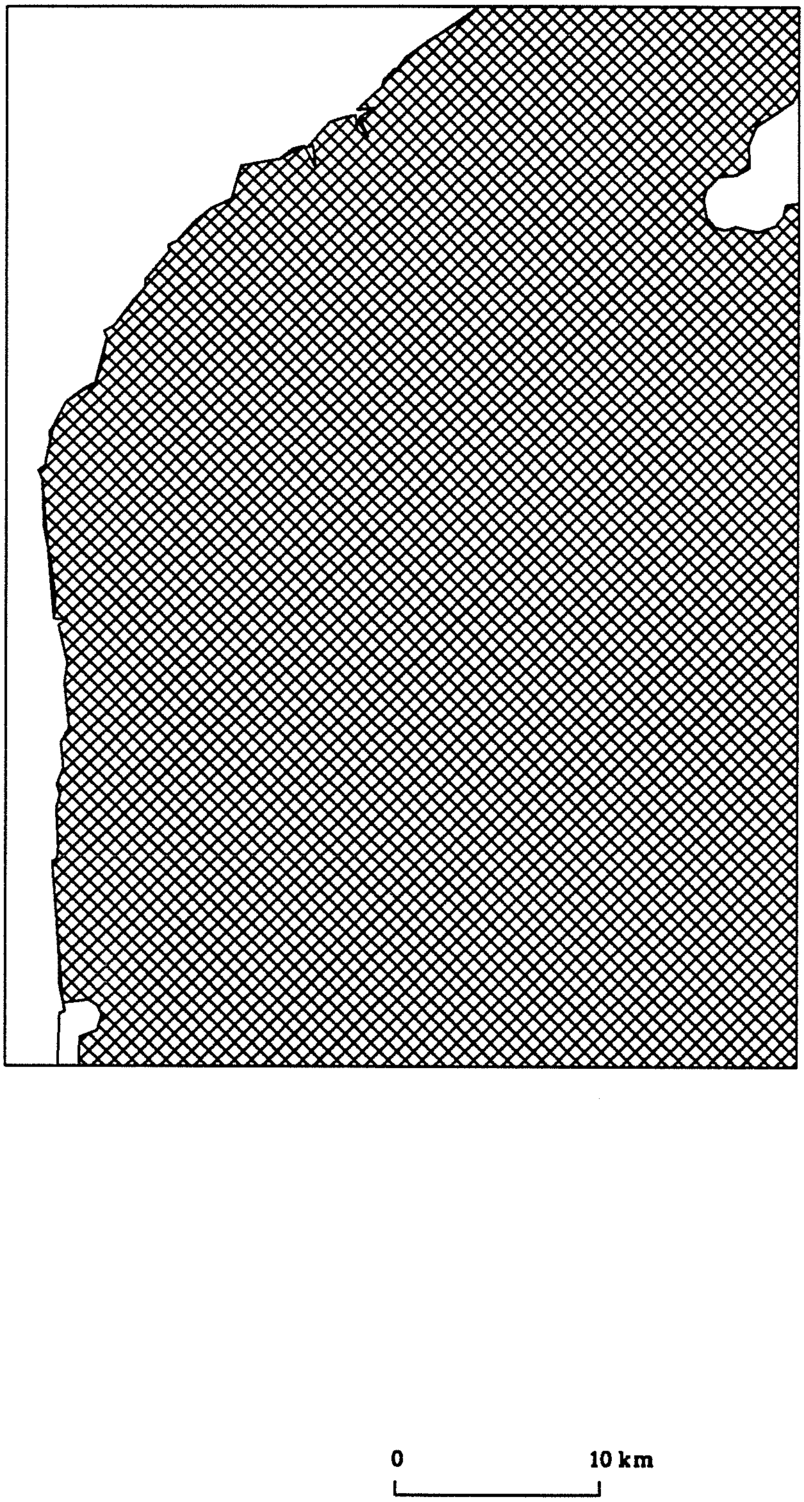
The modification of the database required both spatial changes to accommodate new features (requiring digitising) and attribute changes to account for updated feature descriptions (requiring tabular manipulation). Once the database was modified and checked, the WPM methodology was applied to obtain WPM for the Heaphy scenario. The scenario mapping could then be compared to the WPM for the existing situation allowing changes in the spatial extent of perceived wilderness to be determined.

8.3.3 WPM for the Heaphy Scenario

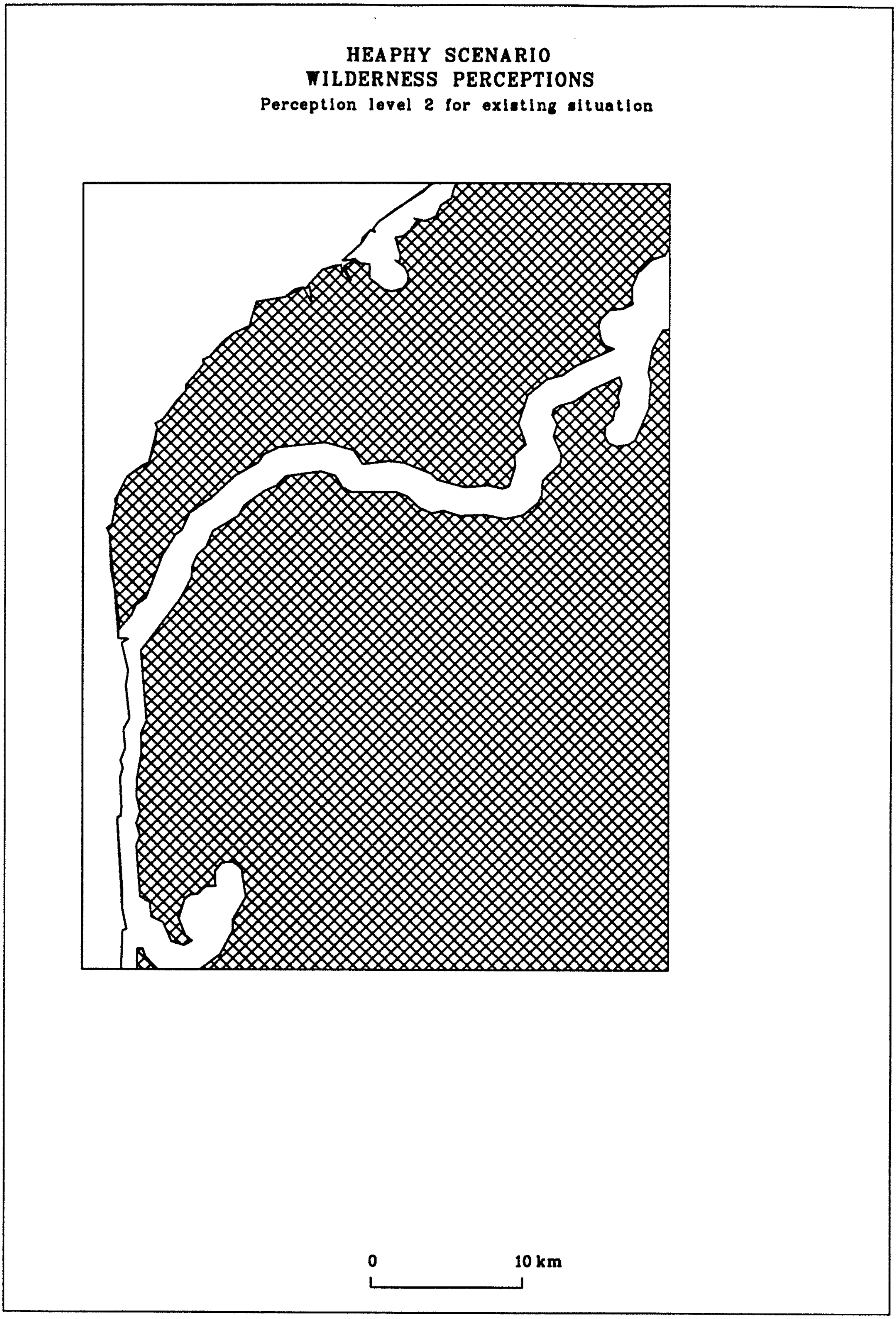
The WPM for the conditions under the existing situation are shown in Maps 8.6–8.10. Wilderness perception mapping for perception level 1 (Map 8.6) shows the area perceived as wilderness in the Heaphy Ecological District by non-purists. This comprises the vast majority (99%) of the district (see Table 8.4) The extent of wilderness perceptions for perception level 2 (Map 8.7) covers 87% of the district. Perceived wilderness accounts for 85% of the district under perception level 3 (Map 8.8) while perceptions of wilderness account for 80% of the district under perception level 4 (Map 8.9).

The aggregate perception map (Map 8.10) shows the perceptual differentials for the ecological district for which the composition by each differential is shown in Table 8.4. Thus, perceptual differential 1/2, the spatial difference in perceived wilderness between perception levels 1 and 2, comprises 12% of the district. Perceptual differential 2/3 accounts for only 2%, and differential 3/4 comprises 5%. The remaining area (80%) is the spatial extent of wilderness for perception level 4 identified above. Compared to NWN Ecological Region the Heaphy Ecological

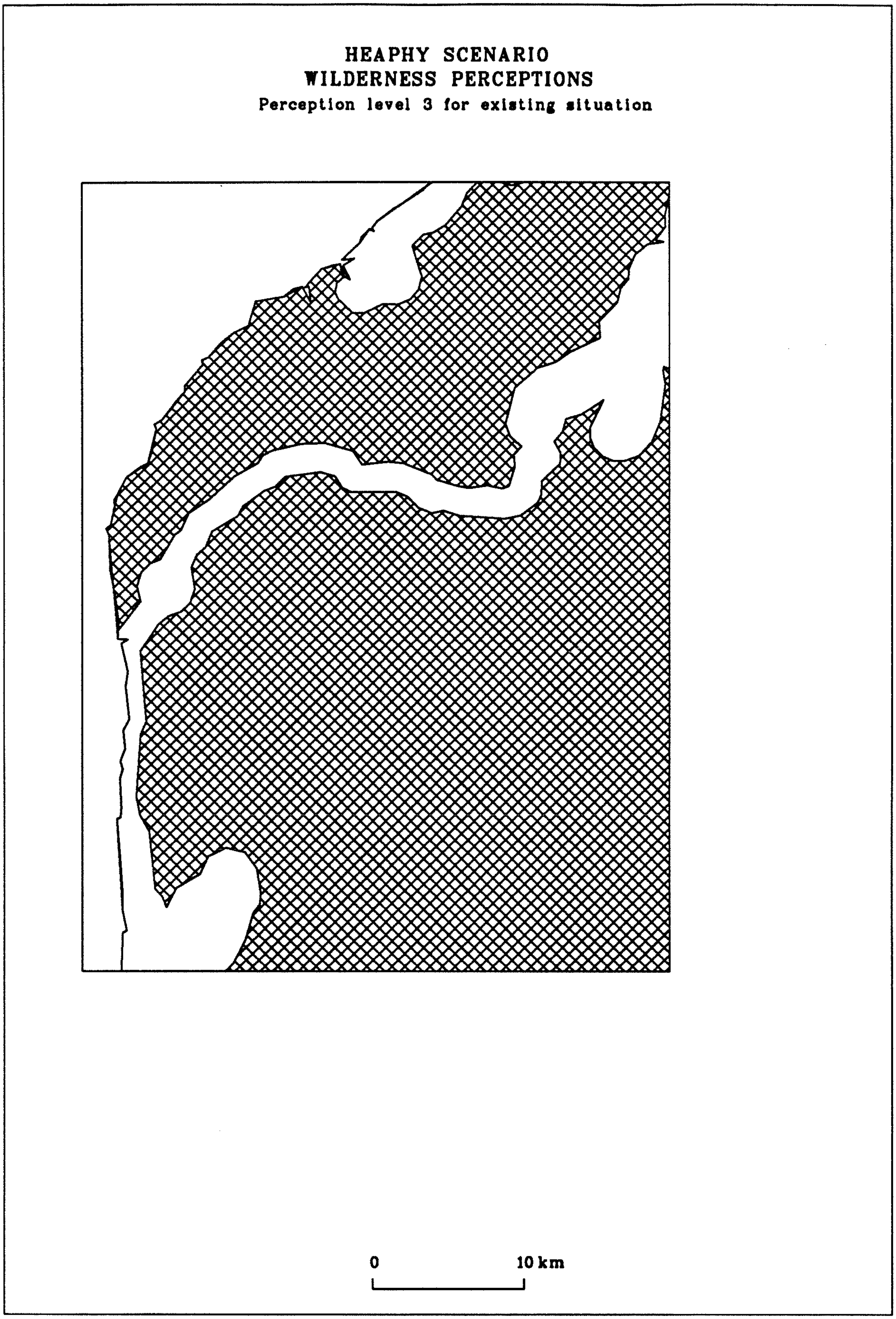
HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 1 for existing situation



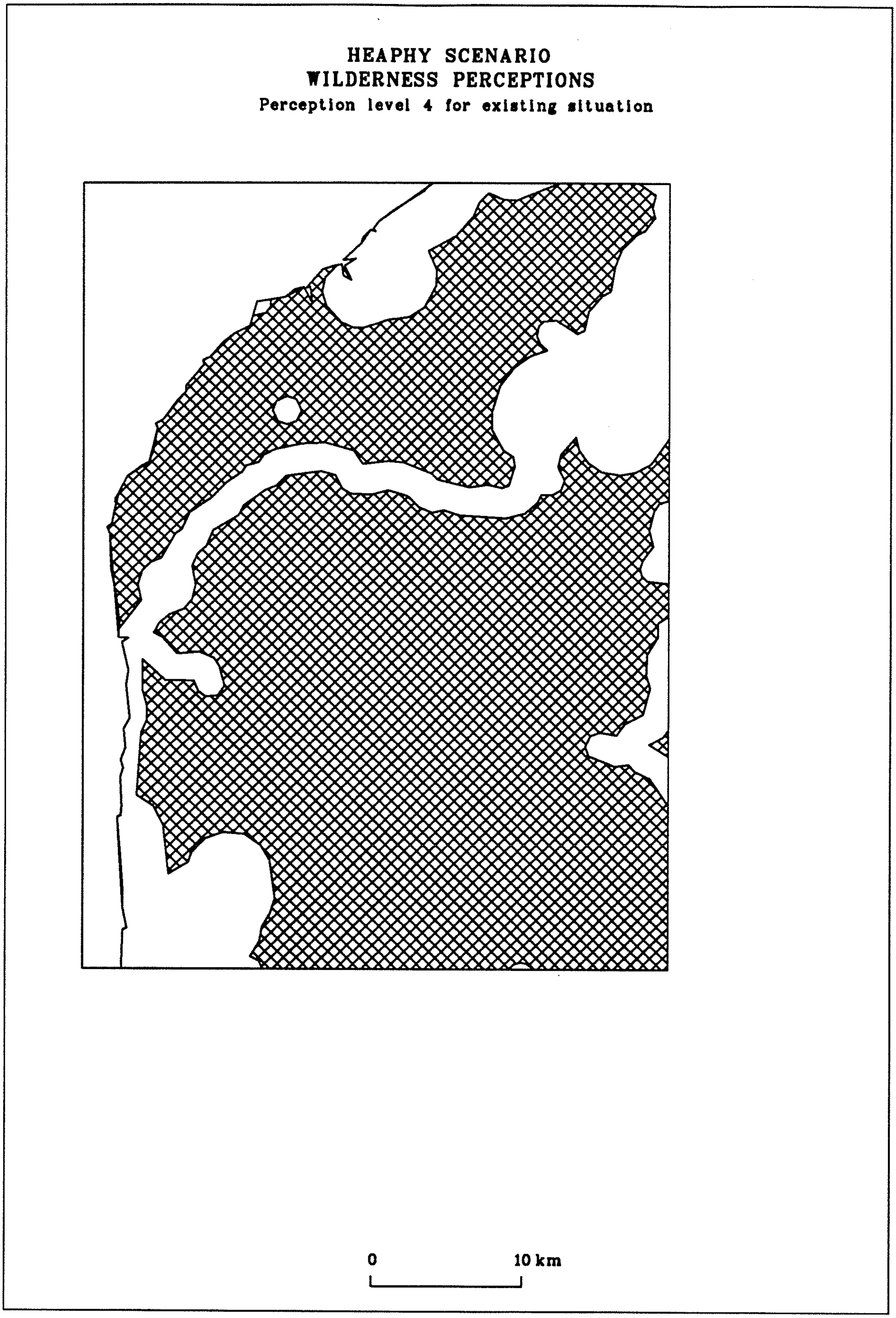
MAP 8.6:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 2 for existing situation
0
10 km

MAP 8.7:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 3 for existing situation
0
10 km

MAP 8.8:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 4 for existing situation
0
10 km

MAP 8.9:

District contains a higher percentage of area perceived as wilderness under all four perception levels.

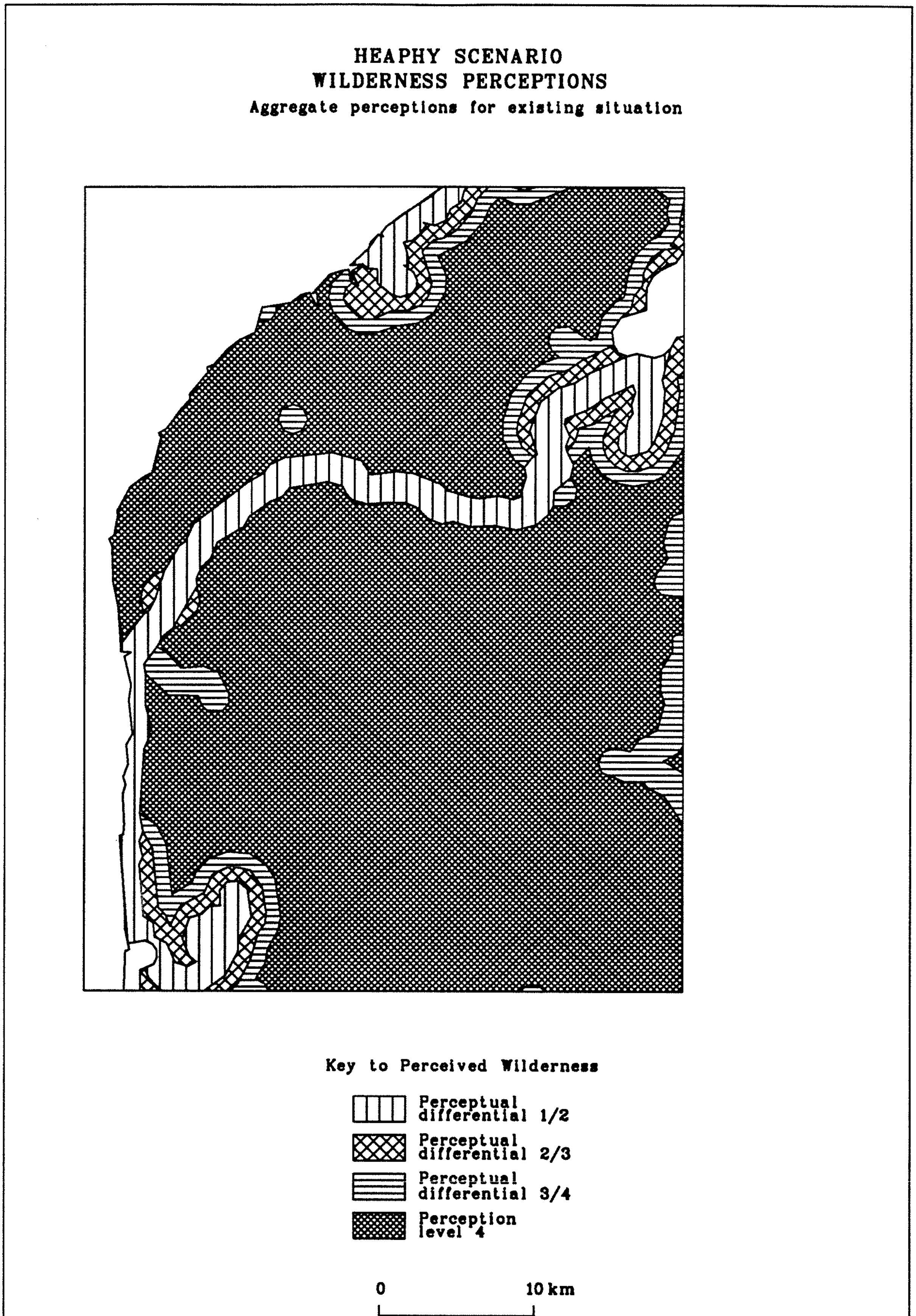
The comparable WPM for the conditions modelled under the Heaphy scenario are contained in Maps 8.11–8.15. These show the expected extent of wilderness perceptions for each perception level and the aggregate perceptions under the scenario proposal. The composition of the district in terms of these perception levels and differentials are shown in Tables 8.4 and 8.5 respectively. The area perceived as wilderness by perception level 1 for the Heaphy scenario (Map 8.11) comprises 99% of the district and represent no change from the existing situation. The extent of perceived wilderness for perception level 2 (Map 8.12) accounts for 84% of the district which signifies a 3% difference from the existing situation. Perceived wilderness for perception level 3 (Map 8.13) comprises 71% of the district, a difference of 14% from the existing situation, while perceptions of wilderness account for only 58% of the district for perception level 4 (Map 8.14), which represents a 22% difference from the existing situation. Map 8.15 shows the aggregate perception map, and its perceptual differentials, for the scenario situation.

PERCEPTUAL LEVEL	EXISTING SITUATION	SCENARIO SITUATION	Δ
1	99%	99%	0%
2	87%	84%	3%
3	85%	71%	14%
4	80%	58%	22%

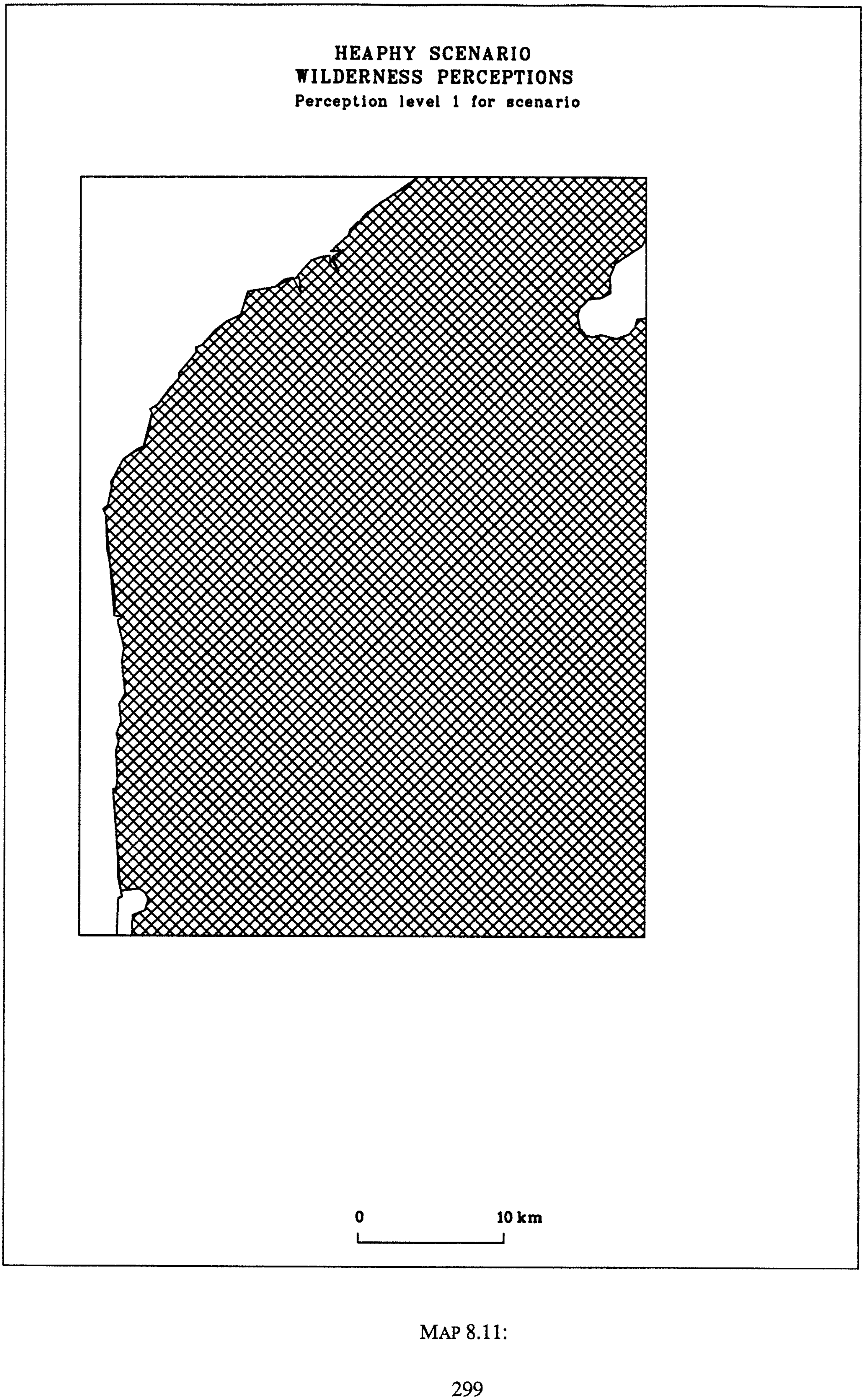
TABLE 8.4: Percentage of Heaphy Ecological District Perceived as Wilderness (WPM) for Existing and Scenario Situations

Differences between the aggregate perceptions pertaining to the Heaphy scenario (Map 8.15) and those for the existing situation (Map 8.10) can also be noted. Thus, perceptual differential 1/2 comprises 16% of the district, a 4% reduction from that for the existing situation. Perceptual differential 2/3 amounts to 13% of the district, an 11% change, and perceptual differential 3/4 accounts for a further 13% of the district, an 8% change. The changes in perceived wilderness resulting from the scenario are more marked for the stronger purist perception levels.

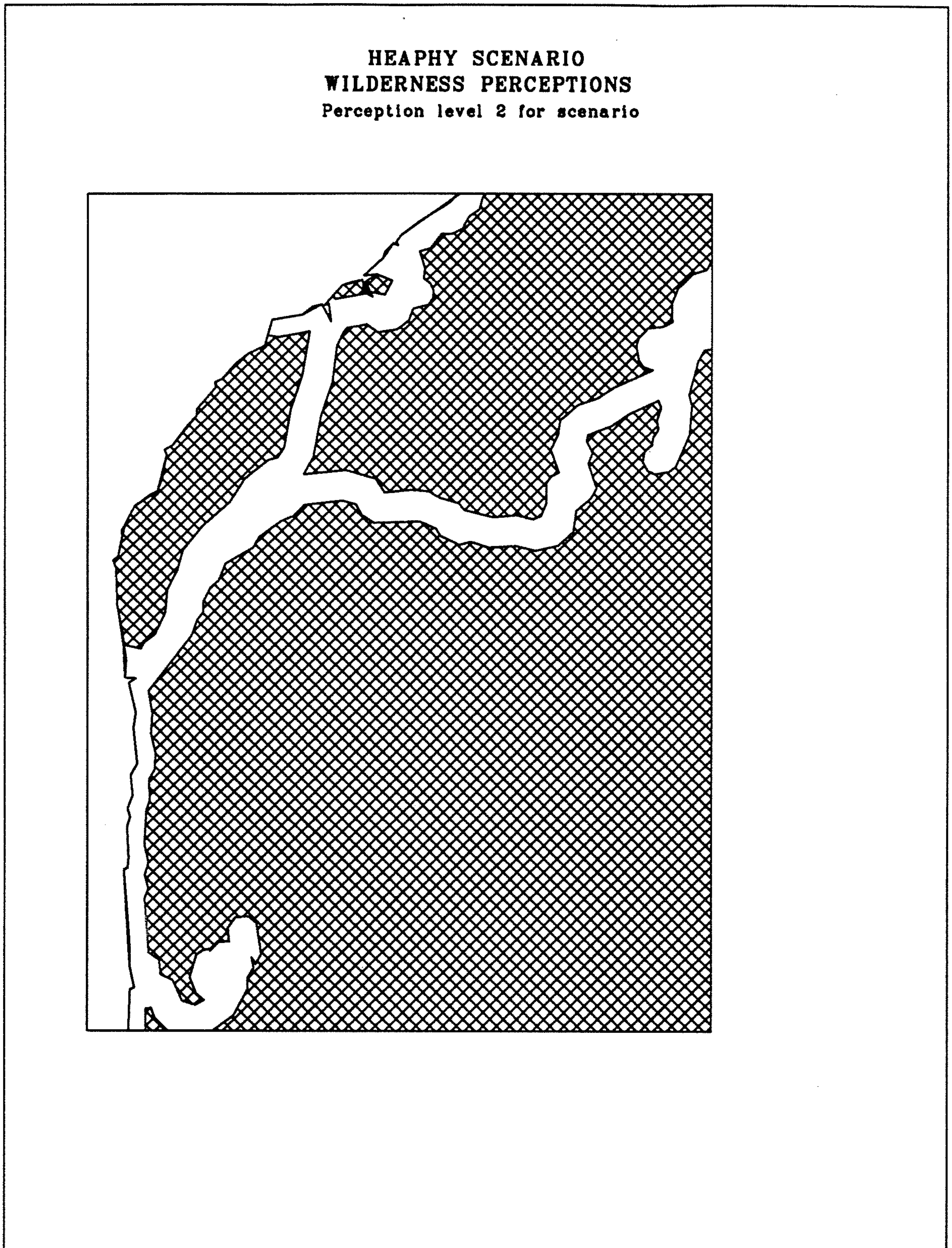
A further representation of changing wilderness perceptions was determined by overlaying the aggregate perception maps for the two situations (Maps 8.10 and 8.15) and extruding the areas for which there had been a change in perceptual differentials (see Map 8.16). The most pronounced effect would be upon perception level 4 for which there is an apparent reduction of 22% in the area of the district


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Aggregate perceptions for existing situation
Key to Perceived Wilderness
Perceptual differential 1/2
Perceptual differential 2/3
Perceptual differential 3/4
Perception level 4
0
10 km

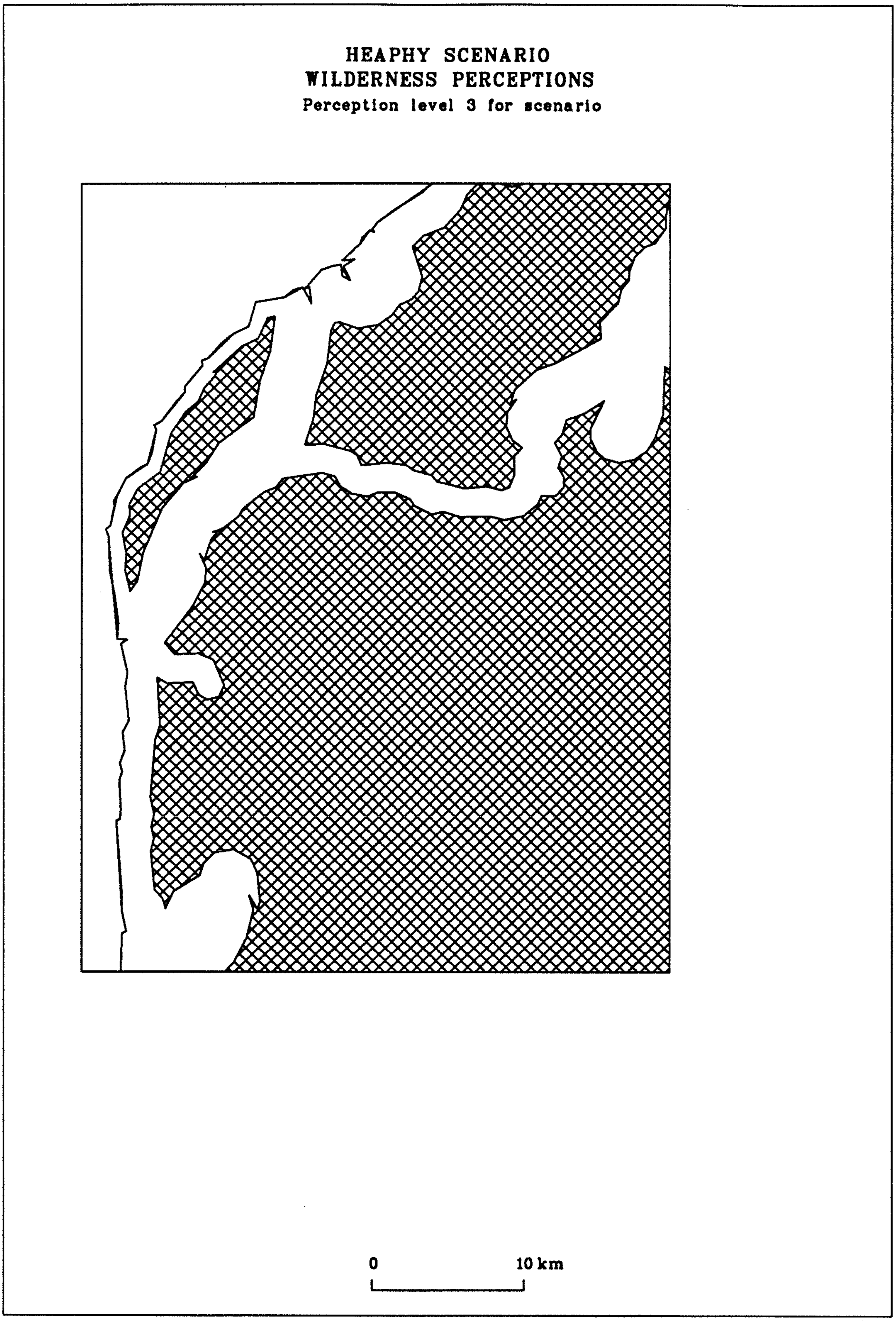
MAP 8.10:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 1 for scenario
0
10 km

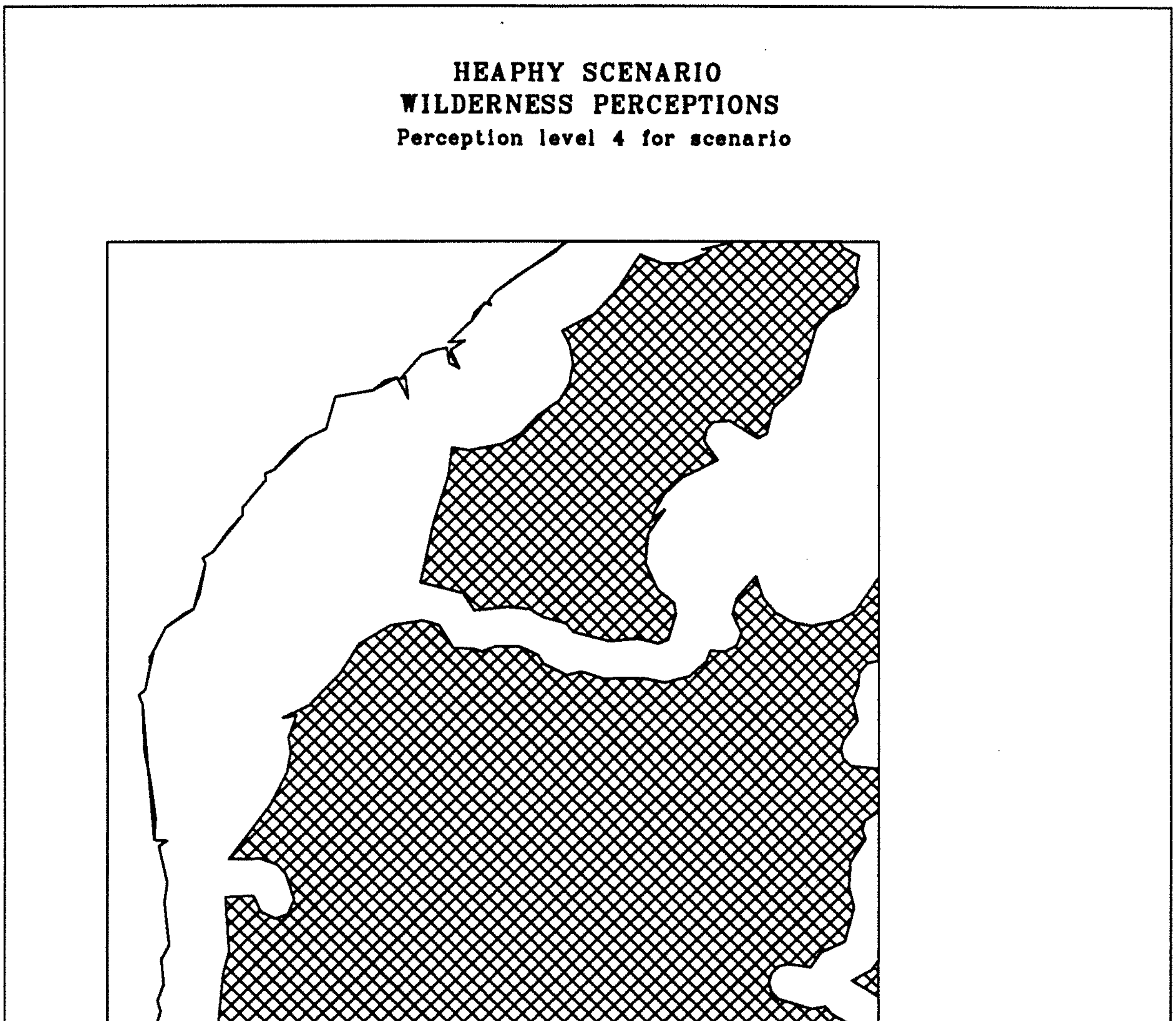
MAP 8.11:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 2 for scenario
0
10 km

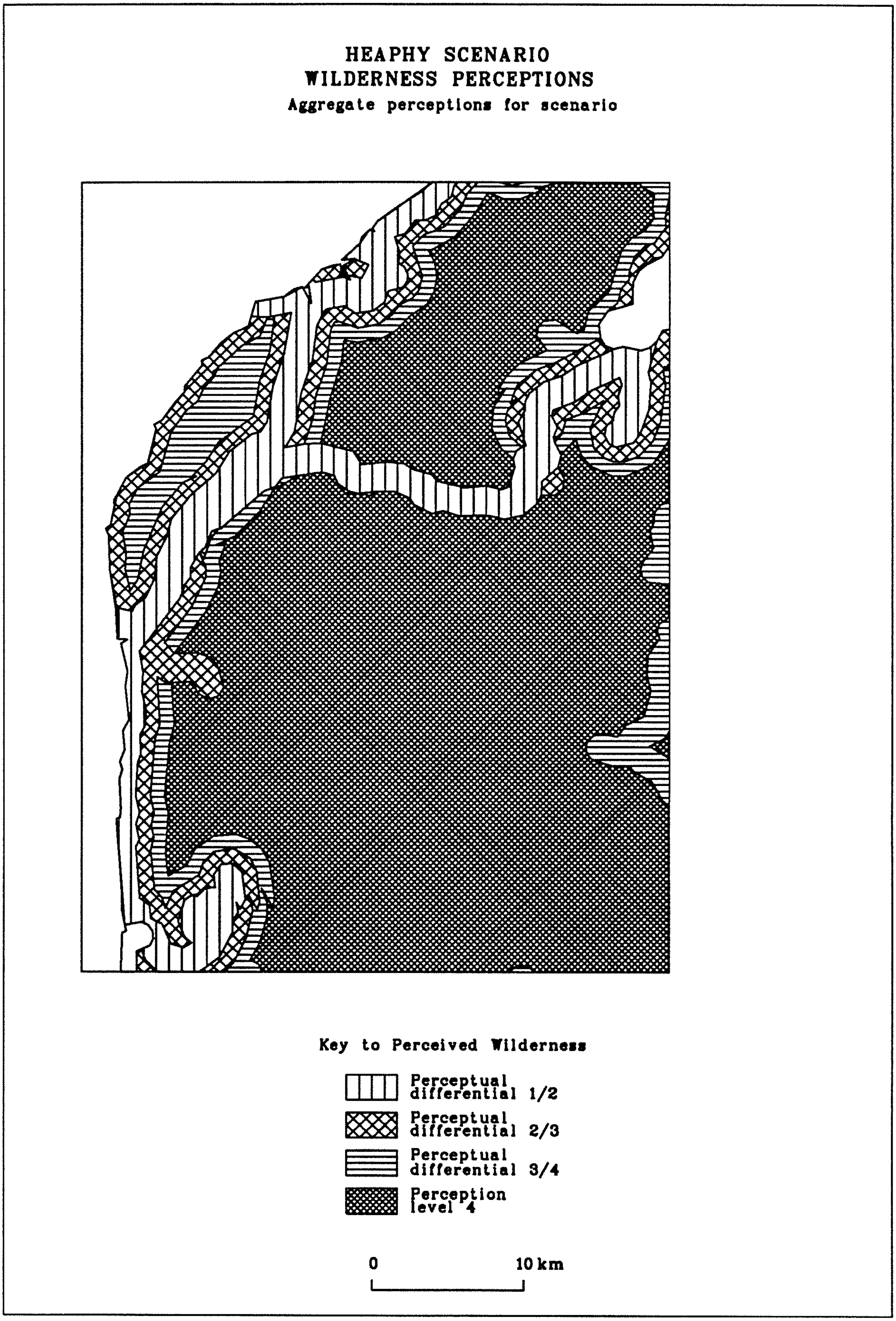
MAP 8.12:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 3 for scenario
0
10 km

MAP 8.13:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perception level 4 for scenario
0
10 km

MAP 8.14:


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Aggregate perceptions for scenario
Key to Perceived Wilderness
Perceptual differential 1/2
Perceptual differential 2/3
Perceptual differential 3/4
Perception level 4
0
10 km

MAP 8.15:

PERCEPTUAL DIFFERENTIAL	EXISTING SITUATION	SCENARIO SITUATION	Δ
1/2	12%	16%	4%
2/3	2%	13%	11%
3/4	5%	13%	8%
4	80%	58%	22%
TOTAL	100%	100%	

TABLE 8.5: Percentage of Heaphy Ecological District comprising each Perceptual Differential for Existing and Scenario Situations

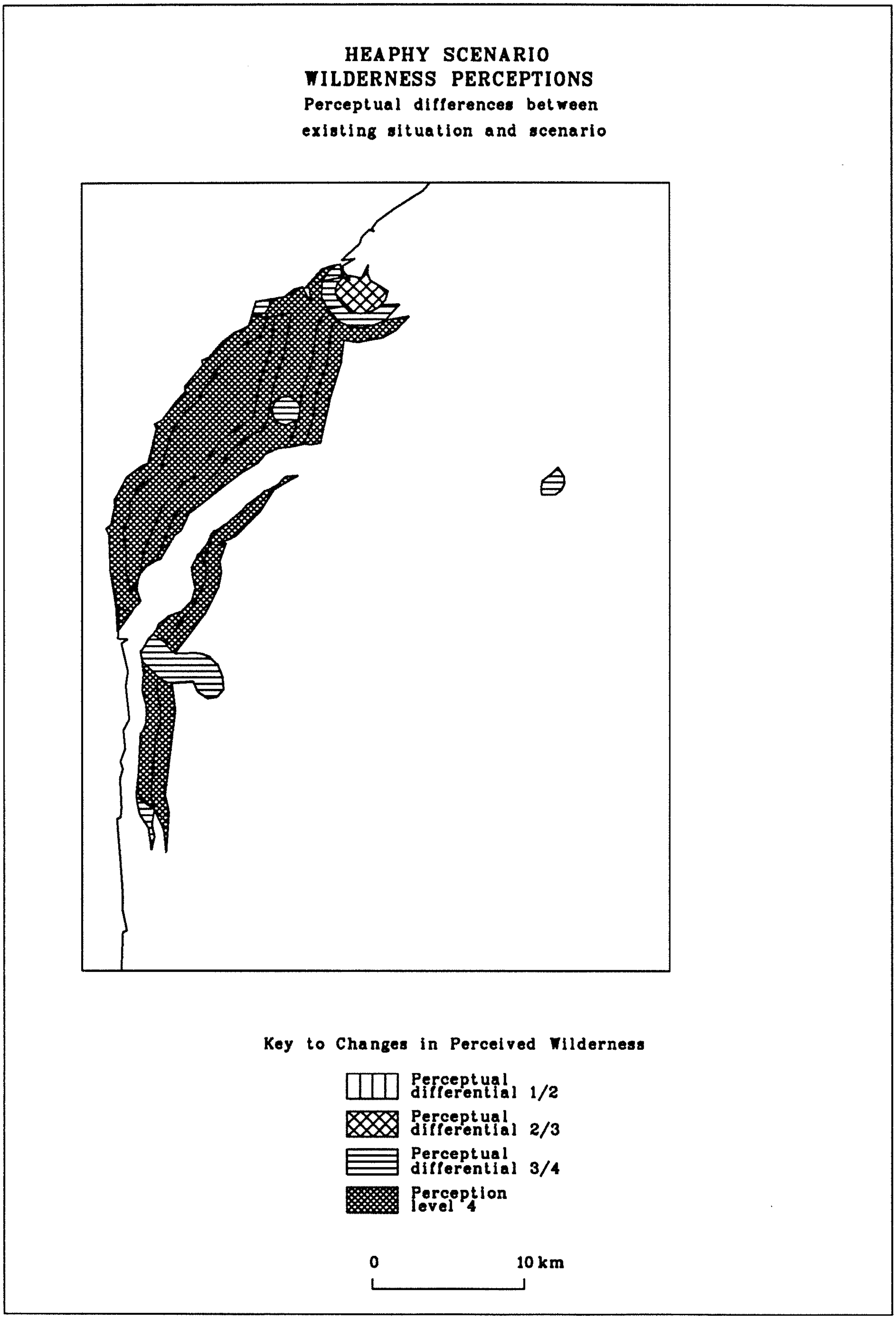
perceived as wilderness. This area most notably occurs along a swath adjacent to the Heaphy/Kahurangi coastline. The effect upon perception level 3 is also substantial, though somewhat smaller in total area, with an apparent reduction of 14% in the area of the district that is perceived as wilderness. This occurs along the Heaphy–Kahurangi coastline also. The Heaphy proposal appears to incur only a 3% reduction in perceived wilderness for perception level 2 while there is no apparent reduction in the area perceived as wilderness for perception level 1, as modelled using the WPM methodology. These results highlight the comparison of the aggregate maps for the existing situation and for the scenario.

8.3.4 The Implications of Predictive Modelling

Multiple wilderness perception mapping has allowed the spatial effects of the Heaphy road proposal, based on perceptions of wilderness, to be identified and quantified in terms of the total area of the Heaphy Ecological District. Much of the area over which perceptions of wilderness appear to have been impacted upon (Map 8.16) also coincides with the Heaphy Ecological Area (see Map 8.1). Thus, both the experiential conditions of wilderness, as identified above, and the ecological conditions, as already indicated by the NCC report, are likely to incur some detrimental effects within the district as a result of the proposal. Most significantly it has now been possible to establish the likely spatial extent of these effects.

Other effects are also likely to be felt outside the Ecological District but within the wider ecological region. For example, a displacement effect of some back-country users from the Heaphy Track to the Wangapeka Track could result with a reduction in perceived wilderness along the latter track for some perception levels, especially on the basis of the solitude property of wilderness.

The WPM allows the manipulation, analysis and spatial determination of the


HEAPHY SCENARIO
WILDERNESS PERCEPTIONS
Perceptual differences between
existing situation and scenario
Key to Changes in Perceived Wilderness
Perceptual differential 1/2
Perceptual differential 2/3
Perceptual differential 3/4
Perception level 4
0
10 km

MAP 8.16:

impacts of a proposal or policy with respect to the relatively subjective and intangible nature of a perceptual construct—wilderness. The WPM approach thus has the ability to portray, and if necessary replicate, the experiential conditions of wilderness on an agreed and understood basis. In so doing, it allows wilderness perceptions to be assessed more effectively in a conflict relating to environmentally sensitive areas, and subsequent decision-making to be improved.

8.4 The Role of WPM as a Wilderness Management Tool

This chapter has, so far, explored the application of WPM, and in particular the ability of WPM to contend with and enhance approaches to, the wilderness management issue. The examination has been considered within the context of previous efforts to balance conditions of wilderness in New Zealand (see Chapter 3) and specifically in North-West Nelson (see Section 8.1). In the remaining section of this chapter the role of WPM, as a wilderness management tool, is discussed in respect to NWN, to New Zealand, and in the broader context of protected areas management. In doing so this section also provides a summary of the pragmatic application of WPM which has been considered above.

8.4.1 The Role of WPM for Wilderness Management in NWN

WPM has the potential to be applied directly, through a 'stand-alone' approach, to the management of conditions of wilderness. This would operate as an allocative mechanism (Section 8.2) for backcountry use, via a management regime that would allow management of wilderness experiences in a variety of levels of environmental conditions. This provides a range of satisfactory experiences, and the maintenance of natural ecological processes through the differential dispersal of recreational use.

The aggregate wilderness perception mapping of NWN (Map 7.27) identified four potential levels of wilderness which provide experiential conditions of wilderness to the respective user groups. While this would provide satisfactory wilderness experiences, the maintenance of ecological conditions is only implied, and an ecological component would need to be incorporated to enable conditions of wilderness to be fully balanced. The approach acts to elucidate the experience domain of wilderness but it must then be placed back into the context of other experiential domains.

The application of WPM to enhance existing approaches which provide a mechanism for balancing the conditions of wilderness is a more pragmatic utilisation of the concept. The analysis of the ROS inventory of NWN with respect to wilderness perception mapping not only verified the applicability of the ROS tool but it was also able to clarify the understanding of ROS within the wilderness experience. Thus, various opportunity classes, notably the three at the natural end of the spectrum, were characterised in terms of the acceptability of the setting as perceived wilderness and allowing the provision of wilderness experiences to be accommodated in various recreation opportunity settings. This ameliorates the conceptual weakness of the setting-experience relationship that underlies ROS, insofar as wilderness is concerned, and enables this particular experience domain to be integrated within the broader spectrum of recreation experiences. This enhancement of a wilderness management approach can be extended to the LAC framework which incorporates the ROS concept. The LAC approach also includes the potential to evaluate and assess ecological conditions so that this approach provides a particularly strong basis for integrating perceptual-experiential and ecological components within a framework that is directed to the resolution of the wilderness management issue. However, in NWN, the use of WPM to enhance wilderness management practices is limited to the ROS system, which has only recently been invoked.

A further application of WPM utilises the mapping concept as a predictive modelling tool with which to assess the effects of land use proposals and policies on perceived wilderness. In NWN the expected changes, resulting from the Heaphy scenario, to the four levels of perceived wilderness were modelled. This not only allows management of the conditions of wilderness so as to accommodate proposals likely to intensify the wilderness management issue, but it is able to provide a sound basis for including information related to a perceptual construct within an environmental debate.

The NWN case-study highlights the potentially useful contribution that WPM is able to make toward balancing experiential and ecological conditions of wilderness in the region. While three different applications of WPM have been considered, the second application—enhancing ROS and LAC—holds the greatest promise in addressing the wilderness management issue.

8.4.2 The Role of WPM for Wilderness Management in New Zealand

The wilderness management issue characterised in NWN is not dissimilar to that prevailing in other regions of the country, albeit in a particular regional protected areas system, so that the WPM approach could be applied throughout New Zealand in a similar fashion.

Since the WPM methodology is based on a New Zealand-wide survey of back-country users, there would be no conceptual difficulty in mapping any other part of New Zealand. In fact, it is quite conceivable that the entire country could be mapped given the appropriate geographic database. However, it would most usefully be applied on a regional scale as this is the level at which strategic conservation planning occurs and which is serviced by 1:250,000 topographic mapping. Map data from a smaller scale would not hold sufficient detail for spatially determining the various perceptual items of wilderness, while larger scale map data (e.g. 1:50,000) would be incongruous with the relatively broad perceptual indicators that have been used. Thus, WPM as it has been developed here is applicable at a regional scale. Any further detail would require elicitation of attitudinal and perceptual data to a finer level of detail consistent with the greater detail of larger scale mapping. Thus, the map data that is used must support an appropriate level of detail in the perceptual data.

As an allocative tool WPM has the potential to provide a more empirical basis to management zoning in other parts of the country. The currently proposed zoning for Mount Aspiring National Park (DoC 1990d), for example, which utilises a three-zone system (a Wilderness Zone, a Low impact Zone and a Moderate impact Zone) could be defined in perceptual terms. As part of an overall regime this would allow experiential conditions of wilderness to be managed in a more informed manner, and subsequently integrated with the management of ecological conditions also.

The ROS is a relatively standard tool for recreation planning in DoC throughout New Zealand so that the enhancement of this approach by WPM would have significant application potential in New Zealand as a whole. In fact, the NWN ROS inventory was the first to adopt nationally approved guidelines for the technique and thus provides an opportunity to clarify the concept, with respect to the wilderness domain at least, as it is implemented in New Zealand. At the present time there is little prospect of a LAC approach being adopted by DoC, although it has been considered, and so the potential of WPM to improve wilderness management through this framework remains an untapped resource.

The Heaphy controversy is typical of regional environmental conflicts in New Zealand, and so the application of WPM as a predictive modelling tool could operate successfully for developmental or policy proposals in other parts of the country. To some extent, the manner of its use for scenario mapping would depend on the scale of analysis required. The recent revival of interest in a Hollyford to Jackson's Bay road in Fiordland would provide another potential issue in which WPM could assist in the resolution of a divisive debate. WPM would most effectively operate by providing an experiential information component in conjunction with other components, such as economic assessments, of the type provides by Kane's (1991) contingency evaluation, and rigorous ecological evaluation.

The WPM approach would appear to offer as much potential for balancing the conditions of wilderness in New Zealand as a whole as it does for North-West Nelson as a single ecological region, and therefore it has much latent capacity to address the wilderness management issue at large.

8.4.3 The Broader Context of WPM for Protected Area Management

Achieving a balance between experiential and ecological conditions of wilderness is not the sole issue confronting the management of protected areas. While wilderness management has been the focus of this research effort, WPM must also be considered within the wider framework of protected areas management. Accordingly, there is a range of other issues, priorities, and information needs which must be taken into account within the broad rubric of conservation management.

Beside experiential information, the assessment of ecological conditions has continually been stressed and this is necessary, not only from the perspective of understanding ecological conditions of wilderness, but as a crucial element in the array of wildlife management issues that must be addressed. Issues such as wild animal control, protected species management, and habitat protection must all be resolved.

However, WPM can be considered as a worthy contributing component in an overall protected areas management process. In particular, the spatial framework within which WPM operates provides a mode by which it can be considered alongside other information components which seem incapable of comparison. This highlights the value of GIS as a decision-support tool; one which advances the spatial expression of wilderness perceptions, assists its integration into the decision-making process, and incorporates it as a crucial component among the plethora of other protected area-related information components.

The central institutional mechanism by which these components are integrated is the CMS and it is within this process that WPM can best be used, assisted by GIS, to improve the cohesion between *protection* and *use* functions in protected areas management.

8.5 Conclusion

The application of a spatial-perceptual approach to the complex and often contentious wilderness management issue has seen the development of WPM as a direct allocation mechanism, as an enhancing mechanism for the ROS and LAC frameworks, and finally as a predictive modelling tool. The implications of implementing WPM in this manner has demonstrated its potential for improving the management of conditions of wilderness in North-West Nelson and, by extension, in New Zealand generally.

Considered as one interacting component within the broader protected area system, WPM is most usefully implemented alongside other conservation information within the CMS process, assisted by GIS, for protected areas management.

9

Concluding Discussion

This study has addressed the need for managers to balance the provision of opportunities for wilderness experiences with the protection of undisturbed ecological processes, in New Zealand's protected areas system. Thus, as stated at the outset the basic aim was:

> *to develop an appropriate methodology for mapping multiple perceptions of wilderness, in order to address the wilderness management issue, and to assess its viability as a management tool.*

This has been accomplished through the following research process, which summarises the structure and findings of the study.

In Part I the analysis of the problem context surrounding the issue brought together a number of broad, yet applied, concepts which were focused on an ordered approach to the problem. Existing, conceptual approaches to wilderness management, which have emerged in various applied fields related to natural resource management (Chapter 2), were found to reflect a common basis in the notion of carrying capacity. Thus, the various experience-based and ecology-based approaches either apply directly, or are reformulations of physical, ecological or social carrying capacity concepts. The intrinsic differences between these approaches, in the manner in which they cope with the central issue, derive mainly from the underlying philosophical rationale, which ranges quite broadly from biocentric to anthropocentric. In fact, wilderness management is essentially a balancing act between ecological and experiential conditions and, therefore, relies implicitly upon information requirements pertaining to these components. In this regard the most highly developed approach was the LAC framework, although this too suffers from a fundamental weakness in the setting-experience relationship on which the approach is based. Related to an experiential information requirement, a perceptual component was identified as providing the necessary linkage in the relationship. The examination of wilderness management practices in New Zealand (Chapter 3), which included a comparative analysis with other countries, highlighted the need for the management of wilderness conditions to be considered as an active management regime rather than as a purely designatory exercise. Chapter 4 then investigated the management of wilderness conditions in terms of a behavioural approach to the human-environment relationship that characterises these conditions. From this view, wilderness perception is shown as a necessary and viable research tool capable of reflecting the considerable variation in wilderness imagery which can exist, despite uncovering a broad consensus in certain aspects of such imagery. This approach facilitated the development of the concept of multiple perceptions of wilderness, which itself provides the potential for a perceptual approach to the wilderness management issue. In conjunction with a perceptual approach, a considered argument has also been made for adopting a spatial approach to management strategies in Chapter 5. A suitable spatial framework for natural resource management is then supported by the application of GIS which, in particular, can provide the appropriate spatial tools and functionality for the spatial determination of perceptual environments.

Part II expressed the objective of the conceptual approach to the problem as:

> *delimiting the spatial extent of multiple perceptions of wilderness, as a means of improving the ability of existing management approaches to contend with balancing conditions of wilderness in protected areas.*

This objective was achieved through the development of two different—but possibly complementary—spatial-perceptual approaches, that provided a basis for operationalising wilderness perception mapping, namely: a relatively intuitive approach; and a more statistically sophisticated approach.

The application of WPM in Part III was assisted by the introduction of a selected case-study, namely North-west Nelson. The mapping output obtained from applying the two methods (Chapter 7) allowed the spatial extent of various backcountry user-levels of wilderness perceptions to be expressed. However, because of the statistical caveats which accompany the multivariate approach, only the intuitive approach was retained for further advanced analysis. Thus, the application of WPM to the wilderness management issue (Chapter 8) was examined through the use of the WPM end-products from Method 1: as a direct allocation tool; as an enhancing mechanism for the ROS and LAC frameworks; and, as a predictive modelling tool. These results effectively demonstrate the considerable potential which exists for addressing the wilderness management issue and for improving wilderness management in New Zealand, by implementing WPM.

The findings from this study point to three important outcomes: the operationalisation of wilderness perceptions; the application of WPM to the management issue; and, the role of GIS in the application and implementation of WPM. These outcomes are now reviewed separately.

9.1 The Operationalisation of Wilderness Perceptions

The core value arising from the study lies with the development and operationalisation of a procedure for determining the spatial extent of wilderness perceptions. This was achieved through the creation of a carefully structured methodology; one that evolved from a broad-ranging analysis of the problem context surrounding the wilderness management issue.

The procedure applies backcountry user perceptions of wilderness settings, as elicited through attitudinal survey, to an appropriate geographic database with the assistance of GIS. It is important to note that the definition of wilderness elements on the basis of purism scale items, which are also the basis for the classification of purism groups, is not a circular redefinition. Rather, it is a differentiation of perceptual variation on each purism item across purism groups (see Figure 9.1).

In this way, the ability to express wilderness as a perceptual construct is quite original and of especial theoretical and practical interest through its conceptualisation as a *spatial-perceptual* model. This combines the behavioural approach, as invoked through the Golledge & Stimson model (1987), with a spatial approach to management strategies which has been expressed by Fagence (1990) in his work on geographically-referenced frameworks. The integration of these useful approaches has permitted the crystallisation of the spatial-perceptual framework for WPM, and its application to protected areas management.

Briefly, WPM is a quantification of the geographic extent of areas coincident with the varying wilderness images held by backcountry users. It is not, however, a qualitative assessment (i.e. that one area is of a higher quality than another), even though wilderness as a concept does have the potential to imbue a certain idea of *quality*. A single rigidly-defined notion of wilderness quality is not strictly possible, whether as a cultural concept or a perceptual construct. Thus, the idea of *high* quality wilderness, as defined in the wilderness quality inventories of Lesslie *et al.* (1987, 1988), relies on a pre-determined definition of wilderness. Inventories of this type provide a relatively objective designation of undeveloped areas to which a certain wilderness quality *label* is attached. However, wilderness *per se*

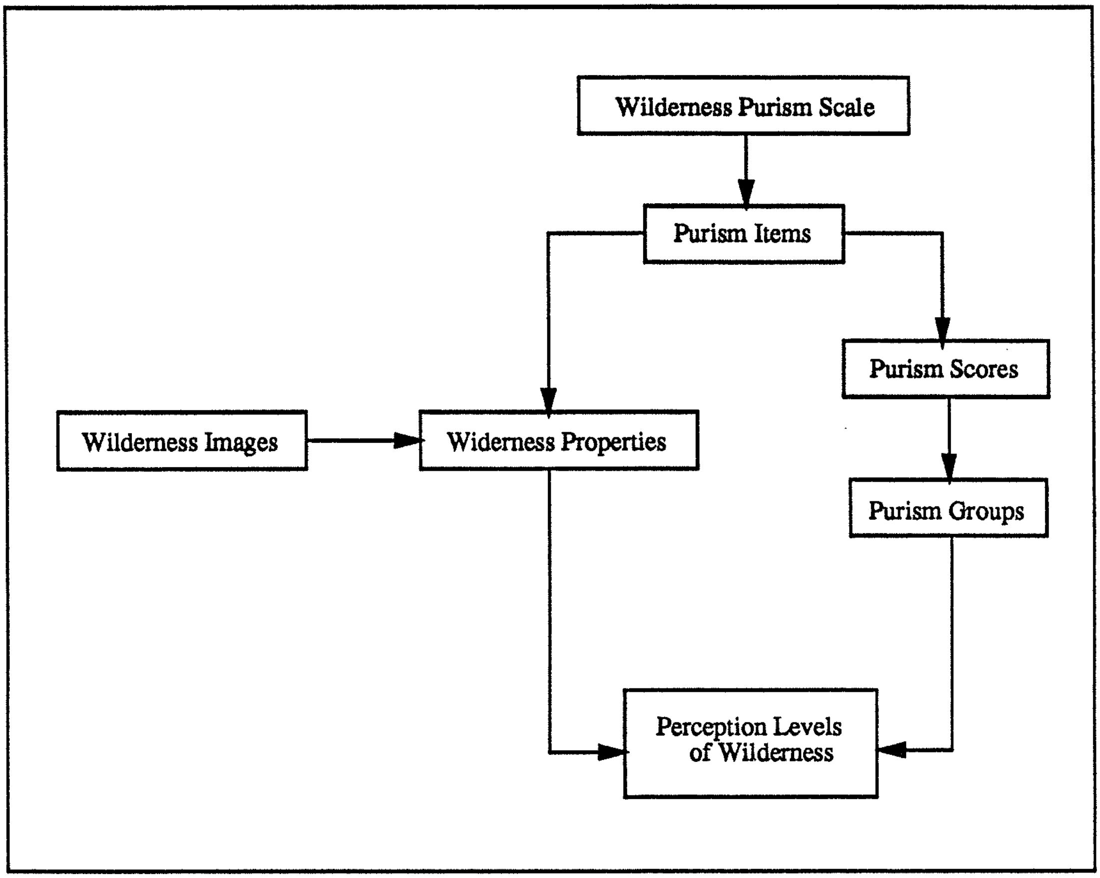


FIGURE 9.1: Schema for the Application of Wilderness Imagery

is subjective by nature and crucially dependent on peoples' varying perceptions of the construct. Moreover, from a management stance, WPM is likely to be more informative than arbitrary qualitative inventories.

9.2 The Application of WPM

While of considerable theoretical interest, much value of WPM lies with its potential as an applied concept. Here the focus is on the application of WPM information to the wilderness management issue. In identifying the varying levels of environmental development, which provide both a range of satisfactory wilderness experiences and a reduction of pressure on ecological processes, WPM is a source of new and useful management information.

The three uses for WPM, as outlined in Chapter 8, are representative of a broad repertoire of applications. The most useful application for the technique arises from the clarity which it provides for the setting-experience relationship, especially pertinent to the experience domain of wilderness, upon which the ROS and LAC frameworks operate. This in turn enables substitutes for experiential conditions to be identified, so that as pressures on protected areas increase, it is possible to establish which of the experiences are uniquely dependent upon particular ecological conditions—for example, absolutely pristine areas—and which are not uniquely dependent. The perceptual information identified by WPM can, therefore, be used as an indirect management technique for altering use distributions (both spatially and temporally) in the manner suggested by Stankey (1989a). As a management tool, such use of information generally has been reviewed by Brown *et al.* (1987) who conclude that although information can be effective in redistributing use, it must be delivered at a point and time in the decision-making process where it is still capable of influencing the individual's behaviour.

To be effective in supporting decision-making, such information must reflect the current situation. The application of the WPM methodology will, therefore, require updating as deemed necessary in order to maintain validity. This would operate at two levels. First, the regular updating of the geographic database for the region being mapped so as to reflect physical changes in the area is required. For example, it would be necessary to account for developments such as new roads, changes in track use and vegetative modifications, which require both spatial and attribute updates. The functionality of GIS is particularly useful in effecting this type of updating process. In practice, the updating could be achieved by the use of more recent map publications, aerial photographs or satellite imagery, and also from updated records such as track counter figures. A second level at which updating may be necessary applies to the perceptual data, and this is likely to be a longer-term requirement. Attitudes are certainly not static, especially with respect to cultural concepts such as wilderness, and they tend to undergo gradual changes and conditioning. Therefore, at some stage in the future it would be appropriate to repeat the questionnaire survey in order to elicit current perceptual data, and then to restructure the methodology accordingly.

The strengthening of existing approaches to wilderness management—in particular the LAC—by WPM provides a unifying framework within which a spatial-perceptual approach can be integrated with an ecological component, such as UET. This provides a more effective approach towards the balancing of wilderness conditions. The UET component makes a useful contribution to the solution of problems associated with establishing biophysical indicators in the LAC method. WPM provides experiential-setting information that the LAC framework has hitherto lacked, and which the ecologically-based approaches do not and cannot accommodate.

The implementation of the integrative framework as described above would provide a more holistic regime of wilderness management in New Zealand rather than dealing with ecological and experiential components separately. Current DoC structure (Chapter 3) is, however, more suited to the latter approach, so that any benefit arising from such a framework would require fundamental policy changes. This is especially pertinent given that the management of conditions of wilderness focuses on balancing use and preservation, but must still relate back to the broader natural resource management system within which such conditions operate.

9.3 The Role of GIS

A key feature of WPM lies with the central role of GIS in both the operationalisation of the methodology, and the application and implementation of its output.

The analytical functionality of GIS plays a fundamental role in operationalising WPM. The use of GIS in the methodology is instrumental in providing a spatial framework on which the whole process relies. The key to using the analytical functionality of GIS effectively in this manner has been to apply such functionality in a systematic approach. This allows for the manipulation, analysis and modelling functions of GIS to be used in a logical sequence in effecting the methodology and its application for management purposes.

The decision-support role of GIS further enhances WPM by facilitating the application of WPM to the particular problem situation thereby, enabling the resource manager to integrate the concept more effectively as part of the planning process. One of the crucial requirements of GIS by resource managers is high functionality (Goodchild 1991 pers.comm.). In terms of supporting decision-making, this centres on the products of GIS analysis, with an emphasis on buffering and overlaying techniques, and on modelling capabilities.

From a decision-support view, it is not so much the technology introduced by the use of GIS that is of value, but rather the substantial advances which come from applying geographic information and providing a spatial dimension. In this context, geographic information is a fundamental and instrumental component for natural resource management-oriented disciplines; one in which a spatial dimension provides a valuable form of understanding. The importance of geographic information in the management of human and natural resources, however, tends to be overlooked and underestimated—perhaps by virtue of its very obviousness. At times this has resulted in a widespread lack of awareness of the potential contribution which GIS can make to resource management (Chorley 1988).

As a decision-support tool GIS also assists the implementation of WPM within its wider natural resource management system. The application and implementation of GIS for protected areas management in New Zealand has, to date, been rather cautious. While GIS is not operational in DoC the department has realised the potential of establishing a geographically based resources information system (Robinson 1985), and applying such information to conservation management planning (McEwen 1990a, Harrison 1991b). More recently, DoC have taken steps to assess the feasibility of GIS for handling its geographic information needs (McEwen 1990b, Harrison 1991b). As demonstrated by the application of WPM and its potential for wilderness management, within the context of a protected areas system, GIS has real, pragmatic worth to contribute in the integration of conservation information for protected areas management.

9.4 Recommendations

The findings of this study have implications for perceptual and resource management research, natural resource management, and the integration of management and research activities. Thus, the following recommendations emerge.

1. The purism items that comprise the wilderness purism scale are not an exhaustive list. While the purism scale does provide a definitive level of differentiation amongst users, there is scope for the expansion of the scale to include such contentious items as aircraft overflights, in order to accommodate the perceptual effect of noise intrusion emanating from this activity.

2. There is a need to field-test the buffer distances developed for purism items, and applied in the methodology. In this study, such distances were based on linear gradations that reflected the corresponding perceptual gradients for purism items, across purism groups. There is, however, potential to determine these on a more theoretical basis, requiring research that focuses on the relationship between perceptual responses to items, and a distance function applicable to such perceptions. A delphi technique might also be carried out on appropriate management personnel to determine suitable buffer distances as seen by an expert group.

3. In this particular investigation, WPM has undergone a number of checks. The GIS database for North-West Nelson, to which the WPM methodology was applied, was itself field-checked and verified, while the test-mapping of a case-study region provided a major verification of the concept. However, a conclusive empirical test of WPM would be by obtaining direct ground truth of some kind. While seemingly difficult to perform, further research could in fact test whether, for representative locations in a mapped region, WPM equates to different perceptual groups' actual perceptions of that particular locality, as a wilderness setting. Certainly, this would be difficult to accomplish representatively for different ground locations and for different users. One possible alternative might be to perform a similar test using a surrogate for the experience, such as photographs, but this would be subject to the difficulties of replicating an experiential phenomena through an incomplete surrogate.

4. While the application of the multivariate approach (Method 2) for WPM was not continued beyond the production of preliminary map results—primarily due to statistical limitations—it nevertheless displayed potential as an alternative method. The exploration and verification of the use of discriminant function analysis in this particular, non-conforming, mode could open the way for the further analysis and application of the multivariate approach. It holds particular promise as a research approach operating in parallel with the pragmatic application of Method 1, and thereby providing a feedback from research to management.

5. Alternative techniques for eliciting perceptions of wilderness for incorporating within the WPM methodology were given some consideration in Chapter 6, but were considered as lying largely beyond the scope of the current research. There is, however, potential for further research to concentrate on this aspect through a comparative examination of alternative elicitory methods, such as personal construct theory or multi-dimensional scaling.

6. In this study WPM has been applied to New Zealand backcountry users, principally for reasons which are pertinent to the wilderness management issue—namely that the cause of imbalance between ecological and experiential conditions stems from backcountry use. It would be possible, however, to widen the scope and apply the methodology to wilderness perceptions of the much broader general public, who tend to use protected areas less frequently and rarely see pristine wilderness, but who, nevertheless, often desire wilderness experiences. The general public survey which paralleled the backcountry user survey used in this study, and also

conducted by Shultis (1991), would provide a suitable perceptual data set for determining the spatial extent of general public perceptions of wilderness. A preliminary analysis of Shultis' general public questionnaire suggests broadly similar results to the backcountry survey but with a sizeable, yet consistent, shift in purism across the sample toward the non-purist end of the wilderness purism scale. While not as relevant to wilderness management, in respect of managing use pressures, the WPM resulting from such a sample could have useful education and advocacy implications for conservation management. The general public, while not necessarily users and therefore unlikely to place immediate impacts upon protected areas, do represent a body of latent demand. This engenders some pragmatic value from the elicitation and mapping of their perceptions of wilderness.

7. The application of the WPM methodology is based on an attitudinal survey of backcountry users from protected areas throughout New Zealand. The analysis of WPM could, therefore, be extended to consider differences amongst respondents interviewed at different locations (i.e. consider the relationship for WPM amongst the 17 conservation estate units where respondents were interviewed). Unfortunately, the small size of sub-samples prevented this from being considered here but it does provide the impetus for a larger sample survey, so that such differences can be tested. Alternatively, a survey of a particular estate area could be conducted, which could then be compared to the broad New Zealand-wide results. Similarly, sub-sample analyses of the perceptual data could provide interesting results for WPM. For example, an examination of differences in spatial-perceptual views of wilderness between male and female respondents could be of considerable interest. Another extension of WPM arises from eliciting the imagery of ethnic groups, e.g. Maoris, or overseas visitors, such as Germans or Japanese, and to process it in a similar way. The determination of the spatial extent of cross-cultural perceptions of New Zealand's natural environments is of much interest academically but should also prove useful in tourism planning and management.

8. In this study the spatial extent of wilderness perceptions has been restricted to the North-West Nelson case-study. The mapping procedure could usefully be extended to other regions and, in fact, to the whole of New Zealand—given the appropriate geographic database. Further, WPM has been applied at a medium-scale for regional level planning, and appears appropriate for the scale and detail of map data (i.e. 1:250,000) and also for the extent of perceptual data obtained from the questionnaire survey. There is ample scope to extend this and to consider the applicability of WPM at a larger scale for more site-specific operational planning. This would require more detailed base map data (e.g. 1:50,000), and correspondingly more detailed perceptual data. In turn, this implies undertaking a more sophisticated questionnaire survey.

9. While the focus in this study has been upon *terrestrial* wilderness, because the very notion of wilderness is a perceptual construct it is conceivable that wilderness experiences might be gained in *subterranean* or *marine* environments—as mooted by Smith & Watson (1979). The WPM methodology then allows such concepts to be operationalised by applying suitable wilderness imagery, and subsequently mapping *underground* and *underwater* wildernesses. The identification of such specialised forms of wilderness would be of value to those who manage experiential and ecological conditions of such environments, as well as being of academic interest. Extending WPM further, wilderness imagery need not be the sole input data since the general methodology could be extended to other perceptual constructs, or attributes of the environment (e.g. scenic quality). Thus, the broad technique of WPM is applicable not only to wilderness management, terrestrial or otherwise, but opens up possibilities in other fields of environmental management.

10. The application of GIS as a decision-support tool to wilderness management, while highlighting the use of perceptual data, has also shown potential for incorporating an ecological component. There is, therefore, scope for further study on the role of GIS in facilitating the application of ecological information to protected area management. Such a study would form a complementary exercise to the application of perceptual information that has been emphasised in this research. Additionally, the place of GIS in the wider protected area management system was considered briefly, and there is scope for a detailed study of the role of GIS in the integration of protection and use functions for conservation management, possibly within the framework of the CMS process.

9.5 Final remarks

In emphasising the synthesis of three quite distinct components, this study has dealt with the application of a perceptual construct to resource management supported by geographic information systems. Leading to a spatial-perceptual model for applying to the specific problem situation, the approach has been focused through a structured framework—the WPM methodology.

The application of that framework has generated new and useful information, especially in the form of wilderness perception mapping, that has clear applicability for protected areas management, and is further enhanced by the use of GIS as a decision-support tool. The development and application of WPM for wilderness management, while manifesting considerable potential, must be recognised as an initial effort. Consequently, the implementation of the concept for resource management requires further refinement and verification—much of which has been outlined in the preceding recommendations. Nevertheless, the concept provides an eminently useful tool which is able to enhance efforts to balance the provision of wilderness experiences with ecological conditions in protected areas. In holistic terms the process has highlighted the value of a broad interdisciplinary approach from an applied research perspective.

Mount Patriarch from Luna Tarn, North-West Nelson Forest Park

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Appendix A

Wilderness Area Provisions and Definitions in New Zealand Legislation and Policy

National Parks Act 1952

(repealed by the National Parks Act 1980)

34. (2) While any area is set apart as a wilderness area,-
(a) It shall be kept and maintained in a state of nature:
(b) No buildings of any description or ski tows or other apparatus shall be erected or constructed thereon:
(c) No horses or other animals or vehicles of any description shall be allowed to be taken onto or used on the area:
(d) No roads, tracks, or trails shall be constructed on the area except such foot tracks as the [Park] Board deems necessary or desirable.

Reserves and Domains Act 1953

(inserted by the 1956 amendment and
repealed by the Reserves Act 1977)

18A. (2) While any public reserve or part thereof is set apart as a wilderness area,-
(a) It shall be kept and maintained in a state of nature:
(b) No buildings of any description or other erections of any kind shall be placed or constructed on the area:
(c) No horses or other animals or vehicles of any description shall be taken on to or used on the area:
(d) No roads, tracks, or trails shall be constructed on the area, except such foot tracks for the use of persons entering the area on foot as the Minister considers necessary or desirable.

Forests Act 1949

(inserted by the 1976 amendment and
repealed by the Conservation Act 1987)

63E. (2) While any area is set apart as a wilderness area,-
(a) It shall be kept and maintained in, or allowed to revert to a state of nature:
(b) No buildings of any description or ski tows or other apparatus shall be erected or constructed thereon:
(c) No animals or vehicles of any description shall be allowed to be taken onto or

used on the area:
(d) No roads, tracks, or trails shall be constructed on the area.
(3) Notwithstanding subsection (2) of this section, the Minister may authorise such works or facilities as he considers desirable or necessary to be erected, constructed, or used on any area for the purpose of attaining or maintaining the natural state of the area.
(4) Subject to this Act and to the imposition of such conditions and restrictions as may be necessary for the preservation of the native flora and fauna or for the welfare in general of wilderness areas, the public shall have freedom of entry and access to wilderness areas.

Reserves Act 1977

47. (2) While any reserve or part thereof is set apart as a wilderness area,-
(a) It shall be kept and maintained in a state of nature:
(b) No buildings of any description or other erections of any kind shall be placed or constructed on the area:
(c) No horses or other animals or vehicles of any description shall be taken on to or used on the area:
(d) No roads, tracks, or trails shall be constructed on the area, except such foot tracks for the use of persons entering the area on foot as the Minister considers necessary or desirable:
Provided that the Minister may permit the erection of temporary huts essential for the control of noxious weeds or noxious animals or for the purposes of scientific study, subject to the removal of such huts as soon as they cease to be essential for weed or animal control or, as the case may be, for that scientific study.

National Parks Act 1980

14. (2) While any area is set apart as a wilderness area,-
(a) It shall be kept and maintained in a state of nature:
(b) No buildings of any description or ski-lifts, or other apparatus shall be erected or constructed in the area:
Provided that the Minister may, on such conditions as he thinks fit, authorise the erection of huts essential for the destruction or eradication of introduced plants or animals in the park or for the purposes of scientific study:
(c) No animals or vehicles of any description shall be allowed to be taken into or used or kept in the area:

(d) No roads, tracks, or trails shall be constructed in the area, except such tracks for the use of persons entering the area on foot as are contemplated by the management plan.

Wilderness Policy 1985

(a) Tracts of land chosen to be protected through appropriate management as wilderness areas should meet the following criteria:
(i) they will be large enough to take at least 2 days foot travel to traverse;
(ii) they should have clearly defined topographic boundaries and be adequately buffered so as to be unaffected, except in minor ways, by human influences;
(iii) they will not have developments such as huts, tracks, bridges, signs, nor mechanised access.

Conservation Act 1987

20. (1) Subject to subsections (2) to (4) of this section, the following provisions apply to every wilderness area:
(a) Its indigenous natural resources shall be preserved:
(b) No building or machinery shall be erected on it:
(c) No building, machinery, or apparatus shall be constructed or maintained on it:
(d) No livestock, vehicles, or aircraft shall be allowed to be taken onto or used on it:
(e) No roads, tracks, or trails shall be constructed on it.
(2) If-
(a) The doing of anything on a wilderness area is in conformity with the conservation management strategy or conservation management plan for the area; and
(b) The Minister is satisfied that its doing is desirable or necessary for the preservation of the area's indigenous natural resources,-
the Minister may authorise it.
(3) If satisfied that the undertaking of any scientific test or study on a wilderness area is desirable, the Minister may authorise it.
(4) Nothing in subsection (1) of this section prevents the doing of any thing for any person's protection, or because of some emergency involving any person's property.

Appendix B

New Zealand Wilderness Policy

Wilderness Policy

The Wilderness Policy developed by the Wilderness Advisory Group and approved by the Ministers of Lands and Forests in 1983 has been endorsed by the Minister of Conservation for the Department of Conservation [dated 23 March 1989].

The Wilderness Experience

(a) The idea of wilderness is very personal. It embodies remoteness and discovery, challenge, solitude, freedom, and romance. It fosters self reliance and empathy with wild nature. Wilderness is therefore principally a recreational and cultural concept which is compatible with nature conservation.

(b) Wilderness recreation is available to everyone and is an important part of the wide range of recreational opportunities that exist and should remain in New Zealand. A wilderness experience can be gained in a variety of natural landscapes but for some people a large natural area is required. However, to retain the widest opportunities for outdoor recreation, management of some large remote areas as wilderness is necessary.

(c) The wild lands of the world are rapidly shrinking and will become rare in the near future. The opportunities New Zealand can offer for wilderness recreation are therefore of international significance.

Wilderness Areas

Wilderness areas are wild lands designated for their protection and managed to perpetuate their natural condition and which appear to have been affected only by the forces of nature, with any imprint of human interference substantially unnoticeable.

(a) Tracts of land chosen to be protected through appropriate management as wilderness areas should meet the following criteria:

(i) they will be large enough to take at least 2 days foot travel to traverse;

(ii) they should have clearly defined topographic boundaries and be adequately buffered so as to be unaffected, except in minor ways, by human influences;

(iii) they will not have developments such as huts, tracks, bridges, signs, nor mechanised access.

(b) A wilderness system should have a wide geographic distribution, and contain diversity in landscape and recreational opportunities.

(c) An area which has a wilderness character but does not meet some of the above criteria and is managed essentially in accordance with the Wilderness Policy may be called a "Remote Experience" area. For instance, such an area could be smaller than a Wilderness Area, or have a minor management incompatibility, such as infrequent air access or a maintained hut.

(d) Wilderness areas may be established under several statutes, or by zoning in management plans.

Legislative provisions:

1. Conservation Land - Section 20 of the Conservation Act 1987.
2. National Parks - Section 14 of the National Parks Act 1980.
3. Reserve Land - Section 47 of the Reserves Act 1977.

(e) Wilderness designation preserves resources and thus options for future use of the land. Ideally wilderness areas will be managed in perpetuity but the designation is not necessarily permanent in terms of the relevant statutes, and can be revoked, if deemed necessary.

(f) Public comment on proposals for the setting apart, revocation or variation of wilderness areas will be sought through news media and management plans in accordance with relevant legislation.

Management of Wilderness Areas

(a) To retain wilderness qualities developments such as huts, tracks, route markers, and bridges are inappropriate, and in the few cases where such facilities exist they should be removed or no longer maintained.

(b) Adjoining lands should be managed as buffers to assist in the protection of a wilderness area. Buffers may contain huts, tracks and bridges but these should be few and vehicle access will be discouraged near the wilderness boundary.

(c) Wilderness is a fragile resource, susceptible to overuse. While wilderness areas are open to everyone, overuse will be minimised by selecting areas for their remoteness rather than regulating access by permit.

(d) To ensure the use of wildlife areas at levels compatible with the maintenance of wilderness values, commercial recreation activities may only be undertaken under licence or permit.

(e) Because wilderness areas are laces for quiet enjoyment, free from obvious human impact, and require physical endeavour to achieve in full measure the wilderness experience, the use of powered vehicles. boats or aircraft will not be permitted. Horses may be allowed where strong historical links exist, and where legislation permits.

(f) Users of wilderness areas should be self sufficient and depend on the natural environment for shelter and fuel only if the use of such resources does not detract from the values of the wilderness.

(g) Logging, roading, hydro electric development, and all but hand-methods of mining are also incompatible.

(h) Exceptions to restrictions on facilities, vehicles, boats and aircraft may apply temporarily to:
(i) search and rescue operations and emergency flights for fire fighting and medical reasons;
(ii) control of introduced plants and animals;
(iii) scientific research which cannot be conducted outside wilderness areas;
(iv) carefully controlled, minimal impact mineral exploration and prospecting.*

* Minimal impact exploration and prospecting will be ensured by strict supervision of the licence conditions applied by Ministry of Energy, in consultation with the Department of Conservation. Activities may include geological mapping, geophysical surveys, geochemical sampling, and machine operated drilling programmes. Earthmoving machinery and road formation will not be permitted. Consequently all drilling equipment and temporary huts will normally be transported by helicopter, unless existing tracks can be used without disturbance to the environment.

Education and Information

(a) Wilderness users will be encouraged to minimise their impact on wilderness by applying the Minimum Impact Code. In addition, it is undesirable in wilderness areas to blaze trees or leave cairns.

(b) Wilderness areas should have their designation identified in management plans but their use will not be promoted.

(c) Wilderness areas will be distinctly named, and information on them may be obtained from the Department of Conservation.

Appendix C

Summary of the Backcountry User Questionnaire conducted by Shultis (1991)

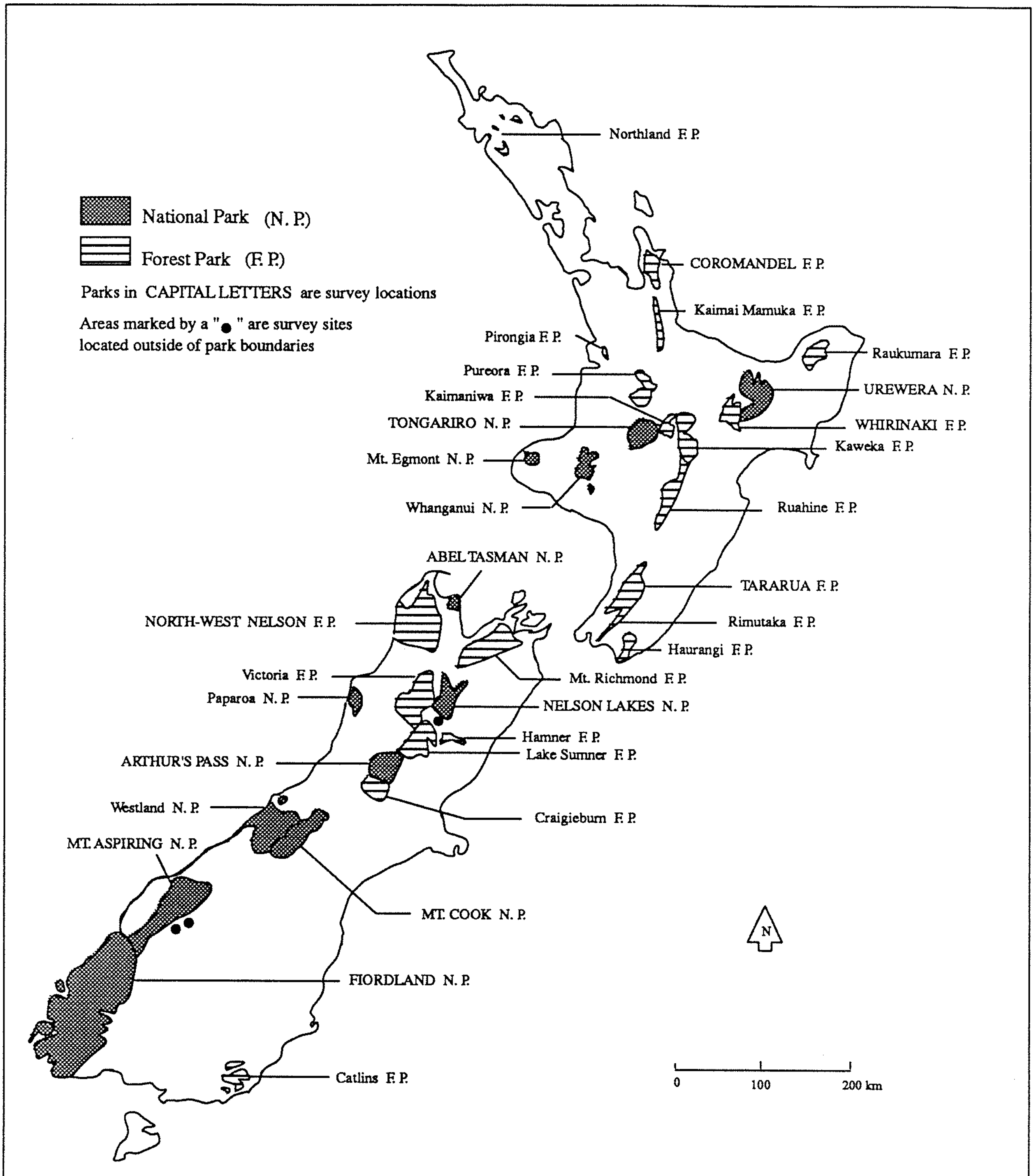
Field Locations and Details for Questionnaire Data Collection (from Shultis 1991)

LOCATION[a]	DATE	YEAR	N[b]	% OF USERS
NORTHERN CIRCUIT (TNP)	Dec. 12 – 18	1987	37	11
WAIKAREMOANA TRACK (UNP)	Dec. 20 – 24	"	10	3
COASTAL TRACK (ATNP)	Dec 31 – Jan. 8	1988	42	13
ROUTEBURN TRACK (FNP)	Jan. 13 – 19	"	59	18
GREENSTONE TRACK (FNP)	Jan. 19 – 25	"	24	7
REES — DART TRACK	Feb. 5 – 10	"	23	7
MATUKITUKI VALLEY	Feb. 10 – 14	"	10	3
PINNACLES TRACK (CFP)	Feb. 26 – March 2	"	5	2
TARARUA F.P.	March 5 – 12	"	17	5
EDWARDS RIVER (APNP)	April 2 – 6	"	22	7
ST. JAMES WALKWAY	Nov. 2 – 8	"	8	2
TRAVERS/SABINE AREA (NLNP)	Nov. 8 – 16	"	18	6
TARARUA F.P.	Dec. 9 – 16	"	5	2
WHAKATANE RIVER (UNP)	Dec. 18 – 23	"	6	2
WHIRINAKI TRACK (WFP)	Dec. 28 – Jan 8	1989	26	8
WANGAPEKA TRACK (NWNFP)	Jan. 12 – 21	"	2	1
HOOKER VALLEY (MCNP)	Jan. 26 – Feb. 4	"	6	2
HOLLYFORD TRACK (FNP)	Feb. 11 – 16	"	2	1
17 LOCATIONS	130 DAYS		N=322	100%

[a]TNP = Tongariro National Park, UNP = Urewera National Park, FNP = Fiordland National Park, CFP = Coromandel Forest Park, APNP = Arthur's Pass National Park, NLNP = Nelson Lakes National Park, WFP = Whirinaki Forest Park, NWNFP = North West Nelson Forest Park, MCNP = Mount Cook National Park

[b]Number of questionnaires completed at each location

Map showing Survey Locations for Shultis' Questionnaire (from Shultis 1991)



Summary of the Data Elements of Shultis' Questionnaire

Wilderness purism and knowledge this was concerned with the users' personal conception of wilderness by measuring, firstly, the desirability of various facilities, activities, and characteristics in what the individual considers to be a wilderness setting. Secondly, their knowledge of what is, and is not, allowed in a designated wilderness area.

Leisure activities and attitudes this was concerned with the general leisure activities with which people spend most of their spare time, their outdoor recreation activities, and their general attitude toward these activities.

Trip characteristics information on the actual backcountry trip being undertaken such as: the main recreation activity pursued; the number of nights on the trip; group size; the number of others seen on the trip; and, the reaction to this presence.

Previous outdoor area experience information on previous trips to natural environment areas such as: the number of days spent in these areas; the motivations for, and benefits from, these trips; and, perceived differences between users and non-users of natural environment areas.

Wilderness attitudes, images and use this was concerned with opinions and attitudes toward wilderness areas (legislative definition), images prompted by the term 'wilderness', visits to wilderness areas, and perceived differences between the nature of, and benefits from, wilderness when compared to other natural environment areas.

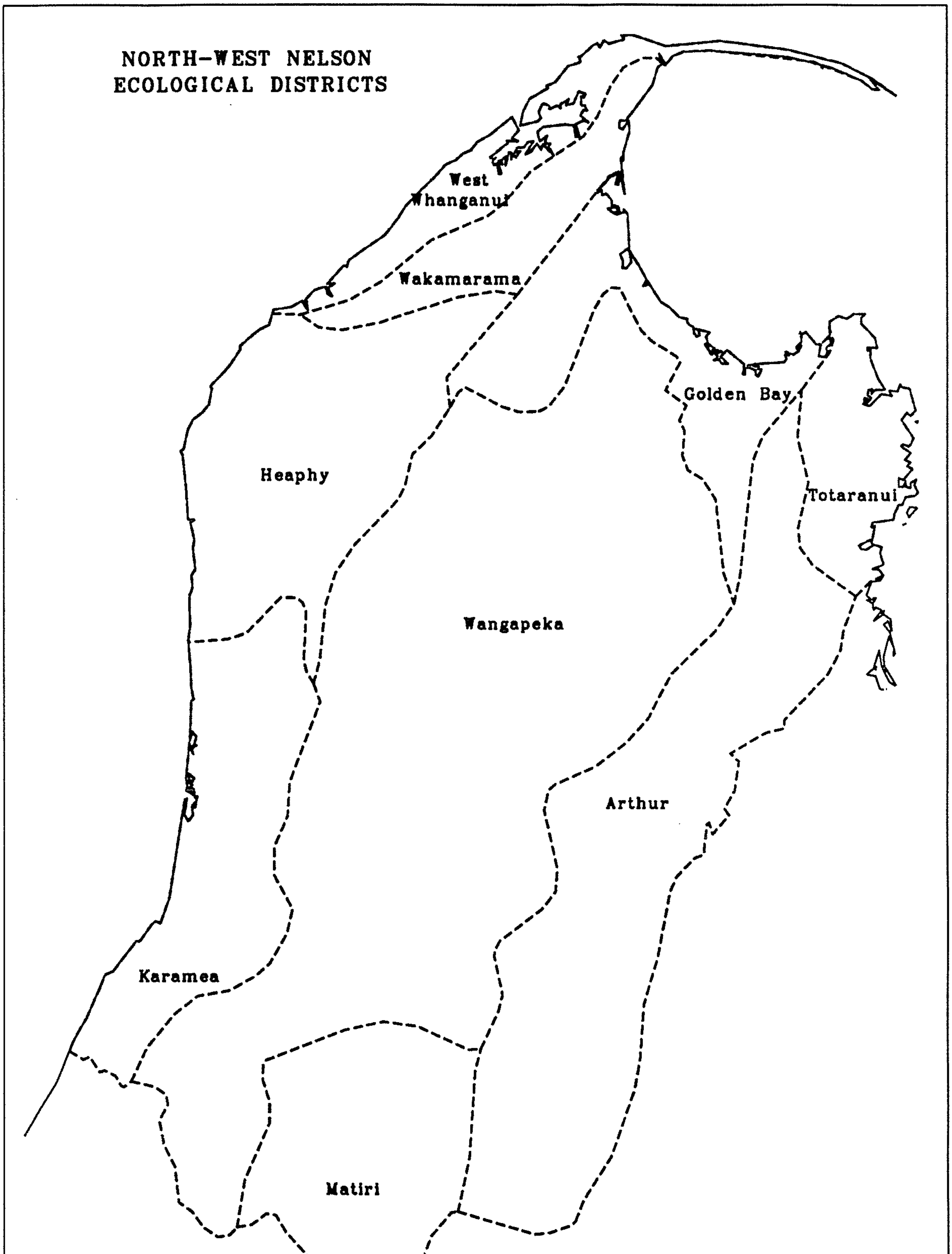
Environmental attitude this was concerned with attitudes toward society's use of the environment and the individual's environmental philosophy.

Demographic details this was concerned with the demographic structure of the sample and referred to sex, marital status, residence, offspring, vacation availability, group membership and ecopolitical activities.

Appendix D

Ecological Descriptions of each Ecological District comprising North-west Nelson Ecological Region

Map showing the Nine Ecological Districts which comprise the North-West Nelson Ecological Region



West Whanganui Ecological District

Criteria: geology, topography, climate floral and faunal affinities (distinguished by the high conservation value of lowland and coastal systems still remaining on high fertility sites).

TOPOGRAPHY/GEOLOGY: comprises the generally low-lying land of relatively young rocks and the steep coastal Tertiary hills at the north-western extremity of the South Island; includes Farewell Spit formed from Holocene sand dunes, the Whanganui Inlet and the uplifted marine bench and terrace, small river valleys and low hills (maximum altitude 272m a.s.l.) to the SW, adjoining the older Paleozoic granites and sediments of the Heaphy and Wakamarama E.Ds. Cliff-forming Oligocene limestones, mudstones and sandstones dominate the coastal landscape. The tertiary hill country includes kaast areas with associated cave systems. An extensive marine bench and its associated cliffs formed by inter-glacial marine transgression has been covered with Holocene deposits and uplifted; this plus the Holocene sand country provide most of the land of agricultural potential. Cretaceous coal measures and conglomerate in the north.

CLIMATE: warm, wet, windy, predominantly coastal climate; rainfall 1200–2000mm pa; strongly influenced by westerly weather patterns.

SOILS: strongly leached to podzolised soils from sandstones, limestones and mudstone on rolling and hilly land with bleached subsurface horizon and iron-humus pans; fertility low, drainage slightly impeded; small areas of alluvial soils on river flats, sandy and gravelly soils on coast and Farewell Spit.

VEGETATION/MODIFICATIONS: originally largely forested, much of the district now farmed; a long history of gold and coal mining, timber extraction and flax-cutting as well as pastoral farming. Large areas are in a derelict state or in secondary vegetation. Remoteness from markets has resulted in many areas of the original lowland and coastal forest remaining intact, including the catchments of the Big and Raukawa Rivers in the south. Many of these are significant because they comprise examples of the original natural landscapes that have been cleared from the remainder of New Zealand. Most of the remaining vegetation on the Tertiary hill country is podocarp (rimu, kahikatea and matai)-hardwood forest. Beech species occur on lower fertility sites, more common on soils from Cretaceous rocks. All beech species present: hard beech and silver beech predominate; red beech confined to higher altitudes in the west and black beech to a few ridges near the coast in the south. Alluvial valleys south of the Whanganui Inlet formerly contained tall forests of kahikatea, northern rata and pukatea: a few valuable remnants survive. Botanically interesting landscapes occur in the Holocene sand country and adjoining Cretaceous conglomerate and coal measures between Wharariki Beach and Cape Farewell.

FLORA etc: vegetation, flora and fauna show strong relationships with northern North Island: the district probably represents a remnant of a continuous pre-Pleistocene land mass. Many plant species, including major tree species, reach their south-western limits here (e.g. *Dysoxylum spectabile, Paratrophis banksii, Entelea arborescens, Phyllocladus trichomanoides, Libocedrus plumosa*); also present are the fern *Blechnum fraseri* and the *psilopsid Tmesipterus lanceolata.* The herb *Cotula calcarea* is endemic.

BIRDS: Farewell Spit is recognised as a wetland of international importance, with a very large number (83) of wetland bird species utilising the area, including many rare migratory waders; large flocks of wading birds (e.g. 27,000 Knots, 19,000 godwits, 8,600 South Island Pied oystercatchers); major moulting site for (introduced) Black Swan (12,000); large breeding colonies of Caspian and White-fronted Tern. Recently established gannet breeding colony—only the second mainland site in New Zealand. Whanganui Inlet also of high wildlife value with large numbers of South Island pied oystercatcher, Banded Dotterel and Black Swan, as well as rare migrant waders. Saltmarsh of Whanganui and Puponga important Banded Rail habitat. Swampy margins of the district's estuaries, Mangarakau wetland and Lake Otuhie are important for Fernbird and Western Weka.

REPTILES: green geckos referable to *Heteropholis tuberculatus* relatively common in scrub and forest throughout this district. There is no clear geographical or morphological boundary between these animals and those considered to be *Heteropholis stellatus* which occur further east. Common gecko (*Hoplodactylus maculatus*) present near coast (all lizards except forest gecko (*Hoplodactylus granulatus*) are very scarce on the West Coast).

INSECTS: include an endemic beetle.

SNAILS: there is a degree of endemism in the invertebrate fauna which includes two new genera and species of punctid land snails; the large land snails *Powelliphanta gilliesi brunnea, P. g. aurea* and *P. g. subfusca* are restricted to the district. It also includes part of the range of *P. g. kahuragica.*

Wakamarama Ecological District

Criteria: topography and geographic position, climate.

TOPOGRAPHY: the north-eastwards extension of the Wakamarama Range: hills, mostly 600–900m a.s.l., maximum altitude 958m; very steep hills in the east of the range, often forming cliffs (Mt Haidinger), gentler hills in the west above West Whanganui Inlet.

GEOLOGY: mostly Cretaceous arkosic sandstones and conglomerate with grit, shale and coalseams; cliff-forming conglomerate e.g. Mt Haidinger; also Lower Paleozoic greywacke, a small area of Upper Paleozoic Karamea Granite at Knuckle Hill and minor stocks of Cretaceous granite. Limestone and dolomite at Mt Burnett (of high economic value).

CLIMATE: distinctive—mild temperatures, with high cloud, rainfall 2000–4000mm p.a., with minimum in winter; prevailing south-west winds but gales not frequent.

SOILS: strongly leached to podzolised soils in the north-east on rolling and hilly land from sandstones etc.; fertility low, drainage impeded; on steeper country in the south-west shallower, stonier, very strongly leached, low fertility soils from range of sedimentary and igneous rocks.

VEGETATION/MODIFICATIONS: substantial areas are still in indigenous forest; excellent sequence of northern rata-pukatea and hardwood forest above Ferntown; though edges of forest heavily logged, still a fine stand of podocarp forest (with northern elements) at c.300m a.s.l. east of Knuckle Hill (includes canopy of rimu, kawaka with kahikatea, miro, tanekaha, over kamahi, toro, hard beech, silver beech and quintinia). Some semi-extensive sheep and cattle farming in the north; feral goats and pigs present in some areas.

FLORA: some floral affinities with the North Island.

BIRDS: continuous mudflats along northern coast important for waders, also Banded Rail; Great Spotted Kiwi, Blue Duck, kaka, Yellow-crowned Parakeet present in forest.

REPTILES: Nelson green gecko (*Heteropholis stellatus*) reported from Mt Burnett and Pakawau.

SNAILS: includes the entire range of *Powelliphanta gilliesi gilliesi* and *P. g. montana*, and part of the range of *P. superba superba* (occurring sympatrically with *P. gilliesi* above about 760m a.s.l. along the Wakamarama Range).

Golden Bay Ecological District

Criteria: climate, topography, geology.

TOPOGRAPHY/GEOLOGY: the glacio-fluvial terraces and flats of coastal and lowland Golden Bay; maximum altitude 655m a.s.l. Mostly Pleistocene and Holocene deposits but also significant areas of Tertiary sediments including limestone outcrops.

CLIMATE: sunny, warm and wet, rainfall 2000–4000mm p.a.; receives very heavy rains at times from north-east and north; the orographic affect of Whakamarama Range protects Golden Bay from prevailing westerly winds.

SOILS: moderately fertile loamy alluvial soils on river flats with good to poor drainage, parts liable to flooding; stony shallow soils on low terraces; deeper gleyed and weakly to moderately podzolised soils on higher terraces; very strongly leached to podzolised soils with impeded drainage on hilly land from siliceous sandstones and mudstones; very strongly leached shallow steepland soils on steeper country; small areas of moderately fertile clayey steepland soils (rendzinas) from marble in east.

VEGETATION/MODIFICATIONS: originally podocarp-hardwood-beech forest; remnants include groves of secondary totara forest in takaka Valley, small stands of kahikatea, rimu, matai, miro, northern rata, pukatea with black beech and hard beech. Extensive areas of pakihi and taller scrub on terraces of both Takaka and Aorere valleys; also extenssive areas of bracken. Most of the district is farmed (dairying with sheep and cattle for finishing).

BIRDS: extensive mudflats around Ruataniwha Inlet form an important part of the Farewell Spit-Golden Bay wader feeding grounds; besides many waders, district is important for Banded Rail and Fernbird; marsh Crake and New Zealand Scaup also present. Other tidal mudflats in district are also important, particularly Wainui Inlet. Forest bird fauna reflects limited habitats still available.

SNAILS: large land snail *Powelliphanta gilliesi compta* is restricted to the limestone outcrop known as "The Castles".

Totaranui Ecological District

Criteria: geology, vegetation, climate, topography.

TOPOGRAPHY/GEOLOGY: highly distinctive district formed from dissected granite hill country reaching about 700m a.s.l.; indented coastline; drained to the east and north.

CLIMATE: sunny with very warm summers, mild winters; drier than most of Region, rainfall 1500–2200mm p.a., winter maximum; very high intensity rains at times from north-east and north.

SOILS: strongly leached low fertility hill and steepland soils from granite.

VEGETATION/MODIFICATIONS: affinities with the NELSON and RICHMOND regions. Originally forested, some Polynesian and much European clearance: now largely in secondary or original forest; remnant pockets of podocarp-hardwood forest dominated by rimu and northern rata with matai, hinau, Hall's totara, occasional pokaka, miro and totara, (understorey containing pigeon-wood, marbleleaf, mahoe, raurekau, tarata, kaikomako, occasional wineberry, titoki, kamahi and nikau); a few kahikatea and pukatea trees remain on damp sites; montane red beech forest occurs on moist deep soils of upper Wainui valley, also smaller stands of red beech, silver beech and black beech and some mixed beech stands; between 300m and 600m a.s.l. from Falls R. to Centre Peak a belt of red beech dominant forest occurs with rimu, matai, miro, hard beech, Hall's totara, hinau, kamahi and northern rata, at higher altitudes southern rata and pokaka. Much of district is in scrub, mostly manuka, kanuka, mingimingi and Pimelea; some red tussock and associated sub-alpine species at Moa Park; black beech dominated forest on drier coastal ridges and headlands, with associated kanuka, red beech, northern rata, hinau, rimu, hard beech; some areas of exotic woody adventive species, e.g. two Hakeas and two pine species. Adele Is. is rat free.

BIRDS: include Great Spotted Kiwi, South Island Kaka, Red-crowned Parakeet, Yellow-crowned Parakeet, South Island Robin, Yellowhead, New Zealand Falcon, kea, Fernbird, Blue Duck. Mudflats at Awaroa Bay and Marahau provide useful wader habitat and breeding places for Banded Dotterel and Variable Oystercatcher. Banded Rail occur throughout; Marsh Crake at Marahau.

REPTILES: Nelson green gecko (*Heteropholis stellatus*) common in scrubland at Sandy Bay and Marahau, and on Adele Is. (only island population of this species); also known on the Takaka Hill.

SNAILS: the large land snail *Powelliphanta hochstetteri hochstetteri* occurs in forest above about 760m a.s.l.

Heaphy Ecological District

Criteria: topography, geology, climate, vegetation.

TOPOGRAPHY: rugged highly dissected hill slopes, particularly in Heaphy River catchment rising to c. 1520m a.s.l. on the Domett Range; with coastal and inland downlands and hills of more gentle relief towards the coast.

GEOLOGY: Permian-Carboniferous Karamea Granite with some areas of Tertiary and Paleozoic sediiments.

CLIMATE: warm, wet, strongly influenced by westerly weather patterns; rainfall 2800–5600mm p.a.

SOILS: on terraces moderately deep podzolised soils and podzols, most with poor drainage; on hilly slopes very strongly leached to podzolised soils with impeded drainage from siliceous sandstone and mudstone; shallow very strongly leached to podzolised steepland soils on steep slopes from range of indurated sedimentary rocks and granites; all soils have low natural fertility.

VEGETATION/MODIFICATIONS: largely unmodified. At lowest altitudes: in the west—dense, wet forest of northern rata, kahikatea, matai with some pukatea, miro, totara, black beech, and hard beech. On mid-slopes: mixed beech-podocarp-hardwood forest. At higher altitudes: silver beech dominated forest, often with southern rata, Hall's totara, *Dracophyllum traversii* and *D. townsonii* On edges of downland: extensive areas of low forest and scrub of mountain beech, manuka, *Quintinea acutifolia*, southern rata, pokaka, stunted rimu, mountain toatoa, *Dacrydium* spp. and *Dracophyllum traversii*. Downlands modified by fire to varying extent; on MacKay Downs clearings of red tussock, *Gleichnia* sp. and pigmy pine interspersed with stunted forest; Gouland, Gunner and Gorton Downs have more extensive open tussock areas, impoverished by fire and former grazing.

FLORA: species reaching their southern limit in this district include titoki and *Pepeomia urvilleana* (occur north of Kohaihai River).

MAMMALS: northernmost breeding colony of New Zealand fur seal in the world near Kahurangi Point.

BIRDS: New Zealand stronghold of Great Spotted Kiwi—very abundant; also important for South Island Kaka; Blue Duck widespread; New Zealand Falcon; Yellow-crowned Parakeet; kea widespread.

REPTILES: green gecko (*Heteropholis* sp.) reported.

SNAILS: very important for land snails with *Powelliphanta gilliesi jamesoni* and 5 subspecies of the large golden *Powelliphanta superba* (*P. s. prouseorum, P. s. harveyi, P. s. moutae, P. s. richardsoni, P. "Gunner River"*) confined to district; most of the range of *P. s. superba* is in Heaphy E.D.

Wangapeka Ecological District

Criteria: topography, vegetation, geology, climate.

TOPOGRAPHY: complex mountainous hinterland; mostly 900–1500m a.s.l.; highest point Mt Kendall, 1810m; drained mostly to the north and west.

GEOLOGY: complex: includes Permian-Carboniferous Karamea granite and Lower Cretaceous granites in the West; Ordovician schist, sub-schist, shale, phyllite, quartzite form a central band running north-south; Upper and Lower Cambrian phorphyritic andesites, basalts, volcanic sandstones etc. in the east; some Tertiary rocks.

CLIMATE: summers warm and sunny; winters cold with heavy frost, snowfalls at high altitudes; rapid weather changes; rainfall 4000–6400mm p.a.

SOILS: mainly shallow, low fertility very strongly leached and podzolised steepland soils from range of indurated sedimentary, metamorphic and igneous rocks; on easier slopes, drainage impeded, some soils have peaty topsoils. Includes small areas of more fertile clay soils (rendzinas) from marble.

VEGETATION: almost entirely indigenous; forest patterns complicated by changes in parent rock and drainage: podocarp and podocarp/beech forest on lower slopes and valleys; black beech on lower alluvial terraces in east and north, absent in west-draining catchments; hard beech often occurs with black beech but has a more western distribution; extensive red beech forest with silver beech and mountain beech at higher levels—mountain beech at treeline in south-east on limestone, silver beech dominates elsewhere, either species forms the treeline; above treeline subalpine scrub, tussockland, alpine herbfields; some pakihi areas.

MAMMALS: the vulnerable lesser short-tailed bat present; the only recent South Island positive identification of the latter species was in Roaring Lion River in 1977.

BIRDS: relatively rich forest bird fauna characteristic of montane and submontane beech forest which cover most of the district. Birds include Great Spotted Kiwi (most abundant in the west). Kaka (widespread), Blue Duck (widespread), New Zealand Scaup (common on inland lakes), New Zealand Falcon (widespread), Yellow-crowned Parakeet, kea (widespread), Rock Wren (widespread in suitable habitat), possibly Yellowhead.

REPTILES: Nelson green gecko (*Heterophilis stellatus*) recorded at Boulder Lake.

INSECTS: include giant wetas *Deinacrida tipiospina* at Lake Cobb and Lake Lockett, *D. connectens* on Mt Arthur tableland.

SNAILS: important for the large land snail genus *Powelliphanta*: includes the total range of *Powelliphanta lignaria ruforadiata, P. l. unicolorata, P. l. o'conneri, P. hochstetteri anatokiensis, and part of the range of P. gilliesi fallax, P. superba superba and P. rossiana patrickensis.*

MODIFICATIONS: feral goats damaging forest on north, west and south edges of district.

Arthur Ecological District

Criteria: geology, topography, climate.

TOPOGRAPHY: mountains and hills, mostly 600–1500m a.s.l.; highest points Mt Arthur, 1777m (on boundary) and Mt Owen 1875m; drained mainly to the south-east, thence to Tasman Bay by north-east trending rivers.

GEOLOGY: Complex: Silurian-Upper Ordovician Mt Arthur marble and indurated mudstone, phyllite, graptolitic shales, quartzitic sandstone, and schist along the west; Devonian amphibolite, horneblende-scist, porphyrite, meta-basalt, serpentine and quartz schist, meta quartzite, biotite and garnet schist in the middle (Riwaka Complex) and Carboniferous? granite in the east.

CLIMATE: summers warm, sunny; winters cold, heavy frosts, snowfalls at high altitudes; drier than Wangapeka district, rainfall 1500–4000mm p.a.

SOILS: on steep country in the south and west low fertility, very strongly leached and podzolised steepland soils, some with impeded drainage, from range of indurated sedimentary, metamorpic and igneous rocks; moderately leached fertile clay soils (rendzinas) from marble in the north; moderately to strongly leached soils from mudstones, sandstones and conglomerates on hill country along north-east boundary; reddish brown moderately fertile clayey soils from basic igneous rocks in central part.

VEGETATION: mostly indigenous; podocarp and podocarp/beech forest on lower slopes and valleys, red beech and silver beech with black beech on lower alluvial terraces; extensive beech forest at higher levels to between 1300 and 1400m a.s.l., mostly mountain beech at treeline, silver beech somewhat lower; above this subalpine scrub, red tussockland and alpine herbfield.

BIRDS: fairly rich bird fauna characteristic of montane and submontane beech forest which covers most of the district; continuous extent of forest in North-west Nelson allow kaka and parakeet populations to persist in Arthur E.D. Great Spotted Kiwi occur mostly in the south, Blue Duck widespread, New Zealand Falcon present, kea widespread, Yellowhead present.

REPTILES: Nelson green gecko (*Heteropholis stellatus*) known from widespread sites in the Arthur Range.

INSECTS: include wetas *Deinacida connectens* on Hoary Head, *D. tipiospina* on Mt Owen and Mt Arthur.

SNAILS: include the large land snail *Powelliphanta hochstetteri hochstetteri* in forest above about 760m a.s.l. on marble north of Mt Arthur, and *P. rossiana patrickensis* above the bushline along the Arthur Range.

MODIFICATION: past and continuing logging and burning of forest edges; resulting scrub supports feral goats and pigs.

Karamea Ecological District

Criteria: topography, geology.

TOPOGRAPHY: low coastal plain with rugged hills to the north, east and south; hills reach 900–1000m a.s.l. in the east. South of Whanganui Head the coast is high and steep; to the north are mainly dunes and two estuaries.

GEOLOGY: underlain by largely Calcereous rocks of Eocene and younger age;

a block of lower Pleistocene Old Man Gravel between the Karamea and Little Wanganui Rivers; limited areas of upper Pleistocene gravels in alluvial and marine terraces; Karamea plain formed of Recent alluvial, swamp, estuarine and dune deposits; Karamea Granite outcrops in the north and east; small outcrops of Tuhua and Paparoa Granite occur in the south and south-west respectively.

CLIMATE: warm, wet, predominantly coastal 2000–3200mm p.a.

SOILS: podzolised and gleyed soils with poor drainage on terrace and rolling lands; very strongly leached to podzolised soils on hill country from a range of rocks; moderately leached soils on steep and hilly slopes from limestone; sand soils on coastal dunes; alluvial soils; small areas of shallow strongly leached steepland soils on lower slopes of mountains; apart from alluvial and limestone soils, natural fertility very low.

VEGETATION/FLORA: originally mostly forested: from silver beech on upper slopes, through red beech, silver beech and hard beech with scattered rimu on mid-slopes, hard beech and kamahi with rimu on lower slopes (especially those with seaward exposure), to dense semi-coastal forest with northern rata, kiekie, nikau etc. at lowest altitudes near the sea. Forests dominated by silver beech on more fertile soils in Oparara and Corbyvale basins; forests dominated by rimu (some with hard beech co-dominant) occur on leached soils on upper Pleistocene terraces; remnants of formerly extensive kahikatea forests occur on the plain; stands of hill country podocarp/hardwood forest lacking beech occur on granite plateau west of upper Oparara River, also south of Karamea Bluff. Considerable areas of seral scrub and young forest on slips and slumps in south of district (formed by 1929 earthquake).

Modified forest remnants occur on plain and slopes, including trees rare in district: true totara, kowhai, akeake (*Dononaea*), kanuka, karaka, pukatea, matai and silver fern. Pakihi vegetation is limited to two interglacial marine terraces adjoining the plain.

Dune vegetation dominated by marram but supports pingao and other native species; native vegetation occurs in Karamea and Oparara estuaries; a few small areas of natural swamp occur in tributary valleys.

A few areas of low-alpine vegetation above a depressed treeline including those species typical of western Nelson mountains: e.g. *Aciphylla hookeri, Celmisia dallii, Gentiana gracifolia.* District forms part of southwards gradient of decreasing floristic diversity along west coast of South Island. Several species (e.g. *Astelia trinervia, Pseudowintera axillaris* extend a little south of the Kohaihai River; pukatea and *Alseuosmia macrophylla* reach their southern limits in this district; apparent natural south-west limit of karaka is south of Kohaihai Bluff.

MAMMALS: include the vulnerable lesser short-tailed bat.

BIRDS: rich and diverse bird fauna particularly concentrated on more fertile sites such as limestone valley floors and the few remnants of coastal forest on alluvium near the sea. Great Spotted Kiwi abundant in places, Blue Duck in Oparara only, New Zealand Falcon in south, kaka, kea and Yellow-crowned Parakeet in Oparara Forest. Several estuaries support high numbers of waterfowl, some migratory waders. Fernbird in swampy fringes and in remnant Kongahu swamp.

REPTILES: speckled skink (*Leiolopisma infrapunctatum*) occurs on the coast at Karamea.

FISH: include giant kokopu (*Galaxias argenteus*) and brown mudfish (Neochanna apoda).

SNAILS: two subspecies of *Powelliphanta* land snails restricted to Karamea: *P. lignaria* between Mokihinui River, Karamea Bluffs road and Six Mile Creek, and *P. l. lusca* between Six Mile Creek, Karamea Bluffs road and Little Wanganui. *P. annectens* occurs beside the Oparara River; over half the range of this species is in this district.

MODIFICATIONS: largely farmed on coastal plain (semi-extensive sheep and cattle and dairying); the large Kongahu swamp draining into Karamea estuary now converted to farmland.

Matiri Ecological District

Criteria: topography (flat tops), geology, vegetation.

TOPOGRAPHY: "flat" topped mountains and steep sided valleys of Matiri Range plus Matiri River catchment; mostly 900–1500m a.s.l.; drained to the south.

GEOLOGY: this includes Lower Paleozoic Tuhua granite, Oligocene (Landon) limestones and Miocene marine mudstone, siltstone and sandstone.

CLIMATE: high rainfall (4000–5000mm p.a.) mountain climate.

SOILS: low fertility, generally shallow, very strongly leached to podzolised steepland soils from Tertiary mudstone, siltstone, sandstone and limestones and from granite; soils on easier slopes and basins have impeded drainage, some with peaty topsoils; small areas of strongly leached soils on terraces bordering lower reaches of Matiri River.

VEGETATION: almost entirely indigenous; reflecting the diversity of soil ages, drainage conditions and altitudes.

Forests—mixed age silver beech dominant forests occur on young surfaces; silver beech forest (with scattered poles and *Griselinia littoralis* in the subcanopy, small leaved species in a shrub layer) forms the treeline at about 1280m a.s.l.; silver beech forest (with *G. littoralis, Dracophyllum traversii, Olearia colensoi, O. lacunosa,* *Psuedopanax linearis*, mountain beech and kaikawaka) occurs on steep wet or cold sites; red beech-silver beech forest with diverse subcanopy, shrub and ground layers, occur on sides of Matiri valley up to 900m; mountain beech forests, some with *Dracophyllum traversii* and *Olearia colensoi*, occur on mudstone and may form the treeline.

Scrub—*Dracophyllum logilolium* in unburnt areas of 1000 Acres Plateau, (mountain flax with celmisias and red tussock on burnt areas); *Coriaria sarmentosa* with *D. longifolium*, composite shrubs and hebes on Misery Plateau margins and steep scarps; small leaved coprosmas on free draining coarse limestone colluvium below scarps. *Dacrydium biforme* and red tussock mosaics occur between forests and red tussocklands in poorly drained sites especially on 1000 Acres Plateau.

Tussocklands—*Chionocloa flavescens* on young sunny sites on Tertiary rocks; *C. pallens* on older, less fertile sites, especially non Tertiary rocks; *C. australis* on Misery Plateau and wet peaty soils in the north; *Rhytidosperma setifolium* widespread immediately below scarps. There are several lakes and wetlands.

FLORA: trenches and sink holes in limestone support extremely variable flora. Certain calcicole species restricted distribution occur, e.g. *Poa* sp.

BIRDS: include Great Spotted Kiwi, Blue Duck (widespread), New Zealand Falcon, kea (widespread), kaka and Yellow-crowned Parakeet.

SNAILS: include good numbers of the alpine land snail *Powelliphanta rossiana patrickensis* on calcium-rich tussocklands.

Appendix E

List of Geographic Features mentioned in the Text with Grid References

Geographic Features and their Grid Reference for NZMS 262-9 (contained in the backpocket of thesis)

NAME OF FEATURE	GRID REFERENCE ON NZMS 262-9 (E) (N)
Abel Tasman Coastline	515 035
Abel Tasman Coastal Track	513 025
Abel Tasman Inland Track	504 031
Anatoki Track	485 033
Anatori River	456 055
Aorere River	479 059
Aorere Valley	475 047
Arthur Range	482 997
Baton River	490 991
Beautiful River	462 002
Boulder Lake	475 035
Brown River	463 039
Cobb Reservoir	480 009
Cobb Valley	480 009
Collingwood	483 059
Crow River	469 989
Farewell Spit	495 077
Flora Track	488 002
Golden Bay	500 060
Gouland Downs	452 034
Gunner Downs	442 019
Heaphy River	435 024
Heaphy Track	458 034

NAME OF FEATURE	GRID REFERENCE ON NZMS 262-9 (E) (N)
Kahurangi Point	444 047
Kakapo Spur	471 007
Karamea	436 995
Karamea Bight	430 010
Karamea Bluffs	435 007
Karamea River	444 995
Kohaihai River	435 011
Leslie River	475 999
Leslie-Karamea Track	475 999
Mackay Downs	446 039
Matiri Track	457 957
Matiri Valley	457 957
Mokihinui Forks	441 962
Mokihinui River	422 964
Mokihinui Track	434 962
Motueka	512 011
Motueka River	511 013
Motueka Valley	495 995
Motupipi	497 039
Mount Arthur	484 999
Mount Owen	472 962
Oparara River	442 009
Owen Track	472 958
Owen Valley	468 951

NAME OF FEATURE	GRID REFERENCE ON NZMS 262-9 (E) (N)
Pakawau	484 068
Perry Saddle	460 034
Pikiruna Ranges	502 033
Pupu Walkway	488 039
Riwaka	509 014
Roaring Lion River	467 010
Rolling River	474 973
Tablelands	481 003
Taitapu Estates	462 057
Takaka	493 039
Takaka River	494 030
Takaka Valley	494 030
Tasman Mountains	460 020
Tasman Bay	530 010
Ugly River	450 007
Upper Cobb Track	473 013
Upper Cobb Valley	473 013
Waingaro Track	481 019
Wakamarama Ranges	464 046
Wangapeka River	483 978
Wangapeka Saddle	462 976
Wangapeka Track	470 973
Wangapeka Valley	470 973
Whanganui Inlet	473 068
Wharariki	483 078

Appendix F

DoC Ecological Area Policy

Ecological Area Policy

The Ecological Area General Policy developed by the New Zealand Forest Service and released in draft form by the Minister of Forests in 1985, although never adopted by the Department of Conservation, is used in principle for general purposes in that Department.

Objectives

Ecological areas are protected primarily for their scientific, particularly ecological values to meet one or more of the following objectives:
(a) to protect portions of natural ecosystems;
(b) to protect rare or unique features including native plants and animals;
(c) to make areas available for study aimed at understanding and explaining natural process;
(d) to act as benchmarks for assessing changes associated with various forms of development within the region;
(e) to act as genetic pools for native plants and animals.
These values, being paramount, must not be jeopardised by any other type of subsidiary use, unless it can be clearly shown that the alternative is in the national interest.

It is recognised that these objectives may sometimes be in conflict. For example, reserves selected to protect representative portions of natural ecosystems may or may not include seral communities, rare or unique features whose continued existence might require positive management, or "interference" with natural processes. In selecting ecological areas the purpose of protection should be identified in each instance.

Where compatible with these primary objectives ecological areas will be managed for the following secondary objectives:
(a) for education and to increase public awareness and appreciation of natural ecosystems and species;
(b) for recreation which is an integrated part of a regional network or which provides opportunities not available elsewhere or which is best achieved in the ecological area.

Criteria for Selection

The following criteria were first developed by the Scientific Coordinating Committee for Beech Research and continue to be used in the selection of an ecological area:

(1) It should represent the full range of land-forms, soil sequences, animal communities, and unmodified vegetation of the ecological district. The inclusion of some modified vegetation may sometimes add to the value of an ecological area.

(2) It should be large with, say, a minimum of 1000ha; a single large reserve is preferable to two or more smaller reserves of the same total area. This is particularly true for preserving the greatest diversity of bird populations.

(3) It is considered legitimate to create small reserves to preserve unique features or special values, although these could present special problems in protection.

(4) It should include at least one complete undisturbed catchment of a permanent waterway.

(5) It should have a compact shape, with the minimum perimeter for the area involved.

(6) Wherever possible, its boundaries should be clearly defined by natural features.

(7) It should be unroaded, at least within the main catchment.

It should be emphasised that not all ecological areas will satisfy all of these criteria.

The degree to which existing and recommended ecological areas meet these criteria indicates the flexibility adopted in their practical application. The majority of ecological areas have been selected to represent sequences of land-forms, soils and vegetation although a proportion are less than 1000 ha in size. Smaller reserves have usually been accepted as the largest available example, taking into account reserve design criteria. Many of the reserves selected to protect unique features or special values are also less than 1000 ha, and most are substantially smaller e.g. *Todea barbara* Ecological Area, 0.5 ha, set aside to protect the southernmost occurrence of *Todea barbara* fern and Nga Morehu Ecological Area, 217 ha, a special purpose reserve to protect two relict hard beech stands in Northland.

Catchments have usually been included within reserve boundaries, although some significant exceptions occur. Topographic features such as ridge lines and streams have been used to define boundaries wherever practical. Nearly all existing ecological areas are not roaded and no new roading has been put through or into proposed or existing ecological areas.

Clearly the above criteria have been and will continue to be tempered by practical limitations.

Management Plan

Management objectives and policies defined in the national context are implemented through management planning. It is a problem-solving process to ensure that decision-making is compatible with the long-term purposes and interests of protection. It also acts as a way of informing the public of and involving them in the decision-making process.

Management plans need not be elaborate documents, they will emphasise key management issues and where action is proposed. They will be backed by inventories of plant and animal species and populations and monitoring programmes.

1. Management plans will identify the primary objectives of management and any other objectives and prescribe any actions to be taken to ensure species survival or ecosystem maintenance.
2. Management plans will be prepared and reviewed on a 5-yearly basis. They will include provisions for fire protection , wild animal, predator, weed and pest control, recreational and scientific use, facilities and, where necessary, featured species management, rare or endangered species management, and mining.
3. Draft and draft review management plans will be publicly advertised and public submissions received on them.
4. Draft plans, review plans and analysis of submissions will be forwarded to the Protected Area Scientific Advisory Committee for comment on scientific aspects of management.
5. Final plans will be approved and published.
6. In response to development issues, e.g. mining, catastrophic events severely modifying ecological values or other events which change the proposed management, review of section or sections of the management plan may be necessary over and above 5 yearly review. These partial reviews will be advertised for public comment and referred to the Protected Area Scientific Advisory Committee for comment.

Appendix G

ROS Class Descriptions used in Nelson/Marlborough Conservancy

Urban

General Description

Opportunities in the class may involve no interaction with the natural environment and are not likely to involve challenge, risk or use of outdoor skills.

Rather than identify opportunities specifically, urban areas (residential/commercial/industrial) have been identified. Full identification of urban opportunities would require separate assessment, which is of non-urban areas.

Urban Fringe

General Description

These are areas of predominantly modified cultural landscape surrounding and within easy access of urban areas. Good provision of facilities may be evident. Recreation opportunities relate mainly to convenience of access for all ages and levels of fitness.

Within the generally developed urban fringe opportunity, there is allowance for natural remnants to be recognised as exceptions.

Boundaries will be formed by cultural features in the main and are likely to form a buffer from urbanised areas.

Setting Characteristics

- Physical setting
  - Accessibility:
    - very accessible to urban/residential environment
    - good network of roads and tracks for driving, walking and cycling
  - Modification:
    - predominantly modified cultural landscape with mixed land uses
- Social setting
  - major interaction with other users likely
  - wide variety of group size
  - visit duration often an hour or two
- Management setting

- Facilities and services:
  * intensive provision of facilities and well maintained
- Restrictions:
  * control is obvious and numerous

Rural

General description

These are areas of predominantly modified primary production environment. Rural landscapes would include most developed farmland, horticultural land and extensively developed exotic forestry.

Challenge, risk and application of outdoor skills are not very important. Recreational opportunities relate mainly to convenience of access and open space for camping, group activities and unobstructed views.

Boundaries are identified by fencelines, roadlines or else natural features.

Setting Characteristics

- Physical setting
  - Accessibility
    * general network of road and vehicle access throughout
    * good aircraft access
  - Modification
    * predominantly modified cultural landscape
- Social setting
  - moderate to high level of social interaction between groups and between activities
  - visit duration often half-day use
  - sense of human activity readily apparent
- Management setting
  - Facilities and services:

    * substantial provision of a wide variety of facilities and services from commercial and club opportunities to publicly managed recreation opportunities
  - Restrictions
    * high degree of control evident

Backcountry

General Description

These are areas of moderately unmodified environment, having a natural appearance which allows for a sense of being close to nature. there is likely to be a wide range of experiences, reflecting the variation of access possible from foot-track access through to sealed-road access.

The sense of self-self reliance and isolation associated with more remote recreation is not important and a reasonable provision of facilities would be expected, associated with the type of access.

A backcountry opportunity provides a similar probability of experiencing interaction with individuals and groups to that of experiencing isolation from evidence of human activity, depending on the type of access.

Boundaries generally follow vegetational limits, ridgelines, and form a buffer from access routes.

Setting Characteristics

- Physical Setting
  - Accessibility
    * access should be moderately provided for both foot and motorised means
    * ranges from good quality walks and tracks to metaled or sealed roads
  - Modification
    * moderately unmodified natural landscape
    * modification is likely to increase with the degree of accessibility which occurs across the opportunity
  - Size

        * generally, area should be large and feel like backcountry
        * ranges from > 1000ha to > 500ha

- Social setting
    - social interaction highly variable with considerable interaction likely on road accessed sites and popular tracks, but to a lesser extent on all terrain roads and some tracks
    - group size will vary
    - visit duration generally full day or overnight

- Management setting
    - Facilities and services:
        * reasonable provision of facilities for camping and picnicking, particularly at the roadside and roadends
        * facilities may be well serviced
    - Restrictions:
        * moderate degree of control evident, but subtle and in harmony with natural environment such as signposts and interpretation boards

Remote

General Description

These are reasonably extensive areas of essentially unmodified environment in which access may be by foot track or unmarked route. Facilities may include huts or shelters.

A remote opportunity provides a moderately high probability of experiencing remoteness, tranquility and self-reliance. Opportunities exist for challenge, risk and the application of outdoor skills.

Boundaries generally follow ridgelines, gullies, streams or other dominant natural features.

Setting Characteristics

- Physical Setting
    - Accessibility—difficult

* non-motorised access only
* some marked routes or tracks may exist

- Size
  * reasonably extensive (>1000ha)

- Social setting
  - group size usually small
  - interaction with other groups unlikely

- Management setting
  - Facilities and services:
    * some facilities such as huts, tracks, bridges, may be provided for safety and site protection
    * maintenance operations to service facilities infrequent and unobtrusive
  - Restrictions:
    * minimal restrictions applied, e.g. hunting permits, fire control and hut fees

Wilderness

General Description

These are extensive areas of unmodified environment with no facilities or tracks provided. The most important criteria is isolation from other users.

A wilderness opportunity provides a very high probability of experiencing isolation from evidence of human activity, independence, closeness to nature, tranquility and self-reliance.

The environment offers a high degree of challenge and risk, requiring application of outdoor and survival skills. Boundaries will generally follow ridgelines.

Setting Characteristics

- Physical Setting
  - Accessibility
    * very difficult

    * by foot only
    * totally dependent upon the environment and skill of the visitor
  - Modification
    * very extensive area (>2000ha)

- Social Setting
  - small group size
  - no evidence of, or encounters with, other users

- Management setting
  - Facilities and services:
    * no huts, tracks or other facilities provided
  - Restrictions
    * no discernible management presence
    * exceptions for the purposes of managing the environment (wild animal control) and SAR
    * aircraft not permitted
    * Departmental Wilderness Policy applies

Appendix H

Nature Conservation Council Inspection Report—Heaphy Track Road

Details (North to South)

1. The northern coastal section is in pasture, with native bush starting a mile or two back from the coast. Milling has reached as far as the Anatori River, and Baigents have milling rights on land as far south as Kahurangi Point; lack of access is at present a deterrent to extending the milling south. Backblocks roading will eventually extend the coastal road as far as the Turimawiwi River. This section of the route presents no engineering difficulties, apart from bridging, and no environmental problems.

2. At Big River, a little north of Kahurangi Point, the route enters the mixed podocarp/hardwood forest and climbs to the MacKay Downs. Much of this forest is included in the area over which Baigents have milling rights. The road would climb 2700 feet in seven miles. Undergrowth is thick. The bush thins out as undergrowth increases, until on the MacKay Downs there is little but stunted teatree with mosses and bog plants. Here the ground is soft and spongy, and a road could be damaging.

3. The Lewis River has its source on the MacKay Downs, and it leaves the tableland in a steep gorge, falling more than 1000 feet in less than a mile. Its course is deeply incised and the steep banks are heavily bush-covered. Roadworks here would be difficult and almost certainly destructive. This part of the route would be within a mile of the Heaphy Track.

4. The junction of the Lewis River and the Heaphy River is almost at sea level, and from here to the coast (a distance of four miles), the river winds between flats covered with heavy coastal vegetation, with nikau predominant. The track and the road route converge at the confluence of these rivers. The nikau are particularly striking because of their profusion and their height, and they make it a landscape which is probably now unique in New Zealand. The track threads its way through nikau groves, along the river-side and under limestone bluffs. A road here would inevitably subdue the beauty of the valley and overwhelm the track.

5. From the mouth of the Heaphy to the road end north of Karamea (10 miles), the route is on the shoreline. Steep hills and bluffs come down to the beach. In places there is room for a road between the sand and the toe of the hill, but in many places a road would have to be cut into the toe of the hill, and very high batters would be necessary. Detailed geological information is not available, and the potential stability of road cuttings excavated into these coastal cliffs is uncertain. The track would be obliterated. Proper disposal of spoil would be impossible. Nikaus occupy the coastal strip where it exists, together with flax, lupin and marram grass, but in many places the band of nikaus is little more than twenty feet wide. A road along here must therefore wipe out a very large proportion of these trees. The beach is white sand, and shelves steeply. A walk along here must be an exhilarating

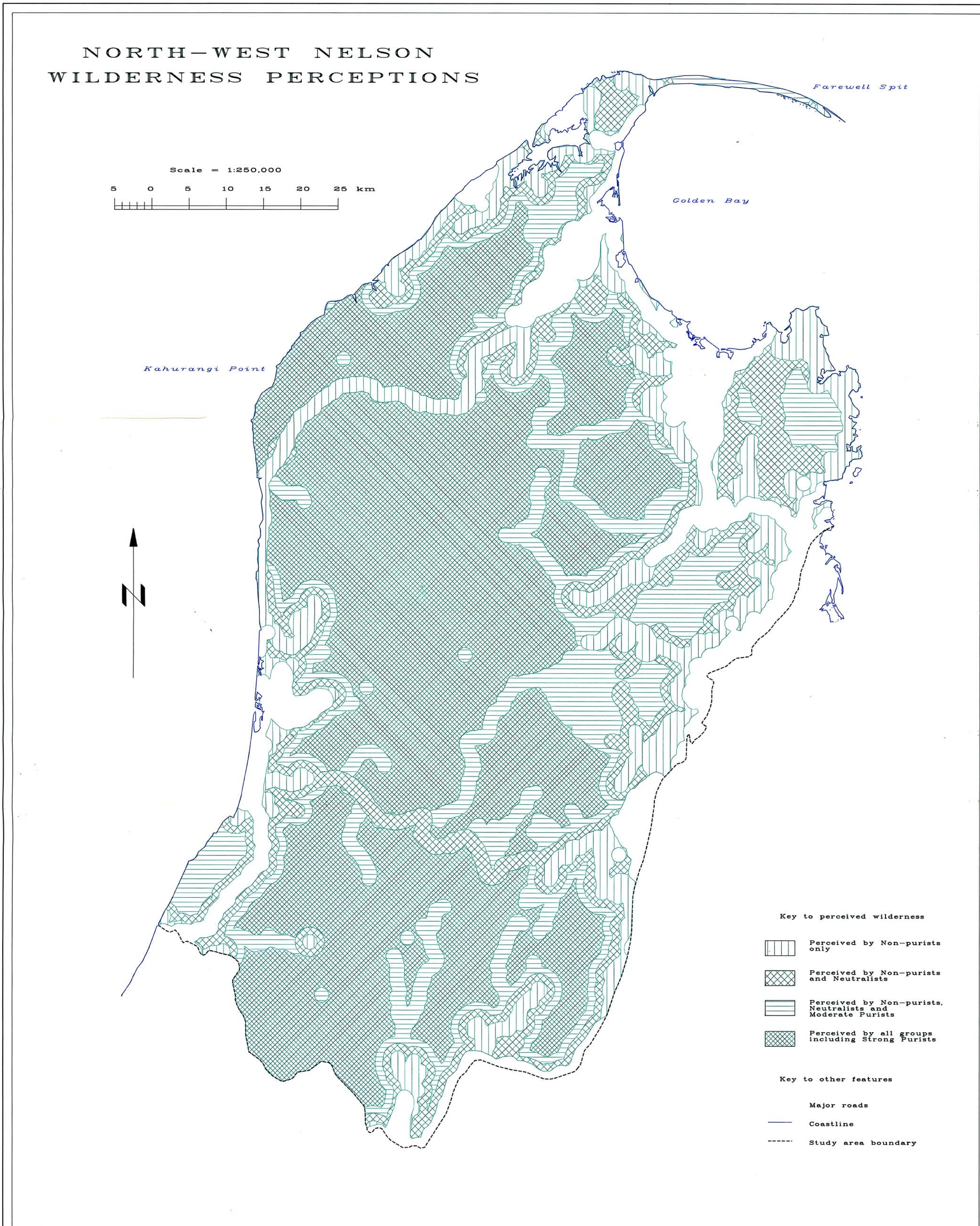
experience.

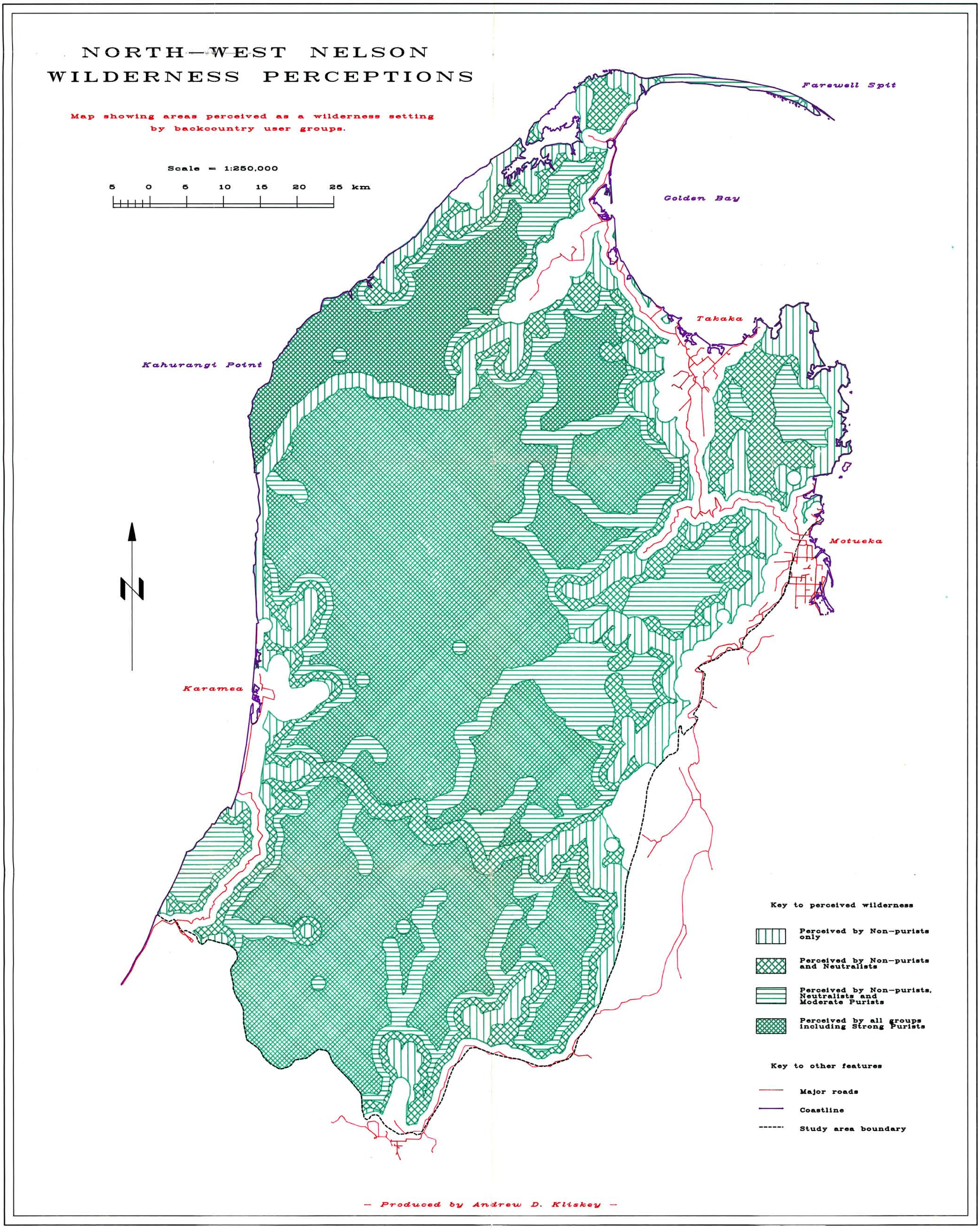
Conclusion

The route as proposed passes through scenery which is on the whole undistinguished until it reaches the Heaphy River. There do not seem to be any scenic features which should make it especially necessary to open up this section, and it is doubtful that it would attract tourists. The southern section provides an unusual and striking landscape, but if a road there destroys what people would want to see, there is little point in building it.

Supporters of the road are claiming that the route would take only a portion (about one third) of the Heaphy Track. To this, the reply must be that it is the most attractive and unusual portion, and that without it the Heaphy Track would be a far less interesting walk. It is the very great variety and change of landscape and vegetation which gives the Heaphy Track its charm and popularity, and the coastal section is a major and indispensable element of the charm.

The land encompassed by the NWNFP is one of the few large areas left in New Zealand which are devoid of roads. This fact is used as an argument to prove that a road is necessary, on the theory that if there is not a road somewhere there ought to be. This is the sort of country which can only suffer from being *opened up*.


NORTH—WEST NELSON
WILDERNESS PERCEPTIONS
Farewell Spit
Golden Bay
Kahurangi Point
Scale = 1:250,000
5 0 5 10 15 20 25 km
Key to perceived wilderness
Perceived by Non—purists only
Perceived by Non—purists and Neutralists
Perceived by Non—purists, Neutralists and Moderate Purists
Perceived by all groups including Strong Purists
Key to other features
Major roads
Coastline
Study area boundary


NORTH—WEST NELSON
WILDERNESS PERCEPTIONS
Map showing areas perceived as a wilderness setting by backcountry user groups.
Scale = 1:250,000
5 0 5 10 15 20 25 km
N
Farewell Spit
Golden Bay
Takaka
Kahurangi Point
Motueka
Karamea
Key to perceived wilderness
Perceived by Non-purists only
Perceived by Non-purists and Neutralists
Perceived by Non-purists, Neutralists and Moderate Purists
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— Produced by Andrew D. Kliskey —